







Modbus Interface Description

Air/water Actuators
General actuators for air and water

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BELIMO

General notes

General information

Date	05.09.2023
Product Name	Air/water actuator
Actuator Type	..M(C)24A-MOD, ..R24A-MOD, ..V(K)24A-MOD, ..F24A-MOD, ..RF24A-MOD, ..H24A-MOD
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

Quick addressing

Actuators support quick addressing via the “Address” and “Adaption” buttons. For detailed information, please see product datasheet (chapter Service).

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. 105 (Malfunction and Service Information).

Example:

The start address to be used is 1664 -> **104** (Register Address) *** 16** (Bit) = **1664**

Interpret values in the registers

All values in the register are unsigned integer data types.

Example:

Read (Function 03, 1 Register)
Value Register No. x
= 0001 1010 1100 1000_2
= $6{,}856_{10}$

Actual value
= value * scaling factor * unit
= 6,856 * 0.01 * unit
= **68.56 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.

Both registers have to be written at once with function „Write Multiple Registers [16]”. It cannot be written together with other registers.

Example:

Register No. x (Value LowWord)	Register No. x + 1 (Value HighWord)
= $14{,}551_{10}$ = $0011\ 1000\ 1101\ 0111_2$	= 19_{10} = $0000\ 0000\ 0001\ 0011_2$

Value LowWord	**Value HighWord**
= 14,551 = $0011\ 1000\ 1101\ 0111_2$	= 19 = $0000\ 0000\ 0001\ 0011_2$

32-bit value
= $0000\ 0000\ 0001\ 0011\ 0011\ 1000\ 1101\ 0111_2$
= $1{,}259{,}735_{10}$
= **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 ($1111\ 1111\ 1111\ 1111_2$).

Register overview

Operation

No.	Address	Register	Access
1	0	Setpoint [%]	R / W
2	1	Override Control	R / W
3	2	Command	R / W
4	3	Actuator Type	R
5	4	Relative Position [%]	R
6	5	Absolute Position [°] [mm]	R
7	6	–	–
8	7	–	–
9	8	Sensor Value 1 [mV] [Ω] [–] [°C] [°F]	R
10	9	–	–
11	10	–	–
12	11	–	–
13	12	Analog Setpoint [%]	R

Configuration

No.	Address	Register	Access
100	99	Bus Termination	R
101	100	Series Number 1st part	
102	101	Series Number 2nd part	R
103	102	Series Number 4th part	
104	103	Firmware Version	R
105	104	Malfunction and Service Information	R
106	105	Min [%]	R / W
107	106	Max [%]	R / W
108	107	Sensor Type 1	R / W
109	108	Bus Fail Position	R / W
110	109	Communication Watchdog	R / W
111	110	–	–
112	111	–	–
113	112	–	–
114	113	–	–
115	114	–	–
116	115	–	–
117	116	–	–
118	117	–	–
119	118	Setpoint Source	R / W
190	189	Fail-Safe Bridging Time	R / W
191	190	Fail-Safe Position	R / W



All writeable registers >100 are persistent and are **not** supposed to be written on a regular basis. Designated registers are highlighted in colour in the document.

Register descriptions

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
1	0	**Setpoint** Setpoint for actuator scaled between Min (Register No. 106) and Max (Register No. 107)	0...10'000 Default: 0	%	0.01	R / W
2	1	**Override Control** Overrides setpoint with defined values. Use of Fast open / Fast close: Fast open and Fast close cycles lead to increased mechanical load. Usage should be limited to certain time-critical events (e.g. frost protection). See information on cycles and running times in the specific data sheet.	0: None 1: Open 2: Close 3: Min 4: Mid 5: Max 6: Fast open 7: Fast close Default: None(0)	–	–	R / W
3	2	**Command** Initiation of actuator functions for service and test. After command is sent, register returns to None(0). With Reset(4), all malfunction and service information (Register No. 105) can be reset.	0: None 1: Adaption 2: Test 3: Sync 4: Reset Default: None(0)	–	–	R / W
4	3	**Actuator type**	0: Actuator not connected **1: Air / water** 2: VAV / EPIV 3: Fire 4: Energy Valve 5: 6way EPIV	–	–	R
5	4	**Relative position**	0...10'000	%	0.01	R
6	5	**Absolute position** The unit depends on the device: [°] for actuators with rotary movement [mm] for actuators with linear movement	0...max angle / stroke	° mm	1 1	R
7	6	–	–	–	–	–
8	7	–	–	–	–	–
9	8	**Sensor 1 value** Current value of sensor 1, depending on the setting of the sensor 1 type (Register No. 108) [mV] if sensor 1 type (Register No. 108) is Active(1) [Ω] if sensor 1 type (Register No. 108) is Passive_1K(2) or Passive_20K(3) [0 / 1] if sensor 1 type (Register No. 108) is Switch(4) [°C] if sensor 1 type (Register No. 108) is PT1000_C(5) or NI1000_C(6) or NTC10K2_C(7) [°F] if sensor 1 type (Register No. 108) is PT1000_F(8) or NI1000_F(9) or NTC10K2_F(10)	0...65'535	mV Ω – °C °F	1 1 0 / 1 0.1 0.1	R
10	9	–	–	–	–	–
11	10	–	–	–	–	–
12	11	–	–	–	–	–
13	12	**Analog setpoint** Shows the setpoint in % if actuator is controlled by analog signal.	0...10'000	%	0.01	R

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
100	99	**Bus termination** Indicates if bus termination (120 Ω) is enabled. Bus termination can be set with the configuration tools.	0: Inactive 1: Active Default: Inactive(0)	–	–	R
101	100	**Series number 1st part** Each device has an unambiguous series number, which is either impressed on or glued to the housing. The series number consists of 4 segments, although only parts 1, 2 and 4 are displayed on Modbus. Example: 00839-31324-064-008 1st part: 00839 2nd part: 31324 4th part: 008	–	–	–	R
102	101	**Series number 2nd part**	–	–	–	R
103	102	**Series number 4th part**	–	–	–	R
104	103	**Firmware version** Firmware version of communication module Example: 302, Version 3.02 For details see Firmware history	–	–	–	R
105	104	**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 actuator range. 1: Mechanical travel increased: The actuator has been moved outside the adapted working range. 2: Actuator cannot move: Mechanical overload, e.g. blocked actuator, etc. 8: Internal activity: Actuator performs a test run, adaptation, etc. 9: Gear train disengaged: The manual override button is pressed. 10: Bus Watchdog triggered: Timeout for the Bus Watchdog expired.	Bitmask = Bit0: – Bit1: Mechanical travel increased Bit2: Actuator cannot move Bit3: – Bit4: – Bit5: – Bit6: – Bit7: – Bit8: Internal activity Bit9: Gear train disengaged Bit10: Bus Watchdog triggered Bit11: – Bit12: – Bit13: – Bit14: – Bit15: –	–	–	R
106	105	**Min** Min has to be ≤ Max -20%	0...Max -20% Default: 0	%	0.01	R / W
107	106	**Max** Max has to be ≥ Min +20%	Min +20...100% Default: 100	%	0.01	R / W
108	107	**Sensor 1 Type** If setpoint source (Register No. 119) is Analog (hybrid mode), the sensor type 1 can be set to Active(1) in order to see the analog setpoint in mV. Note: After changing the sensor type, it might be necessary to restart the actuator in order for correct sensor values to be read out. For setting "4: Switch" it is mandatory that the analog control signal is parametrised to 2...10 V.	0: None 1: Active / hybrid 2: Passive_1K 3: Passive_20K 4: Switch 5: PT1000_C 6: NI1000_C 7: NTC10K2_C 8: PT1000_F 9: NI1000_F 10: NTC10K2_F Default: None(0)	–	–	R / W

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
109	108	**Bus fail position** Modbus communication is not monitored by default. In the event of a breakdown in communication, the actuator retains the current setpoint. The bus implementation tracks 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) expires, the actuator moves to the bus fail position. Triggered bus watchdog is indicated in the malfunction and service i (Register No. 105). In hybrid mode (SpSource (Register No. 119) = Analog, bus monitoring is not activated.	0: None / last setpoint 1: Fast close 2: Fast open 3: Mid position (parametrised) Default: None(0)	–	–	R / W
110	109	**Timeout for Bus Watchdog in s** Time until bus fail will be detected. If Bus Watchdog = 0 then deactivated If bus fail position (Register No. 109) different from 0, the bus fail position becomes active after the timeout for Bus Watchdog has expired.	0...3'600 Default: 0 If bus fail position (Register No. 109) not None(0), then Default: 120	s	1	R / W
111	110	–	–	–	–	–
112	111	–	–	–	–	–
113	112	–	–	–	–	–
114	113	–	–	–	–	–
115	114	–	–	–	–	–
116	115	–	–	–	–	–
117	116	–	–	–	–	–
118	117	–	–	–	–	–
119	118	**Setpoint source** Analog: Setpoint from analog signal 0...10 V on wire 3 Bus: Setpoint from Modbus (Register No. 1)	0: Analog 1: Bus Default: Bus(1)	–	–	R / W
190	189	**Fail-safe bridging time** In the event of a power failure, the actuator will remain stationary in accordance with the set bridging time. Only for electronic fail-safe actuators	0...10	s	1	R / W
191	190	**Fail-safe position** In the event of a power failure, the actuator will move into the selected fail-safe position, taking into account the bridging time that has been set. The rotary knob must be set to “Tool” position. Only for electronic fail-safe actuators	0...10'000	%	0.01	R / W

Description Access: R = Read, W = Write

Alles inklusive

Belimo ist Weltmarktführer in Entwicklung, Herstellung und Vertrieb von Feldgeräten zur energieeffizienten Regelung von Heizungs-, Lüftungs- und Klimaanlagen. Klappenantriebe, Regelventile, Sensoren und Zähler bilden dabei unser Kerngeschäft.

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BELIMO Automation AG
Brunnenbachstrasse 1, 8340 Hinwil, Schweiz
+41 43 843 61 11, info@belimo.ch, www.belimo.com