

Air damper actuators

Rotary version, modulating, AC 24 V

GBB16...1



Electric, rotary actuators, nominal torque 20 N, operating voltage AC 24 V, DC 0...10 V modulating control signal, feedback signal DC 0...10 V for position indication, span mechanically adjustable between 0... 90°, pre-wired with 0.9m long connection cables.

Type-specific variations with adjustable control signal for offset and span and with adjustable auxiliary switches for supplementary functions.

Use

To control air dampers in installations with constant or variable air volume (VAV)

- using a nominal torque of 20 Nm for damper surfaces up to 3 m², friction-dependent.
- connecting to controllers with continuous output signals DC 0...10 V.

Functions

Basic functions

Rotational movement

- The actuator's rotational movement (clockwise or counterclockwise) can be selected using the rotational movement switch.
- As soon as the device receives an input signal (> 0 V), the actuator moves toward "90°". As long as the control signal is constant, the actuator remains in its position.
- When the control signal is interrupted, but voltage remains, the actuator returns to "0°".
- When the operating voltage is interrupted, the actuator remains in its current position, but the holding torque is reduced.

Position indication

- Mechanics: The position indicator located on the shaft adapter displays the rotational angle position of the damper blade.
- Electronics: The actuator's electronics generate a DC 0...10 V output voltage that is proportional to the rotational angle of 0°...90°.

Manual override

To manually adjust the actuator or the air dampers, the gear train must be disengaged using the button "PUSH". Refer to "Operating and setting elements" in the chapter "Mechanical design".

Mechanical limitation of rotational angle	The rotational angle of the shaft adapter can be limited to 5° increments between 0° and 90°.
Type-specific functions	
Adjustable control signal (operating function)	<p>Offset and span for the rotational movement (0...90°) can be adjusted using two potentiometers (refer to "Technical design"). Actuators featuring this function can be used for the following applications:</p> <ul style="list-style-type: none"> • Dampers with a rotational angle limitation, for instance in the 0°...45° span, can be controlled using the full control signal range 0...10 V. • As a sequencing actuator in control circuits that can only apply a 0...10 V control signal to control more than one sequence. • In control systems with a control signal that deviates from 0...10 V, for instance 2...10 V.
Adjustable auxiliary switches	<p>Auxiliary switches provide supplementary functions. The switching points for switches A and B (one changeover switch each) can be set independently in increments of 5° within the 0°...90° rotational angle.</p> <p>Refer to "Technical design", "Commissioning notes", and "Internal diagram".</p>

Summary of types

AC 24 V Operating voltage				
Control signal	Standard application (Offset and span not adjustable)		Application with adjustable control signal (For offset and span)	
	no auxiliary switch	with auxiliary switch	no auxiliary switch	with auxiliary switch
DC 0...10 V	GBB161.1E	GBB166.1E	GBB163.1E	GBB164.1E

Delivery	Due to various mounting options, depending on the shaft length, we do not pre-assemble actuator parts. The shaft adapter with position indicator and mounting parts are shipped in a separate container with the actuator.
Accessories	<p>To turn the rotary movement into a linear stroke, the following accessories can be used:</p> <ul style="list-style-type: none"> • Linear set (Mounting plate with external bearing) ASK71.1 • Linear set (Lever) ASK71.3 • Linear set (Lever and mounting plate) ASK71.4
Connection cables	The actuator comes with 0.9 m long pre-wired connection cables.
Note	The auxiliary switch and/or potentiometer for the Offset and span cannot be added in the field . Please order the type that includes the desired option.

Equipment combination	The actuator can be connected to all regulating and controlling devices that transmit a continuous DC 0...10 V signal and adhere to all relevant safety rules and regulations.
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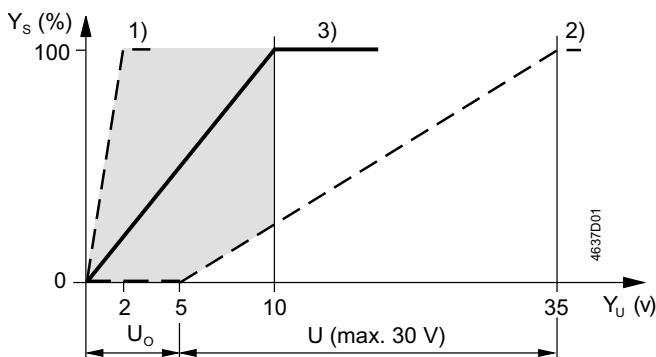
Technical design

Motor technology

Adjustable operating function (type-specific)

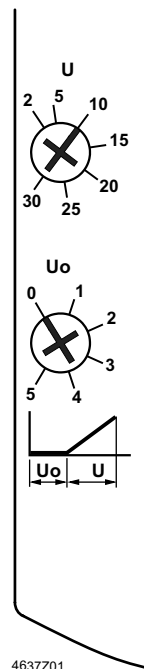
The brushless DC motor provides accurate speed control, torque monitoring, and a reliable fail-safe function which protects the actuator as well as the dampers.

A modulating DC 0..10 V control signal from the controller operates the actuator. The rotational angle is proportional to the control signal. Using "U_o" on the potentiometer, you can set the offset of 0...5 V, and together with the potentiometer "ΔU", you can set the span of 2...30 V.



Y_s Positioning span (100 % = angle of rotation 90°)
 Y_u Control signal
 U_o Offset span
 ΔU Span (for Y_s = 100 %)

- 1) U_o = 0 V, ΔU = 2 V offset = 0 V, min. span for Y_s = 100 %
- 2) U_o = 5 V, ΔU = 30 V max. offset=5 V, max. span for Y_s = 100 %
- 3) U_o = 0 V, ΔU = 10 V factory setting



Example

Control signal
 DC 2 V...10 V

Formula

Open the actuator from 0% ... 50 % (= 45°) using a control signal of U_{min} = 2 V to U_{max} = 10 V.

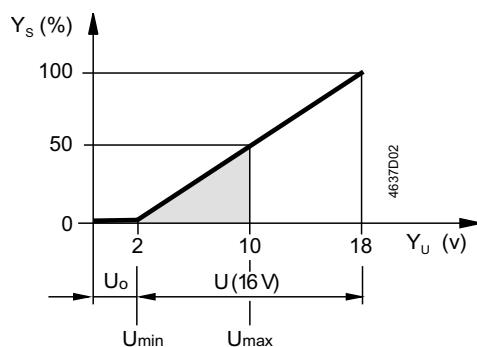
Calculating the value for ΔU:

$$U = \frac{\text{Nominal angle of rotation in \% (U}_{\text{max}} - U_{\text{min}})}{\text{Working angle of rotation in \%}} = \frac{100 \cdot (10 - 2)}{50} = 16 \text{ V}$$

4637Z10E

Potentiometer setting

U_o = 2 V ; ΔU = 16 V



U_{min} = min. control signal (Offset)
 U_{max} = max. control signal (End position)

Adjustable auxiliary switches (type-specific)

The illustration below shows the adjustable switching values for auxiliary switches A and B in relation to the rotational angle.

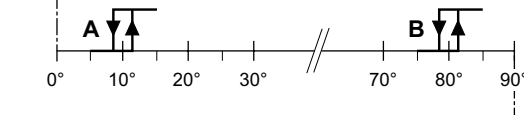
Mounting position for
shaft adapter/position
indicator

**Actuator scale:
Clockwise**

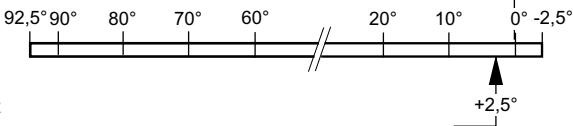


Setting increments: 5°
Switching hysteresis: 2°

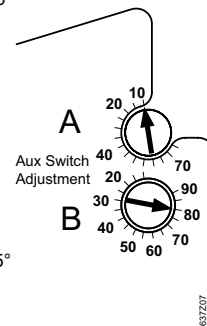
**Adjustment span for
switches A and B**



**Actuator scale:
Counterclockwise**



Setting position for shaft
adapter/position
indicator



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 (clockwise movement).

Mechanical design

Basic components

Housing

Robust, lightweight all metal housing made from aluminum diecast which guarantees a long actuator life even under extreme ambient conditions.

Gear train

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

Factory setting for the actuator

The actuator's factory setting $+2,5^\circ$ ensures a tight close-off for the air dampers.

Manual adjustment

The actuator can be manually adjusted by pushing the button "PUSH".

Self-centering shaft adapter

The actuator can be fastened to shafts with various diameters and in various shapes (square, round) using just one screw due to the L&G patented mounting. Insert the shaft adapter from either side into the opening for the shaft adapter depending on the damper shaft length. For short shafts, the shaft adapter is on the duct side. The shaft adapter coupling and the shaft holding are coupled via double-sided gearing.

Mechanical limitation of the rotational angle

The limitation of the rotational angle can be adjusted in the span of $0...90^\circ$ in increments of 5° .

Setting the rotational movement direction

The rotational movement switch on the front of the actuator serves to set the desired actuator movement direction.

Mounting bracket

A metal strip with bolt serves to fasten the actuator on the opposite side of the shaft holding.

Electrical connection

All actuators come with pre-wired 0.9 m long connection cables.

Type-specific elements

Auxiliary switches

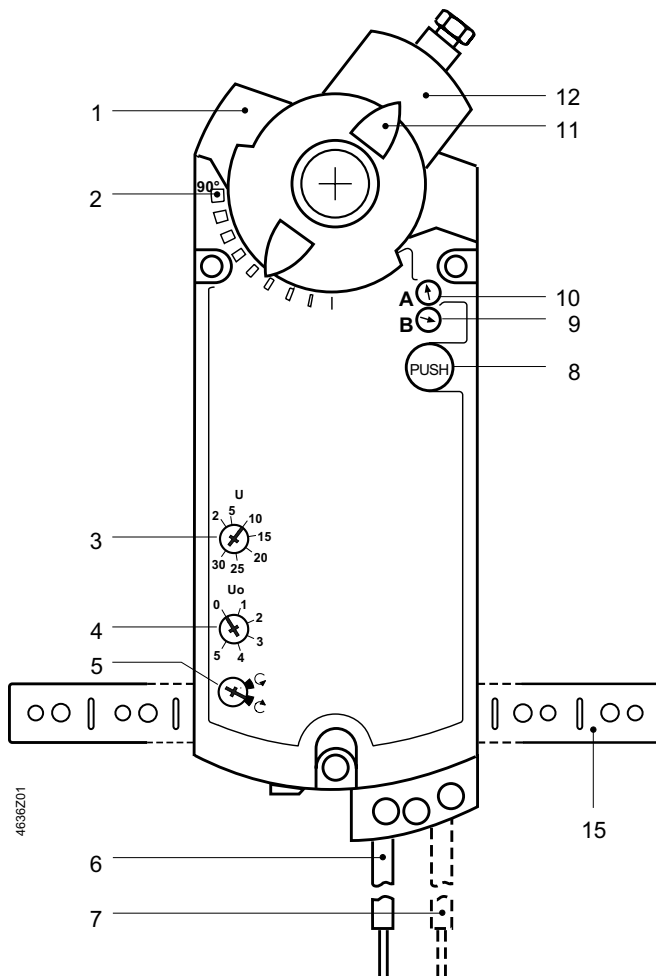
For supplementary functions, the auxiliary switches A and B can be adjusted on the actuator front, below the opening for the shaft adapter.

Potentiometer for offset and span

Both potentiometers for the operating function U_0 and ΔU are accessible on the actuator front.

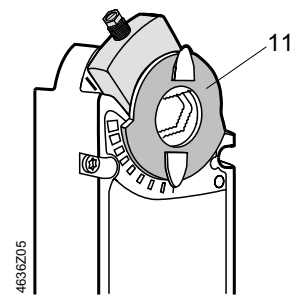
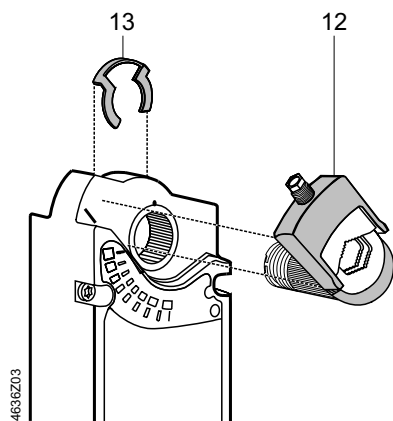
Setting and operating elements

Refer to "Technical design" and "Commissioning notes" in this data sheet.

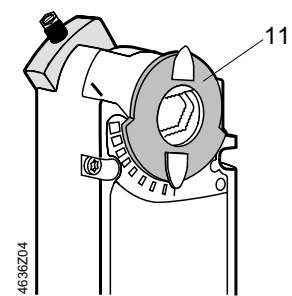
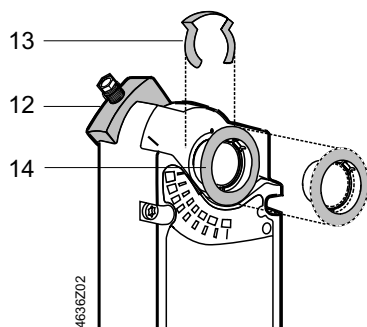


- 1 Housing
- 2 Angle of rotation scale 0°...90°
- 3 Potentiometer to adjust the span
- 4 Potentiometer to adjust the offset span
- 5 Rotational movement switch
- 6 Connection cable for power supply and control signal
- 7 Connection cable for auxiliary switches
- 8 Gear train disengagement button
- 9,10 Adjustment dials for auxiliary switches A and B
- 11 Position indicator
- 12 Self-centering shaft adapter
- 13 Locking ring for shaft adapter
- 14 Adapter for position indicator
- 15 Mounting bracket

Arrangement for long shaft adapters



Arrangement for short shaft adapters



Engineering notes



The basic system data for the control systems in use contains all engineering notes. Read all the engineering notes before mounting, wiring, and commissioning the actuator. Pay special attention to all safety information and follow all hints and notes relating to control signals DC 0...10 V.

Proper use

These actuators must be used in a system only for applications as described in the basic system data documents for the applied control systems. Additionally, all actuator specific features and rules must be observed as described in the brief description on the title page of this data sheet (bold print) and in the chapters "Use", "Engineering notes", and "Technical data".



All paragraphs marked with the special warning triangle as illustrated on the left contain additional safety information and limitations that must be observed under any circumstances to avoid physical injuries or damages to equipment.

Power Supply AC 24 V

These actuators must only be used with **safety extra-low voltage** (SELV/PELV) in accordance with EN 60 730.

Auxiliary switches A, B

Use either **line voltage** or **safety extra-low voltage** for auxiliary switches A and B. Do not mix the two for operation. Operation using various phases is permissible.



Warning

Do not open the actuator!

Electric parallel connection of actuators

Electric parallel connection for the same actuator types is admissible provided the operating voltage is within the required tolerance. Voltage drops at the feed lines must be included. With the L&G 0...10 V controller output, you can connect a maximum of 10 actuators

Note

Do not mechanically couple the actuators.

Required actuators

The quantity of actuators required depends on several torque factors. After obtaining the damper torque rating (Nm/m²) from the manufacturer and determining the damper area, calculate the torque required to move the damper as follows:

Total Torque = Torque Rating × Damper Area

Total quantity of actuators required::

Formula

$$\text{Number of actuators} = \frac{\text{Total Damper Torque required}}{\text{SF}^1 \times \text{Actuator Torque (Refer to Specifications)}}$$

¹ Safety Factor: When calculating the number of actuators required, a safety factor should be included for unaccountable variables such as slight misalignments, aging of the damper, etc. A suggested safety factor is 0.80 (or 80% of the rated torque).

Sizing transformers for AC 24 V

- Use safety insulating transformers with double insulation in accordance with EN 60 742; The transformers must be made for 100% runtime.
- Observe all local safety rules and regulations pertaining to sizing and protecting transformers.
- Determine the transformer's power consumption by adding the power consumption in VA for all actuators used.

Wiring and commissioning

Refer to "Commissioning notes" and "Internal diagram" in this data sheet as well as to the HVAC job drawings.

Settings

The values for the offset (ΔU) and positioning range (U_o) must be entered in the respective control diagrams.

Mounting notes

Mounting instructions	All information and steps to properly prepare and mount the actuator are listed in the Mounting Instruction guide M4626 delivered with the actuator. The shaft adapter as well as all other individual parts are not pre-mounted as the actuator components are put together differently depending on the damper shaft length. Refer to "Mechanical design" in this data sheet.
Mounting bracket	If you mount the actuator directly on the damper shaft, the mounting bracket must be used. The insertion depth for the shaft into the housing must be sufficient and guaranteed.
Damper shafts	Information on minimum length and diameter for the damper shaft is listed in "Technical data".
Mounting position	Select the mounting position so that you can easily access the cables as well as the setting dials on the front of the actuator. Refer to "Dimensions".
Factory setting	The actuator is shipped with a factory setting of + 2,5° which ensures a tight close-off for the air dampers.
Manual adjustment	To ensure a tight close-off function for the dampers and the exact switching position for switches A and B, the actuator can only be adjusted with a mounted shaft adapter and position indicator in accordance with the mounting instructions.
Mechanical limitation of the rotational angle	If necessary, you can limit the rotational angle in increments of 5° for the entire span by positioning the shaft adapter in the respective position.
Using the mounting sets	The wall and duct mounting sets which are used to change the rotational movement into a linear stroke as described in "Summary of Types" are mounted separately.

Commissioning notes

References	<p>All information necessary for commissioning is contained in the following:</p> <ul style="list-style-type: none">• This data sheet (4636)• Mounting instructions M4613• Job diagram
Ambient conditions	Check to ensure that all permissible values as contained in "Technical data" are observed.
Mechanical check	<ul style="list-style-type: none">• Check for proper mounting and to ensure that all mechanical settings are in accordance with the plant-specific requirements. Additionally, ensure that the dampers are shut tight when in the closed position.• Fasten the actuator securely to avoid side load• Check the rotation direction: The dampers can be manually adjusted by pushing the button "PUSH".
Electrical check	<ul style="list-style-type: none">• Check to ensure that the cables are connected in accordance with the plant wiring diagram.• The operating voltage AC 24 V (SELV/PELV) must be within the tolerance values.• Functional check:<ul style="list-style-type: none">– When applying a DC 10 V control signal, the actuator must turn from 0° to 90° (or end position with the rotational movement angle).– The rotational movement at the selector switch must match the desired damper movement direction.– After interrupting the operating voltage, the actuator stops.– After interrupting the control signal, but with the operating voltage still on, the actuator returns to the "0°" position.• Output voltage DC 0...10 V for the position indication while the actuator moves from 0...90° .

- Switch the auxiliary switch contacts "A" and "B" while the actuator reaches the respective switching positions.

Factory setting for the rotational movement switch

The switch is set to the movement position "Clockwise".

Factory settings for auxiliary switches A and B (see "Technical design")

The auxiliary switches are factory set:
Switch A: Switching point at 5°
Switch B: Switching point at 85°

To change the settings of A and B, use a flat blade screwdriver to turn the switch adjustment dials to the desired setting.

Note

The angle values are valid only for the actuator position "0°" (Clockwise movement).

Operating function factory setting

The potentiometers which are used to adjust the offset and span settings have the following factory setting:

Offset "U₀" = 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".

Technical data

Power supply AC24 V

Operating voltage	AC 24 V ± 20 %
Safety extra-low voltage (SELV/PELV) in accordance with	EN 60 730
Requirements for external safety insulating transformer (100% duty) to	EN 60 742
Feeder protection external	max. 10 A
Frequency	50/60 Hz
Power consumption: running	4 VA/2 W
holding	1.8 VA/1 W

Control signal input

Input voltage (wires 8-2)	DC 0...10 V
Max. permissible input voltage	DC 35 V
Input resistance	>100 kΩ
Neutral zone NZ (for non-adjustable operating function)	200 mV

Operating function only for GBB163.1E and GBB164.1E

Offset U ₀ (adjustable using a potentiometer)	DC 0...5 V
Span ΔU for Y _s = 100 % (adjustable using a potentiometer)	DC 2...30 V
Neutral zone NZ (for adjustable operating function)	2 % of ΔU

Output signal for position indication

Output signal (wires 9-2)	
Output voltage (for Y _s = 0...100%)	DC 0...10 V
Max. output current	DC ± 1 mA
Protected against false connections	max. AC 24 V

Auxiliary switches

Only for GBB164.1E
and GBB166.1E

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
no load	10 ⁶ switchings
Voltage	AC 24...230 V
Voltage proof auxiliary switch to housing	AC 4 kV
Setting range for switchover contacts	5°...85°
Setting increments	5°
Switching hysteresis	2°
Factory setting:	
Switch A	5°
Switch B	85°

Connection cables

Power supply and signal line (wires 1-2-8-9)	4 x 0.75 mm ²
Auxiliary switches (wires S1...S6)	6 x 0.75 mm ²
Permissible signal line length	300 m

Mechanical data

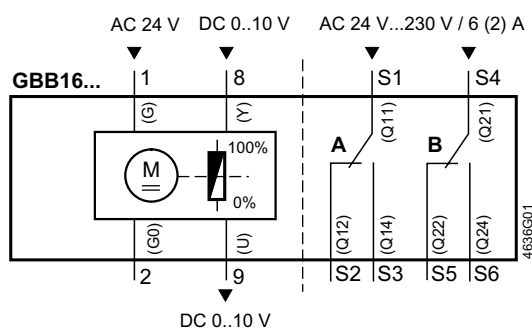
Nominal torque	20 Nm
Minimum holding torque (with operating voltage)	> 20 Nm
Minimum holding torque (no operating voltage)	> 6 Nm
Maximum torque	< 40 Nm
Nominal angle of rotation (with positioning indication)	90°
Max. angle of rotation (mechanically limited)	95°
Runtime for nominal angle of rotation 90° (motor operation)	150 s

	Direction of rotation (determined by switch setting)	clockwise/counter clockwise
	Mechanical life	10 ⁵ cycles
	Dimensions for the damper shaft	
	Round	8...25.6 mm
	Square	6...18 mm
	Min. length	20 mm
	Max. shaft hardness	< 400HV
	Actuator dimensions	see "Dimensions"
	Weight	2 kg
Ambient conditions	Transport	IEC 721-3-2
	Climatic conditions	Class 2K3
	Temperature	-32...+70 °C
	Humidity	< 95% r. h.
	Mechanical conditions	Class 2M2
	Operation	IEC 721-3-3
	Climatic conditions	Class 3K5
	Temperature	-32...+55 °C
	Humidity (non-condensing)	< 95% r. h.
IP-Code	Housing type according to EN 60 529	IP 44
CE-Conformity	In accordance with the directives set forth by the European Union	
	Electromagnetic compatibility (EMC)	89/336/EEC
	Low voltage directive	73/23/EEC
Product standards	Automatic electric regulating and controlling devices for residential use and other applications (Type 1)	EN 60 730
Electromagnetic compatibility	Emissions	EN 50 081-1
	Immunity	EN 50 082-1

Diagrams

Internal diagram

GBB161.1E
GBB166.1E
GBB163.1E
GBB164.1E

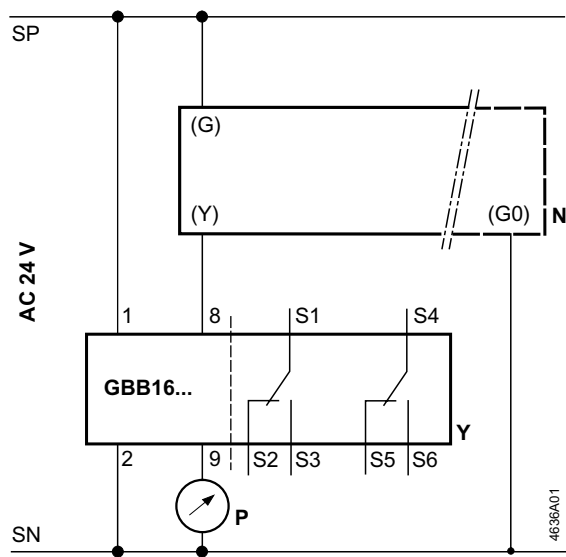


Cable labeling

All wires are color-coded and labeled.

Connection cable	Wire labeling	Designation	Color	L&G terminal code
Actuators AC 24 V	1	System potential AC 24 V	red	G
	2	System neutral	black	G0
	8	Control signal DC 0 ... 10 V	gray	Y
	9	Positioning indication DC 0 ... 10 V	pink	U
Auxiliary switches	S1	Switch A Input	gray/red	Q11
	S2	Switch A Normally closed contact	gray/blue	Q12
	S3	Switch A Normally open contact	gray/pink	Q14
	S4	Switch B Input	black/red	Q21
	S5	Switch B Normally closed contact	black/blue	Q22
	S6	Switch B Normally open contact	black/pink	Q24

GBB161.1E
GBB166.1E
GBB163.1E
GBB164.1E



- | | |
|-----------|------------------------|
| N | Controller or I/O unit |
| Y | Actuator GCA16... |
| P | Position indicator |
| SP | System potential |
| SN | System neutral |

Technical drawing of the 4613M02 device, showing dimensions and specifications:

- Top View:**
 - Overall width: 300
 - Distance from left edge to center: 197
 - Distance from center to right edge: 73
 - Distance from left edge to mounting hole center: 900
 - Distance from mounting hole center to center: 85.8
 - Distance from center to mounting hole center: 27.6
 - Distance from center to mounting hole center: max. 20
 - Angle: max. 95°
 - Mounting hole diameter: Ø 8... 25,6 mm
 - Mounting hole diameter: □ 6... 18 mm
 - Mounting hole diameter: Ø 5,7
 - Mounting hole diameter: Taptite M6 x 16
 - Distance from center to mounting hole center: min. 100
- Side View:**
 - Overall height: 100
- Detail View:**
 - Overall height: 230
 - Distance from top edge to mounting hole center: 10
 - Distance from mounting hole center to bottom edge: 67.5
 - Distance from mounting hole center to bottom edge: 4.2
 - Distance from mounting hole center to bottom edge: 3
 - Distance from mounting hole center to bottom edge: 1.5
 - Distance from mounting hole center to bottom edge: 20
 - Distance from mounting hole center to bottom edge: 13.5

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