

Modbus Interface Description



JR actuator Rotary actuator for butterfly valves

Edition 2024-10 / V1.06

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Modbus general notes

General information

Date	21.06.2024
Product Name	JR actuator
Actuator Type	JR..A-BAC-..
Protocol	Modbus RTU over RS-485

Modbus RTU

Transmission Formats	1-8-N-2, 1-8-N-1, 1-8-E-1, 1-8-O-1 (Default: 1-8-N-2)
Baud Rates	9'600, 19'200, 38'400, 76'800, 115'200 Bd (Default: 38'400 Bd)
Address	1...247 (Default: 1)
Number of Nodes	Max. 32 (without repeater)
Terminating Resistor	120 Ω

Parametrisation

Tool	Belimo Assistant 2
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Register implementation

All data is arranged in a table and addressed by 1..n (Register No.) or 0..n-1 (Address). No distinction is made between data types (Discrete Inputs, Coils, Input Registers and Holding Registers). As a consequence, all data can be accessed with the two commands for Holding Register. The commands for Discrete Inputs and Input Registers can be used as an alternative.

Supported commands

Standard commands:	Optional commands:
Read Holding Registers [3]	Read Discrete Inputs [2]
Write Single Register [6]	Read Input Registers [4]
	Write Multiple Registers [16]

Command

“Read Discrete Inputs”

The command reads one or more bits and can alternatively be used for Register No. 108 (Malfunction and Service Information).

Example:

The start address to be used is 1719 -> **107** (Register Address) * **16** (Bit) = **1712**

Interpret values in the registers

All values in the register are unsigned integer data types. Exceptions are marked with **. Signed integers are represented as two's complement.

Example unsigned integer:	Example signed integer:
Read (Function 03, 1 Register)	Read (Function 03, 1 Register)
Value Register No. x	Value Register No. x
= 0001 1010 1100 1000 ₂	= 1111 1101 1111 0010 ₂
= 6,856 ₁₀	= -526 ₁₀
Actual value	Actual value
= value * scaling factor * unit	= value * scaling factor * unit
= 6,856 * 0.01 * unit	= -526 ₁₀ * 0.01 * unit
= 68.56 unit	= -5.26 unit

32-bit values in two registers

Values that exceed 65,535 are stored in two consecutive registers and have to be interpreted as "little endian byte swap" / LSW (Least Significant Word) first.
 Note: While the regular "little endian" interpretation refers to the each byte (8 bit Word) per register, the additional "byte swap" interpretation leads to where "little endian" refers to the 16 bit Word of one register.

Example:

Register No. x (Value LowWord)	Register No. x + 1 (Value HighWord)
= 14,551 ₁₀	= 19 ₁₀
= 0011 1000 1101 0111 ₂	= 0000 0000 0001 0011 ₂

Value LowWord = 14,551 = 0011 1000 1101 0111 ₂	Value HighWord = 19 = 0000 0000 0001 0011 ₂
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32-bit value
 = 0000 0000 0001 0011 0011 1000 1101 0111₂
 = 1,259,735₁₀
 = **1,259.735 unit**

Math formula:

32-bit value = (Value HighWord * 65,536) + Value LowWord
 32-bit value = (19 * 65,536) + 14,551
 = 1,259,735
 = 1,259.735 unit

Deactivated registers

If a register is not supported by a device or by a device setting, this is indicated by 65,535 (1111 1111 1111 1111₂).

Modbus register overview

Operation

No.	Address	Register	Access
1	0	Relative Setpoint [%]	R / W
2	1	Override Control	R / W
3	2	–	–
4	3	Device Type	R
5	4	Relative Position [%]	R
6	5	Absolute Position [°]	R
..	..	–	–
12	11	Analog Setpoint [%]	R
13	12	Sensor 1 Value	R
14	13	Sensor 1 Temperature [°C] **)	R
15	14	Sensor 1 Temperature [°F] **)	R
16	15	Sensor 1 Temperature [selected unit] **)	R
..	..	–	–
50	49	Sensor 2 Value	R
51	50	Sensor 2 Temperature [°C] **)	R
52	51	Sensor 2 Temperature [°F] **)	R
53	52	Sensor 2 Temperature [selected unit] **)	R

**) signed integer

Description Access: R = Read, W = Write

Service

No.	Address	Register	Access
100	99	Bus Termination	R
101	100	Series Number 1 st part	R
102	101	Series Number 2 nd part	R
103	102	Series Number 4 th part	R
104	103	Firmware Version	R
105	104	–	–
106	105	–	–
107	106	Maximum Limit [%]	R / W
108	107	Malfunction and Service Information	R
109	108	Bus Watchdog Fail Action	R / W
110	109	Timeout for Bus Watchdog [s]	R / W
..	..	–	–
119	118	Setpoint Source	R / W
120	119	–	–
121	120	Sensor 1 Type	R / W
122	121	Sensor 1 Passive Type	R / W
123	122	Sensor 2 Type	R / W
124	123	Sensor 2 Passive Type	R / W
..	..	–	–
152	151	Select Temperature Unit	R / W

Description Access: R = Read, W = Write



All writeable registers >100 are persistent and are **not** supposed to be written on a regular basis.

Modbus register description

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
1	0	Relative setpoint The setpoint is related to the position. See also Register No. 5 and Register No. 107. Overridden = true, if forced control (bus, tool and analog forced control) is active.	0...10'000 Default: 0	%	0.01	R / W
2	1	Override control Overrides setpoint with defined values	0: None 1: Open 2: Close 3: – 4: Mid 5: Max 6: – 7: – 8: – 9: – 10: – Default: 0	–	1	R / W
4	3	Device type	0: Device not connected 1: Air / Water 2: VAV / EPIV 3: Fire 4: Energy Valve 5: 6-way EPIV	–	–	R
5	4	Relative position	0...10'000	%	0.01	R
6	5	Absolute position	0...9'500	°	0.01	R
12	11	Analog setpoint Shows the setpoint in % if actuator is controlled by analog signal (Register Nr. 119).	0...10'000	%	0.01	R
13	12	Sensor 1 value The conversion of passive sensors can be selected by Register No. 122. Scaling depends on the sensor type PT1000 / Ni1000 → 1 NTC10K → 10	0...55'000	mV 0 / 1 Ω	1 – 1	R
14	13	Sensor 1 temperature	–2'731...1'768	°C	0.1	R
15	14	Sensor 1 temperature	–4'596...3'503	°F	0.1	R
16	15	Sensor 1 temperature Unit can be selected by Register No. 152.	–2'731...1'768°C 0...4'500 K –4'596...3'503°F	0: °C 1: K 2: °F	0.1	R
50	49	Sensor 2 value The conversion of passive sensors can be selected by Register No. 124. Scaling depends on the sensor type PT1000 / Ni1000 → 1 NTC10K → 10	0...55'000	mV 0 / 1 Ω	1 – 1	R
51	50	Sensor 2 temperature	–2'731...1'768	°C	0.1	R
52	51	Sensor 2 temperature	–4'596...3'503	°F	0.1	R
53	52	Sensor 2 temperature Unit can be selected by Register Nr. 152.	–2'731...1'768°C 0...4'500 K –4'596...3'503°F	0: °C 1: K 2: °F	0.1	R

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
100	99	Bus termination	0: Disabled 1: Enabled	–	1	R
101	100	Series number 1st part	–	–	1	R
102	101	Series number 2nd part	–	–	1	R
103	102	Series number 4th part	–	–	1	R
104	103	Firmware version	–	–	1	R
107	106	Maximum limit Max has to be $\geq 30\%$	3'000...10'000 Default: 10'000	%	0.01	R / W
108	107	Malfunction and service information Value is bit-coded. More than one bit can be set to 1. Not all bits mentioned in the enumeration are used for this product range. 3: Gear train disengaged / hand crank plugged 5: Actuator cannot move: Mechanical overload due to blocked valve, etc. 9: Watchdog triggered: Timeout for the Bus Watchdog expired.	Bitmask = 0: Power fail 1: – 2: – 3: Gear train disengaged / hand crank plugged 4: – 5: Mechanical overload 6: – 7: – 8: – 9: Watchdog triggered 10: – 11: – 12: – 13: – 14: – 15: –	–	1	R
109	108	Bus watchdog fail action The bus monitoring controls the Modbus communication. If neither the Setpoint (Register No. 1) nor the Override Control (Register No. 2) is renewed before the Timeout for Bus Watchdog (Register No. 110), the actuator is controlled by the Bus Watchdog Fail Action. Triggered bus monitoring is indicated in the Malfunction and Service Information (Register No. 108).	0: None 1: Open 2: Close 3: Max 4: – 5: Mid 6: – 7: – 8: – 9: – 10: – 11: – 12: – 13: – Default: 0	–	1	R / W
110	109	Timeout for bus watchdog If no write request is received within the timeout, the device will execute the action defined in Register No. 109 (bus watchdog fail action).	5...3'600 Default: 120	s	1	R / W
119	118	Setpoint source If Analog (1), then actuator is controlled by analog signal 0...10 V on wire 3. If Bus (2), then setpoint via bus.	0: Analog 1: Bus Default: 0	–	1	R / W

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
121	120	Sensor 1 type Additional sensor input	0: None 1: Active 2: – 3: Passive 4: Switch Default: 0	–	1	R / W
122	121	Sensor 1 passive type Value selection related to selected units on Register No.152. Only available if Register No. 121 Sensor 1 type is set to value 3 "Passive".	0: None 1: PT1000 2: Ni1000EU 3: – 4: – 5: – 6: – 7: NTC10k2 8: NTC10k3 Default: 0	–	1	R / W
123	122	Sensor 2 type Additional sensor input	0: None 1: Active 2: – 3: Passive 4: Switch Default: 0	–	1	R / W
124	123	Sensor 2 passive type Value selection related to selected units on Register No.152. Only available if Register No. 123 Sensor 2 type is set to value 3 "Passive".	0: None 1: PT1000 2: Ni1000EU 3: – 4: – 5: – 6: – 7: NTC10k2 8: NTC10k3 Default: 0	–	1	R / W
152	151	Select temperature unit	0: °C 1: K 2: °F Default: 0	–	–	R / W

Description Access: R = Read, W = Write

All inclusive.

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