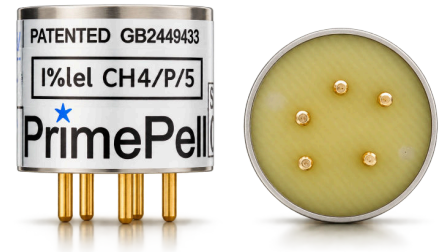


PrimePell

Pellistor Replacement Infrared Gas Sensor

Infrared hydrocarbon measurement in a pellistor-compatible footprint — pellistor-mimic bridge output with similar relative responses to key hydrocarbons.


0–100 % VOL

Methane maximum measuring range

Pellistor mimic

Direct replacement in existing catalytic-bead circuits

3.0–5.0 v

80 mA typical operating current

01 Key Features

Operates independent of supply polarity — as a pellistor

Relative responses to key hydrocarbons — similar to a pellistor

Latest technology MEMS detectors — patented design, GB2449433

All metal construction with isolated housing — All metal construction with isolated housing

Pellistor mimic bridge output — voltage rises across detector connections in gas, as a pellistor

Operating voltage range 3.0 V – 5.0 — 80 mA typical operating current

Sensing ranges 0–100 % LEL methane, 0–100 % LEL hydrocarbons or 0–100 % volume methane

Wide operating temperature range — fast response and immunity from 'poisoning'

02 At a Glance

ITEM	SPECIFICATION
Target gas	Hydrocarbon gases (methane calibrated)
Measuring ranges	0–100 % LEL methane / 0–100 % LEL hydrocarbons / 0–100 % volume methane
Minimum resolution	At zero < 0.5% of range, At range < 2% of range
Output formats	Pellistor-mimic bridge, linear voltage, serial communications
Supply voltage	3.0 V – 5.0 V (80 mA average typical)
Response time (T90)	< 30 s
Operating temperature	–30 °C to +50 °C
Weight	18.0 g
Approvals / IP	Not Ex approved; house in a suitable Ex enclosure in hazardous areas
Patent	GB2449433

Operation & hydrocarbon response

03 Description and Operation

The PrimePell sensor uses the non-dispersive infrared method to detect the presence of hydrocarbon gases. The sensor contains an infrared radiation source, a dual element custom infrared detector, a unique optical waveguide into which gas diffuses and internal ARM7 core microprocessor based electronics to provide a voltage output which is independent of the power supply polarity.

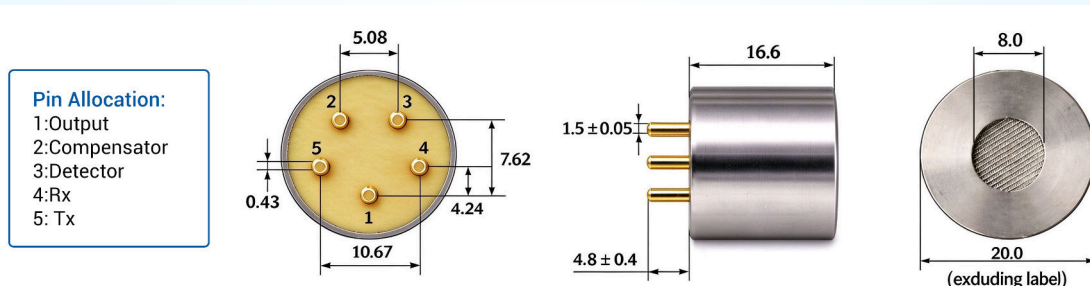
The sensor can be configured to provide a pellistor format output, typically mid supply at zero with the voltage output increasing with respect to the detector pin by 100 mV at range, or a linear voltage output, typically 0.4 V – 2.0 V over range with respect to the negative supply pin. In addition, the output can be read and the internal configuration can be accessed by a serial communications link. The communication link contacts are pads in the 3-pin version PrimePell and pins in the 5-pin version PrimePell.

The internal electronics perform all the functions of driving the optical parts of the sensor, extracting the detector signals, converting the signals to a concentration, applying temperature compensation and scaling the output. When in a pellistor configuration, the PrimePell can replace catalytic sensors in existing circuitry subject to the power supply requirements. External components will be required to meet the power supply requirement when a PrimePell is used in constant current pellistor circuitry. The PrimePell is not currently Ex approved so should be housed in a suitable Ex enclosure when used in hazardous areas.

Technical support on implementation and application notes are available from Clairair Limited.

04 Outline Details

All dimensions in millimetres (± 0.1 mm unless noted). Rx and Tx are pads in the 3-pin format. The sensor body is an all-metal construction with an isolated housing and a small internal volume. Mechanical outline drawings, 3-pin and 5-pin footprint details, and recommended PCB socket information are available from Clairair on request.



05 Hydrocarbon Response Characteristics

Unless otherwise specified, the Prime Pell is calibrated to provide an output signal linearised for % LEL methane during manufacture. The LEL is equivalent to 4.4 % volume methane or 5 % volume methane depending on the geographic requirement and must be specified when ordering.

CALIBRATION OPTIONS

% LEL CH₄

Standard calibration

4.4% / 5%

LEL methane basis

0–100% vol CH₄

Optional methane range

0–100% LEL

Specific hydrocarbon



PrimePell responds to a range of hydrocarbon gases irrespective of the calibration. Unlike a pellistor, a PrimePell will not detect acetylene or hydrogen. Typical relative responses to some hydrocarbons on a 0–100 % LEL methane scale are available from Clairair on request.

Performance & diagnostics

06 Performance and Diagnostics

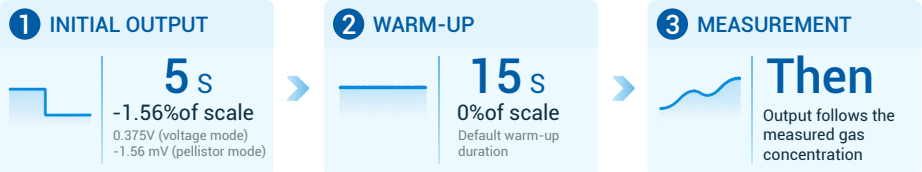
6.1 Temperature Compensation



The PrimePell is temperature compensated for both zero and span at the calibration gas concentration level.

6.2 Sensor Warm-up

When power is first applied or when a reset has occurred or during recovery from a fault condition the PrimePell outputs -1.56% of scale (0.375 V in voltage mode or -1.56 mV in pellistor mode) for 5 seconds then outputs 0% of scale for a warm-up period (default is 15 seconds). After this time the output follows the extracted gas value.



6.3 Fault Indication

The PrimePell continuously monitors several internal parameters to ensure that the internal hardware and software are operating correctly. If a fault condition is detected then the output is set to 0 V in the case of a voltage output (equivalent to -25% FSD for a 4 mA zero) or to approximately -200% scale in pellistor output, emulating a partly open compensator. Some faults are recoverable (e.g. a brown-out in incoming supply voltage) and the PrimePell continuously checks for possible recovery. If a fault can be recovered from then the output follows the sensor warm-up sequence before following the extracted gas value.

6.4 Reliability – Failure Modes Effects and Diagnostic Analysis (FMEDA)

An FMEDA on the PrimePell produced the following summary results.

ITEM	VALUE	ITEM	VALUE
Conditions	Ground fixed, JAN to MILHDBK217F	λ SD	921 FIT
Subsystem type	B (complex, using microcontrollers or programmable logic)	λ SU	3 FIT
Hardware fault tolerance	0	λ DD	859 FIT
Mode	High demand (continuous use of operation)	λ DU	96 FIT
Probability of dangerous failure per hour	9.5×10^{-7}	SFF	94.9 %

07 Output Formats

Every PrimePell can be configured for a pellistor-mimic bridge output or a linear voltage output. Both output formats are independent of supply polarity.

Pellistor-mimic bridge

100 mV

Mid-supply at zero; output voltage rises with respect to the detector pin by 100 mV at range, exactly as a catalytic pellistor

Linear voltage

0.4–2.0 V

$0.4\text{ V} - 2.0\text{ V}$ over range with respect to the negative supply pin

Serial communications

Rx / Tx

Output can be read and the internal configuration accessed over a serial link (pads in the 3-pin version, pins in the 5-pin version)

Ratings & specification

08 Absolute Maximum Ratings



Ambient temperature range

-40 °C to +80 °C


Supply voltage (between pins 2 and 3)

5.5 V

09 Handling Precautions



Electrostatic sensitive devices

The Prime range of sensors contains electrostatic sensitive components. Anti-static handling precautions should be observed when handling these products.



Soldering and mounting

Soldering to the pins may seriously damage the sensor. Connections should be made via PCB sockets only.

- Recommended socket: Wearnes Cambion reference 450-3326-01-06-00
- 3-pin version: Rx and Tx are brought out as pads

10 Specification

Unless otherwise stated, all data was taken using: supply voltage 3.5 V; ambient temperature 20 °C to 25 °C; ambient pressure 995 hPa to 1020 hPa; gases diluted in nitrogen; gas flow rate 1 litre/min across the sensor face.

PARAMETER	VALUE
Supply voltage range	3.0 V – 5.0 V
Power consumption	280 mW typical
Nominal ranges	0 – 100 % LEL methane, 0 – 100 % LEL hydrocarbons or 0 – 100 % volume methane
Default output range – pellistor mode	0 – 100 mV from mid-supply relative to detector pin
Default output range – voltage mode	0.4 V – 2.0 V
Warm-up time – to operation	< 60 s
Warm-up time – to specification	< 3 minutes
Response time (T90)	< 30 s to a step change in gas concentration
Minimum resolution	At zero: < 0.5 % of range / At range: < 2 % of range
Zero repeatability	± 1 % of range
Accuracy	± 3 % of range up to 50 % of range; ± 5 % of range above 50 % of range
MTBF	> 5 years
Digital interface format	8 data bits, 1 stop bit, no parity
Digital interface baud rate	38 400 (default), 19 200, 9 600
Digital interface logic levels	VINL input low: < 0.8 V / VINH input high: > 2.0 V / VOL output low: < 0.4 V / VOH output high: > 2.4 V
Weight	18.0 grams
Vibration	Complies with EN 61779-1
Relative humidity	0 – 95 % RH non-condensing
Operating temperature range	-30 °C to +50 °C
Storage temperature range	-40 °C to +80 °C
Operating pressure range	700 – 1300 hPa

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Configure your PrimePell

11 Ordering Information

The PrimePell is available in the configurations listed below. Please specify the required configuration when ordering.

PrimePell / V / 5 I%lel CH₄

CH₄ =Methane

Hydrocarbons

Range:

I%lel =0-100% LEL CH₄(0- 4,4% vol)
 N%lel =0-100% LEL CH₄(0- 5% vol)
 0-100% Vol CH₄
 0-100% LEL Hydrocarbons
 Q =Customized

Pin number & certification:

3 =3 pins Not Ex approved
 5 =5 pins Not Ex approved
 3Ex =3 pins with Ex approved
 5Ex =5 pins with Ex approved

Output:

V =Linear voltage 0.4 V – 2.0 V
 P =pellistor mimic bridge



All Prime sensors have both serial communications and analogue (voltage or pellistor) outputs.

The bridge output is indicated to use when substituting a pellistor

Please quote the model, pin configuration, calibration gas and range, LEL basis (where applicable) and output format with your order. For custom calibrations, quantities and lead times, please contact Clairair.

12 Contact and Support

Technical support on implementation and application notes are available from Clairair Limited.



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