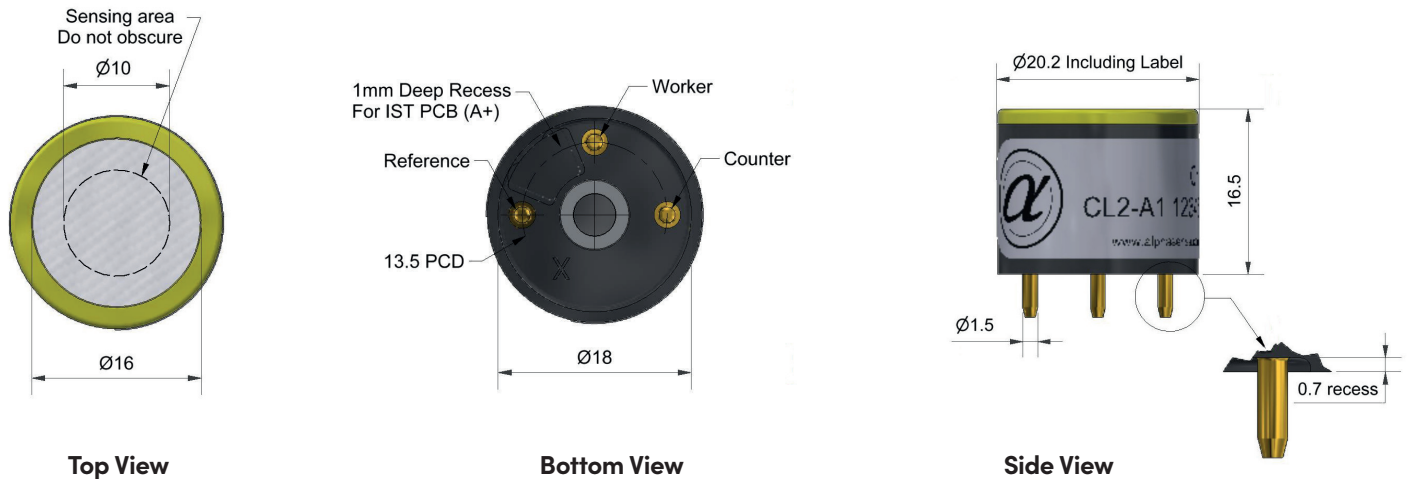


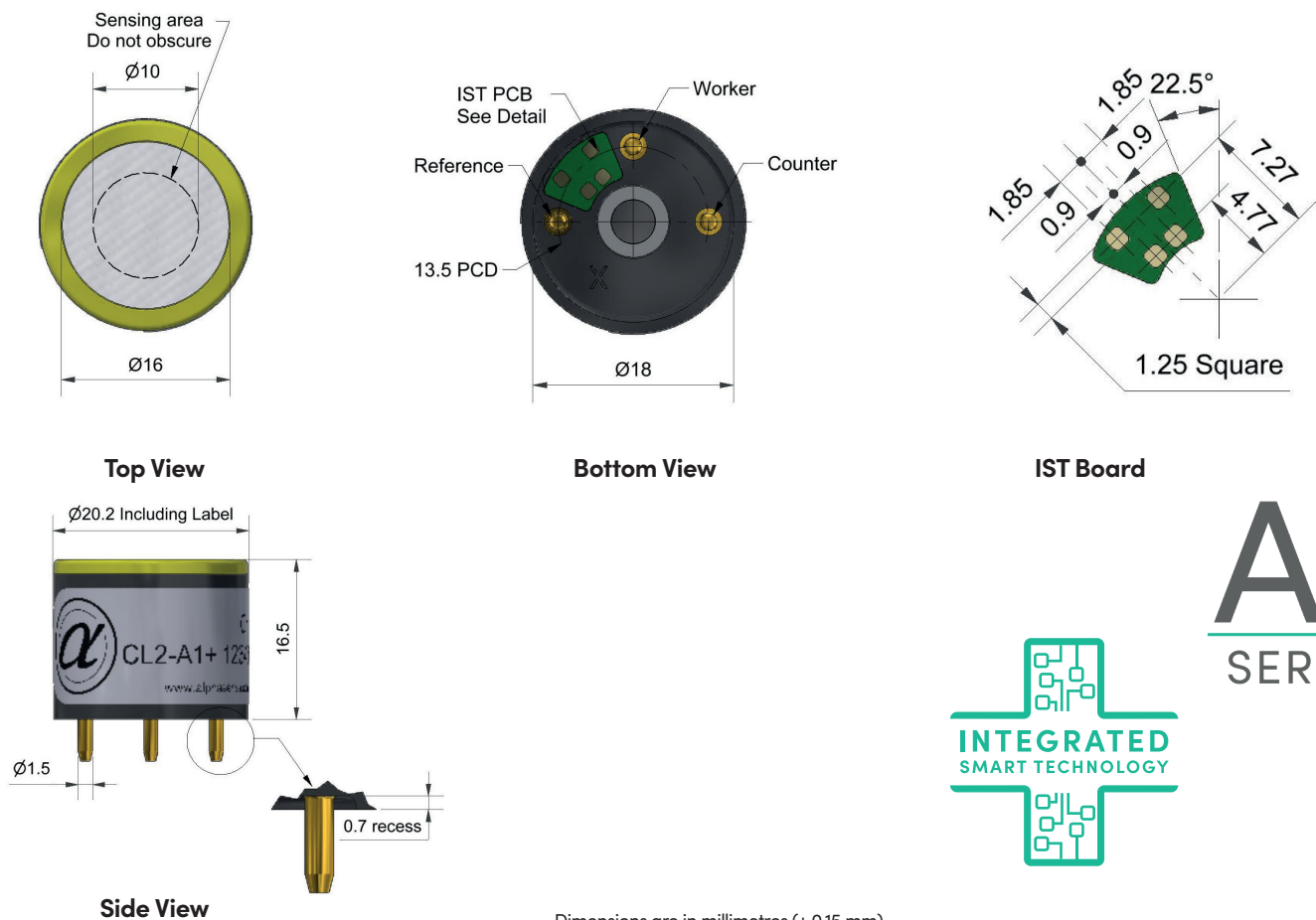
## CL2-A1/CL2-A1+ Chlorine Sensor

The CL2-A1 sensor is a PPM sensor that is designed for a broad variety of applications and instrumentation including portable gas detectors and fixed gas detection systems for industrial safety, environmental air quality, combustion analysis and process control. The A series is the most widely used sensor format for portable gas detection applications. It is available in our standard format (CL2-A1) and with our patented Integrated Smart Technology (CL2-A1+) that has an IST board with a memory chip and temperature sensor integrated in the sensor. The + sensors store specific calibration, specification, and identification data on every sensor allowing plug and play operation. The on-board temperature sensor improves the accuracy and simplicity of temperature compensation algorithms.

### CL2-A1 Chlorine Sensor – 3-Electrode



### CL2-A1 Chlorine Sensor – 3-Electrode (with Integrated Smart Technology)



Dimensions are in millimetres ( $\pm 0.15$  mm).

## Sensor Data

|                           |                                           |                                                                    |                                     |
|---------------------------|-------------------------------------------|--------------------------------------------------------------------|-------------------------------------|
| <b>Performance</b>        | Sensitivity                               | nA/ppm in 10ppm Cl <sub>2</sub>                                    | -350 to -750                        |
|                           | Response time                             | '90 (s) from zero to 10ppm Cl <sub>2</sub> (33Ω load resistor) ppm | < 60                                |
|                           | Zero current                              | equivalent in zero air                                             | ± 0.4                               |
|                           | Resolution                                | RMS noise (ppm equivalent, 33Ω load resistor)                      | < 0.02                              |
|                           | Range                                     | ppm limit of performance warranty                                  | 20                                  |
|                           | Linearity                                 | ppm error at full scale, linear at zero and 5ppm Cl <sub>2</sub>   | ± 1.5                               |
|                           | Overgas limit                             | maximum ppm for stable response to gas pulse                       | 50                                  |
| <b>Lifetime</b>           | Zero drift                                | ppm equivalent change/year in lab air, monthly test                | < 0.05                              |
|                           | Sensitivity drift                         | % change/year in lab air, monthly test                             | < 10                                |
|                           | Operating life                            | months until 80% original signal (24-month warranted)              | > 24                                |
| <b>Environmental</b>      | Sensitivity @ -20°C                       | % (output @ -20°C/output @ 20°C) @ 10ppm Cl <sub>2</sub>           | 65 to 85                            |
|                           | Sensitivity @ 50°C                        | % (output @ 50°C/output @ 20°C) @ 10ppm Cl <sub>2</sub>            | 105 to 125                          |
|                           | Zero @ -20°C                              | ppm equivalent change from 20°C                                    | <± 0.2                              |
|                           | Zero @ 50°C                               | ppm equivalent change from 20°C                                    | < 0 to -0.8                         |
| <b>Cross Sensitivity</b>  | H <sub>2</sub> S sensitivity              | % measured gas @ 20ppm                                             | H <sub>2</sub> S < -300             |
|                           | NO <sub>2</sub> sensitivity               | % measured gas @ 10ppm                                             | NO <sub>2</sub> 100                 |
|                           | NO sensitivity                            | % measured gas @ 50ppm                                             | NO < 3                              |
|                           | SO <sub>2</sub> sensitivity               | % measured gas @ 20ppm                                             | SO <sub>2</sub> < -8                |
|                           | CO sensitivity                            | % measured gas @ 400ppm                                            | CO < 0.1                            |
|                           | H <sub>2</sub> sensitivity                | % measured gas @ 400ppm                                            | H <sub>2</sub> < 0.1                |
|                           | C <sub>2</sub> H <sub>4</sub> sensitivity | % measured gas @ 400ppm                                            | C <sub>2</sub> H <sub>4</sub> < 0.1 |
| <b>Key Specifications</b> | Temperature range                         | °C                                                                 | -20 to 50                           |
|                           | Pressure range                            | kPa                                                                | 80 to 120                           |
|                           | Humidity range                            | %rh continuous                                                     | 15 to 90                            |
|                           | Storage period                            | months @ 3 to 20°C (stored in sealed pot)                          | 6                                   |
|                           | Load resistor                             | Ω (for optimum performance)                                        | 33                                  |
|                           | Weight                                    | g                                                                  | < 6                                 |

**Figure 1 Sensitivity Temperature Dependence**

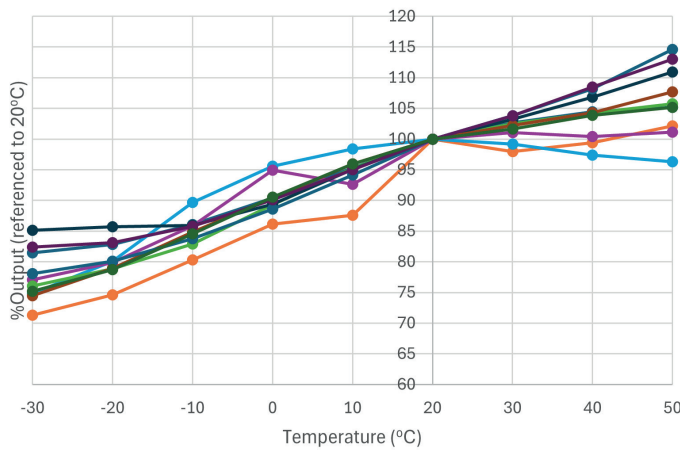


Figure 1 shows the variation in sensitivity caused by changes in temperature.

This data is taken from a typical batch of sensors. The mean and 95% confidence intervals are shown.

Chlorine gas tests are difficult, especially at higher temperatures.

**Figure 2 Zero Temperature Dependence**

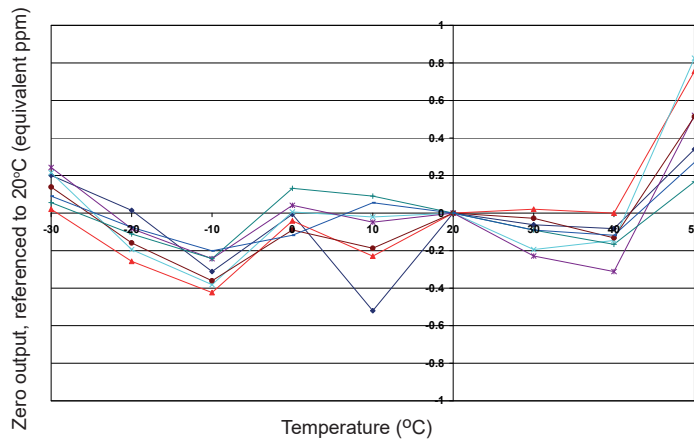


Figure 2 shows the variation in zero output caused by changes in temperature, expressed as ppm gas equivalent, referenced to zero at 20°C.

This data is taken from a typical batch of sensors.

**Figure 3 Response to 10ppm Cl<sub>2</sub> changes with temperature**

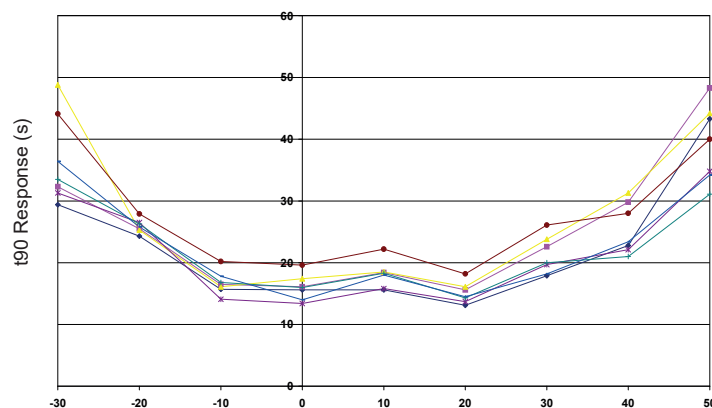


Figure 3 shows the response time temperature dependence for a typical batch of sensors.

Normally the response time increases as the temperature decreases, but for chlorine it also increases at higher temperatures, reflecting the complex chemistry.

IST Board Data

Interface

|                            |                                                       |
|----------------------------|-------------------------------------------------------|
| Communication Bus          | Compatible with the 400 kHz I <sup>2</sup> C protocol |
| Max. Bus Speed             | Up to 1 MHz                                           |
| Input Logic Levels         | High (Recessive) < 2.3 V   Low (Dominant) < 0.2 V     |
| Absolute Max. Input Signal | 3.6 V                                                 |

Electrical

|                            |                                                                                                  |
|----------------------------|--------------------------------------------------------------------------------------------------|
| Supply Voltage Range       | 1.7 V to 3.6 V                                                                                   |
| Supply current – Stand-By  | < 5 µA                                                                                           |
| Supply current – Operating | < 0.15 mA (temperature reading only)<br>< 2.15 mA (temperature reading + memory reading/writing) |
| Power Supply Conditioning  | Built-In 100 nF decoupling capacitor                                                             |
| ESD Protection             | 4 kV (human body model) – Enhanced ESD / Latch-Up protection                                     |
| Bus Pins Input Capacitance | 15 pF max.                                                                                       |

Performance

|                             |                      |
|-----------------------------|----------------------|
| Operational Temperature     | –40 °C to +85 °C     |
| Temperature Sensor Accuracy | ±1°C (–0°C to +70°C) |
| Memory Data Retention       | > 200 years          |
| Memory Write Cycles         | > 4,000,000          |

Data & Communication

|                                |                                                       |
|--------------------------------|-------------------------------------------------------|
| Memory IC & I2C Address        | M24128X-FCU   Device Address: R – 0xA0 / W – 0xA1     |
| Temperature IC & I2C Address   | MAX31875R0TZS+T   Device Address: R – 0x90 / W – 0x91 |
| Product Data Start Address     | 0x0900                                                |
| Calibration Data Start Address | 0x0B00                                                |
| User Data Area                 | 0x0D00 – 0x18FF (3,072 Bytes)                         |
| CRC Polynomial                 | 0x 01 04C1 1DB7                                       |
| Digital Signature Algorithm    | SHA-256                                               |

Factory-populated data

15,000+ locations

|                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Product Data</b></p> <p>Data Format Version</p> <p>Customer (OEM) ID</p> <p>Product ID</p> <p>Type of Sensor / Target Gas</p> <p>Sensor Serial Number</p> <p>End of Storage Period Date</p> <p>Sensor Replacement Date</p> <p>Product Data Checksum</p> <p>Alphasense Digital Signature</p> <p>Customer Digital Signature</p> | <p><b>Calibration</b></p> <p>Calibration Data Units</p> <p>Zero (clean dry air) Output</p> <p>Calibration Span</p> <p>Calibration Output</p> <p>Sensitivity</p> <p>Calibration Date</p> <p>Calibration Data Checksum</p> <p>Calibration Data Signature</p> | <p><b>Sensor Specification</b></p> <p>Over-gas limit</p> <p>Concentration Range</p> <p>Temperature Range Low</p> <p>Temperature Range High</p> <p>Humidity Range Low</p> <p>Humidity Range High</p> <p>Pressure Range Low</p> <p>Pressure Range High</p> <p>Specification Checksum</p> | <p><b>Customer Specific</b></p> <p>Custom Parameters</p> <p>Re-Calibration Due Date</p> <p>Operational Limits:</p> <p>Low   High   STEL   TWA</p> <p>Next Bump Test Due Date</p> <p>User Data Area</p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Note:** Above 85% rh and 40°C a maximum continuous exposure period of 10 days is warranted. Where such exposure occurs the sensor will recover normal electrolyte volumes when allowed to rest at lower % rh and temperature levels for several days.

At the end of the product's life, do not dispose of any electronic sensor, component or instrument in the domestic waste, but contact the instrument manufacturer, Alphasense or its distributor for disposal instructions. NOTE: all sensors are tested at ambient environmental conditions unless otherwise stated. As applications of use are outside our control, the information provided is given without legal responsibility. Customers should test under their own conditions, to ensure that the sensors are suitable for their own requirements.

In the interest of continued product improvement, we reserve the right to change design features and specifications without prior notification. The data contained in this document is for guidance only. Alphasense Ltd accepts no liability for any consequential losses, injury or damage resulting from the use of this document or the information contained within.(©ALPHASENSE LTD) Doc. Ref. CL2-A1/JUN24