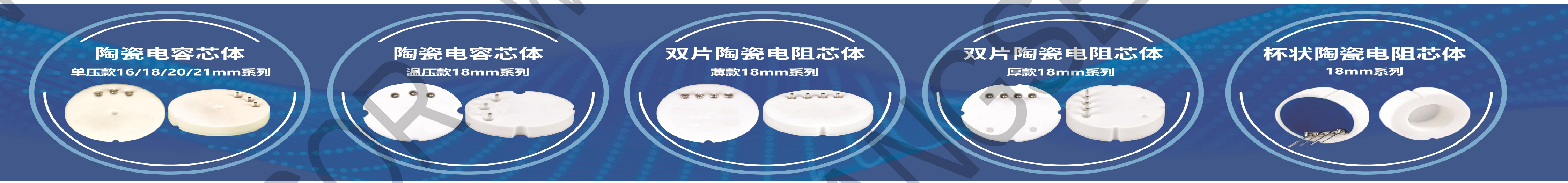
聚德寿
WANGSENSOR

Design Guide for Flush Mount Ceramic Resistive Pressure Sensors

Wangsensor Technology Co., Ltd.



Contents

I.Working Principle of Flush Mount Ceramic Resistive Pressure Sensors

聚德寿 WANGSENSOR

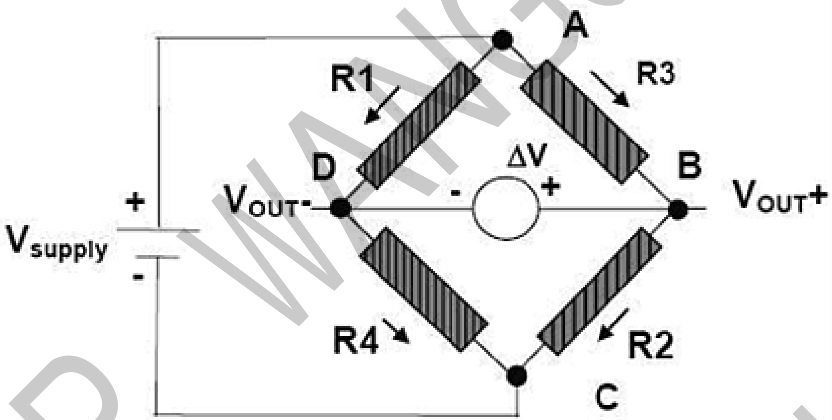
1.1 Principle of Ceramic Resistive Pressure Sensing Element

When the sensing element is not under pressure, the ceramic membrane does not deform, and the resistance values of R1, R2, R3, and R4 remain unchanged. Therefore, the output voltage is a fixed value, calculated as follows:

$$V_{OUT}=V_{supply}*[R2/(R2+R3)-R4/(R4+R1)]$$

When the sensing element is under pressure, the ceramic membrane undergoes small deflection deformation, and the resistance values of R1, R2, R3, and R4 change, and the output voltage increases accordingly. The V_{OUT} calculation formula is as follows:

$$V_{OUT}=V_{supply}*[(R2+\triangle R2)/((R2+\triangle R2)+(R3+\triangle R3))-(R4+\triangle R4)/((R4+\triangle R4)+(R1+\triangle R1))]$$



Note:

Vout: Output voltage signal
R1: Resistance value of resistor bridge R1
R2: Resistance value of resistor bridge R2
R3: Resistance value of resistor bridge R3
R4: Resistance value of resistor bridge R4
△Rx: Resistance change of resistor bridge Rx

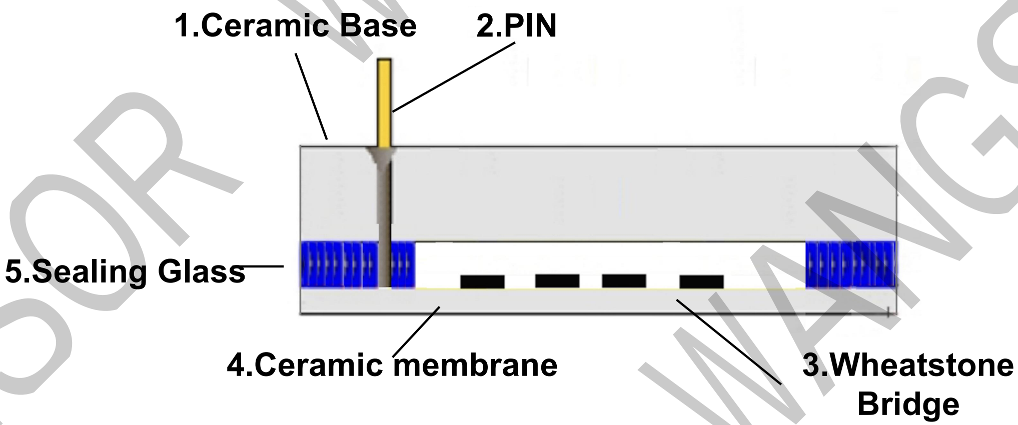
I.Working Principle of Flush Mount Ceramic Resistive Pressure Sensors

1.2 Signal Processing of Ceramic Resistive Pressure Sensors

The ceramic resistive pressure sensing element is a pressure-sensitive element based on a thick-film Wheatstone bridge. When the ceramic membrane is stressed and deformed, the Wheatstone bridge is unbalanced and outputs a corresponding linear voltage signal. The output signal is amplified by an ASIC, and non-linearity correction compensation and temperature compensation are performed to finally obtain a pressure-voltage/current (05V/ current 420mA) linear output signal.

I.Working Principle of Flush Mount Ceramic Resistive Pressure

1.3 Structure of Ceramic Resistive Pressure Sensing Element



The ceramic resistive pressure sensing element is composed of five parts: a thicker ceramic base, a thinner ceramic membrane, sealing glass, a Wheatstone bridge, and a signal output PIN.

1.Ceramic Base: Core structural component

2.PIN:Outputs the voltage signal to the outside

3.Ceramic membrane: Senses pressure and generates corresponding displacement (Pressure → Deformation)

4.Wheatstone Bridge: Converts pressure into a voltage signal (Deformation → Voltage)

5.Sealing Glass: Firmly and hermetically seals the ceramic membrane to the ceramic base

II.Model of Flush Mount Ceramic Resistive Pressure Sensing Element

2.1 Description of Ceramic Resistive Pressure Sensing Element Traceability Code

Model

Traceability Code

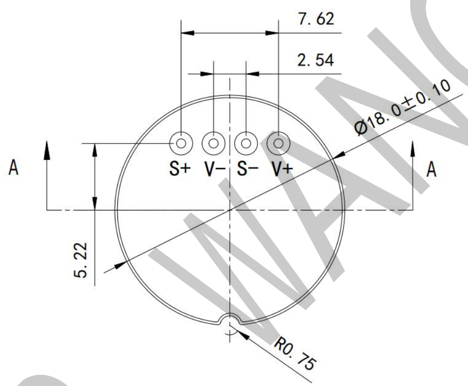
R R18 A 010 **

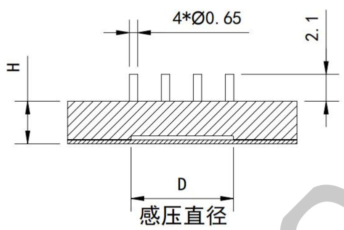
(1) (2) (3) (4) (5)

No.	Meaning
(1)Category	R: Ceramic Resistive Pressure Sensing Element
(2)Dimensions	R18: Round, Diameter 18.0mm
(3)Pressure Type	A: Absolute; G: Gauge
(4)Pressure Range	010: 10bar
(5)Special Code	H: Thick; L: Thin

聚德寿 WANGSENSOR

2.2 Structure Dimensions and Basic Parameters of Ceramic Resistive Pressure Sensing Element - 18 Thin Absolute Pressure Series





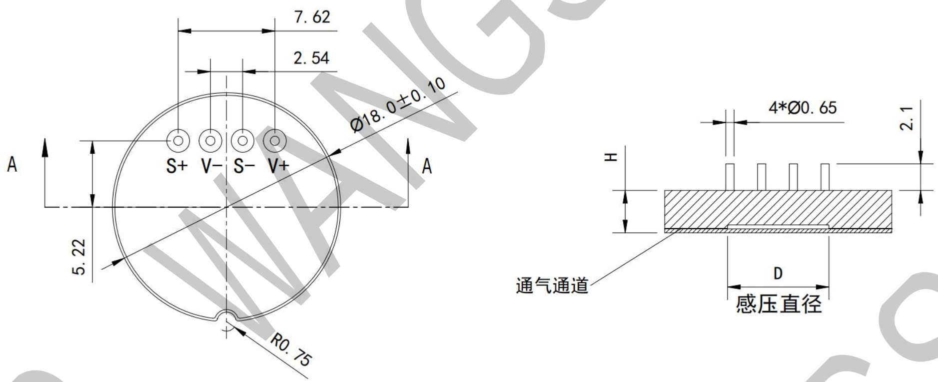
Model	Range (MPa)	Overload (MPa)	Burst (MPa)	Thickness H (mm)	Zero Pressure Output (mV/V)	Sensitivity △V (mV)	Sensing Diameter D (mm)
RR18A010L	1	＞2.0	＞25.0	3.33±0.05	-6.0~+6.0	2.0-4.0	8
RR18A020L	2	＞4.0	＞25.0	3.47±0.05	-6.0~+6.0	2.0-4.0	8
RR18A035L	3.5	＞7.0	＞25.0	3.58±0.05	-6.0~+6.0	2.0-4.0	8
RR18A050L	5	＞10.0	＞25.0	3.71±0.05	-6.0~+6.0	2.0-4.0	8

Pin Code	*Pin Definition*
S+	*Output Signal Positive*
S-	*Output Signal Negative*
V+	*Excitation Voltage Source Positive*
V-	*Excitation Voltage Source Negative*
Pin (S+, S-): Voltage signal output	

Note: The above voltage signals are measured with a desktop multimeter under standard atmospheric pressure environment (temperature: 15-35℃, atmospheric pressure: 86~106KpaA, humidity≤70%RH), and the gas source is 99.7% N2.
Sensitivity calculation formula △V=Vx-V0 (=full scale output-zero pressure output)
Overload pressure: At 20-25℃, apply the specified overload pressure and maintain for 60S. After pressure relief, the function of the ceramic resistive pressure sensing element meets the specification requirements within the working range pressure range.
Burst pressure: At 20-25℃, apply 25MPa pressure and maintain for 60S. There is no structural burst of the product during the pressurization process.

II.Model of Flush Mount Ceramic Resistive Pressure Sensing Element

2.3 Structure and Parameters of Ceramic Resistive Pressure Sensing Element - 18 Thin Gauge Pressure Series



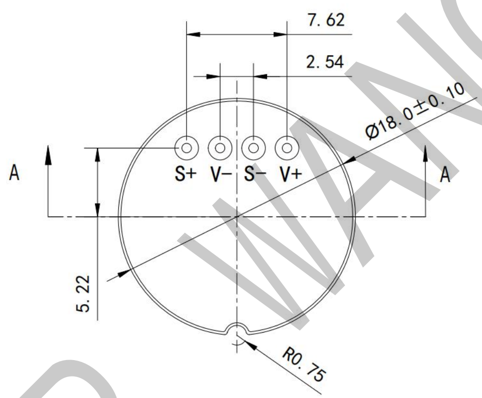
Model	Range (MPa)	Overload (MPa)	Burst (MPa)	Thickness H (mm)	Zero Pressure Output (mV/V)	Sensitivity △V (mV)	Sensing Diameter D (mm)
RR18G010L	1	＞2.0	＞3.0	3.33±0.05	-6.0~+6.0	2.0-4.0	8
RR18G020L	2	＞4.0	＞6.0	3.47±0.05	-6.0~+6.0	2.0-4.0	8
RR18G035L	3.5	＞7.0	＞10.5	3.58±0.05	-6.0~+6.0	2.0-4.0	8
RR18G050L	5	＞10.0	＞15.0	3.71±0.05	-6.0~+6.0	2.0-4.0	8

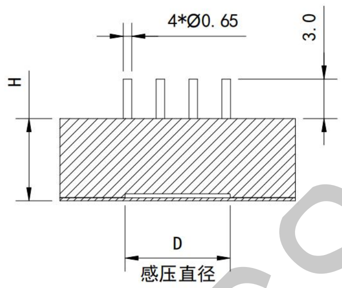
Pin Code	*Pin Definition*
S+	*Output Signal Positive*
S-	*Output Signal Negative*
V+	*Excitation Voltage Source Positive*
V-	*Excitation Voltage Source Negative*
Pin (S+, S-): Voltage signal output	

Note: The above voltage signals are measured with a desktop multimeter under standard atmospheric pressure environment (temperature: 15-35℃, atmospheric pressure: 86~106KpaA, humidity≤70%RH), and the gas source is 99.7% N2.
Sensitivity calculation formula △V=Vx-V0 (=full scale output-zero pressure output)
Overload pressure: At 20-25℃, apply the specified overload pressure and maintain for 60S. After pressure relief, the function of the ceramic resistive pressure core meets the specification requirements within the working range pressure range.
Burst pressure: At 20-25℃, apply 3 times the range pressure and maintain for 60S. There is no structural burst of the product during the pressurization process.

II.Model of Flush Mount Ceramic Resistive Pressure Sensing Element

2.4 Structure and Parameters of Ceramic Resistive Pressure Sensing Element - 18 Thick Absolute Pressure Series





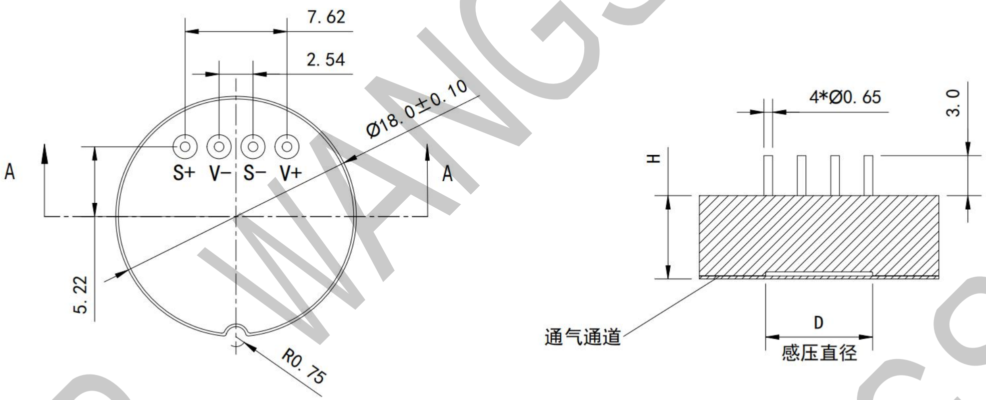
Model	Range (MPa)	Overload (MPa)	Burst (MPa)	Thickness H (mm)	Zero Pressure Output (mV/V)	Sensitivity △V (mV)	Sensing Diameter D (mm)
RR18A010H	1	＞2.0	＞35.0	6.33±0.05	-6.0~+6.0	2.0-4.0	8
RR18A020H	2	＞4.0	＞35.0	6.47±0.05	-6.0~+6.0	2.0-4.0	8
RR18A035H	3.5	＞7.0	＞35.0	6.58±0.05	-6.0~+6.0	2.0-4.0	8
RR18A050H	5	＞10.0	＞35.0	6.71±0.05	-6.0~+6.0	2.0-4.0	8

Pin Code	*Pin Definition*
S+	*Output Signal Positive*
S-	*Output Signal Negative*
V+	*Excitation Voltage Source Positive*
V-	*Excitation Voltage Source Negative*
Pin (S+, S-): Voltage signal output	

Note: The above voltage signals are measured with a desktop multimeter under standard atmospheric pressure environment (temperature: 15-35℃, atmospheric pressure: 86~106KpaA, humidity≤70%RH), and the gas source is 99.7% N2.
Sensitivity calculation formula △V=Vx-V0 (=full scale output-zero pressure output)
Overload pressure: At 20-25℃, apply the specified overload pressure and maintain for 60S. After pressure relief, the function of the ceramic resistive pressure sensing element meets the specification requirements within the working range pressure range.
Burst pressure: At 20-25℃, apply 35MPa pressure and maintain for 60S. There is no structural burst of the product during the pressurization process.

II.Model of Flush Mount Ceramic Resistive Pressure Sensing Element

2.5 Structure and Parameters of Ceramic Resistive Pressure Sensing Element - 18 Thick Gauge Pressure Series



Model	Range (MPa)	Overload (MPa)	Burst (MPa)	Thickness H (mm)	Zero Pressure Output (mV/V)	Sensitivity △V (mV)	Sensing Diameter D (mm)
RR18G010H	1	＞2.0	＞3.0	6.33±0.05	-6.0~+6.0	2.0-4.0	8
RR18G020H	2	＞4.0	＞6.0	6.47±0.05	-6.0~+6.0	2.0-4.0	8
RR18G035H	3.5	＞7.0	＞10.5	6.58±0.05	-6.0~+6.0	2.0-4.0	8
RR18G050H	5	＞10.0	＞15.0	6.71±0.05	-6.0~+6.0	2.0-4.0	8

Pin Code	*Pin Definition*
S+	*Output Signal Positive*
S-	*Output Signal Negative*
V+	*Excitation Voltage Source Positive*
V-	*Excitation Voltage Source Negative*
Pin (S+, S-): Voltage signal output	

Note: The above voltage signals are measured with a desktop multimeter under standard atmospheric pressure environment (temperature: 15-35℃, atmospheric pressure: 86~106KpaA, humidity≤70%RH), and the gas source is 99.7% N2.
Sensitivity calculation formula △V=Vx-V0 (=full scale output-zero pressure output)
Overload pressure: At 20-25℃, apply the specified overload pressure and maintain for 60S. After pressure relief, the function of the ceramic resistive pressure core meets the specification requirements within the working range pressure range.
Burst pressure: At 20-25℃, apply 3 times the range pressure and maintain for 60S. There is no structural burst of the product during the pressurization process.

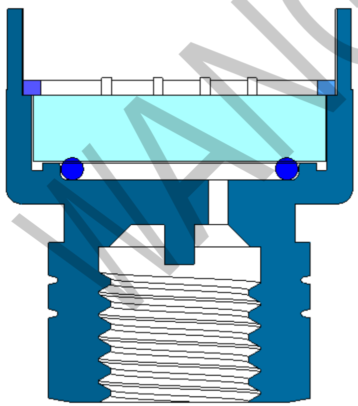
II.Model of Flush Mount Ceramic Resistive Pressure Sensing Element

2.6 Characteristic Parameters of Ceramic Resistive Pressure Sensing Element

Parameter	Unit	Specification
Material	-	96% Al2O3
Service Life	-	＞3 million cycles
Working Temperature	℃	-40~140
Working Voltage	V	2~10
Input Impedance	kΩ	10.0 ±3.0
Hysteresis & Repeatability	%FS	≤±0.15
Non-linearity	%FS	≤±0.15
Temperature Drift	%FS/K	±0.025 Max
Stability	%FS/y	≤0.3

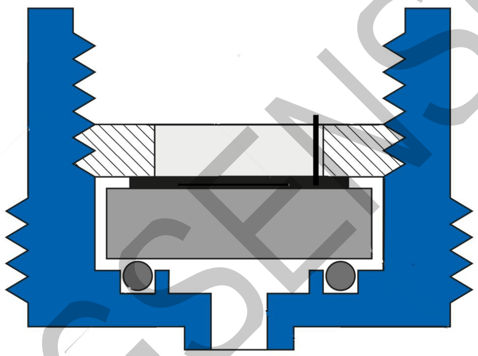
3.1 Typical Packaging Structures of Ceramic Resistive Pressure Sensors

Snap Ring Structure



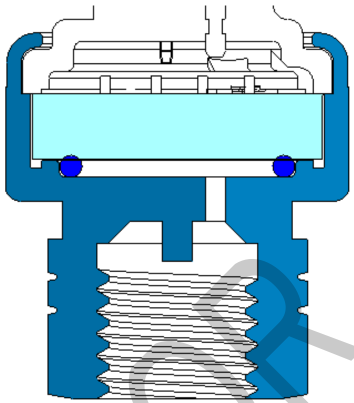
End face sealing.
Snap ring limits compression.
Many influencing factors, difficult to control compression, complex assembly.

Threaded Structure:



End face sealing.
Thread torque limits compression.
Easy to loosen, complex assembly.

Riveting Structure



End face sealing.
Riveting force limits compression.
Flanged riveting of the shell, easy for automatic assembly, simple and reliable.

聚德寿
WANGSENSOR

For more technical details, please contact our staff.

深圳聚德寿科技有限公司

SHENZHEN WANGSENSOR TECHNOLOGY CO.,LTD

聚德寿 WANGSENSOR

DEDICATION LEADS TO PROFESSIONALISM

THANK YOU