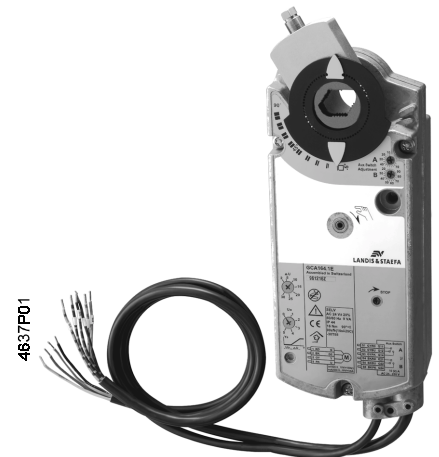


OpenAir™

Air damper actuators

Rotary version, modulating,
with spring return, AC 24 V

GCA16...1



Electromotive rotary actuators, DC 0...10 modulating control signal, nominal torque 16 Nm, spring return to fail-safe position, operating voltage AC 24 V, feedback signal DC 0...10 V for position indication, span mechanically adjustable between 0...90°, pre-wired with 0.9 m long connection cables. Type-specific variations with adjustable control signal for offset and span and/or with adjustable auxiliary switches for supplementary functions.

Use

To control air dampers in ventilation and air conditioning plants

- using a nominal torque of 16 Nm for damper surfaces up to 3 m², friction-dependent.
- connecting to controllers with continuous output signals DC 0...10 V.
- requiring fail-safe position (zero position) when there is a power failure.

Functions

Basic functions

Rotational movement

- Right or left direction by attaching the actuator on the damper shaft in the respective position.
- 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, the actuator returns to "0°".

Fail-safe function

In the event of power failure or when the operating voltage is shut off, the actuator spring returns to the fail-safe position "0" .

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

The actuator can be turned to any position using a hex wrench and locked using a screwdriver. After mechanically releasing the lock or after briefly applying operating voltage, the actuator returns to the "0" position.

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)

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:

- Dampers with a rotational angle limitation, for instance in the 0°...45° span, can be controlled using the full control signal range DC 0...10 V.
- As a sequencing actuator in control circuits that can only apply a DC 0...10 V control signal to control more than one sequence.
- In control systems with a control signal that deviates from DC 0...10 V, for instance DC 2...10 V.

Adjustable auxiliary switches

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.

Refer to "Technical design", "Commissioning notes", and "Internal diagram".

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 2 auxiliary switches	no auxiliary switch	with 2 auxiliary switches
DC 0...10 V	GCA161.1E	GCA166.1E	GCA163.1E	GCA164.1E

Ordering

The auxiliary switches **cannot** be integrated retroactively. For that reason, order the respective type that contains the desired option.

Delivery

Due to various mounting options depending on the direction of rotation and shaft length, separate parts such as the shaft adapter with position indicator and other mounting parts are shipped separately with the actuator.

Connection cables

The actuator comes with 0.9 m long pre-wired connection cables.

Accessories and spare parts

The following accessories and spare parts are available for function upgrades of the actuators; see data sheet N4699:

Accessories

- Rotary/linear set for duct mounting **ASK71.1**
- Rotary/linear set for wall mounting **ASK71.2**
- Rotary/linear set with lever **ASK71.3**
- Rotary/linear set with lever and mounting plate **ASK71.4**
- Weather shield **ASK75.1**

Spare parts and ordering information as per data sheet

N4699

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.

Technical design

Motor technology

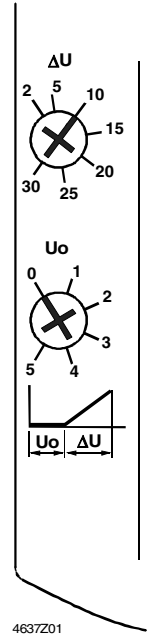
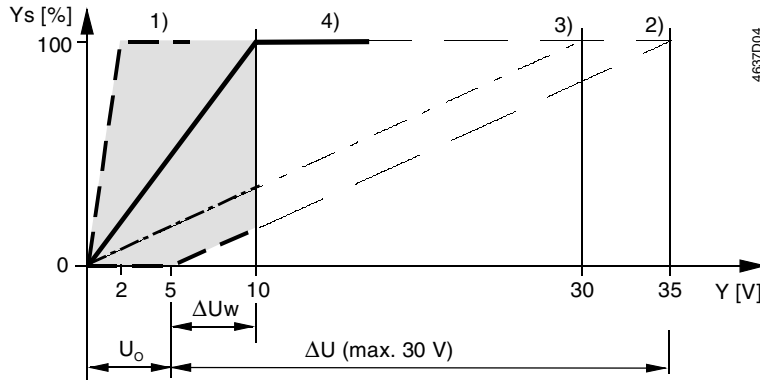
The brushless DC motor provides accurate speed control, torque monitoring, and a reliable fail-safe function which protects the actuator as well as the dampers.

Spring return mechanism in the event of power failure

Springs supply the fail-safe function. The problems caused by conventional frictional grip for multi-stage gearing are solved using a second, synchronously turning spring in the motor which eliminates the motor's frictional grip.

Adjustable operating function (type-specific)

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 DC 0...5 V, and together with the potentiometer "ΔU", you can set the span of DC 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 %)
- ΔU_w Effective span at Y_{max} = DC 10 V

Examples of the diagram

	Control signal Y	Pos. range Y _s	Settings	
			U _o	ΔU
1)	DC 0...2 V	0...100 %	DC 0 V	DC 2 V
2)	DC 5...10 V	0...17 %	DC 5 V	DC 30 V
	DC 5...35 V	0...100 %		
3)	DC 0...10 V	0...33 %	DC 0 V	DC 30 V
	DC 0...30 V	0...100 %		
4) *	DC 0...10 V	0...100 %	DC 0 V	DC 10 V

* Characteristic curve for factory setting or standard version

Example

Determine the span ΔU if the actuator is to open from 0...50 % at a positioning signal of Y = DC 2...10 V.

The offset span U_o is 2 V.

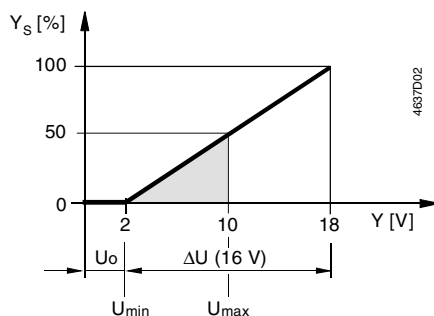
Calculate the setting values for ΔU:

Formula

$$\Delta U = \frac{\text{max. pos. range } Y_{s\text{max}} [\%]}{\text{Span } Y_s [\%]} \cdot (10 [\text{V}] - U_o [\text{V}]) = \frac{100\%}{50\%} \cdot (10 \text{ V} - 2 \text{ V}) = 16 \text{ V}$$

Potentiometer settings

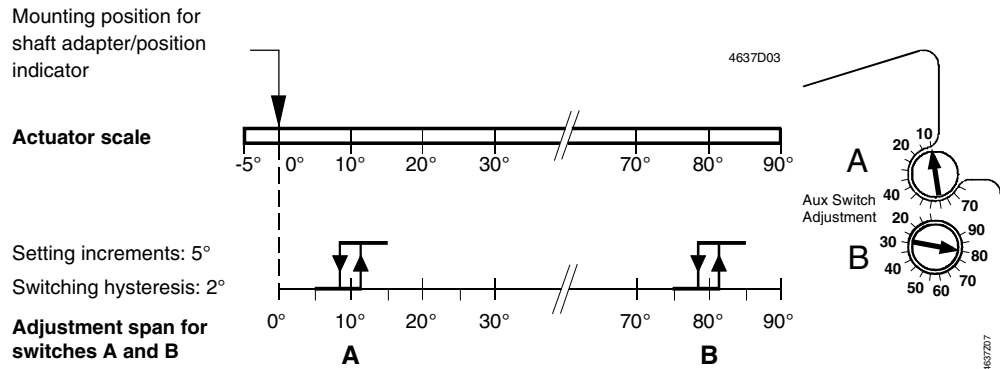
U_o = 2 V ; ΔU = 16 V



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.



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.

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.

Spring preload

The spring has a factory set preload of 5° which ensures tight close-off for the air dampers.

Manual adjustment

A wrench lock in the center of the actuator allows the manual setting of the gears. A hex wrench is supplied.

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° in increments of 5°.

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.

Note

You can mount the actuator on either side depending on the required rotation direction. All setting and operating elements are available on both sides of the actuator.

Type-specific elements

Auxiliary switches

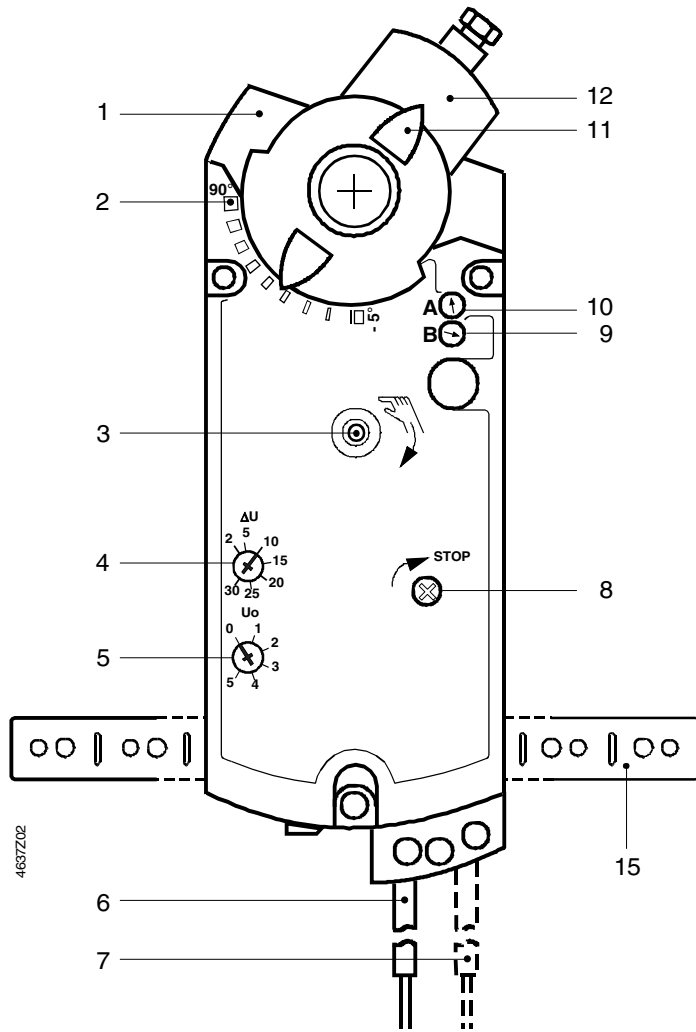
For supplementary functions, the auxiliary switches A and B can be adjusted on the actuator front, below the opening for the shaft adapter.

Potentiometer for offset and span

The two potentiometers responsible for the operating functions U_0 and ΔU can both be accessed on either side of the actuator front.

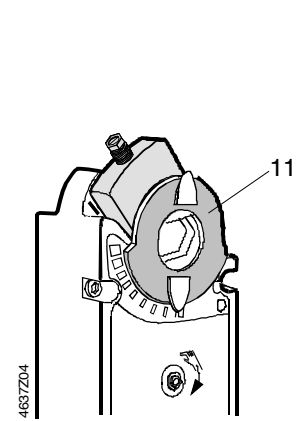
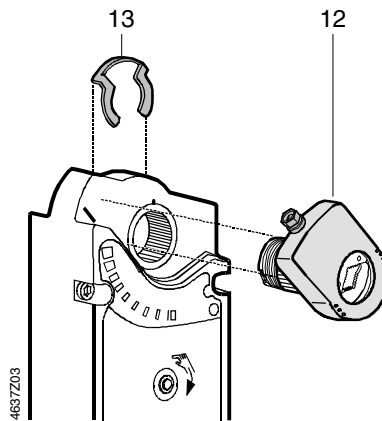
Setting and operating elements

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

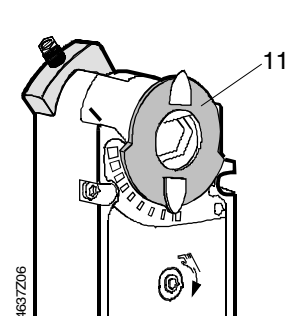
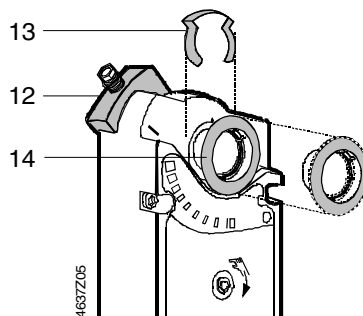


- 1 Housing
- 2 Angle of rotation scale 0°...90°
- 3 Wrench lock for manual override
- 4 Potentiometer to adjust the span
- 5 Potentiometer to adjust the offset span
- 6 Connection cable for power supply and control signal
- 7 Connection cable for auxiliary switches
- 8 Stop shaft for gear train
- 9,10 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.

AC 24 V supply

These actuators must only be used with **safety extra-low voltage (SELV)** or **protection by extra-low voltage (PELV)** in accordance with HD 384.

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. However, operation using various phases is permissible.



Warning, maintenance

Do not open the actuator!

The actuator is maintenance-free. Maintenance work may only be conducted by the manufacturer.

Parallel connection of actuators

- **Electric:** Electric parallel connection for the same actuator types is permissible provided the operating voltage is within the required tolerance. Voltage drops at the feed lines must be included. A maximum of 10 actuators can be connected to the LG-typical DC 0...10V controller output
- **Mechanical:** 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

Calculating the required actuators

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

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).

Note

If the calculated number of actuators is > 1, the damper construction must be adjusted accordingly.

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_0) 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 M4613 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 direction of rotation (right or left) and the damper shaft length. Refer to "Mechanical design" in this data sheet.
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".
Housing protection	In order to satisfy the requirements as per IP54, the following mounting conditions must be fulfilled: <ul style="list-style-type: none">• Mount the actuators only vertically (cabling see below) for air dampers with horizontal shafts.• When the actuator is mounted directly on the damper shaft, the mounting angle may be a maximum of $\pm 45^\circ$.• Use the ASK75.1 weather shield for mounting in any other position.
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".
Spring preload	The actuator is shipped with a 5° preload which ensures closing pressure for the air dampers.
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 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	All information necessary for commissioning is contained in the following: <ul style="list-style-type: none">• This data sheet 4637• Mounting instructions M4613• Job diagram
Environmental 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: Manually change the damper position by turning the gearing using a plug-in hex wrench in accordance with the mounting instructions.
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">– Proper operating voltage by applying an input signal DC 10 V. The actuator must move from 0° to 90° (or end position with rotational angle limitation).– After interrupting the supply voltage, the actuator must return to the zero-position.• Check the output voltage DC 0...10 V for the position indication while moving the actuator from 0°...90°.• Switch the auxiliary switch contacts "A" and "B" while the actuator reaches the respective switching positions.

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.

Important

The angle values are valid only for the actuator position "0°". (The setting shafts turn together with the actuator).

Operating function factory setting

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

Offset "U_o" = 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 AC 24 V

Operating voltage	AC 24 V ± 20 %
Safety extra-low voltage (SELV) or protection by extra-low voltage (PELV) as per	HD 384
Protection class	III as per 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	9 VA/6 W
holding	5 VA/2.2 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 for GCA163.1E GCA164.1E

Offset U _o (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 for GCA164.1E GCA166.1E

Contact rating	6 A resistive, 2 A inductive
Life: 10 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
Protection class	II as per EN 60 730
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	16 Nm
Restoring torque (for power failure)	16 Nm
Min. holding torque	> 16 Nm
Max. torque	< 50 Nm
Nominal angle of rotation (with positioning indicator)	90 °
Max. angle of rotation (mechanically limited)	95°± 2°
Runtime for nominal angle of rotation 90° (motor operation)	90 s

Closing (on power loss) with spring return	15 s
Direction of rotation (determined by type of mounting)	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	< 400 HV
Actuator dimensions	see "Dimensions"
Weight	2 kg

Environmental conditions

Transport	IEC 721-3-2
Climatic conditions	Class 2K2
Temperature	-32...+70 °C
Humidity (non-condensing)	< 95% r.h.
Mechanical conditions	Class 2M3
Operation	IEC 721-3-3
Climatic conditions	Class 3K5
Mounting location	Inside, weather-protected
Temperature	-32...+55 °C
Humidity (non-condensing)	< 95% r.h.

IP-Code

Housing type according to EN 60 529	IP 54
-------------------------------------	-------

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 60 730-2-14
---	----------------

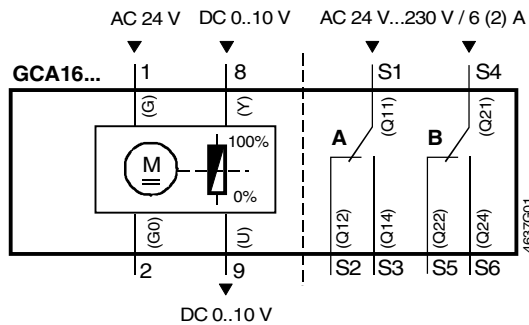
Electromagnetic compatibility

Emissions	EN 50 081-1
Immunity	EN 50 082-2

Diagrams

Internal diagram

GCA161.1E
GCA166.1E
GCA163.1E
GCA164.1E



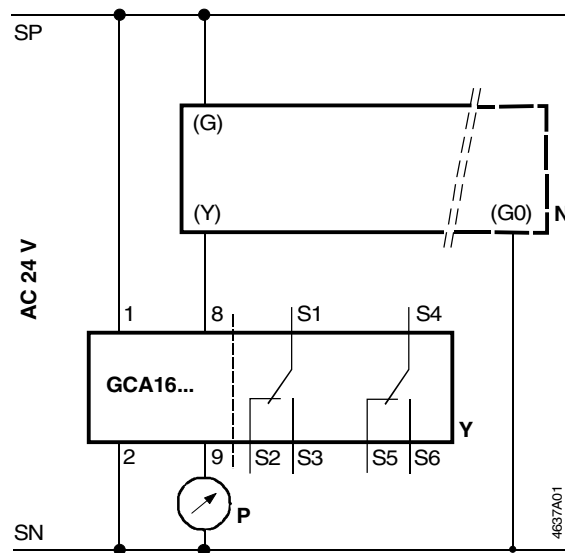
Cable labeling

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

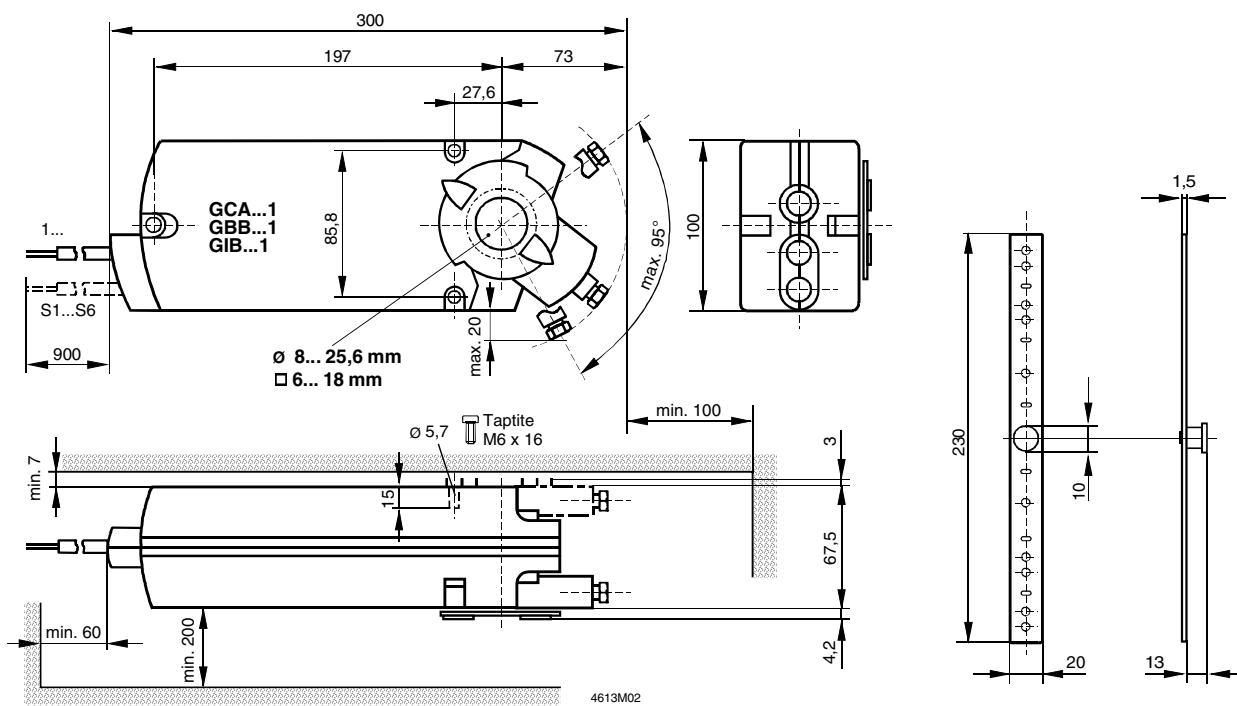
Connection diagram

GCA161.1E
GCA166.1E
GCA163.1E
GCA164.1E



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

Dimensions



Dimensions in mm

© 1999 Siemens Building Technologies Ltd.

CM2N4637E / 02.1999
10/10

Siemens Building Technologies
Landis & Staefa Division