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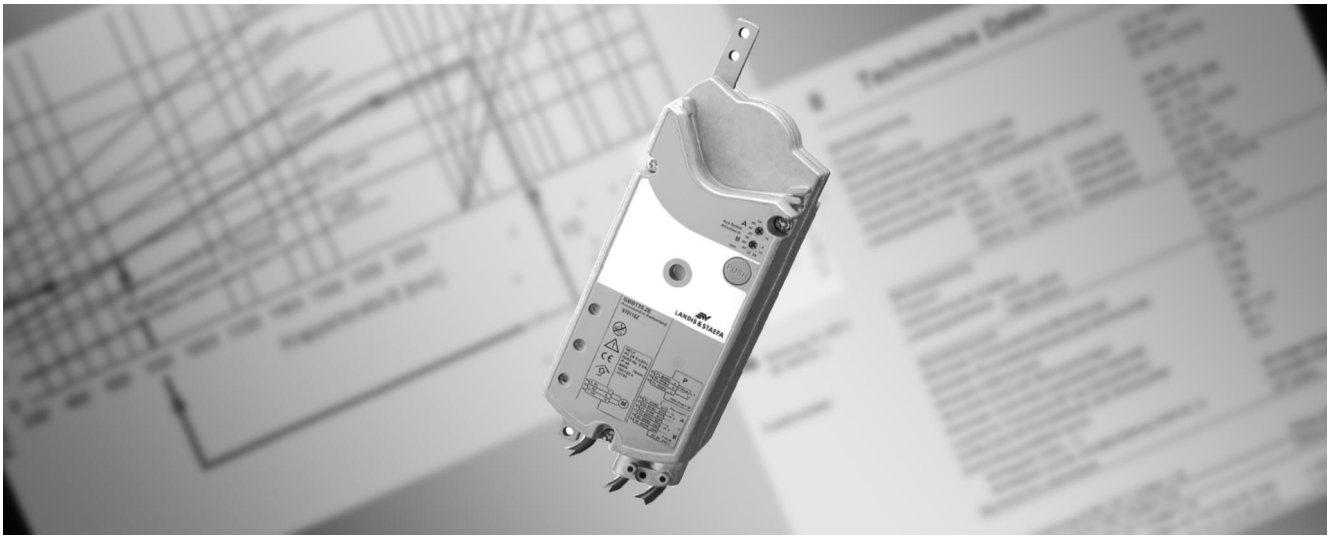

OpenAir™
Linear actuators GBB…2
Technical basics

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Building Technologies

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1 Introduction

1.1 Revision history

Changes	Date	Chapter	Pages
EU and RCM Conformity	26.02.2016	8	24
European Directive 2012/19/EU		10	28
Types GBB135.2E / 335.2E / 164.2E / 166.2E removed	16.09.2013	all	whole Document
Mounting notes / Device protection	07.11.2005	5	16
Technical data / Degree of protection		8	24
Electrical parallel connection of actuators	18.02.2005	4.2	14
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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…2 linear 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...2 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 Linear 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 linear actuators are used in ventilation and air conditioning plants to operate rotary and linear dampers:

- For damper areas up to 4 m^2, friction-dependent
- Suitable for modulating controllers (DC 0...10 V) or three-position controllers (e.g. rotary and linear dampers for air outlets)

2.2 Type summary

The following table shows the options for the linear actuator types.

GBB...	131.2E	136.2E	331.2E	336.2E	161.2E	163.2E
Mode of control	Three-position				Modulating	
Operating voltage AC 24 V	X	X			X	X
Operating voltage AC 230 V			X	X		
Positioning signal Y						
DC 0...10 V					X	
DC 0...35 V with characteristic function						X
Position indicator U = DC 0...10 V					X	X
Auxiliary switches (two)		X		X		
Linear travel direction switch					X	X

Accessories

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

Linear/rotary set with mounting plate	**ASK72.1**
Linear/rotary set with mounting plate	**ASK72.2**
Weather shield	**ASK75.2**
Data sheet for accessories	**N4699**

2.3 Description of functions

2.3.1 Description of functions for GBB...2

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

Type	GBB13..2 / GBB33..2	GBB16..2
Mode of control	Three-position	Modulating
Positioning signal with adjustable characteristic function		DC 0...35 V with offset Uo = 0...5 V and span ∆U = 2...30 V
Linear travel, linear travel direction	The direction of linear travel depends:	
	On the mode of control. With no power applied, the actuator remains in the respective position.	• On the position of the linear travel 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: Electrically		• Position indicator: Output voltage U = DC 0...10 V is generated proportional to the linear travel • The direction of action (inverted or not inverted) of output voltage U depends on the position of thelinear travel direction switch
Auxiliary switches	The switching points for auxiliary switches A and B can be set independent of each other in increments of 4.0 between 4.0 and 66.8 mm.	
Manual adjustment	The push rod can be manually adjusted by pressing the gear train disengagement button.	

2.3.2 Supplementary information on the description of functions for GBB16..2

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

Characteristic function (GBB163.2)

Offset Uo and span ∆U can be adjusted using two potentiometers (see section 3.3 "Adjustable characteristic function"). The maximum permissible input voltage (Uo + ∆U) is DC 35 V.

Application

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

- Dampers with a linear travel limitation, for instance in the 0...30 mm 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 fulfilled (see chapter 4 "Engineering notes").

Actuator type	Mode of control	Controller output
GBB13..2	Three-position	AC 24 V
GBB33..2	Three-position	AC 230 V
GBB16..2	Modulating	DC 0...10 V DC 0...35 V

2.5 Mechanical design

Brief description
The electromotoric GBB..2 linear actuators are available for three-position and modulating control. The nominal linear force is 550 N. The actuator has prewired connecting cables.

Housing
Robust, light-weight full metal housing made of die-cast aluminum. 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.

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

Electrical connection
All actuators have prewired, 0.9 m long (standard length) connecting cables.

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

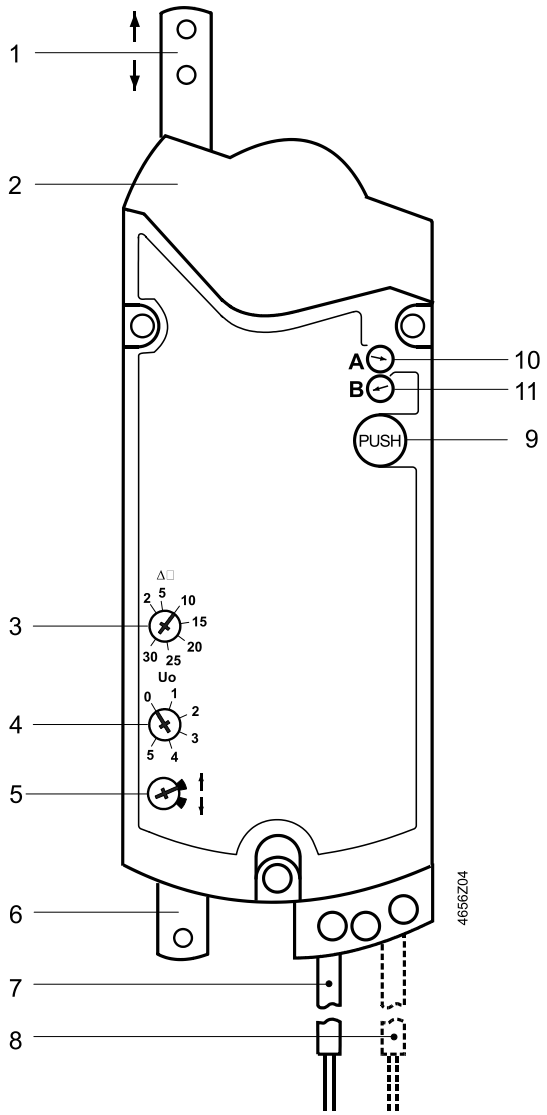
Auxiliary switches
For auxiliary functions, you can adjust auxiliary switches A and B on the actuator front.

Potentiometer for offset and span
Both potentiometers for the characteristic functions Uo and ∆U are accessible on the front.

Linear travel direction (only for GBB16..2)
The linear travel direction switches exist only in modulating actuators and are accessible from the front.

2.6 Setting and operating elements

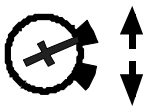
Linear actuator



Legend

1	Push rod	↑ Outward ↓ Inward
2	Housing	
3	Potentiometer to set the span	
4	Potentiometer to set the offset	
5	Linear travel direction switch: Outward / inward	
6	Mounting bracket	
7	Connecting cable for power supply and positioning signal	
8	Connecting cable for auxiliary switches	
9	Gear train disengagement button	
10	Setting shaft for auxiliary switch A	
11	Setting shaft for auxiliary switch B	

Linear travel direction switch



(Factory setting: Outward)

3 Technical design

Introduction

This chapter discusses the following topics:

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

3.1 Drive motor

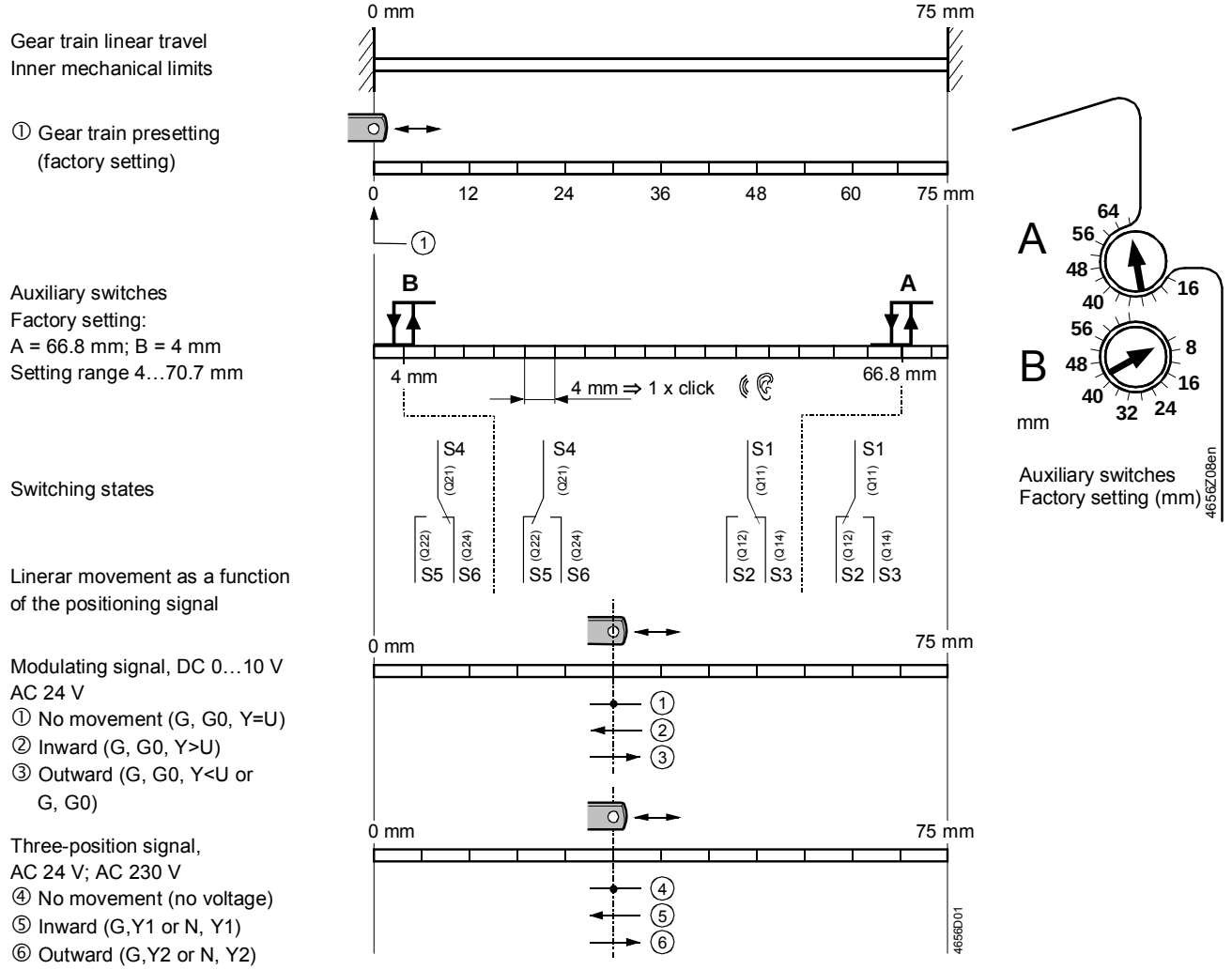
Drive motor

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

3.2 Linear travel, auxiliary switches and positioning signal

Mechanical and electrical functions

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



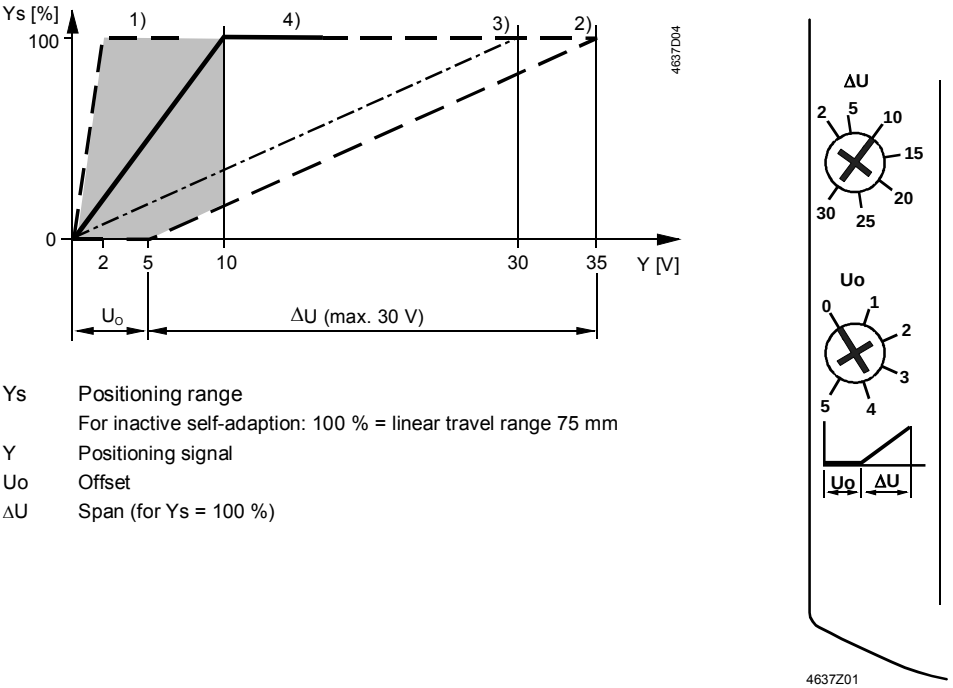
Note

The setting shafts for the auxiliary switches turn together with the actuator. The scales are valid only for the **zero position of the actuator** (push rod retracted) on "**outward**" linear travel.

3.3 Adjustable characteristic function

Actuators
GBB163.2

A modulating positioning signal DC 0…35 V from a controller drives the actuator. The linear travel 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-adaption: 100 % = linear travel range 75 mm
Y Positioning signal
Uo Offset
ΔU Span (for Ys = 100 %)

Examples as per the diagram

Example	Positioning signal Y	Pos. 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

Determine 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 linear travel range is 75 mm.

Formula

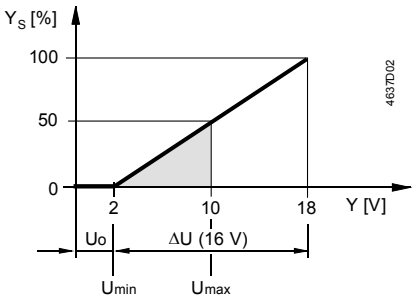
Calculating the setting value for ΔU:

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

Potentiometer settings

Uo = 2 V, ΔU = 16 V

Characteristic function for example



Max. positioning range Ysmax = 100 % (75 mm)
Span range Ys = 50 % (37.5 mm)
Offset Uo = **2 V**
Span ΔU = **16 V**

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

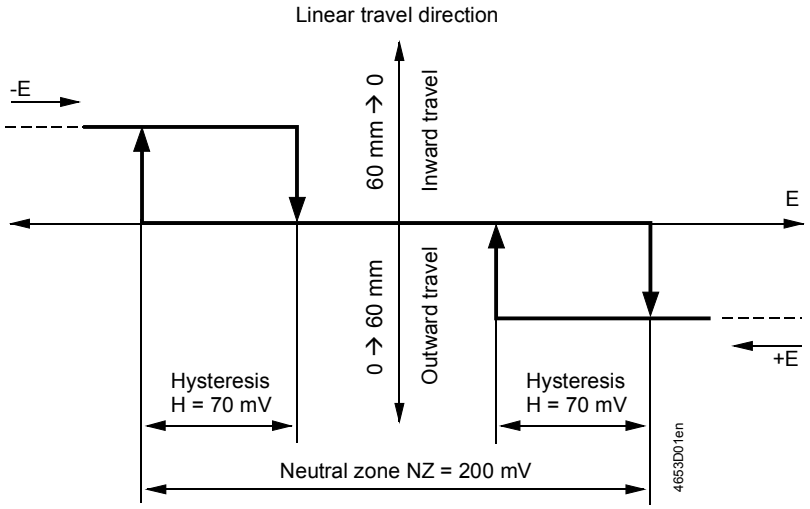
3.4 Neutral zone

Actuators
GBB16...2 (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**) and if the linear travel direction is set to **"outward travel"**.



Actuators
GBB163.2,
(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 %
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 % runtime 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

⚠ 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.

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 linear actuator

Required linear actuator

To determine the linear actuator, define the required total torque for the damper system. The total torque and the given construction allow you to determine the linear force. The type of actuator then results from the table:

If the linear force is	then use type
≤ 125 N	GDB...2 (max. 180 N)
≤ 250 N	GLB...2 (max. 350 N)
≤ 400 N	GEB...2 (max. 800 N)
≤ 550 N	GBB...2 (max. 1100 N)

5 Mounting notes

Mounting instructions	All information and steps to properly prepare and mount the actuator are available in the mounting instructions 4 319 2686 0 (M4656) delivered with the actuator.
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 the bottom). • Mount the actuator at max. +/- 45 ° to the vertical line.
Linear force support	• Rotary damper application: To support the linear force a stable support for the actuator in accordance with the mounting instructions is required. • Linear damper application: Secure the actuator using two taptite M6 screws.
Manual adjustment	You can manually adjust the push rod by pressing the gear train disengagement button. To ensure a tight shutoff function for the dampers and the exact switching position for switches A and B, adjust the actuator only if not voltage is applied.
Mechanical limitation of linear travel	If needed, you can limit the linear travel by selecting a specific damper lever length or by using the linear/rotary set ASK72.1 or ASK72.2.
Application of the linear/rotary sets	Mount the sets to convert a rotary movement to linear movement (refer to section 2.2 "Type summary") by following the separate mounting instructions.

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
- "Diagrams" in chapter 9, and the
- HVAC plant diagram.

6.1 Permissible line lengths and cross-sectional area

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

Note

To determine the permissible line length, 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
GBB13..2	AC 24 V	G, Y1, Y2	4 % each (tot. 8 %) of AC 24 V
GBB16..2	AC 24 V	G0, G G0, Y, U	4 % each (tot. 8 %) of AC 24 V 1 % each of DC 10 V
GBB33..2	AC 230 V	L, N	2 % each (tot. 4 %) of AC 230 V

Notes on the G0 line (GBB16..2)

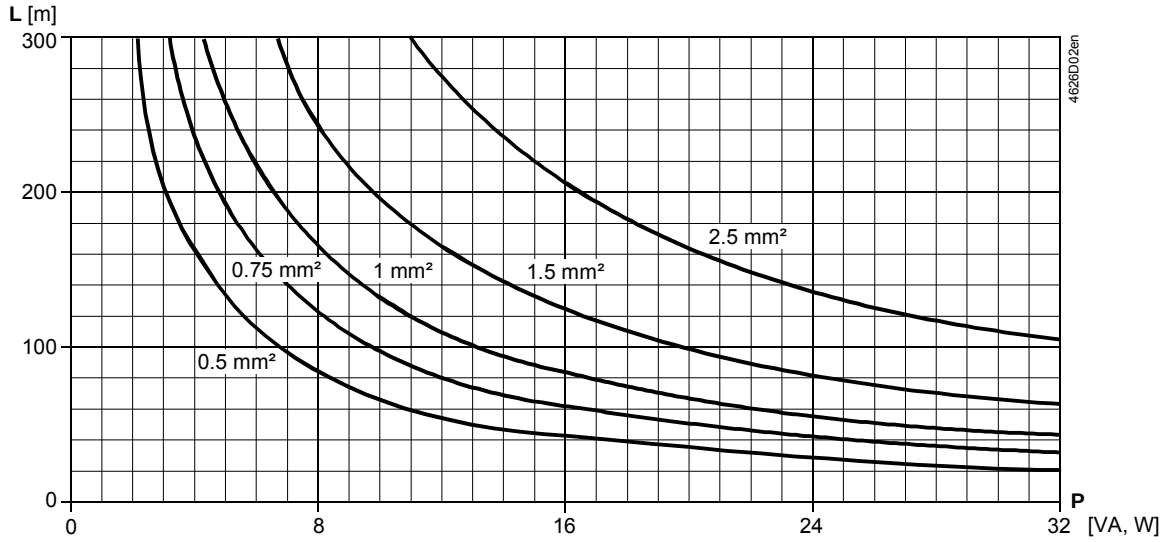
Consider the following criteria:

- 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 (ca. DC 8 mA)
  - Positioning signal current DC 0.1 mA (from Y = DC 10...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

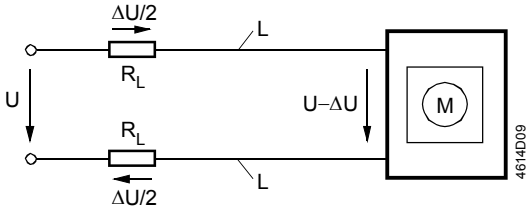
The diagram applies to AC 24 V and shows the permissible line length **L** as a function of consumption **P** and as a parameter of the cross-sectional area.



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 diagram.
- P is the primary power consumption for all actuators connected in parallel.

Diagram:
Voltage drop on the supply lines



Formula for line length

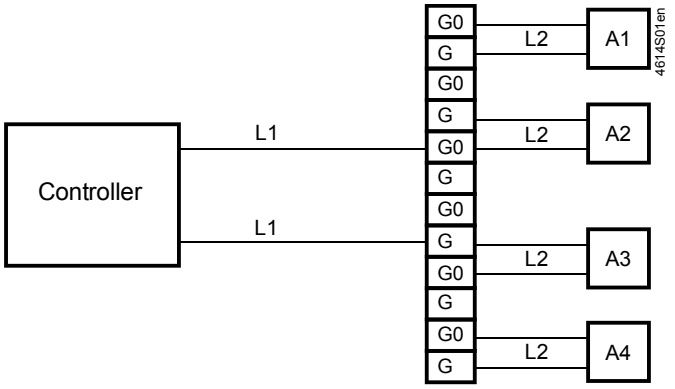
The maximum line length can be calculated using the following formula.

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 [mm²]
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 area 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..2

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

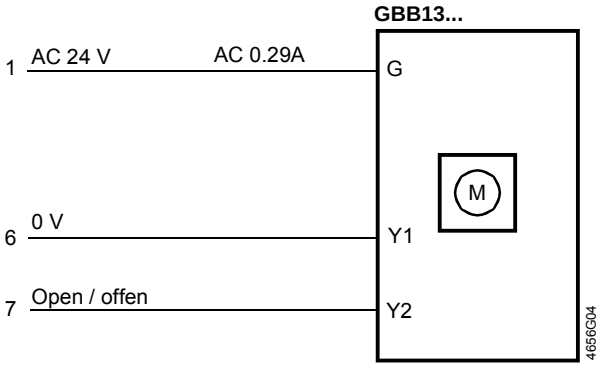
Power consumption and perm. voltage drop with one actuator

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

Operating voltage/ positioning 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)

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 GBB13..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
GBB16..2

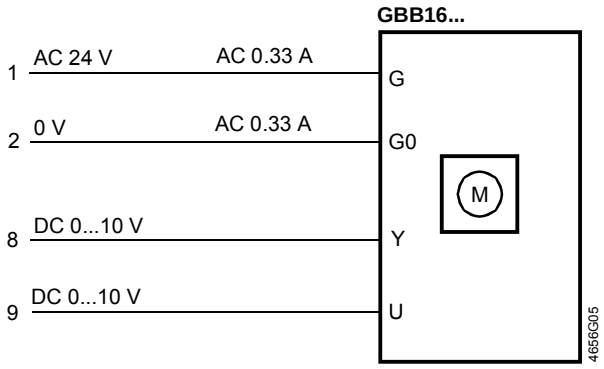
With AC supply, the G0 line has a AC 0.33 A supply current and a DC 0.1 mA positioning signal current (from Y = DC 0...10 V). The AC voltage drop on the G0 line does not impact the positioning signal Y.

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

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 GEB16..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 line cross-sectional area, or
  102 m at 2.5 mm^2 line cross-sectional area.

7 Commissioning notes

References

All information necessary for commissioning is contained in the following:

- This document ("Technical basics" Z4656en)
- Mounting instructions 74 319 2686 0 (M4656)
- 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.
- Linear movement check: Manually change the damper setting by pressing the gear train disengagement button and moving the push rod (only if no voltage is applied).
- Linear force support: Make sure the actuator is properly secured at the maximum possible tight shutoff of the dampers.

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

Linear movement: Three-position control
GBB13..2, GBB33..2

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

Wire connections		Linear travel direction
AC 24 V	**AC 230 V**	
1 – 6	4 – 6	Inward
1 – 7	4 – 7	Outward
1 – 6 / 1 – 7 open	4 – 6 / 4 – 7 open	Actuator stays in position reached

Linear movement: Modulating control
GBB16..2

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

- When applying input signal Y = DC 10 V, the push rod travels inward or outward depending on the position of the linear travel direction switch.
- The linear travel direction set at the 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 push rod returns to its zero position.

Characteristic function for the positioning signal
GBB163.2

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
GBB16..2

Check of output voltage U:

- For inactive self-adaption: U = DC 0...10 V for the **linear travel range of 75 mm**
- For active self-adaption: U = DC 0...10 V for the **determined linear travel range**

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 to the desired value by means of a screwdriver tool (see section 3.2, "Linear travel, auxiliary switches").

Important

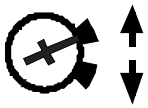
The scale values are valid only for the **zero position** of the actuator in the **"outward"** direction of linear travel.

Factory setting

The auxiliary switches have the following factory settings:

- Switch A: Switching point at 4 mm
- Switch B: Switching point at 66.8 mm

Linear travel direction switch
of GBB16..2



The selected direction of linear travel must agree with the required movement of the air damper.

Factory setting

Outward

8 Technical data

⚠ AC 24 V power supply (SELV/PELV) GBB13..2, GBB16..2	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 GBB13..2:	Actuator running	7 VA / 7 W
	GBB16..2:	Actuator running	8 VA / 8 W
		Holding	1.1 W
⚠ AC 230 V power supply GBB33..2	Operating voltage		AC 230 V ± 10 %
	Frequency		50/60 Hz
	Supply line fuse		max. 10 A
	Power consumption:	Actuator running	5 VA / 5 W
Function data	Nominal linear force		550 N
	Maximum linear force (blocked)		1100 N
	Minimum holding force		550 N
	Maximum linear travel (mechanically limited)		75 mm
	Runtime for 75 mm linear travel		150 s (50 Hz) / 125 s (60 Hz)
	Mechanical life		10^5 cycles

⚠ Inputs

Positioning signal for GBB13..2	Operating voltage AC 24 V	(wires 1-6)	inward travel
		(wires 1-7)	outward travel
Positioning signal for GBB33..2	Operating voltage AC 230 V	(wires 4-6)	inward travel
		(wires 4-7)	outward travel
Positioning signal for GBB16..2	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 non-adjustable characteristic function		200 mV
	for adjustable characteristic function		2 % of ΔU
	Hysteresis for non-adjustable characteristic function		70 mV
	for adjustable characteristic function		0.7 % of ΔU
Adjustable characteristic for GBB163.2,	Adjustable with 2 potentiometers:		
	Offset Uo		DC 0...5 V
	Span ΔU for Ys = 100 %		DC 2...30 V
	Max. input voltage		DC 35 V
	Protected against faulty wiring		max. AC 24 V

⚠ Outputs

Position indicator for GBB16...2	Output signal (wires 9-2)	
	Output voltage (for Ys = 0...100 %)	DC 0...10 V
	Max. output current	DC ± 1 mA
	Protected against faulty wiring	max. AC 24 V

⚠ Auxiliary switches for GBB136.2, GBB336.2	Contact rating		6 A res., 2 A ind.
	Life:	6 A ind., 2 A ind.	10^4 cycles
		5 A ind., 1 A ind.	5 x 10^4 cycles
		without load	10^6 cycles
	Switching voltage		AC 24...230 V
	Nominal current res./ind.		6 A / 2 A
	Electric strength auxiliary switch against housing		AC 4 kV
	Switching range for auxiliary switches		4...70.7 mm
	Setting increments		4 mm
	Switching hysteresis		2 mm
	Factory switch setting		
	Switch A		4 mm
	Switch B		66.8 mm
Connecting cables	Cross section of prewired connecting cables		0.75 mm^2
	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 60730
	AC 24 V		III
	AC 230 V		II
	Feedback potentiometer		III
	Auxiliary switches		II
Environmental conditions	Operation		EN 60721-3-3
	Climatic conditions		class 3K5
	Mounting location		interior, weather-protected
	Temperature		–32....+55 °C
	Humidity (noncondensing)		< 95 % r. h.
	Transport		EN 60721-3-2
	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 (Application)		For residential, commercial and industrial environments
	EU Conformity (CE)		A5W00004366 [1]
	RCM Conformity		A5W00004367 [1]
	Environmental compatibility [2]		CE1E4626en [1]
Dimensions	Actuator W x H x D (see "Dimensions")		100 x 298 x 67.5 mm
	Push rod (profile)		15 x 5 mm
Weight	Without packaging		2 kg

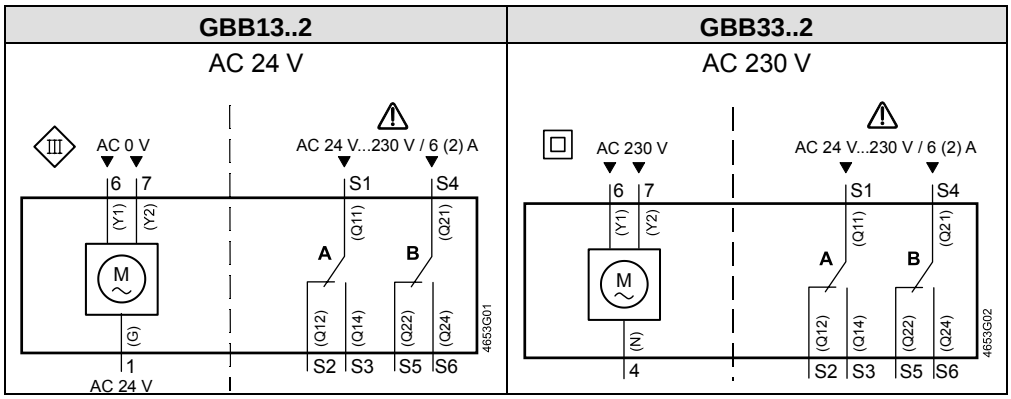
[1] The documents can be downloaded from http://siemens.com/bt/download

[2] The product environmental declaration contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal).

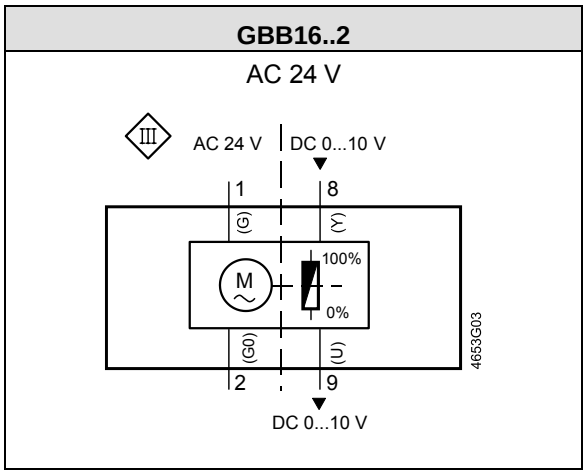
9 Diagrams

9.1 Internal diagrams

Three-position control



Modulating control
Y = DC 0...10 V, 0...35 V



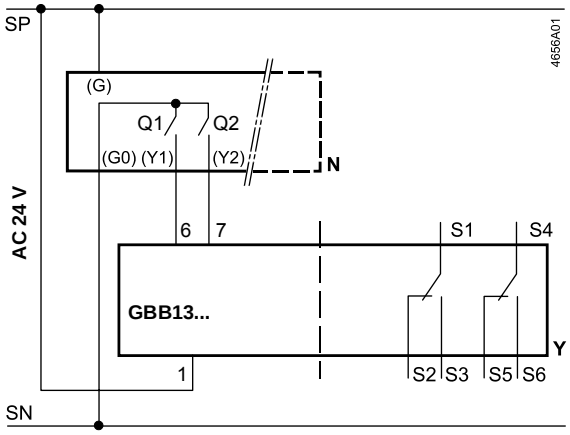
9.2 Cable labeling

All wires are color-coded and labeled.

Pin	Cable				Meaning
	Code	No.	Color	Abbreviation	
Actuators AC 24 V	G	1	red	RD	System potential AC 24 V
	G0	2	black	BK	System neutral
	Y1	6	purple	VT	Pos. signal AC 0 V, inward travel
	Y2	7	orange	OG	Pos. signal AC 0 V, outward travel
	Y	8	gray	GY	Pos. signal DC 0...10 V, 0...35 V
	U	9	pink	PK	Position indication DC 0...10 V
Actuators AC 230 V	N	4	blue	BU	Neutral conductor
	Y1	6	black	BK	Pos. signal AC 230 V, inward travel
	Y2	7	white	WH	Pos. signal AC 230 V, outward travel
Auxiliary switches	Q11	S1	gray/red	GY RD	Switch A Input
	Q12	S2	gray/blue	GY BU	Switch A Normally Closed contact
	Q14	S3	gray/pink	GY PK	Switch A Normally Open contact
	Q21	S4	black/red	BK RD	Switch B Input
	Q22	S5	black/blue	BK BU	Switch B Normally Closed contact
	Q24	S6	black/pink	BK PK	Switch B Normally Open contact

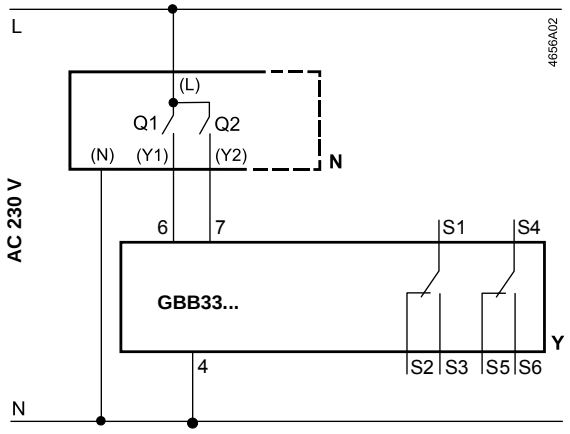
9.3 Connection diagrams (three-position control)

GBB13..2
AC 24 V (SELV/PELV)



N Controller
Y Actuator GBB13..2
SP System potential AC 24 V
SN System neutral
Q1, Q2 Controller contacts

GBB33..2
AC 230 V



N Controller
Y Actuator GBB33..2
L System potential AC 230
N System neutral
Q1, Q2 Controller contacts

Operating states for actuators GBB13..2, GBB33..2

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

Controller contacts Q1	Controller contacts Q2	Operating state
		Remains in position reached
		↓
		↑
		Not permissible

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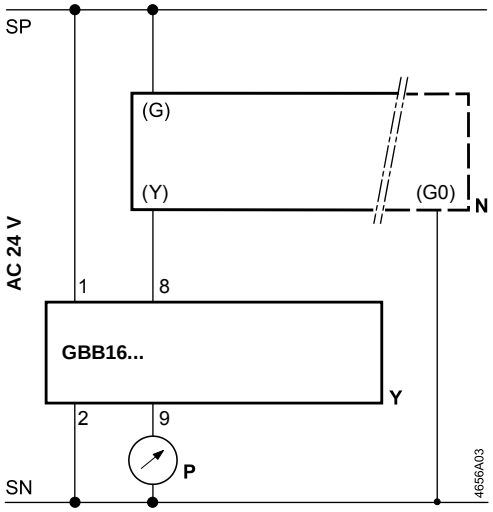
9.4 Connection diagrams (modulating)

9.4.1 Typical application

The controller output is connected directly to the actuator input.

GBB16..2

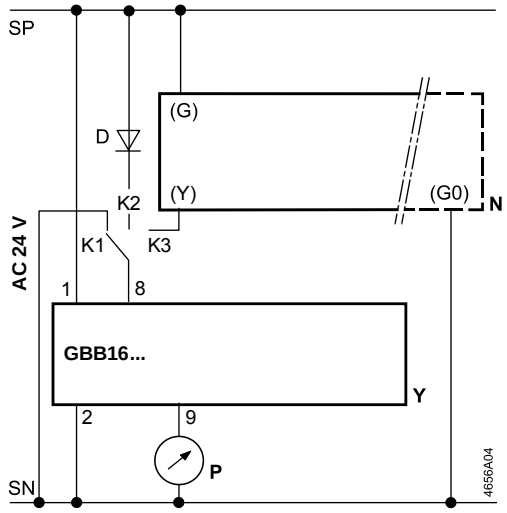


N Controller
Y Actuator GBB16..2
P Position indication
SP System potential AC 24 V
SN System neutral

9.4.2 Special diagram for modulating control

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

Modulating control, fully open, fully locked with GBB16..2



N Controller
Y Actuator GBB16..2
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 GBB16..2

Switch contacts	Operating state	Linear direction	
K3	Modulating control	↕	↕
K2	Fully open	↑	↓
K1	Fully closed	↓	↑
Linear travel direction Switch		↕	

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Note GBB163.2

*) Actuators with adjustable characteristic function: Full opening cannot be reached (depending on Uo, ∆U) in this position (switch contact K2).

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.

  See also European Directive 2012/19/EU
- 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.

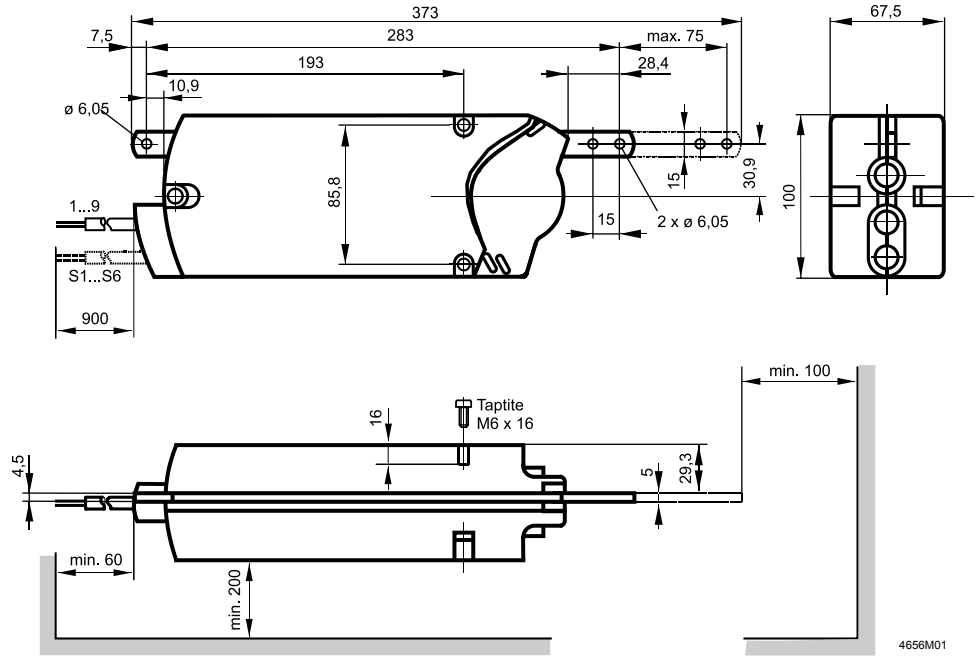
11 Appendix

Chapter contents

This chapter contains:

- Linear 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 linear 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

Document number (classification no.)	Title/description	Contents
CM2N4656en (N4656)	Actuators for air dampers, linear version (GBB...2: Three-position, modulating)	Type overview, function and selection criteria
4 319 2686 0 (M4656)	Mounting instructions	Instructions on mounting a linear actuator

Accessories

CM2N4699en (N4699)	Accessories and spare parts for actuators ASK7	Overview, allocation to actuator type, and application
4 319 2724 0 (M4656.1)	Linear/rotary set with mounting plate ASK72.1	Mounting instructions and application examples
4 319 2848 0 (N4656.2)	Linear/rotary set with mounting plate ASK72.2	Mounting instructions and application examples
4 319 2947 0 (N4656.3)	Weather shield for linear actuator ASK75.2	Preparation and mounting instructions

Standards

HD 384	Electrical installations in buildings
EN 61558	Safety of transformers, mains-powered units and similar equipment
EN 60730	Automatic electrical controls for household and similar use
IEC/EN 60000-6-1 IEC/EN 60000-6-2	Electromagnetic compatibility: Immunity Electromagnetic compatibility: Immunity
IEC/EN 60000-6-3	Electromagnetic compatibility: Emissions
2004/108/EC	Directive for electromagnetic compatibility
2006/95/EC	Low voltage directive

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