

## Product Overview

The Prana Air Nitrogen Dioxide (NO<sub>2</sub>) Sensor is a highly accurate, industrial-grade electrochemical sensor designed for precise detection and monitoring of nitrogen dioxide gas concentrations in ambient air. Engineered with advanced sensing technology, this module offers an exceptional measurement range from 0.001 ppm to 9.999 ppm with an ultra-fine resolution of 0.001 ppm, making it ideal for both environmental monitoring and stringent industrial safety applications.

The sensor features standard UART digital output (TX/RX) for seamless integration into various microcontrollers and air quality monitoring systems. Its robust cylindrical design (22.8mm diameter) ensures durability while maintaining a compact footprint for versatile deployment.



## Key Features

- Ultra-high precision with 0.001 ppm resolution.
- Wide detection range (0 to 9.999 ppm).
- Digital UART output for easy integration.
- Wide operating temperature range (-20°C ~ 50°C).
- Long operational lifespan with low power consumption.
- Standardized pin layout for mass production.

## Target Applications

- Ambient Air Quality Monitoring Stations
- Industrial Safety & Leak Detection
- Water Treatment Plant Monitoring
- HVAC and Indoor Air Quality (IAQ) Systems
- Portable Gas Detectors
- Medical and Sterilization Equipment

## Technical Specifications

| Parameter                   | Specifications                                       |
|-----------------------------|------------------------------------------------------|
| Product Model               | PA-NO2-9.999PPM                                      |
| Target Gas                  | Nitrogen Dioxide (NO <sub>2</sub> )                  |
| Measurement Range           | 0.001 ppm to 9.999 ppm                               |
| Resolution                  | 0.001 ppm                                            |
| Operating Humidity Range    | 15%RH-90% RH (non-condensing)                        |
| Operating Temperature Range | -20°C ~ 50°C                                         |
| Storage Temperature         | 0°C ~ 25°C                                           |
| Output Data                 | UART Output (3.3V Level)                             |
| Dimensions (Body)           | 22.8 mm x 25.0 mm (Height)                           |
| Pin Length                  | 5.6 mm                                               |
| Pin Diameter                | 1.4 mm                                               |
| Test Accuracy               | ±0.01PPM or ±10% of test value, whichever is greater |
| Service Life                | 2 years (in air, -20°C ~ 50°C)                       |
| Operating Voltage           | 3.7V ~ 5.5V                                          |
| Preheat Time                | ≤30 Seconds                                          |
| Response Time               | ≤30 Seconds                                          |
| Recovery Time               | ≤60 Seconds                                          |
| Maximum Allowable Overload  | 50PPM (prolonged overload will damage the sensor)    |

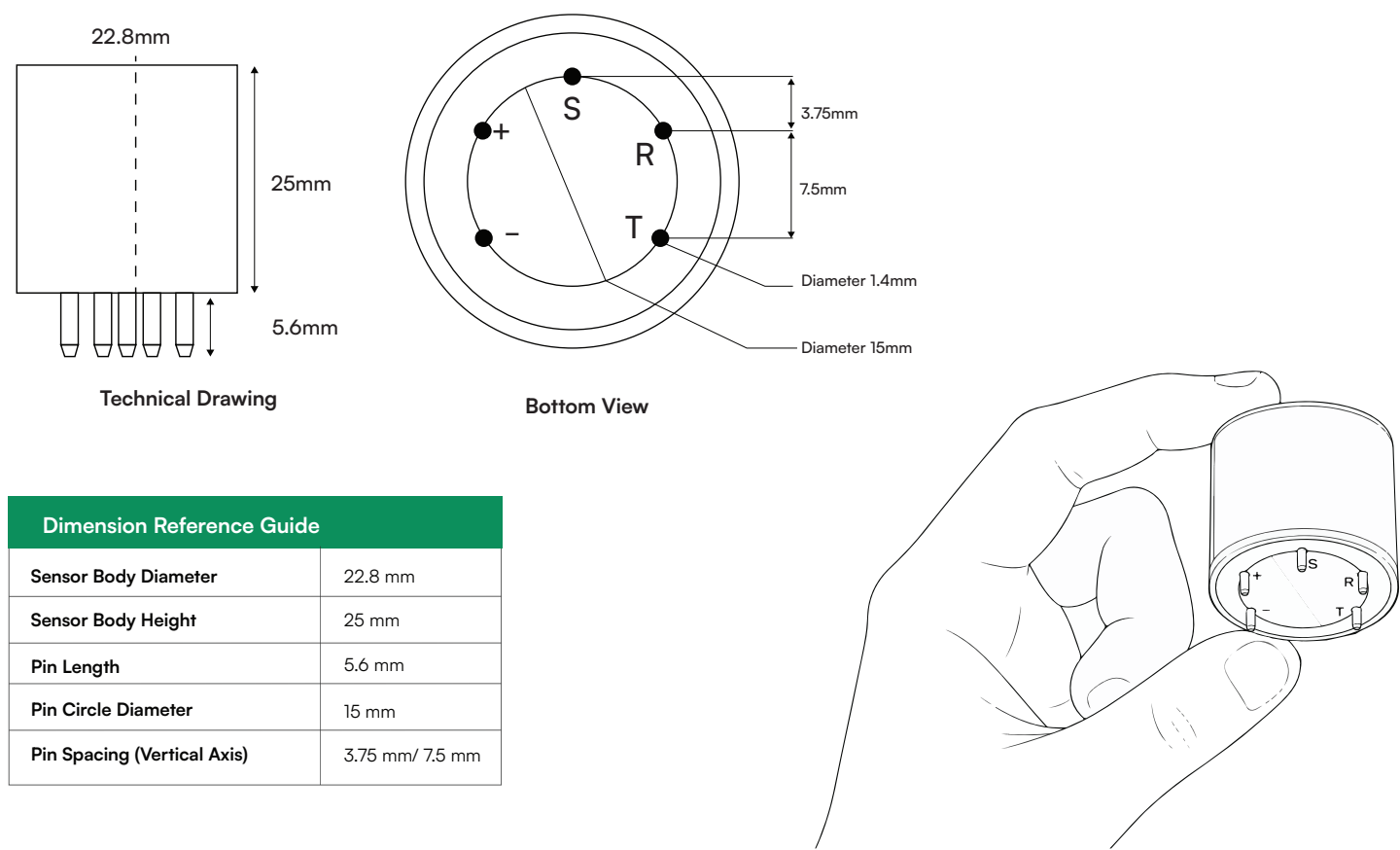
## Pin Configuration & Output

The Sensor Module is equipped with 5 connecting pins.

| Pin Name | Original Label (Diagram) | Description/ Function                                                  |
|----------|--------------------------|------------------------------------------------------------------------|
| +        | Power Positive (+)       | Power Positive (VCC)                                                   |
| -        | Power Negative (-)       | Power Negative (GND)                                                   |
| R        | R : RX (Receive)         | UART Receive Data                                                      |
| T        | T : TX (Transmit)        | UART Transmit Data                                                     |
| S        | S : Calibration pin      | Calibration pin ( <b>Note: Please leave floating/ Do not connect</b> ) |

## Structural Dimensions

The diagram below illustrates the mechanical dimensions and bottom-view pin layout of the sensor.



| Dimension Reference Guide   |                 |
|-----------------------------|-----------------|
| Sensor Body Diameter        | 22.8 mm         |
| Sensor Body Height          | 25 mm           |
| Pin Length                  | 5.6 mm          |
| Pin Circle Diameter         | 15 mm           |
| Pin Spacing (Vertical Axis) | 3.75 mm/ 7.5 mm |

## Communication Protocol

### General Settings

|           |        |
|-----------|--------|
| Baud Rate | 9600   |
| Data Bits | 8 bits |
| Stop Bits | 1 bit  |
| Parity    | None   |

## Communication Commands

Communication is divided into active upload mode and query-response mode. The factory default is active upload, sending a concentration value every 1 second. The active upload data display format is as follows:

Table 5

| Byte0      | Byte1    | Byte2 | Byte3                 | Byte4               | Byte5              | Byte6                | Byte7               | Byte8    |
|------------|----------|-------|-----------------------|---------------------|--------------------|----------------------|---------------------|----------|
| Start byte | Gas name | Unit  | Decimal places (none) | Gas conc. high byte | Gas conc. low byte | Full scale high byte | Full scale low byte | Checksum |
| 0xFF       | 0x12     | 0x04  | 0x00                  | 0x00                | 0x25               | 0x27                 | 0x0F                | 0x25     |

Gas concentration value PPM = (gas concentration high byte x 256 + gas concentration low byte) / 1000

If the user has switched to query-response mode and needs to switch back to active upload mode, send the following command format:

Table 6

| Byte0      | Byte1    | Byte2          | Byte3         | Byte4    | Byte5    | Byte6    | Byte7    | Byte8    |
|------------|----------|----------------|---------------|----------|----------|----------|----------|----------|
| Start byte | Reserved | Switch command | Active upload | Reserved | Reserved | Reserved | Reserved | Checksum |
| 0xFF       | 0x01     | 0x78           | 0x40          | 0x00     | 0x00     | 0x00     | 0x00     | 0x47     |

When the user needs query-response mode, they can turn off active upload by sending the command format below, and then send the read-concentration command. The command format to turn off active upload is as follows:

Table 7

| Byte0      | Byte1    | Byte2          | Byte3          | Byte4    | Byte5    | Byte6    | Byte7    | Byte8    |
|------------|----------|----------------|----------------|----------|----------|----------|----------|----------|
| Start byte | Reserved | Switch command | Query-response | Reserved | Reserved | Reserved | Reserved | Checksum |
| 0xFF       | 0x01     | 0x78           | 0x41           | 0x00     | 0x00     | 0x00     | 0x00     | 0x46     |

In query-response mode, the command format to read the concentration is as follows:

Table 8

| Byte0      | Byte1    | Byte2   | Byte3    | Byte4    | Byte5    | Byte6    | Byte7    | Byte8    |
|------------|----------|---------|----------|----------|----------|----------|----------|----------|
| Start byte | Reserved | Command | Reserved | Reserved | Reserved | Reserved | Reserved | Checksum |
| 0xFF       | 0x01     | 0x86    | 0x00     | 0x00     | 0x00     | 0x00     | 0x00     | 0x79     |

The returned sensor concentration value is in the following display format (same as the active upload format):

Table 9

| Byte0      | Byte1    | Byte2 | Byte3                 | Byte4               | Byte5              | Byte6                | Byte7               | Byte8    |
|------------|----------|-------|-----------------------|---------------------|--------------------|----------------------|---------------------|----------|
| Start byte | Gas name | Unit  | Decimal places (none) | Gas conc. high byte | Gas conc. low byte | Full scale high byte | Full scale low byte | Checksum |
| 0xFF       | 0x12     | 0x04  | 0x00                  | 0x00                | 0x25               | 0x27                 | 0x0F                | 0x25     |

Gas concentration value PPM = (gas concentration high byte x 256 + gas concentration low byte) / 1000

## HEX to Decimal

| H2S     |      |      |
|---------|------|------|
| HEX     | 0xFF | 0x19 |
| Decimal | 255  | 25   |

| O3      |      |      |
|---------|------|------|
| HEX     | 0xFF | 0x11 |
| Decimal | 255  | 17   |

| NO2     |      |      |
|---------|------|------|
| HEX     | 0xFF | 0x12 |
| Decimal | 255  | 18   |

| CO      |      |      |
|---------|------|------|
| HEX     | 0xFF | 0x14 |
| Decimal | 255  | 20   |

| SO2     |      |      |
|---------|------|------|
| HEX     | 0xFF | 0x13 |
| Decimal | 255  | 19   |

| NH3     |      |      |
|---------|------|------|
| HEX     | 0xFF | 0x18 |
| Decimal | 255  | 24   |

| HCHO    |      |      |
|---------|------|------|
| HEX     | 0xFF | 0x17 |
| Decimal | 255  | 23   |

# Checksum Calculation

Checksum = (Bitwise inversion of (Byte1+Byte2+.....+Byte7)) + 1

Reference example code is as follows:

```

/*****
* Function name: unsigned char FucChecksum(uchar *i, uchar ln)
* Description: Sum checksum (sum of protocol elements 1\2\3\4\5\6\7
*   for send/receive, then invert +1)
* Notes: Sum elements 1 through the second-to-last element of the
*   array, then invert and add 1 (array must contain more than 2
*   elements)
*****/

(unsigned char FucChecksum(unsigned char *i, unsigned char ln)

    unsigned char j, tempq = 0;
    i += 1;
    for (j = 0; j < (ln - 2); j++)

        tempq += *i;
    } i++;

    tempq = (~tempq) + 1;
    return (tempq);
}
```

# Cross Sensitivity

|                                           |                            |                               |        |
|-------------------------------------------|----------------------------|-------------------------------|--------|
| O <sub>3</sub> filter capacity (ppm hrs)  | @ 5ppm                     | O <sub>3</sub>                | < -500 |
| H <sub>2</sub> S sensitivity              | % measured gas @ 5ppm      | H <sub>2</sub> S              | < -80  |
| NO sensitivity                            | % measured gas @ 5ppm      | NO                            | <5     |
| Cl <sub>2</sub> sensitivity               | % measured gas @ 5ppm      | Cl <sub>2</sub>               | <100   |
| SO <sub>2</sub> sensitivity               | % measured gas @ 5ppm      | SO <sub>2</sub>               | < -3   |
| CO sensitivity                            | % measured gas @ 5ppm      | CO                            | < -3   |
| C <sub>2</sub> H <sub>4</sub> sensitivity | % measured gas @ 100ppm    | C <sub>2</sub> H <sub>4</sub> | < 0.1  |
| NH <sub>3</sub> sensitivity               | % measured gas @ 20ppm     | NH <sub>3</sub>               | < 0.1  |
| H <sub>2</sub> sensitivity                | % measured gas @ 100ppm    | H <sub>2</sub>                | < 0.1  |
| CO <sub>2</sub> sensitivity               | % measured gas @ 5% volume | CO <sub>2</sub>               | < 0.1  |
| Halothane sensitivity                     | % measured gas @ 100ppm    | Halothane                     | nd     |

## Product Gallery & Modules

The Prana Air sensor ecosystem includes the core electrochemical sensing elements (shown in the protective foam packaging).



Mass Production Trays



Sensor Elements

Disclaimer: The specifications and dimensions provided in this datasheet are based on testing at standard optimal conditions (24°C). Actual performance may vary depending on environmental factors such as humidity, pressure, and integration methods. Prana Air Private Limited reserves the right to modify product specifications without prior notice.

## Precautions

- Electrolyte leakage can cause damage; do not disassemble the sensor without authorization.
- Avoid exposing the sensor to organic solvents (including silicone rubber and other adhesives), paints, chemical agents, oils, and high-concentration gases.
- All electrochemical sensors must not be completely encapsulated with resin materials, nor immersed in an oxygen-free environment, as this will damage the sensor's performance.
- All electrochemical sensors must not be used for extended periods in environments containing corrosive gases, as corrosive gases will damage the sensor.
- Zero-point gas calibration must be performed in a clean atmosphere.
- During sensor testing and application, avoid direct vertical gas intake onto the front of the sensor.
- The gas intake surface of the sensor must not be blocked or contaminated.
- The waterproof, breathable membrane on top of the sensor must never be removed or artificially damaged.
- The sensor must not be subjected to excessive impact or vibration.
- Do not use the sensor if the housing is damaged, deformed, or otherwise compromised.
- After prolonged use in high-concentration gas environments, the sensor will recover to its initial state relatively slowly.
- During storage, the working electrode and counter electrode of the sensor should be kept in a short-circuited state.
- Do not use hot-melt adhesive or sealants with a curing temperature above 80°C to encapsulate the sensor.
- Do not store or use the sensor for extended periods in high-concentration alkaline gas environments.