

**Technical specifications**

**Characteristics**

Purpose:	Measurement of gas density
Principle:	digital output for quartz based density measurement
Ambient temperature:	-40... +80°C
Media temperature:	-40... +80°C
Storage temperature:	-40... +80°C
Protection:	IP65
Measuring range:	0 ... 1100 kPa absolute
Overpressure:	1500 kPa absolute
Humidity:	98% relative
Vibration:	15 g (max. 6 mm), (5 ... 2000 Hz)
Shock:	100g/ 6 ms

**Mechanical data**

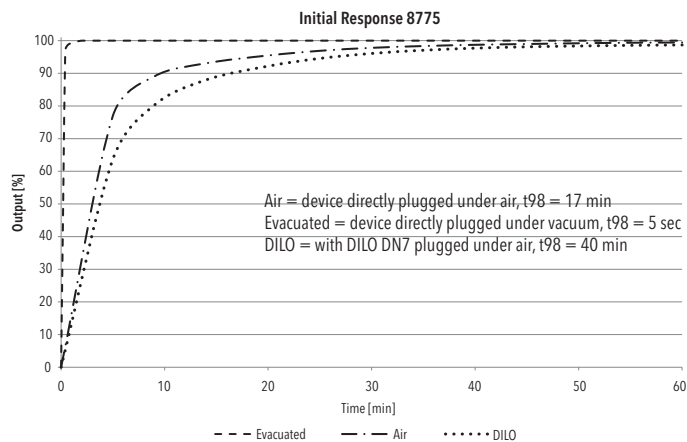
Material:	
Pressure connection:	1.4435 (AISI316L)
Housing:	1.4301
O-Ring:	EPDM
Male electrical plug:	see ordering information
Mounting:	any position
Weight:	~ 200 ... 400 g

**Type label (Identification)**

For all inquiries please indicate:	
Instrument type:	Type: 8775.XX.XXXX.XX
Instrument serial number:	S/N: XXXXXX.X.XX.XX-XXX

**Initial response time after installation**

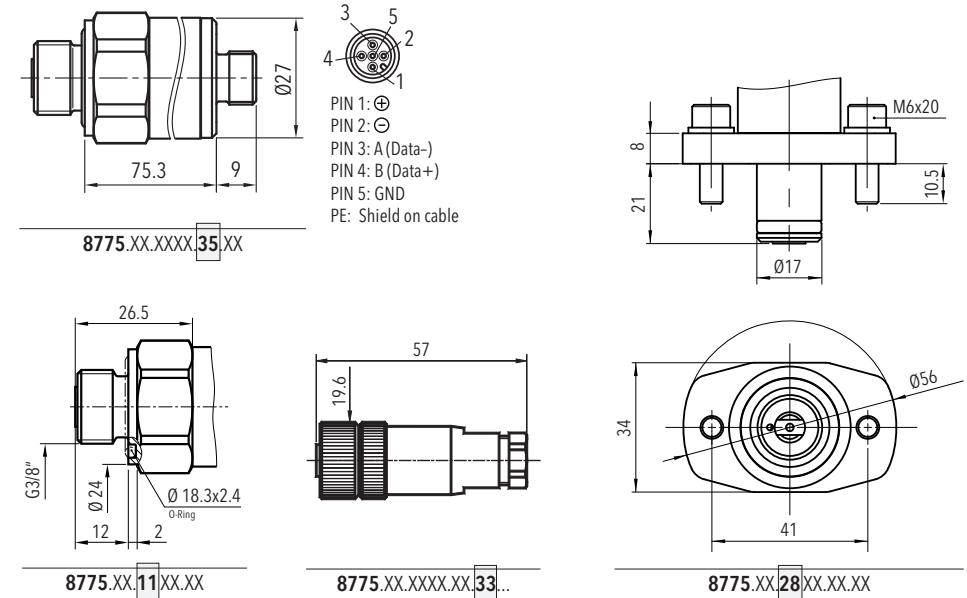
t98 = Time scale for very first installation, measured value within 98% of exact value



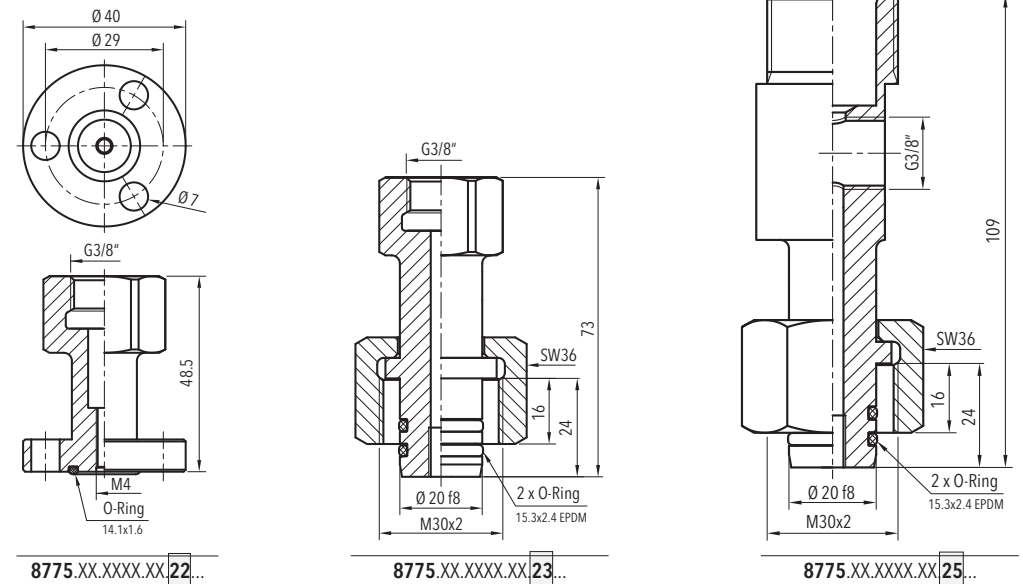
**Electrical data**

Output signal:	RS485/Modbus (RTU)
Parameters:	density [kg/m <sup>3</sup> ], SF <sub>6</sub> pressure [kPa abs.] @ 20°C, temperature [K], SF <sub>6</sub> pressure [kPa abs.] @ temp. var. [K] (SF <sub>6</sub> Pressure only correct for 100 % SF <sub>6</sub> gas)
Resolution density:	13 bit
Resolution temperature:	10 bit
Accuracy density:	±1.0 % FS typ. ±1.8 % FS max. ±2.5 % FS typ. ±4.0 % FS max.
Accuracy temperature (when installed):	
Measuring range:	0 ... 1100 kPa absolute @ 20°C 0...60 kg SF <sub>6</sub> /m <sup>3</sup>
Measuring range temperature:	-40...+80°C
Earthing:	via gas connection of sensor
Supply voltage:	11...32 VDC
Dielectrical strength:	500 VAC, 50 Hz
Resistance of insulation:	>10 MΩ, 500 VDC
<b>Modbus settings:</b>	
Baudrate:	1200...57600
Parity:	none (2 stop bits) odd (1 stop bit) even (1 stop bit)
Slave-ID:	1...247
Max. devices in one bus:	64

**Dimensions**



**Adapters**



Frame description

Slave Address	Function Code	Data	CRC
1 byte	1 byte	0..252 byte(s)	2 bytes CRC Hi CRC Lo

Sensor data

FC 04 Read Input Registers (read Sensor data from slave device)

Value	Address #	Register #	Scale	Unit	Data range
SF <sub>6</sub> gas density <sup>(1)</sup>	0	1	Value*0.01	kg/m <sup>3</sup>	0..60 kg/m <sup>3</sup>
SF <sub>6</sub> gas pressure (@20°C) <sup>(1) (2)</sup>	1	2	Value*0.1	kPa	0..1100 kPa
SF <sub>6</sub> gas temperature	2	3	Value*0.1	K	215..360 K
SF <sub>6</sub> gas pressure (var °C) <sup>(1) (2)</sup>	3	4	Value*0.1	kPa	0..1100 kPa
Slave ID	4	5	-	-	1..247
Serial number Hi	5	6	-	-	-
Serial number Low	6	7	-	-	-
SW release	7	8	Value*0.1	-	-
Quartz frequency <sup>(1)</sup>	8	9	Value*0.01	Hz	10..300 Hz

<sup>(1)</sup> Change to 0xFFFF if value range is exceeded

<sup>(2)</sup> SF<sub>6</sub> pressure value only correct for 100 % SF<sub>6</sub> gas

Sensor settings

FC 06 Write Single Register, FC 16 Write Multiple Registers, FC 03 Read Holding Registers

Value	Address #	Register #	Valid values / Description															
Not used	0	1	-															
Not used	1	2	-															
Slave ID	2	3	1...247															
Baudrate Hi	3	4	0															
Baudrate Low	4	5	1200, 2400, 4800, 9600, 14400, 19200, 28800, 38400, 56000, 57600															
Parity	5	6	0 = none parity (2 stop bits) 1 = odd parity (1 stop bit) 2 = even parity (1 stop bit)															
Mode	6	7	0 = RTU															
Bootloader	7	8	1 = Enter bootloader mode for 10s															
Write permissions (read only)	8	9	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="5">Register 9</th> </tr> <tr> <th>Bit #</th> <th>3</th> <th>2</th> <th>1</th> <th>0</th> </tr> </thead> <tbody> <tr> <td></td> <td>Mode</td> <td>Parity</td> <td>Baud</td> <td>Slave ID</td> </tr> </tbody> </table> <p style="text-align: center;">0: write permission, 1: no write permission</p>	Register 9					Bit #	3	2	1	0		Mode	Parity	Baud	Slave ID
Register 9																		
Bit #	3	2	1	0														
	Mode	Parity	Baud	Slave ID														

Sensor status

FC 02 Read Discrete Inputs

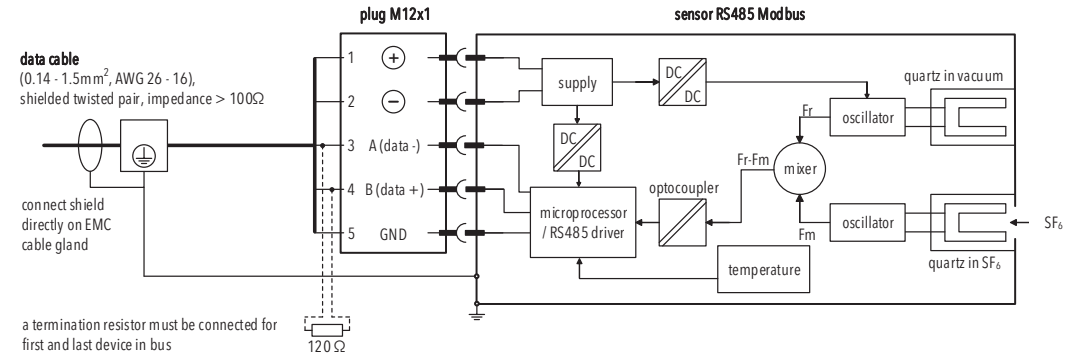
Value	Bit #	Description
Sensor error	0	0 = sensor is working properly, 1 = sensor error

For Modbus examples see: [www.trafag.com/H73519](http://www.trafag.com/H73519)

Electrical connection

Wiring diagram

8775.XX.XXXX.XX



## Modbus Examples

### FC04 Read Input Registers: Request of "SF6 gas density" value

Slave device address: 5, Start address: 0, Quantity of registers: 1

Master request (Tx)							
ID	FC	Start addr. Hi	Start addr. Lo	Quan. reg. Hi	Quan reg. Low	CRC Hi	CRC Low
0x05	0x04	0x00	0x00	0x00	0x01	0x30	0x4E

Slave response (Rx)						
ID	FC	Byte count	Input reg. 0 Hi	Input reg. 0 Low	CRC Hi	CRC Low
0x05	0x04	0x02	0x00	0x89	0x89	0x56

↓
137 <sub>Dez</sub> -> 1.37 kg/m <sup>3</sup>
SF <sub>6</sub> gas density

### Change Slave-ID with broadcast

The slave ID can alternatively be changed with broadcast if the current slave address is not known.

1. Split the serial number (visible on the identification plate) into two 16 bit numbers.

- S/N: 100309-004 -> dec2hex (100309004<sub>DEC</sub>) = 05FA980C<sub>HEX</sub>
- Serial Hi = 05FA<sub>HEX</sub>, Serial Low = 980C<sub>HEX</sub>

2. FC06 / FC16

- Register Address # 0: Serial Hi
- Register Address # 1: Serial Low
- Register Address # 2: New slave ID (1..247)

### FC06 Write Single Register: Set "Slave address" to a new value

Current Slave Device address: 5, Start address: 2, Register value: 6 (Slave Address changes to 6 after slave response)

Master request (Tx)							
ID	FC	Start addr. Hi	Start addr. Low	Reg. value Hi	Reg. value Low	CRC Hi	CRC Low
0x05	0x06	0x00	0x02	0x00	0x06	0xA9	0x4E

Slave response (Rx)							
ID	FC	Start addr. Hi	Start addr. Lo	Reg. value Hi	Reg. value Low	CRC Hi	CRC Low
0x05	0x06	0x00	0x02	0x00	0x06	0x30	0x4E

#	Exceptional Responses
01	<b>Illegal function</b> The function code received in the query is not an allowable action for the server (or slave). This may be because the function code is only applicable to newer devices, and was not implemented in the unit selected. It could also indicate that the server (or slave) is in the wrong state to process a request of this type, for example because it is unconfigured and is being asked to return register values.
02	<b>Illegal data address</b> The data address received in the query is not an allowable address for the server (or slave). More specifically, the combination of reference number and transfer length is invalid. For a controller with 100 registers, a request with offset 96 and length 4 would succeed. A request with offset 96 and length 5 will generate exception 02.
03	<b>Illegal data value</b> A value contained in the query data field is not an allowable value for the server (or slave). This indicates a fault in the structure of the remainder of a complex request, such as that the implied length is incorrect. It specifically does NOT mean that a data item submitted for storage in a register has a value outside the expectation of the application program, since the MODBUS protocol is unaware of the significance of any particular value of any particular register.
04	<b>Slave device failure</b> An unrecoverable error occurred while the server (or slave) was attempting to perform the requested action.

### Example

The master sends a request to a slave device with FC04 for the data address 0x09 (only 0x00..0x08 is supported).

Master request (Tx)							
ID	FC	Start addr. Hi	Start addr. Lo	Quan. reg. Hi	Quan reg. Low	CRC Hi	CRC Low
0x05	0x04	0x00	0x09	0x00	0x01	0xE0	0x4C

In an exception response, the server sets the most significant bit (MSB) of the function code to 1 (function code value in an exception is exactly 80 hexadecimal higher than in a normal response).

Slave response (Rx)				
ID	FC	Exception code	CRC Hi	CRC Low
0x05	0x84	0x02	0x89	0x56
	↓	↓		
	0x84 -> Exception Response 0x84 -> Function Code 04	0x02 -> Exception Code „Illegal data address“		