Pressure sensors

Differential pressure transmitter (voltage output)

Series/Type:	**MiniCell Series**
Ordering code:	
Date:	2021-10-21
Version:	1.3

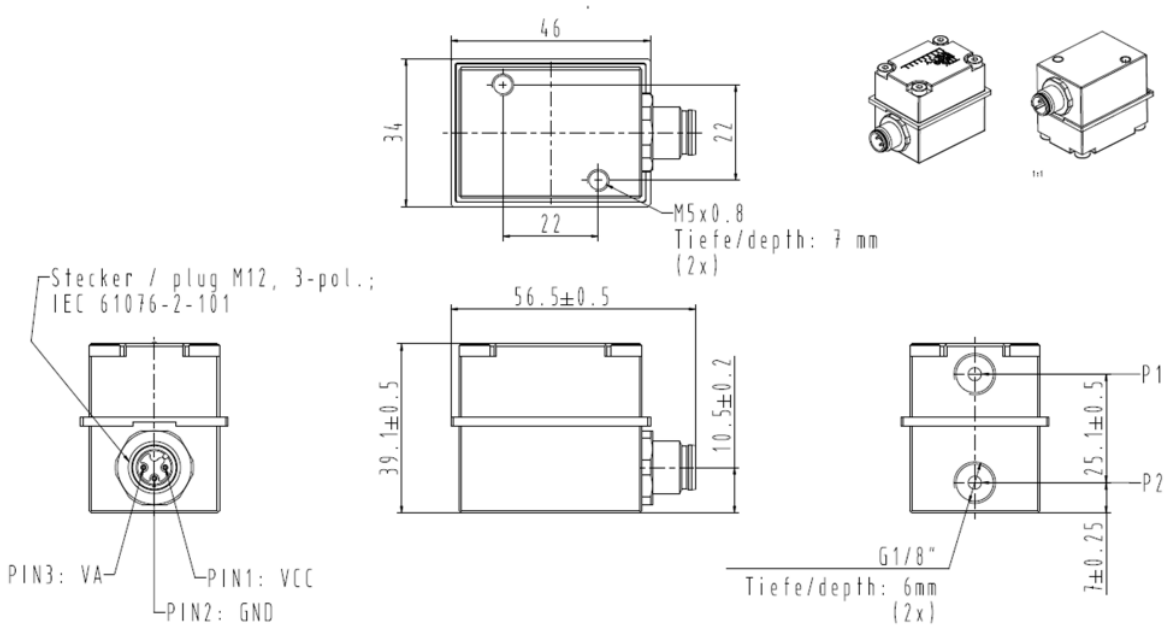
Applications

- Miniaturized differential pressure transmitter for industrial applications with small installation space - usage for gauge pressure also possible
- High resistance against media like diluted acids, contaminated air, exhaust gases
- Typical applications in pumps and compressors, hydraulic and pneumatic systems, automotive test systems, energy and water management
- Measurement tasks like filter monitoring, flow control, fluid level measurement and leak detection in extended temperature range of -20 °C … 140 °C

Features

- Sensing element based on piezoresistive MEMS technology, media separation by steel membranes, robust housing, IP 67 protection
- High media resistance due to high alloyed steel: sensor cell AISI 316L, housing AISI 316, internal sealings EPDM
- Voltage output signal (0.5 V … 4.5 V, ratiometric) proportional to pressure and supply voltage
- The integrated signal conditioner provides a calibrated output signal with a high immunity against electromagnetic influences (EMI) and overvoltage and reverse voltage protection
- Various connecting possibilities to G 1/8“ pressure ports and M12 electrical plug
- Pressure connectors for 6x4 mm tube enclosed
- Mounting direction will not influence the output signal
- RoHS-compatible, halogen free according to IEC 61249-2-21 clause 3.1

Dimensional drawings



Dimensions in mm

Technical data

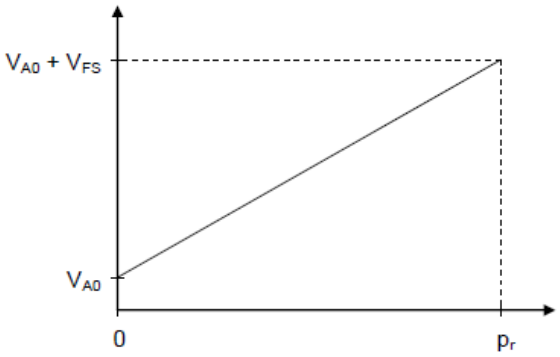
Absolute maximum ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Common sensor characteristics						
Temperature ranges						
Storage temperature range	T_{st}	[1]	–40		+140	°C
Operating temperature range	T_a	[2]	–20		+140	°C
Compensated temperature range	T_c	[3]	–20		+140	°C
Supply voltage /-current						
Supply voltage	V_{CC}	[4]	4.5		5.5	V
Supply current	I_{CC}	without output current I_A [5]			7	mA
Signal output current	I_A	[6]			2	mA
Load resistor	R_L	[6]	2.7			k Ω
Overvoltage	V_{ov}	[7]	33			V
Output signal at sensor failure	V_{ERR}	[8]			0.25	V
Output signal (ratiometric) @ T_a = 25°C, I_A < 0.1 mA						
Offset	V_{A0}	[9]		10		%V_{CC}
Offset	V_{A0}	@V_{CC} = 5 V [9]		0.5		V
Signal at rated pressure	V_{pr}	[10]		90		%V_{CC}
Signal at rated pressure	V_{pr}	@V_{CC} = 5 V [10]		4.5		V
Measuring error I_A < 0.1 mA, p_{line} = ambient pressure						
Non-linearity	L	[11]		±0.25	±0.5	% FS
Response time	t_{10-90}	[12]			10	ms
Specific pressure ranges and Measuring error I_A < 0.1 mA, p_{line} = ambient pressure						
AMD 0.500 KA VR Z1E L ST B745						
Rated differential pressure	p_r	One-sided output [13]		0 … 0.5		bar
Overpressure	p_{ov}	[14]			2	bar
Burst pressure	p_{burst}	[15]			3	bar
Line pressure	p_{line}	[16]	0.1		5	bar a
Line overpressure	$p_{ov\ line}$	[17]	0.01		16	bar a
Line burst pressure	$p_{burst\ line}$	[18]	0.01		30	bar a
Total error	E_T	T_a = 0 ... 85 °C, [19]			±2.0	% FS
	E_T	Ta = –20 ... 140 °C, [19]			±2.5	% FS

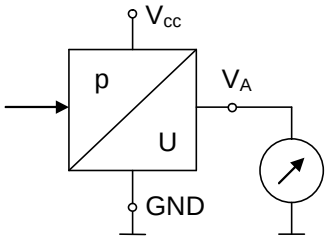
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
AMD 1.000 KA VR Z1E L ST B746						
Rated differential pressure	p_r	One-sided output [13)]		0 … 1		bar
Overpressure	p_{ov}	[14)]			2.5	bar
Burst pressure	p_{burst}	[15)]			3	bar
Line pressure	p_{line}	[16)]	0.1		5	bar a
Line overpressure	$p_{ov\ line}$	[17)]	0.01		16	bar a
Line burst pressure	$p_{burst\ line}$	[18)]	0.01		30	bar a
Total error	E_T	T_a = 0 ... 85 °C, [19)]			±1.5	% FS
	E_T	Ta = –20 ... 140 °C, [19)]			±2.0	% FS
AMD 2.500 KA VR Z1E L ST B747						
Rated differential pressure	p_r	One-sided output [13)]		0 … 2.5		bar
Overpressure	p_{ov}	[14)]			5	bar
Burst pressure	p_{burst}	[15)]			7.5	bar
Line pressure	p_{line}	[16)]	0.1		16	bar a
Line overpressure	$p_{ov\ line}$	[17)]	0.01		25	bar a
Line burst pressure	$p_{burst\ line}$	[18)]	0.01		30	bar a
Total error	E_T	T_a = 0 ... 85 °C, [19)]			±1.0	% FS
	E_T	Ta = –20 ... 140 °C, [19)]			±1.5	% FS
AMD 5.000 KA VR Z1E L ST B748						
Rated differential pressure	p_r	One-sided output [13)]		0 … 5		bar
Overpressure	p_{ov}	[14)]			10	bar
Burst pressure	p_{burst}	[15)]			15	bar
Line pressure	p_{line}	[16)]	0.1		20	bar a
Line overpressure	$p_{ov\ line}$	[17)]	0.01		30	bar a
Line burst pressure	$p_{burst\ line}$	[18)]	0.01		30	bar a
Total error	E_T	T_a = 0 ... 85 °C, [19)]			±1.0	% FS
	E_T	Ta = –20 ... 140 °C, [19)]			±1.5	% FS
AMD 10.00 KA VR Z1E L ST B749						
Rated differential pressure	p_r	Tzb7		0 … 10		bar
Overpressure	p_{ov}	[14)]			20	bar
Burst pressure	p_{burst}	[15)]			30	bar
Line pressure	p_{line}	[16)]	0.1		30	bar a
Line overpressure	$p_{ov\ line}$	[17)]	0.01		30	bar a
Line burst pressure	$p_{burst\ line}$	[18)]	0.01		30	bar a
Total error	E_T	T_a = 0 ... 85 °C, [19)]			±1.0	% FS
	E_T	Ta = –20 ... 140 °C, [19)]			±1.5	% FS

Output Characteristics

One-sided output



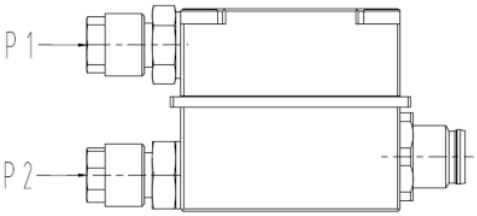
Connection diagram



Terminal assignment

Pin	Symbol	Signal
1	V_{CC}	Supply voltage
2	GND	Ground connected to housing
3	V_A	Output signal

Pressure feed

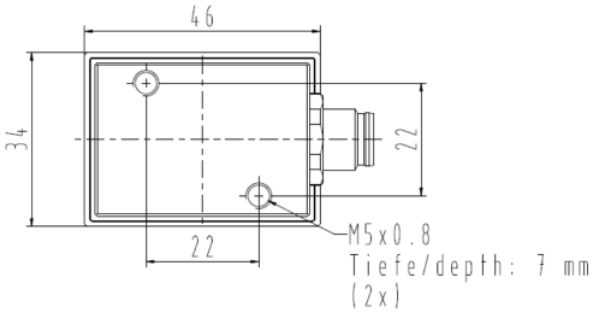


$p_r = p_1$ (high pressure) - p_2 (low pressure)
$p_{ov} = p_1$ (high pressure) - p_2 (low pressure)

Hose connector (included)

- Thread: G1/8 “
- Hose connection for tube Ø 6 mm
- Nickel plated brass
- O-Ring: EPDM

Sensor mounting



Please attend to mounting advises given on page 8.

Type designation

Types and pressure ranges are distinguished by label on sensor housing.

Type	Rated differential pressure		Ordering Code
AMD 0.500 KA VR Z1E L ST B745	0 ... 0.5	bar	B58622M3273B745
AMD 1.000 KA VR Z1E L ST B746	0 … 1.0	bar	B58622M3214B746
AMD 2.500 KA VR Z1E L ST B747	0 … 2.5	bar	B58622M3244B747
AMD 5.000 KA VR Z1E L ST B748	0 … 5.0	bar	B58622M3274B748
AMD 10.00 KA VR Z1E L ST B749	0 … 10.0	bar	B58622M3215B749

Labeling enables a distinction of pressure ranges and may vanish after installation or over lifetime.

Symbols and terms

1) Storage temperature range T_{st}
A storage of the pressure sensor within the temperature range $T_{st,min}$ up to $T_{st,max}$ and without applied pressure and supply voltage will not affect the performance of the pressure sensor.

2) Operating temperature range T_a
An operation of the pressure sensor within the temperature range $T_{a,min}$ up to $T_{a,max}$ will not affect the performance of the pressure sensor.

3) Compensated temperature range T_c
While operating the pressure sensor within the temperature range $T_{c,min}$ up to $T_{c,max}$, the deviation of the output signal will not exceed the temperature specific measurement error. Out of the compensated temperature range, the deviations may increase.

4) Supply voltage V_{CC}
$V_{CC,max}$ is the maximum of permissible supply voltage, which can be applied without damages.
$V_{CC,min}$ is the minimum of required supply voltage, which has to be applied for normal operation.

5) Supply current I_{CC}
$I_{CC,}$ is the maximum of current required to run the pressure sensor. Additional to the supply current I_{CC} the signal output current I_A is working.

6) Signal output current I_A , Load resistor R_L
$I_{A,max}$ is the maximum permissible sink current of the signal output. The signal output current is depending on the voltage of the output signal and the load resistor R_L. Exceeding (e.g. short circuit) of the signal output current I_A may cause irreparable damages.

7) Overvoltage V_{ov}
Maximum voltage being applied in any polarity to all contact pins without damaging the pressure sensor.

8) Output signal at sensor failure V_{ERR}
Output voltage of the sensor, if the signal conditioner detects a serious internal functional error.

9) Offset V_{A0}
The offset V_{A0} is the signal output $V_A(p = 0)$ at zero pressure. The value is related to the supply voltage V_{CC}.

One-sided output: $V_{A0} = 0.1\ V_{CC}$
Symmetrical output: $V_{A0} = 0.5\ V_{CC}$

10) Signal at rated pressure V_{pr}
The value is related to the supply voltage V_{CC}.

One-sided output: $V_{FS} = FS = V_A(pr) – V_{A0} = 0.9\ V_{CC}$

11) Non-linearity L (including pressure hysteresis)
The non-linearity is the deviation of the real sensor characteristic $V_A = f(p)$ from the ideal straight line.
It can be approximated by a polynomial of second order, with the maximum at $p_M = p_r / 2$.
The equation to calculate the non-linearity is:

$$L = \frac{V_A(p_x) - V_{A0}}{V_A(p_r) - V_{A0}} - \frac{p_x}{p_r}$$

12) Response time $t_{10\text{-}90}$
Delay between a pressure change (10 ... 90% p_r) and the corresponding signal output change (10 ... 90% FS) based on theoretical estimations.

13) Rated pressure p_r
Within the rated pressure range 0 up to p_r (symmetrical output: $\pm p_r$) the signal output characteristic corresponds to this specification. Rated pressure is defined as: $p_r = p_1 – p_2$.

14) Overpressure p_{OV}
1000 pressure cycles within the pressure range 0 up to p_{ov} will not affect the performance of the pressure sensor.
Overpressure is defined as: $p_{ov} = p_1 – p_2$.

15) Burst pressure p_{burst}
Bust pressure p_{burst} is the maximum of permissible pressure applied without causing leackage of the sensor.
Measurement performance of the sensor may be affected. Bust pressure is defined as: $p_{burst} = p_1 – p_2$.

[16] **Line pressure p_{Line}**
Line pressure p_{line} is defined as the maximum common mode pressure working on both pressure ports simultaneously. Line pressure above ambient pressure may lead to an additional total error of the sensor.

[17] **Line overpressure $p_{ov\ line}$**
1000 pressure cycles within the pressure range 0 up to $p_{ov\ line}$ working on both pressure ports simultaneously will not affect the performance of the pressure sensor.

[18] **Line burst pressure $p_{burst\ line}$**
Line bust pressure $p_{burst\ line}$ is the maximum of permissible pressure working on both pressure ports simultaneously without causing leackage of the sensor. Measurement performance of the sensor may be affected.

[19] **Total measuring error E_T**
Total measuring error E_T includes offset error, span error, nonlinearity, pressure hysteresis, temperature hysteresis, and signal noise. It describes the deviation of the signal to the nominal output characteristic.

Cautions and warnings

Storage

All pressure sensors should be stored in their original packaging. Maximum storage and time in original package is 2 years after the date of production. Transmitters should not be placed in harmful environments such as corrosive gases nor exposed to heat or direct sunlight, which may cause deformations. Similar effects may result from extreme storage temperatures and climatic conditions. Avoid storing the sensors in an environment where condensation may form or in a location exposed to corrosive gases, which will adversely affect their performance.

Mounting

Mounting torque of pressure ports screwed in sensors housing has to be checked. Before usage test leak tightness of mounted pressure ports. Be assure, that pressure ports fulfil temperature, media and pressure requirements.
If senor is mounted by using the two M5 threads check length and mounting torque of used screws. Release all mounting processes carefully.

Operation (general)

Media compatibility with the pressure sensors has to be checked to prevent their failure. The use of other media can cause damage and malfunction. Never use pressure sensors in atmospheres containing explosive liquids or gases.

Ensure pressure equalization to the environment, if gauge pressure sensors are used. Avoid operating the pressure sensors in an environment where condensation may form or in a location exposed to corrosive gases. These environments adversely affect their performance.

If the operating pressure is not within the rated pressure range, it may change the output characteristics. Be sure that the applicable pressure does not exceed the over pressure, as it may damage the pressure sensor.

Do not exceed the maximum rated supply voltage nor the rated storage temperature range, as it may damage the pressure sensor.

Temperature variations in both the ambient conditions and the media (liquid or gas) can affect the accuracy of the output signal from the pressure sensors. Be sure to check the operating temperature range and thermal error specification of the pressure sensors to determine their suitability for the application.

Connections have to be wired in accordance with the terminal assignment specified in the data sheets. Care should be taken as reversed pin connections can damage the pressure transmitters or degrade their performance. Contact between the pressure sensor terminals and metals or other materials may cause errors in the output characteristics.

This listing does not claim to be complete, but merely reflects the experience of TDK Electronics AG.

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