AMS 2710
PCB pressure sensor module with 0 .. 10 V output

FEATURES

- **Universal pressure sensor module with 0 .. 10 V voltage output**

- **Fully calibrated and temperature compensated sensor module**

- **Variants for (bidirectional) differential, gage, absolute and barometric pressure**

- **Wide variety of pressure ranges: 5 mbar up to 2 bar**

- **Piezoresistive sensing principle**

- **High precision signal conditioning**

- **Typical accuracy < 0.5 %FSO @ room temperature for standard pressure ranges**

- **Typical overall error < 0.7 %FSO within -25 .. +85 °C for standard pressure ranges**

- **Supply voltage range: 12 .. 36 V**

- **Integrated circuit protection against reverse polarity, current limited output**

- **Different product variants with solder pads, terminal block or DIL pins**

- **Ready for packaging or integration in other assemblies**

- **Compact size (30 mm x 27.5 mm x 14.3 mm)**

- **RoHS and REACH compliant**

GENERAL DESCRIPTION

AMS 2710 is a series of miniaturized pressure sensor modules with analog 0 .. 10 V output in various pressure ranges. The sensor modules are calibrated and temperature compensated in a wide temperature range of -25 .. 85 °C and allow precise pressure measurements with high long term stability.

With its large supply voltage range of 12 .. 36 V, reverse polarity protection (Vs - GND) and the current limited voltage output the sensor modules AMS 2710 are especially suitable for applications in industrial environments.

AMS 2710 can be easily integrated in other assemblies or used stand alone in a suitable package. Pressure is applied via metal pressure ports, the electrical connection can be done via solder pads, pin connectors or a PCB terminal block.

The pressure sensor modules in the AMS 2710 series are available for various pressure ranges and types: Differential (relative) devices in pressure ranges from 0 .. 5 mbar up to 0 .. 2 bar, absolute pressure variants for 0 .. 1 and 0 .. 2 bar as well as a barometric type for 0.7 .. 1.2 bar. Bidirectional differential devices are available from -5 .. +5 mbar up to -1 .. +1 bar for measurement of positive and negative pressure differences. Other pressure ranges or modifications are available on request.

TYPICAL APPLICATIONS

- Static pressure sensing

- Dynamic pressure sensing

- Barometric pressure sensing

- Vacuum measurement

- Level measurement

- Gas flow measurement
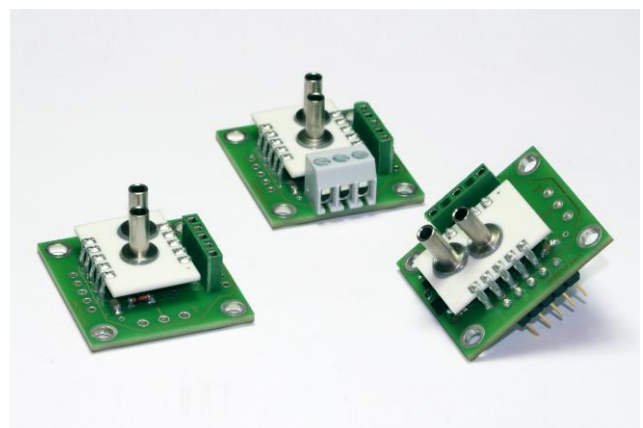
- Heating, Ventilation and Air Conditioning (HVAC)

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PRESSURE RANGES

Pressure sensor module type (code)	Pressure type	Pressure range in mbar	Burst pressure[1] in bar	Pressure range in PSI	Burst pressure[1] in PSI
Ultra low pressure					
AMS 2710-0005-D	differential / relative	0 .. +5	> 0.2	0 .. 0.073	> 3
AMS 2710-0010-D	differential / relative	0 .. 10	> 0.2	0 .. 0.145	> 3
AMS 2710-0005-D-B	bidirectional differential	-5 .. +5	> 0.2	-0.073 .. +0.073	> 3
AMS 2710-0010-D-B	bidirectional differential	-10 .. +10	> 0.2	-0.145 .. +0.145	> 3
Low pressure					
AMS 2710-0020-D	differential / relative	0 .. 20	> 0.4	0 .. 0.290	> 6
AMS 2710-0050-D	differential / relative	0 .. 50	> 1	0 .. 0.725	> 15
AMS 2710-0100-D	differential / relative	0 .. 100	> 1	0 .. 1.450	> 15
AMS 2710-0020-D-B	bidirectional differential	-20 .. +20	> 0.4	-0.290 .. +0.290	> 6
AMS 2710-0050-D-B	bidirectional differential	-50 .. +50	> 1	-0.725 .. +0.725	> 15
AMS 2710-0100-D-B	bidirectional differential	-100 .. +100	> 1	-1.450 .. +1.450	> 15
Standard pressure					
AMS 2710-0200-D	differential / relative	0 .. 200	> 5	0 .. 2.901	> 72
AMS 2710-0350-D	differential / relative	0 .. 350	> 5	0 .. 5.076	> 72
AMS 2710-0500-D	differential / relative	0 .. 500	> 5	0 .. 7.251	> 72
AMS 2710-1000-D	differential / relative	0 .. 1000	> 5	0 .. 14.50	> 72
AMS 2710-2000-D	differential / relative	0 .. 2000	> 5	0 .. 29.01	> 72
AMS 2710-0200-D-B	bidirectional differential	-200 .. +200	> 5	-2.901 .. +2.901	> 72
AMS 2710-0350-D-B	bidirectional differential	-350 .. +350	> 5	-5.076 .. +5.076	> 72
AMS 2710-1000-D-B	bidirectional differential	-1000 .. +1000	> 5	-14.50 .. +14.50	> 72
AMS 2710-1000-A	absolute	0 .. 1000	> 5	0 .. 14.50	> 72
AMS 2710-2000-A	absolute	0 .. 2000	> 5	0 .. 29.010	> 72
AMS 2710-1200-B	barometric	700 .. 1200	> 5	10.15 .. 17.40	> 72

Table 1: **AMS 2710 standard pressure ranges (other ranges on request)**

Notes:

1) Burst pressure is defined as the maximum pressure, which can be applied to one pressure port relative to the other port (or while only one pressure port is connected) without causing damages / leaks.

MAXIMUM RATINGS

Parameter	Minimum	Typical	Maximum	Units
Absolute maximum supply voltage: V_{max}			36	V
Operating and storage temperature: T	-25		85	°C
Common mode pressure: p_{CM}[1]			16	bar
Output short circuit resistance duration against GND	1800			s

Table 2: **Maximum ratings**

Notes:

1) Common mode pressure is defined as the maximum pressure, which can be applied simultaneously on both pressure ports of a differential or bidirectional pressure sensor module without causing damages, while no differential pressure is applied.

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SPECIFICATIONS

All parameters apply to $V_S = 24\ V$, $T_{op} = 25°C$ and $R_L = 10\ k\Omega$, unless otherwise stated.

Parameter	Minimum	Typical	Maximum	Units
Analog output signal				
@ specified minimum pressure (see "pressure ranges")[1]	0	< 0.025	0.05	V
@ specified maximum pressure (see "pressure ranges")[1]		10		V
Full span output (FSO)[2]		10		V
without pressure (only bidirectional differential types)		5		V
Accuracy[3] @ $T_{op} = 25°C$				
Ultra low pressure types (5, 10 mbar)		±1.0	±1.5	%FSO
Low pressure types (20, 50, 100 mbar)		±0.5	±1.0	%FSO
Standard pressure types (≥ 200 mbar)		±0.5	±1.0	%FSO
Overall error[4] @ $T_{op} = -25 .. 85°C$				
Ultra low pressure types (5, 10 mbar)		±1.5	±2.5	%FSO
Low pressure types (20, 50, 100 mbar)		±1.0	±2.0	%FSO
Standard pressure types (≥ 200 mbar)		±0.7	±1.5	%FSO
Long term stability			< 0.5	%FSO/a
Nonlinearity[5]	-0.3	< 0.1	0.3	%FSO
Resolution analog output signal			0.05	%FSO
Supply voltage (V_S to Ground)	12	24	36	V
Current consumption			10	mA
Response time (10% .. 90% rise time)		1	2	ms
Load resistor R_L	1			kΩ
Capacitive load			50	nF
Dependency of V_{OUT} on V_S [6]			< 0.1	%FSO
Pressure Changes	10^6			
Compensated operating temperature range	-25		85	°C
Weight (AMS2710 without terminal block)		6.7		gram
Dimensions (l x w x h, standard version with tubes)	30.0 x 27.5 x 14.3			mm^3
Media compatibility	See notes[7], [8]			

Table 3: **Specifications**

SPECIFICATION NOTES:

1) Pressure ranges are specified in *Table 1*.
2) The Full Span Output (FSO) is the algebraic difference between the output signal at the specified minimum pressure and the output signal at the specified maximum pressure (nominal FSO = 10 V).
3) The accuracy is defined as the maximum deviation of the measurement value from the ideal transfer function at room temperature (RT) in %FSO including the adjustment error (offset and span), nonlinearity, pressure hysteresis and repeatability. Nonlinearity is the measured deviation from the best fit straight line (BFSL) across the entire pressure range. Pressure hysteresis is the maximum deviation of the output value at any pressure within the specified range when the pressure is cycled to and from the specified minimum or maximum pressure. Repeatability is the maximum variation of the output value at any pressure within the specified range over 10 pressure cycles.
4) The overall error (also known as total error band, TEB) is defined as the maximum deviation of the measurement value from the ideal transfer function in %FSO across the entire temperature range (-25 .. 85 °C).

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5) Defined as best fit straight line (BFSL).

6) The given value is the maximum deviation from the output voltage at $V_S = 24\ V$ over the complete supply voltage range at any pressure in the specified range. It is normalized to the FSO.

7) Media compatibility of pressure port 1 (for a description of port 1, see *Figure 3*): fluids and gases non-corrosive to ceramics, silicon, Pyrex and RTV silicone rubber.

8) Media compatibility of pressure port 2 (for a description of port 2, see *Figure 3*): clean, dry gases, non-corrosive to ceramics, silicon, RTV silicone rubber, gold and tin (alkaline or acidic liquids can destroy AMS 2710).

FUNCTIONAL DESCRIPTION

AMS 2710 pressure sensor modules combine piezoresistive pressure sensing technology with modern mixed-signal conditioning on a compact PCB.

The physical pressure to be measured is converted into a differential voltage signal at AMS 2710's piezoresistive pressure sensing element. This differential voltage is signal-conditioned and converted into a standardized 0 .. 10 V voltage output signal in the following way (see *Figure 1*):

At first the sensing element's differential voltage signal is pre-amplified and converted into a digital signal using a 14-bit ADC. This digitized signal is processed mathematically by the ASIC's integrated microcontroller unit (µC) to achieve a calibrated and temperature compensated output signal. Herefore the µC uses a correction algorithm and individual correction coefficients stored in the ASIC's EEPROM during AMS 2710's factory calibration process. The temperature value needed for temperature compensation is measured directly at the pressure sensing element. An 11-bit DAC reconverts the corrected digital signal into an analog voltage signal, which is then amplified to obtain the 0 .. 10 V output voltage V_{OUT}.

AMS 2710's output voltage V_{OUT} is independent of the applied supply voltage and a linear function of the applied pressure p[1]. It is given by:

$$V_{OUT}(p) = \frac{p - p_{min}}{p_{max} - p_{min}} \cdot 10\ V \tag{1}$$

wherein p_{min} is the sensor's specified minimum pressure and p_{max} is the specified maximum pressure, given by the sensor's pressure range in *Table 1*.
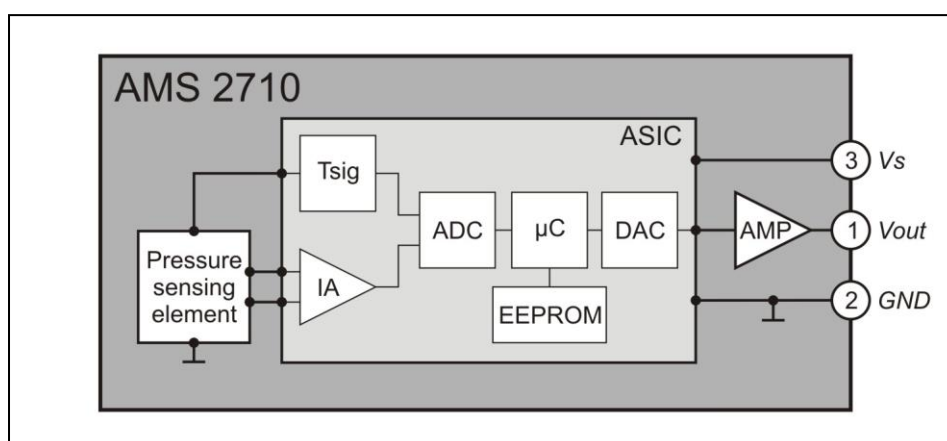
Figure 1: **AMS 2710's block diagram**

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[1] The applied pressure p is the pressure difference between port 1 and 2 for differential and bidirectional differential pressure sensor modules. For relative pressure types it is the pressure difference between port 1 and ambient pressure and for absolute and barometric pressure types it is the pressure at port 2 (for the definition of ports see *Figure 3*).

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INITIAL OPERATION

AMS 2710 can be screw mounted using the four through bores (Ø 3 mm for M2.5 screws) at its edges. As an alternative the DIL version can be plugged or soldered on a PCB using its ten DIL pins.

AMS 2710's electrical connection is shown in *Figure 2*. Vs and GND are directly connected to the power supply's positive output and GND. Vout can be connected to a voltmeter directly to measure the output signal voltage V_{OUT} (referenced to GND) or a load resistor R_L can be connected between Vout and GND and V_{OUT} can be measured parallel to R_L. Please take care that the power supply is set to a voltage in the range between 12 and 36 V and that it is able to source at least 10 mA (for $R_L \geq 10\ k\Omega$).

In practice the electrical connection can be established in the following ways: In the standard version (type AMS 2710-XXXX-Y-1, where XXXX has to be replaced with the four-digit pressure range and Y with the symbol for the pressure type, see "Information for Ordering") it is possible to solder wires to the respective soldering pads (see *Figure 3*) or to use a male multipoint connector (matching to TE connector 215297-5). In the terminal block version (type AMS 2710-XXXX-Y-2) a terminal block allows the installation of a three-wire cable without soldering. The DIL version (type AMS2710-XXXX-Y-3) can be easily plugged or soldered onto a PCB using the sensor's DIL pins.

The pressure connection is made using AMS 2710's metal pressure ports. Depending on the used type of pressure sensor module and the type of measuring pressure one or two of the pressure ports have to be connected to the measuring media/volume. For the pressures at port 1 and port 2 (for definition of the ports see *Figure 3*) the following requirements have to be fulfilled, where p_1 is the pressure at port 1 and p_2 is the pressure at port 2:

|	
for differential pressure (type AMS 2710-XXXX-D-..):	$p_1 > p_2$
for relative / gage pressure (type AMS 2710-XXXX-D-..):	$p_1 > p_{ambient}$, $p_1 =$ measuring pressure
for bidirectional differential pressure (type AMS 2710-XXXX-D-B-..):	$p_1 > p_2$ or $p_1 < p_2$ possible
for absolute pressure (type AMS 2710-XXXX-A-..):	$p_2 =$ measuring pressure
for barometric pressure (type AMS 2710-XXXX-B-..):	$p_2 =$ measuring pressure

The maximum pressures (see *Table 1*) and the guidelines concerning media compatibility (specification notes 7) and 8)) have to be taken into account.
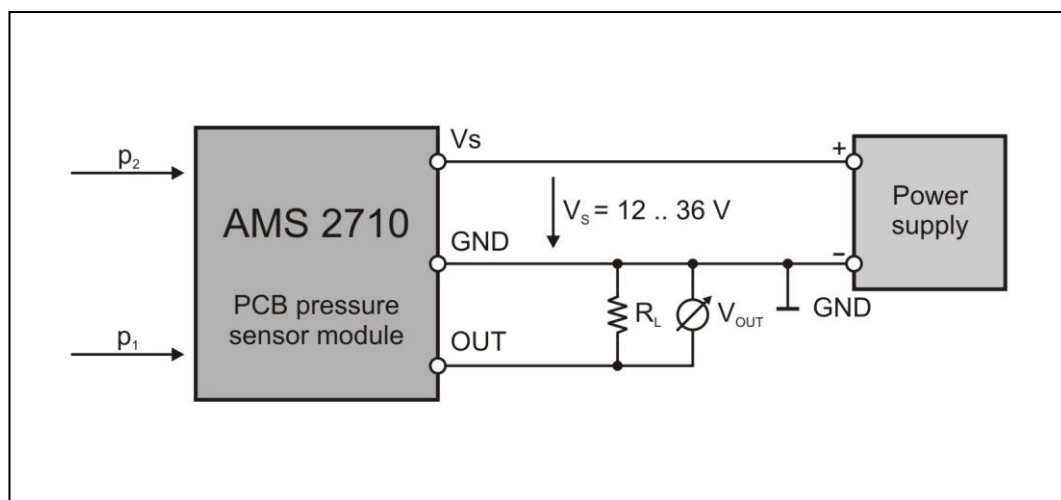
Figure 2: **Electrical connection of AMS 2710**

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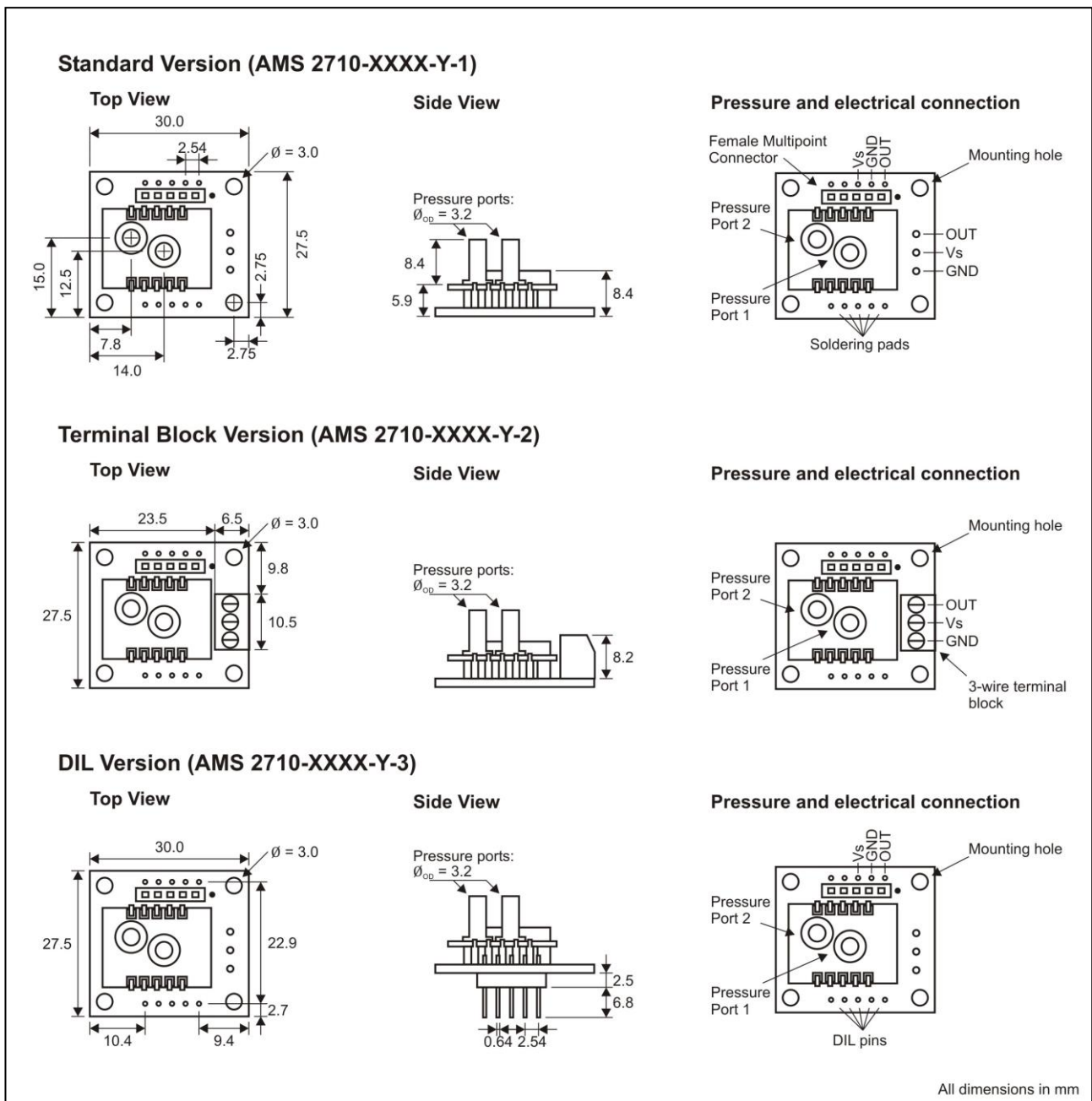
DIMENSIONS AND PINOUT

Standard Version (AMS 2710-XXXX-Y-1)

Top View — 30.0, 2.54, Ø = 3.0, 27.5, 15.0, 12.5, 2.75, 7.8, 2.75, 14.0

Side View — Pressure ports: Ø$_{OD}$ = 3.2, 8.4, 5.9, 8.4

Pressure and electrical connection — Female Multipoint Connector, Vs, GND, OUT, Mounting hole, Pressure Port 2, OUT, Vs, GND, Pressure Port 1, Soldering pads

Terminal Block Version (AMS 2710-XXXX-Y-2)

Top View — 23.5, 6.5, Ø = 3.0, 9.8, 27.5, 10.5

Side View — Pressure ports: Ø$_{OD}$ = 3.2, 8.2

Pressure and electrical connection — Mounting hole, Pressure Port 2, OUT, Vs, GND, Pressure Port 1, 3-wire terminal block

DIL Version (AMS 2710-XXXX-Y-3)

Top View — 30.0, Ø = 3.0, 27.5, 22.9, 2.7, 10.4, 9.4

Side View — Pressure ports: Ø$_{OD}$ = 3.2, 2.5, 6.8, 0.64, 2.54

Pressure and electrical connection — Vs, GND, OUT, Mounting hole, Pressure Port 2, Pressure Port 1, DIL pins

All dimensions in mm

Figure 3: **Dimensions and pinout of AMS 2710**

Notes:

1. Absolute and barometric pressure types only have pressure port 2.
2. The electrical connection can be established using the soldering pads, a male multipoint connector (matching to TE connector 215297-5), a terminal block or DIL pins.
3. For pressure connections Analog Microelectronics recommends a silicone tubing (inner diameter $Ø_{ID}$ = 2 mm, outer diameter $Ø_{OD}$ = 6 mm).
4. If silicone tubing is used it is recommended to use hose clamps.

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INFORMATION FOR ORDERING

Ordering code:
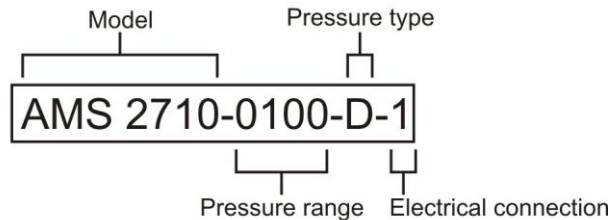
Pressure range:

Pressure range code	mbar	PSI	kPa
0005	5	0.073	0.5
0010	10	0.145	1
0020	20	0.290	2
0050	50	0.725	5
0100	100	1.450	10
0200	200	2.901	20
0350	350	5.076	35
0500	500	7.251	50
1000	1000	14.50	100
1200	1200	17.40	120
2000	2000	29.01	200

Table 4: Pressure ranges

Pressure type:

Pressure type code		Available pressure ranges
D	differential / relative (gage)	0 .. 5 mbar to 0 .. 2 bar
D-B	bidirectional differential	-5 .. +5 mbar to -1000 .. +1000 mbar
A	absolute	0 .. 1000 mbar and 0 .. 2000 mbar
B	barometric (absolute)	700 .. 1200 mbar

Table 5: Pressure types

Electrical connection type:

Code		Connection type
1	standard version	Soldering pads and female connector
2	terminal block version	Terminal block with screws
3	DIL version	Pins

Table 6: Electrical connections

ADDITIONAL EQUIPMENT

ORDER NUMBER	DELIVERY FORM
AMS2710-TUBING	matching silicone tubing (please order in meters)

NOTES

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