SIEMENS

OpenAir™
Rotary damper actuators without spring return GDB/GLB
Technical basics

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1 Introduction

1.1 Revision history

Changes	Date	Chapter	Pages
Typ GSF..1 removed	19.09.2013	all	whole Document
Types GDB/GLB..1J and GDB/GLB..1L removed	01.02.2011	all	whole Document
Diversification of the range of products with the types GDB/GLB..1J and GDB/GLB..1L	30.07.2004	all	whole Document
Electrical parallel connection	31.03.2005	4.2	16
Permissible line lengths and cross-sectional aera		6.1	20/21
Technical data (Dimensions)		8	27
Environmental compatibility and disposal		10	32
Referenced documents (Documents and standards)		11.3	34

1.2 About this document

Main target group

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

Purpose

This document provides basic knowledge. In addition to background information, it contains general technical fundamentals on the GDB..1.. / GLB..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 GDB..1.. / GLB..1.. for:

- Three-position control and
- Modulating control

The following topics are discussed:

- Type summery 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 rotary actuators

Introduction

This chapter provides information on application, functions, and equipment combinations. Furthermore, it contains a type summery 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 0.8 m^2 (GDB) and 1.5 m^2 (GLB), 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 actuator types.

Mode of control Mode of control Modulating

GDB../GLB..	131.1E	132.1E	136.1E	331.1E	332.1E	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 Characteristic function Uo, ΔU								X	X	
Position indicator U = DC 0...10 V							X	X	X	X
Feedback potentiometer 1 kΩ		X			X					
Self-adaption of rotary angle range							X	X	X	X
Auxilliary switches (two)			X			X			X	X
Rotary direction switch							X	X	X	X

Accessories, spare parts

See data Sheet for accessories and spare parts N4698

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

Accessories

Rotary/linear set with lever	**ASK71.5**
Rotary/linear set for duct and wall mounting	**ASK71.6**
Universal lever	**ASK71.9**
Long lever, T-level valve BG and inserts	**ASK78.x**

2.3 Description of functions

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

Type	**GDB13..1../GLB13..1.. GDB33..1 GLB33..1**	**GDB16..1../GLB16..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 ∆U = 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 DIL switch clockwise / counterclockwise • 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: Mechanical	Rotary angle position indication by using a position indicator	
Position indication: Electrical	Connecting the feedback potentiometer to an external voltage source results in a voltage proportional to the rotary angle.	Position indicator: Output voltage U = DC 0...10 V is generated proportional to the rotational angle. The direction of action (inverted or not inverted) of output voltage U depends on the DIL switch position.
Auxiliary switch	The switching points for auxiliary switches A and B can be set independent of each other in increments of 5° within 0 to 90°.	
Self-adaptation of rotary angle range		• The actuator automatically determines the mechanical end of range for the rotational angle • The characteristic function (Uo, ∆U) is mapped to the determined rotary angle range
Manual adjustment	The actuator can be manually adjusted by pressing the gear train disengagement button.	
Mechanical limitation of rotary angle	The rotary angle can be limited with an adjusting screw within 0 to 90°.	

2.3.1 Supplementary information on the description of functions for modulating actuators.

Characteristic function
GDB/GLB163.1,
GDB/GLB164.1

Offset Uo and span ΔU can be adjusted using two potentiometers (see section 3.4 “Adjustable characteristic function”). Actuators featuring this function can be used for the following applications:

- Dampers with a rotary angle limitation can, for instance, be controlled in the range of 0°...45° on a control signal of max. DC 10 V (offset Uo and effective span ΔUw, with or without self-adaption)
- As a sequencing actuator in control loops that can only apply a DC 0...10 V control signal to control more than one sequence
- In control systems with a control signal deviating from DC 0...10 V such as DC 2…10 V

Self-adaption of the rotary angle range
GDB/GLB16..1

The actuator automatically determines the mechanical end of range for the rotary angle on:

- Activated self-adaption and switching-on of operating voltage
- Switch-on and switch-off for self-adaption when operating voltage is supplied

The table shows the different effects of the characteristic function’s mapping to the rotary angle range for “inactive self-adaptation” and “active self-adaption” (refer to section 3.4 “Adjustable characteristic function”).

Inactive self-adaption	Active self-adaption
• The actuator maps the characteristic function (Uo, ΔU) to the positioning range Ys = 100 % for **rotary angle 90°** • The actuator calibrates the position indication with U = DC 0...10 V for **rotary angle 90°**	• The actuator maps the characteristic function (Uo, ΔU) to the positioning range Ys = 100 % for **the determined rotary angle range** • The actuator calibrates the position indication with U = DC 0...10 V for **rotary angle 90°**

Electronics calibrates the positioning signal according to the adjusted rotary angle range for the following types of actuators:
GDB / GLB161.1.., GDB / GLB166.1E with DC 0…10 V
GDB / GLB163.1.. and GDB / GLB 164.1E with the selected values of offset Uo and span ΔU (refer to section 3 «Technical design»)

Note
The output voltage for position indication will not be affected, that is, the full span of 100 % (nominal rotary angle 90°) corresponds to DC 0…10 V.

2.4 Controllers

The actuators can be connected to all controllers having the following outputs.
All safety-related requirements must be met (refer to section 4 “Engineering notes”).

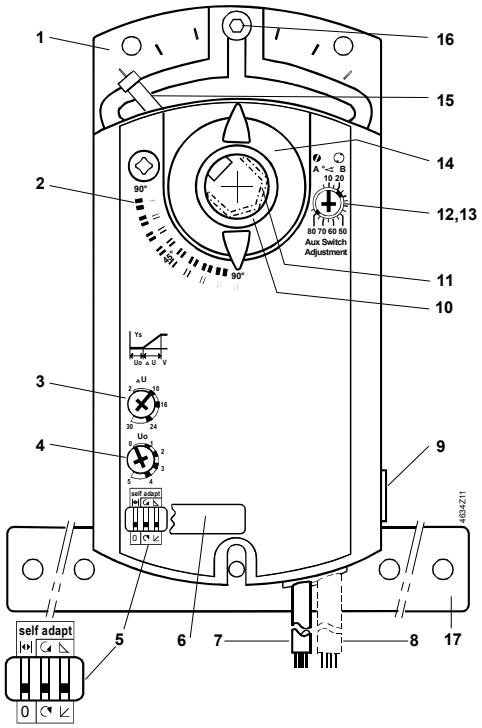
Actuator type	Mode of control	Controller output
GDB13..1/GLB13..1	Three-position	AC 24 V
GDB33..1/GLB33..1	Three-position	AC 230 V
GDB16..1/GLB16..1	Modulating	DC 0...10 V / DC 0...35 V

2.5 Mechanical design

Description	The electromotoric rotary GDB/GLB..1.. actuators are available for three-position and modulating control. The maximum torque is 5 Nm (GDB) and 10 Nm (GLB). The actuators are equipped with prewired connecting cables.
Housing	Robust, light-weight plastic housing. 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.
Shaft fastening	The coupling bushing is made from hardened sintered steel. This mounting type allows for fastening the actuator to shafts with various diameters and in various shapes (square, round) using just one socket head cap screw (4 mm).
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 metal strip is used to attach the actuator.
Centering element	Ensuring a friction-locked connection between a damper shaft with a small diameter (8...10 mm) and the coupling bushing Reducing the vertical movement of the actuator by applying eccentric movement.
Electrical connection	The actuators are equipped with prewired 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.
DIL switches	The DIL switches are accessible from the front and can be used for: – self-adaptation – direction of rotation – inverted or non-inverted output voltage operating function
Feedback potentiometer for position indication	The potentiometer is integrated and can be connected by means of a cable.
Cover for DIL switch	This cover protects the DIL switch against dust and water spray.

2.6 Setting and operating elements

Actuator



Legend

1 Base plate and housing
2 Rotational angle scales 0°...90° / 90°…0°
3 Potentiometer to adjust the span ΔU
4 Potentiometer to set the offset U_0
5 DIL switches for
– self-adaptation
– direction of rotation
– inverted or non-inverted output voltage operating function
6 Cover for DIL switches
7 Connecting cable for power, control signal and position indication
8 Connecting cable for auxiliary switches or feedback potentiometer
9 Slider to disengage the gear train
10 Coupling bushing
11 Centering element (shaft diameter 8…10 mm)
12,13 Setting shafts for auxiliary switches A and B
14 Position indicator
15 Adjustment lever with shaft fastening screw
16 Adjusting screw for rotational angle limitation
17 Mounting bracket

DIL switches settings

The following functions can be set and thus require checking.

DIL switch 1: Self-adaption

Self-adaptation can either be ON or OFF. See “Functions” for a functional description.

Factory setting: Self-adaption OFF (0)

DIL switch 2: Direction of rotation

The rotational movement direction must match the desired damper movement direction (clockwise or counter-clockwise).

Factory setting: Clockwise direction (↷).

DIL switch 3: Output voltage characteristic

Output voltage characteristic U of the electrical position indication can be selected independent of the rotational movement direction. The following variants are possible:

Rot. movement direction 0…90°	DIL switch position	Output voltage U
↷	non-inverted	DC 0…10 V
↷	inverted	DC 10…0 V
↶	non-inverted	DC 0…10 V
↶	inverted	DC 10…0 V

Factory setting

Characteristic non-inverted (∠)

Y_S = 0…100 % (0°…90°)

U = DC 0…10 V

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

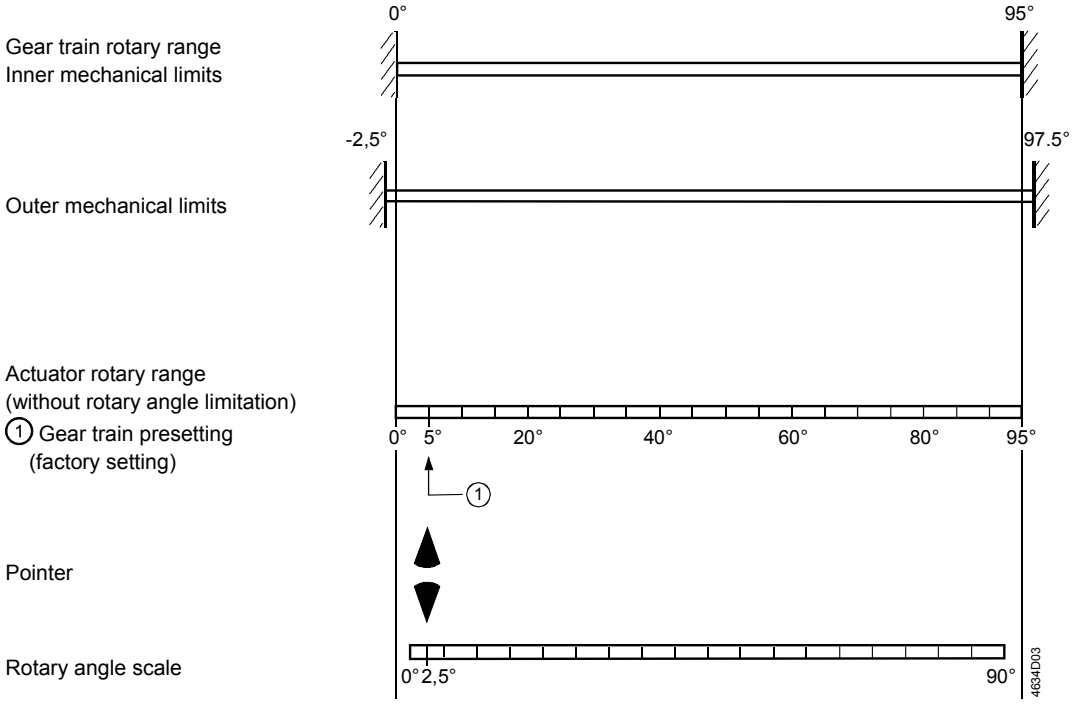
Drive motor

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

3.2 Rotary range and mechanical limitation

Mechanical functions

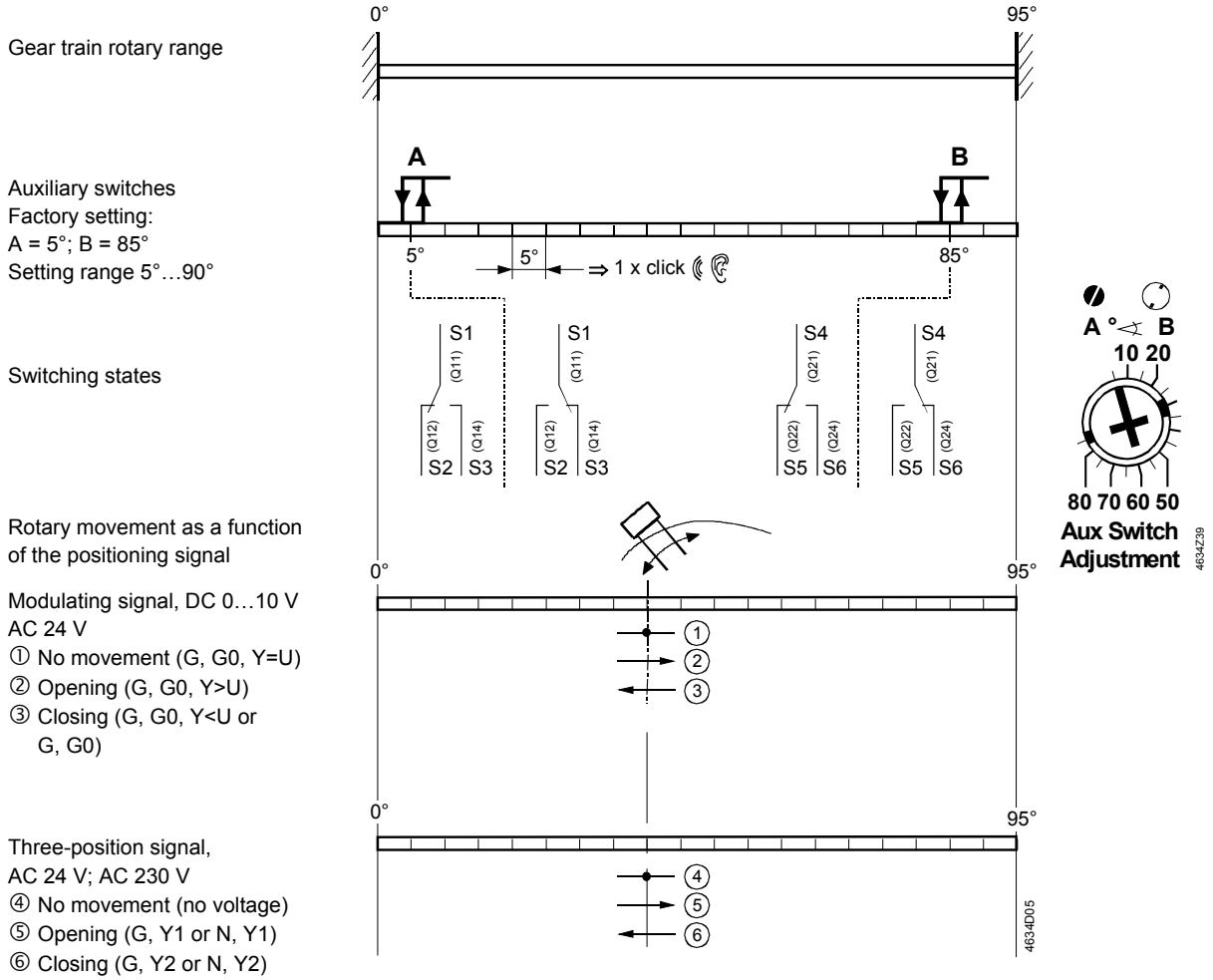
The illustration below shows the relationship between the inner and outer mechanical limitation of the rotary range.



3.3 Auxiliary switches and positioning signals

Electrical functions

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



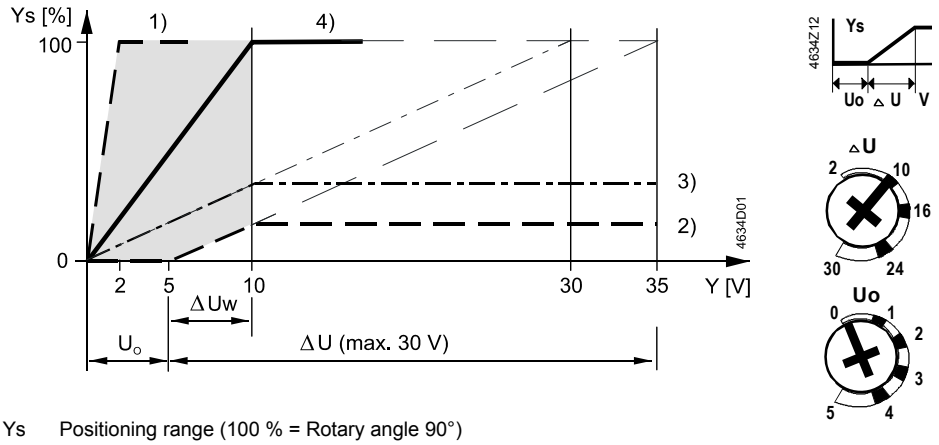
Note

The setting shafts for the auxiliary switches turn together with the adapter. The scales thus only refer **to the "0°" actuator position (clockwise direction).**

3.4 Adjustable characteristic function

Actuators
GDB/GLB163.1,
GDB/GLB164.1

A modulating positioning signal DC 0..35 V from a controller controls the actuator. The rotary angle 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 (100 % = Rotary angle 90°)
Y Control signal
Uo Offset range
ΔU Span (for Ys = 100 %)
(virtual span if Y> 10 V)
ΔUw Effective span = 10 V - Uo

Examples as per diagram	Set offset Uo	Span ΔU		Control range Ys
		Set	Effective	
1) Min. span	DC 0 V	DC 2 V	DC 2 V	100 % / 90°
2) Min. rotational angle	DC 5 V	DC 30 V	DC 5 V	16.7 % / 15°
3) Min. rotational angle	DC 0 V	DC 30 V	DC 10 V	33.3 % / 30°
4) Factory setting	DC 0 V	DC 10 V	DC 10 V	100 % / 90°

Note

The Y input is limited to a max. of DC 10 V, i.e., voltages > DC 10 V are limited
The virtual adjustable span ΔU is max. 30 V
The effective span ΔUw = 10 V - Uo is between 0 V and 10 V

Example

Define the adjustable span ΔU for an actuator that is to open from 0...50 % (0…45°).
The offset Uo is 2 V.

Formula

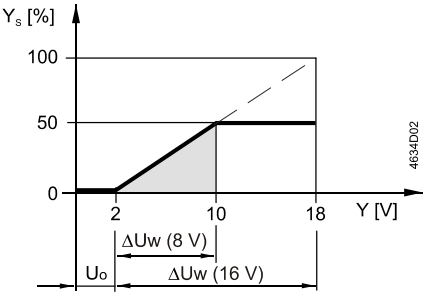
Calculating the setting value for ΔU:

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

Potentiometer settings

Uo = 2 V, ΔU = 16 V

Characteristic function for the example



Max. positioning range
Ysmax = 100 % (90°)
Span Ys = 50 % (45°)
Offset Uo = 2 V
Virtual span ΔU = 16 V
Effective span ΔUw = 8 V

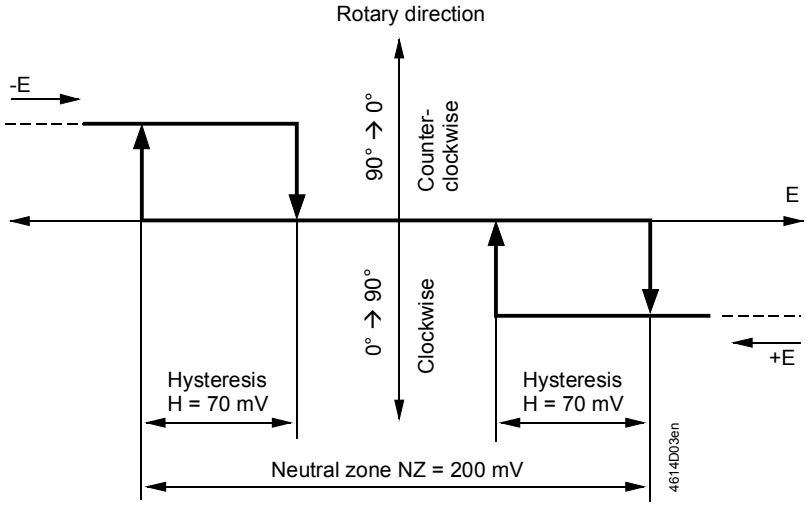
3.5 Neutral zone

Actuators
GDB16..1../GLB16..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 rotary direction, including hysteresis and neutral zone.

Actuators
GDB163.1/GDB164.1
GLB163.1/GLB164.1
(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 may result.

⚠ General regulations

Observe the following general regulations during engineering and project execution:
Electric and high-power 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 automation 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 by **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 transformers as per EN 61558, with double insulation, designed for 100 % run time 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, additional line G0 (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.

⚠ Feedback potentiometer for position indication

Include the potentiometer's electric data to indicate the damper position via external switching.

Electrical parallel connection of actuators

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 device 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 used with 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 using 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.

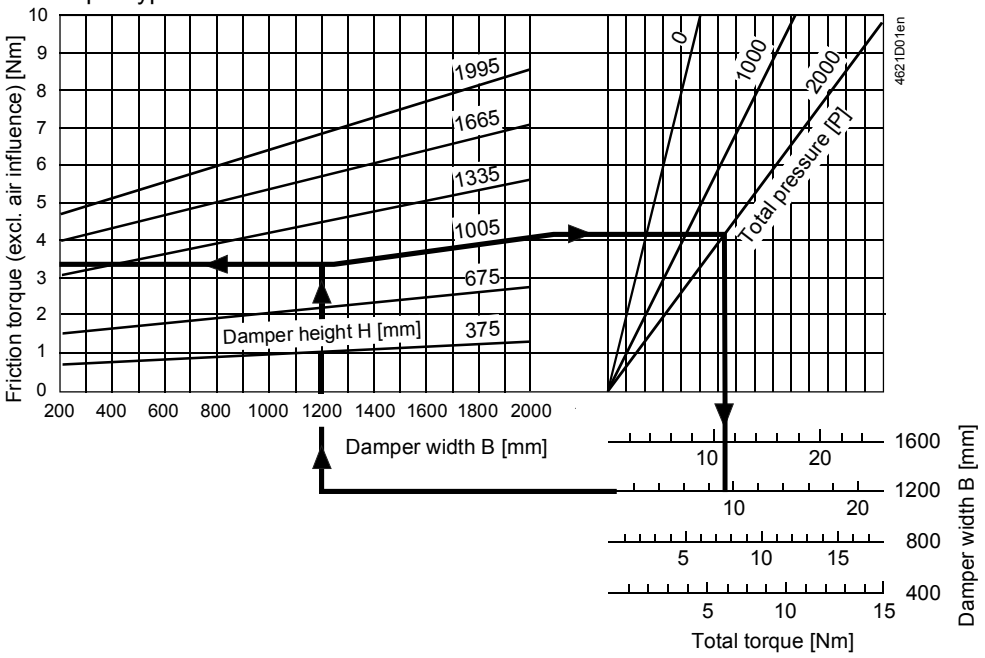
4.4 Determining the actuator

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 diagrams.

Sizing chart

The following diagram (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) [2]
≤ 25 Nm	GBB..1 (25 Nm) [3]
≤ 30 Nm	2 x GEB..1 (2 x 15 Nm) [4]
≤ 35 Nm	GIB..1 (35 Nm) [5]
≤ 70 Nm	2 x GIB..1 (2 x 35 Nm) [6]

Notes

[1] Safety Factor SF:
When calculating the number of actuators, remember to include non-definable 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 10 Nm, you can use the following:

[2] One actuator of type series GEB...1 or

[3] One actuator of type series GBB...1 or

[4] Two actuators (tandem-mounted “Powerpack”) of type series GEB13..1, GEB33..1, or

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

[6] 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, N4656 and N4698).

5 Mounting notes

Mounting instructions	All information and steps to properly prepare and mount the actuator are available in the Mounting Instructions 4 319 2883 0 (M4634), and 74 319 0394 0 (M4628) delivered with the actuator.
Mounting position	Choose the actuator's mounting position so that you can easily access the cables, the setting elements on the front of the actuator, as well as the terminal strip and the post headers. Refer to section 11.11 and 11.12 "Dimensions".
Device protection	IP54 (note mounting instructions)
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 +5° which ensures a tight close-off for the air dampers.
Manual adjustment	The actuator can be manually adjusted by pushing the gear train disengagement button.
Mechanical limitation of rotary angle	If necessary, you can limit the rotary angle at increments of 2° for the entire span by positioning the adjustment lever with shaft fastening screw 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.

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 0, and the
HVAC plant diagram.

6.1 Permissible line lengths and cross-sectional aera

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

Note

To determine the line length and cross section, 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
GDB/GLB13..1..	AC 24 V	G, Y1, Y2	4 % each (tot. 8 %) of AC 24 V
GDB16..1/GLB16..1..	AC 24 V	G0, G G0, Y, U	4 % each (tot. 8 %) of AC 24 V 1 % of DC 10 V
GDB/GLB32..1	AC 230 V	L, N	2 % each (tot. 4 %) of AC 230 V

Notes on the G0 line GDB16..1../ GLB16..1..

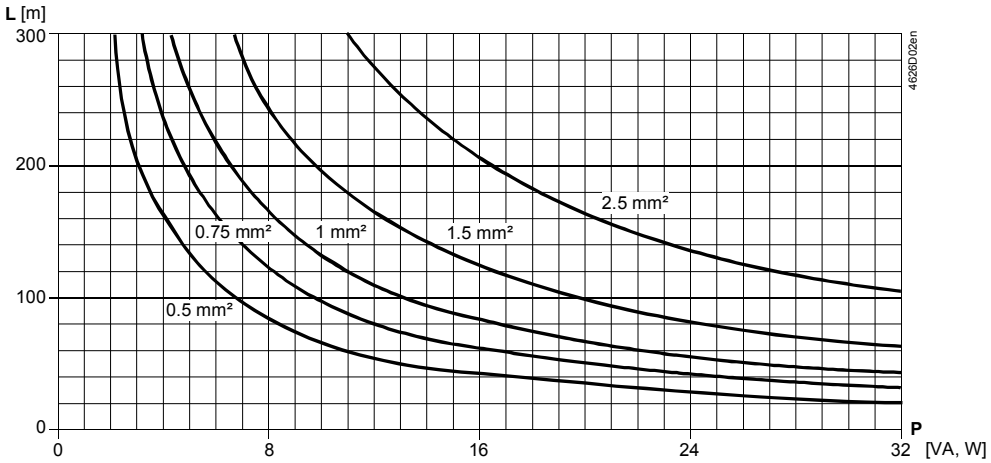
Consider the following criteria:
For modulating control:
The permissible positioning signal error caused by a voltage drop in the line current on the G0 line must not exceed 1 %
The G0 line’s voltage drop caused by surges in the DC circuit in the actuator may not exceed 2 Vpp
In the case of improper 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 % over 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

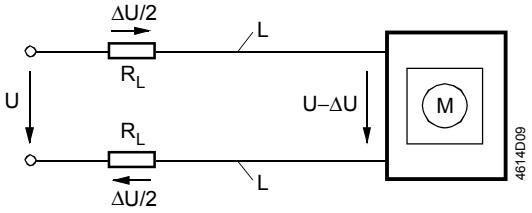
The chart applies to AC 24 V and shows the permissible line length **L** as a function of consumption **P** and as a parameter of the line cross sections.



Notes on chart

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

Basic diagram:
Voltage drop on the supply lines



Formula for line length

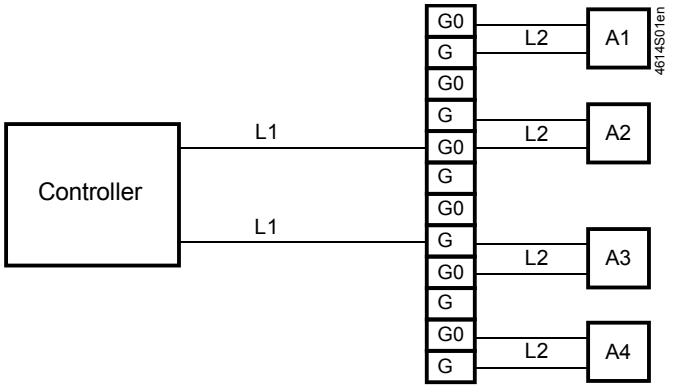
The maximum line length can be calculated using the following formula:

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 Line cross section 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 plate
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 sections 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
GDB/GLB13..1..

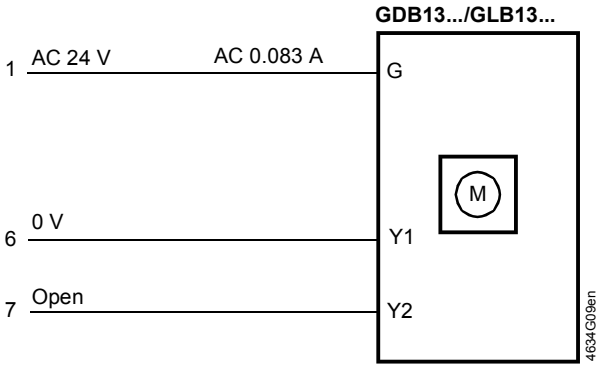
With three-position actuators, only the situation as presented under AC 24 V is important. Sizing takes place via lines 1 (G), 6 (Y1), and 7 (Y2).
The table shows the power consumption of an actuator as well as the permissible voltage drop.

Power consumption and perm. voltage drop with one actuator

Operating voltage/pos. signal	Power consumption	Perm. voltage drop for line 1 (G), 6 (Y1), 7 (Y2)
AC 24 V	2 VA	∆U/U = max. 8 % (4 % each per line)

Diagram: Conduction 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 GDB/GLB13..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 2 VA = 4 VA.
Line current = 2 x 0.083 A = 0.167 A.
Max. permissible single line length: 275 m at 0.75 mm^2 cross-sectional area section.

6.3 Actuator wiring (modulating)

Modulating actuators
GDB16..1../GLB16..1..

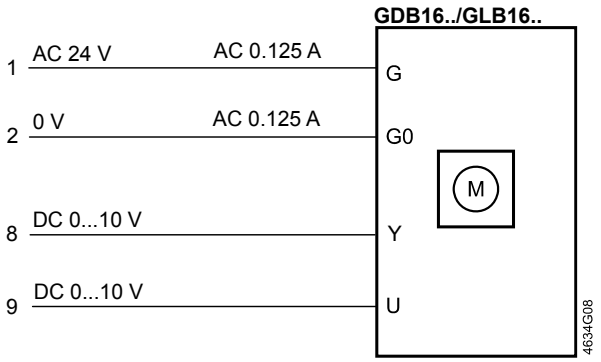
With AC supply, the G0 line has an AC 0.23 A supply current and a DC 0.1 mA positioning signal current (from Y = DC 0...10 V). The AC voltage drop on the G0 line does not impact the positioning signal Y.

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	3 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 GDB16..1 / GLB16..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 3 VA = 12 VA
Line current = 4 x 0.125 A = 0.5 A
Permissible single line length for G, G0:
- 165 m at 1.5 mm^2 line cross section, or
- 275 m at 2.5 mm^2 line cross section

7 Commissioning notes

References

All information necessary for commissioning is contained in the following:
This document (“Technical basics” Z4634en)
Mounting Instructions 74 319 2883 0 (M4634)
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 closed fully 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 not 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
GDB13..1 / GLB13..1,
GDB33..1 / GLB33..1

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

Wire connections		Rotary direction
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
GDB16..1../GLB16..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 DIL switch setting)
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
GDB163.1 / GLB163.1,
GDB164.1 / GLB164.1

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 rotary angle 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 with a screwdriver to the desired value
(see section 3.2, “Rotary 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:

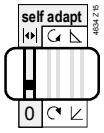
Switch A: Switchover point at 5°
Switch B: Switchover point at 85°

DIL switches for GDB16..1../GLB16..1..

DIL switch settings

The following functions can be set and thus require checking.

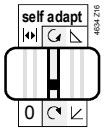
DIL switch 1: Self-adaption



Self-adaption can either be ON or OFF. See “Functions” for a functional description

Factory setting: Self-adaption OFF (0)

DIL switch 2: Direction of rotation



The rotational movement direction must match the desired damper movement direction (clockwise or counter-clockwise)

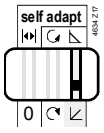
Factory setting: Clockwise direction (↻)

DIL switch 3: Output voltage characteristics for position indication

The operating action of output voltage U of the electrical position indication can be selected independent of the rotational movement direction. The following variants are possible:

Rot. movement direction 0…90°	DIL switch position	Output voltage U
↻	non-inverted	DC 0…10 V
↻	inverted	DC 10…0 V
↺	non-inverted	DC 0…10 V
↺	inverted	DC 10…0 V

Factory setting



Characteristic non-inverted (∠)

Y_S = 0…100 % (0°…90°)

U = DC 0…10 V

Control signal operating function, factory setting

The potentiometers which are used to set the offset and span have the following factory setting: offset Uo = 0 V ; span ΔU = 10 V
The desired value can be adjusted using a flat blade screwdriver in accordance with the information supplied in “Technical design”.

8 Technical data

⚠ AC 24 V supply (SELV/PELV) for GDB13..1../GLB13..1.. GDB16..1../GLB16..1..

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 61558
Supply line fuse			max. 10 A
Power consumption	GDB/GLB13..1:	Running	2 VA / 1 W
	GDB/GLB16..1:	Running	3 VA / 2 W
		Holding	1 W

⚠ AC 230 V power supply for GDB/GLB33..1

Operating voltage		AC 230 V ± 10 %
Frequency		50/60 Hz
Supply line fuse		max. 10 A
Power consumption	Running	2 VA / 1W

Functional data

Nominal torque	5 Nm (GDB / 10 Nm (GLB)
Maximum torque (when locked)	7 Nm (GDB / 14 Nm (GLB)
Minimum holding torque	5 Nm (GDB / 10 Nm (GLB)
Nominal rotary angle (with position indication)	90 °
Maximum rotary angle (mechanic limitation)	95° ± 2°
Runtime for 90° rotary angle	150 s (GDB / GLB)
Mechanical life	10^5 cycles

⚠ Inputs

Positioning signal for GDB13..1../GLB13..1..

Operating voltage AC 24 V	(wires 1-6/G-Y1)	clockwise
	(wires 1-7/G-Y2)	counterclockwise

Positioning signal for GDB33..1/GLB33..1

Operating voltage AC 230 V	(wires 4-6/N-Y1)	clockwise
	(wires 4-7/N-Y1-Y2)	counterclockwise

Positioning signal for GDB16..1../GLB16..1..

Input voltage (wires 8-2/Y-G0)		DC 0...10 V
Current consumption		0.1 mA
Input resistance		> 100 kΩ
Max. permissible input voltage		DC 35 V limited to 10 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 function for GDB163.1../ GLB163.1.., GDB164.1/ GLB164.1

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 GDB16..1../GLB16..1..

Output signal (wires 9-2/U-G0)	
Output voltage U	DC 0...10 V
Max. output current	DC ± 1 mA
Protected against faulty wiring	max. AC 24 V

Feedback potentiometer for GDB132.1/GLB132.1, GDB332.1/GLB332.1

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 GDB136.1/GLB136.1 GDB336.1/GLB336.1 GDB164.1/GLB164.1 GDB166.1/GLB166.1	Contact rating		6 A resistive, 2 A inductive
	Life:	6 A resistive, 2 A inductive	10^4 switchings
		5 A resistive, 1 A inductive	5 x 10^4 switchings
		without load	10^6 switchings
	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 and M4634		IP54
Protection class	Insulation class		as per EN 60730
	AC 24 V, Feedback potentiometer		III
	AC 230 V, Auxiliary switches		II
Environmental conditions	Operation		IEC 60721-3-3
	Climatic conditions		Class 3K5
	Mounting location		interior, weather-protected
	Temperature extended		-32...+55 °C
	Humidity (non-condensing)		< RH 95 %
	Transport		IEC 60721-3-2
	Climatic conditions		Class 2K3
	Temperature extended		-32…+70 °C
	Humidity (non-condensing)		< 95 % R.H.
	Storage		IEC 60721-3-1
	Climatic conditions		Class 1K3
	Temperature extended		-32…+50 °C
	Humidity (non-condensing)		< 95 % R.H.
	Mechanical conditions		Class 2M2
Standards and directives	Product safety		
	Automatic electrical controls		EN 60730-2-14
	for household and similar use		(type 1)
	Electromagnetic compatibility (EMC)		
	Immunity for all models, except GDB/GLB. 32.1		IEC/EN 61000-6-2
	Immunity for GDB/GLB.32.1		IEC/EN 61000-6-1
	Emissions for all models		IEC/EN 61000-6-3
	CE Conformity to		
	EMC-directive		2004/108/EEC
	Low-voltage directive		2006/95/EEC
	C-Tick conformity to		
	Radio Interference Emission Standard		AS/NZS 61000-6-3
Dimensions	Actuator W x H x D (see “Dimensions 11.1”)		70.7 x 137.0 x 60.6 mm
	Damper shaft		
	round		8...16 mm
	round		8...10 mm with centering element
	Square		6...12.8 mm
	Min. length		30 mm
	Max. shaft hardness		< 300 HV
Weight	Standard type without packaging		0.48 kg

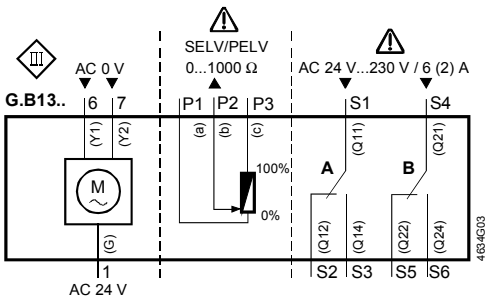
9 Diagrams

9.1 Internal diagrams

Three-position control

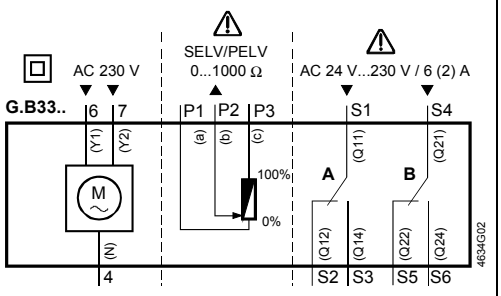
GDB13..1 / GLB13..1

AC 24 V



GDB33..1 / GLB33..1

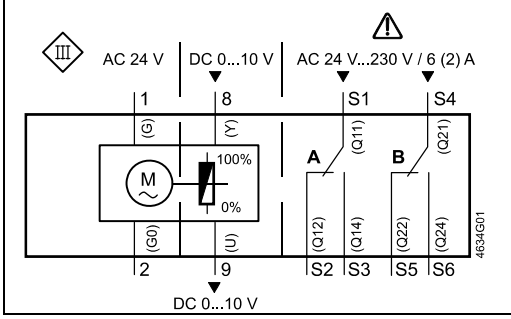
AC 230 V



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

GDB16..1 / GLB16..1

AC 24 V



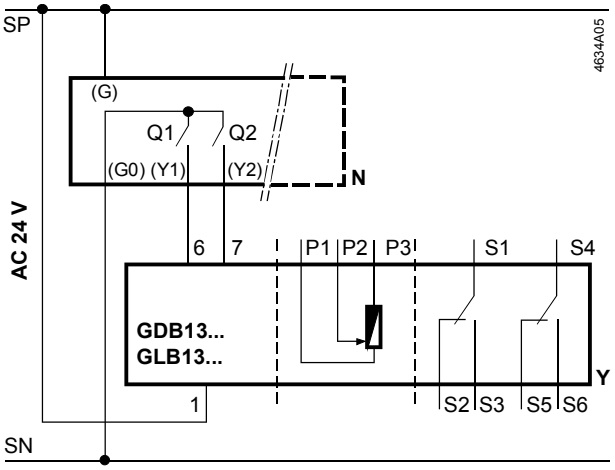
9.2 Cable labeling

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	Positioning signal AC 0 V, “clockwise”
	Y2	7	orange	OG	Positioning signal AC 0 V, “counter-clockwise”
	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	Positioning signal AC 230 V, “clockwise”
	Y2	7	white	WH	Pos. signal AC 230 V, “counter-clockwise”
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
Feedback potentiometer	a	P1	white/red	WH RD	Potentiometer 0...100 % (P1-P2)
	b	P2	white/blue	WH BU	Potentiometer pick-off
	c	P3	white/pink	WH PK	Potentiometer 100...0 % (P3-P2)

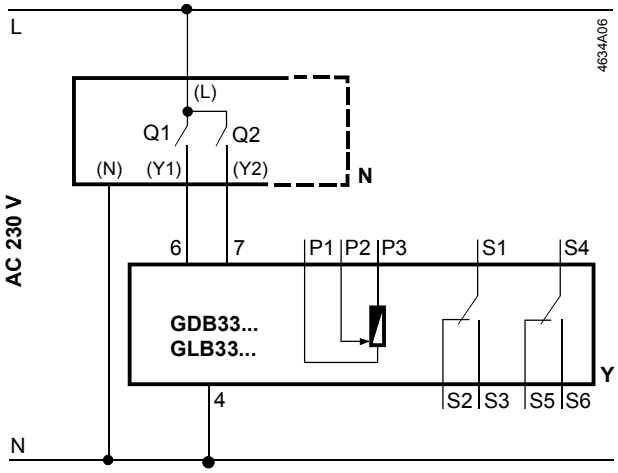
9.3 Connection diagrams (three-position control)

GDB13..1.. / GLB13..1..
AC 24 V



N Controller
Y Actuator GDB/GLB13..1..
SP System potential AC 24 V
SN System neutral
Q1, Q2 Controller contacts

GDB33..1 / GLB33..1
AC 230 V



N Controller
Y Actuator GDB/GLB33..1
L System potential AC 230 V
N System neutral
Q1, Q2 Controller contacts

Operating states for actuators GDB13..1../GLB13..1.., GDB33..1/GLB33..1

The table shows the actuator's operating state for rotary 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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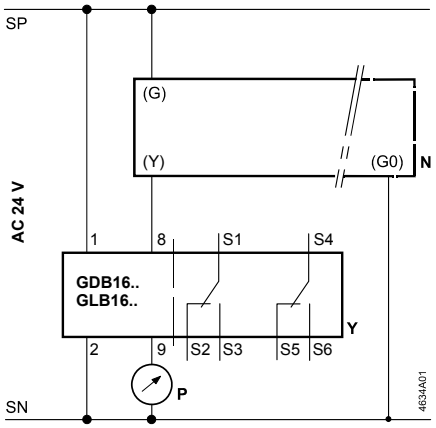
9.4 Connection diagrams (modulating)

9.4.1 Typical application

The controller output is connected directly to the actuator input.

GDB16..1.. / GLB16..1..

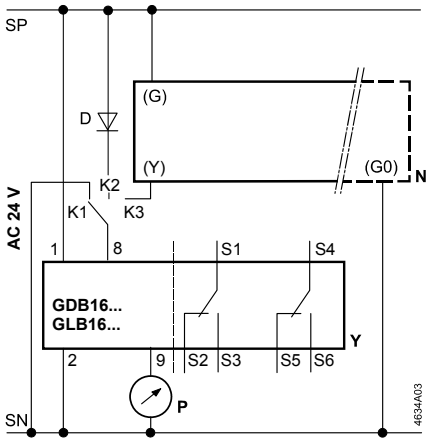


N	Controller
Y	Actuator GDB16..1../GLB16..1..
P	Position indication
SP	System potential AC 24 V
SN	System neutral

9.4.2 Special diagram for modulating control

The following connection 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 closed with GDB16..1../GLB16..1..



N	Controller
Y	Actuator GDB16..1../GLB16..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 GDB16..1../GLB16..1..

Switch contacts	Operating state	Rotary direction	
K3	Modulating control		
K2	Fully open		
K1	Fully closed		
DIL switch position		self adapt 0	self adapt 0

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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

This actuator was developed and manufactured by using environmentally-compatible materials and by complying with environmental standards.
For disposal, please remember the following at the end of product life or on defects:

The device consists of

- Plastics
- Materials such as steel, ferrite magnetic core, etc.

Do not dispose of as household garbage. This particularly applies 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.
Adhere 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

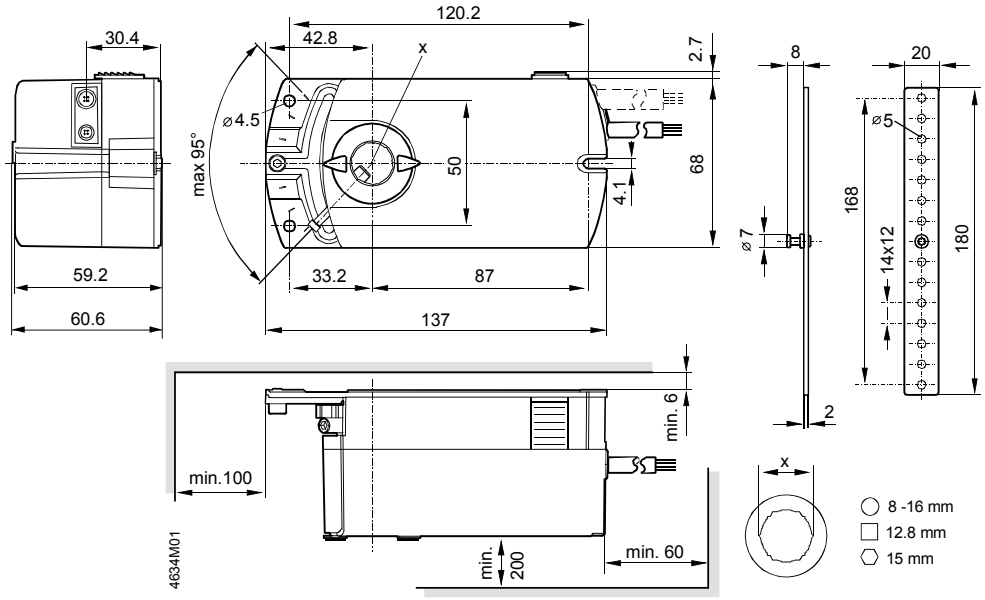
The environmental declarations for these actuators contain detailed information on the materials and volumes used. Request a declaration at your local Siemens sales office.

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
Technical basics (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
GDB...1/GLB...1

Document number (classification no.)	Title/description	Contents
CM2N4634en (N4634)	Actuators for air dampers, rotary version (GDB...1/GLB...1: Three-pos. and modulating)	Type overview, function and selection criteria
4 319 2883 0 (M4634)	Mounting instructions on GDB...1 und GLB...1	Instructions on mounting a rotary actuator without spring return

Accessories for type series GDB..1../GLB..1..

CM2N4698en (N4698)	Accessories and spare parts for actuators GDB…1.., GLB…1..	Overview, allocation to actuator type, and application
74 319 0000 0 (M4634.1)	Rotary/linear set with lever **ASK71.5**	Mounting Instructions and application examples
74 319 0026 0 (M4634.2)	Rotary/linear set with lever and angle bracket for duct and wall mounting **ASK71.6**	
74 319 0236 0 (M4614.1)	Universal lever **ASK71.9**	
7431906620 (M4634.3)	**ASK75.5** Weather shield for rotary actuator **ASK75.5** Weather shield for linear actuator	
	Shaft insert **ASK78.3**	
	Centering insert round ½" **ASK78.5**	
	Centering insert square profile 8 mm **ASK78.6**	
	Centering insert square profile 10 mm **ASK78.7**	
	Centering insert round 10 mm **ASK78.9**	
	Centering insert round 12 mm **ASK78.10**	
	Centering insert D-Profile FIX dia 12 x 9 mm **ASK78.12**	
	Centering insert, square profile 8 mm **ASK78.14**	

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 61000-6-3	Electromagnetic compatibility: Emissions
IEC/EN 61000-6-1 IEC/EN 61000-6-2	Electromagnetic compatibility: Immunity
2004/108/EEC	Directive for electromagnetic compatibility
2006/95/EEC	Low-voltage directive

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