



Modbus Interface Description

2-way EPIV, DN 15...50 (Version 4.2) **Electronic pressure-independent characterized control valve**

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General notes

General information

Date	06/07/2023
Product Name	2-way EPIV
Product Model Number	EP.R2+(K)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)
Address	1...247 (Default: 1)
Number of Nodes	Max. 32 (without repeater)
Terminating Resistor	120 Ω

Configuration

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

Read Holding Registers [3]
Write Single Register [6]
Read Discrete Inputs [2]
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 No.) * **16** (Bit) = **1664**

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:

Read (Function 03, 1 Register)
Value Register No. x
= 0001 1010 1100 1000₂
= 6,856₁₀

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

Example signed integer:

Read (Function 03, 1 Register)
Value Register No. x
= 1111 1101 1111 0010₂
= -526₁₀

Actual value
= value * scaling factor * unit
= -526 * 0.01 * 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 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	= 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).

Register overview

Operation

No.	Address	Register	Access
1	0	Setpoint Relative [%]	R / W
2	1	Override Control	R / W
3	2	Command	R / W
4	3	Device Type	R
5	4	Relative Position [%]	R
6	5	Absolute Position [°]	R
7	6	Relative Volumetric Flow [%]	R
8	7	Absolute Volumetric Flow [l/s]	R
9	8	Absolute Volumetric Flow [gpm]	R
10	9	Absolute Volumetric Flow [selected unit]	LowWord R
11	10		HighWord
12	11	Setpoint Analog [%]	R
13	12	Sensor 1 Value [mV] [-]	R
..	..	-	-
16	15	Setpoint Absolute Volumetric Flow [l/s]	R
17	16	Setpoint Absolute Volumetric Flow [gpm]	R
18	17	Setpoint Absolute Volumetric Flow [selected unit]	LowWord R
19	18		HighWord
..	..	-	-
22	21	Temperature (flow body) [°C] **)	R
23	22	Temperature (flow body) [°F] **)	R
..	..	-	-
26	25	Glycol Concentration [%]	R
60	59	Accumulated volume [m ³]	LowWord R
61	60		HighWord
62	61	Accumulated volume [gal]	LowWord R
63	62		HighWord
64	63	Accumulated volume [selected unit]	LowWord R
65	64		HighWord

**) signed integer

Service

No.	Address	Register	Access
100	99	Bus Termination	R
101	100	Series Number 1 st part	
102	101	Series Number 2 nd part	R
103	102	Series Number 4 th part	
104	103	Firmware Version	R
105	104	Malfunction and Service Information	R
106	105	Minimum Volumetric Flow [%]	R / W
107	106	Maximum Volumetric Flow [%]	R / W
..	..	-	-
109	108	Bus Fail Action	R / W
110	109	Timeout for Bus Watchdog [s]	R / W
111	110	Nominal Volumetric Flow [l/s]	R
112	111	Nominal Volumetric Flow [gpm]	R
113	112	Nominal Volumetric Flow [selected unit]	LowWord
114	113		HighWord
..	..	-	-
117	116	Control Mode	R / W
..	..	-	-
119	118	Setpoint Source	R / W
..	..	-	-
121	120	Sensor 1 Type	R / W
..	..	-	-
130	129	Minimum Volumetric Flow Limit (V'_{min}) [l/s]	R / W
131	130	Minimum Volumetric Flow Limit (V'_{min}) [gpm]	R / W
132	131	Minimum Volumetric Flow Limit (V'_{min}) [selected unit]	LowWord
133	132		HighWord
134	133	Maximum Volumetric Flow Limit (V'_{max}) [l/s]	R / W
135	134	Maximum Volumetric Flow Limit (V'_{max}) [gpm]	R / W
136	135	Maximum Volumetric Flow Limit (V'_{max}) [selected unit]	LowWord
137	136		HighWord
..	..	-	-
148	147	Unit Selection Flow	R / W
..	..	-	-
150	149	Unit Selection Volume	R / W
..	..	-	-
201	200	Flow Meter Serial Number First Digits	LowWord
202	201		HighWord
203	202	Flow Meter Serial Number Last Digits	LowWord
204	203		HighWord



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 description

Control and general settings

These registers can be used to control and configure the fundamental functionalities and read the corresponding values of the 2-way EPIV.

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
1	0	<p>Setpoint relative The setpoint is related to either the position or the volumetric flow (of V'_{min}, V'_{max}). Is is scaled between Min and Max limits.</p> <p>The data point is active if the setpoint is controlled by Register No. 119: Setpoint source = 1: Bus.</p> <p>See also: Register No. 106: Minimum volumetric flow Register No. 107: Maximum volumetric flow</p>	0...10'000 Default: 0	%	0.01	R / W
12	11	<p>Setpoint analog Shows the setpoint in % if actuator is controlled by Register No. 119: Setpoint source = 0: Analog.</p> <p>Not considered if override control (bus, tool, and/or forced control) is active.</p>	0...10'000	%	0.01	R
5	4	Relative position	0...10'000	%	0.01	R
6	5	Absolute position	0...9'600	°	0.01	R
119	118	<p>Setpoint source Analog: Setpoint from analog signal 0.5...10 V on wire 3 Bus: Relative setpoint via Bus Register No.1: Setpoint relative</p>	0: Analog 1: Bus Default: 0	–	–	R / W
117	116	<p>Control mode This value defines the interpretation of the setpoint. A reset will be performed if the state of this object is changed.</p>	0: Position control 1: Flow control Default: 1	–	–	R / W
2	1	<p>Override control Override the setpoint with defined values</p> <p>Override minimum and maximum flow correspond to Position or Flow control mode.</p> <p>→ Unit can be selected by Register No. 117: Control mode</p>	0: None 1: Open valve 2: Close valve 3: Minimum flow 4: – 5: Maximum flow 6: Nominal flow 7: – 8: – 9: – 10: Motor stop Default: 0	–	–	R / W
3	2	<p>Command Initiation of actuator functions for service and test. After command is sent, value changes back to 0: None.</p>	0: None 1: – 2: Sync Default: 0	–	–	R / W
109	108	<p>Bus fail action In the event of a breakdown in communication, the actuator enables the bus fail action.</p> <p>The bus monitoring controls the bus communication. If neither Register No. 1: Setpoint relative nor Register No. 2: Override control is renewed before Register No. 110: Timeout for bus watchdog, the actuator moves to the bus fail position.</p> <p>Triggered bus monitoring is indicated as error in Register No. 105: Malfunction and service information.</p>	0: None 1: Open 2: Close 3: Max 4: Min 5: – 6: Stop Default: 0	–	–	R / W

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
110	109	Timeout for communication 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
100	99	Bus termination Indicates if bus termination (120 Ω) is enabled. Bus termination can be set by with Belimo Assistant 2.	0: Disabled 1: Enabled Default: 0	–	–	R
4	3	Device type	0: Device not connected 1: Air / Water 2: VAV / EPIV / Flow sensor 3: Fire 4: Energy valve / Energy meter 5: 6-way EPIV	–	–	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 1 st part: 00839 2 nd part: 31324 4 th part: 008	–	–	1	R
102	101	Series number 2nd part	–	–	1	R
103	102	Series number 4th part	–	–	1	R
104	103	Firmware version Firmware version of communication module. Example: 400, version 4.00. For details see Release notes.	–	–	1	R

Access definition: R = Read, W = Write

Note: According to the present configuration settings of the EPIV (e.g. DN size), the HVAC application may perform a size limitation within the indicated Modbus value range. Each EPIV may have different HVAC value size limitations. See corresponding product datasheet.

Flow

These registers can be used to configure and read values related to Flow control.
For setpoint see Register No. 1: Setpoint relative in section "Control and general settings".

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
16	15	Setpoint absolute volumetric flow	0...6'300	l/s	0.01	R
17	16	Setpoint absolute volumetric flow	0...998.5	gpm	0.1	R
18	17		0...6 0...22'700	m ³ /s m ³ /h		
19	18	Setpoint absolute volumetric flow → Unit can be selected by Register No. 148: Unit selection flow	0...6305 0...378'333 0...22'700'000 0...99'945 0...13'360	l/s l/min l/h gpm cfm	0.001	R
7	6	Relative volumetric flow Related to V' _{max} Register No. 107: Maximum volumetric flow	0...15'000	%	0.01	R
8	7	Absolute volumetric flow Sensor reading up to 2.5*V' _{nom} possible. Actual measuring range depends on device type (see datasheet).	0...1'576	l/s	0.01	R
9	8	Absolute volumetric flow Sensor reading up to 2.5*V' _{nom} possible. Actual measuring range depends on device type (see datasheet).	0...2'498	gpm	0.1	R
10	9	Absolute volumetric flow Sensor reading up to 2.5*V' _{nom} possible. Actual measuring range depends on device type (see datasheet).	0...15 0...56'750 0...15'762	m ³ /s m ³ /h l/s		
11	10	Absolute volumetric flow → Unit can be selected by Register No. 148: Unit selection flow	0...945'832 0...56'750'000 0...249'862 0...33'400	l/min l/h gpm cfm	0.001	R
106	105	Minimum volumetric flow Minimum flow limitation can be set from 2.5% of V' _{nom} to V' _{max} . Minimum flow limit deactivated if V' _{min} = 0.	0...V' _{max} Default: 0	%	0.01	R / W
130	129	Minimum volumetric flow limit Minimum Flow limitation can be set from 2.5% of V' _{nom} to V' _{max} . Minimum Flow limit deactivated if V' _{min} = 0.	0...630.5	l/s	0.01	R / W
131	130	Minimum volumetric flow limit Minimum Flow limitation can be set from 2.5% of V' _{nom} to V' _{max} . Minimum Flow limit deactivated if V' _{min} = 0.	0...999.4	gpm	0.1	R / W
132	131	Minimal volumetric flow in selected unit → Unit can be selected by Register No. 148: Unit selection flow	0...6 0...22'700 0...6'305 0...378'333	m ³ /s m ³ /h l/s l/min	0.001	R / W
133	132	Minimum Flow limitation can be set from 2.5% of V' _{nom} to V' _{max} . Minimum Flow limit deactivated if V' _{min} = 0.	0...22'700'000 0...99'945 0...13'360	l/h gpm cfm		
107	106	Maximum volumetric flow Maximum flow limit in % between 25% and 100% of V' _{nom} . Values below 25% will be adjusted to 25%. The Maximum flow setpoint is related to V' _{nom} "Nominal volumetric flow" (Register No. 111,112, 113/114)) and is considered when Control mode Register No. 117 = Flow control.	2'500...10'000 Default: 10'000	%	0.01	R / W

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access	
134	133	Maximum volumetric flow limit (V'_{max}) Values below 25% will be adjusted to 25%.	10.4...630.5	l/s	0.01	R / W	
135	134	Maximum volumetric flow limit (V'_{max}) Values below 25% will be adjusted to 25%	1.04...63	gpm	0.1	R / W	
136	135	Absolute maximum volumetric flow limit in selected unit (V'_{max}) Values below 25% will be adjusted to 25%	0.1...6	m ³ /s	0.001	R / W	
137	136		375...22'700 104...6'305 6'250...378'333 374'994...22'700'000 1'651...99'945 221...13'360	m ³ /h l/s l/min l/h gpm cfm			
111	110	Nominal volumetric flow (V'_{nom})	0...10'000	l/s	0.01	R	
112	111	Nominal volumetric flow (V'_{nom})	0...15'850	gpm	0.1	R	
113	112	Nominal volumetric flow (V'_{nom}) → Unit can be selected by Register No. 148: Unit selection flow	0...6	m ³ /s	0.001	R	
114	113		0...22'700 0...6'305 0...378'333 0...22'700'000 0...99'945 0...13360	m ³ /h l/s l/min l/h gpm cfm			
148	147	Unit selection flow The selected unit is valid for Register No. 10: Absolute volumetric flow Register No. 18: Setpoint absolute volumetric flow Register No. 113: Nominal volumetric flow Register No. 132: Minimal volumetric flow in selected unit Register No. 136: Maximal volumetric flow in selected unit	0: m ³ /s 1: m ³ /h 2: l/s 3: l/min	4: l/h 5: gpm 6: cfm Default: 4	-	R / W	
60	59	Accumulated volume (cannot be reset)	0...2'147'483'600		m ³	0.01	R
61	60		0...2'147'483'647		gal	1	R
62	61	Accumulated volume (cannot be reset)	0...42'000'000		m ³	1	R
63	62		0...42'000'000'000		l		
64	63	Accumulated volume in selected unit (cannot be reset) → Unit can be selected by Register No. 150: Unit selection volume	0...11'095'226'199		gal	1	R
65	64		0...1'483'216'002.3		cf		
150	149	Unit selection volume	0: m ³ 1: Litre 2: Gallon 3: cf	Default: 0	-	R / W	

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
26	25	Glycol concentration Effective measuring range depends on device type (see datasheet)	0...6'000	%	0.01	R
201	200	Flow meter serial number first digits ProductionOrderNumber	–	–	1	R
203	202	Flow meter serial number last digits ProductionSequenceNumber	–	–	1	R

Access definition: R = Read, W = Write

Note: According to the present configuration settings of the EPIV (e.g. DN size), the HVAC application may perform a size limitation within the indicated Modbus value range. Each EPIV may have different HVAC value size limitations. See corresponding product datasheet.

Temperature

The measured temperature values can be read out via the registers below.

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
22	21	Temperature (flow body)	-2'000...15'000	°C	0.01	R
23	22	Temperature (flow body)	-400...30'200	°F	0.01	R

Conversion of sensor signals

These registers can be used to configure additional Sensor 1 Input on Y3 and read related values.

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
13	12	Sensor 1 value Current value of sensor 1, depending on Register No. 121: Sensor 1 type	0...65'535	mV –	1	R
121	120	Sensor 1 type Additional sensor input Only selectable if Register No. 119: Setpoint source = 1: Bus.	0: None 1: Active 2: – 3: – 4: Switch Default: 0	–	–	R / W

Access definition: R = Read, W = Write

Note: According to the present configuration settings of the EPIV (e.g. DN size), the HVAC application may perform a size limitation within the indicated Modbus value range. Each EPIV may have different HVAC value size limitations. See corresponding product datasheet.

Health state

These registers allow to determine malfunctions, service information and error state of the 2-way EPIV.

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
105	104	<p>Malfunction and service information</p> <p>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.</p> <p>Bitmask =</p> <p>0: Communication with actuator not possible. Defective components, cable disconnected.</p> <p>1: Manual override button is pressed</p> <p>2: Mechanical overload due to blocked valve, etc.</p> <p>3: Reverse flow is detected. Pump pressure too low; high resistance in the flow circuit; flushing bypass open; V'_{max} setting too high.</p> <p>4: Setpoint cannot be reached within 15 min during flow control. Pump pressure too low; high resistance in the flow circuit; flushing bypass open; V'_{max} setting too high.</p> <p>5: Flow is measured but valve position is closed. Actuator incorrectly mounted.</p> <p>6: Actual flow exceeds the designed nominal flow.</p> <p>7: Air in the system, error occurred during flow measurement. Water contamination, not specified fluid used.</p> <p>9: Error with embedded temperature sensor.</p> <p>10: Internal communication to flow sensor interrupted.</p> <p>11: Measured temperature and glycol concentration indicate that grease ice can build up.</p> <p>12: Medium contains glycol.</p> <p>15: Timeout for the Bus watchdog expired. No update of Setpoint / Override within specified time, independent of configured Bus fail action.</p>	<p>0: No communication to actuator</p> <p>1: Gear train disengaged</p> <p>2: Actuator cannot move</p> <p>3: Reverse flow</p> <p>4: Flow setpoint not reached</p> <p>5: Flow with closed valve</p> <p>6: Flow actual exceeds flow nominal</p> <p>7: Flow measurement error</p> <p>8: –</p> <p>9: Flowbody temperature error</p> <p>10: Communication to sensor interrupted</p> <p>11: Freeze warning</p> <p>12: Glycol detected</p> <p>13: –</p> <p>14: –</p> <p>15: Bus watchdog triggered</p>	–	–	R

Access definition: R = Read, W = Write

Note: According to the present configuration settings of the EPIV (e.g. DN size), the HVAC application may perform a size limitation within the indicated Modbus value range. Each EPIV may have different HVAC value size limitations. See corresponding product datasheet.

All inclusive.

Belimo is the global market leader in the development, production, and sales of field devices for the energy-efficient control of heating, ventilation and air-conditioning systems. The focus of our core business is on damper actuators, control valves, sensors and meters.

Always focusing on customer value, we deliver more than only products. We offer you the complete product range for the regulation and control of HVAC systems from a single source. At the same time, we rely on tested Swiss quality with a five-year warranty. Our worldwide representatives in over 80 countries guarantee short delivery times and comprehensive support through the entire product life. Belimo does indeed include everything.

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