## IR-TuCAN Infrared Tire Tracking Temperature Sensor

The IR-TuCAN tire tracking temperature sensor is a CAN based standalone multichannel infrared sensor featuring a first-of-its-kind thermal-zone algorithm to continuously track the tire through steering and suspension motion.

The sensor utilizes a 16x12 thermal imager with a maximum measurement range of -20°C to 300°C and a 120° field of view (FOV). The output frequency is user adjustable up to a max of 64hz.

With a wide input voltage range, the sensor can be wired directly to the vehicle's 12V system. Data output is achieved via either CAN 2.0 or CAN-FD protocols. The enclosure is IP66 rated* and features an integral connector.

**Tire Tracking:** An onboard algorithm is used to track the tire edges as it moves with the suspension and steering. 7 equal spaced zones across the tire are sampled and their temperatures output. If the tire moves outside of the camera's FOV, the output will be clipped to the edge of the sensor's FOV. This active tire tracking makes data analysis a breeze, as the measurement zones always fall on the same physical location on the tire.

**Thermal Video Mode:** In this mode the sensor acts as a traditional thermal imager, outputting the temperature at each pixel. NOTE: this full frame output can be enabled alongside the tire tracking mode if desired. NOTE: due to the raw amount of data that can be output with this mode enabled, it is not recommended to use this mode either with a compatible CAN-FD bus or keep the output frequency low to avoid overloading your CAN bus.

**Configuration GUI:** The IR-TuCAN configuration GUI can be used to update the various sensor parameters and settings as well as view the outputs of up to 4 sensors at a time (a compatible CAN dongle is needed to use the GUI).

## Specifications

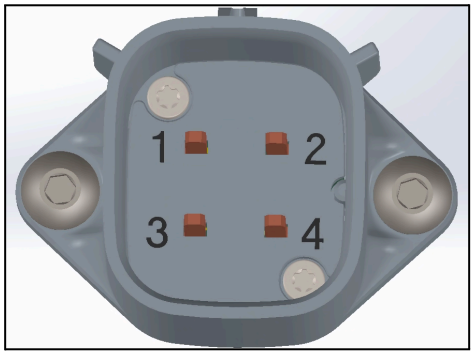
| **Sensor** | |
|---|---|
| Sensor Measurement Range (Raw Sensor Range) | -40°C to 300°C |
| Sensor Measurement Range (Default CAN Output) | -40°C to 215°C |
| Temperature Output Frequency | 1-64 Hz (user configurable) |
| Communication Protocol | CAN 2.0 and CAN FD (user configurable) |
| Field of View (horizontal) | 110° |
| Field of View (vertical) | 75° |
| Accuracy (center of sensor FOV) | ± 1°C |
| Accuracy (edge of sensor FOV) | ± 2°C |
| Ambient Temperature Tolerance | -40 to 85°C |
| Additional Features | Sensor ambient temperature reporting |

| Electrical | |
|---|---|
| Supply Voltage Range | 6 to 36 V |
| Supply Current (Typical) | 20mA |
| Additional Features | Reverse polarity protection |

| Mechanical | |
|---|---|
| Mass | 7g (without mating connector installed) |
| Protection Rating* | IP66 |
| Mating Connector Part Numbers** | Housing: Molex 0194180018<br>Contacts: Molex 0330012005 |

*With a mating connector installed.
**Mating housing and contacts Included with sensor.

## Pinout




Pin 1: CAN Low
Pin 2: VIN (6-36V)
Pin 3: Can High
Pin 4: GND

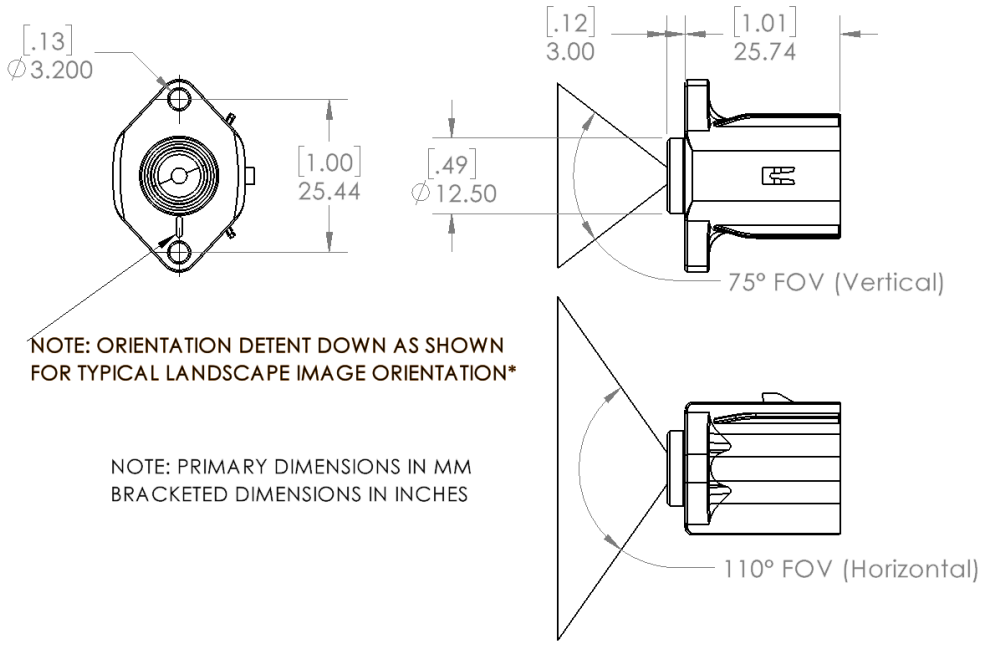
## Distance vs Sensing Width

| Distance From Face of Sensor | Sensing Width* |
|---|---|
| 20mm | 57mm |
| 40mm | 114mm |
| 60mm | 171mm |
| 80mm | 228mm |
| 100mm | 286mm |
| 120mm | 343mm |
| 140mm | 400mm |
| 160mm | 457mm |

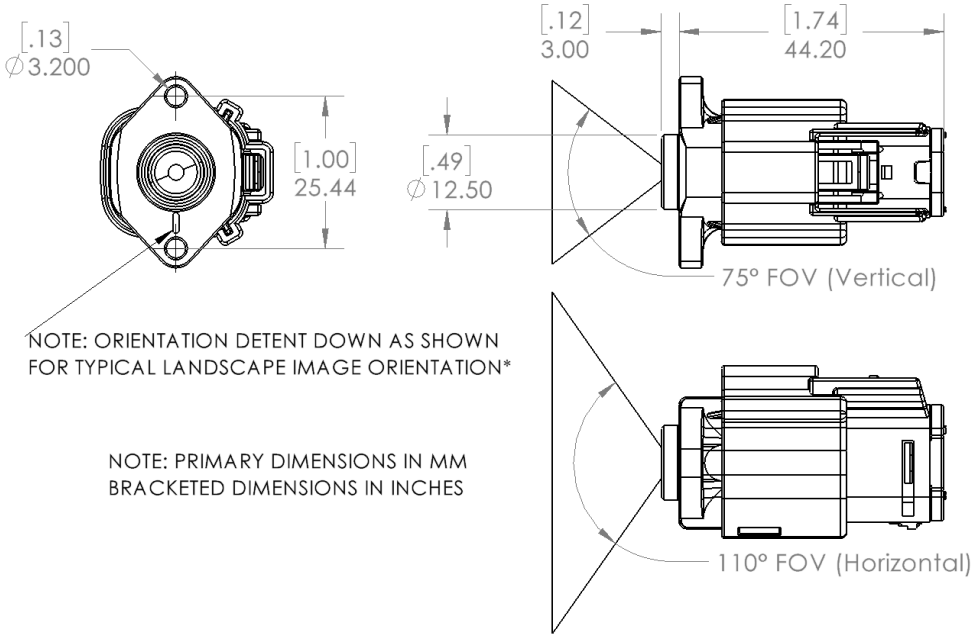
*The field of view is recommended to be 30% larger than the tire width, when suspension is at the maximum compression.

## Dimensions ...

Without Mating Connector




With Mating Connector




*For typical orientation, when the sensor is mounted above the tire, the orientation detent in the housing should be pointing towards the rear of the vehicle. This way, the output zones of the sensor (Zone1-7) will read left to right across the tire when viewed from above

## CAN Message Description

Can message IDs are indexed from a unique BASE_ID per sensor.

| **Default BASE_ID** | |
|---|---|
| Front Left | 0x350 |
| Front Right | 0x370 |
| Rear Left | 0x390 |
| Rear Right | 0x3A0 |

| **Message Overview** | |
|---|---|
| BASE - 2 ** | RESERVED for flashing |
| BASE - 1 ** | RESERVED for flashing |
| BASE + 0 | 7 zones plus status flags |
| BASE + 1 | Sensor configuration |
| BASE + 2 | Tracking information (default disabled) |
| BASE + 3 through BASE + 26 * | Video (default disabled)*** |

*When using CAN FD mode, video is only BASE+3 through BASE+5
**Sensor does not respond on these IDs under normal operation
***Disabled by default, can be enabled in the programming GUI

### **Base ID + 0:** Core Signals (sensor to bus)

| **Byte 0** | **Byte 1** | **Byte 2** | **Byte 3** | **Byte 4** | **Byte 5** | **Byte 6** | **Byte 7** |
|---|---|---|---|---|---|---|---|
| zone 1 temp* | zone 2 temp* | zone 3 temp* | zone 4 temp* | zone 5 temp* | zone 6 temp* | zone 7 temp* | status |

*Temperature in degrees celsius + 40 format, effective range -40 to 215

### **Base ID + 1:** Sensor Configuration (unidirectional)

| **Byte 0** | **Byte 1** | **Byte 2** |
|---|---|---|
| bits [6:7]: config type<br>bits [0:5]: payload length in bytes<br><br>type = 0: get memory<br>type = 1: temporary set memory*<br>type = 2: reserved<br>type = 3: reset memory | memory offset (LSB) | memory offset (MSB) |

*Used by GUI for live sensor configuration preview communication. Interaction not required.*

## **Base ID + 2:** Tracking Metadata (sensor to bus) - *default disabled*

| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byte 7 |
|---|---|---|---|---|---|---|---|
| left edge top index | left edge bottom index | right edge top index | right edge bottom index | sensor ambient temperature* | reserved | reserved | reserved |

*temperature in degrees celsius + 40 format, effective range -40 to 215

## **Base ID +3 through +26:** Video (sensor to bus)** - *default disabled*

| Byte 0 | Byte 1 | Byte 2 | Byte 3 | Byte 4 | Byte 5 | Byte 6 | Byte 7 |
|---|---|---|---|---|---|---|---|
| pixel n+0 temp* | pixel n+1 temp* | pixel n+2 temp* | pixel n+3 temp* | pixel n+4 temp* | pixel n+5 temp* | pixel n+6 temp* | pixel n+7 temp* |

*Temperature in degrees celsius + 40 format, effective range -40 to 215

**When sensor is configured to CAN FD operation, messages are 64 bytes in length

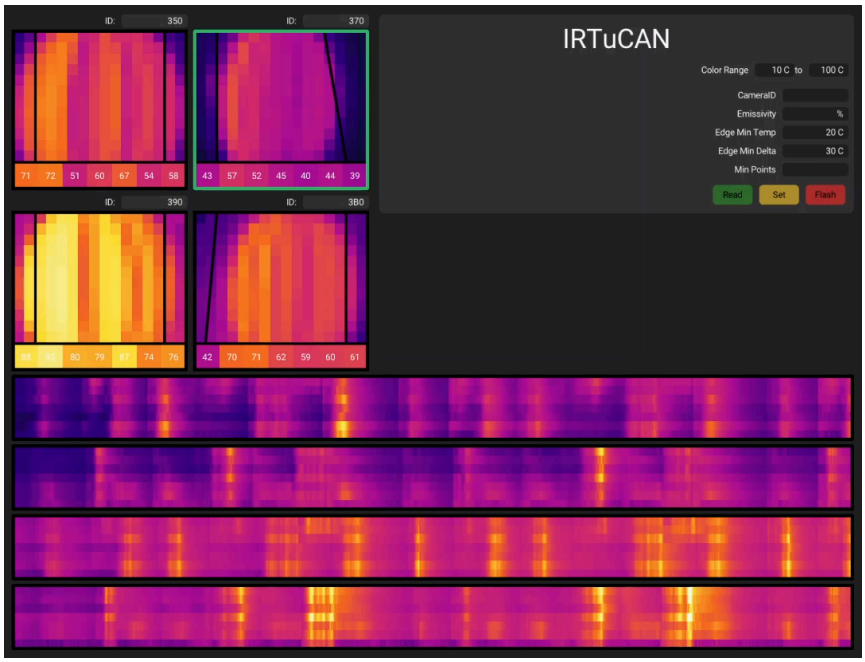
Each video frame is 192 bytes, streamed on sequential can messages. A total of 24 IDs are used for CAN 2.0 operation, and 3 IDs are used in CAN FD operation.

## Programming GUI

The included Programming GUI provides real-time visualization and configuration of the sensor for:

- Previewing temperature video
- Monitoring zone history
- Adjusting all sensor parameters
- Viewing tire zones and edge tracking

Communication with the device is handled exclusively over CAN.



## Typical Application Example Install ...

Front*

Rear**

*Front Left sensor installed directly over the top of the tire with orientation detent toward the rear of the vehicle. Sensor installed at ~112mm above the static loaded tire surface (245mm section width tire) (this makes the sensing width zone 30% wider than the tire itself). For front tires, the sensor should be installed as directly above the tire as possible to ensure the tire is within the sensor viewing range throughout the steering travel.

**Rear Left sensor installed more ahead of the tire (orientation detent again towards the rear of the vehicle). This is possible for the rears as steering is not a concern.