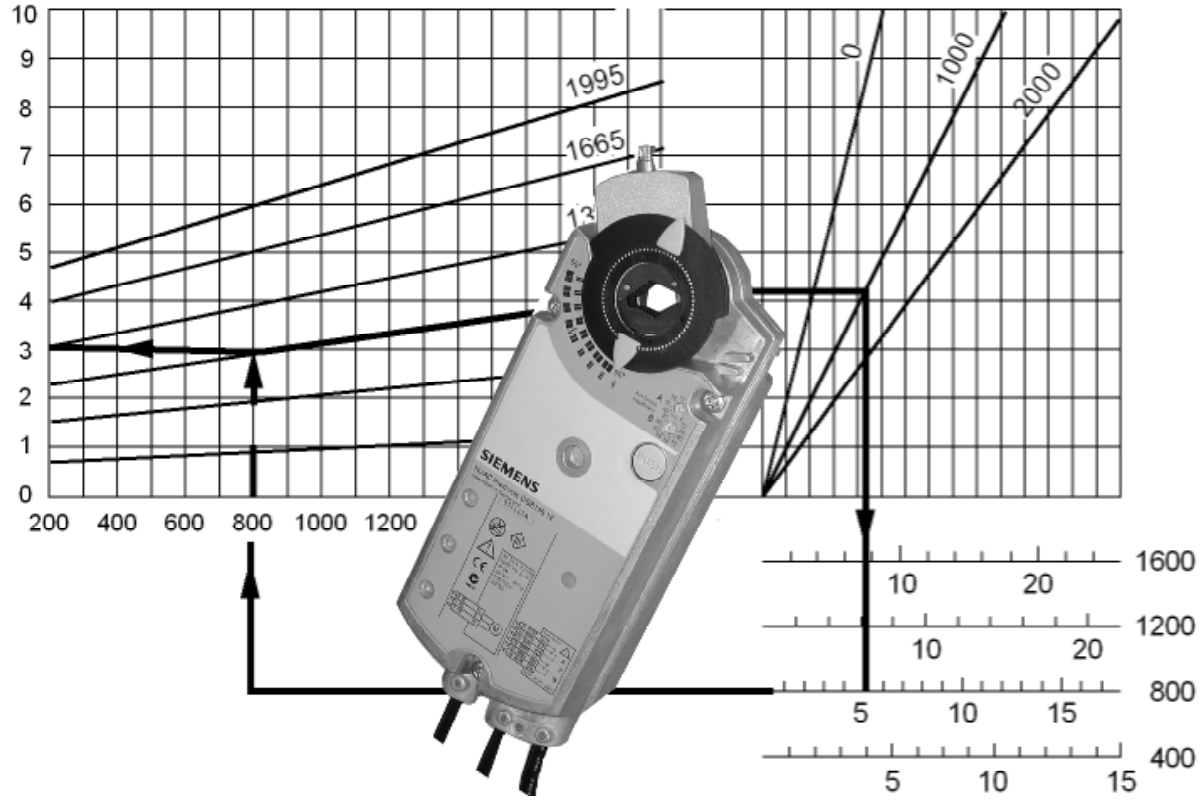
SIEMENS



OpenAir™
Rotary actuators without spring return GBB/GIB…1
Technical basics

Edition 2.2
CE1Z4626en
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Building Technologies
HVAC Products

Contents

1 Introduction

1.1 Revision history

Changes	Date	Chapter	Pages
Powerpack	03.12.2003	2.2 / 2.3.1	6, 7
Setting and operating elements		2.6	9
Mechanical parallel connection of two actuators		4.2 / 5 / 6.2 / 6.3	15, 18, 21,22
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1.2 About this document

Main audience

This document targets engineering, product management, and commissioning staff in the DUs.

Purpose

This document provides basic knowledge. In addition to background information, it contains general technical fundamentals on the GBB/GIB…1 rotary actuator series. It offers all information on engineering, correct mounting and wiring, commissioning, and service.

Referenced documents

Section 11.2 "Referenced documents" contains a list of documents on rotary and linear actuators with accessories.

1.3 Document contents

This document contains basic technical information on type series GBB/GIB...1 for:

- Three-position control, and
- Modulating control

The following topics are discussed:

- Type summary and description of the available options
- Applications and functions
- Actuator design including setting and operating elements
- Adjustable auxiliary switches and characteristic function
- Notes on engineering and safety-specific guidelines and regulations
- Notes on mounting, wiring, and commissioning
- Technical data
- Diagrams
- Environmental compatibility and disposal

2 Non-spring return actuators

Introduction

This chapter provides information on application, functions, and equipment combinations. Furthermore, it contains a type summary and explains the actuator design including setting and operating elements for this family of actuators.

2.1 Application

The actuators are used in ventilation and air conditioning plants to operate air dampers and air throttles:

- For damper areas up to 4 m^2, friction-dependent
- Suitable for modulating controllers (DC 0...10 V) or three-position controllers (e.g. for outside air dampers)
- For dampers having two actuators on the same damper shaft (tandem-mounted actuators or Powerpack)

2.2 Type summary

The following table shows the options for the actuator types.

GBB/GIB...	**131.1E**	**135.1E**	**136.1E**	**331.1E**	**335.1E**	**336.1E**	**161.1E**	**163.1E**	**164.1E**	**166.1E**
Mode of control	Three-position						Modulating			
Operating voltage AC 24 V	X	X	X				X	X	X	X
Operating voltage AC 230 V				X	X	X				
Positioning signal input Y										
DC 0...10 V							X			X
DC 0...35 V with characteristic function								X	X	
Position indicator U = DC 0...10 V							X	X	X	X
Feedback potentiometer 1kΩ		X			X					
Auxiliary switches (two)		X	X		X	X			X	X
Rotary direction switch							X	X	X	X
Powerpack (two actuators)	X	X	X	X	X	X	X	X	X	X

Accessories, spare parts

For functional enhancements of the actuators, the following accessories are available:

Accessories

External auxiliary switches (1 Switch)	**ASC77.1**
External auxiliary switches (2 Switches)	**ASC77.2**
Rotary/linear set for duct mounting	**ASK71.1**
Rotary/linear set for frame mounting	**ASK71.2**
Rotary/linear set with lever	**ASK71.3**
Rotary/linear set with lever and mounting plate	**ASK71.4**
Universal lever	**ASK71.9**
Bracket for powerpack	**ASK73.1**
Self-aligning bracket for powerpack	**ASK73.2**
Special shaft adapter	**ASK74.1**
Weather shield for rotary actuator	**ASK75.1**
Data sheet for accessories and spare parts	**N4699**

2.3 Description of functions

2.3.1 Description of functions for GBB/GIB...1

The functions are listed in a table and are assigned to the respective modes of control.

Type	**GBB/GIB13..1 / GBB/GIB33..1**	**GBB/GIB16..1**
Mode of control	Three-position	Modulating
Positioning signal with adjustable characteristic function		Y = DC 0...35 V with offset Uo = 0...5 V and span ΔU = 2...30 V
Rotary movement, direction of rotation	Clockwise or counter-clockwise direction depends:	
	On the mode of control. With no power applied, the actuator remains in the respective position.	• On the position of the rotary direction switch • On the positioning signal The actuator stays in the position reached: • If the positioning signal is maintained at a constant value • If the supply voltage is interrupted
Position indication: Mechanically	Rotary angle position indication by using a position indicator.	
Position indication: Electrically	Connecting the feedback potentiometer to an external voltage source results in voltage supply proportional to the angular rotation.	• Position indicator: Output voltage U = DC 0...10 V is generated proportional to the angular rotation. • The direction of action (inverted or not inverted) of output voltage U depends on the position of the rotary direction switch.
Auxiliary switches	The switching points for auxiliary switches A and B can be set independent of each other in increments of 5° within 5° to 90°.	
Response on damper blocking		The actuator is equipped with an automatic switch-off mechanism.
Powerpack (two actuators)	Mounting two of the same actuator types on the same damper shaft will result in a double torque.(with accessories ASK73.1)	Mounting two of the same actuator types on the same damper shaft will result in a double torque.(with accessories ASK73.2)
Manual adjustment	The actuator can be manually adjusted by pressing the gear train disengagement button.	
Limitation of angular rotation	The angular rotation for the shaft adapter can be limited mechanically by inserting the shaft adapter in 5° increments.	

2.3.2 Supplementary information on the description of functions for GBB/GIB16..1

Supplement

The following information applies to **modulating** actuators.

Characteristic function (GBB/GIB163.1, GBB/GIB164.1)

Offset Uo and span ΔU can be adjusted using two potentiometers (see section 3.4 "Adjustable characteristic function"). The maximum permissible input voltage (Uo + ΔU) is DC 35 V.

Application

Actuators featuring this function can be used for the following applications:

- Dampers with a rotary angle limitation, for instance in the 0°...45° range, can be controlled using the full positioning signal range DC 0...10 V.
- As a sequencing actuator in control loops that can only apply a DC 0...10 V positioning signal to control more than one sequence.
- In control systems with a positioning signal deviating from DC 0...10 V such as DC 2...10 V or DC 0…35 V.

2.4 Controllers

The actuators can be connected to all controllers having the following outputs.
All safety-related requirements must be met (see chapter 4 "Engineering notes").

Actuator type	Mode of control	Controller output
GBB/GIB13..1	Three-position	AC 24 V
GBB/GIB33..1	Three-position	AC 230 V
GBB/GIB16..1	Modulating	DC 0...10 V / DC 0...35 V

2.5 Mechanical design

Brief description

The electromotoric GBB/GIB...1 actuators are available for three-position and modulating control. The maximum torque is 20/35 Nm. The actuator's connecting cables are prewired.

Housing

Robust, light-weight full metal housing made of die-cast aluminium. The housing guarantees a long actuator life even under harsh environmental conditions.

Gear train

Maintenance-free and noise-free gear train with stall and overload protection for the life of the actuator.

Self-centering shaft adapter

This mounting type allows for securing the actuator to shafts with various diameters and in various shapes (square, round) using just one screw.
Insert the shaft adapter from either side into the opening for the shaft adapter.
For short shafts, the shaft adapter is on the air duct side.
The shaft adapter coupling and the adapter holding are coupled by means of double-sided gearing.

Manual adjustment

When no voltage is supplied, you can manually adjust the actuator or the air damper by pressing the gear train disengagement button.

Mounting bracket

A bolted perforated metal strip is used to attach the actuator.

Electrical connection

All actuators have prewired 0.9 m long connecting cables.

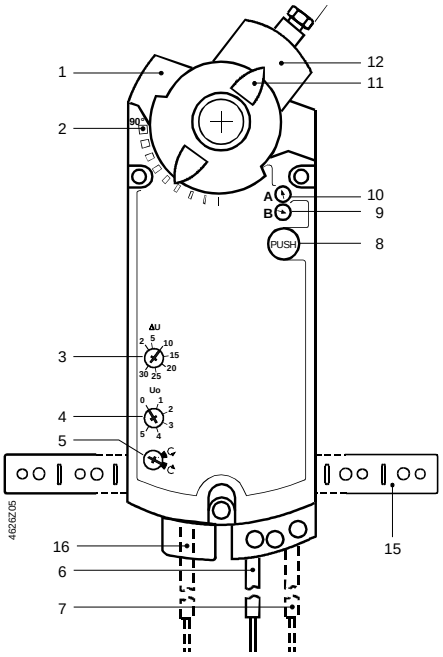
Type-specific elements

The actuators can be delivered as a type-specific variant having the following elements:

Auxiliary switch	For auxiliary functions, you can adjust auxiliary switches A and B on the actuator front.
Potentiometer for offset and span	Both potentiometers for the characteristic functions Uo and ΔU are accessible on the front.
Rotary direction switch (only for GBB/GIB16..1)	The rotary direction switch exists only in modulating actuators and is accessible from the front (see section 2.6 "Setting and operating elements“).
Feedback potentiometer for position indication	The potentiometer is integrated and can be connected by means of a cable.

2.6 Setting and operating elements

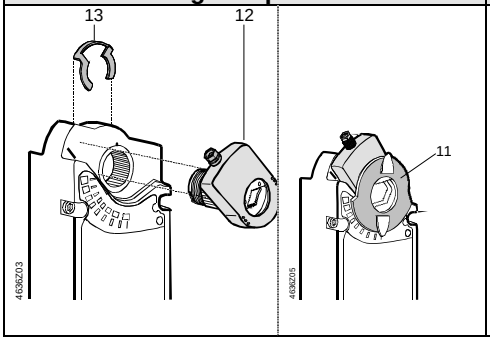
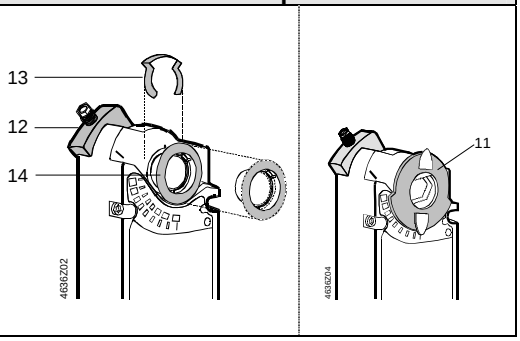
Actuator



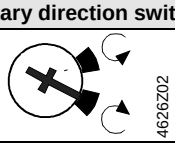
Legend

1	Housing
2	Rotary angle scale 0°...90°
3	Potentiometer to adjust the span
4	Potentiometer to set the offset
5	Rotary direction switch
6	Connecting cable for power and positioning signal
7	Connecting cable for auxiliary switches
8	Gear train disengagement button
9,10	Setting shafts for auxiliary switches A and B
11	Position indicator
12	Self-centering shaft adapter
13	Locking ring for shaft adapter
14	Adapter for position indicator
15	Mounting bracket
16	Connecting cable for feedback potentiometer

Arrangement of shaft adapter

For long damper shafts	For short damper shafts
	

Rotary direction switch
(legend pos. 5)
GBB/GIB16..1

Direction of rotation	Rotary direction switch	Direction of rotation	Function
Counter-clockwise ↺	 4626Z02	Clockwise ↻ (factory setting)	**Direction of rotation**

3 Technical design

Introduction

This chapter discusses the following topics:

- Drive motor
- Adjustable auxiliary switches
- Adjustable characteristic function (positioning signal, DC 0...35 V)
- Control characteristics by including the neutral zone

3.1 Drive motor

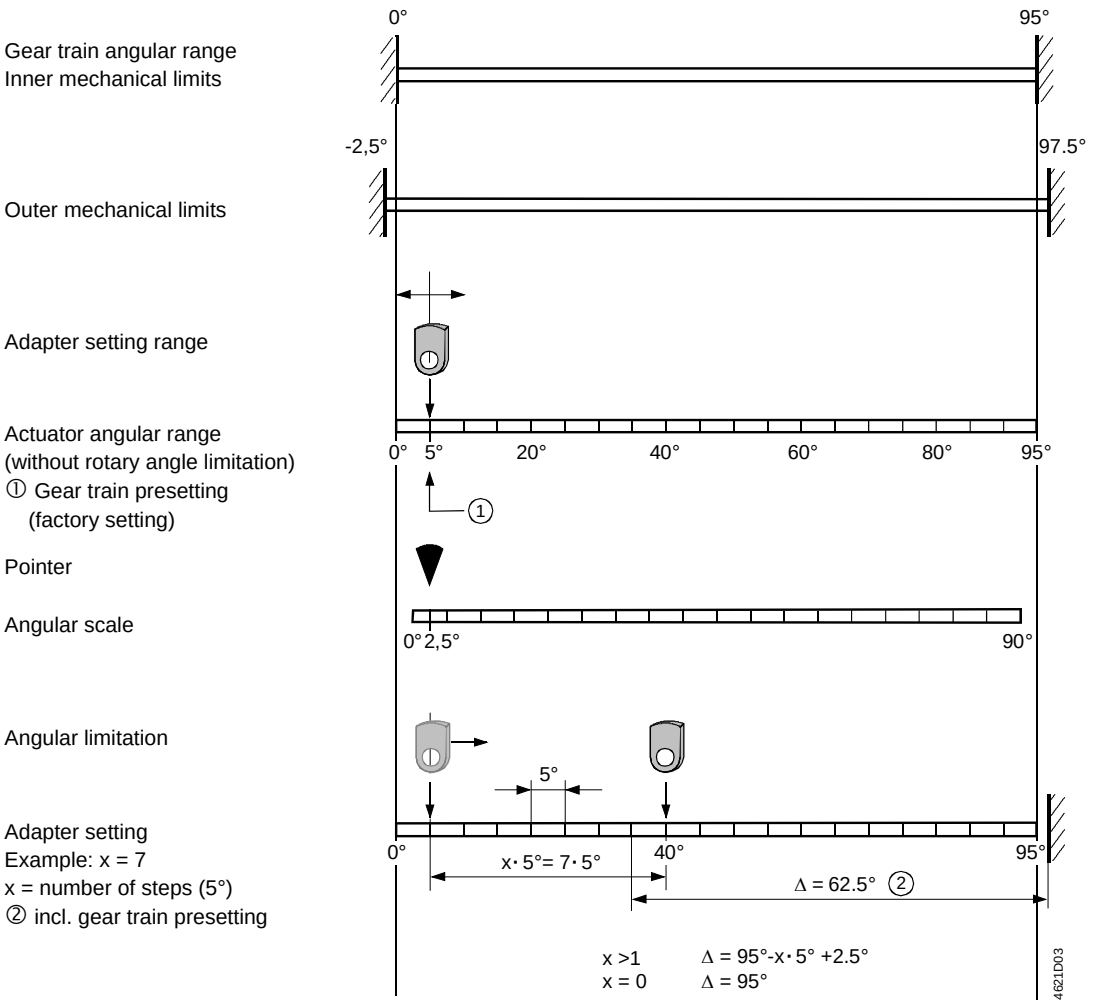
Drive motor

A synchronous motor enables accurate speed control. The magnetic clutch serves as a torque supervision to protect both actuator and damper.

3.2 Angular range and mechanical limitation

Mechanical functions

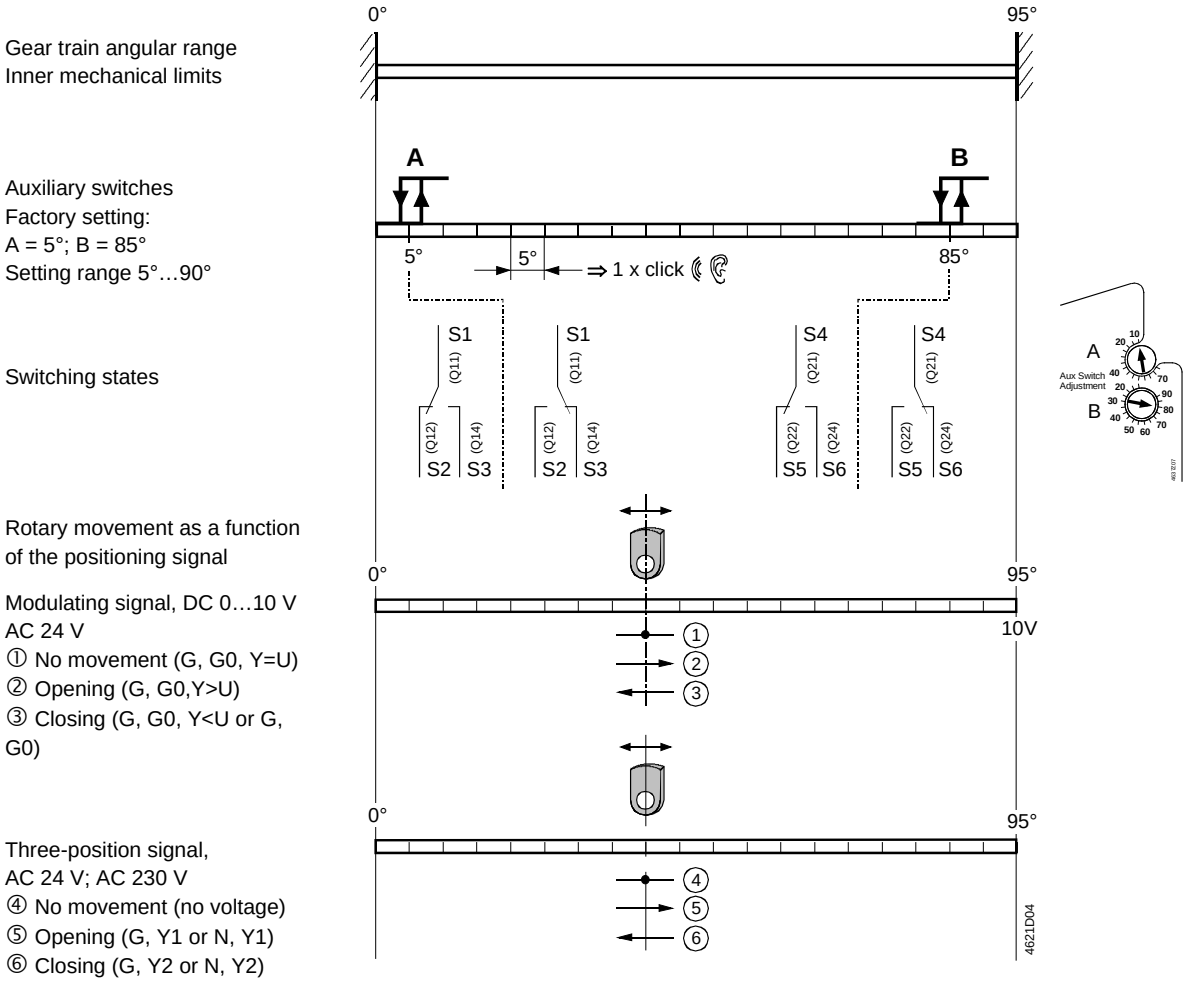
The illustration below shows the relationship between the inner and outer mechanical limitation of the angular range.



3.3 Auxiliary switches and positioning signals

Electrical functions

The illustration below shows the relationship between the angular rotation, the adjustable switching points for auxiliary switches A and B and the positioning signal.



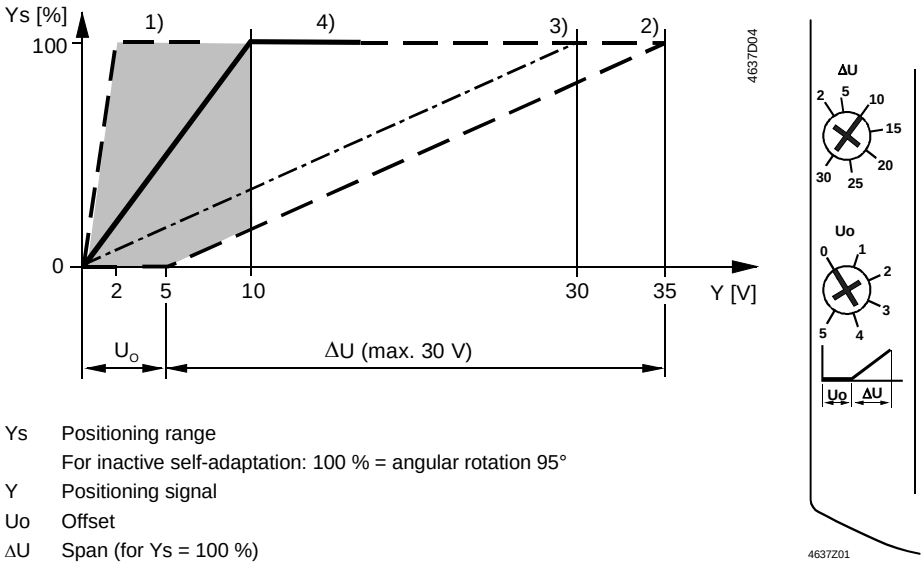
Note

The setting shafts for the auxiliary switches turn together with the adapter. The scales thus only refer to the **inner mechnical 0° limit**.

3.4 Adjustable characteristic function

Actuators
GBB/GIB163.1,
GBB/GIB164.1

A modulating positioning signal DC 0..35 V from a controller drives the actuator. The angular rotation is proportional to the positioning signal. Using potentiometer "Uo", you can set the offset for DC 0...5 V, and with potentiometer "ΔU", you can set the span for DC 2...30 V.



Ys Positioning range
For inactive self-adaptation: 100 % = angular rotation 95°
Y Positioning signal
Uo Offset
ΔU Span (for Ys = 100 %)

Examples as per the diagram

Example	Positioning signal Y	Positioning range Ys	Settings Uo	Settings ΔU
1)	DC 0...2 V	0...100 %	DC 0 V	DC 2 V
2)	DC 5...10 V DC 5...35 V	0...17 % 0...100 %	DC 5 V	DC 30 V
3)	DC 0...10 V DC 0...30 V	0...33 % 0...100 %	DC 0 V	DC 30 V
4)*	DC 0...10 V	0...100 %	DC 0 V	DC 10 V

4)* Characteristic curve for factory setting

Note

- The Y input is limited to max. DC 35 V
- The adjustable span ΔU is max. 30 V

Example

Define the adjustable span ΔU if the actuator is to open from 0...50 % at a positioning signal of Y = DC 2…10 V. The offset Uo thus amounts to 2 V. The angle of rotation is 90°.

Formula

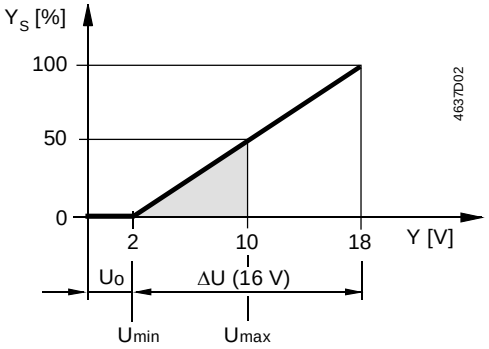
Calculating the setting value for ΔU:

$$\Delta U = \frac{\text{max. positioning range Ys max [\%]}}{\text{span positioning range Ys [\%]}} \cdot (10\,[\text{V}] - \text{Uo}\,[\text{V}]) = \frac{100\ \%}{50\ \%} \cdot (10\ \text{V} - 2\ \text{V}) = 16\ \text{V}$$

Potentiometer settings

Uo = 2 V, ΔU = 16 V

Characteristic function for the example



Max. positioning range Ysmax = 100 % (95°)
Span Ys = 50 % (47.5°)
Offset Uo = **2 V**
Span ΔU = **16 V**

Effective span
ΔUw = Umax – Umin
= 10 V - 2 V = 8 V

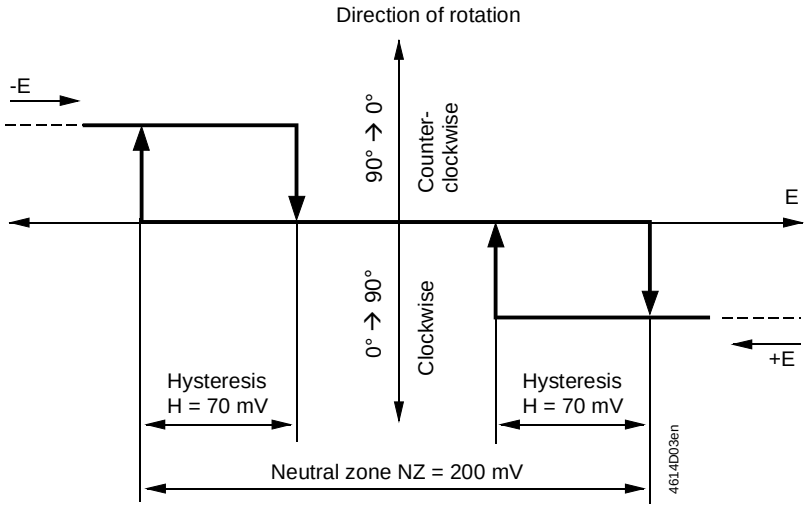
3.5 Neutral zone

Actuators
GBB/GIB16...1
(DC 0...10 V)

For modulating actuators, note the control characteristic for the selected switch-on point of the setpoint. The diagram shows the setting characteristics by including the neutral zone for range DC 0...10 V.

Note

The diagram shows the setting characteristics by including the neutral zone. The values for the neutral zone listed in the diagram apply to DC 0...10 V (**without characteristic function**).



The diagram shows the relationship between the differential voltage E = Y – U (difference between setpoint Y and actual value U) and the direction rotation, including hysteresis and neutral zone.

Actuators
GBB/GIB163.1,
GBB/GIB164.1
(DC 0...35 V)

For DC 0...35 V (**with characteristic function**) the following values apply:
Neutral zone NZ = 2 % of span ΔU
Hysteresis H = 0.7 % of span ΔU

4 Engineering notes

Introduction

Carefully study the basics of the control systems used before proceeding to the sections below, and pay special attention to all safety-related information.

Intended use

Use these actuators in a system only for applications as described in the basic system documentation of the control systems used. Additionally, note the actuator-specific properties and conditions as described in this chapter and in chapter 8 "Technical data".

4.1 Safety notes

Please observe the following notes

This chapter explains general and system-specific regulations for mains and operating voltages. It also contains important information regarding your own safety and that of your plant.

Safety note

The warning triangle to the left means that you must observe all respectively listed regulations and notes.
If ignored, injuries and equipment damages can result.

General regulations

Observe the following general regulations during engineering and project execution:

- Electric and high-voltage regulations of the respective country
- Other mandatory country regulations
- House installation regulations of the respective country
- Regulations by the energy supplier
- Diagrams, cable lists, dispositions, specifications, and instructions as per the customer or the engineering company
- Third-party regulations from, e.g., the general contractors or building contractors

Safety

Electrical safety in Siemens building management and control systems primarily depends on **extra-low voltage with safe isolation from mains voltage**.

SELV, PELV

Depending on the earthing of extra-low voltage, SELV or PELV applications as per HD384 "Electrical plants in buildings" result:
Unearthed = **S**afety **E**xtra-**L**ow **V**oltage **SELV**
Grounded = **P**rotective **E**xtra-**L**ow **V**oltage **PELV**

Earthing of G0 (system neutral)

Observe the following for grounding G0:

- As a rule, earthing as well as nonearthing of G0 is permissible for AC 24 V operating voltage. However, observe all local regulations and customary procedures.
- For functional reasons, earthing may be required or not permissible.

Recommendation on earthing G0

- **As a rule, ground AC 24 V systems** if not otherwise indicated by the manufacturer.
- To avoid earth loops, connect systems with **PELV** to the earth at **only one end** in the system, normally at the transformer, unless otherwise specified.

⚠ Operating voltage AC 24 V, AC 230 V

The following regulations apply to these operating voltages:

	Regulation
Operating voltage AC 24 V	The operating voltage must comply with the requirements for SELV or PELV: • Permissible deviation of AC 24 V nominal voltage at the actuators: +/–20 %
Operating voltage AC 230 V	• Permissible deviation of AC 230 V nominal voltage at the actuators: +/–10 %
Specification on AC 24 V transformers	• Safety isolating transformers as per EN 61 558, with double insulation, designed for 100 % duty to supply SELV or PELV circuits • Determine the transformer's power consumption by adding up the power consumption in VA for all actuators used. • The capacity used from the transformer should amount to at least 50 % of the nominal load for efficiency reasons (power efficiency) • The nominal capacity of the transformer must be at least 25 VA. For smaller transformers, the ratio between voltage at idle time to voltage at full load is unsatisfactory (> + 20 %)
Fuse of AC 24 V operating voltage	Transformers, secondary side: • According to the effective load of all connected devices • Line G (system potential) must always be fused. • Where required, line G0 also (system neutral)
Fuse of AC 230 V mains voltage	Transformers, primary side, as per the applicable installation regulations of the respective country

4.2 Device-specific regulations

⚠ Device safety

Safety for the devices is ensured by (among other aspects):
- Supply of AC 24 V extra-low voltage as per **SELV** or **PELV**
- Double insulation between AC 230 V mains voltage and SELV/PELV circuits

Mechanical parallel connection of actuators

- Mount max. two actuators on the same damper shaft. Use the mounting bracket to also secure the second actuator (see powerpack-accessories in section 2.2).

⚠ Auxiliary switches A, B

Apply **only mains voltage** or **only safety extra-low voltage** to the switching outputs of auxiliary switches A and B. Mixed operation is not permissible. Operation using various phases is not permissible.

⚠ Feedback potentiometer for position indication

Consider the potentiometer's electric data to indicate the damper position via the external circuit.

Electrical parallel connection of actuators

Same device types with index A can be electrical parallel wired.
Same device types with index B (or higher) can also be electrical parallel wired.

Mix of electrical parallel wiring of device types with index A and B (or higher) is not possible.

Up to 10 actuators of the same device type can be electrical parallel wired. Cable length and cable cross section have to be respected.

See chapter 6 "Wiring notes" for more information.


Caution, maintenance

Do not open the actuator.
The actuator is maintenance-free. Only the manufacturer may conduct any repair work.

4.3 Notes on EMC optimization

Running cables in a duct

Make sure to separate high-interference cables from equipment susceptible to interference.

Cable types

- Cables emitting interference: Motor cables, particularly motors supplied by variable speed drives, energy cables
- Cables susceptible to interference: Control cables, extra-low voltage cables, interface cables, LAN cables, digital and analog signal cables

Cable segregation

- You can run both cable types in the same cable ducting, but in different compartments.
- If ducting with three closed sides and a partition is not available, separate the interference-emitting cables from other cables by a minimum of 150 mm or route in separate ducting.
- Cross high-interference cables with equipment susceptible to interference only at right angles.
- When, as an exception, signal and interference-emitting supply cables are run in parallel, the risk of interference is very high. In this case, limit the cable length of the positioning signal line DC 0...10 V for modulating actuators.

Unshielded cables

We recommend to use unshielded cables. When selecting unshielded cables, follow the manufacturer's installation recommendations. In general, **unshielded twisted-pair** cables have sufficient EMC characteristics for building services (incl. data applications) as well as the advantage that no provision is required for coupling to the surrounding earth.

4.4 Determining the actuator

Required actuator torque

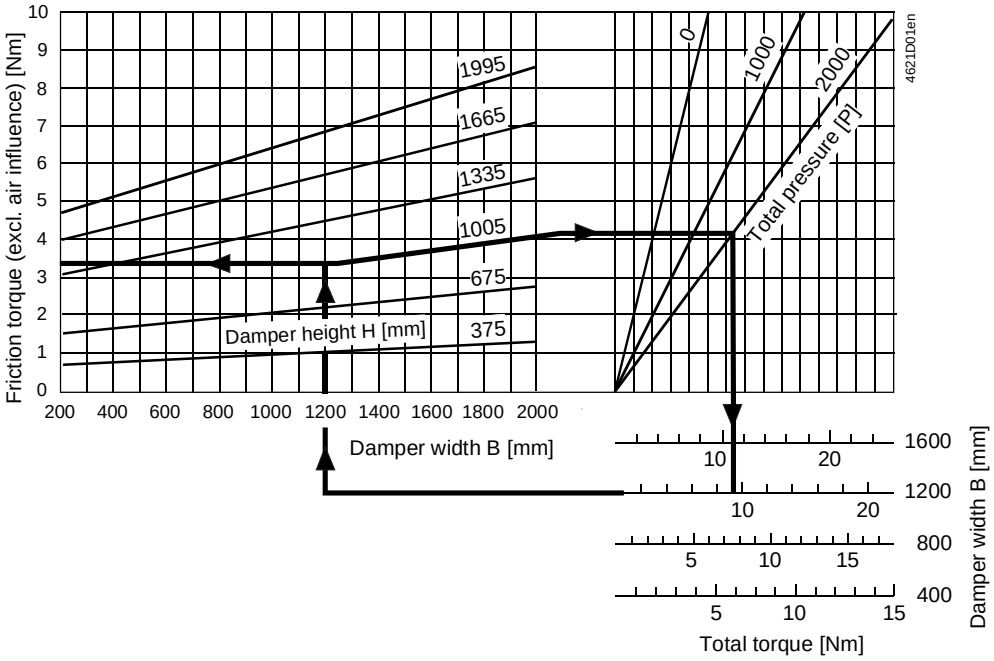
Selection of the actuator depends on several torque factors. After obtaining the damper torque rating [Nm/m^2] from the manufacturer and determining the damper area, calculate the total torque required to move the damper as follows:

Total torque [Nm] = torque rating [Nm/m^2] × damper area [m^2].

Instead of the torque rating, the total torque can also be determined from the manufacturer's sizing charts.

Sizing chart

The following chart (example EMCO) allows for determining the total torque for this air damper type.



Example

Damper for blinds:

Width	= 1200 mm
Height	= 1005 mm
Total pressure	= 2000 Pa

The total torque of about **10 Nm** results from the chart.

Determining the actuator type

Determine your type of actuator from the table below:

If $\frac{\text{total torque [Nm]}}{\text{SF}^{1}}$	**then use type**
≤ 15 Nm	GEB...1 (15 Nm)
≤ 25 Nm	GBB...1 (25 Nm) [2]
≤ 30 Nm	2 x GEB...1 (2 x 15 Nm) [3]
≤ 35 Nm	GIB...1 (35 Nm) [4]
≤ 70 Nm	2 x GIB...1 (2 x 35 Nm) [5]

Notes

[1] Safety Factor SF:
When calculating the number of actuators, remember to include nondefinable variables such as slight misalignment, damper age, etc., as a safety factor. We recommend a total safety factor of 0.8.
Apply the same factor when calculating the actuator torque by the torque rating.

If the required actuator torque is greater than 15 Nm, you can use the following:

[2] One actuator of type series GBB...1, or

[3] Two actuators (tandem-mounted powerpack) of type series GEB13..1, GEB33..1, or

[4] One actuator of type series GIB...1 .

[5] If the actuator torque is greater than 35 Nm, two actuators of type series GIB...1 can mechanically be connected and mounted on the damper shaft.
(See data sheets N4621, N4626, and N4699).

5 Mounting notes

Mounting instructions	All information and steps to properly prepare and mount the actuator are available in the mounting instructions 4 319 2685 0 (M4626) delivered with the actuator. The shaft adapter as well as all other individual parts are not premounted, as the actuator components are put together differently depending on damper shaft length. Refer to section 2.5 “Mechanical design".
Mounting position	Choose the actuator's mounting position so that you can easily access the cables as well as the setting elements on the front of the actuator. Refer to section 11.1 "Dimensions".
Device protection	To satisfy the IP54 protection class requirements, the following conditions must be fulfilled: • The actuators are equipped only for vertical mounting (cable entries at bottom) with air dampers having a horizontal shaft. • The actuator mounted on the damper shaft may be mounted by max. +/– 45° to the vertical line: • Use the weather shield ASK75.1 for any mounting position.
Mounting bracket	The mounting bracket (see dimensions) is required for mounting on the damper shaft. The insertion depth for the bolt into the housing must be sufficient and guaranteed.
Factory setting	The actuator comes with a factory setting of +2.5° which ensures a tight close-off for the air dampers.
Manual adjustment	The actuator can be manually adjusted by pressing the gear train disengagement button. To ensure a tight close-off function for the dampers and the exact switching position for switches A and B, adjust the actuator only if the **shaft adapter and the position indicator are mounted** in accordance with the mounting instructions.
Mechanical limitation of angular rotation	If necessary, you can limit the angular rotation at increments of 5° for the entire span by positioning the shaft adapter in the respective position.
Damper shafts	Refer to chapter 8 "Technical data" for information on minimum length and diameter of the damper shafts.
Use of rotary/linear sets	Mount the mounting sets for converting a rotary movement to linear movement (section 2.2 "Type summary") as per the separate mounting instructions.
Tandem (powerpack) mounting	When mounting two actuators on the same damper shaft (for GBBGIB13..1 and GBB/GIB33..1), use the ASK73.1 mounting bracket. For GBB/GIB16… use the ASK73.2 mounting bracket.

6 Wiring notes

Introduction

Prior to wiring, study all information in the following sections:

- "Safety notes" in section 4.1
- "Device-specific regulations" in section 4.2
- "Notes on EMC optimization" in section 4.3
- "Connection Diagrams" in chapter 9, and the
- HVAC plant diagram.

6.1 Permissible line lengths and cross sectional area

The permissible line lengths and cross-sectional areas depend on the actuators' power consumption and the voltage drop of the connection lines to the controller. Determine the necessary line length from the following diagram and the formulas.

Note

To determine the line length and cross-sectional area, adhere to the permissible operating voltage tolerance at the actuator (see chapter 8 "Technical data") in addition to the permissible voltage drop between the signal and supply lines (see table below).

Permissible voltage drop

The line sizing between the controller and the actuators depends on the actuator type used and is determined on the following basis.

Type	Operating voltage	Line	Max. permissible voltage drop
GBB/GIB13..1	AC 24 V	G, Y1, Y2	4 % each (tot. 8 %) of AC 24 V
GBB/GIB16..1	AC 24 V	G0, G G0, Y, U	4 % each (tot. 8 %) of AC 24 V 1 % of DC 10 V
GBB/GIB33..1	AC 230 V	L, N	2 % each (tot. 4 %) of AC 230 V

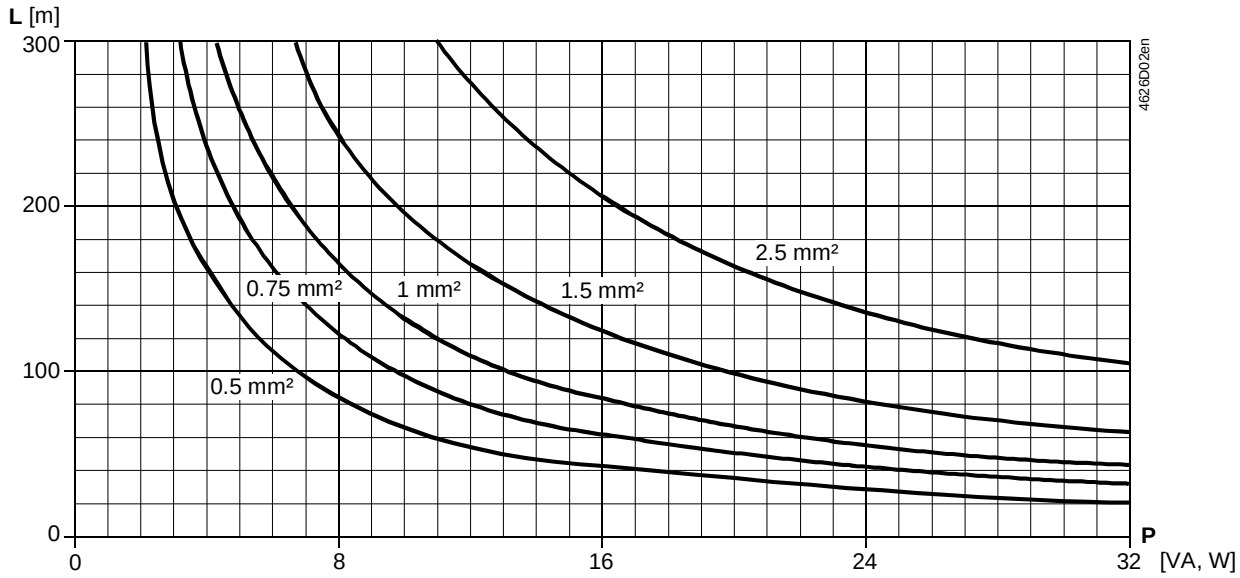
Notes on the G0 line (GEB16..1)

Consider the following criteria:

- For modulating control:
  The permissible positioning signal error caused by a voltage drop in the line current on the G0 line must not exceed 1%.
- The G0 line's voltage drop caused by surges in the DC circuit in the actuator may not exceed 2 Vpp.
- In the case of improper sizing of the G0 line, actuator load changes may cause natural oscillation due to a change in the DC voltage drop.
- The supply voltage loss at AC 24 V may not exceed 8 % (4 % across G0 line).
- **DC voltage drop across the G0 line** is caused as follows:
  - Asymmetrically in the internal actuator supply (approx. DC 8 mA)
  - Positioning signal current DC 0.1 mA (from Y = DC 0...10 V)
  - Positioning signal current DC 1 mA (from U = DC 0...10 V).
- **It can be ignored for the following aspects.**

Line length/ consumption AC 24 V

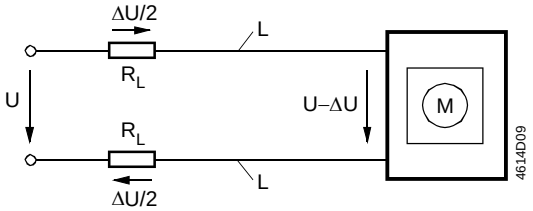
The diagram applies to AC 24 V and shows the permissible line length **L** as a function of consumption **P** and as a parameter of the cross-sectional area.



Notes on diagram

- The values in [VA, W] on the P-axis are allocated to the permissible voltage drops (ΔU/2U = 4 %) on line L as per the above table and to the P&I diagram.
- P is the primary power consumption for all actuators connected in parallel.

P&I diagram: Voltage drop on the supply lines



Formula for line length

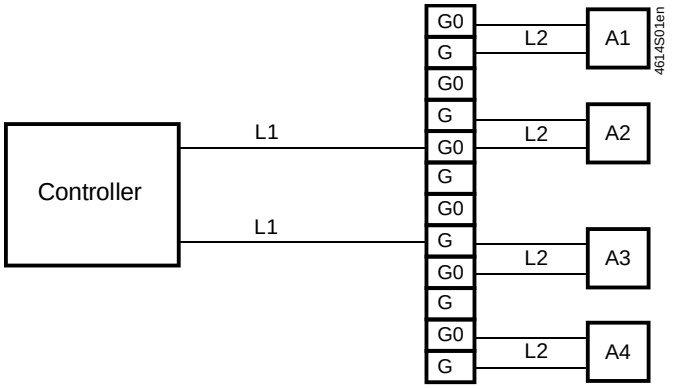
The maximum line length can be calculated using the following formula.

Operating voltage	Perm. voltage drop / line	Formula for line length
AC 24 V	4 % of AC 24 V	$L = \frac{1313 \bullet A}{P}$ [m]
	1 % of DC 10 V	$L = \frac{5.47 \bullet A}{I(DC)}$ [m]
AC 230 V	2 % of AC 230 V	$L = 46 \bullet \frac{1313 \bullet A}{P}$ [m]

A Cross-sectional area in [mm^2]
L Permissible line length in [m]
P Power consumption in [VA] or [W];
the value is printed on the actuator's type field
I(DC) DC current portion in line G0 in [A]

Line length for actuators connected in parallel

The following sections show how to determine the permissible line length and cross-sectional areas for the various actuators based on examples.
The examples for actuators connected in parallel apply to the following arrangement:



Assumption

The line resistances of L2 are equal and can be ignored for L1. Separately calculate the permissible line lengths L2 for other connections (ring, star-like).

6.2 Actuator wiring (three-position)

Actuators with three-position control
GBB13..1

With three-position actuators, only the situation as presented under **AC 24 V** is important. Sizing takes place via lines 1 (G), 6 (Y1), and 7 (Y2).

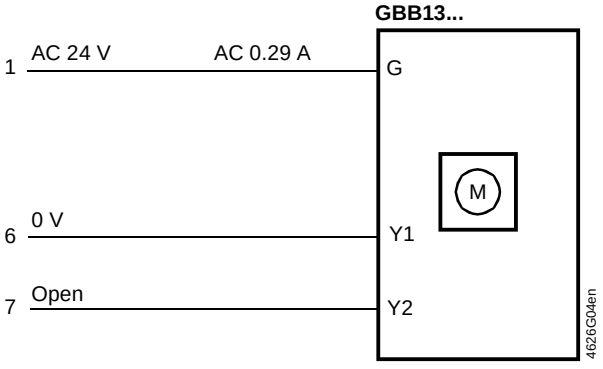
Power consumption and perm. voltage drop with one actuator

The table shows the power consumption of an actuator as well as the permissible voltage drop.

Operating voltage/pos. signal	**Power consumption**	**Perm. voltage drop for line 1 (G), 6 (Y1), 7 (Y2)**
AC 24 V	7 VA	∆U/U = max. 8 % (4 % each per line)

P&I diagram:
Currents at AC 24 V

The diagram shows the currents in the connecting lines for **one actuator**.



Example:
Parallel connection of two actuators

Determining the line lengths for two actuators GBB/GIB13..1 and AC 24 V supply.
Only the currents in line 1 (G) and 6 (Y1) or 7 (Y2) determine the line sizing.
Max. permissible voltage drop = **4 % per line** (total 8 %).

- Consumption = 2 x 7 VA = 14 VA
- Line current = 2 x 0.29 A = 0.58 A

Max. permissible single line length: 140 m at 1.5 mm^2 cross-sectional area.

6.3 Actuator wiring (modulating)

Modulating actuators
GBB/GIB16..1

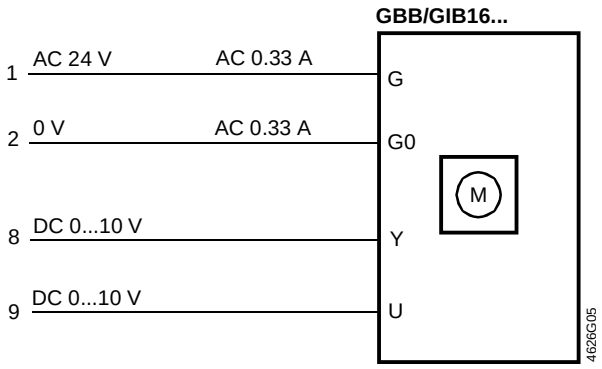
With AC supply, the G0 line has a AC 0.33 A supply current and a DC 0.1 mA positioning signal current (from Y = DC 0...10 V). The AC voltage drop on the G0 line does not impact the positioning signal Y.

Power consumption and perm. voltage drop with one actuator

Operating voltage	Power consumption	Perm. voltage drop for line 1 (G)2 (G0)
AC 24 V	8 VA	4 % of AC 24 V

P&I diagram:
Currents

The diagram shows the currents in the connecting lines for **one actuator**.



Example:
Parallel connection of four actuators

Determining the line lengths for four actuators GBB/GIB16..1 and AC 24 V supply. Only the AC currents in line 1 (G) and 2 (G0) determine the line sizing.
Max. permissible voltage drop = **4 % per line**.

- Consumption = 4 x 8 VA = 32 VA
- Line current = 4 x 0.33 A = 1.32 A
- **Permissible single line length for G, G0:**
  61 m at 1.5 mm^2 cross-sectional area, or
  102 m at 2.5 mm^2 cross-sectional area

7 Commissioning notes

References

All information necessary for commissioning is contained in the following:

- This document ("Technical basics" Z4626en)
- Mounting instructions 4 319 2685 0 (M4626)
- HVAC plant diagram

7.1 General checks

Environmental conditions

Check to ensure that all permissible values as contained in chapter 8 "Technical data" are observed.

Mechanical check

- Check for proper mounting and to ensure that all mechanical settings correspond to the plant-specific requirements. Additionally, ensure that the dampers are shut tight when in the fully closed position.
- Fasten the actuator securely to avoid side load.
- Rotary movement check: Manually change the damper setting by pressing the gear train disengagement button and turn the adapter (only if no voltage is applied).

Electrical check

- Check to ensure that the cables are connected in accordance with the plant wiring diagram.
- The operating voltage AC 24 V (SELV/PELV) or AC 230 V must be within the tolerance values.

7.2 Electrical functional check

Rotary movement: Three-position control
GBB/GIB13..1,
GBB/GIB33..1

Check the actuator operating states as follows (also refer to section 9.3 "Connection diagrams (three-position control)".

Wire connections		Direction of rotation
AC 24 V	**AC 230 V**	
1 – 6	4 – 6	Clockwise
1 – 7	4 – 7	Counter-clockwise
1 – 6 / 1 – 7 open	4 – 6 / 4 – 7 open	Actuator stays in position reached

Rotary movement: Modulating control
GBB/GIB16..1

Check the actuator operating states as follows (see also section 9.4 "Connection diagrams (modulating)"):

- When applying input signal Y = DC 10 V, the actuator turns (clockwise or counter-clockwise as per the rotary direction switch setting).
- The direction of rotation set at the rotary direction switch must match the desired damper movement direction.
- After interrupting the AC 24 V operating voltage, the actuator stops.
- After interrupting positioning signal Y, but while operating voltage is still supplied, the actuator returns to the zero position.

Characteristic function for the positioning signal
GBB/GIB163.1,
GBB/GIB164.1

Factory setting: The potentiometers for setting the offset Uo and span ∆U are set to the following values: Uo = 0 V, ∆U = 10 V.

Note

Specify the values set for Uo and ∆U in the plant papers.

Position indicator

Check of output voltage U:

- U = DC 0...10 V for **angular rotation 90°**.

Feedback potentiometer

Measures resistance changes while the actuator turns from 0 to 90°.

Auxiliary switches A and B

- Switchover of the auxiliary switch contacts "A" and "B" as soon as the actuator reaches the respective switching positions.
- Set the setting shafts (part of the delivery) to the desired value by means of a screwdriver (see section 3.2 "Angular range and mechanical limitation").

Important

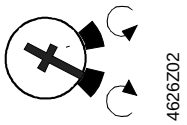
The angle values are valid only for the **zero** position of the actuator (clockwise direction).

Factory setting

The auxiliary switches have the following factory settings:

- Switch A: Switchover point at 5°
- Switch B: Switchover point at 85°

Rotary direction switch
for GBB/GIB16..1



The set direction of rotation must agree with the required direction of rotation of the air damper..

Factory setting: ↻

For the special diagrams according to section 9.4.2, the operating states must also be checked.

8 Technical data

⚠ AC 24 V supply (SELV/PELV)	Operating voltage		AC 24 V ± 20 %
	Frequency		50/60 Hz
	Safety extra-low voltage (SELV) or		
	Protective extra-low voltage (PELV) as per		HD 384
	Requirements for external safety isolating transformer (100 % duty)		as per EN 61 558
	Supply line fuse		max. 10 A
	Power consumption	GBB/GIB13..1: Running	7 VA, 7 W
		GBB/GIB16..1: Running	8 VA, 8 W
		GBB/GIB16..1: Holding	1.1 W
⚠ AC 230 V power supply	Operating voltage		AC 230 V ± 10 %
	Frequency		50/60 Hz
	Supply line fuse		max. 10 A
	Power consumption:	GBB/GIB33..1: Running	5 VA, 5 W
Functional data	Nominal torque		25 Nm GBB
			35 Nm GIB
	Maximum torque (blocked)		50 Nm GBB
			75 Nm GIB
	Nominal rotary angle / max. rotary angle		90 ° / 95° ± 2°
	Runtime for 90° rotary angle		150 s (50 Hz) / 125 s (60 Hz)
	Mechanical life		10^5 cycles

⚠ Inputs

Positioning signal for GBB/GIB13..1	Operating voltage AC 24 V	(wires 1-6)	clockwise
		(wires 1-7)	Counter-clockwise
Positioning signal for GBB/GIB33..1	Operating voltage AC 230 V	(wires 4-6)	clockwise
		(wires 4-7)	Counter-clockwise
Positioning signal for GBB/GIB16..1	Input voltage (wires 8-2)		DC 0...10 V
	Current consumption		0.1 mA
	Input resistance		> 100 kΩ
	Max. permissible input voltage		DC 35 V
	Protected against faulty wiring		max. AC 24 V
	Neutral zone	for nonadjustable characteristic function	200 mV
		for adjustable characteristic function	2 % of ΔU
	Hysteresis	for nonadjustable characteristic function	70 mV
		for adjustable characteristic function	0.7 % of ΔU
Adjustable characteristic function for GBB/GIB163.1, GBB/GIB164.1	Adjustable with 2 potentiometers:		
	Offset Uo		DC 0...5 V
	Span ΔU		DC 2...30 V
	Max. input voltage		DC 35 V
	Protected against faulty wiring		max. AC 24 V

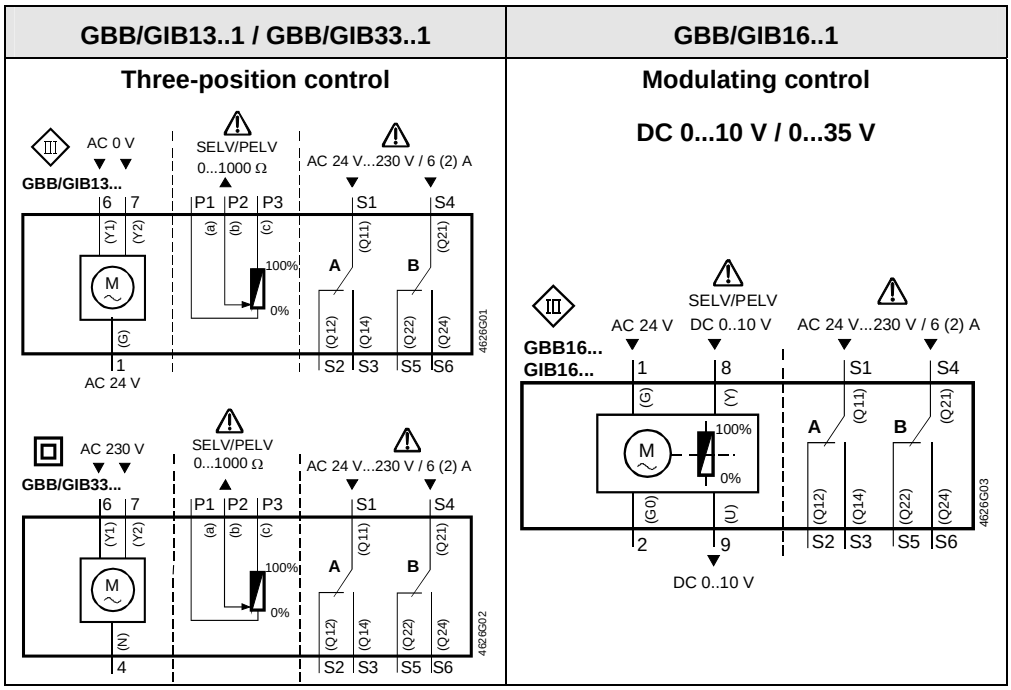
⚠ Outputs

Position indicator for GBB/GIB16...1	Output signal (wires 9-2)		
	Output voltage U		DC 0...10 V
	Max. output current		DC ± 1 mA
	Protected against faulty wiring		max. AC 24 V
Feedback potentiometer for GBB/GIB135.1, GBB/GIB335.1	Change of resistance (wires P1-P2)		0...1000 Ω
	Load		< 1 W
	Max. sliding contact current		< 10 mA
	Permissible voltage at potentiometer (SELV/PELV)		AC 24 V
	Insulation resistance between potentiometer and housing		AC 500 V

⚠ Auxiliary switches for GBB/GIB136.1, GBB/GIB336.1 GBB/GIB164.1, GBB/GIB166.1	Contact rating		6 A res., 2 A ind.
	Life:	6 A res., 2 A ind.	10^4 cycles
		5 A res., 1 A ind.	5 x 10^4 cycles
		without load	10^6 cycles
	Switching voltage		AC 24...230 V
	Nominal current resistive/inductive		6 A / 2 A
	Electric strength auxiliary switch against housing		AC 4 kV
	Switching range for auxiliary switches		5°...90°
	Setting increments		5°
	Switching hysteresis		2°
	Factory switch setting		
	Switch A		5°
	Switch B		85°
Connection cables	Cross section of prewired connection cables		0.75 mm^2
	Standard cable length		0.9 m
	Permissible length for signal lines		300 m (see chapter 6)
Degree of protection of housing	Degree of protection as per EN 60 529		IP 54
Protection class	Insulation class		as per EN 60 730
	AC 24 V		III
	AC 230 V		II
	Feedback potentiometer		III
	Auxiliary switches		II
Environmental conditions	Operation		IEC 721-3-3
	Climatic conditions		class 3K5
	Mounting location		interior, weather-protected
	Temperature		–32....+55 °C
	Humidity (noncondensing)		< 95 % r. h.
	Transport		IEC 721-3-2
	Climatic conditions		class 2K2
	Temperature		–32...+70 °C
	Humidity (noncondensing)		< 95 % r. h.
	Mechanical conditions		class 2M3
Standards and directives	Product safety		
	Automatic electrical controls		EN 60 730-2-14
	for household and similar use		(type 1)
	Electromagnetic compatibility (EMC)		
	Immunity for all models, except GBB/GIB.35.1x		IEC/EN 61 000-6-2
	Immunity for GBB/GIB.35.1x		IEC/EN 61 000-6-1
	Emissions for all models		IEC/EN 61 000-6-3
	CE conformity		
	Electromagnetic compatibility as per		89/336/EEC
	Low-voltage directive		73/23/EEC
	conformity		
	Australian EMC Framework		Radio Communication Act 1992
	Radio Interference Emission Standard		AS / NZS 3548
Dimensions	Actuator W x H x D (see "Dimensions")		100 x 300 x 67.5 mm
	Damper shaft		
	Round		8...25.6 mm
	Square		6...18 mm
	Min. length		20 mm
	Max. shaft hardness		< 400 HV
Weight	Without packaging		
	GBB/GIB...		2 kg

9 Diagrams

9.1 Internal diagrams



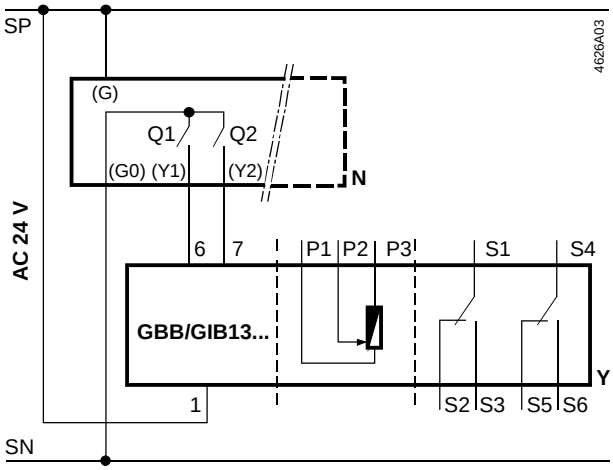
9.2 Cable labeling

All wires are color-coded and labeled.

Pin	Cable				Meaning
	Code	No.	Color	Abbreviation	
Actuators AC 24V	G G0 Y1 Y2 Y U	1 2 6 7 8 9	red black purple orange grey pink	RD BK VT OG GY PK	System potential AC 24 V System neutral Pos. signal AC 0 V, "clockwise" Pos. signal AC 0 V, "counter-clockwise" Pos. signal DC 0...10 V, 0...35 V Position indication DC 0...10 V
Actuators AC 230V	N Y1 Y2	4 6 7	blue black white	BU BK WH	Neutral Pos. signal AC 230 V, "clockwise" Pos. signal AC 230 V, "counter-clockwise"
Auxiliary switches	Q11 Q12 Q14 Q21 Q22 Q24	S1 S2 S3 S4 S5 S6	grey/red grey/blue grey/pink black/red black/blue black/pink	GY RD GY BU GY PK BK RD BK BU BK PK	Switch A input Switch A normally-closed contact Switch A normally-open contact Switch B input Switch B normally-closed contact Switch B normally-open contact
Feedback potentiometer	a b c	P1 P2 P3	white/red white/blue white/pink	WH RD WH BU WH PK	Potentiometer 0...100 % (P1-P2) Potentiometer pick-off Potentiometer 100...0 % (P3-P2)

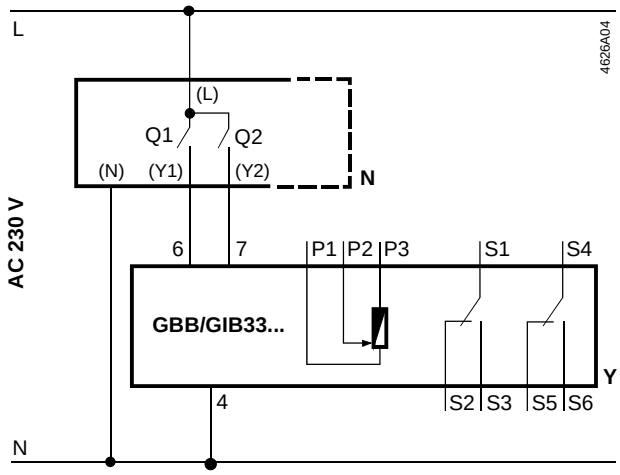
9.3 Connection diagrams (three-position control)

GBB/GIB13..1
AC 24 V



N Controller
Y Actuator GBB/GIB13..1
SP System potential AC 24 V
SN System neutral
Q1, Q2 Controller contacts

GBB/GIB33..1
AC 230 V



N Controller
Y Actuator GBB/GIB33..1
L System potential AC 230 V
N System neutral
Q1, Q2 Controller contacts

Operating states for actuators GBB/GIB13..1, GBB/GIB33..1

The table shows the actuator's operating state for both directions of rotation regardless of the position of the controller contacts Q1 and Q2.

Controller contacts Q1	Controller contacts Q2	Operating state
		Remains in current position
		Not permissible

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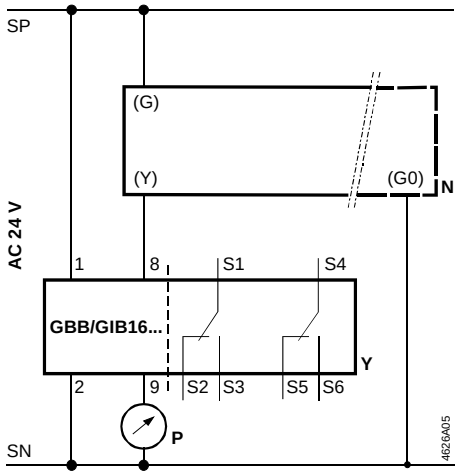
9.4 Connection diagrams (modulating)

9.4.1 Typical application

The controller output is connected directly to the actuator input.

GBB/GIB16..1

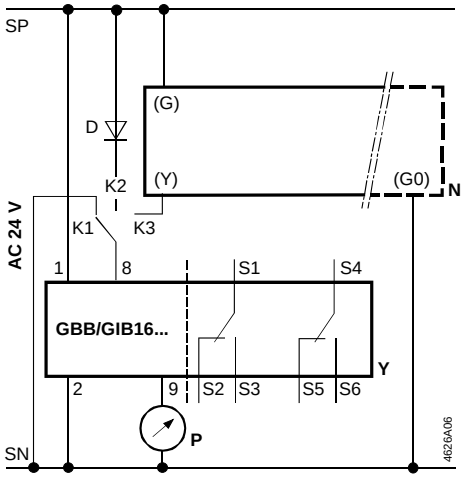


N	Controller
Y	Actuator GBB/GIB16..1
P	Position indication
SP	System potential AC 24 V
SN	System neutral

9.4.2 Special diagram for modulating control

The following diagram enables enable different operating states of the actuator depending on the position of the changeover switch with switch contacts K1, K2, K3 (see table of operating states).

Modulating control, fully open, fully locked with GBB/GIB16..1



N	Controller
Y	Actuator GBB/GIB16..1
P	Position indication
SP	System potential AC 24 V
SN	System neutral
D	Diode (e.g. R4000)
K1...K3	Switch contacts (10 V / 0.1 mA)

Operating states with GBB/GIB16..1

Switch contacts	**Operating state**	**Direction of rotation**	
K3	Modulating control		
K2	Fully open		
K1	Fully closed		
Rotary direction switch		**Factory setting**	

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Note

*) Full opening for actuator types with adjustable characteristic function depends on the set voltage values (Uo, ΔU) and the supply voltage tolerance.

10 Environmental compatibility and disposal

General notes

These actuators were developed and manufactured by using environmentally-compatible materials and by complying with our environmental standards.

For disposal, please remember the following at the end of product life or on defects:

- The device consists of
  - Materials such as steel, die-cast aluminum and die-cast zinc.

Do not dispose of as household garbage. This applies particularly to the circuit board.

- As a rule, dispose of all waste in an environmentally compatible manner and in accordance with environmental, recycling, and disposal techniques.
  Ad-here to all local and applicable laws.
- The aim is to achieve maximum recyclability at the lowest possible pollution. To do this, note the various material and disposal notes printed on specific parts.

Environmental declaration

The environmental declarations for these actuators contain detailed information on the materials and volumes used. Request a declaration at your local Siemens sales office.

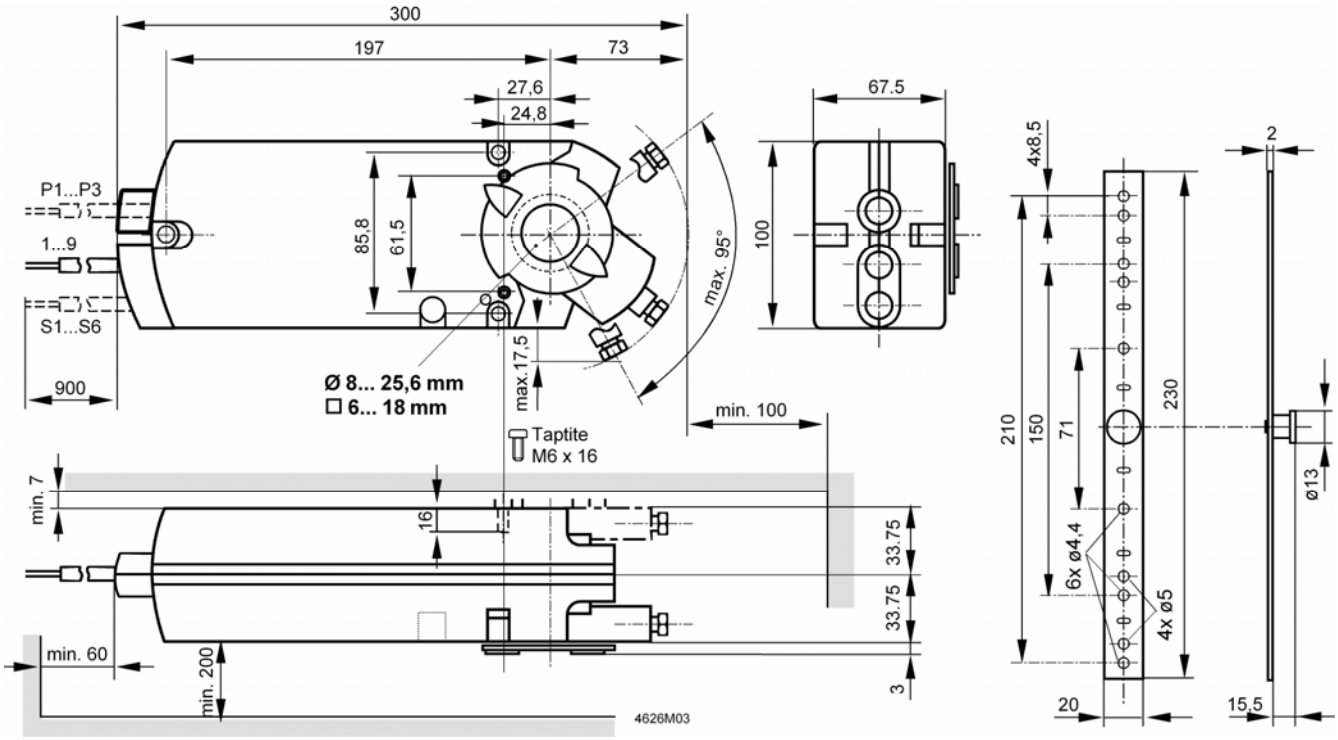
11 Appendix

Chapter contents

This chapter contains:

- Actuator dimensions
- Referenced documents

11.1 Dimensions



Dimensions in mm

11.2 Referenced documents

Purpose of this listing

The previous chapters contain all information relevant to safety and project-specific requirements, mounting, wiring, and commissioning of actuators.

Documents and standards

The following list contains all documents referenced by this document on basics:

- Data sheets (N....) with detailed specifications
- Basic documentation (Z....) with basics on air damper actuators
- Mounting instructions (M….), documents supplied with product

Note

The document and classification numbers listed in the table below match those of the database “STEP” on the company-internal Intranet.

Standards

All standards and directives relevant to engineering are also listed.

Technical documentation
Type series GBB/GIB...1

Document number (classification no.)	Title/description	Contents
N4626en (N4626)	Actuators for air dampers, rotary version (GBB/GIB...1: Three-position, modulating)	Type overview, function and selection criteria
4 319 2685 0 (M4626)	Mounting instructions on GBB/GIB...1	Instructions on mounting a rotary actuator without spring return

Accessories for type series GBB/GIB...1

N4699en (N4699)	Accessories and spare parts for air dampers actuators ASK7...	Overview, allocation to actuator type and application
N4615en (N4615)	External Auxiliary Switches ASC77…	Detailed specifications
74 319 0413 0 (M4615)	External Auxiliary Switches ASC77…	Mounting instructions and application examples
4 319 2659 0 (M4626.1)	Rotary/linear set for duct mounting ASK71.1	
4 319 2708 0 (M4626.2)	Rotary/linear set for frame mounting ASK71.2	
4 319 2725 0 (M4626.3)	Rotary/linear set with lever ASK71.3	
4 319 2846 0 (M4626.4)	Rotary/linear set with lever and mounting plate ASK71.4	
74 319 0236 0 (M4614.1)	Universal lever ASK71.9	
4 319 2849 0 (M4613.1)	Bracket for powerpack ASK73.1	
4 319 2950 0 (M4613.2)	Self-aligning bracket for powerpack ASK73.2	
4 718 1406 0	Special shaft adapter ASK74.1	
4 319 2946 0 (M4626.11)	Weather shield for rotary actuator ASK75.1	

Standards

HD 384	Electrical installations in buildings
EN 61 558	Safety of transformers, mains-powered units and similar equipment
EN 60 730	Automatic electrical controls for household and similar use
IEC/EN 61 000-6-3 IEC/EN 61 000-6-2	Electromagnetic compatibility: Emissions Electromagnetic compatibility: Immunity
IEC/EN 61 000-6-1	Electromagnetic compatibility: Immunity
89/336/EEC	Directive for electromagnetic compatibility
73/23/EEC	Low-voltage directive

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