



Pressure sensors

Pressure transmitter with analog output

Series/Type: AFA 11.00 VR Z15E L ST 1.0 B768
Ordering code: B58620F3800B768
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Applications

- Industrial applications for absolute pressure transmitters such as:
 - Industrial process control
 - Food packaging systems
 - Pumps
 - Pneumatic controls
 - Automation



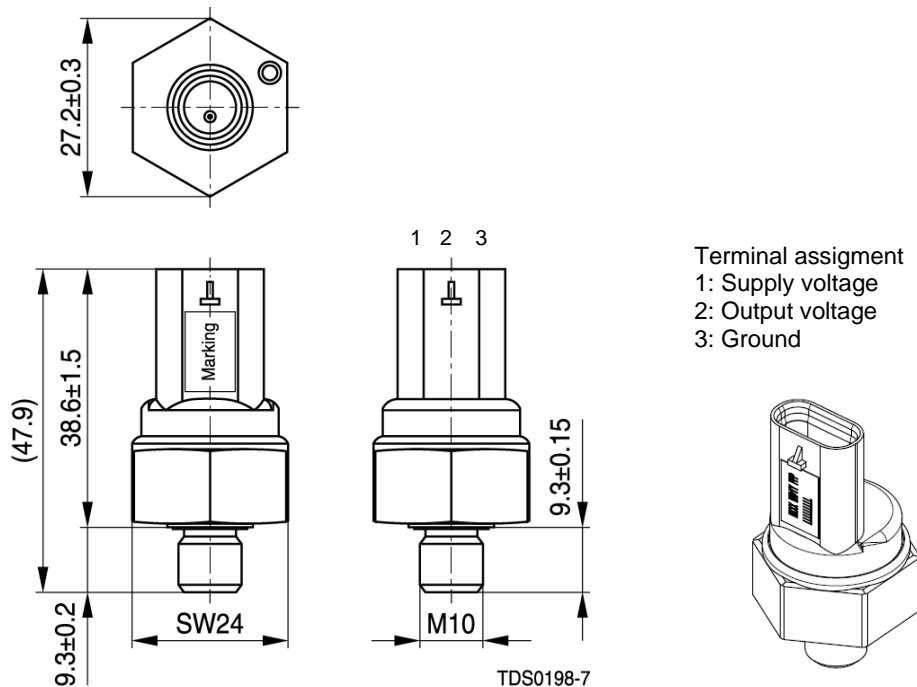
Features

- Suitable for applications with pressure ranges of 1 to 11 bar in extended temperature range up to 125 °C
- High resistance to non-freezing media like fuel, diluted acids, contaminated air
- Voltage output signal (0.5 V to 4.5 V at 5 V_{supply}) proportional to pressure and supply voltage (ratiometric)
- Pressure sensor based on piezoresistive MEMS technology
- The integrated signal conditioner compensates non-linearity and temperature errors and supplies a precise calibrated, amplified output signal with a high immunity against electromagnetic influences
- High resistance to large variety of media. Only unsuitable against substances which react with silicon, glass, FKM, stainless steel
- Overvoltage and reverse voltage protection
- Short response time (typical 1 ms / max. 2 ms)
- High measuring accuracy (± 0.5 V)
- Wire harness with 1 m long cable included
- RoHS compatible, halogen free according to IEC 61249-2-21 clause 3.1

Options

- Customer specific output characteristics and connectors on request

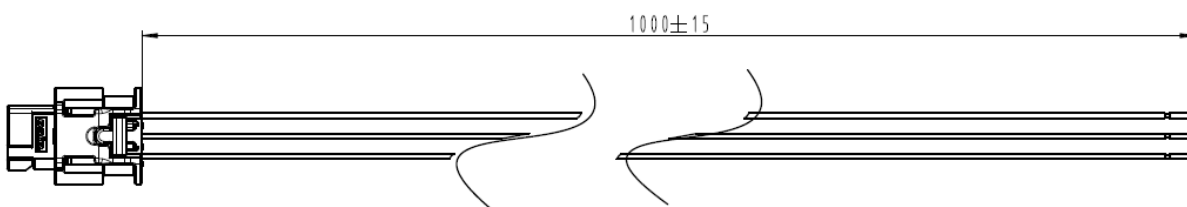
Dimensional drawings



Terminal assignment
 1: Supply voltage
 2: Output voltage
 3: Ground

Dimensions in mm

Wire adapter for industrial application



Dimensions in mm

Technical data
Absolute maximum ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Tightening torque	M			M10x1	6.5	Nm

Temperature ranges

Storage temperature	T _{st}	1)	-40		+125	°C
Operating temperature	T _o	2)	-20		+125	°C

Pressure ranges

Rated absolute pressure	p _r	Absolut pressure ⁴⁾	1.0		11.0	bar
Over pressure	p _{ov}	Absolut pressure ⁵⁾	15.0			bar
Burst pressure	p _{burst}	Absolut pressure ¹¹⁾	30.0			bar
Ambient pressure	p _{amb}	Absolut pressure	100			mbar

Supply voltage /-current

Supply voltage	V _{supply}	⁰⁶⁾	4.5	5.0	5.5	V
Reverse voltage, overvoltage	V _{over}	¹³⁾	-33		+33	V
Supply current	I _{supply}	Without load current		7.5	9.5	mA
Signal output current	I _{out}	⁰⁷⁾			2.5	mA
Short circuit current	I _{out, sc}	⁰⁸⁾	-25		25	mA

Load

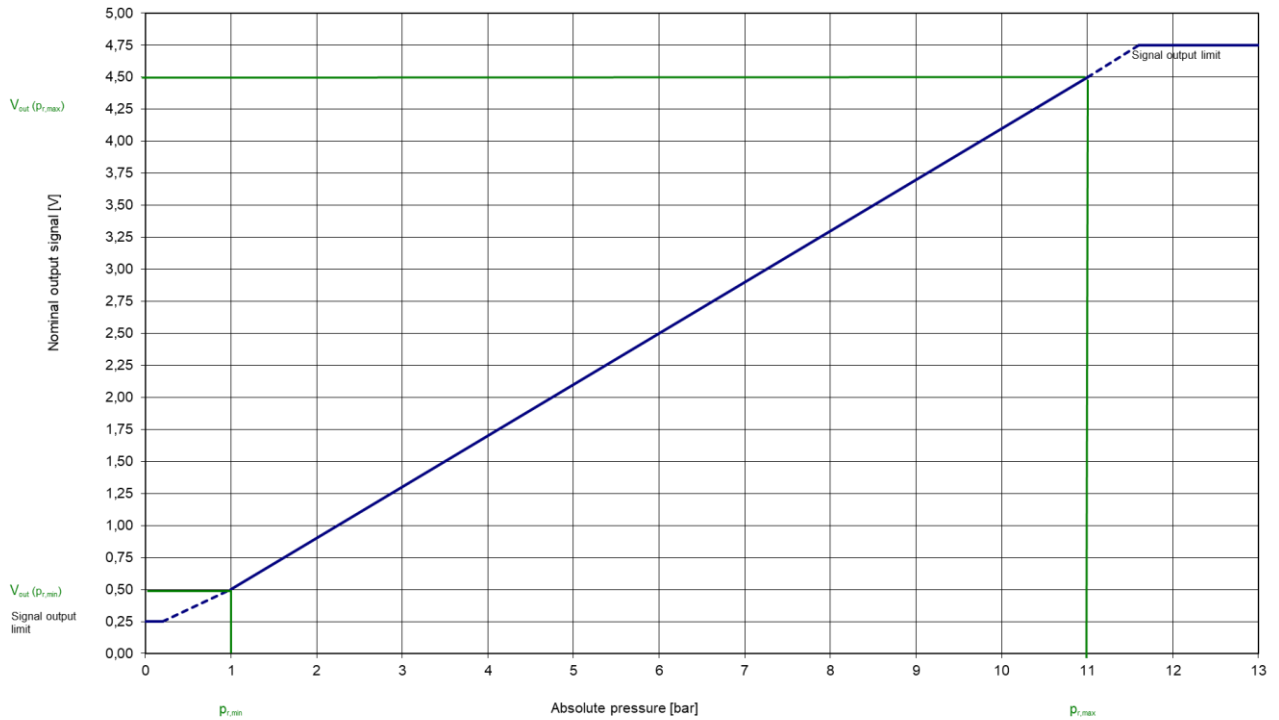
Load resistor	R _{load}		2.0			kΩ
Load capacity	C _{load}	Including harness capacity			95	nF

Characteristics

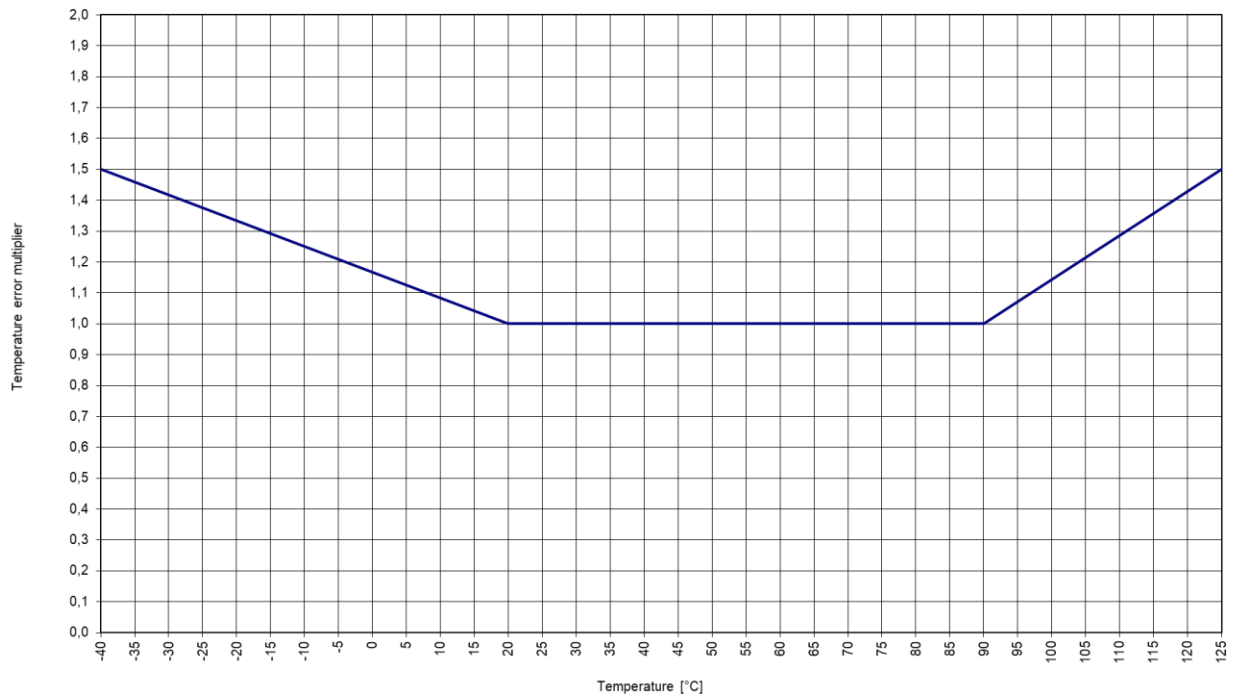
Output signal characteristic (at $T_o = 25\text{ °C}$, $V_{\text{supply}} = 5\text{ V}$)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output at $p_{r,\text{min}}$	$V_{\text{out}}(p_{r,\text{min}})$	Ratiometric ⁹⁾		0.5		V
Signal span (full scale)	V_{FS}	Ratiometric ¹⁰⁾		4.0		V
Compensated temperature	$V_{\text{out}}(p_{r,\text{max}})$	Ratiometric ⁹⁾		4.5		V
Output signal limits		Ratiometric ⁹⁾	0.25		4.75	V
Startup time	t_{startup}	Can be reduced on request			150	ms
Response time	T10-90	¹²⁾		1	2	ms
Initial accuracy	$E_{\text{ini.}} 20/80$	at $T_o = 20 \dots 80\text{ °C}$	-63		+63	mbar
			-0.5		+0.5	% V_{supply}
	$E_{\text{ini.}} -40/125$	at $T_o = -40 \dots 20\text{ °C}$, $80 \dots 125\text{ °C}$	-188		+188	mbar
			-1.5		+1.5	% V_{supply}
Accuracy after exposure to typical automotive validation program	$E_{\text{total.}} 20/80$	at $T_o = 20 \dots 80\text{ °C}$	-250		+250	mbar
			-2.0		+2.0	% V_{supply}
	$E_{\text{total.}} -40/125$	at $T_o = -40 \dots 20\text{ °C}$, $80 \dots 125\text{ °C}$	See temperature error multiplier on page 6			

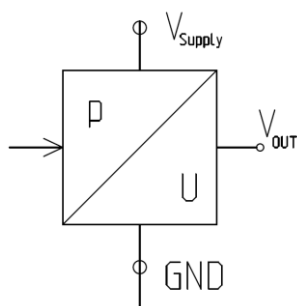
Output signal @ $T_o = 25^\circ\text{C}$, $V_{\text{supply}} = 5\text{ V}$



Temperature error multiplier



Connection diagram



Terminal assignment

Pin	Symbol	Signal	Wire color
1	V_{supply}	Supply voltage	red
2	V_{out}	Output signal ANALOG	blue
3	GND	Ground	black

Media compatibility

The pressure sensors high resistance is approved with the following media:

- Fuel
- Diesel
- Methanol
- Ethanol

Application with following media needs to be specifically evaluated. Please consult TDK Electronics for application with the following media:

- Engine oil
- Hydraulic fluid
- Coolant media
- Water
- Water vapor

The pressure sensor is not compatible with:

- Media that is freezing in application temperature range
- The diameter of the media path to the pressure sensing element is 0.4 mm
Usage of appropriate filters has to be considered in order to avoid clogging of the media path when used with contaminated fluids.

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_o**
An operation of the pressure sensor within the temperature range $T_{o,min}$ up to $T_{o,max}$ 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 temperature error multiplier is 1. Out of the compensated temperature range, the deviations may increase.
- 4) **Rated pressure p_r**
Within the rated pressure range $p_{r,min}$ up to $p_{r,max}$ the signal output characteristic corresponds to this specification.
- 5) **Overpressure p_{ov}**
The sensor does not work correctly in the pressure range $p_{r,max}$ up to $p_{ov,min}$ but will return to normal operation after having been subjected to up to 1000 cycles of overpressure within the pressure range $p_{r,min}$ up to $p_{ov,min}$. The sensor cannot be expected to return to normal operation after having been subjected to a pressure above the overpressure $p_{ov,min}$.
- 6) **Supply voltage V_{supply}**
 $V_{supply,max}$ is the maximum permissible supply voltage, which can be applied without damages.
 $V_{supply,min}$ is the minimum required supply voltage, which has to be applied for normal operation.
- 7) **Signal output current I_{out}**
Maximum output current with $R_{load} = 2.0 \text{ k}\Omega$ and supply voltage in the in the range of $V_{supply,min}$ up to $V_{supply,max}$.
- 8) **Short circuit current $I_{out,sc}$**
Maximum short circuit current at following conditions: minimum output voltage to V_{supply} or maximum output voltage to Ground
- 9) **Ratiometric output**
The output voltage V_{out} is ratiometric to the supply voltage ($V_{out} \sim V_{supply}$).
Example: $V_{out}(pr,min) = 0.04 \text{ V/V}$
with $V_{supply} = 5 \text{ V}$, $V_{out}(pr,min) = 0.04 \text{ V/V} * 5 \text{ V} = 0.2 \text{ V}$
with $V_{supply} = 5.1 \text{ V}$, $V_{out}(pr,min) = 0.04 \text{ V/V} * 5.1 \text{ V} = 0.204 \text{ V}$
- 10) **Signal span (Full Scale)**
 $VFS = FS = V_{out}(pr,max) - V_{out}(pr,min)$
- 11) **Burst pressure p_{burst}**
The sensor cannot be expected to return to normal operation after having been subjected to a pressure in the range of p_{ov} and p_{burst} .
The sensor will not cause leakage of the pressure medium when exposed to pressures up to the burst pressure.
- 12) **Response time t_{10-90}**
Delay between a pressure change (10 ... 90% p_r) and the corresponding signal output change (10 ... 90% FS).
Response time cannot be measured and is evaluated theoretically (it is not possible to generate an adequate pressure jump function).
- 13) **Reverse voltage, Overvoltage**
If supplied with a supply voltage of $V_{ov,min}$ up to $V_{supply,min}$ the sensor does not work correctly (reverse voltage). If supplied with a supply voltage of $V_{supply,max}$ up to $V_{ov,max}$ the sensor does not work correctly (overvoltage). The sensor will return to normal operation after having been subjected to reverse voltage and overvoltage in the range of $V_{ov,min}$ up to $V_{ov,max}$ for 1 hour maximum.

Storage

All pressure sensors should be stored in their original packaging. They 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 sensor dies in an environment where condensation may form or in a location exposed to corrosive gases, which will adversely affect their performance. Plastic materials should not be used for wrapping/packing when storing or transporting these sensors, as they may become charged.

Mounting

The correct application of the sensor and the connector on the sensor must be checked prior to use with pressure media. Thread of the pressure sensor has to fully screwed in to pressure interface. Test leak tightness of mounted pressure interface before usage! Be assure, that pressure interfaces fulfil temperature, media and pressure requirements.

Release all mounting processes carefully. Ensure to apply appropriate mounting torque.

Warning: Always use metal hexagon to screw in the sensor. Never apply torque to connector or plastic housing as it may damage the sensor and lead to malfunction!

Operation

Media compatibility with the pressure sensors must be ensured 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. Do not use the pressure sensor with media containing impermissible particle sizes (See media compatibility). Usage of filters is recommended in order to avoid infiltration with impermissible particle sizes.

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. This may also happen with pressure sensor if an incorrect mounting method is used. 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 must 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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Important notes

8. The trade names EPCOS, CarXield, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, ModCap, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, ThermoFuse, WindCap, XieldCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.tdk-electronics.tdk.com/trademarks.

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