SIEMENS

Modbus air pressure sensor with I/O extension

QBM97..

QBM97.. air pressure sensor with I/O extension is designed for Modbus RTU communication networks. The QBM97.. offers easy installation and reduced plant wiring efforts with HVAC industry wide proven sensor technology.

- Modbus RTU communication interface
- Two analog inputs for 0...10 V or passive temperature elements
- Two analog outputs for 0...10 V
- Available with one or two differential pressure sensor elements
- Pressure sensor elements with high accuracy and long-term stability via ceramic strain-gauge technology with different pressure ranges from 0...500 – 7000 Pa
- Simple installation, reduced wiring effort through decentralized node
- Available with M12 plug & play connectors for power and communication
- DIP switches for addressing and Modbus line termination
- Push button for automated on-event addressing together with Climatix controllers

QBM97.. Modbus air pressure sensor with I/O extension

The QBM97.. comes with one or two sensor elements, different pressure ranges and with or without M12 connector for power and communication.

QBM97.. without M12 connector

QBM97.. with M12 connector

Type/ASN	Stock number/SSN	Pressure range	Inputs/Outputs	M12 connector	MOQ
Types with 1 sensor					
QBM9705/109C	S55730-S705-C109	1x 0…500 Pa	2 AI, 2 AO	-	20
QBM9710/109C	S55730-S710-C109	1x 0…1250 Pa	2 AI, 2 AO	-	20
QBM9720/109C	S55730-S720-C109	1x 0…2500 Pa	2 AI, 2 AO	-	20
QBM9750/109C	S55730-S750-C109	1x 0…5500 Pa	2 AI, 2 AO	-	20
QBM9770/109C	S55730-S770-C109	1x 0…7000 Pa	2 AI, 2 AO	-	20
Types with two sensors					
QBM9755/109C	S55730-S755-C109	1x 0…500 Pa & 1x 0…500 Pa	2 AI, 2 AO	-	20
QBM9711/109C	S55730-S711-C109	1x 0…1250 Pa & 1x 0…1250 Pa	2 AI, 2 AO	-	20
QBM9711/109M	S55730-S711-M109	1x 0…1250 Pa & 1x 0…1250 Pa	2 AI, 2 AO	Yes	20
QBM9712/109C	S55730-S712-C109	1x 0…1250 Pa & 1x 0…2500 Pa	2 AI, 2 AO	-	20
QBM9712/109M	S55730-S712-M109	1x 0…1250 Pa & 1x 0…2500 Pa	2 AI, 2 AO	Yes	20
QBM9717/109C	S55730-S717-C109	1x 0…1250 Pa & 1x 0…7000 Pa	2 AI, 2 AO	-	20
QBM9722/109C	S55730-S722-C109	1x 0…2500 Pa & 1x 0…2500 Pa	2 AI, 2 AO	-	20
QBM9777/109C	S55730-S777-C109	1x 0…7000 Pa & 1x 0…7000 Pa	2 AI, 2 AO	-	20
		Conversion: 100 Pa = 1 hPa = 1 mbar			

Ordering

When ordering a QBM97.. Modbus air pressure sensor with I/O extension, please specify the quantity and type.

ℹ️ Please observe the minimum order quantity (MOQ). One ASN order equals a box with 20 sensors.

Please request your Siemens sales regional center for other QBM97.. types or customization.

Accessory

Connection kits

Type/ASN	Stock number/SSN	Designation	MOQ
AQB9120/101A	S55843-Z120-A101	Connection kit for ventilation duct, two metal nipples 90° angled, including one tube 2 m long	1
AQB9220/101A	S55843-Z220-A101	Connection kit for ventilation duct, two plastic nipples, straight, including one tube 2 m long	1

Field of application

Focus segment

- Air handling units (AHU), with communication between controller and field devices and connected to cloud enabling plant digitalization.
- Support of Ecodesign directive ErP 2016/2018 through the use of bus-compatible sensors for monitoring filters, including cloud visualization

Typical use

The QBM97.. Modbus air pressure sensor and I/O extension is used in ventilation systems and air handling units (AHU):

- to measure and monitor pressure in air ducts and over filters and fans
- on the supply and extract air side

The QBM97.. is ideally suited for a multitude of tasks in the HVAC industry:

- measures relative and differential pressure and flow of air and non-aggressive gases
- available with one or two differential pressure sensors
- allows the observation of pressure or volumetric flow at two individual points in the system

Topology

AHU topology with Modbus field devices and sensors

- The following digital AHU topology illustrates an example for using the QBM97 Modbus air pressure sensor in an AHU application with peripheral bus for Modbus field devices and sensors.
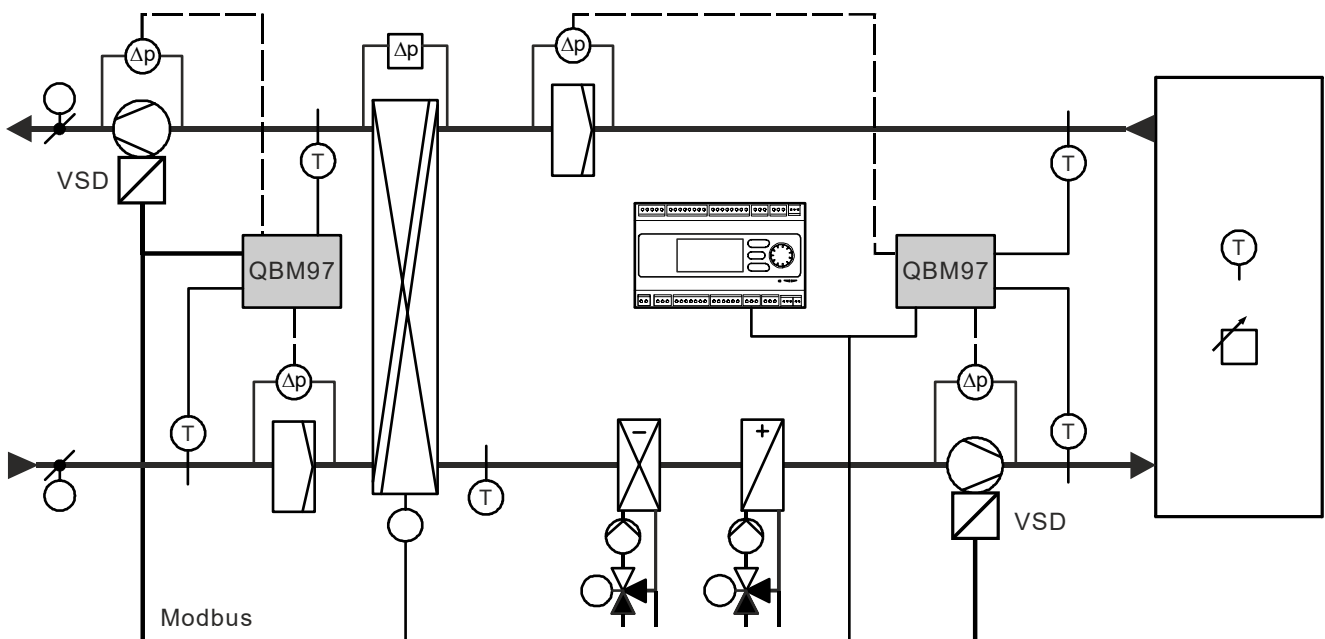
Sensor technology

The built-in sensors of the QBM97.. are based on the unique and in HVAC and automotive industry well-proven ceramic strain-gauge beam technology.

- The accurate sensors with long-term stability for all measured variables are completely maintenance free, providing cost savings over the whole lifetime of the plant.
- The sensor elements are also suited for demanding applications in the food or pharmaceutical industry.

Decentralized node via Modbus (RTU) combined with inputs/outputs

The QBM97.. with its Modbus communication interface is a decentralized node, when using the inputs and outputs for sensors and field devices:

- For example temperature sensors can be linked to the analog inputs, actors can be linked to the analog outputs.
- Having these elements on the Modbus communication reduces wiring efforts and installation costs.

Innovative housing design with quick release fasteners

The housing of the QBM97.. comes with quick release fasteners, which can be pushed in by hand, making screws and tools for opening and closing the sensor unnecessary. This innovative housing design could be made true due to a patented sealing which is injected directly during the plastic injection moulding process. A high protection grade of IP54 is guaranteed, providing a wide range of application areas.

Plug & play M12 connector

The sensor can be ordered with a M12 connector for power and communication for plug & play connection during installation.

Workflows and 'How to instructions' for the following functions can be found in manual A6V11478123.

DIP switches for addressing and Modbus line termination

For flexible use and wide range of application the QBM97.. Modbus air pressure sensor with I/O extension can be addressed via its DIP switches with other controllers than Climatix controllers.

Push button for automated on-event addressing together with Climatix controllers

The QBM97.. can be paired (addressed) easily and fast with Climatix controllers with the inbuilt push button for on-event addressing. On-event push button addressing is implemented in Siemens Modbus sensors and devices for digital air handling unit (AHU), providing a consistent, easy and fast commissioning process for manufacturers and installers.

Zero point factory reset

Through push button a zero point and a factory reset can comfortably be done.

Siemens as global technology partner

The QBM97.. is distributed globally via the Siemens sales network. The sensor is tested according to the major international standards such as EU and RCM conformity, UL approbation and EAC, making possible a worldwide field of application. Continuous innovations and development, as well as sustained quality, logistic processes, spare parts management and customer support make Siemens a valued technology partner.

PCB overview
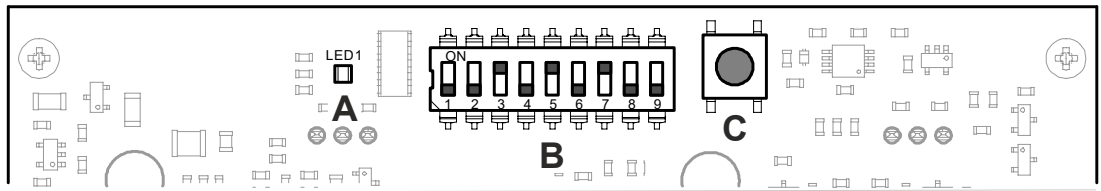
Element	Description
A	Status LED
B	DIP switches
C	Push button

Status LED indicator

Color	Flash response	Function
Red	Blinking, 1 second on, 5 seconds off	• Internal error
Red	Blinking, 0.1 seconds on, 1 second off	• Invalid configuration
Orange	Continuous	• Waiting for on-event addressing
Orange	Blinking, 1 second on, 5 seconds off	• Bus communication failure
Orange	Blinking, 0.1 seconds on, 1 second off	• Device not configured (factory settings)
Green	Continuous	• Start up
Green	Blinking	• Normal operating mode
Green	Flickering	• Bus communication
Blue	Continuous	• Zero point reset

ℹ️ Workflows and 'How to instructions' for the DIP switches and the push button can be found in manual A6V11478123.
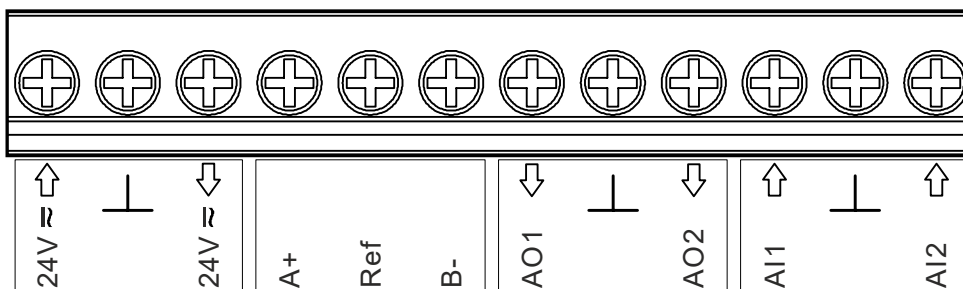
DIP switches
- Use DIP switches for adjustment of the Modbus address (DIPs 1 to 8) and for Modbus line termination (DIP 9).
- The DIP switches have priority over register 'Modbus address'.

Push button

Duration of operation	Function
5...10 s	On-event addressing
10...20 s	Zero point reset
20...30 s	Reset to factory setting

Terminals

Terminal	Description	M12 pin
24V≈ →	Power AC 24V / DC 24V	2
⊥	GND	3
24V≈ ←	Power supply external devices AC 24V / DC 24V	
A+, REF, B-	Modbus, RS-485 **NOTICE! Not galvanically separated**	4, 1, 5
AO1 ←	Analog output 1	
⊥	GND	
AO2 ←	Analog output 2	
AI1 →	Analog input 1	
⊥	GND	
AI2 →	Analog input 2	

M12 connector: Connector type code A, 5-pole
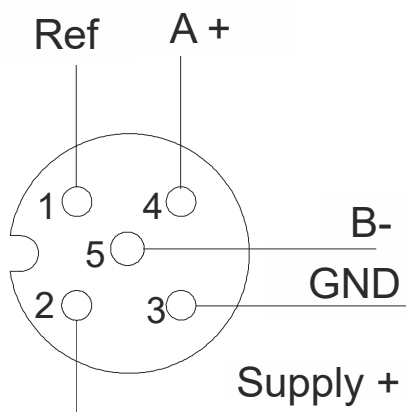
Note: For description see table above

Power data

Power	A6V11478118_en_c
Operating voltage	AC/DC 24 V ±15 %
Frequency	50/60 Hz
Protection class	III (SELV / PELV), UL Class 2 **NOTICE! Limited energy circuit 15 VA or less.**
Power consumption	<2 VA
Current draw AC	max. 25 mA @ AC 24 V
Current draw DC	max. 25 mA @ DC 24 V
24V external power supply for active sensors	max current: 80 mA

Functional data

Pressure measuring	
Ranges	See "Type overview / order data [→ 2]".
Variables	Pa, Psi, mmHG, mmH$_2$O (configured via application)
Sensing element	Piezo-resistive ● ceramic bar: Al$_2$O$_3$ (96%) ● diaphragm: silicone
Response time	<1 s

Pressure measuring: Accuracy						
Parameter	Unit	0…500Pa	0…1250Pa	0…2500Pa	0…5500Pa	0…7000Pa
Overall accuracy at 20° C	%fs	<±1.0	<±0.5	<±0.5	<±0.6	<±0.7
Overall accuracy at 0…50° C	%fs	<±2.0	<±1.0	<±1.0	<±0.8	<±0.8
Resolution	%fs	<0.1				
Long-term stability acc. DIN EN 60770	%fs	<±1.0				

Note: fs = full scale

Limits	
Tolerable overload on one side	• on Px +: 10000 Pa • on Px -: 400 Pa
Rupture pressure	• at room temperature: 2x overload • at 70 °C: 1.5x overload
Media / Admissible temperature	Air and neutral gases / 0…70 °C
Maximal tube length	15 m

Data for volume flow calculation	
Permitted k factor range	0...1500
Calculation formula	$Q = k \times \sqrt{\Delta p}$
Measuring variables	l/s, m³/h, m³/s

	NOTICE
i	**Accuracy of volume flow calculation** The accuracy of the volume flow calculation is proportional to the root of the pressure measurement accuracy multiplied by the k-factor.

Additional data	
Pressure connections	$\varnothing$ 6,2 mm, (for pipe inside $\varnothing$ 5 mm)
Maintenance	Maintenance free

Modbus RTU communication

Item	Specification
Address range	1...247 (255 = default)
Baudrate	9˙600...57˙600
Format	Modbus RTU
Line termination	selectable via DIP switch 9
Hardware	RS485
Default configuration	9600E1 (9600 baud rate, 1 stop bit, even parity)

Cable types

Interface	Specification
Signal lines (Inputs/ outputs)	Screw terminals for wire and stranded conductors: • Wire: 0.5…2.5 mm^2 **NOTICE! Use copper conductors only.**

Cable bushings	• QBM97.. screwed connectors
	   – 2 x cable glands screwed for cable $\varnothing$ 3…6 mm (wrench size 15 mm)
	   – 2 x cable glands screwed for cable $\varnothing$ 5…10 mm (wrench size 20 mm)
	 • QBM97.. with M12 plugged and screwed connectors
	   – 1 x M12 socket for plugged Modbus communication and power supply
	   – 2 x cable glands screwed for cable $\varnothing$ 3…6 mm (wrench size 15 mm)
	   – 1 x cable glands screwed for cable $\varnothing$ 5…10 mm (wrench size 20 mm)

Modbus	2 or 3-wire, twisted, shielded, if >3 m

Wire lengths

Interface	Wire lengths
Signal wiring	Max. 50 m
Modbus	Max. 100 m

Inputs and outputs

Analog inputs AI1, AI2				
Type	Range	Accuracy	Resolution	TK/B$_{25/85}$
Pt1000	-50...+150 °C	±0.5 K	0.1 K	3850 ppm/K
LG-Ni1000	-40...+120 °C	±0.5 K	0.1 K	5000 ppm/K
NTC10k	-40...-25 °C	±1.0 K	0.2 K	3979
	-25...+75 °C	±0.5 K	0.1 K	3979
	+75...+100 °C	±1.0 K	0.3 K	3979
	+100...+125 °C	±3.0 K	1.0 K	3979
	+125...+150 °C	±6.0 K	2.5 K	3979
Ni1000	-50...+150 °C	±0.5 K	0.1 K	6180 ppm/K
Input DC 0...10 V	0 V	±5 mV	<5 mV	-
	5 V	±25 mV	<5 mV	-
	10 V	± 50mV	<5 mV	-
Input resistance	> 100 kΩ			

ℹ	NOTICE
	Configuration: default settings of AI1 and AI2
	• The configuration of AI1 and AI2 is done via application/HMI. • Default setting is "no sensor" (for details see "Modbus registers [➜ 15]").

Analog outputs AO1, AO2			
Type	Voltage	Resolution	Accuracy
Output DC 0...10 V	0 V	< 11 mV	±66 mV
	5°V	< 11 mV	±95 mV
	10 V	< 11 mV	±124 mV
	• Output current: Maximum 1 mA (short-circuit proof) • Minimal load: 10 kΩ		

ℹ	NOTICE
	Configuration: default settings of AO1 and AO2
	• The configuration of AO1 and AO2 is done via application/HMI. • Default setting: AO1 shows pressure sensor1, AO2 shows pressure sensor2 (for details see "Modbus registers [➜ 15]").

Conformity

Ambient conditions and protection classification	
Classification as per EN 60730	
Degree of pollution	3
Impulse voltage	330 V
Degree of protection of housing to EN 60529	IP54
Climatic ambient conditions as per EN 60721-3 Transport / Storage	• Temperature: -30...+70 °C • Air humidity: 5…90 % (non-condensing)
Operation	• Temperature: -25...+50 °C • Air humidity: 5…90 % (non-condensing)

Standards, directives and approvals	
Product standard	EN 60730-1 Automatic electronic controls for household and similar use
Electromagnetic compatibility	For residential, commercial, and industrial environments
EU conformity (CE)	A5W00050769_en
RCM conformity	A5W00050770_en
UL Approbation	ANSI/UL 60730-1 http://database.ul.com
EAC	Eurasian compliance
Environmental compatibility	The product environmental declaration (A6V11616725_en) contains data on environmentally compatible product design and assessments (RoHS compliance, materials composition, packaging, environmental benefit, disposal).

Housing and weight

Housing	
Material, Color/Look	• Polycarbonat PC / Polyamide (PA) • Transparent
Dimensions	See "Dimensions [➜ 14]"

Weight	
QBM97..	~250 g

Additional information

Document title	Topics	Document ID:
Datasheet: Modbus air pressure sensor with I/O extension: QBM97..	Functions, use, technical data, terminals, dimensions and Modbus registers	A6V11478118
User guide: Modbus air pressure sensor with I/O extension: QBM97..	Installation, commissioning, engineering, maintenance and Modbus registers	A6V11478123
Integration guide: Modbus communication	Modbus networks, electrical and grounding information plus commissioning workflow	J3960
Basic documentation: Climatix AHU application	Complete description of the Climatix AHU application, including integration of Modbus devices	P3997

Notes

Safety: National regulations

	⚠ CAUTION
⚠	**National safety regulations**
	Failure to comply with national safety regulations may result in personal injury and property damage.
	• Observe national provisions and comply with the appropriate safety regulations.

Mounting

Mounting location

QBM97.. air pressure sensor with I/O extension is suited for direct mounting on air ducts, walls, or in control panels. The following points must be observed.

	NOTICE
❗	**Inaccurate measurements due to wrong mounting location.**
	An environment subject to high pressure pulses and/or significant thermal changes can lead to inaccurate measurements and/or zero shift.
	• Avoid the mentioned mounting locations.
	• A zero shift can be corrected with the function zero point reset.

Mounting position

	NOTICE
❗	**Condensation and damage to the device.**
	If the pressure connection nipples point upwards or are at a lower level than the air duct probes, condensation can collect inside the sensor, causing damage to the device.
	• Mount QBM97.. vertically with pressure nipples facing down.
	• Mount QBM97.. higher than the duct probes.

Connecting tubes

	NOTICE
❗	**Damage to the device when mounting or removing the device.**
	The device can be damaged, if the system is not depressurized when mounting or removing it.
	• Depressurize the system prior to mounting or removing the sensor.

The pressure tubing for the sensor nipples are connected as following to the differential pressure sensor:

On the air duct side	On the pressure sensor side
Tubing with higher pressure side (lower vacuum)	Connect to pressure nipple "+".
Tubing with lower pressure side (higher vacuum)	Connect to pressure nipple "-".

ℹ️	NOTICE
	Polarity reversal protection
	The device is short circuit proof and protected against polarity reversal. Each connection is protected against crossover up to maximum supply voltage.

Save mode and analog outputs

The QBM97.. is delivered with a 'Save mode' function to prevent damage in the event of an open circuit to the Modbus connection. The analog outputs are switched to DC 0 V if communication is lost for > 60 seconds.

Disposal

	The device is considered an electronic device for disposal in accordance with the European Guidelines and may not be disposed of as domestic garbage.
	• Dispose of the device through channels provided for this purpose.
	• Comply with all local and currently applicable laws and regulations.

QBM97.. (all dimensions in mm)
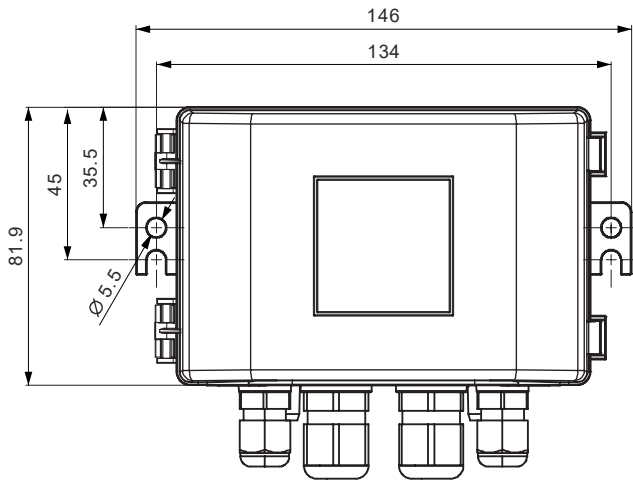
Front view QBM97.. (here: without M12)
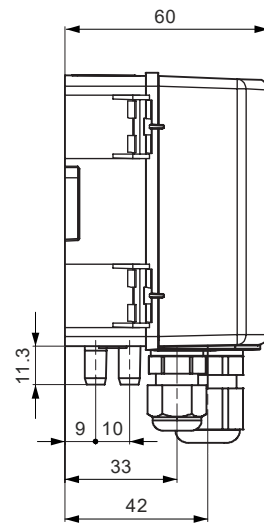
Side view QBM97.. (here: without M12)

Bottom view QBM97.. (opened cover)

AQB9120/101A and AQB9220/101A

Modbus registers

Supported function codes	
03 (0x03)	Read holding register
04 (0x04)	Read input registers
06 (0x06)	Write single register
16 (0x10)	Write multiple registers

> **i** Any changes of settings are completed with setting 4x0768 (Bus config command) to "1" (toggle bit).

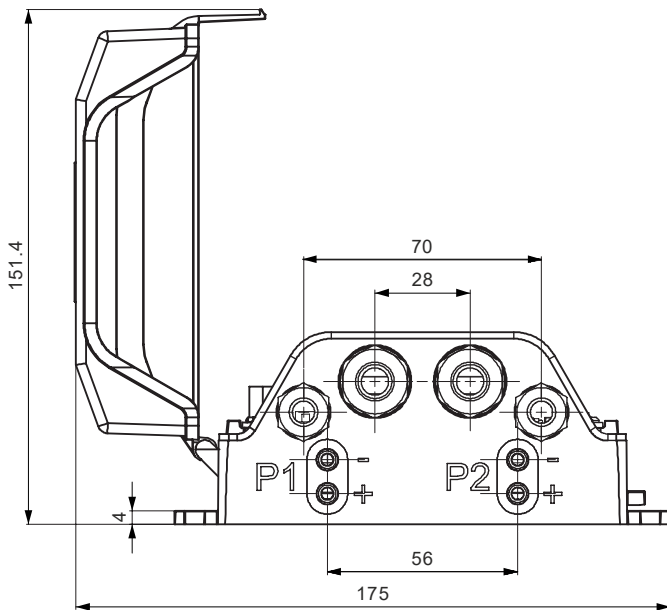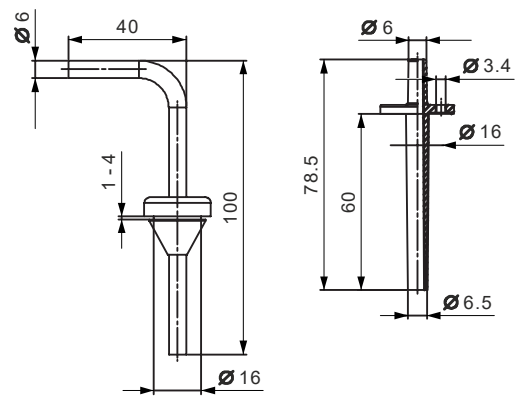| Addr	Description	Unit	Scaling	R/W	Range	Data type
4x0001	Type		1	R	9705 = 1 x 500Pa 9710 = 1 x 1250Pa 9720 = 1 x 2500Pa 9750 = 1 x 5500Pa 9770 = 1 x 7000Pa 9755 = 2 x 500Pa 9711 = 2 x 1250Pa 9712 = 1 x 1250Pa + 1 x 2500Pa 9717 = 1 x 1250Pa + 1 x 7000Pa 9722 = 2 x 2500Pa 9777 = 2 x 7000Pa	uint16_t
4x0002	Error Code		1	R		uint16_t
4x0003	Analog output coupling		1	R/W	0 = analog output coupled with differential pressure sensors = default 1 = analog output coupled as defined in 4x0028/4x0058 (setpoint)	uint16_t
4x0004	Differential pressure 1- Reliability		1	R		uint16_t
4x0005	Differential pressure 1 - Value		see config.	R		uint16_t
4x0006	Differential pressure 2 - Reliability		1	R		uint16_t
4x0007	Differential pressure 2 - Value		see config.	R		uint16_t
4x0008	Analog input 1 - Reliability		1	R		uint16_t
4x0009	Analog input 1 - Value	°C / mV	0.1 / 1	R		int16_t
4x0010	Analog input 2 - Reliability		1	R		uint16_t
4x0011	Analog input 2 - Value	°C / mV	0.1 / 1	R		int16_t

Analog Input 1						
Addr	Description	Unit	Scaling	R/W	Range	Data type
4x0020	Reliability		1	R		uint16_t
4x0021	Value	°C / mV	0.1 / 1	R		int16_t
4x0022	Sensortype AI1		1	R/W	0 = no Sensor (default) 1 = PT1000 2 = LG-Ni 1000 3 = NTC 10k 4 = NI 1000 5 = 0…10V	uint16_t

Analog Output 1

Addr	Description	Unit	Scaling	R/W	Range	Data type
4x0027	Value	mV	1	R/W	0 ≤ VAL ≤ 10500	uint16_t
4x0028	Dependence		1	R/W	0 = value @ 4x0027 = default if 4x0003=1 1 = with Analog input 1 2 = with Analog input 2 3 = with pressure sensor 1 = default if 4x0003=0 4 = with pressure sensor 2	uint16_t
4x0029	Scaling low - (0.0V)	mV	1	R/W	0 ≤ VAL < Scaling high (0 = default)	uint16_t
4x0030	Scaling high - (10.0V)	mV	1	R/W	Scaling low < VAL (10000 = default)	uint16_t

Differential pressure 1

Addr	Description	Unit	Scaling	R/W	Range	Data type
4x0035	Reliability		1	R		uint16_t
4x0036	Value		1	R		uint16_t
4x0037	Unit		1	R/W	0 = Pa = (default) 1 = PSI 2 = mmHG 3 = mmH2O	uint16_t
4x0038	Value [Pa]	Pa	1	R		uint16_t
4x0039	Value [PSI]	PSI	0.0001	R		uint16_t
4x0040	Zero point calibration		1	R/W	0 = no action (toggle bit) 1 = zero point calibration P1+P2 2 = zero point calibration P1 3 = zero point reset to factory setting P1+P2 4 = zero point reset to factory setting P1	uint16_t
4x0041	Sensor 1 full scale value	Pa	1	R		uint16_t
4x0042	Average 500 ms	see config #4x0037		R		uint16_t
4x0043	Average 1000 ms	see config #4x0037		R		uint16_t
4x0044	Average 4000 ms	see config #4x0037		R		uint16_t
4x0045	Average 16000 ms	see config #4x0037		R		uint16_t

Analog Input 2

Addr	Description	Unit	Scaling	R/W	Range	Data type
4x0050	Reliability		1	R		uint16_t
4x0051	Value	°C/mV	0.1/1	R		int16_t
4x0052	Sensortype AI2		1	R/W	0 = no Sensor (default) 1 = PT1000 2 = LG-Ni 1000 3 = NTC 10k 4 = NI 1000 5 = 0…10V	uint16_t

Analog Output 2

Addr	Description	Unit	Scaling	R/W	Range	Data type
4x0057	Value	mV	1	R/W	0 ≤ VAL ≤ 10000	uint16_t

4x0058	Dependence		1	R/W	0 = value @ 4x0057 = default if 4x0003=1 1 = with Analog input 1 2 = with Analog input 2 3 = with pressure sensor 1 4 = with pressure sensor 2 = default if 4x0003=0	uint16_t
4x0059	Scaling low - (0V)	mV	1	R/W	0 ≤ VAL < Scaling high (0 = default)	uint16_t
4x0060	Scaling high - (10V)	mV	1	R/W	Scaling low < VAL (10000 = default)	uint16_t

Differential pressure 2

Addr	Description	Unit	Scaling	R/W	Range	Data type
4x0065	Reliability		1	R		uint16_t
4x0066	Value		1	R		uint16_t
4x0067	Unit		1	R/W	0 = Pa = default 1 = PSI 2 = mmHG 3 = mmH2O	uint16_t
4x0068	Value [Pa]	Pa	1	R		uint16_t
4x0069	Value [PSI]	PSI	0.0001	R		uint16_t
4x0070	Zero point calibration		1	R/W	0 = no action (toggle bit) 1 = zero point calibration P1+P2 2 = zero point calibration P2 3 = zero point reset to factory setting P1+P2 4 = zero point reset to factory setting P2	uint16_t
4x0071	Sensor 2 full scale value	Pa	1	R		uint16_t
4x0072	Average 500 ms	see config #4x0067		R		uint16_t
4x0073	Average 1000 ms	see config #4x0067		R		uint16_t
4x0074	Average 4000 ms	see config #4x0067		R		uint16_t
4x0075	Average 16000 ms	see config #4x0067		R		uint16_t

Flow (Diff-pressure Sensor 1)

Addr	Description	Unit	Scaling	R/W	Range	Data type
4x0081	Flow low		0.01	R		uint16_t
4x0082	Flow high		0.01	R		uint16_t
4x0083	k factor		1	R/W	0 ≤ VAL ≤ 1500	uint16_t
4x0085	Unit		1	R/W	0 = m3/h (default) 1 = m3/s 2 = l/s	uint16_t

Flow (Diff-pressure Sensor 2)

Addr	Description	Unit	Scaling	R/W	Range	Data type
4x0091	Flow low		0.01	R		uint16_t
4x0092	Flow high		0.01	R		uint16_t
4x0093	k factor		1	R/W	0 ≤ VAL ≤ 1500	uint16_t
4x0095	Unit		1	R/W	0 = m3/h (default) 1 = m3/s 2 = l/s	uint16_t

Modbus Settings (according to Climatix)						
Addr	Description	Unit	Scaling	R/W	Range	Data type
4x0764	Modbus address		1	R/W	1 ≤ VAL ≤ 247 255 = default	uint16_t
4x0765	Baudrate		1	R/W	0 = auto (default) 1 = 9600 2 = 19200 3 = 38400 4 = 57600	uint16_t
4x0766	Format		1	R/W	0 = 1-8-E-1 (default) 1 = 1-8-O-1 2 = 1-8-N-1 3 = 1-8-N-2	uint16_t
4x0768	Bus config command		1	R/W	0 = ready (default) 1 = load 2 = discard	uint16_t

Addr	Description	Unit	Scaling	R/W	Range	Data type
4x9014	Software version		1	R		uint16_t

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