

e2v

VQ549ZD/W Optimised Performance Gas Sensing Head for Mining Type Applications

FEATURES

- Fully certified flameproof component with integral sinter
- Integral pellistors
- Low power
- Standard miniature body size
- Poison resistant - silicones and hydrogen sulfide
- Shock resistant
- ATEX certified Ex II 2G Ex d IIC Gb ($T_a = -40$ to $+55$ °C)
- ATEX certified Ex I M2 Ex d I Mb ($T_a = -40$ to $+55$ °C)
- IECEx certified Ex d IIC Gb ($T_a = -40$ to $+55$ °C)
- IECEx certified Ex d I Mb ($T_a = -40$ to $+55$ °C)
- CSA certified - File 107498
- UL recognised - File E186043

INTRODUCTION

The VQ549ZD/W is an improved version of the VQ549ZD sensor. It is a low power, highly poison-resistant device in a certified flameproof enclosure.

The VQ549ZD/W has been designed to provide the basic sensor performance that will enable a suitable instrument to meet the various (Group 1) mining performance standards. In particular, the sensor has enhanced shock resistance.

The VQ549ZD/W, whilst being optimised for its methane response (up to 5% volume in air), will also detect other flammable gases and vapours. For further information, contact e2v technologies.

OPERATING PRINCIPLES

The detector consists of a fine coil of platinum wire embedded in a ceramic bead incorporating a noble metal catalyst. The coil acts both as an electrical heater and as a resistance thermometer. The bead is mounted on a header with connecting leads and is surrounded by a metal can with the end open to the atmosphere. If a flammable gas is present when the bead is heated to about 400 - 500 °C, the gas will oxidise and the resultant release of energy will heat the bead still further. This increase in temperature is detected as an increase in resistance of the coil.

The temperature of the coil is also affected by ambient temperature and by variations in thermal conductivity of the air caused by the possible presence of inert gases such as carbon dioxide. To compensate for temperature changes not caused by the oxidation of the flammable gas a second, inert bead is used. This compensator is made in the same way as a detector bead except that instead of incorporating a catalyst in the ceramic bead, the bead is treated so that oxidation cannot take place. The two beads are then used in a circuit that detects the difference in their resistances. Since the two beads are generally of a different colour, they have different emissivities and hence different slope resistances. Therefore, to obtain the best temperature performance, it is necessary to connect a fixed resistor in parallel with the compensator to correct for its higher slope resistance.



For the VQ549ZD/W, a carefully matched set of detector, compensator and resistor are encapsulated in a cylindrical stainless steel housing with an integral stainless steel sinter at one end to permit the entry of the atmosphere. Electrical connections are made to three pins at the other end of the body.

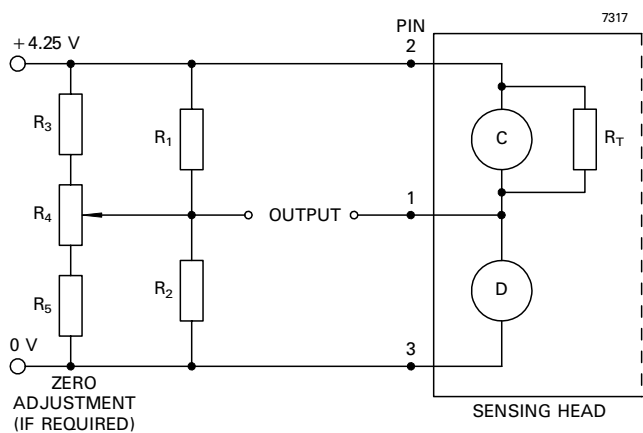
OPERATION

The output of a sensor is dependent on a complex combustion process established around the sensing beads. It is imperative that the layers of gas around the beads are not disturbed, otherwise the bead temperature and hence device output will change. The design of the VQ549ZD/W housing achieves this requirement, provided the user takes care not to allow strong draughts to blow directly onto the sinter.

It is recommended that the detector and compensator be run in a Wheatstone Bridge circuit so that a difference signal may be obtained. A suitable circuit is shown in Fig. 1.

In use, the bridge supply voltage should be stable to within ± 0.1 V, or the output in clean air may change in sympathy.

Although it is generally recommended that pellistors should be run with a constant voltage supply to the bridge, it is possible to use a constant current supply provided that the voltage across the bridge in clean air remains within the recommended limits.



$R_1 = R_2 = 500\Omega$ to $10\text{ k}\Omega$
 $R_3 = R_5 \approx 10R_1$
 $R_4 \approx 20R_1$

Fig. 1. Recommended circuit diagram

CERTIFICATIONS

SIRA Certification Services, EU Notified Body No. 0518, have certified the VQ549ZD/W under the ATEX Directive, 94/9/EC, and the IECEx Scheme. Certificate number SIRA 01ATEX1073U certifies it as a flameproof component to EN60079-0:2006 (including amendments A1 and A2) and EN60079-1:2007. **Instructions specific to hazardous area installations apply.** Certificate number IECEx SIR 04.0014X certifies it as a flameproof component to IEC60079-0 Ed. 5 and IEC60079-1 Ed. 6.

The Canadian Standards Association has issued a component certification for the VQ549ZD/W for use as part of an intrinsically safe portable combustible gas detector or housed in a remote sensor housing. It has satisfied the requirements of CSA standard C22.2 No. 30-M 1986 and UL standard 1203 as a flame arrestor for Class 1, Groups A, B, C and D.

Underwriters Laboratories Inc. recognise the VQ549ZD/W as a component in intrinsically safe single- or multi-gas detectors for use in Class 1, Division 1, Groups A, B, C and D hazardous locations. It has satisfied the requirements of UL913, fifth edition.

INSTRUCTIONS

Instructions specific to hazardous area installations (reference European ATEX Directive 94/9/EC. Annex II, 1.0.6).

The following instructions apply to equipment covered by certificate number SIRA 01ATEX1073U.

1. The VQ549ZD/W Gas Sensing Head is component-approved only and may not be used as a stand-alone item in a hazardous area without further protection.
2. The component is certified for use only in ambient temperatures between -40 and $+55\text{ }^\circ\text{C}$ and should not be used outside this range.
3. The maximum input power shall not exceed 2.5 W .
4. For the purpose of temperature classification of the apparatus in which the VQ549ZD/W Gas Sensing Head is used, the maximum temperature rise on any external surface does not exceed $64\text{ }^\circ\text{C}$.
5. The VQ549ZD/W Gas Sensing Head has not been assessed as a safety device (EHSR 1.5).

6. There are no user-serviceable parts in the component.
7. The end-user/installer should be aware that the certification of the VQ549ZD/W Gas Sensing Head relies on the following materials used in its construction, which are suitable for most common applications:
 Enclosure Stainless Steel
 Sinter Stainless Steel
 Bushing Epoxy resin
8. In accordance with the Note in EN60079-0:2006 Clause 6.1(a), the end-user/installer shall inform the manufacturer of any adverse conditions that the VQ549ZD/W Gas Sensing Head may encounter. This is to ensure that the VQ549ZD/W Gas Sensing Head is not subject to conditions that may cause degradation of these materials.
8. The certification markings for the VQ549ZD/W Gas Sensing Head are:

Ex II 2G Ex d IIC Gb and Ex I M2 Ex d I Mb

MARKING

Each sensing head carries a serial number and all the information required by the certifications.

GENERAL DATA

This information relates to the device operating continuously in the recommended bridge circuit

Gases detected	most flammable gases and vapours
Operation	continuous
Bridge supply voltage (see note 1)	4.15 to 4.35 V
Sensor current (at $4.25 \pm 0.1\text{ V}$)	50 to 60 mA
Minimum sensitivity (measured with 1% methane, 20% LEL, at $4.25 \pm 0.1\text{ V}$)	30 mV/% methane
Zero offset range in clean air (at $4.25 \pm 0.1\text{ V}$)	$\pm 20\text{ mV max}$
Zero offset with temperature	$\leq 0.2\%$ methane variation from reading at $20\text{ }^\circ\text{C}$ to -10 and $+40\text{ }^\circ\text{C}$
Linearity	linear up to 3% methane
Response time (t_{50}) (see note 2)	10 s max
Maximum gas concentration (see note 3)	5% methane in air
Long-term zero drift (see note 4)	$< 0.75\text{ mV/month}$
Long-term sensitivity drift (see note 4)	$< 2.5\%$ full scale/month

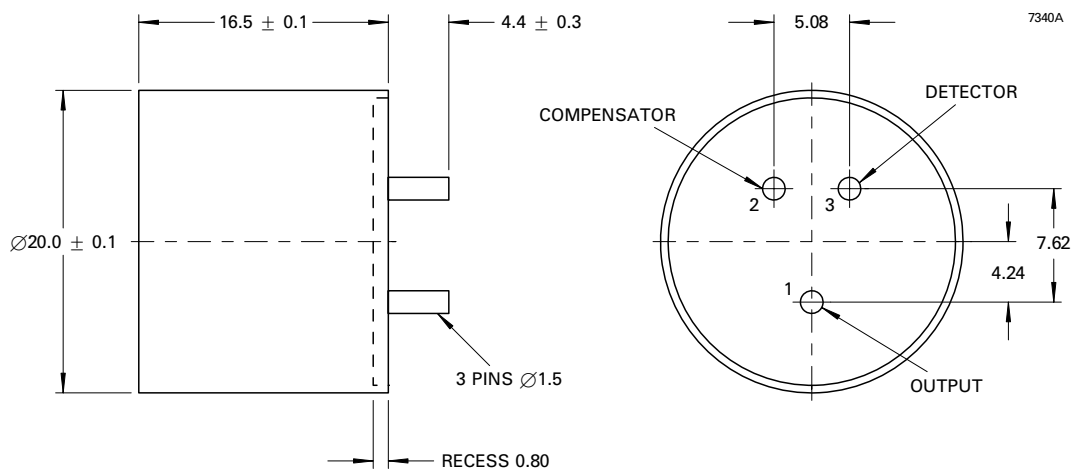
MAXIMUM RATINGS (Absolute values)

Input voltages between pins:	
pins 2 and 3	5.0 V
pins 1 and 2	2.5 V
pins 1 and 3	2.5 V
Operation, storage in original packaging and shipping:	
temperature	-40 to $+55\text{ }^\circ\text{C}$
humidity	0 to 80% RH non-condensing

NOTES

1. The polarity of the supply voltage may be reversed without harm. The only effect is to reverse the polarity of the output signal.
2. Measured at $4.25 \pm 0.1\text{ V}$ using 1% methane in an e2v technologies test manifold.
3. Exceeding these limits may degrade the stability of sensitivity or zero offset. The calibration of the sensor should be checked if it has been exposed, whilst operating, to gas concentrations greater than the Lower Explosive Limit.
4. Over a 600-day period.

OUTLINE (All dimensions in millimetres; dimensions without limits are nominal)



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