



USER MANUAL

Ecumaster CAN Thermal Camera

Document version: 1.0

Firmware version 12.3 or later

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Contents

- 1. Device description.....3
- 2. Specification..... 3
- 3. Installation..... 5
- 4. PC connection.....6
- 5. Light Client description..... 7
- 6. CAN stream..... 9
- 7. Document history..... 10

1. Device description

The CAN Thermal Camera is designed to measure the temperature of objects at multiple points using infrared waves and transmit this data over a CAN bus. Its primary use is to measure the temperature of tires or brake discs across 16 different points along their width. The device can measure the temperature of almost any object, but emissivity must be considered.

Two versions of the camera are available: the **Tire Temp Camera** and the **Brake Disc Temp Camera**. The key differences between these versions are their temperature measurement ranges and fields of view. Any differences in operation, configuration, or installation between the two versions are clearly outlined in the device manual.

Key Features:

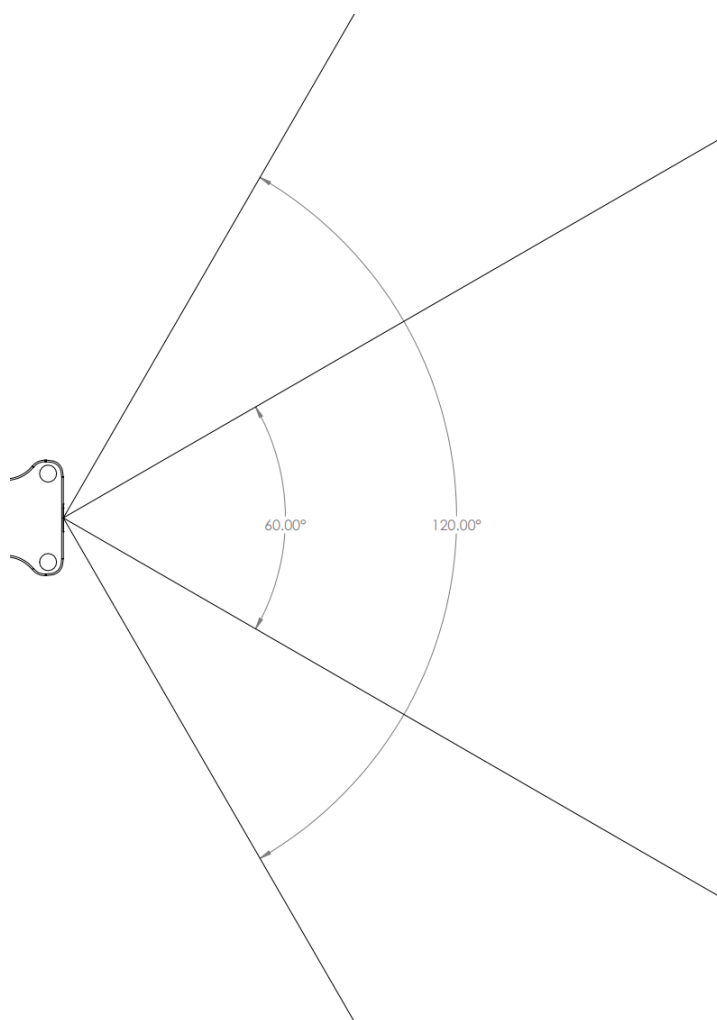
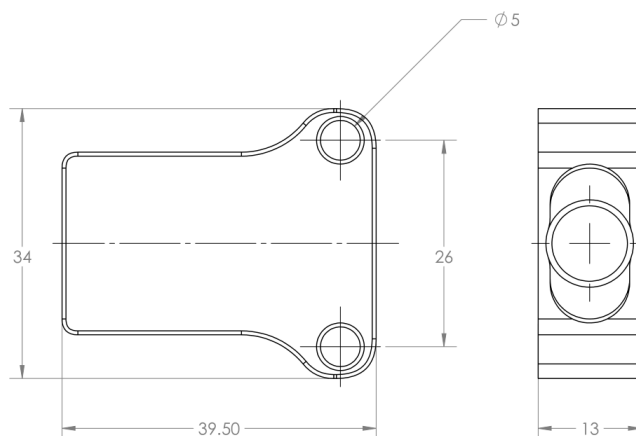
- Measures temperatures at 16 points along the width of the object.
- Utilizes infrared waves for precise surface temperature readings.
- Sends temperature data over a CAN bus network.
- Available in two versions tailored for tire and brake disc temperature measurements.

2. Specification

| Specification | |
|-----------------------------|--|
| Operating supply voltage | 6-22V, immunity to transients according to ISO 7637 |
| Reverse polarity protection | Yes, internal up to 16V |
| Operating temperature range | -40 to +85°C |
| Enclosure | IP67, bespoke CNC machined aluminium |
| Size and weight | 40x34x13mm (case), 46g (with harness) |
| Connector | Deutsch DTM04-4P |
| CAN bus bitrate | 1Mbps (default), 500kbps, 250kbps, 125kbps |
| CAN termination | None |
| PC communication | Using USB to CAN interface (Ecumaster USBtoCAN, Peak, Kvaser) |
| Measurement points | 16 |
| Measurement frequency | 5 Hz |

| | |
|----------------------------|--|
| Measured temperature range | 0 – 255 °C (Tire Temp) 0 – 1020 °C (Brake Temp) |
| Field of view | 120° x 25° (horizontal, vertical) - Tire Temp 60° x 25° (horizontal, vertical) - Brake Temp |

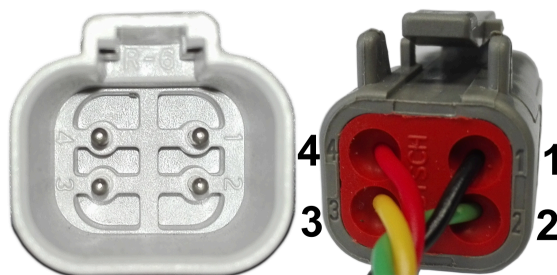
All dimensions in mm



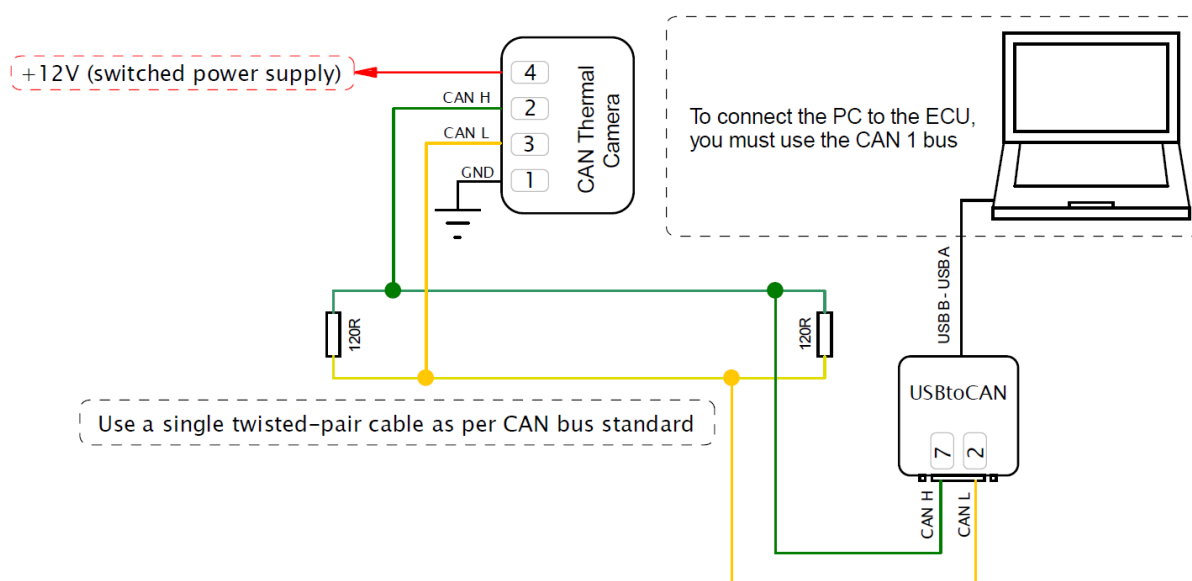
3. Installation

Pinout

| Pin | Description |
|-----|-------------|
| 1 | Ground |
| 2 | CAN High |
| 3 | CAN Low |
| 4 | +12V |



Wiring diagram



Device placement

On the housing of the camera, there is a round indentation on one side, indicating the direction of the first measurement point.



When using the device to measure tire temperature, it is recommended to position it in front of or above the wheel to minimize the possibility of debris hitting the sensor.

If the sensor is mounted in front of the steered wheel it has to steer with it. To achieve this, the sensor should be attached to an arm connected to the knuckle, ensuring synchronized movement with the wheel.

If it is not possible to mount the sensor in front of the wheel, it should be positioned above the wheel.

Mounting Distance Calculation

The following equations can be used to calculate the optimal mounting distance for the sensor from the tire or brake disc surface, depending on the measurement type and field of view:

- **Tire Temperature Measurement** (120° field of view):

$$\text{Distance} = \frac{\text{Tire width}}{3.4641}$$

- **Brake Temperature Measurement** (60° field of view):

$$\text{Distance} = \frac{\text{Brake disc width}}{1.1547}$$

The tire or brake disc width can be measured in either millimeters or inches, and the resulting distance will be in the same unit.

4. PC connection

Communication with the PC software is done via CAN bus, which requires a special interface to convert CAN bus communication to USB 2.0. This interface is an independent device and must be purchased separately.

Supported interfaces:

- Ecumaster USBtoCAN (driver and manual: <https://www.ecumaster.com/products/usb-to-can/>)
- Peak System
- Kvaser

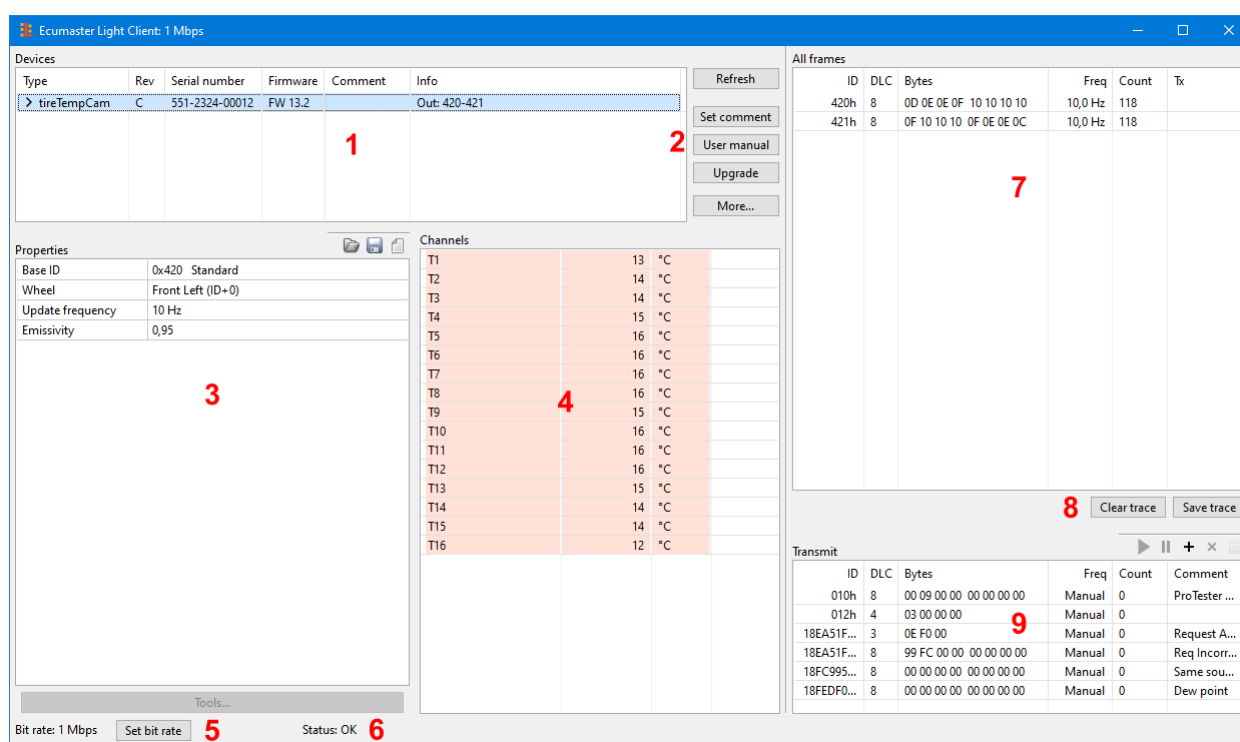
5. Light Client description

Ecumaster Light Client is the configuration software for many Ecumaster products and also serves as a tool for CAN bus monitoring.

Light Client can be used to check available devices on the CAN bus, display channel values, change CAN bus bitrate, and modify device specific properties. CAN bus monitoring is made possible through a list of frames grouped by ID, the ability to save traffic trace files, and the option to send custom messages on the CAN bus.

The software and manual can be downloaded from: <https://www.ecumaster.com/products/light-client/>.

Light Client with TireTempCamera connected:



User interface description:

1. List of the devices available on the CAN bus. General information about the device. Double click a row to select the device and display its channels and properties.
2. Device control buttons:
 - Refresh – refresh the list of the devices
 - Set comment – set a comment for the device
 - User manual – go to the online user manual
 - Restore – restore the device to default settings
 - Upgrade – upgrade the device firmware, either online or using a local file

3. List of properties for the device
4. List of channels sent over the CAN bus
5. Button for changing bit rate of all devices compatible with Light Client
6. CAN bus status information
7. List of received frames on the CAN bus, grouped by ID
8. Clear trace button removes all received frames from history and Save trace button saves that history to a text file
9. Transmit window allows you to set custom frames to be sent over the CAN bus

Properties

Device properties can be changed using the Ecumaster Light Client software and the connection interface. Each setting is described below:

| Parameter | Description |
|------------------|--|
| Base ID | The base CAN ID for output data |
| Wheel | <p>Wheel selection offsets Base ID:</p> <ul style="list-style-type: none">• Front Left (Base ID + 0)• Front Right (Base ID + 2)• Rear Left (Base ID + 4)• Rear Right (Base ID + 6) <p>When you purchase a set of 4 cameras, they are preconfigured and labeled with stickers: FL, FR, RL, and RR. Each camera is set with the correct Wheel ID.</p> |
| Update frequency | Update frequency of the CAN output data |
| Emissivity | <p>Emissivity represents how much infrared radiation a surface emits (range: 0.0–1.0).</p> <p>Different materials have different emissivity values. For example, tires typically have an emissivity of 0.97. You can adjust this setting to calibrate the sensor for maximum accuracy.</p> <p>To calibrate, heat the tire or brake disc, measure it with a thermometer, and adjust the emissivity until the camera shows the same temperature.</p> |

Channels

Channels represent different data values sent over the CAN bus. These channels are transmitted as raw values, meaning that obtaining a value with the correct unit requires some calculations.

$$Value[unit] = \frac{Value[raw] * Multiplier}{Divider} + Offset$$

| Channel | Description |
|------------------|---|
| TX ¹⁾ | Temperature of point X in degrees Celsius |

¹⁾ X is temperature point from 1 to 16

6. CAN stream

The tables below describe how each channel is positioned within CAN frames and how to obtain the correct values.

| Byte | Channel | Data type | Range | Multiplier | Divider | Offset | Unit |
|--|---------|---------------|-------|--------------------|---------|--------|------|
| Base ID + Wheel Offset (default: 0x420 + [0, 2, 4, 6]) | | | | | | | |
| 0 | T1 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| 1 | T2 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| 2 | T3 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| 3 | T4 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| 4 | T5 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| 5 | T6 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| 6 | T7 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| 7 | T8 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| Base ID+1 + Wheel Offset (default: 0x421 + [0, 2, 4, 6]) | | | | | | | |
| 0 | T9 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| 1 | T10 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| 2 | T11 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| 3 | T12 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| 4 | T13 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| 5 | T14 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |

| Byte | Channel | Data type | Range | Multiplier | Divider | Offset | Unit |
|------|---------|---------------|-------|--------------------|---------|--------|------|
| 6 | T15 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |
| 7 | T16 | 8bit unsigned | 0-255 | 1 (4) [*] | 1 | 0 | °C |

* 1 – the multiplier for tire temperature;

4 – the multiplier for brake temperature

7. Document history

| Revision | Date | Changes |
|----------|------------|---|
| 0.1 | 2019.03.22 | Initial release |
| 0.2 | 2019.04.12 | Added Light Client description |
| 1.0 | 2025.04.01 | Document layout updated to follow the Ecumaster standard format The structure and text have been refined and improved for better readability and clarity |