- **Direct in-situ measurement of NO$_2$, NO, (NO$_X$), CO, Visibility and Temperature**
- **Direct optical measurement of nitrogen dioxide (NO$_2$) using differential absorption**
- **Visibility measurement using accepted light transmission opacity technique**
- **Proven infrared spectroscopy technique for NO & CO measurement**
- **High quality 316 stainless steel construction ensuring a long service life**
- **Pre-aligned quick release TX and RX heads enabling simpler installation and easier maintenance**
- **IP67 rated external enclosure with quick release dust protection tubes**

The VICONOX tunnel monitor is a sing le sensor solution for measuring NO$_2$, NO, (NO$_X$), CO, visibility and temperature within a traffic tunnel, rail tunnel or other confined space.

The VICONOX uses a combination of differential optical absorption and infrared spectroscopy to measure nitrogen dioxide (NO$_2$), nitric oxide (NO) and carbon monoxide (CO) in tunnel atmospheres whilst measuring visibility by using the standard light transmission obscuration technique. NO$_X$ levels are calculated from the measured NO and NO$_2$ concentrations.

The VICONOX also measures temperature and humidity so all measurements are compensated for both factors to ensure stable readings across all conditions.

The VICONOX can measure up to six (6) parameters simultaneously (including temperature) or combinations thereof. This not only minimises capital cost but also minimises the requirements for cabling, installation and start-up.

The VICONOX is available in the following configurations:

| Model | | | | | | |
|-------|-----|-----|-----|-----|-----|------|
|       | Vis | CO  | NO  | NO$_2$ | NO$_X$ | Temp |
| VICONOX-0 | √ |   |   |   |   | √ |
| VICONOX-1 | √ | √ |   |   |   | √ |
| VICONOX-2 | √ | √ | √ |   | √ | √ |
| VICONOX-3 | √ | √ |   | √ |   | √ |
| VICONOX-4 | √ |   | √ | √ | √ | √ |
| VICONOX-5 | √ | √ | √ | √ | √ | √ |

Having been designed specifically for tunnel environments, the VICONOX is of rugged construction using powder coated 316 stainless steel to achieve an IP67 / NEMA 6P protection rating. This instrument can withstand the corrosive atmosphere and regular tunnel washing that the tunnel environment endures.

The VICONOX has been designed for ease of use and to minimise tunnel maintenance by using an automatic zero level calibration function. The instrument also performs detailed self-diagnosis to provide information on any instrument faults as well warnings that should be checked at the next scheduled maintenance. The routine maintenance is typically every 12 months consisting of an instrument check and clean. In the unlikely event of a faulty TX or RX head the use of cable sockets and a quick release mounting, makes it very easy to replace a head.

The VICONOX is an intelligent analyser with on-board industry standard SCADA/PLC interface options, such as 0/2/4…20mA outputs, alarm relay contacts and a choice of serial communications protocols. As such the VICONOX has no need for a control unit although one is available as an option. As a stand-alone instrument the VICONOX is set-up and controlled using the supplied utility software, installed on a PC or laptop and connected via the USB connector on the RX.

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# VICONOX
## Combined CO, NO, NO₂ and Visibility Monitor for Tunnels

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## Specification

**NO₂ Measurement Performance**

| No. | Parameter | Units | Min | Max | Comment |
|-----|-----------|-------|-----|-----|---------|
| 1 | Path Length | m | 5 | 12 | Optimum 10m |
| 2 | Measurement Range | ppm (ppb) | 0 | 10 | User selectable (Option) |
| 3 | Resolution | ppm | | 0.01 | Display resolution |
| 4 | Accuracy | % | -5 | +5 | Of Reading (at 10m path length) |
| 5 | Detection Limit | ppm | | 0.05 | At 10m path length |
| 6 | Damping | s | 1 | 999 | Default setting is 20s |
| 7 | Temperature Stability | ppm | -0.05 | +0.05 | At 10m path length |

**Visibility Measurement Performance**

| No. | Parameter | Units | Min | Max | Comment |
|-----|-----------|-------|-----|-----|---------|
| 8 | Measurement Range | | | | User selectable |
| | Transmission | T | 0 | 1.000 | |
| | Extinction Coefficient (k) | $m^{-1}$ | 0 | 0.1000 | |
| | Meteorological Optical Range (MOR) | m | 0 | 15000 | |
| | Opacity | % | 0 | 100 | |
| | Particulate Density (Dust) | $mg/m^3$ | 0 | 100 | With density scale factor =1.0 |
| 9 | Resolution | | | | Display resolution |
| | Transmission | T | | 0.001 | |
| | Extinction Coefficient (k) | $m^{-1}$ | | 0.0001 | |
| | Meteorological Optical Range (MOR) | m | | 1 | |
| | Opacity | % | | 0.1 | |
| | Particulate Density (Dust) | $mg/m^3$ | | 0.1 | |
| 10 | Accuracy | % | | | |
| | Extinction Coefficient (k) | $m^{-1}$ | -0.0005 | +0.0005 | At 10m path length |
| | Opacity | % | -0.5 | +0.5 | |
| 11 | Damping | s | 1 | 999 | Default setting is 3s |
| 12 | Temperature Stability | | | | |
| | Extinction Coefficient (k) | $m^{-1}$ | -0.001 | +0.001 | At 10m path length |
| | Opacity | % | -1 | +1 | |

**CO/NO (NO$_X$) Measurement Performance**

| No. | Parameter | | Units | Min | Max | Comment |
|-----|-----------|---|-------|-----|-----|---------|
| 13 | Display range | | ppm | 0 | 500 | User selectable |
| 14 | Resolution | | ppm | | 0.1 | Display resolution |
| 15 | Accuracy | CO | % | -5 | +5 | Of Reading |
| | | NO (NO$_X$) | % | -10 | +10 | Instrument calibrated in-situ |
| 16 | Detection Limit | CO | ppm | | 1 | |
| | | NO (NO$_X$) | ppm | | 2 | |
| 17 | Damping | CO | s | 100 | | |
| | | NO (NOX) | s | 200 | | |
| 18 | Temperature Stability | | ppm | -2 | +2 | At 10m path length |

**Temperature Measurement Performance**

| No. | Parameter | Units | Min | Max | Comment |
|-----|-----------|-------|-----|-----|---------|
| 19 | Display range | ºC | -40 | +100 | User selectable |
| 20 | Resolution | ºC | | 0.1 | Display resolution |
| 21 | Accuracy | ºC | -2 | +2 | |

**Power**

| No. | Parameter | Units | Min | Max | Comment |
|-----|-----------|-------|-----|-----|---------|
| 22 | Voltage | Vdc | +24 | | |
| 23 | Voltage Tolerance | % | -10 | +10 | |
| 24 | Nominal Current Consumption | A | | 2 | |
| 25 | Power Up Current Consumption | A | | 3 | |

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**Interface Options**

| | | | | | |
|---|---|---|---|---|---|
| 26 | Serial outputs | | | | ModBus RTU via RS485<br>External USB (RX) |
| 27 | Analogue Outputs (four) | mA | 0 / 2 / 4 | 20 | Isolated and scalable (user selected) |
| 28 | Digital Relay Contacts (five) | A | 0 | 3 | @30Vdc (signal levels and data valid) |

**Physical**

| | | | | | |
|---|---|---|---|---|---|
| 29 | Ingress Protection | | | IP67 | |
| 30 | Operating Temperature | °C | -20 | +55 | |
| 31 | Operating Humidity | % | | 100 | |
| 32 | Materials | | | | Stainless Steel (powder coated) |
| 33 | Dimensions | mm | 180 x 210 x 200 | | Each head (without sight tubes) |
| 34 | Weight | kg | | 5.3 | Each head |

**Compliance & Design**

| | | | | | |
|---|---|---|---|---|---|
| 35 | Regulatory Compliance | | | | 2014/30/EU (Electromagnetic Radiation)<br>2014/35/EU (Low Voltage) |
| 36 | Design Life | Years | 20 | | |
| 37 | MTBF | Years | >10 | | |
| 38 | Warranty | Months | 24 | | Return to base warranty. Extensions available. |

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## Installation Overview



Scope of Supply table:

| | |
|---|---|
| TX Head | Tunnel Sensors |
| RX Head | Tunnel Sensors |
| TX/RX Interconnect Cable | Tunnel Sensors (13m) |
| Power / Comms Cable | Tunnel Sensors (2m) |
| Outputs Cable | Tunnel Sensors (2m) |
| USB Cable | Customer |
| Laptop PC | Customer |
| PC Software | Tunnel Sensors |

Diagram labels: 24Vdc, ModBus RTU, 0/2/4...20mA Analogue Outputs (x5), Digital Relay Contacts (x5), Power / Comms Cable, Outputs Cable, RX, USB, TX/RX Interconnect Cable, Optimum Separation = 10m, Traffic Direction, TX

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## Dimensions RX Head (mm)
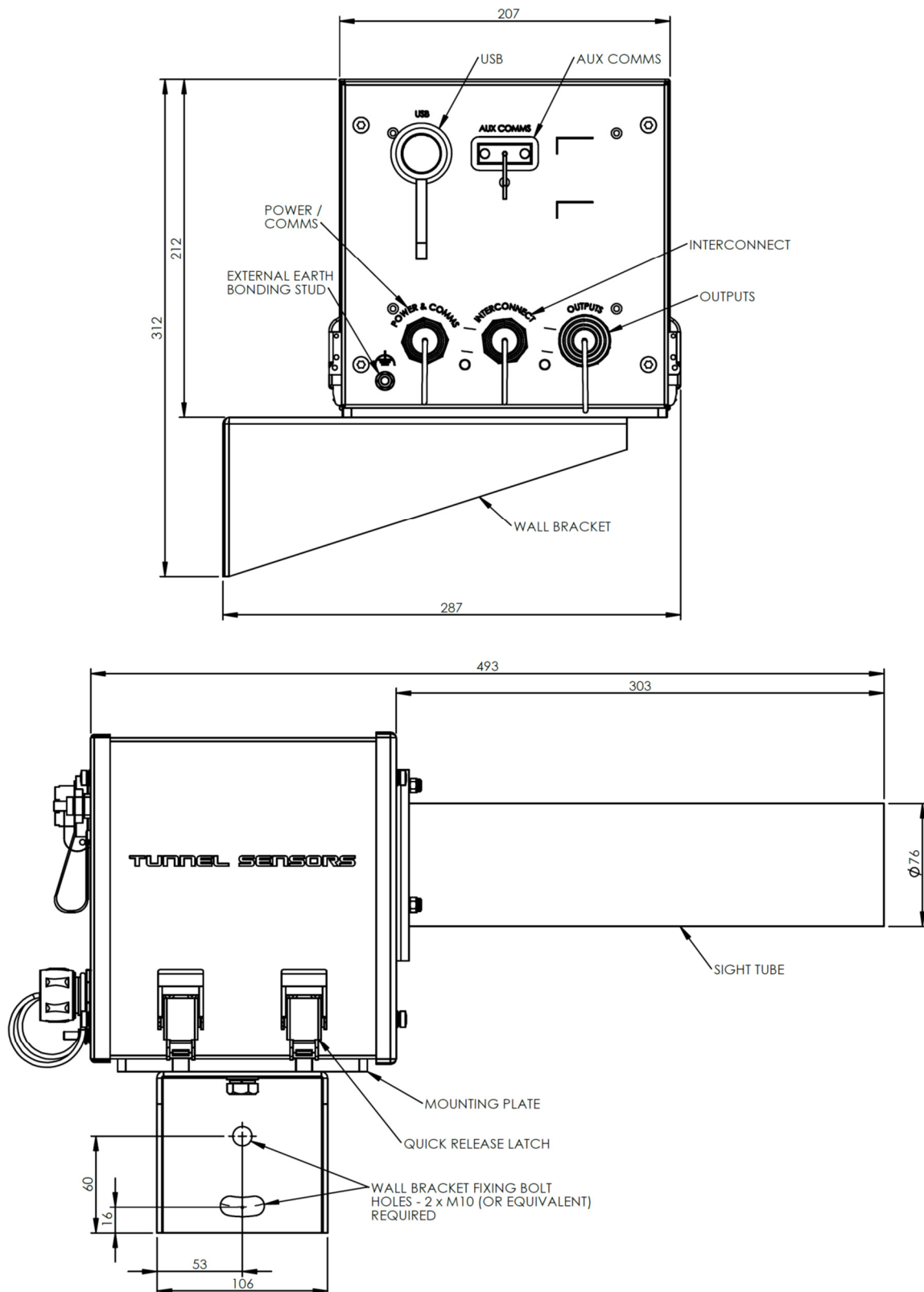
207

USB

AUX COMMS

212

312

POWER / COMMS

EXTERNAL EARTH BONDING STUD

INTERCONNECT

OUTPUTS

POWER & COMMS

INTERCONNECT

OUTPUTS

WALL BRACKET

287

493

303

Ø76

TUNNEL SENSORS

SIGHT TUBE

MOUNTING PLATE

QUICK RELEASE LATCH

60

16

WALL BRACKET FIXING BOLT
HOLES - 2 x M10 (OR EQUIVALENT)
REQUIRED

53

106

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## Options & Accessories

| Description | Order Code | Notes |
|---|---|---|
| VICONOX Instrument | TSL-VICONOX-0<br>TSL-VICONOX-1<br>TSL-VICONOX-2<br>TSL-VICONOX-3<br>TSL-VICONOX-4<br>TSL-VICONOX-5 | All include:<br>TX head & RX head with sight tubes;<br>13m interconnecting cable;<br>2 off wall brackets;<br>2m power / comms cable;<br>2m outputs cable. |
| Cable | CBL-098<br>CBL-099 | 7-core screened LSHZ cable<br>20-core screened LSHZ cable |
| Cable Assemblies | CBL-103<br>CBL-104<br>CBL-105<br>CBL-106<br>CBL-158<br>CBL-192 | Power / comms cable – 10m length<br>Outputs cable – 10m length<br>Power / comms cable – 20m length<br>Outputs cable -20m length<br>Interconnecting cable – 20m length<br>Interconnecting cable – 15m length |
| Combined Termination Unit | TSL-CTU | Local cable termination unit for VICONOX electrical connections, based on a choice of DIN rail terminals – see separate datasheet for details. |
| | TSL-CTU-P | Local termination unit with integral 24V PSU for VICONOX electrical connections, based on a choice of DIN rail terminals and a 75W PSU - see separate datasheet for details. |
| Large Combined Termination Unit | TSL-CTU-L1 | Large local termination unit for VICONOX electrical connections, with circuit board mounted two-part terminals – see separate datasheet for details. |
| | TSL-CTU-L1-P | Large local termination unit with integral 24V PSU for VICONOX electrical connections, with circuit board mounted two-part terminals and a 75W PSU - see separate datasheet for details. |
| Audit Filter Kit | TSL-VX-AFK-0 | Audit kit including optical filters and optical filter holder necessary for calibration checking VICONOX-0 |
| | TSL-VX-AFK-1 | Audit kit including optical filters, optical filter holder, and gas filled check cell necessary for calibration checking VICONOX-1 |
| | TSL-VX-AFK-2 | Audit kit including optical filters, optical filter holder, and gas filled check cell necessary for calibration checking VICONOX-2 |

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| | | |
|---|---|---|
| | TSL-VX-AFK-3 | Audit kit including optical filters, optical filter holder, and gas filled check cell necessary for calibration checking VICONOX-3 |
| | TSL-VX-AFK-4 | Audit kit including optical filters, optical filter holder, and gas filled check cell necessary for calibration checking VICONOX-4 |
| | TSL-VX-AFK-5 | Audit kit including optical filters, optical filter holder, and gas filled check cell necessary for calibration checking VICONOX-5 |

Note that the actual part may differ from the above representative pictures.