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SCHMIDT® Technology

SCHMIDT® Volume Flow Sensor
IL 30.2xx

Addition for digital communication
Instructions for Use

SCHMIDT® Volume Flow Sensor
IL 30.2xx – Digital Communication

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1 Important information

These operating instructions contain all information required for communication with a **SCHMIDT®** volume flow sensors of type **IL 30.2xx** via its digital interface:

- Please also read the "Instructions for Use IL 30.0xx" (Mat. no. 574673.02), as these operating instructions are a supplement for using digital communication with the sensor.
- These instructions for use must be read completely and observed carefully before putting the unit into operation.
- Any claims under the manufacturer's liability for damage resulting from non-observance or non-compliance with these instructions will become void.
- **SCHMIDT Technology** cannot give any warranty as to its suitability for a certain purpose and cannot be held liable for errors contained in these instructions for use or for accidental or sequential damage in connection with the delivery, performance or use of this unit.

Symbols used in this manual

The symbols used in this manual are explained in the following section.

Danger warnings and safety instructions. Read carefully!
Non-observance of these instructions may lead to injury of personal or malfunction of the device.

2 Digital interface

The sensor has a Modbus RTU compatible interface with the following properties:

- Electrical: RS485 (EIA-485), 2-wire, 3.3 V
- Termination resistor: Not integrated
- Baudrate: 9600 (fix, not changeable)
- Setting: 8 data bits, no parity bit, 1 stop bit

To ensure trouble-free operation on a Modbus, the sensor must be configured for **Modbus operation** (see register „*Modbus mode*“, no. 40021, page *10*).

The configuration for Modbus operation can be specified on ordering the sensor (default: module interface).
Alternatively, the optional "PC Programming Kit" (mat. No.: 546710) is available as an accessory for this purpose and for further parameterization of the sensor.

3 Modbus

Communication with the sensor takes place in accordance with "Modbus Application Protocol v1.1a" in **Modbus RTU** operating mode.
The FreeMODBUS library is used for this (see chapter *8*).

Modbus Konfiguration

Function	Description
Protocol	Modbus Application Protocol v1.1a
Operating mode	Modbus RTU
Device type	Server
Address range	1 ... 247 (default value on delivery: 42)
Broadcast address	0
Byte order	Big-endian (DC BA)
Response time	Typically < 10 ms

Table 1

Supported functions

The sensor supports the following Modbus commands:

Function	Subfunction	Description
03 (0x03)		Read Holding Register
04 (0x04)		Read Input Register
06 (0x06)		Write Single Holding Register
16 (0x10)		Write Multiple Holding Registers
43 (0x2B)	14 (0x0E)	Read Device Identification

Table 2

Data types

Type	Description	Number of Register
u_Int_8	Unsigned integer	1
Int_8	Signed integer	1
u_Int_16	Unsigned integer	1
Int_16	Signed integer	1
u_Int_32	Unsigned integer	2
Int_32	Signed Integer	2
FP_32	Floating point (IEEE 754 binary32)	2
String	String of characters	Depending on parameter

Table 3

4 Register map

Input register (read only)

Function 04 (0x04): Read input register

System				
Register	**Address**	**Description**	**Unit**	**Type**
30001 – 30002	0	Serial number of sensor		u_Int_32
30003 – 30004	2	Material number of sensor		u_Int_32
30005 – 30014	4	Sensor type		String

Flow velocity[1]				
Register	**Address**	**Description**	**Unit**	**Type**
31001 – 31002	1000	Flow velocity	mm/s	Int_32
31003 – 31004	1002	Flow velocity	m/s	FP_32
31005 – 31006	1004	Flow velocity	km/h	FP_32
31007 – 31008	1006	Flow velocity	ft/s	FP_32
31009 – 31010	1008	Flow velocity	mph	FP_32

Volume Flow				
Register	**Address**	**Description**	**Unit**	**Type**
32001 – 32002	2000	Volume flow	l/min	FP_32
32003 – 32004	2002	Volume flow	m³/h	FP_32
32005 – 32006	2004	Volume flow	cf/min	FP_32

Medium Temperature				
Register	**Address**	**Description**	**Unit**	**Type**
33001 – 33002	3000	Medium Temperature	°C	FP_32
33003 – 33004	3002	Medium Temperature	°F	FP_32
33005 – 33006	3004	Medium Temperature	K	FP_32

Configurable data area – read values			
Register	**Address**	**Description**	**Type**
34001 – 34032	4000 – 4031	User defined register (indirect registers) Index 0 – 31	u_Int_16

[1] The flow velocity is measured (maximum value in the centre of the pipe); from this, the volume flow is calculated.

Holding Register (read / write)

Function 03 (0x03): Read holding register
Function 06 (0x06): Write holding register (single)
Function 16 (0x10): Write holding registers (multiple)

System				
Register	**Address**	**Description**	**Unit**	**Type**
40001	0	Server ID		u_Int_8
40021	20	Modbus mode		u_Int_8

Measurement ranges				
Register	**Address**	**Description**	**Unit**	**Type**
42109 – 42110	2108	Start of measuring range for analog output $\dot{V}_N$ (volume flow)	l/min	FP_32
42111 – 42112	2110	End of measuring range for analog output $\dot{V}_N$ (volume flow)	l/min	FP_32

Measurement				
Register	**Address**	**Description**	**Unit**	**Type**
42151	2150	Smoothing		u_Int_16

Configurable data area – configuration			
Register	**Address**	**Description**	**Type**
44001 – 44032	4000 – 4031	User defined register (indirect registers) Index 0 – 31	u_Int_16

5 Register descriptions

Input register (read only)

Serial number		
Register 30001 – 30002	Address 0	Type u_Int_32
• Serial number of sensor		

Material number		
Register 30003 – 30004	Address 2	Type u_Int_32
• Material number of sensor • Depends on sensor type		

Sensor type		
Register 30005 – 300014	Address 4	Type string
• Type of sensor as string with a length of 20 characters (depends on sensor type): - "IL 30.208 (572 900) " - "IL 30.212 (572 901) "		

Flow velocity		
Register 31001 – 31002	Address 1000	Type Int_32
• Flow velocity in [mm/s] • The output is given as standard flow velocity (w_N). • The step response time can be adjusted using the “Smoothing” register.		

Flow velocity		
Register 31003 – 31004	Address 1002	Type FP_32
• Flow velocity in [m/s] • The output is given as standard flow velocity (w_N). • The step response time can be adjusted using the “Smoothing” register.		

Flow velocity		
Register 31005 – 31006	Address 1004	Type FP_32
• Flow velocity in [km/h] • The output is given as standard flow velocity (w_N). • The step response time can be adjusted using the “Smoothing” register.		

Flow velocity		
Register 31007 – 31008	Address 1006	Type FP_32
• Flow velocity in [ft/s] • The output is given as standard flow velocity (w_N). • The step response time can be adjusted using the “Smoothing” register.		

Flow velocity		
Register 31009 – 31010	Address 1008	Type FP_32
• Flow velocity in [mph] • The output is given as standard flow velocity (w_N). • The step response time can be adjusted using the “Smoothing” register.		

Volume Flow		
Register 32001 – 32002	Address 2000	Type FP_32
• Volume Flow in [l/min] • The output is given as standard volume flow ($\dot{V}_N$). • The step response time can be adjusted using the “Smoothing” register.		

Volume Flow		
Register 32003 – 32004	Address 2002	Type FP_32
• Volume Flow in [m³/h] • The output is given as standard volume flow ($\dot{V}_N$). • The step response time can be adjusted using the “Smoothing” register.		

Volume Flow		
Register 32005 – 32006	Address 2004	Type FP_32
• Volume Flow in [cf/min.] • The output is given as standard volume flow ($\dot{V}_N$). • The step response time can be adjusted using the “Smoothing” register.		

Medium Temperature		
Register 33001 – 33002	Address 3000	Type FP_32
• Medium temperature in [°C]		

Temperature of medium		
Register 33003 – 33004	Address 3002	Type FP_32
• Medium temperature in [°F]		

Temperature of medium		
Register 33005 – 33006	Address 3004	Type FP_32
• Medium temperature in [K]		

Configurable data area – read values		
Register 34001 – 34032	Address 4000	Type u_Int_16
• Register for reading the user-defined registers (indirect registers, see chapter 7).		

Holding Register (read / write)

Server ID		
Register 40001	Address 0	Type u_Int_8

- Modbus address under which the sensor can be addressed.
- Valid values: 1 ... 247 (default: 42)
- The set value is used after a restart of the sensor.

Modbus mode		
Register 40021	Address 20	Type u_Int_8

- Operating mode of the digital interface.
- Valid values:
  - 0 Auto (just single device, no bus operation)
  - 1 Modbus
  - 2 RS485 (▼ for internal use)
  - 3 First use (▼ for internal use)
- The set value is used after a restart of the sensor.

Volume flow - measuring range start		
Register 42109 – 42110	Address 2108	Type FP_32

- Sets the lower limit for the analog output (in [l/min]).
- This value has no influence on the digital value output.
- Valid values: 0 ... measuring range end
  (Measuring range start must be lower than measuring range end!)

Volume flow - measuring range end		
Register 42111 – 42112	Address 2110	Type FP_32

- Sets the upper limit for the analog output ([l/min]).
- This value has no influence on the digital value output.
- Valid values: Measuring range start ... measuring range of sensor
  (Measuring range end must be higher than measuring range start!)

Smoothing		
Register 42151	Address 2150	Type u_Int_16

- Smoothing of flow measurement:
- Small, rapid flow changes are smoothed.
- Valid values:
  - 0 No smoothing
  - 1 Slight smoothing
  - 2 Medium smoothing
  - 3 Strong smoothing

Configurable data area – configuration		
Register 44001 – 44032	Address 4000	Type u_Int_16

- Register for configuring the user-defined registers (indirect registers, see chapter 7).

6 Device Identification

Function 43 (0x2B), sub function (0x0E): Read device identification

The device identification consists of ASCII characters called objects.

The sensor supports "basic values" and "regular values".

Basic Device Identification

Objekt	Bezeichnung	Wert
0	Vendor name	SCHMIDT Technology GmbH
1	Product code	E.g.: IL 30.208 (572 900)
2	Revision	Vx.y.z

Regular Device Identification

Objekt	Bezeichnung	Wert
0	Vendor name	SCHMIDT Technology GmbH
1	Product code	E.g.: IL 30.208 (572 901)
2	Revision	Vx.y.z
3	Vendor URL	www.schmidttechnology.de
4	Product name	Volume Flow Sensor
5	Model name	E.g.: IL 30.208

7 Using indirect registers

The user-defined registers can be used to combine a set of registers so that they can be read with a single read command (Read Input Register, function 04).

For this purpose, the register numbers of the data to be read are entered in "Configurable data area - configuration" (registers: 44001 - 44032). These can then be read out via "Configurable data area - read area" (registers: 34001 - 34032).

Example:

The volume flow in [m³/h] and the temperature of the medium in [°C] are to be read out.

Instead of querying the values with two individual read accesses, these can be combined into a group via the user-defined registers:

Specify the required registers in the desired order:

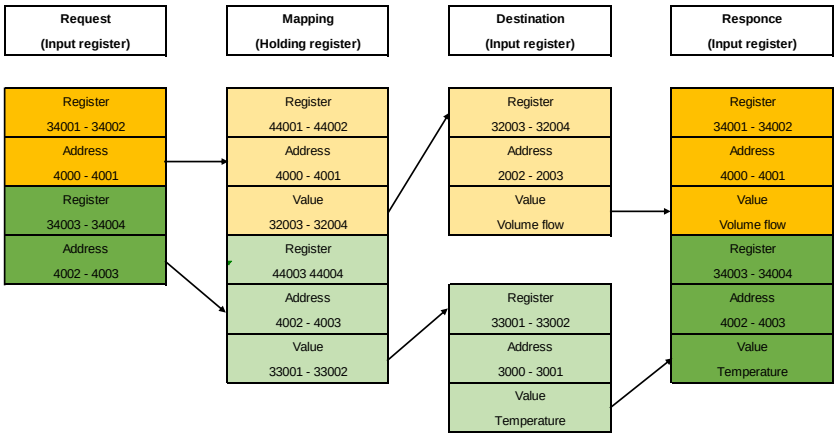
Register	Address	Description
32003 – 32004	2002 – 2003	Vol. Flow in [m³/h]
33001 – 33002	3000 – 3001	Medium temperature in [°C]

The configuration data only needs to be written to the corresponding registers once:

Write Multiple Holding Registers (start address 4000, 4 registers)			
Register	**Address**	**Value**	**Description**
44001	4000	32003	Vol. Flow Reg. 1
44002	4001	32004	Vol. Flow Reg. 2
44003	4002	33001	Temp. Reg. 1
44004	4003	33002	Temp. Reg. 2

The values (volume flow and medium temperature) can then be read as a group:

Read Input Register (start address 4000, 4 registers)		
Register 34001 – 34002	Address 4000	Type FP_32
• Volume Flow in [m³/h] • Indirect register from 44001 – 44002 (pointing to ⇨ 32003 – 32004) • Data type corresponds to the addressed data type (here: volume flow)		
Register 34003 – 34004	Address 4002	Type FP_32
• Medium temperature in [°C] • Indirect register from 44003 - 44004 (pointing to ⇨ 33001 – 33002) • Data type corresponds to the addressed data type (here: Medium temperature)		



8 License agreement FreeModbus

FreeMODBUS is a free implementation of the MODBUS protocol. FreeMODBUS is licensed under the BSD, which allows it to be used in commercial environments.

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