



Electronic pressure-independent characterised control valve with energy monitoring

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Modbus General Notes

General information	Parameterisation:	through the integrated web server	
	Modbus RTU	Protocol:	Modbus RTU / RS-485
		Number of nodes:	Max. 32 (without repeater)
		Transmission formats:	1-8-N-2, 1-8-N-1, 1-8-E-1, 1-8-O-1 <i>Default: 1-8-N-2</i>
		Baud rate:	9,600, 19,200, 38,400, 76,800, 115,200 Bd <i>Default: 38,400 Bd</i>
	Terminating resistor:	120 Ω, can be activated through integrated webserver <i>Default: inactive</i>	
Modbus TCP	Protocol	TCP over IP network	
	Port	open <i>Default: 502</i>	

Register implementation All data is arranged in a table and addressed by 1..n (register) 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.

Standard 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 Address) * **16** (Bit) = **1664**

Interpret values in the registers **All values in the register are unsigned integer with exception of Register No. 17/19.**
Signed integers are represented as two's complement.

Example unsigned integer Read (Function 03, 1 Register) Value Register No. 12 = 0001'1010'1100'1000₂ = 6,856₁₀
Actual Value = Value * Scaling factor * Unit = 6,856 * 0.01 * m³/h = **68.56 m³/h**

Example signed integer Read (Function 03, 1 Register) Value Register No. 17 = 1111'1101'1111'0010₂ = -526₁₀
Actual Value = Value * Scaling factor * Unit = -526 * 0.01 * °C = **-5.26 °C**

32-Bit Values in two registers **Both registers have to be written at once with function "Write Multiple Registers [16]"**

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. 10 (AbsFlow LowByte) = 14,551₁₀ = 0011'1000'1101'0111₂
Register No. 11 (AbsFlow HighByte) = 19₁₀ = 0000'0000'0001'0011₂

AbsFlow High Byte	AbsFlow Low Byte
19	14,551
0000'0000'0001'0011	0011'1000'1101'0111

→ AbsFlow = 0000'0000'0001'0011'0011'1000'1101'0111₂ = 1,259,735₁₀ = **1259.735 l/h**

Math formula:

AbsFlow = (AbsFlow HighByte * 65,536) + AbsFlow LowByte
AbsFlow = (19 * 65,536) + 14,551 = 1,259,735 = **1259.735 l/h**

Modbus Register Overview

No.	Adr	Register	R/W
1	0	Setpoint [%]	R/W
2	1	Override control	R/W
3	2	-	R
4	3	Actuator type	R
5	4	Relative position [%]	R
6	5	Absolute position [°]	R
7	6	Relative Flow [%]	R
8	7	Absolute flow [UnitSel]	LData
9	8		HData
10	9	Absolute flow [l/s]	LData
11	10		HData
12	11	Absolute flow [gpm]	LData
13	12		HData
14	13	Setpoint Absolute Flow [UnitSel]	LData
15	14		HData
16	15	Setpoint Analog [V]	R
17	16	Temperature 1 [°C]	R
18	17	Temperature 1 [°F]	R
19	18	Temperature 2 [°C]	R
20	19	Temperature 2 [°F]	R
21	20	Delta Temperature [K]	R
22	21	Delta Temperature [°F]	R
23	22	Glycol Concentration [%]	R
24	23	Relative power [%]	R
25	24	Absolute Power [UnitSel]	LData
26	25		HData
27	26	Absolute Power [kW]	LData
28	27		HData
29	28	Absolute Power [kBTU/h]	LData
30	29		HData
31	30	Energy Cooling [UnitSel]	LData
32	31		HData
33	32	Energy Cooling [kWh]	LData
34	33		HData
35	34	Energy Cooling [kBTU]	LData
36	35		HData
37	36	Energy Heating [UnitSel]	LData
38	37		HData
39	38	Energy Heating [kWh]	LData
40	39		HData
41	40	Energy Heating [kBTU]	LData
42	41		HData

101	100	Series number 1 st part		R
102	101	Series number 2 nd part		
103	102	Series number 4 th part		
104	103	Firmware version		R
105	104	Malfunction & Service information		R
106	105	Vmax [%]		R/W
107	106	Absolute Vmax [l/s]	LData	R/W
108	107		HData	
109	108	Absolute Vmax [gpm]	LData	R/W
110	109		HData	
111	110	Absolute Vnom [UnitSel]	LData	R
112	111		HData	
113	112	Absolute Vnom [l/s]	LData	R
114	113		HData	
115	114	Absolute Vnom [gpm]	LData	R
116	115		HData	
117	116	Pmax [%]		R/W
118	117	Absolute Pmax [kW]	LData	R/W
119	118		HData	
120	119	Absolute Pmax [kBTU/h]	LData	R/W
121	120		HData	
122	121	Absolute Pnom [UnitSel]	LData	R
123	122		HData	
124	123	Absolute Pnom [kW]	LData	R
125	124		HData	
126	125	Absolute Pnom [kBTU/h]	LData	R
127	126		HData	
128	127	-		R
129	128	-		R
130	129	-		R
131	130	DeltaT Limitation [K]		R/W
132	131	DeltaT Manager Status		R
133	132	Setpoint DeltaT [K]		R/W
134	133	Setpoint DeltaT [°F]		R/W
135	134	Setpoint Flow at DeltaT [l/s]	LData	R/W
136	135		HData	
137	136	Setpoint Flow at DeltaT [gpm]	LData	R/W
138	137		HData	
139	138	-		R
140	139	-		R
141	140	Control Mode		R/W
142	141	Unit Selection Flow		R/W
143	142	Unit Selection Power		R/W
144	143	Unit Selection Energy		R/W
145	144	Setpoint Source		R/W

Modbus Register Description

Register 1: Setpoint	Setpoint for actuator setting in hundredths of one percent Scaling factor: 0.01 → i.e. 0...10,000 corresponds to 0...100%
Position Control	Setpoint 0...100% refers to relative position 0...100%
Flow Control	Setpoint 0...100% refers to range 0... Vmax
Power Control	Setpoint 0...100% refers to range 0... Pmax

**Register 2:
Override control** Overriding the setpoint (Register No. 1) with defined values

0	None
1	Close
2	Open
3	Vnom
4	Vmax
5	MotStop
6	Pnom
7	Pmax

**Register 3:
(Reserved)** Not used in this device. Constant value 65'535

**Register 4:
Actuator type** Actuator type; the allocation may deviate from the basic category with some actuators.

0	Unknow
1	Air & Water
2	EPIV / VAV
3	Fire
4	EnergyValve
5	6way EPIV

**Register 5:
Relative position** Relative position of actuator in hundredths of one percent [%]
Scaling factor: 0.01 → i.e. 0...10,000 corresponds to 0...100%

**Register 6:
Absolute Position** Absolute position of actuator in hundredths of one degree [°]
Scaling factor: 0.01 → i.e. 0 ... 9,000 corresponds to 0...90°

**Register 7:
Relative Flow** Relative flow in hundredths of one percent of active Vmax
Scaling factor: 0.01 → i.e. 0 ... 10,000 correspond to 0 ... 100%

**Register 8/9:
Absolute Flow UnitSel** Absolute Flow in unit which is selected for Flow in Register No. 142
Scaling factor: 0.001

**Register 10/11:
Absolute Flow in l/s** Absolute Flow in l/s
Scaling factor: 0.001 → i.e. 350 corresponds to 0.350 l/s

**Register 12/13:
Absolute Flow in gpm** Absolute Flow in gpm
Scaling factor: 0.001 → i.e. 1,200 corresponds to 1.200 gpm

**Register 14/15:
Setpoint Absolute Flow UnitSel** Setpoint as Absolut Flow
Related to unit selected in Register No. 142
Scaling factor: 0.001

**Register 16:
Setpoint Analog** Setpoint as analog value in hundredths of a Volt
Scaling factor: 0.01
i.e 0...1,000 corresponds to 0.00...10.00V

**Register 17:
Temperature 1 in Celsius** Remote Temperature in hundredths of one degree Celsius [°C]
Scaling factor: 0.01
Signed Value Two's complement
→ i.e. 0 ... 12,000 corresponds to 0.00...120.00°C
→ i.e. 64,536 ... 65,535 corresponds to -10.00...-0.01°C

**Register 18:
Temperature 1 in Fahrenheit** Remote Temperature in hundredths of one degree Fahrenheit [°F]
Scaling factor: 0.01 → i.e. 1,400 ... 24,800 corresponds to 14...248°F

Register 19: Temperature 2 in Celsius Signed Value <u>Two's complement</u>	Embedded Temperature in hundredths of one degree Celsius [°C] Scaling factor: 0.01 → i.e. 0 ... 12,000 corresponds to 0.00...120.00°C → i.e. 64,536 ... 65,535 corresponds to -10.00...-0.01°C
Register 20: Temperature 2 in Fahrenheit	Embedded Temperature in hundredths of one degree Fahrenheit [°F] Scaling factor: 0.01 → i.e. 0 ... 24,800 corresponds to 14...248°F
Register 21: Delta Temperature in Kelvin	Delta Temperature in hundredths of one degree Celsius [K] Scaling factor: 0.01 → i.e. 0 ... 13,000 corresponds to 0...130K
Register 22: Delta Temperature in Fahrenheit	Delta Temperature in hundredths of one degree Celsius [°F] Scaling factor: 0.01 → i.e. 0 ... 26,600 corresponds to 0...266°F
Register 23: Glycol Concentration	Glycol Concentration in hundredths of one percent Scaling factor: 0.01 → i.e. 0...10,000 corresponds to 0...100% If measurement is locked, constant value 65'535
Register 24: Relative Power	Relative Power in hundredths of one percent of active Pmax Scaling factor: 0.01 → i.e. 0 ... 10,000 correspond to 0 ... 100%
Register 25/26: Absolute Power UnitSel	Absolute Power in unit which is selected for Power in Register No. 143 Scaling factor: 0.001
Register 27/28: Absolute Power in kW	Absolute Power in kW Scaling factor: 0.001 → i.e. 0...2,147,483,647 corresponds to 0...2,147,483.647 kW
Register 29/30: Absolute Power in kBTU/h	Absolute Power in kBTU/h Scaling factor: 0.001 → i.e. 0...2,147,483,647 corresponds to 0...2,147,483.647 kBTU/h
Register 31/32: Energy Cooling UnitSel	Cooling Energy in unit which is selected for Energy in Register No. 144 Scaling factor: 1
Register 33/34: Energy Cooling in kWh	Cooling Energy in kWh Scaling factor: 1 → i.e. 0...2,147,483,647 corresponds to 0...2,147,483.647 kWh
Register 35/36: Energy Cooling in kBTU	Cooling Energy in kBTU Scaling factor: 1 → i.e. 0...2,147,483,647 corresponds to 0...2,147,483.647 kBTU
Register 37/38: Energy Heating UnitSel	Heating Energy in unit which is selected for Energy in Register No. 144 Scaling factor: 1
Register 39/40: Energy Heating in kWh	Heating Energy in kWh Scaling factor: 1 → i.e. 0...2,147,483,647 corresponds to 0...2,147,483.647 kWh
Register 41/42: Energy Heating in kBTU	Heating Energy in kBTU Scaling factor: 1 → i.e. 0...2,147,483,647 corresponds to 0...2,147,483.647 kBTU

**Register 101-103:
Series number**

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: 21706-20004-022-028

Register 101	Register 102	Register 103
1 st part	2 nd part	4 th part
21706	20004	028

**Register 104:
Firmware Version**

Model version
e.g. 101 V1.01

**Register 105:
Malfunction and service information**

The status information is split into messages about the actuator (malfunctions) and other service information

Bit	Description
0	Error Sensor T1
1	Error Sensor T2
2	Error Flow Sensor
3	Actuator cannot move
4	Flow with closed valve
5	Air bubbles
6	Flow not reached
7	Power not realized
8	-
9	Gear disengagement active
10	-
11	Reverse flow
12	MP communication faulty
13	Freeze warning
14	-
15	-

Description

Error Sensor T1: Error with remote temperature sensor
 Error Sensor T2: Error with embedded temperature sensor
 Error Flow Sensor: Error with the flow sensor
 Actuator can't move: Mechanical overload due to blocked valve, etc.
 Flow with closed valve: Flow is measured but position of valve is closed
 Airbubbles: Air bubbles in the hydronic system
 Flow not reached: Setpoint cannot be reached within 5 min during flow control
 Power not realized: Setpoint cannot be reached within 5 min during power control
 Gear disengagement active: Gear disengaged button is pressed
 Reverse flow: Reverse flow is detected
 MP communication faulty: Internal communication between sensor and actuator faulty
 Freeze warning: Measured temperature & glycol concentration indicate that grease ice can build up

**Register 106:
Vmax setting**

Maximum limit of Flow in hundredths of one percent of Vnom
 Scaling factor: 0.01 → i.e. 3,000...10,000 correspond to 30...100%

**Register 107/108:
Vmax setting in l/s**

Maximum limit of Flow in l/s
 Scaling factor: 0.001 → i.e. 350 corresponds to 0.350 l/s
Both registers have to be written at once with function "Write Multiple Registers [16]"

**Register 109/110:
Vmax setting in gpm**

Maximum limit of Flow in gpm
 Scaling factor: 0.001 → i.e. 1,200 corresponds to 1.200 gpm
Both registers have to be written at once with function "Write Multiple Registers [16]"

**Register 111/112:
Vnom in UnitSel**

Nominal volume in unit which is selected in Register No. 142
 Scaling factor: 0.001

**Register 113/114:
Vnom in l/s**

Nominal volume in l/s
 Scaling factor: 0.001 → i.e. 350 corresponds to 0.350 l/s

**Register 115/116:
Vnom in gpm**

Nominal volume in gpm
 Scaling factor: 0.001 → i.e. 1,200 corresponds to 1.200 gpm

Register 117: Maximum limit of power in hundredths of one percent of Pnom
Pmax setting Scaling factor: 0.01 → i.e. 10...1,000 correspond to 1...100%

Register 118/119: Maximum limit of power in kW
Pmax setting in kW Scaling factor: 0.001 → i.e. 70,000 corresponds to 70 kW
Both registers have to be written at once with function "Write Multiple Registers [16]"

Register 120/121: Maximum limit of power in kBTU/h
Pmax setting in kBTU/h Scaling factor: 0.001 → i.e. 2,390,000 corresponds to 2,390.000 kBTU/h
Both registers have to be written at once with function "Write Multiple Registers [16]"

Register 122/123: Nominal power in unit which is selected in Register No. 143
Pnom in UnitSel Scaling factor: 0.001

Register 124/125: Nominal power in kW
Pnom in kW Scaling factor: 0.001 → i.e. 70,000 corresponds to 70 kW

Register 126/127: Nominal power in kBTU/h
Pnom in kBTU/h Scaling factor: 0.001 → i.e. 2,390,000 corresponds to 2,390.000 kBTU/h

Register 128: Not used in this device. Constant value 65'535
(Reserved)

Register 129: Not used in this device. Constant value 65'535
(Reserved)

Register 130: Not used in this device. Constant value 65'535
(Reserved)

Register 131: Selection of DeltaT activation and operation mode
DeltaT Limitation

0	Disabled
1	dT-Manager
2	dT-Manager scaling

Description Disabled: dT-Manager not activated
dT-Manager: dT-Manager activated with no restriction to flow
dT-Manager scaling: dT-Manager activated with restriction of flow
→ Register No. 135/136 or 137/138

Register 132: Indicates the status of the dT manager
DeltaT Manager Status

0	Not selected
1	Standby
2	Active
3	Scaling standby
4	Scaling active

Description Not selected: dT-Manager deactivated
Standby: dT-Manager activated but not active
Active: dT-Manager active
Scaling standby: dT-Manager active with no limitation to the flow
Scaling active: dT-Manager active with limitation to the flow
→ Register No. 135/136 or 137/138

Register 133: Delta Temperature in hundredths of one degree Celsius [K]
Setpoint Delta Temperature in Kelvin Scaling factor: 0.01 → i.e. 1 ... 5,500 corresponds to 1...55 K

Register 134: Delta Temperature in hundredths of one degree Celsius [°F]
Setpoint Delta Temp in Fahrenheit Scaling factor: 0.01 → i.e. 2 ... 10,000 corresponds to 2...100 F

Register 135/136: Setpoint Flow in l/s at DeltaT
Setpoint Absolute Flow at dT in l/s Scaling factor: 0.001 → i.e. 350 corresponds to 0.350 l/s

Register 137/138: Setpoint Flow in gpm at DeltaT
Setpoint Absolute Flow at dT in gpm Scaling factor: 0.001 → i.e. 1,200 corresponds to 1.200 gpm

Register 139: Not used in this device. Constant value 65'535
(Reserved)

Register 140: Not used in this device. Constant value 65'535
(Reserved)

Register 141: Control Mode of the EV. This value defines the interpretation of the setpoint
Control mode → Register No. 1

0	Position Control
1	Flow Control
2	Power Control

Register 142: Selection of Flow Unit defines unit of Register No. 8/9, 14/15, 111/112
Unit Selection Flow

0	m ³ /s
1	m ³ /h
2	l/s
3	l/min
4	l/h
5	gpm
6	cfm

Register 143: Selection of Power Unit defines unit of Register No. 25/26, 122/123
Unit Selection Power

0	W
1	kW
2	BTU/h
3	kBTU/h
4	Tons

Register 144: Selection of Energy Unit defines unit of Register No. 31/32, 37/38
Unit Selection Energy

0	J
1	kWh
2	MWh
3	kBTU
4	tonh
5	MJ
6	GJ

Register 145: Source of setpoint. The actuator has the possibility to be controlled with an
Setpoint Source analog input and at the same time being integrated on Modbus (Monitoring).
Depending on this setting the setpoint by bus or analog input is valid.

0	Analog
1	Bus

Description Analog: Setpoint from analog signal 0...10V on wire 3
Bus: Setpoint from Modbus → Register No. 1