AMS 4712
Ready-to-use pressure sensor with 4...20mA output

Analog - Digitale
Mikromechanische
Sensorsysteme

GENERAL DESCRIPTION

AMS 4712 is a new series of miniaturized pressure sensors with high precision measurement capability combined with a 4...20mA current loop output in 2-wire technology. The sensors are calibrated and compensated in a wide temperature range of -25...+85°C and are custom-tailored for industrial applications.

The sensor comes in a robust plastic package and is ready for use. No additional components are required, except for a load resistor. Pressure is applied via two side ports and the two-wire-current-loop is applied via a sensor M5 plug and screw connector. The package provides a dust- and water-tight protection conform to IP67.

The sensors in the AMS 4712 series are available for various applications and pressure ranges: differential (relative) devices in pressure ranges from 0…5mbar up 0…2bar, absolute (and barometric) pressure variants for 0…1bar and 0…2bar. Bidirectional differential devices for positive and negative pressure are available from -5/+5mbar up to -1/+1bar. Other pressure ranges (also in PSI) are available on request.

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FEATURES

- **Differential / gage / bidirectional and absolute / barometric versions**
- **Calibrated and temperature-compensated**
- **2-wire 4-20mA current loop output**
- **Wide range of supply voltage**
- **High precision at room temp.**
- **Low total error at -25…+85°C**
- **Compact and robust package**
- **M5 sensor connector**
- **Dust- and water-tight (IP67)**
- **Ready for use**
- **Easy to assemble**
- **RoHS compliant**

APPLICATIONS

- Static pressure sensing
- Dynamic pressure sensing
- Measurement of vacuum
- Measurement of levels
- Gas flow measurement
- Barometric sensing

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PRESSURE RANGES

Sensor type (code)	Pressure type	Pressure range in mbar	Burst pressure in bar	Pressure range in PSI	Burst pressure in PSI
Ultra low pressure					
AMS 4712-0005-D	differential / relative	0…5	5	0…0,073	73
AMS 4712-0010-D	differential / relative	0…10	5	0…0,145	73
AMS 4712-0005-D-B	bidirectional differential	-5/+5	5	-0,073/+0,073	73
AMS 4712-0010-D-B	bidirectional differential	-10/+10	5	-0,145/+0,145	73
Low pressure					
AMS 4712-0020-D	differential / relative	0…20	5	0…0,290	73
AMS 4712-0050-D	differential / relative	0…50	5	0…0,725	73
AMS 4712-0100-D	differential / relative	0…100	5	0…1,450	73
AMS 4712-0020-D-B	bidirectional differential	-20/+20	5	-0,290/+0,290	73
AMS 4712-0050-D-B	bidirectional differential	-50/+50	5	-0,725/+0,725	73
AMS 4712-0100-D-B	bidirectional differential	-100/+100	5	-1,450/+1,450	73
Standard pressure					
AMS 4712-0200-D	differential / relative	0…200	5	0…2,901	73
AMS 4712-0350-D	differential / relative	0…350	5	0…5,076	73
AMS 4712-1000-D	differential / relative	0…1000	5	0…14,50	73
AMS 4712-2000-D	differential / relative	0…2000	5	0…29,01	73
AMS 4712-0200-D-B	bidirectional differential	-200/+200	5	-2,901/+2,901	73
AMS 4712-0350-D-B	bidirectional differential	-350/+350	5	-5,076/+5,076	73
AMS 4712-1000-D-B	bidirectional differential	-1000/+1000	5	-14,50/+14,50	73
AMS 4712-1000-A	absolute	0…1000	5	0…14,50	73
AMS 4712-2000-A	absolute	0…2000	5	0…29,01	73
AMS 4712-1200-B	barometric	700…1200	5	10,15…17,4	73

***Table 1*: AMS 4712 standard pressure ranges (other ranges on request)**

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SPECIFICATIONS

All parameters are measured at room temperature (25°C) while applying supply V_S = 24V and load resistor R_L = 100Ω, unless otherwise stated.

Parameter	Minimum	Typical	Maximum	Units
Analog output signal				
@ specified minimum pressure (see "Pressure range")		4		mA
@ specified maximum pressure (see "Pressure range")		20		mA
Full span output (FSO) [1]		16		mA
without pressure (bidirectional differential)		12		mA
Accuracy [2] @ T = 25°C				
Ultra low pressure sensors		±1	±1,5	%FSO
Low pressure sensors		±0,5	±1,0	%FSO
Standard pressure sensors		±0,3	±0,5	%FSO
Total accuracy [3] @ T = -25...85°C				
Ultra low pressure sensors		±1,5	±2,5	%FSO
Low pressure sensors		±1	±2,0	%FSO
Standard pressure sensors		±0,5	±1,0	%FSO
Linearity [4]	-0,3		+0,3	%FSO
Resolution			0,05	%FSO
Supply voltage (V_S to ground) [5] [6]	8	24	36	V
Response time (10%...90% rise time)		2,5	4	ms
Load resistor R_L [6]			600	Ω
Dependency on supply voltage			0,02	%FSO/V
Dependency on load resistor (R_L = 100...600Ω)			0,1	%FSO
Pressure changes	10^6			
Compensated operating temperature range	-25		85	°C
Storage temperature range	-40		100	°C
Weight without cable		20		gram
Media compatibility	See notes [7] [8]			
Protection classification [9]	IP67			

Table 2: **Specifications**

NOTES OF TABLE 2

1) 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 (see "Pressure range" in Table 1).

2) Accuracy is defined as the maximum deviation of the measurement value from the ideal characteristic curve at room temperature (RT) in %FSO including the adjustment error (offset and span), nonlinearity, pressure hysteresis and repeatability. Nonlinearity is the measured deviation at half maximum pressure 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 this pressure is cycled to and from the minimum or maximum rated pressure. Repeatability is the maximum deviation of the output value at any pressure within the specified range after 10 pressure cycles.

3) The total accuracy is defined as the overall error, i.e. the maximum deviation of the measurement value from the ideal characteristic curve in %FSO across the entire temperature range (-25 … 85°C).
4) Defined as best fit straight line (BFSL)
5) Source of supply voltage $\mathbf{V_S}$ must provide **minimum 20mA**
6) Supply voltage $\mathbf{V_S \geq 8V + 20mA \cdot R_L}$, a minimum load R_L=100 Ohm is recommended
7) Compatibility of media applied at Port 1: fluids and gases non-corrosive to ceramics, silicon, Pyrex, RTV silicone rubber and Zytel PA66.
8) Compatibility of media applied at Port 2: clean, dry gases, non-corrosive to ceramics, silicon, RTV silicone rubber, gold, tin and Zytel PA66 (alkaline or acidic liquids can destroy the sensor).
9) With tubes applied at Port 1 and Port 2

DESCRIPTION OF FUNCTION

AMS 4712 consists of a piezoresistive silicon sensing element and an integrated signal conditioning circuit assembled in a robust plastic package.

The physical pressure, which is applied at the package pressure ports (see *Figure 3*) is measured at AMS 4712's piezoresistive pressure sensing element where the pressure is converted into a differential voltage signal which is almost proportional to the pressure. This voltage signal is corrected and conditioned by the ASIC and at least available at the 2-wire current loop output (output current of 4...20mA or for bidirectional differential version 12mA ± 8mA). The current flows through load resistor R_L – which may be installed at a far distance to AMS 4712 – and the generated voltage via R_L can be measured as signal V_A. This signal corresponds to the applied pressure p (see *Figure 1*).

Calibration and temperature compensation is one process of the AMS 4712 production. The temperature compensated is within the entire temperature range of operation (-25…85 °C). For this reason the specified total accuracy of AMS 4712 is finally presented as error over all.

DIAGRAM

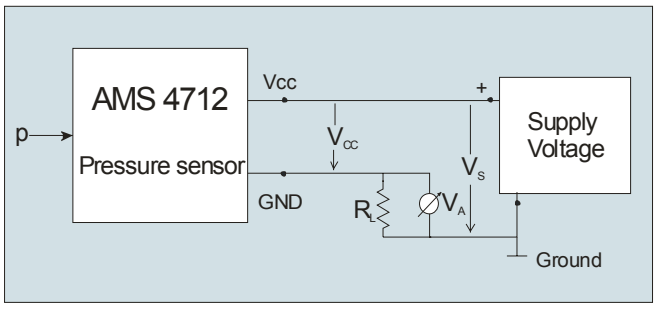

Figure 1: **2-wire current loop operation with AMS 4712**

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STARTING UP

AMS 4712 can be screw mounted in a fast and easy way using the two through bores (ø 3.2mm) at the edge of the package, which also provides a dust- and water-tight protection and a maintenance-free lifetime.

The sensors are connected up electrically by the M5 plug and screw connector (series 707 from Binder GmbH); Pin 1 (Vcc) and Pin 4 (GND) are connected for the 2-wire current loop operation as shown in *Figure 1* and *Figure 3.* Pin 1 (Vcc) is connected directly to +pole of supply voltage V_S. Pin 4 (GND) is connected via load resistor R_L to Ground. Depending on supply voltage V_S (8…36V to Ground) the load resistor R_L has to be dimensioned within the working range illustrated in *Figure 2*. At a very long distance between load resistor R_L and AMS 4712, an additional cable resistance R_l should be taken into account:

$V_S \geq 8V + 20mA \cdot R_L + 20mA \cdot R_l$ (Supply voltage **V_S** must be able to provide a current of **minimum 20mA**)

Depending on the applied pressure the output current generates the pressure corresponding signal voltage V_A through load resistor R_L.

The pressure connection is made using the two pressure ports (hose connectors) of the sensors package. Depending on the type of sensor and measuring pressure one or two of the pressure ports are connected up to the measuring media / volume. For the pressures at port 1 and port 2 (see *Figure 3*) the following requirements have to be fulfilled (according to the definition p_1 = pressure at port 1 and p_2 =pressure at port 2):

for differential / relative pressure sensors (label AMS 4712-XXXX-**D**):	**$p_1 > p_2$**
for bidirectional differential sensors (label AMS 4712-XXXX-**D-B**):	**$p_1 > p_2$ or $p_1 < p_2$ possible**
for absolute pressure sensors (label AMS 4712-XXXX-**A**) and barometric pressure sensors (label AMS 4712-XXXX-**B**):	**p_2 = measuring pressure.**

The maximum pressures and the guidelines governing media compatibility must be taken into account here (see "Specifications", notes 7 and 8).

RANGE OF LOAD RESISTOR R_L

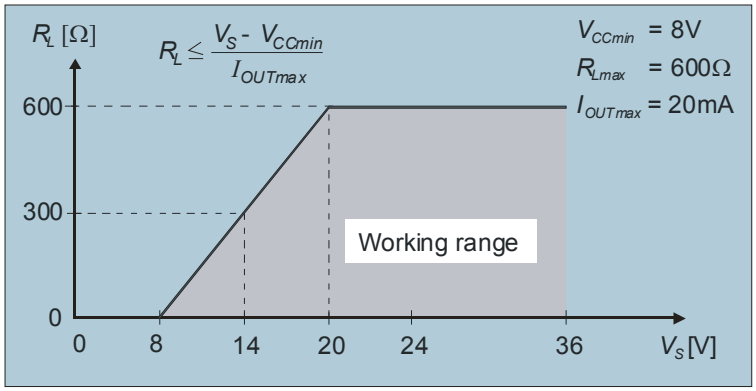

***Figure 2*: Working range of load resistor R_L**

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PACKAGE DIMENSIONS

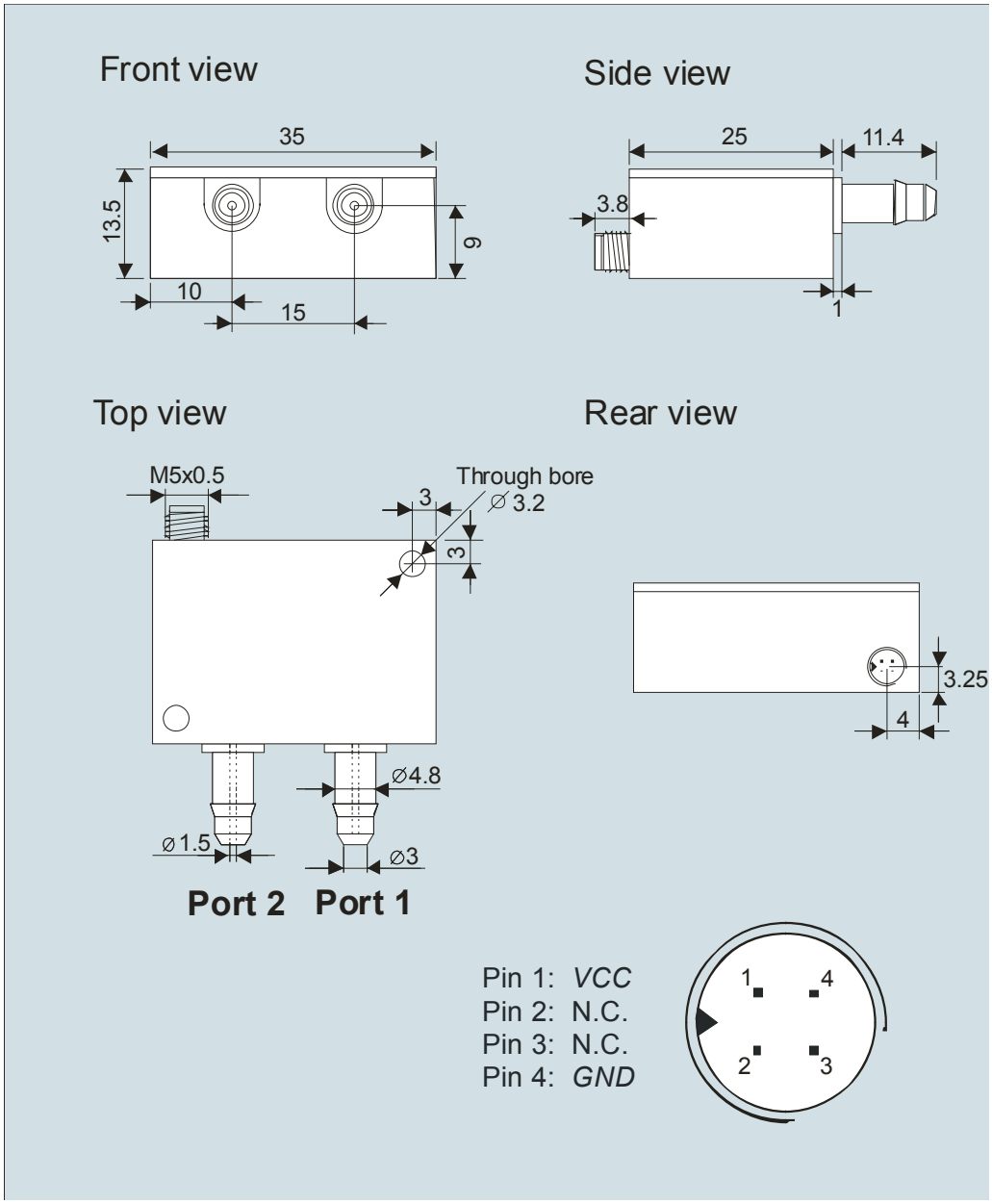

***Figure 3*: Dimensions of AMS 4712 package**

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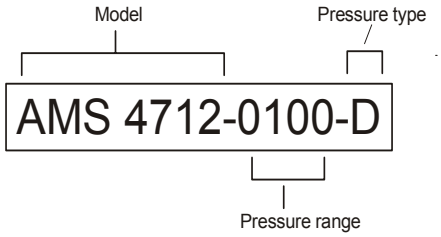
INFORMATION FOR ORDERING

Ordering code:



Pressure range:

Pressure range code	PSI	mbar	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
1000	1000	14,50	100
1200	1200	17,40	120
2000	2000	29,01	200

Table 3: **Pressure ranges**

Pressure type:

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

Table 4: **Pressure types**

ADDITIONAL EQUIPMENT

A 3-wire cable of 2 m length with M5 sensor connector (female) series 707 from Binder GmbH is offered for an extra charge.

Wiring: Brown - Vcc
Blue - n.c.
Black - Ground