

Electromotive actuators for valves

Modbus communication profiles



Actuators SA../MO

- SAS61../MO operating voltage AC 24 V / DC 24 V
RS-485 for Modbus RTU communication
- SAT61../MO operating voltage AC 24 V / DC 24 V
RS-485 for Modbus RTU communication
- SAX61../MO operating voltage AC 24 V / DC 24 V
RS-485 for Modbus RTU communication
- SAY61../MO operating voltage AC 24 V / DC 24 V
RS-485 for Modbus RTU communication
- SAV61../MO operating voltage AC 24 V / DC 24 V
RS-485 for Modbus RTU communication

This document describes the network functions of the actuator series SA..61../MO.

Functions

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 / 76.8 / 115.2 kBaud
Transmission formats	1-8-E-1, 1-8-O-1, 1-8-N-1, 1-8-N-2
Bus termination	120 Ω electronically switchable

A detailed description of the device functions and operation is available in the documentation on basics, document numbers CE1P4040 and CE1P4041.

The documents can be downloaded at <http://siemens.com/bt/download>, see also "Product documentation [► 3]".

Type summary

Type	Stock number	Stroke	Operating voltage	Positioning		
				signal	force	time
SAS61.03/MO	S55158-A121	5.5 mm	AC/DC 24 V	Modbus RTU	400 N	30 s
SAS61.33/MO	S55158-A122				300 N	8 s
SAT61.008/MO	S55158-A123					15 s
SAT61.51/MO	S55158-A124					
SAX61.03/MO	S55150-A140	20 mm			800 N	30 s
SAX61P03/MO	S55150-A143				500 N	
SAY61P03/MO	S55150-A145	200 N				
SAV61.00/MO	S55150-A141	40 mm			1600 N	120 s
SAV61P00/MO	S55150-A144				1100 N	

Title	Contents	Document no.
Actuators SAX.., SAY.., SAV.., SAL.. for valves	Basic documentation: Detailed information on stroke actuators including Modbus types, for valves with 20/40 mm stroke, and rotary actuators for butterfly valves	CE1P4040en
Actuators SAS.., SAT.. for valves	Basic documentation: Detailed information on stroke actuators including Modbus types, for valves with 5.5 mm stroke	CE1P4041en
Electromotive actuators for valves SAX..	Data sheet: Product description SAX..	CE1N4501
Electromotive actuators for valves SAX..P..	Data sheet: Product description SAX..P..	CE1N4509
Electromotive actuators for valves SAY..P..	Data sheet: Product description SAY..P..	A6V10628469
Electromotive actuators for valves SAV..	Data sheet: Product description SAV..	CE1N4503
Electromotive actuators for valves SAV..P..	Data sheet: Product description SAV..P..	CE1N4510
Electromotive actuators for valves SAS..	Data sheet: Product description SAS..	CE1N4581
Electromotive actuators for valves SAT..	Data sheet: Product description SAT..	CE1N4584
Climatix, Standard application for air handling units	Overview / Description: Climatix air conditioning application	CE1A3975
Mounting instructions S..6../MO and G..161../MO	Mounting instructions: Mounting and installation instructions	Printed on the device, and A5W00027551
Valve Actuator DIL Switch Characteristic Overview	Commissioning / Configuration: Illustration/description of the characteristics of the valve and actuator combination, depending on the 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 via the local HMI, see "User interface [► 5]".

Check the following during commissioning:

- *Bus configuration* (address, baud rate, transmission format and optional bus termination). The initial address 255 ²⁾ allows multiple actuators to be mounted and commissioned at the same time without interfering with each other.
- *Actuator parameters* (opening direction, positioning limits, position adaption etc.). These values can be read via the Modbus register. Parameters may not be written cyclically.

¹⁾ Documents can be downloaded at <http://siemens.com/bt/download>.

²⁾ The address 255 means "unassigned", and must be adjusted for the adapter to be operable.

Full or partial configuration via bus

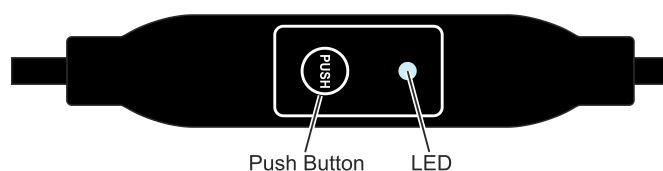
The devices can be configured via bus if the pre-commissioning settings allow for a connection between the Modbus client/programming tool and peripheral devices (i.e. non-conflicting addresses and matching baud rate / transmission format).

- *Full configuration via bus*: Given a unique Modbus address, the client/programming tool can establish a connection after start-up using the presets for transmission format and baud rate (or auto-baud).
- *Partial configuration via bus*: Given a non-unique Modbus address, the address must first be set to a unique value, either by inputting it with the pushbutton (cf. "Enter address with pushbutton [► 7]") or by setting the address to 246 by pressing the pushbutton 5...10 seconds (cf. "Pushbutton operation [► 5]"). Subsequently, the client/programming tool can establish a connection after start-up using the presets for transmission format and baud rate (or auto-baud).

Once a connection is established, the bus and actuator parameters can be set via bus to the intended values. When writing to the bus parameters, "1 = Load" must be written to Reg. 768 within 30 seconds; otherwise, the changes are discarded.

Example: The table shows the register values before and after changing them 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



Pushbutton operation

Action		Pushbutton operation	Feedback
Return current Modbus address (starting from lowest digit)		Briefly press button 1 x (<1 s)	1st digit (single digit): red 10-digit (double digit): green 100-digit (triple digit): orange LED blinks blue 1 x after address indication if bus termination is switched on. Example: 124 = 4 x red, 2 x green, 1 x orange
Switch bus termination on/off			
	Switch on	Press button 3 x Wait >1 s	LED stops blinking/flashing.
		<i>Within 10 s:</i> Briefly press button 1 x (<1 s)	LED flashes blue 1 x blue (termination mode on). Button not pressed within 10 s: - Address (and bus termination, if applicable) is indicated. - Device enters normal mode.
		<i>Within 10 s:</i> Press and hold button until LED turns red	LED is lit red (confirmation). Button not pressed within 10 s: - Address (and bus termination, if applicable) is indicated. - Device enters normal mode.
		Release button	LED turns off. Address is indicated. LED blinks blue 1 x after address indication (termination mode on). Device enters normal mode.
	Switch off	Press button 3 x Wait >1 s	LED stops blinking/flashing.
		<i>Within 10 s:</i> Press and hold button until LED turns red	LED is lit red (confirmation). Button not pressed within 10 s: - Address (and bus termination, if applicable) is indicated. - Device enters normal mode.
		Release button	LED turns off. Address is indicated. [LED DOES NOT flash blue following address indication (termination mode off).] Device enters normal mode.
Enter Modbus address with pushbutton		Press and hold button 1...5 s	See "Enter address with pushbutton [▶ 7]"

Action	Pushbutton operation	Feedback
Enable pushbutton addressing (when using Climatix controllers)	Press and hold button 5...10 s	LED is lit red and turns off after 5 s.
	Release button	LED is lit orange.
Reset to factory settings	Press and hold button >10 s	LED flashes orange.

LED colors and blinking patterns

Color	Blinking pattern	Description
Green	1 s on / 5 s off	Normal mode without bus traffic
	Flickering	Normal mode with bus traffic
Orange ¹⁾ / Green	1 s orange / 1 s green	Override control mode
Orange ¹⁾	1 s on / 1 s off	Bus parameters not yet configured
	1 s on / 5 s off	Backup mode (replacement mode)
Red	Steady	• Mechanical error • Device jammed • Manual intervention • 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

¹⁾ The color of the orange LED can vary depending on the viewing angle, and appear more yellow or greenish.

Reset actuator with pushbutton

1. Press and hold button >10 s.
⇒ LED flashes **orange**.
2. Release button *while* LED is flashing.
⇒ LED flashes for another 3 s.
⇒ If the button is pressed again *during* these 3 s, **the reset is canceled**.
3. Press button *after* these 3 s.
⇒ LED is lit **red** (reset) while the device restarts.

Enter address with pushbutton

Display current address (starting from lowest address digit)

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

- ◆ Briefly press button (<1 s).
- ⇒ Current Modbus address is indicated.

Colors / blinking pattern			
	1-digit: red	10-digit: green	100-digit: orange
Example for address 124 :			
LED			
Note	The address is both entered and indicated starting at the lowest digit (1st digit), see figure above. (Example: 124 starts with 4 x red)		

Enter new address (starting from lowest address digit)

1. Enter addressing mode:

- Press button >1 s, until LED is lit **red**.
- Release button (before LED turns off).

2. Enter digits: Press button n times.

- ⇒ LED flashes 1 x per press of the button as feedback.
Colors: 1-digit: **red** / 10-digit: **green** / 100-digit: **orange**

3. Save digits:

- Press and hold button, until LED is lit the color of the following digit.
- Release button.

4. Save address:

- Press button, until LED is lit **red** (confirmation).
- Release button.

⇒ Address is saved and repeated 1 x as confirmation.



Digits are skipped by holding the button until the LED is lit the color of the digit to be entered.



An address can be saved at any point, i.e. already after setting the 1-digit, or after setting the 1- and 10-digits.



If after entering the address, the button is released before the LED is lit red, the entered address is discarded.

Set address "124"

1. Enter addressing mode: press button 1...5 s.
2. Enter 1-digit: press button 4 x.
⇒ LED flashes **red** 1 x per press of the button.
3. Save 1-digit: press and hold button.
⇒ LED is lit **green**.
4. Release button.
5. Enter 10-digit: press button 2 x.
⇒ LED flashes **green** 1 x per press of the button.
6. Save 10-digit: press and hold button.
⇒ LED is lit **orange**.
7. Release button.
8. Enter 100-digit: press button 1 x.
⇒ LED flashes **orange** 1 x per press of the button.
9. Save address: press and hold button.
⇒ LED is lit **red**.
10. Release button.
⇒ Address is saved and repeated 1 x as confirmation.

Set address "50"

1. Enter addressing mode: press button 1...5 s.
2. Skip 1-digit: press and hold button.
⇒ LED is lit **green**.
3. Release button.
4. Enter 10-digit: press button 5 x.
⇒ LED flashes **green** 1 x per press of the button.
5. Save 10-digit: press and hold button.
⇒ LED is lit **orange**.
6. Release button.
7. Save address (skip 100-digit): press and hold button.
⇒ LED is lit **red**.
8. Release button.
⇒ Address is saved and repeated 1 x as confirmation.

Set address "7"

1. Enter addressing mode: press button 1...5 s.
2. Enter 1-digit: press button 7 x.
⇒ LED flashes **red** 1 x per press of the button.
3. Save address (skip 10- and 100-digits): press and hold button.
⇒ LED is lit **red**.
4. Release button.
⇒ Address is saved and repeated 1 x as confirmation.

Reg.	Addr.	Name	R/W	Range / Listing	Factory setting
Process values					
1	0	Setpoint	RW	0...100 % = 0...10000	-
2	1	Override control	RW	0 = Off / 1 = Extend / 2 = Retract / 3 = Stop	
3	2	Actual value	R	0...100 % = 0...10000	
256	255	Command	RW	0 = Ready / 1 = Calibration in process / 2 = Self-test / 3 = Reinitialize / 4 = Remote reset	

Reg.	Addr.	Name	R/W	Range / Listing	Factory setting
Parameter ¹⁾					
262	261	Actuator runtime	R	30	30 s
263	262	Positioning signal curve between Y and U	RW	0 = Linear / 1 = Logarithmic For detailed information, see "Valve Actuator DIL Switch Characteristic Overview" / A6V12050595 ("Product documentation [► 3]")	[Dependent on type]
264	263	Valve jam monitoring tolerance	RW	0...100 % = 0...10000	[Dependent on type]
513	512	Backup mode (replacement mode)	RW	0 = Go to backup position / 1 = Not available / 2 = Deactivated	2 = Deactivated
514	513	Backup position	RW	0...100 % = 0...10000	0 %
515	514	Backup timeout	RW	0...900	900 s
516	515	Start-up setpoint	RW	0...100 % = 0...10000	0 %
764	763	Modbus address	RW	1...245 / 255 = "unassigned" ²⁾ 246 = On-event addressing 248 → 255 = "unassigned"	255
765	764	Baud rate	RW	0 = Auto / 1 = 9600 / 2 = 19200 / 3 = 38400 / 4 = 57600 / 5 = 76800 / 6 = 115200	0 = Auto
766	765	Transmission format	RW	0 = 1-8-E-1 / 1 = 1-8-O-1 / 2 = 1-8-N-1 / 3 = 1-8-N-2-	0 = 1-8-E-1
767	766	Bus termination	RW	0 = Off / 1 = On 120 Ω, electronically switchable	0 = Off
768	767	Bus conf. command	RW	0 = Ready / 1 = Load / 2 = Discard	0 = Ready
769	768	State	R	See "Register 769 "State" [► 11]"	-

¹⁾ Parameters may not be written cyclically!

²⁾ If the address is set to 248 or higher, it is instead automatically set to the initial address 255 as soon as Reg. 268 is set to 1 ("Load").

Statistics/Counters				
Reg.	Name	R/W	Meaning	Example
1025	Cumulated up time (HWord)	R	HWord + LWord = cumulated time device has been on (hex), i.e. the motor has been running or holding, in seconds	1025 = 00 12 (hex) 1026 = A2 E1 (hex) 12A2E1 (hex) → 1221345 (dec) → Cum. up time = 1'221'345 s
1026	Cumulated up time (LWord)	R		
1027	Cumulated running time (HWord)	R	HWord + LWord = cumulated running time (hex), i.e. for how long has the motor run, in seconds	1027 = 00 08 (hex) 1028 = 12 51 (hex) 81251 (hex) → 528977 (dec) → Cum. running time = 528.977 s
1028	Cumulated running time (LWord)	R		
1029	Repositioning counter (HWord)	R	HWord + LWord = how often has the positioning signal been changed	1029 = 00 00 (hex) 1030 = A0 01 (hex) - A001 (hex) → 40961 (dec) → Repositioned = 40.961 times
1030	Repositioning counter (LWord)	R		
1031	Power-up counter	R	How often (hex) has the device been started up	1031 = 00 A2 (hex) → 162 (dec) → Powered up = 162 times
1032	Jam counter	R	How often (hex) has the device breached the valve jam tolerance (reg. 264)	1032 = 00 02 (hex) → 2 (dec) → Jams counted = 2

Device information									
Reg.	Name	R/W	Meaning	Example					
1281	Factory index	R	Two bytes, each encoding an ASCII character	• 1281 = 00 5A (hex) → 0Z → Device is of series = "Z"					
1282	Factory date (HWord)	R	Two bytes, the lower encoding the year (hex)	• 1282 = 00 18 (hex) • 1283 = 02 0F (hex)					
1283	Factory date (LWord)	R	Two bytes, HByte encoding the month (hex), LByte encoding the day (hex)			HWord	LWord		
						-	YY	MM	DD
					Hex	00	18	02	0F
					Dec	00	24	02	15
			→ Device was manufactured = February 15, 2024						
1284	Serial number (HWord)	R	HWord + LWord = Serial no. (hex)	• 1284 = 00 0A (hex) • 1285 = A2 06 (hex) • → AA206 (hex) = 696838 (dec) → Device has serial no. = "696838"					
1285	Serial number (LWord)	R							

Device information				
Reg.	Name	R/W	Meaning	Example
1289	Firmware version (HWord)	R	Two bytes, HByte corresponds to the major version, LByte corresponds to the minor version	1289 = 03 01 (hex) 1290 = 03 07 (hex) → 775 (dec)
1290	Firmware revision (LWord)	R	Two bytes, encoding the patch version (hex)	→ Firmware version = "03.01.0775"
1291	Hardware version	R	Two bytes, each encoding an ASCII character	1291 = 42 00 (hex) → Hardware version = "B"
1409...16	ASN [characters 16...1]	R	Two bytes per register, each of which encodes an ASCII character. First characters encoded in Reg. 1409.	1409 = 53 41 (hex) → SA 1410 = 54 36 (hex) → T6 1411 = 31 2E (hex) → 1. 1412 = 30 30 (hex) → 00 1413 = 38 2F (hex) → 8/ 1414 = 4D 4F (hex) → MO → ASN = "SAT61.008/MO"

Register 769 "State"

Service flags			
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⁾	1 = Mechanical error, device jammed, manual intervention or calibration	Bit 10	1 = Self-test successful
Bit 05	1 = Not available	Bit 11	1 = Not available

¹⁾ After 10 seconds

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...245 / 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 / 76.8 / 115.2
	Factory setting	Auto
	Bus termination	120 Ω electronically switchable
	Factory setting	Off



The following applies to drives with fail safe function:
When the temperature limiter is triggered, the drive can no longer be addressed via the bus

Connection diagram

Connection diagram	Wire code	Wire color	Terminal code	Meaning	
III 1 (G) 6 (REF) 8 (+) 9 (-) M 100% 0% (G0) 2	Cable 1: Power supply				
	1	red	RD	G	Voltage phase AC 24 V
	2	black	BK	G0	Voltage neutral line AV 24 V
	Kabel 2: Communication				
	6	purple	VT	REF	Reference line (Modbus RTU)
	8	gray	GY	+	Bus + (Modbus RTU)
	9	pink	PK	-	Bus - (Modbus RTU)

NOTICE

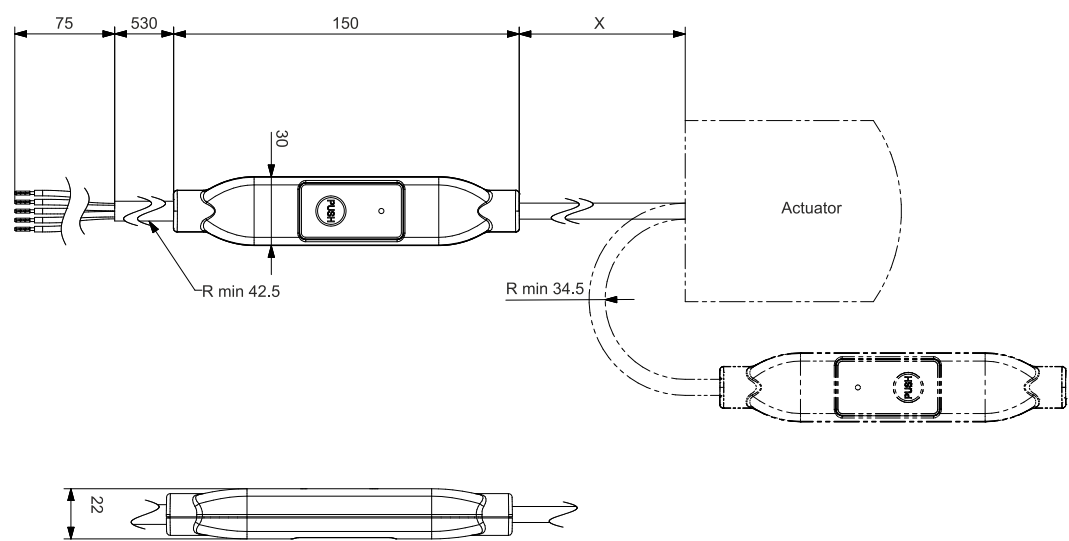


Operating voltage on terminals G and G0 must comply with the requirements for SELV or PELV.
Safety transformers featuring twofold insulation must be used as per EN 61558; they must be designed for 100 % duty cycle.

Connection cable		
Cable length		0.9 m
Power supply	Number and diameter of wires	5 x 0.75 mm ²
Communication		

Dimensions

External Modbus converter



Dimensions in mm

	X	
	[mm]	[kg]
	250	0.15

Revision numbers

Type	Stock no.	Valid from rev. no.	Type	Stock no.	Valid from rev. no.
SAS61.03/MO	S55158-A121	..A	SAX61.03/MO	S55150-A140	..A
SAS61.33/MO	S55158-A122	..A	SAX61P03/MO	S55150-A143	..A
SAT61.008/MO	S55158-A123	..A	SAY61P03/MO	S55150-A145	..A
SAT61.51/MO	S55158-A124	..A	SAV61.00/MO	S55150-A141	..A
			SAV61P00/MO	S55150-A144	..A

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Smart Infrastructure
Global Headquarters
Theilerstrasse 1a
CH-6300 Zug
+41 58 724 2424
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