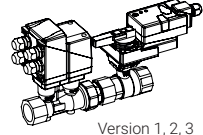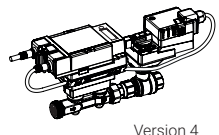# Modbus Interface Description

Where is the Ethernet socket?	
On the actuator	**On the flow sensor**
Version 1, 2, 3	Version 4
❌ See „Data-pool Vaues Energy Valve (V1, V2, V3)"	Stay with this document ✅
For guidance in replacing an old EV with EV V4 -> see "Replacement Guide V1, V2, V3 vs. V4"	

Modbus

Energy Valve DN 15...50 (Version 4)

Edition 2024-01 / V4.1.1

BELIMO®

Contents

Modbus general notes

General information	Date	15.01.2022
	Product Name	Energy Valve
	Product Model Number	EV..R2+(K)BAC (Version 4, DN 15...50)
		EV..R2+MID (Version 4, DN 15...50)
		EV..R3+BAC (Version 4, DN 15...50)
	Protocol	Modbus RTU over RS-485, Modbus TCP over Ethernet
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
Modbus TCP	Port	open (Default: 502)
Parametrisation	Tool	Assistant App or through the integrated web server

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:
Read Holding Registers [3]
Write Single Register [6]

Optional Commands:
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:	Example signed integer:
Read (Function 03, 1 Register) Value Register No. x $= 0001\ 1010\ 1100\ 1000_2$ $= 6{,}856_{10}$	Read (Function 03, 1 Register) Value Register No. x $= 1111\ 1101\ 1111\ 0010_2$ $= -526_{10}$
Actual value = value * scaling factor * unit = 6,856 * 0.01 * unit = **68.56 unit**	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" / LSW (Least Significant Word) first.

Example:

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

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

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 ($1111\ 1111\ 1111\ 1111_2$).

Modbus register overview

Operation

No.	Address	Register		Access
1	0	Setpoint [%]		R / W
2	1	Override Control (override control value as AO)		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	Relative Volumetric Flow [%]		R
8	7	Absolute Volumetric Flow [l/s] 0...45 l/s (0...45'000)		R
9	8	Absolute Volumetric Flow [gpm] 0...713 gpm (0...7'130)		R
10	9	Absolute Volumetric Flow [selected unit]	LowWord	R
11	10		HighWord	
12	11	Setpoint Analog [%]		R
13	12	Sensor Value 1 [mV] [Ω] [-]		R
14	13	Sensor 1 as Analog Value [°C] **)		R
15	14	Sensor 1 as Analog Value [°F] **)		R
16	15	SpAbsFlow [l/s]		R
17	16	SpAbsFlow [gpm]		R
18	17	SpAbsFlow [selected unit]	LowWord	R
19	18		HighWord	
20	19	Temperature 1 (external) [°C] **)		R
21	20	Temperature 1 (external) [°F] **)		R
22	21	Temperature 2 (integrated) [°C] **)		R
23	22	Temperature 2 (integrated) [°F] **)		R
24	23	Delta Temperature [K]		R
25	24	Delta Temperature [°F]		R
26	25	Glycol Concentration [%]		R
27	26	Relative Power [%]		R
28	27	Absolute Cooling Power [kW]	LowWord	R
29	28		HighWord	
30	29	Absolute Cooling Power [kBTU/h]	LowWord	R
31	30		HighWord	
32	31	Absolute Cooling Power [selected unit]	LowWord	R
33	32		HighWord	
34	33	Absolute Heating Power [kW]	LowWord	R
35	34		HighWord	

**) signed integer

No.	Address	Register		Access
36	35	Absolute Heating Power [kBTU/h]	LowWord	R
37	36		HighWord	
38	37	Absolute Heating Power [selected unit]	LowWord	R
39	38		HighWord	
40	39	Setpoint DeltaT [K]		R / W
41	40	Setpoint DeltaT [°F]		R / W
42	41	Setpoint Absolute Flow DeltaT [l/s]	LowWord	R / W
43	42		HighWord	
44	43	Setpoint Absolute Flow DeltaT [gpm]	LowWord	R / W
45	44		HighWord	
46	45	Setpoint Absolute Flow DeltaT [selected unit]	LowWord	R / W
47	46		HighWord	
..	..	–		–
60	59	Total Volume [m³]	LowWord	R
61	60		HighWord	
62	61	Total Volume [gal]	LowWord	R
63	62		HighWord	
64	63	Total Volume [selected unit]	LowWord	R
65	64		HighWord	
66	65	Cooling Energy [kWh]	LowWord	R
67	66		HighWord	
68	67	Cooling Energy [kBTU]	LowWord	R
69	68		HighWord	
70	69	Cooling Energy [selected unit]	LowWord	R
71	70		HighWord	
72	71	Heating Energy [kWh]	LowWord	R
73	72		HighWord	
74	73	Heating Energy [kBTU]	LowWord	R
75	74		HighWord	
76	75	Heating Energy [selected units]	LowWord	R
77	76		HighWord	

Definition Access: R = Read, W = Write

Modbus register overview

Service

No.	Address	Register		Access
100	99	Bus Termination		R
101	100	Series Number 1st Part		R
102	101	Series Number 2nd Part		R
103	102	Series Number 4th Part		R
104	103	Firmware Version		R
105	104	Malfunction and Service Information		R
106	105	V'min [%]		R / W
107	106	V'max [%]		R / W
..	..	–		–
109	108	Bus Fail Setpoint		R / W
110	109	Communication Watchdog		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	R
114	115		HighWord	
..	..	–		–
117	116	Control Mode		R / W
118	117	–		–
119	118	Setpoint Source		R / W
120	119	–		–
121	120	Sensor 1 Input Type		R / W
122	121	Sensor 1 Passive Sensor Type		R / W
123	122	Sensor 1 as Analog Value [°C]		R
124	123	Sensor 1 as analog value [°F]		R
..	..	–		–
130	129	V'min [l/s]		R / W
131	130	V'min [gpm]		R / W
132	131	V'min [selected unit]	LowWord	R / W
133	132		HighWord	
134	133	V'max [l/s]		R / W
135	134	V'max [gpm]		R / W
136	135	V'max [selected unit]	LowWord	R / W
137	136		HighWord	
..	..	–		–
148	147	Unit Selection Flow		R / W
149	148	Unit Selection Power		R / W

No.	Address	Register		Access
150	149	Unit Selection Total Flow		R / W
151	150	Unit Selection Energy		R / W
..	..	–		–
160	159	Nominal Power [kW]	LowWord	R
161	160		HighWord	
162	161	Nominal Power [kBTU/h]	LowWord	R
163	162		HighWord	
164	163	Nominal Power [selected unit]	LowWord	R
165	164		HighWord	
166	165	Max Power [%]		R / W
167	166	Absolute P_{max} [kW]	LowWord	R / W
168	167		HighWord	
169	168	Absolute P_{max} [kBTU/h]	LowWord	R / W
170	169		HighWord	
171	170	Absolute P_{max} [selected units]	LowWord	R / W
172	171		HighWord	
..	..	–		–
180	179	DeltaT_Limitation		R / W
181	180	DeltaT Manager Status		R / W
..	..	–		–
201	200	Energy Meter Serial Number First Digits	LowWord	R
202	201		HighWord	
203	202	Energy Meter Serial Number Last Digits	LowWord	R
204	203		HighWord	
205	204	Select Meter Registers		R / W

Definition Access: R = Read, W = Write

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

No.	Address	Description Comment	Range, enumeration		Unit	Scaling	Access
1	0	**Setpoint**	0...10'000 Default: 0		%	0.01	R / W
2	1	**Override control** Overrides setpoint with defined values.	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	–	1	R / W
3	2	**Command**	0: None 1: – 2: Sync.	Default: 0	–	–	R / W

4	3	**Actuator type**	0: Device not
			   connected
			1: Air/Water
			2: VAV / EPIV
				3: Fire
				4: Energy Valve /
				   Flow meter
				5: 6-way EPIV
					–	1	R

5	4	**Relative position**	0...10'000		%	0.01	R
6	5	**Absolute position**	0...max angle		° mm	0.01	R
7	6	**Relative volumetric flow** Related to V'$_{max}$ "Maximum Flow Limit" (Register No. 107)	0...15'000		%	0.01	R
8	7	**Absolute volumetric flow**	0...1.5*V'$_{nom}$		l/s	0.01	R
9	8	**Absolute volumetric flow**	0...16'000		gpm	0.1	–
10	9	**Absolute volumetric flow in selected unit**	0...360'000'000		UnitSel	0.001	R
11	10	→ based on selection in Register No. 148					
12	11	**Setpoint analog**	0...10'000		%	0.01	R
13	12	**Sensor value 1** For Resistance values scaling as follows applies PT1000 / Ni1000 → 1 NTC10K → 10	0...65'535		mV Ω –	1 1 / 10 0 / 1	R
14	13	**Sensor 1 as analog value**	−400...24'800		°C	0.01	R
15	14	**Sensor 1 as analog value**	−400...24'800		°F	0.01	R
16	15	**SpAbsFlow** Setpoint absolute volumetric flow	0...10'000		[l/s]	0.01	R
17	16	**SpAbsFlow** Setpoint absolute volumetric flow	0...16'000		gpm	0.1	R
18	17	**SpAbsFlow in selected unit** Setpoint absolute volumetric flow	0...360'000'000		UnitSel	0.001	R
19	18	→ based on selection in Register No. 148					
20	19	**Temperature 1 (external)**	−2'000...12'0000		°C	0.01	R
21	20	**Temperature 1 (external)**	−400...24'800		°F	0.01	R
22	21	**Temperature 2 (integrated)**	−2'000...12'0000		°C	0.01	R
23	22	**Temperature 2 (integrated)**	−400...24'800		°F	0.01	R
24	23	**DeltaT_K**	0...14'000		K	0.01	R
25	24	**DeltaT_F**	0...25'200		°F	0.01	R
26	25	**Glycol concentration**	0...10'000		%	0.01	R

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
27	26	**Relative power**	0...30'000	%	0.01	R
28	27	**Absolute power cooling**	0...21'500'000	kW	0.001	R
29	28					
30	29	**Absolute power cooling**	0...74'150'000	kBTU/h	0.001	R
31	30					
32	31	**Absolute power cooling in selected unit** ➜ based on selection in Register No. 149	0...741'500'000	UnitSel	0.1	R
33	32					
34	33	**Absolute power heating**	0...21'500'000	kW	0.001	R
35	34					
36	35	**Absolute power heating**	0...74'150'000	kBTU/h	0.001	R
37	36					
38	37	**Absolute power heating in selected unit** ➜ based on selection in Register No. 149	0...74'150'000	UnitSel	0.0	R
39	38					
40	39	**Setpoint DeltaT**	100...5'500	K	0.01	R / W
41	40	**Setpoint DeltaT**	180...9'900	°F	0.01	R / W
42	41	**Setpoint absolute flow DeltaT**	0...100'000	l/s	0.001	R / W
43	42					
44	43	**Setpoint absolute flow DeltaT**	0...160'000	gpm	0.01	R / W
45	44					
46	45	**Setpoint absolute dlow DeltaT in selected unit** ➜ based on selection in Register No. 148	0...360'000'000	UnitSel	0.001	R / W
47	46					
..	..	–	–	–	–	–
60	59	**Total volume**	0...2'147'483'600	m³	0.01	R
61	60					
62	61	**Total volume**	0...2'147'483'647	gal	1	R
63	62					
64	63	**Total volume in selected unit** ➜ based on selection in Register No. 150	0...2'147'483'647	UnitSel	1	R
65	64					
66	65	**Cooling energy**	0...2'147'483'647	kWh	1	R
67	66					
68	67	**Cooling energy**	0...2'147'483'647	kBTU	1	R
69	68					
70	69	**Cooling energy in selected unit** ➜ based on selection in Register No. 151	0...2'147'483'647	UnitSel	1	R
71	70					
72	71	**Heating energy**	0...2'147'483'647	kWh	1	R
73	72					
74	73	**Heating energy**	0...2'147'483'647	kBTU	1	R
75	74					

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
76	75	**Heating energy in selected unit** ➜ based on selection in Register No. 151	0...2'147'483'647	UnitSel	1	R
77	76					
..	..	–	–	–	–	–
100	99	**Bus termination** Indicates if bus termination (120 Ω) is enabled. Bus termination can be set with configuration tools.	1: Enabled Default: 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: 400, Version 4.00 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 product range. 0: No communication to actuator: Communication with actuator not possible. 1: Gear train disengagement: Gear train disengaged button is pressed 2: Actuator cannot move: Mechanical overload due to blocked valve, etc. (only available for EV..R+KBAC) 3: Reverse flow: Reverse flow is detected 4: Flow setpoint not reached: Setpoint cannot be reached within 15 min during flow control 5: Flow with closed valve: Flow is measured but position of valve is closed 6: Flow actual exceeds flow nominal: Actual flow exceeds the designed nominal flow 7: Flow measurement error: Air in the system, error occurred during flow measurement 8: Remote temperature not OK: No connection to external temperature sensor 9: Flowbody temperature not OK: Error with embedded temperature sensor 10: Communication to sensor interrupted: Internal communication to flow sensor interrupted 11: Freeze warning: Measured temperature & glycol concentration indicate that grease ice can build up 12: Glycol detected: Glycol was detected in a MID application 13: Power setpoint not reached: Setpoint cannot be reached within 15 min during power control	Bitmask = 0: No communication to actuator 1: Gear train disengaged 2: Actuator cannot move 3: Reverse flow 4: Flow setpoint not reached 5: Flow with closed valve 6: Flow actual exceeds flow nominal 7: Flow measurement error 8: Remote temperature not OK 9: Flowbody temperature not OK 10: Communication to sensor interrupted 11: Freeze warning 12: Glycol detected 13: Power setpoint not reached 14: – 15: –	–	–	R
106	105	**V'$_{min}$**	0...V'$_{max}$ Default: 0	%	0.01	R / W

No.	Address	Description Comment	Range, enumeration		Unit	Scaling	Access
107	106	**V'$_{max}$** 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 = Flow Control or Power Control.	2'500...10'000 Default: 10'000		%	0.01	R / W
109	108	**Bus fail setpoint** Modbus communication is not monitored as standard. In the event of a breakdown in communication, the actuator retains the current setpoint. 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; Default: 120 s), the actuator controls to the Bus Fail position. Triggered bus monitoring is indicated in the Malfunction and Service Information (Register No. 105).	0...10'000 Default: 0		%	0.01	R / W
110	109	**Communication watchdog** Time until bus fail will be detected. If bus watchdog = 0 then deactivated. If bus fail setpoint (Register No. 110) different from 0, then timeout for bus watchdog is by Default 120s (parameterizable). Not functional ➜ reserved for future	0...3'600 Default: 0 (120)		s	1	R / W
111	110	**Nominal volumetric flow** (V'$_{nom}$)	0...10'000		/s	0.01	R
112	111	**Nominal volumetric flow** (V'$_{nom}$)	0...16'000		gpm	0.1	R
113	112	**Nominal volumetric flow (qp) in selected unit** (V'$_{nom}$)	0...360'000'000		UnitSel	0.001	R
114	113	➜ based on selection in Register No. 148					
..	..	–	–		–	–	–
117	116	**Control mode**	0: Position control 1: Flow control 2: Power control	Default: 1	–	–	R / W
119	118	**Setpoint Source** Analog: Setpoint from analog signal 0.5...10V on wire 3 Bus: Setpoint from Modbus (Register No. 1)	0: Analog 1: Bus Default: 0		–	–	R / W
..	..	–	–		–	–	–
121	120	**Sensor 1 type** Additional sensor input Only selectable if SpSource (Register No. 119) is set to bus.	0: None 1: Active 2: –	3: Passive 4: Switch Default: 0	–	–	R / W
122	121	**Sensor 1 passive sensor type**	0: Resistance Measurement 1: PT1000 2: Ni1000 3: – 4: –	5: – 6: – 7: NTC10k2 8: NTC10k3 Default: 0	–	–	R / W

No.	Address	Description Comment	Range, enumeration		Unit	Scaling	Access
123	122	**Sensor 1 as analog value**	−10°C to 120°C		°C	–	R
124	123	**Sensor 1 as analog value**	14°F to 248°F		°F	–	R
..	..	–	–		–	–	–
130	129	**V'$_{min}$**	0...V'$_{max}$		l/s	0.01	R / W
131	130	**V'$_{min}$**	0...V'$_{max}$		gpm	0.1	R / W
132	131	**Minimal volumetric flow in selected unit**	0...V'$_{max}$		UnitSel	0.001	R / W
133	132	➡ based on selection in Register No. 148					
134	133	**V'$_{max}$**	25% of V'$_{nom}$...V'$_{nom}$		l/s	0.01	R / W
135	134	**V'$_{max}$**	25% of V'$_{nom}$...V'$_{nom}$		gpm	0.1	R / W
136	135	**Maximal volumetric flow in selected unit**	25% of V'$_{nom}$...V'$_{nom}$		UnitSel	0.001	R / W
137	136	➡ based on selection in Register No. 148					
..	..	–	–		–	–	–
148	147	**Unit selection flow**	0: m³/s 1: m³/h 2: l/s 3: l/min	4: l/h 5: gpm 6: cfm Default: 4	–	–	R / W
149	148	**Unit selection power**	0: W 1: kW 2: MW 3: BTU/h	4: kBTU/h 5: ton Default: 1	–	–	R / W
150	149	**Unit selection volume**	0: m³ 1: Litre 2: Gallon	3: cf Default: 0	–	–	R / W
151	150	**Unit selection energy**	0: J 1: kJ 2: MJ 3: GJ 4: Wh 5: kWh	6: MWh 7: BTU 8: kBTU 9: ton Default: 5	–	–	–
..	..	–	–		–	–	–
160	159	**Nominal power**	0...21'500'000		kW	0.001	R
161	160						
162	161	**Nominal power**	0...74'150'000		kBTU/h	0.001	R
163	162						
164	163	**Nominal power in selected unit**	0...741'500'000		UnitSel	0.1	R
165	164	➡ based on selection in Register No. 149					
166	165	**Max power**	0.5...100%		%	0.01	R / W
167	166	**Absolute P$_{max}$**	0.5% of P$_{nom}$...P$_{nom}$		kW	0.001	R / W
168	167						
169	168	**Absolute P$_{max}$**	0.5% of P$_{nom}$...P$_{nom}$		kBTU/h	0.001	R / W
170	169						
171	170	**Absolute P$_{max}$ in selected unit**	0.5% of P$_{nom}$...P$_{nom}$		UnitSel	0.01	R / W
172	171	➡ based on selection in Register No. 149					

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
..	..	–	–	–	–	–
180	179	**DeltaT_Limitation**	0: Disabled 1: dT-Manager 2: dT-Manager scaling Default: 0	–	–	R / $W
181	180	**DeltaT manager status**	0: Not selected　　3: Scaling standby 1: Standby　　　　4: Scaling active 2: Active	–	–	R
..	..	–	–	–	–	–
201	200	**Energy meter serial number first digits** ProductionOrderNumber	–	–	1	R
202	201					
203	202	**Energy meter serial number last digits** ProductionSequenceNumber	–	–	1	R
204	203					
205	204	**Select meter register** Value 0 only available for models with MID certification: EV..R2+MID. For non MID certified models value 1 is defined as default. Select between certified meter register and lifetime register. The certified meter register will be reset when the sensor module is replaced. The lifetime register is compensated for glycol (if applicable). Avoid toggling between the two registers as this will affect data logging. Following registers depend on the selected meter register: Register No. 60/61 Register No. 62/63 Register No. 64/65 Register No. 66/67 Register No. 68/69 Register No. 70/71 Register No. 72/73 Register No. 74/75 Register No. 76/77	0: Certified meter register 1: Lifetime meter register Default: 0	–	–	R / W

Definition Access: R = Read, W = Write

Note: According to the present configuration settings of the Energy Valve (e.g. DN size) the HVAC application may perform a size limitation within the indicated Modbus value range.
Each Energy Valve may have different HVAC value size limitations.

All inclusive.

Belimo as a global market leader develops innovative solutions for the controlling of heating, ventilation and air-conditioning systems. Damper actuators, control valves, sensors and meters represent our core business.

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.

The "small" Belimo devices have a big impact on comfort, energy efficiency, safety, installation and maintenance.

In short: Small devices, big impact.

5 — 5-year warranty

On site around the globe

Complete product range

Tested quality

Short delivery times

Comprehensive support

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