SIEMENS

Rotary actuators for ball valves

Modbus communication profiles

GDB161.9E/MO   GLB161.9E/MO   GLD161.9E/MO   GMA161.9E/MO

Rotary actuators G../MO

- GDB161.9E/MO operating voltage AC 24 V/ DC 24 V RS-485 for Modbus RTU communication
- GLB161.9E/MO Operating voltage AC 24 V/ DC 24 V RS-485 for Modbus RTU communication
- GLD161.9E/MO operating voltage AC 24 V/ DC 24 V RS-485 for Modbus RTU communication
- GMA161.9E/MO operating voltage AC 24 V/ DC 24 V RS-485 for Modbus RTU communication

This document describes the network functions of the rotary actuators series G../MO.

Function	Description
Communication	Modbus RTU (RS-485), not galvanically isolated
Functions	● Setpoint 0...100 % valve setting ● Actual value 0...100 % for valve setting ● Override control Open / Close / Min / Max / Stop ● Setpoint monitoring and backup mode
Supported baud rates	9.6 / 19.2 / 38.4 / 57.6 / 78.4 / 115.2 kBaud
Transmission formats	1-8-E-1, 1-8-N-1, 1-8-O-1, 1-8-N-2
Bus termination	120 Ω electronically switchable

Documents can be downloaded at http://siemens.com/bt/download.

Product documentation

Title	Contents	Document number
Rotary actuators for ball valves GDB..9E..	Data sheet: Product description GDB..9E..	A6V10636150
Rotary actuators for ball valves GLB..9E..	Data sheet: Product description GLB..9E..	A6V10636203
Rotary actuators for ball valves GLD161.9E..	Data sheet: Product description GLD161.9E..	A6V11171770
Rotary actuators for ball valves GMA..9E..	Data sheet: Product description GMA..9E..	CE1N4658
Climatix, standard application for air handling units	Overview / Description: Climatix air conditioning application	CE1A3975
Mounting instructions rotary actuator GDB..9E..	Mounting instructions: Mounting and installation instructions	A5W00005998
Mounting instructions rotary actuator GLB..9E..	Mounting instructions: Mounting and installation instructions	A5W00005999
Mounting instructions rotary actuator GLD..9E..	Mounting instructions: Mounting and installation instructions	A5W00035347
Mounting instructions rotary actuator GMA..9E..	Mounting instructions: Mounting and installation instructions	74 319 0653 0
Valve Actuator DIL Switch Characteristic Overview	Commissioning / configuration: Depictions, description of actuator and valve characteristics based on DIL switch setting	A6V12050595

Related documents such as environmental declarations, CE declarations, etc., can be downloaded at the following Internet address:

http://siemens.com/bt/download

Notes

Safety

	⚠ CAUTION
⚠	**National safety regulations**
	Failure to comply with national safety regulations may result in personal injury and property damage.
	● Observe national provisions and comply with the appropriate safety regulations.

The devices were developed specifically for use with Climatix pushbutton configuration as described in document CE1A3975 [1].

The bus configuration can alternatively be configured by the local HMI, see section User interface [▶ 5].

Check the following during commissioning:

- Bus configuration (address, baudrate, transmission mode, and optional bus termination). The default address 255 allows mounting and commissioning of multiple actuators at the same time without interfering with each other.
- Actuator parameters (Opening direction, position limits, position adaptation, etc.). The value can be read over the Modbus register.

[1]   Documents can be downloaded at http://siemens.com/bt/download.

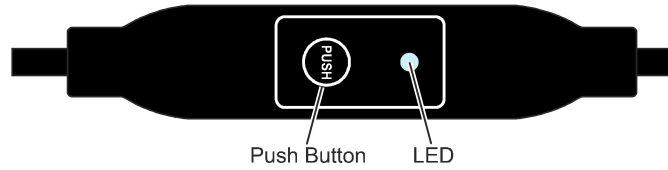**Full or partial configuration via bus**

The devices can be configured over bus if the pre-commissioning settings allow for a connection between the Modbus master / programming tool and peripheral devices (i.e. non-conflicting addresses and matching baudrate / transmission format).

- Full configuration via bus: A unique Modbus address can connect by the Modbus master/programming tool after startup using the presets for transmission format and baud rate (or auto-baud).
- Partial configuration over the bus: A Modbus address that is not unique must be first set to a unique address, either by using the address input with pushbutton (see Enter address using pushbutton [▶ 7]) or by setting the address to 246 by pressing the pushbutton > 5s and < 10s (see Pushbutton operation [▶ 5]). The Modbus master/programming tool can then connect after startup using the the presets for transmission format and baud rate (or auto-baud).

The bus and actuator parameters can be set to target values on an existing connection over the bus. For write operations to the bus parameters, "1 = Load" must be written to Reg 768 within 30 seconds; the changes are otherwise discarded.

Example: The table shows the register values before and after the change via bus access.

Register	Name	Before change	After change
764	Modbus address	246	12
765	Baud rate	0 = Auto	1 = 9600
766	Transmission format	0 = 1-8-E-1	3 = 1-8-N-2
767	Bus termination	0 = Off	0 = Off
768	Bus conf. command	0 = Ready	1 = Load

Push Button   LED

Pushbutton operation

Action		Pushbutton operation	Feedback message
Return current Modbus address (starting from lowest address position)		Press button < 1 s	• 1st digit (single digit): red • 10-digit (double digit): green • 100-digit (triple digit): orange LED blinks blue 1 x after the address indication if bus termination is switched on. Example: 124 = 4 x red, 2 x green, 1 x orange
Switch on/off bus termination			
	Switch on	Press button 3 x	Blinking or flashing of LED stops (termination mode).
		Briefly press button 1 x	Blue LED flashes 1 x.
		Hold button until the LED turns red	Red LED is lit (confirmation).
		Release button	LED not lit. Address is indicated. LED blinks blue 1 x after the address indication. Device enters normal mode.
	Switch off	Press button 3 x	Blinking or flashing of LED stops (termination mode).
		Briefly press button 1 x	Red LED is lit (confirmation).
		Release button	Device enters normal mode.
Enter Modbus address using pushbutton		Press button > 1 s and < 5 s	See Enter address using pushbutton [▶ 7]
Enable pushbutton addressing (together with Climatix™ controllers)		Press button > 5 s and < 10 s	Red LED is lit and goes off after 5 s.
		Release button	Orange LED lit.
Reset to factory settings		Press button > 10 s	LED flashes orange.

LED colors and flashing patterns

Color	Blinking pattern	Description
Green	1 s on / 5 s off	Normal mode without bus traffic
	Flickering	Normal mode with bus traffic
Orange / green	1 s orange / 1 s green	Device is in override control mode
Orange	1 s on / 1 s off	Bus parameter not yet configured
	1 s on / 5 s off	Device is in backup mode (replacement mode)
Red	Permanently lit	Mechanical error, device blocked, manual intervention or calibration
	1 s on / 5 s off	Internal error
	0.1 s on / 1 s off	Invalid configuration, e.g. Min = Max
Blue	Flickers 1 x after indicating the address	Bus termination active

Reset actuator with pushbutton

1. Press button > 10 s.
   - LED flashes **orange**.

2. Release button *while* LED is still flashing.
   - LED flashes another 3 s.

3. Press button *within* these 3 s.
   - Reset is cancelled.

4. Press button *after* these 3 s.
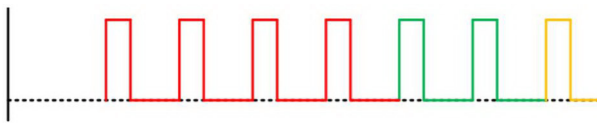
⇒ LED is **red** (Reset) while the device restarts.

Display current address (starting from lowest address position)

The Modbus address can be set without an extra tool using pushbutton addressing.

To display the current Modbus address, press the button <1s.

Colors		
1-digit: **red**	10-digit: **green**	100-digit: **orange**

Example for address **124**:

LED	
Note	The address is entered and displayed beginning at the lowest digit (1st digit), see figure above. (Example: 124 starts with 4 x red)

Enter new address (starting from lowest address position)

1. **Enable addressing mode**: Press button > 1 s.
   - LED is **red.**
     – Release pushbutton (before LED turns off).

2. **Enter digits**: Press button n-times.
   - LED flashes 1 x for each press of the button as feedback.
     1st digit: **red** / 2nd digit: **green** / 3rd digit: **orange**.

3. **Save digits**: Hold pushbutton.
   - LED lights in the color of the following digits.
     – Release pushbutton.

4. **Save address**: Hold pushbutton.
   - LED is **red** (confirmation).
     – Release pushbutton.

⇒ The entered address is indicated again 1 x for confirmation.

i The address is discarded if the button is released before the LED lights redn.

Set address „124":

1. Enable addressing mode.

2. Set 1-digit: Press button 4 x.
   - LED flashes **rot** for each press of the button.

3. Save 1-digit: Hold button.
   - LED is lit **green**.
     – Release button.

4. Set 10-digit: Press button 2 x.
   - LED flashes **green** for each press of the button.

5. Save 10-digit: Hold button.
   - LED is lit **orange**.
     – Release button.

6. Set 100-digit: Press button 1 x.
   - LED flashes **orange** for each press of the button.

7. Save address: Hold button.
   - LED is lit **rot**.
     – Release button.

⇒ The address is saved and is repeated 1 x for confirmation.

Set address „50":

1. Enable addressing mode.

2. Skip 1-digit: Hold button.
   - LED is lit **grün**.
     – Release button.

3. Set 10-digit: Press button 5 x.
   - LED flashes **green** for each press of the button.

4. Save address (skip 100-digit): Hold button.
   - LED is lit **rot**.
     – Release button.

⇒ The address is saved and is repeated 1 x for confirmation.

Set address „5":

1. Enable addressing mode.

2. Set 1-digit: Press button 5 x..
   - LED flashes **rot** for each press of the button.

3. Save address (skip 10-digit and 100-digit): Hold button.
   - LED is lit **rot**.
     - Release button.

⇒ The address is saved and is repeated 1 x for confirmation.

Modbus registers

Reg.	Name	R/W	Range/Listing	Factory setting
Process values				
1	Setpoint	RW	0...100 % = 0...10000	-
2	Forced control	RW	0 = Off / 1 = Open / 2 = Close / 3 = Stop	
3	Actual Value	R	0...100 % = 0...10000	
256	Command	RW	0 = Ready or calibrating / 1 = No available / 2 = Self-test / 3 = Reinitialize / 4 = Remote reset	

Reg.	Name	R/W	Range/Listing	Factory setting
Parameter				
260	MinPosition	R	0...100 % = 0...10000	0 %
261	MaxPosition	R	0...100 % = 0...10000	100 %
262	Actuator runtime	R	Compare technical data of respective actuator	
513	Backup mode (replacement mode)	RW	0 = Go to backup position / 1 = Not available / 2 = Deactivated	2 = Deactivated
514	Backup position	RW	0...100 % = 0...10000	0 %
515	Backup timeout	RW	0...65535	900 s
516	Start-up setpoint	RW	0...100 % = 0...10000	0 %
764	Modbus address	RW	1...248 / 255 = "Unassigned"	255 = "Unassigned"
765	Baud rate	RW	0 = Auto / 1 = 9600 / 2 = 19200 / 3 = 38400 / 4 = 57600 / 5 = 76800 / 6 = 115200	0
766	Transmission format	RW	0 = 1-8-E-1 / 1 = 1-8-O-1 / 2 = 1-8-N-1 / 3 = 1-8-N-2-	0
767	Bus termination	RW	0 = Off / 1 = On 120 Ω electronically switchable	0
768	Bus conf. command	RW	0 = Ready / 1 = Load / 2 = Discard	0
769	Status	R	See Register 769 "State" [▶ 10]	-

Device information										
1281	Index	R	Two bytes, each coding an ASCII character	Example: 00 5A Æ 00 "Z" Device is of series "Z"						
1282	Factory Date HWord	R	Two bytes, the lower coding the year (hex)	Example: Reg. 1282 = 000F Reg. 1283 = 0418						
						HWord		LWord		
						-	YY	MM	DD	
1283	Factory Date LWord	R	Two bytes, HByte codes the month (hex), LByte the day (hex)	Hex	00	0F	04	18		
				Dec	00	15	04	24		
				➔ Device was manufactured 24 April, 2015						
1284-85	Serial number	R	Hword + LWord = Series number (hex)	Example: Reg. 1284 ➔ 000A Reg. 1285 ➔ A206 ➔ AA206 (hex) = 696838 (dec)						
1409-16	ASN [characters 16..1]	R	Each register two bytes, each coding an ASCII char. ASN is coded beginning with reg. 1409	Example: 0x47 44 = GD 0x42 31 = B1 0x38 31 = 81 0x2E 31 = .1 0x45 2F = E/ 0x4D 4F = MO ➔ ASN = "GDB181.9E/MO"						

[1]   Documents can be downloaded at http://siemens.com/bt/download.

Register 769 "State"

Status			
Bit 00	1 = Reserved	Bit 06	1 = Not available
Bit 01	1 = Backup mode active	Bit 07	1 = Not available
Bit 02	1 = Not available	Bit 08	1 = Not available
Bit 03	1 = Not available	Bit 09	1 = Self-test failed
Bit 04	1 = Mechanical fault, device jammed or manual override [1] or calibrating [1]	Bit 10	1 = Self-test successful
Bit 05	1 = Not available	Bit 11	1 = Not available

Supported function codes

Function codes	
03 (0x03)	Read holding register
04 (0x04)	Read input registers
06 (0x06)	Write single register
16 (0x10)	Write multiple registers (Limit: Max. 120 registers within one write operation)

Communication properties

Communication		
Communication protocol	Modbus RTU	RS-485, not galvanically isolated
	Number of nodes	Max. 32
	Address range	1...248 / 255
	Factory setting	255
	Transmission formats	1-8-E-1, 1-8-N-1, 1-8-O-1, 1-8-N-2
	Factory setting	1-8-E-1
	Baud rates (kbaud)	Auto / 9.6 / 19.2 / 38.4 / 57.6 / 78.4 / 115.2
	Factory setting	Auto
	Bus termination	120 Ω electronically switchable
	Factory setting	Off

Function description

Register 1/3 "Setpoint/actual value"

The controller setpoint for the position to move to, 0...100 % stroke/angle of rotation, scaling 0.01, i.e. 0 % = 0 and 100 % = 10000

The actual value reported by the device, with the same scaling.

Register 256 "Restarting the device"

Restarting by:

- resetting power (turning operating voltage off and on)
- Sending "ReInitDevice" command.

⇒ Actuator restarts and sets all process values except actual value (= 50%) and setpoint (= startup setpoint) to factory settings.

Register 256 "Self-test"

When triggered, the self test drives the actuator to the detected limits and sets the flags in register 769 according to the result (bit 09 = 1 "failed" or bit 10 = 1 "passed").

The self-test fails, if the limits were not reached from the lower end (equates to a jam). Exceeding the min/max values does not fail the self-test.

i	The self-test can only be performed, if bit 04 = 0 in register 769 "Status", in other words, there is currently no blockage or manual operation

Register 256 "Reset"

The actuator supports the following reset/re-initialization behavior:

- Local reset by push-button
- Reset over bus with command "Remote-Reset"

Effect of reset:

- Process values except actual value and setpoint are reset to factory settings.
- Network parameters (register 513...516 and 764...768) are only reset in case of a local reset. When resetting over the network, the network parameters are retained, as otherwise communication would be lost.
- Not reset are: Counters and device info.

Register 260/261 "Minimum and maximum position"

Electronic positioning limitation

Register 262 "Actuator runtime"

Read only; positioning time from one stop to another.

Register 513...515 "Backup mode"

The device can be configured to go to a defined state if communication to the controller is lost.

- Waiting time to recognize communication loss → Register 515
- Reaction:
    - Go to a predefined backup position → Register 514
    - Deactivate (factory setting): The actuator controls to the last received setpoint, until a new valid setpoint is received.

Register 516 "Startup setpoint"

The parameter defines a positioning setpoint for the actuator at initial commissioning or after a power reset, before receiving a new valid setpoint from the controller.

Register 794...766 "Modbus configuration"

Configures the RS-485 address and transmission parameters.

Register 767 "Bus termination"

Defines the electronic switching 120 Ω resistance for bus termination.

Register 768 "Bus config. command"

The "Load" function must be queried in the register within 30 s to save the parameters if parameters in Registers 764...766 "Modbus configuration" are changed over the bus. Otherwise, the changes are discarded.

Device diagram / connecting cable

The actuators come with a prewired connecting cable. All devices connected to it must be connected to the same neutral line G0.

| Wire code	Wire color		Termi-nal code	Meaning	Connection diagram
1	red	RD	G	Voltage phase AC 24 V	
2	black	BK	G0	Voltage neutral line AC 24 V	
6	violet	VT	REF	Reference line (Modbus RTU)	
8	gray	GY	+	Bus + (Modbus RTU)	
9	pink	PK	-	Bus - (Modbus RTU)	

Note

Operating voltage on terminals G and G0 must comply with the requirements for SELV or PELV.

Safety transformers featuring twofold insulation must be used as per EN 61558; they must be designed for 100% duty.

Connection		
Cable length		0.9 m
Voltage supply / communication	Wire number and diameter	5 x 0.75 mm^2

External Modbus converter
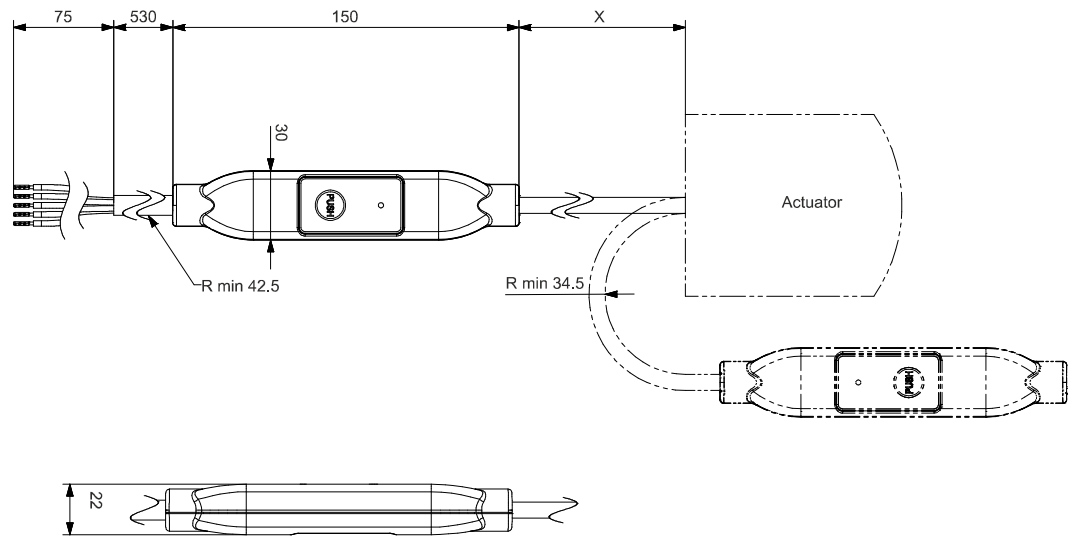
Dimensions in mm

X [mm]	kg [kg]
250	0.15

Revision numbers

Type	Firmware version	Valid from rev. no.
GDB161.9E/MO S55499-D682	2.1	..A
GLB161.9E/MO S55499-D681	2.1	..K
GLD161.9E/MO S55499-D695	2.1	..F
GMA161.9E/MO S55499-D683	2.1	..C