



# Modbus Interface Description



## Flow Sensor 22PF-1U..

Edition 2023-11 / V4.2

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# Modbus general notes

## General information

Date	15.12.2022
Product Name	Flow Sensor
Product Model Number	22PF-x1(X)Ux2(x3(x4))-(SG) X1: 1, 5 x2: C, D, E, F, G, H, H x3: H, N, K x4: H, T
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

## Parametrisation

Tool	Belimo Assistant App
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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.

## 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 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 <sub>2</sub> = 6,856 <sub>10</sub>	Read (Function 03, 1 Register) Value Register No. x = 1111 1101 1111 0010 <sub>2</sub> = -526 <sub>10</sub>
Actual value = value * scaling factor * unit = 6,856 * 0.01 * unit = <b>68.56 unit</b>	Actual value = value * scaling factor * unit = -526 * 0.01 * unit = <b>-5.26 unit</b>

## 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.

Example:

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

<b>Value LowWord</b> = 14,551 = 0011 1000 1101 0111 <sub>2</sub>	<b>Value HighWord</b> = 19 = 0000 0000 0001 0011 <sub>2</sub>
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32-bit value  
 = 0000 0000 0001 0011 0011 1000 1101 0111<sub>2</sub>  
 = 1,259,735<sub>10</sub>  
 = **1,259.735 unit**

Math formula:

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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<sub>2</sub>).

# Modbus register overview

## Operation

No.	Address	Register	Access
..	..	-	-
7	6	Relative Volumetric Flow in % of full scale (FS)	R
8	7	Absolute Volumetric Flow [l/s]	R
9	8	Absolute Volumetric Flow [gpm]	R
10	9	Absolute Volumetric Flow in selected unit	LowWord
11	10		HighWord
..	..	-	-
13	12	Sensor Value [mV] [-]	R
..	..	-	-
22	21	T_C **)	R
23	22	T_F **)	R
26	25	Glycol Concentration [%]	R

\*\*) signed integer

## Accumulation

No.	Address	Register	Access
60	59	Total Volume m <sup>3</sup>	LowWord
61	60		HighWord
62	61	Total Volume gal	LowWord
63	62		HighWord
64	63	Total Volume in selected units	LowWord
65	64		HighWord

## Service

No.	Address	Register	Access
100	99	Bus Termination	R
101	100	Series Number 1 <sup>st</sup> part	
102	101	Series Number 2 <sup>nd</sup> part	R
103	102	Series Number 4 <sup>th</sup> part	
104	103	Firmware Version	–
105	104	Malfunction and Service Information	R
..	..	–	–
111	110	FS (full scale, max. flow) in l/s	R
112	111	FS (full scale, max. flow) in gpm	R
113	112	FS (full scale, max. flow) in selected units	LowWord
114	113		HighWord
..	..	–	–
121	120	Sensor 1 Type	R / W
..	..	–	–
148	147	Unit Selected Flow	R / W
150	149	Unit Selected 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.

## Modbus register description

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
7	6	<b>Relative volumetric flow</b> Relative volumetric flow in % of "FS" (Full scale) Related to "FS" (Register No. 111, 112, 113/114)	0...15'000	%	0.01	R
8	7	<b>Absolute volumetric flow</b>	0...10'000	l/s	0.01	R
9	8	<b>Absolute volumetric flow</b>	0...16'000	gpm	0.1	R
10	9	<b>Absolute volumetric flow in selected unit</b> → based on selection in Register No. 148	0...360'000'000	UnitSel	0.001	R
11	10		Actual range determined by elected unit			
13	12	<b>Sensor value 1</b>	0...65'535	mV	1 0/1	R
..	..	-	-	-	-	-
22	21	<b>T_C</b>	-2'000...12'000	°C	0.01	R
23	22	<b>T_F</b>	-400...24'800	°F	0.01	R
26	25	<b>Glycol concentration</b>	0...10'000	%	0.01	R
..	..	-	-	-	-	-
60	59	<b>Total volume</b>	0...2'147'483'600	m <sup>3</sup>	0.01	R
61	60					
62	61	<b>Total volume</b>	0...2'147'483'647	gal	1	R
63	62					
64	63	<b>Total volume in selected unit</b> → based on selection in Register No. 150	0...2'147'483'647	UnitSel	1	R
65	64					
..	..	-	-	-	-	-
100	99	<b>Bus termination</b> Indicates if bus termination (120Ω) is enabled. Bus termination can be set by configuration tools.	0: Disabled 1: Enabled Default: 0	-	-	R
101	100	<b>Series number 1<sup>st</sup> part</b> 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 <sup>st</sup> part: 00839 2 <sup>nd</sup> part: 31324 4 <sup>th</sup> part: 008	-	-	-	R

No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
102	101	<b>Series number 2<sup>nd</sup> part</b>	–	–	–	R
103	102	<b>Series number 4<sup>th</sup> part</b>	–	–	–	R
104	103	<b>Firmware version</b>	–	–	–	R
105	104	<b>Malfunction and service information</b> 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: Reverse flow: Wrong flow direction. 6: Flow actual exceeds FS: Actual flow exceeds FS (designed nominal volumetric flow) 7: Flow measurement error: Airbubbles, water contamination, not specified fluid used. 9: Flowbody temperature error: Temperature sensor defect. 11: Freeze warning: Water/glycol used tends to freeze. 12: Glycol detected: Medium, contains glycol although not set.	Bitmask = 0: – 1: – 2: – 3: Reverse flow 4: – 5: – 6: Flow actual exceeds FS 7: Flow measurement error 8: – 9: Flowbody temperature error 10: – 11: Freeze warning 12: Glycol detected 13: – 14: – 15: –	–	–	R
..	..	–	–	–	–	–
111	110	<b>FS (full scale, max. flow)</b>	0...10'000	l/s	0.01	R
112	111	<b>FS (full scale, max. flow)</b>	0...16'000	gpm	0.1	R
113	112	<b>FS (full scale, max. flow) in selected units</b>	0...360'000'000	UnitSel	0.001	R
114	113	→ based on selection in Register No. 148	Actual range determined by selected unit			
..	..	–	–	–	–	–
121	120	<b>Sensor 1 type</b> Additional sensor input	0: None 1: Active 2: - 3: - 4: Switch Default: 0	–	–	R / W
..	..	–	–	–	–	–
148	147	<b>Unit selection flow</b>	0: m <sup>3</sup> /s 1: m <sup>3</sup> /h 2: l/s 3: l/min 4: l/h 5: gpm 6: cfm Default: 4	–	–	R / W
150	149	<b>Unit selection volume</b>	0: m <sup>3</sup> 1: Litre 2: Gallon 3: cf Default: 0	–	–	R / W
..	..	–	–	–	–	–



No.	Address	Description Comment	Range, enumeration	Unit	Scaling	Access
201	200	<b>Flow Meter serial number first digits</b> ProductionOrderNumber	-	-	1	R
203	202	<b>Flow Meter serial number last digits</b> ProductionSequenceNumber	-	-	1	R
204	203					

Access: R = Read, W = Write

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

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