# PrimePellRP

## Reduced Power Infrared Gas Sensor

Reduced-power infrared hydrocarbon measurement — 15 mA average typical operating current, with 0.4–2.0 V linear voltage output.




**0–100** % LEL
Methane / hydrocarbon measuring range

**15** mA
Average typical operating current

**3.0–5.0** V
45 mW typical power at 3.0 V supply

## 01 Key Features

- **Operates independent of supply polarity** — simple, polarity-independent integration
- **0.4–2.0 V linear voltage output** plus UART serial communications
- **Sensing ranges 0–100 % LEL methane, 0–100 % LEL hydrocarbons or 0–100 % volume methane**
- **Flexible electronic configuration access** — wide operating temperature range
- **Microprocessor-generated linear voltage output** — independent of supply polarity
- **Operating voltage range 3.0 V – 5.0 V** — 15 mA average typical operating current
- **All metal construction with isolated housing** — small internal volume
- **Fast response** — 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 | linear voltage, serial communications |
| Supply voltage | 3.0 V – 5.0 V (15 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 PrimePellRP 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 microprocessor-based electronics to provide a voltage output which is independent of the power supply polarity.

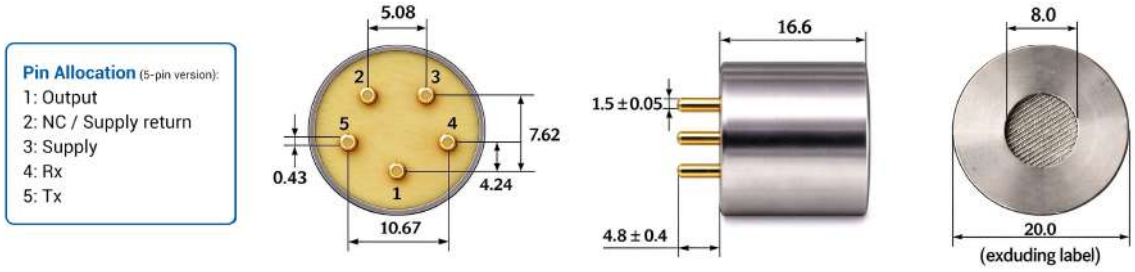
The sensor can be configured a linear voltage output, typically 0.4 V – 2.0 V over range with respect to the negative supply pin. In addition, the output can be read, and the internal configuration can be accessed by a serial communications link. The communication link contacts are pads in the 3-pin version PrimePellRP.Unlike pellistor-type sensors, the PrimePellRP does not use a compensator element. The output is a microprocessor-generated linear voltage (0.4 V–2.0 V over range) referenced to the negative supply pin, and is independent of supply polarity.

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. The PrimePellRP 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 Pin Allocation (5-pin version)

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 PrimePellRP s calibrated during manufacture to provide a linearised output signal for % LEL methane.
The LEL basis (4.4 % or 5 % volume methane) must be specified when ordering.

CALIBRATION OPTIONS

| % LEL $CH_4$ | 4.4% / 5% | 0–100% vol $CH_4$ | 0–100% LEL |
|---|---|---|---|
| Standard calibration | LEL methane basis | Optional range | Specific hydrocarbon |

**Will not detect acetylene or hydrogen.**Unlike a pellistor, a PrimePellRP 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

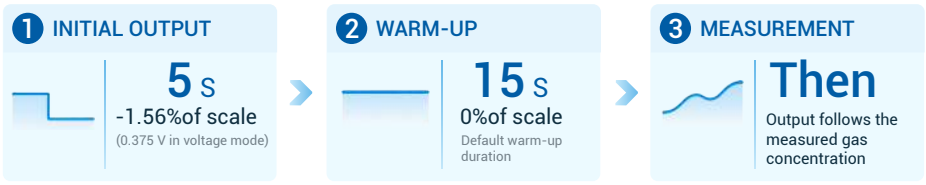
## 06 Performance and Diagnostics

### 6.1 Temperature Compensation

The PrimePellRP 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 automatic recovery from a fault condition the Prime RP outputs −1.56 % of scale (0.375 V in voltage 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 PrimePellRP continuously monitors several internal parameters to ensure that the internal hardware and software are operating correctly. If a fault condition is detected, the voltage output is set to 0 V. Some faults are recoverable (e.g. a brown-out in the incoming supply voltage) and the PrimePellRP continuously checks for possible recovery. If a fault can be recovered from, 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 PrimePellRP produced the following summary results.

| ITEM | VALUE |
|---|---|
| Conditions | Ground fixed, JAN to MILHDBK217F |
| Subsystem type | B (complex, using microcontrollers or programmable logic) |
| Hardware fault tolerance | 0 |
| Mode | High demand (continuous use of operation) |
| Probability of dangerous failure per hour | $9.5 \times 10^{-7}$ |

| ITEM | VALUE |
|---|---|
| λSD | 921 FIT |
| λSU | 3 FIT |
| λDD | 859 FIT |
| λDU | 96 FIT |
| SFF | 94.9 % |

## 07 Output Formats

The PrimePellRP provides a linear voltage output independent of supply polarity.The output is not a bridge (ratiometric) output; it is a ground-referenced linear voltage generated by the internal microprocessor.

**Linear voltage**

**0.4–2.0 V**

0.4 V – 2.0 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 | 45 mW typical at 3.0 V supply |
| Nominal ranges | 0 – 100 % LEL methane, 0 – 100 % LEL hydrocarbons or 0 – 100 % volume methane |
| 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 PrimePellRP

## 11 Ordering Information

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

**PrimePellRP / 5 I%lel $CH_4$**

**CH4 =Methane**

Hydrocarbons

**Range:**

I%lel =0-100% LEL $CH_4$( 0- 4,4% vol)
N%lel =0-100% LEL $CH_4$(0- 5% vol)
0-100% Vol $CH_4$
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

All Prime Reduced Power series sensors have both serial communications and analogue voltage outputs.

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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