

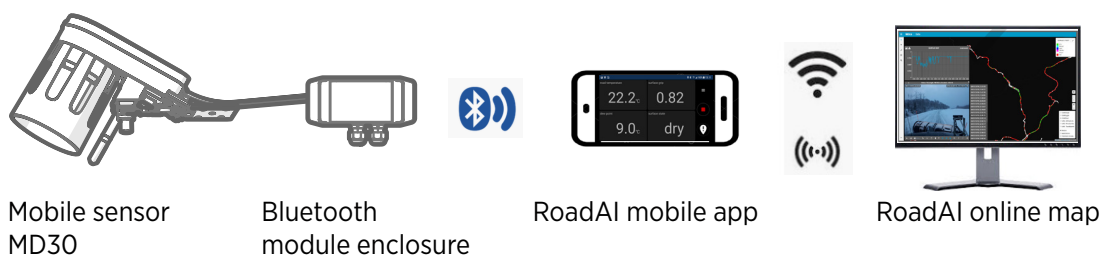
# Setup Guide

## Installation and Calibration Vaisala Mobile Detector MD30

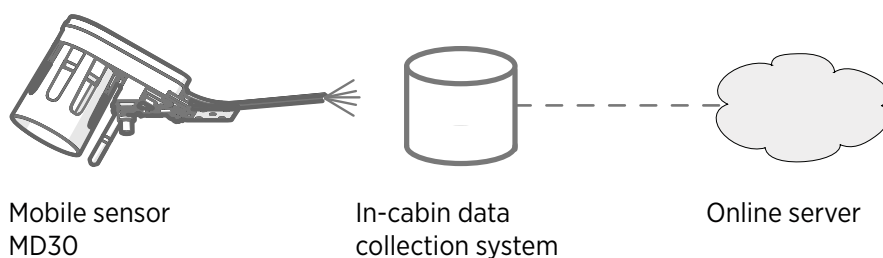
### System overview

This document instructs MD30 mobile sensor installation for the RoadAI systems and the other data collection systems.

#### MD30 and Vaisala RoadAI system



#### MD30 and other data collection system



Other MD30 instructions include:

1. *Vaisala Mobile Detector MD30 Product and Package Description Reference Guide*
2. *Vaisala Mobile Detector MD30 Maintenance and Troubleshooting Reference Guide*

For RoadAI system:

1. RoadAI provisioning setup
2. RoadAI with MD30 Usage Instructions (available in the Help section of RoadAI online map)

For other data collection system:

1. *Vaisala Mobile Detector MD30 Interface Description*



Hand tools not supplied by Vaisala. For more information, see *Vaisala Mobile Detector MD30 Product and Package Description Reference Guide*.



If you have trouble setting up MD30, see *Vaisala Mobile Detector MD30 Maintenance and Troubleshooting Reference Guide* and <https://www.vaisala.com/en/support/md30>.



PUBLISHED BY  
Vaisala Oyj  
Vanha Nurmiyarventie 21  
FI-01670 Vantaa, Finland  
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# VAISALA

# Installation location

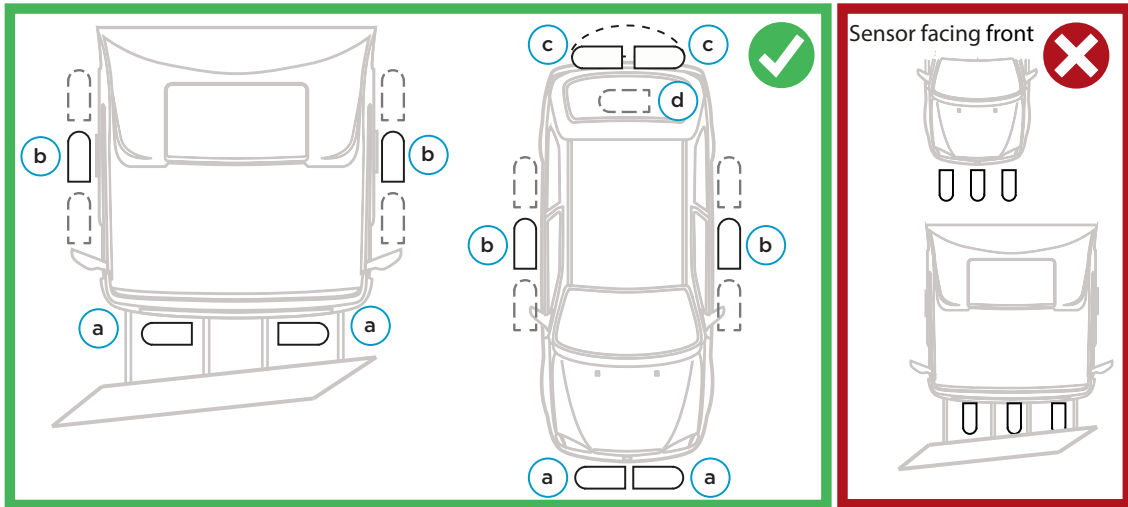


Table 1 Sensor location on vehicle

		a	b	c	d
Installation position suitability for measurements		Front of vehicle (behind plow)	Side of vehicle	Back of vehicle	Under vehicle
X <sub>s</sub>	Surface state	++	++	+	++
T <sub>s</sub>	Surface temperature	++	++	+	+++
T <sub>a</sub>	Air temperature	++	+	--	--
T <sub>d</sub>	Dew point and frost point temperature	++	+	-	-
RH	Relative humidity	++	+	--	--

**i** Install the mobile sensor outside the vehicle. Install the mobile device (phone or tablet), Bluetooth module, and other equipment and accessories inside the vehicle.

**i** You can detach the surface temperature sensor and air temperature and humidity sensor and install them separately if needed. See [Mounting temperature sensors separately \(with optional accessory kit\) \(page 4\)](#).

**i** Depending on the vehicle, you may need to use a custom installation extension.

**i** Make sure that air can flow freely through the hood. This helps to keep the hood clean.

# Mounting MD30 on vehicle

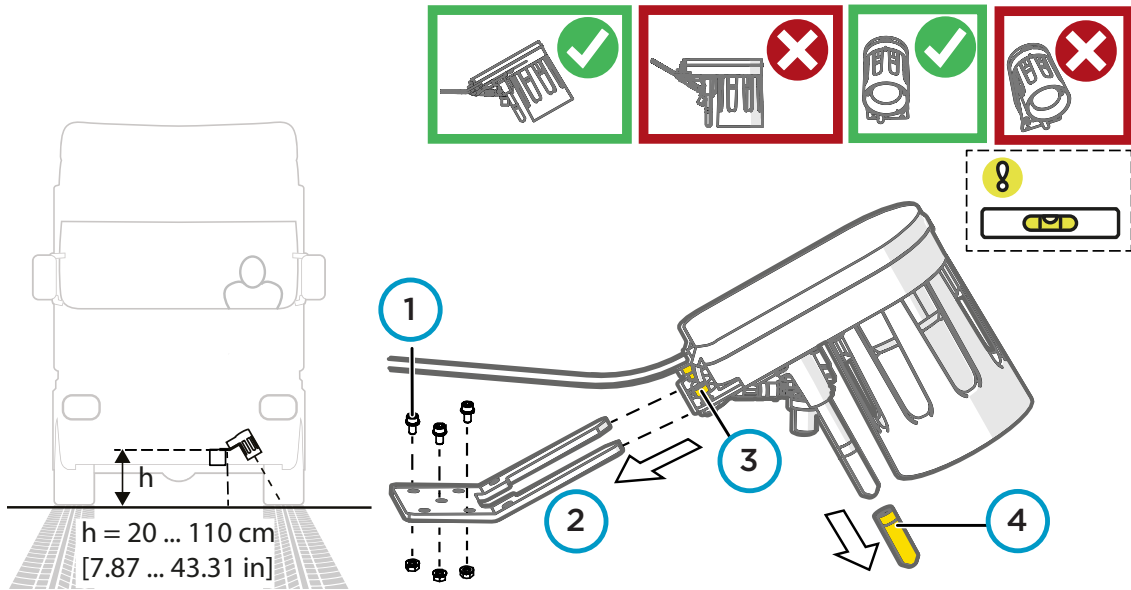
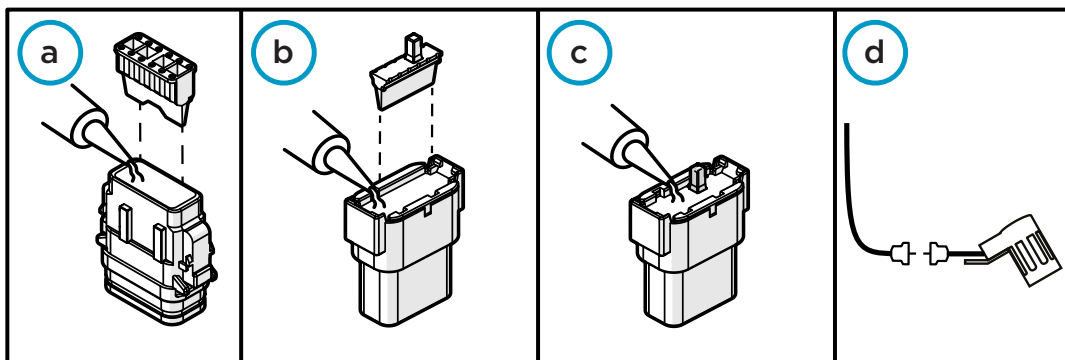


Figure 1 Mounting height and angle

- ▶ 1. Fix with M6 × 25 mm screws (min. 3 pcs).
2. Push the sensor to the bracket.
3. Tighten the screws (2 pcs).
4. Remove the cover.
5. To finalize the mounting, apply electric joint compound to the connector between the mobile sensor and 8-m extension cable.

**i** To order electric joint compound (12475SP), see *Vaisala Mobile Detector MD30 Maintenance and Troubleshooting Reference Guide*.

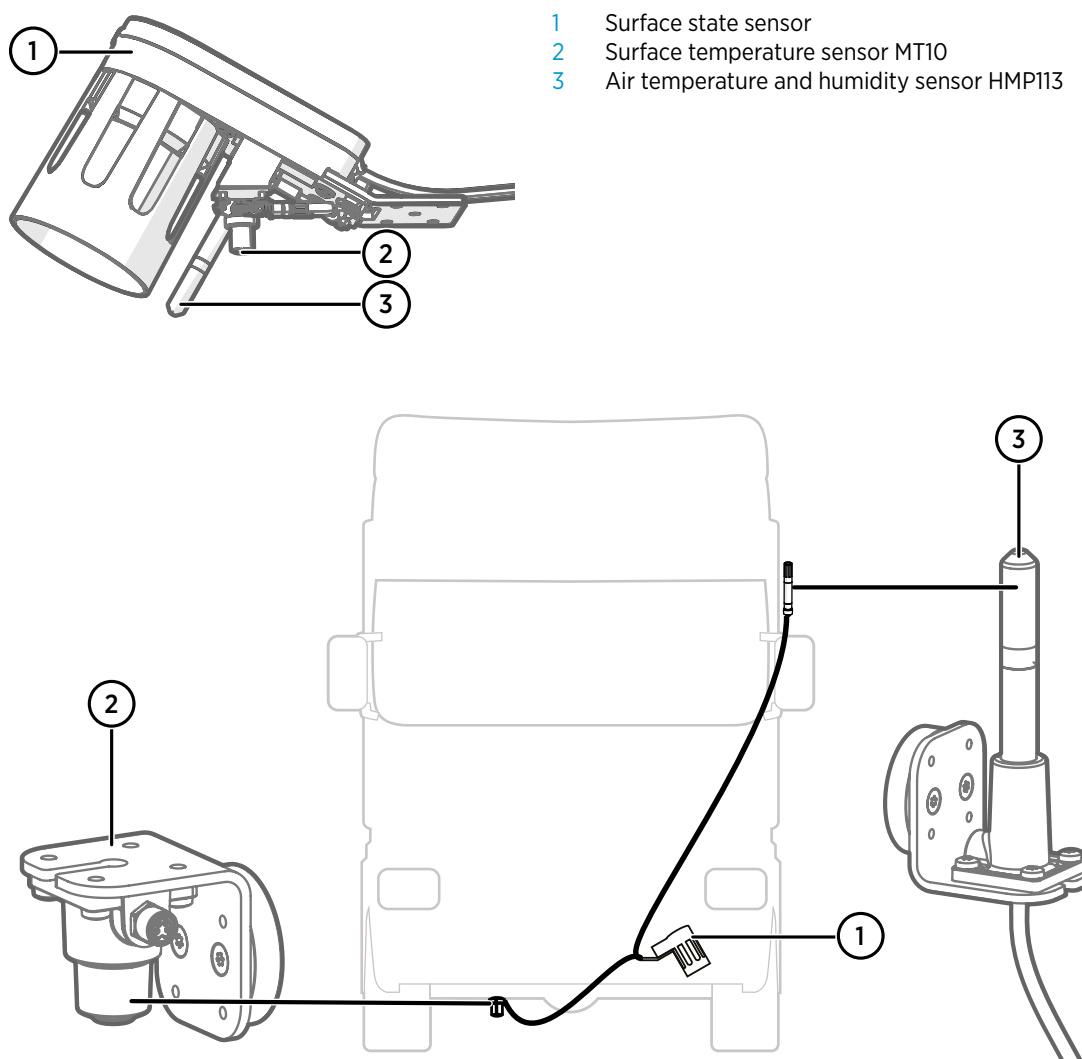


- a. Use pliers to remove the orange part from the male connector, apply electric joint compound, and insert the orange part back.
- b. Repeat for the female connector.
- c. Apply electric joint compound on top of the female connector.
- d. Connect the 8-m (26-ft) extension cable to the mobile sensor.

## Mounting temperature sensors separately (with optional accessory kit)

Install one of the temperature sensors or both separately. Recommendations for optimal performance:

- HMP113: mount to a location with good air flow and away from heat sources such as car engine.
- MT10: mount under the vehicle and away from heat sources, reflections from sky, and sunlight.



For installation details, see *Mounting Temperature Sensors Separately Installation Guide*.



To order relevant accessories (MD30EXTSET), see *Vaisala Mobile Detector MD30 Maintenance and Troubleshooting Reference Guide*.

# Cabling and Calibration

To complete the MD30 installation, perform the listed steps based on your system type.

## Instructions for RoadAI systems

If you are using MD30 through a mobile device (RoadAI), continue with the following instructions in this order:

- [Cabling Bluetooth module enclosure \(page 6\)](#)
- [Pairing Bluetooth module \(page 7\)](#)
- [Calibration step 1: window cleaning \(page 9\)](#)
- [Calibration step 2: plate reference \(page 10\)](#)
- [Calibration step 3: dry road reference \(page 12\)](#)
- [Verifying RoadAI operation \(page 14\)](#)

## Instructions for other data collection systems

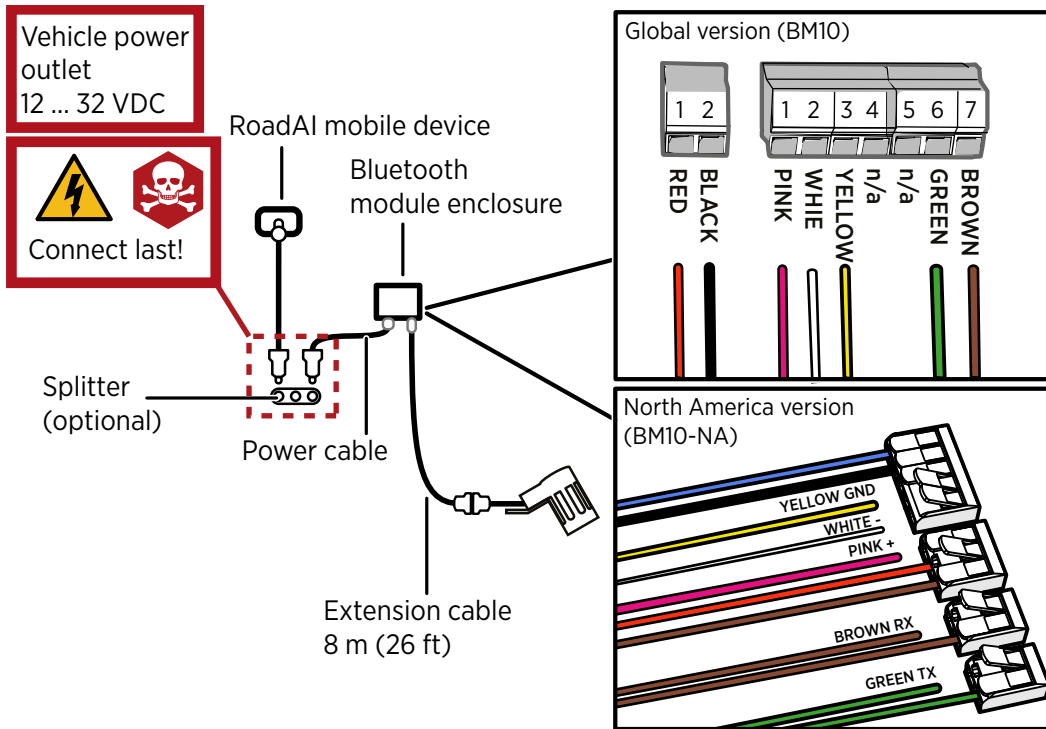
If you are using MD30 with some other data collection system, continue with the following instructions in this order:

- [Cabling and data transfer \(page 16\)](#)
- [Calibration step 1: window cleaning \(page 18\)](#)
- [Calibration step 2: plate reference \(page 19\)](#)
- [Calibration step 3: dry road reference \(page 21\)](#)

# Cabling Bluetooth module enclosure

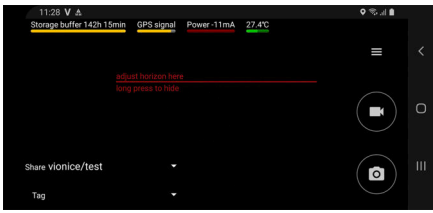
- ▶ 1. Select a suitable location for the Bluetooth module enclosure in the vehicle cabin.
2. Open the enclosure by removing the 4 screws and the lid.
3. Route the extension cable from the mobile sensor towards the Bluetooth module enclosure.
4. Connect the extension cable wires in the Bluetooth module enclosure as shown in the following figure.

**i** Follow the instructions that are relevant to your version of the Bluetooth module enclosure.



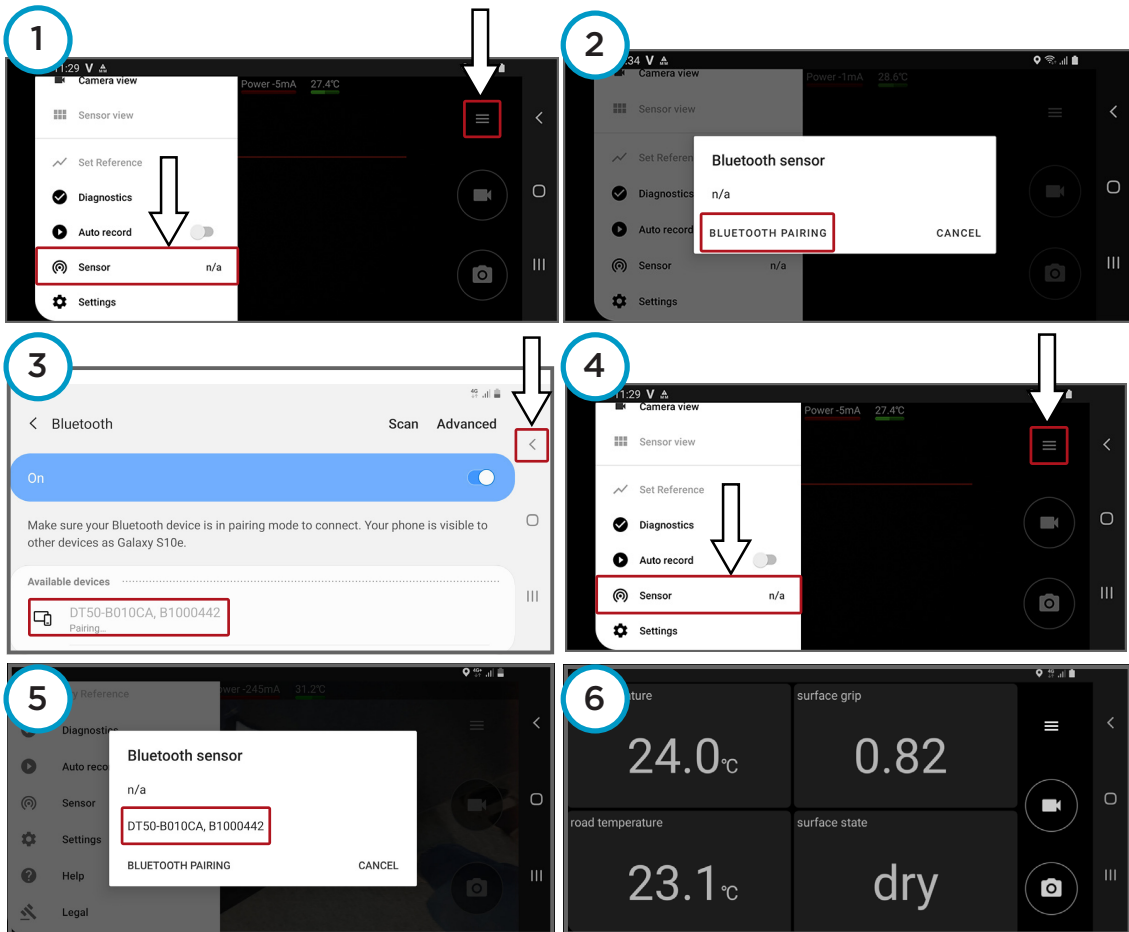
5. Route the power cable from the Bluetooth module enclosure next to the vehicle power outlet and connect it.  
If you use a splitter, connect that first. You can use the existing plug or unscrew the plug, strip the cable, and connect the wires.
6. Attach the lid to the enclosure. Tighten the cable glands.
7. Attach the enclosure to a suitable location in the vehicle cabin using adhesive tape or other fasteners.
8. Secure the MD30 cable and connector to the vehicle with cable ties.

# Pairing Bluetooth module



- If you have not set up the RoadAI mobile app, go to [setup.vaisala.ai](http://setup.vaisala.ai) on the web and follow the instructions. Check also that you have the *Vaisala RoadAI mobile setup* email which contains your login credentials.
- When done, make sure that the mobile device is showing this screen.

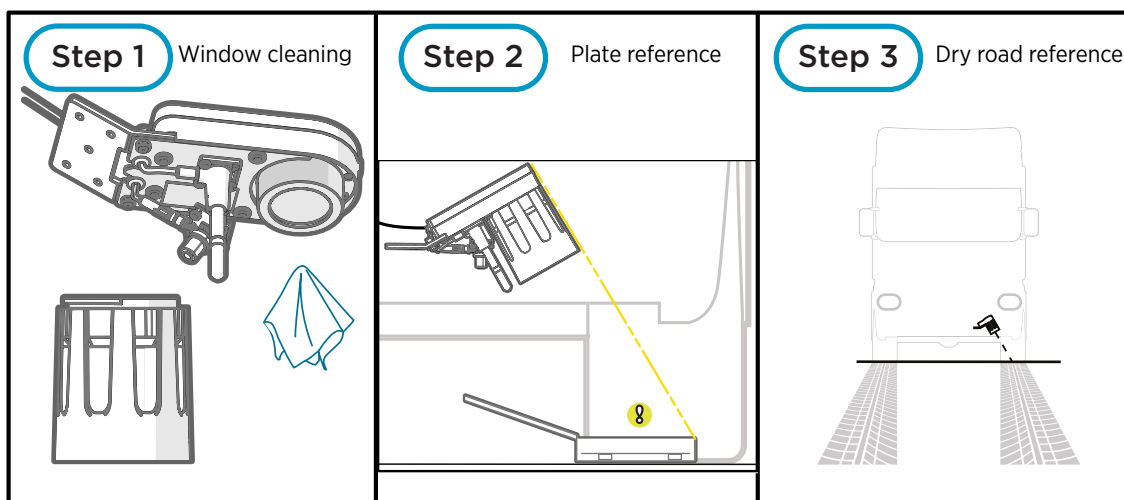
- ▶ 1. In the RoadAI mobile app, select the menu. From the menu, select **Sensor**.
2. Select **Bluetooth pairing**.
3. Pair the mobile device with the Bluetooth module, which is shown with a serial number. Check the serial number from the cover of the Bluetooth module enclosure. When paired, select the small arrow to go back.
4. Select the menu. Select **Sensor**.
5. Select the sensor you just paired. There is a notification about the need to calibrate. Ignore the message for the time being (next step is calibration), and the mobile device starts to show measurement data.
6. The app opens showing the measurements. Install the mobile device holder on the vehicle dashboard or on the windshield. In the RoadAI menu, select **Camera View** and verify that the camera has a clear view of the road.



## Calibration overview

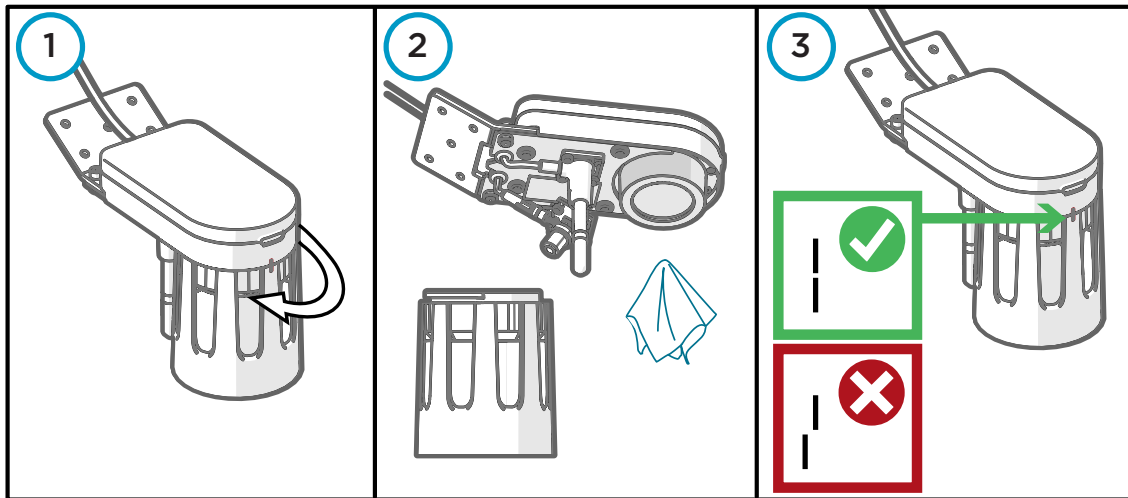


MD30 calibration is a 3-step process. Make sure that you complete all the steps before starting to use MD30 for the first time.





## Calibration step 1: window cleaning



- ▶ 1. Remove the hood by turning it counterclockwise.
- 2. Apply glass cleaner on the window of the surface state sensor. Clean with a soft, lint-free cloth. Clean also the hood.
- 3. Attach the hood to the body by turning the hood clockwise. Make sure that the markings in the hood and sensor body are aligned.

## Calibration step 2: plate reference

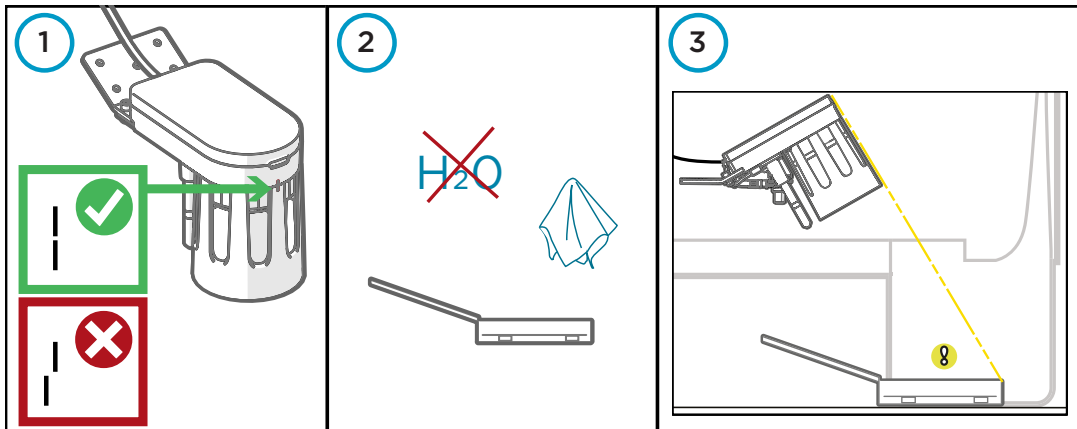
The reference setting is performed using the reference plate.

Requirement	Description
Mobile sensor placement	Installed on vehicle
Vehicle position	At a standstill
Reference plate surface	Dry, no condensation
Conditions, indoors	Clean and dry space
Conditions, outdoors	No precipitation or fog

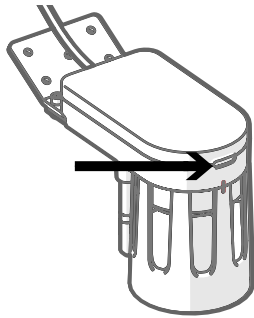
Plate adjustment minimizes the effects caused by different installation heights and differences between individual mobile sensors. Repeat this procedure when changing the installation position.

**CAUTION!** Keep the reference plate container closed when not in use. Handle the reference plate with care and keep it clean. Avoid scratching the surface. The reference plate is made of optically reflective material.

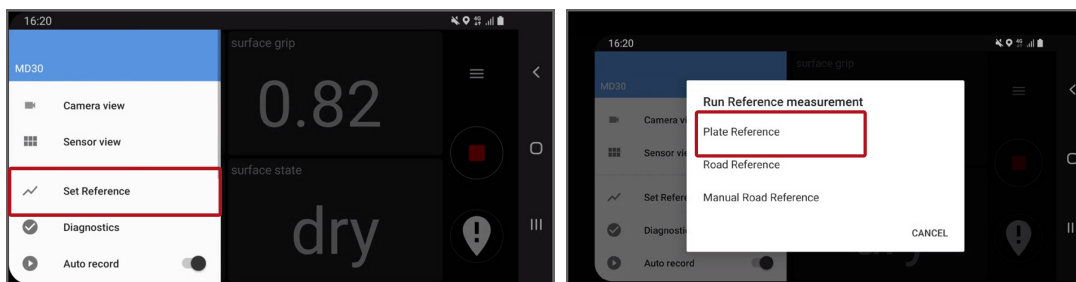
1. Check that the markings in the body and hood are aligned.
2. Open the reference plate container. Check that the reference plate is clean and dry. If it is not, carefully remove the dirt.
3. Place the reference plate as shown.



4. Check that the mobile sensor is powered and operational (green LED in the mobile sensor is blinking).  
Check that there are no error messages by scrolling right in the RoadAI app measurement grid.



5. In RoadAI mobile app, go to the menu and select **Set Reference > Plate Reference**.



The adjustment takes typically 30 seconds.

If the adjustment is not successful, repeat the procedure.

6. In the RoadAI mobile app, check that the calibration is successful by checking from errors that calibration has not been interrupted.

# Calibration step 3: dry road reference

Sensor needs a reference of how local dry road looks like. The reference setting is performed while driving on the most common road surface type in the road network. This optimizes the sensor performance on the road type in question.

Do one of the following:

- Option A: drive on local dry road with the most common surface type.
- Option B: use factory coefficients temporarily before local dry road becomes available.
- Option C: copy local dry coefficient values from another sensor.

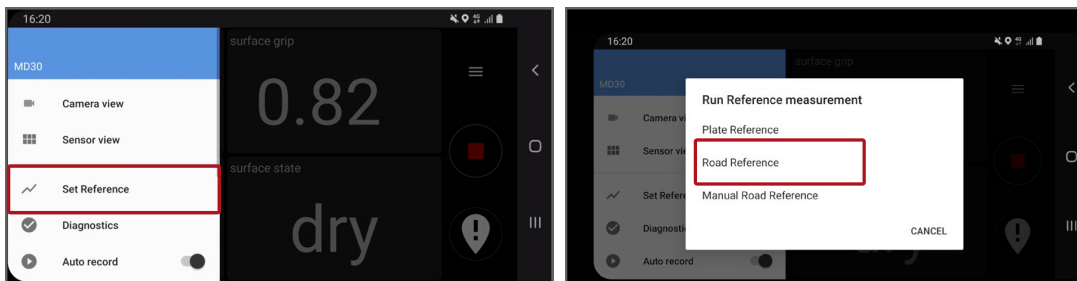
## Option A: driving on local dry road

Drive on dry road for 30 seconds to get an average reference from local road.

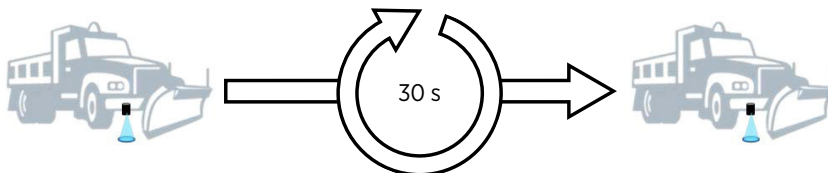
Requirement	Description
Mobile sensor location	Installed on vehicle
Vehicle position	Moving
Surface state	Completely dry road surface
Surface condition	Old asphalt; avoid newly laid asphalt
Surface material	Prefer asphalt over concrete unless concrete is the most common surface material in the area of interest

Recommended for first-time use of sensor and first adaptation for the specific road surface type.

- ▶ 1. Select a location where the road surface type is representative of the most commonly existing surface type in the area of interest.
2. Check that the mobile sensor is reporting data and there are no errors.
3. In RoadAI app, select **Set Reference > Road Reference**.



4. Drive for a minimum of 30 seconds on dry road. Check possible error messages. If the RoadAI app indicates that the measurement is done, the calibration was successful.



5. When measurement is done, write down the surface coefficients to use later on with another sensor. Scroll right in the **Sensor View**. If the adaptation was not successful, repeat the procedure.

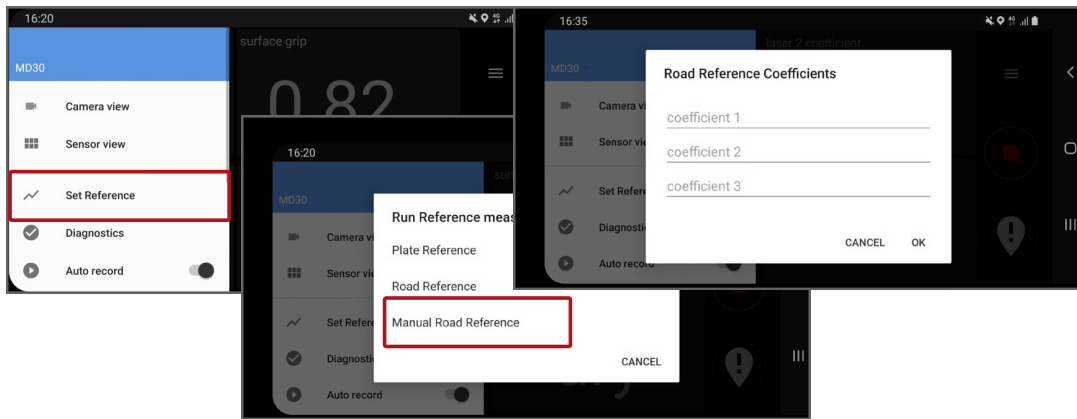
## Option B: using factory coefficients

Recommended to use factory default coefficient values if typical local dry road is not available and the values cannot be copied from another sensor for which dry reference has already been done.

- ▶ 1. In the RoadAI app, scroll right in the measurement grid to check that the sensor uses the following co-efficient values: **3.696**, **3.729**, and **3.664**



If not, select **Set Reference > Manual Road Reference**, and type the 3 values.



## Option C: copying coefficient values from another sensor

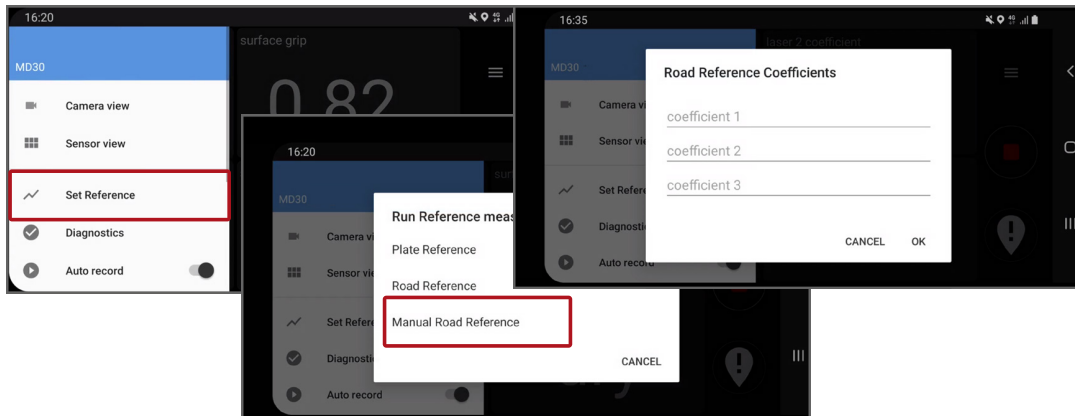
The sensor to which you are copying the values:

- Must have plate reference done
- Must be used in the same area as the sensor from which you copy the values

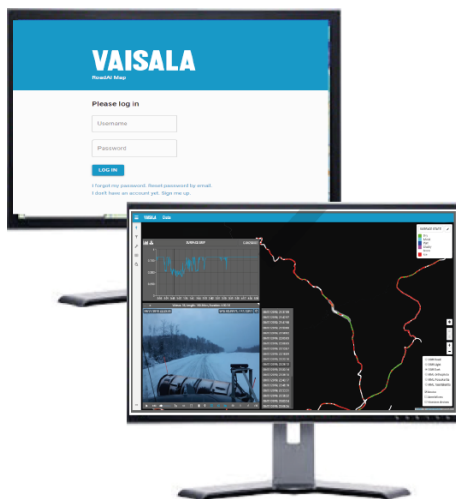
Recommended to copy dry road coefficient values from one sensor to another when dry road reference has been done on a similar road surface before and surface coefficients are known.

- ▶ 1. Check the values from a sensor that you are using in the same area.  
In the RoadAI app, scroll right in the measurement grid.

- For the sensor that you want to calibrate, go to the RoadAI app, select **Set Reference > Manual Road Reference**, and type the 3 values.



## Verifying RoadAI operation



- Connect the mobile sensor and mobile device to the vehicle power outlet. Start the car.
- In RoadAI mobile app, enable **Auto-record**. RoadAI automatically starts recording data when the mobile device is connected to a charger and stops when charging is disconnected.
- In the RoadAI mobile app, check **Diagnostics**. Under heading **Upload**, check that uploading is ongoing.
- Log in to the web app at <https://map.vionice.io> and check that data is visible.

## Instructions for other data collection systems

If you are using MD30 with some other data collection system, continue with the following instructions in this order:

- [Cabling and data transfer \(page 16\)](#)
- [Calibration step 1: window cleaning \(page 18\)](#)
- [Calibration step 2: plate reference \(page 19\)](#)
- [Calibration step 3: dry road reference \(page 21\)](#)

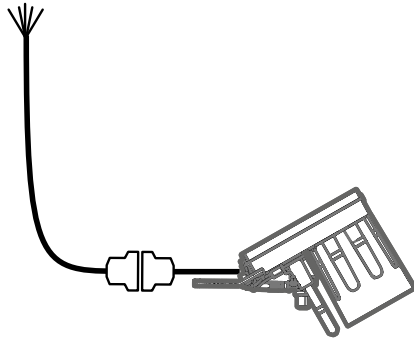
## Cabling and data transfer

For direct data transfer from the mobile sensor to an in-cabin data collection system, implement the MD30 interface. The data is transferred in binary format using RS-232 communication.



The MD30 interface is described in *Vaisala Mobile Detector MD30 Interface Description*.

1. Connect the open-ended extension cable to your vehicle system. The pinout is shown in the table.



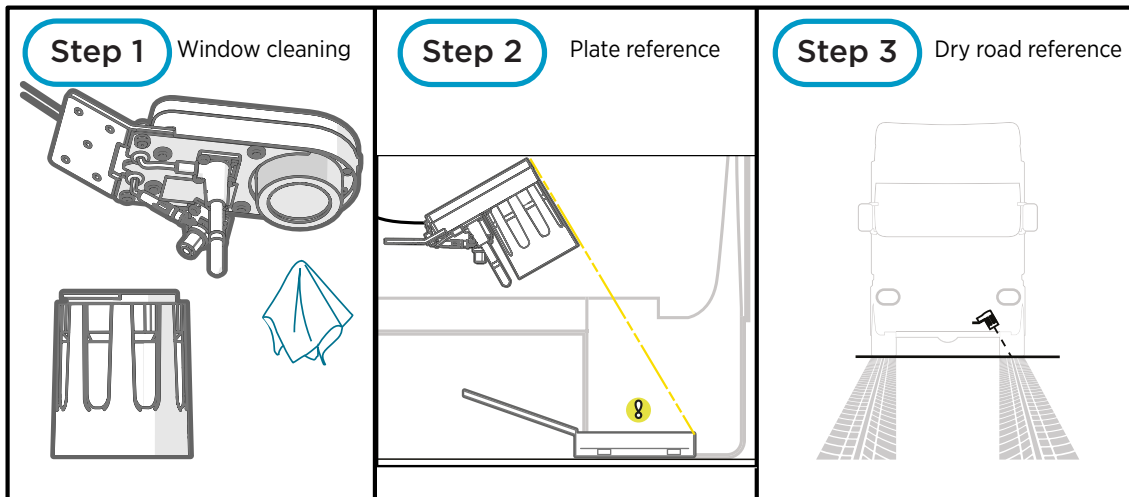
Wire color	RS-232/Power
Pink	Vin+
White	Vin-
Yellow	GND (RS-232)
Green	TX (RS-232)
Brown	RX (RS-232)



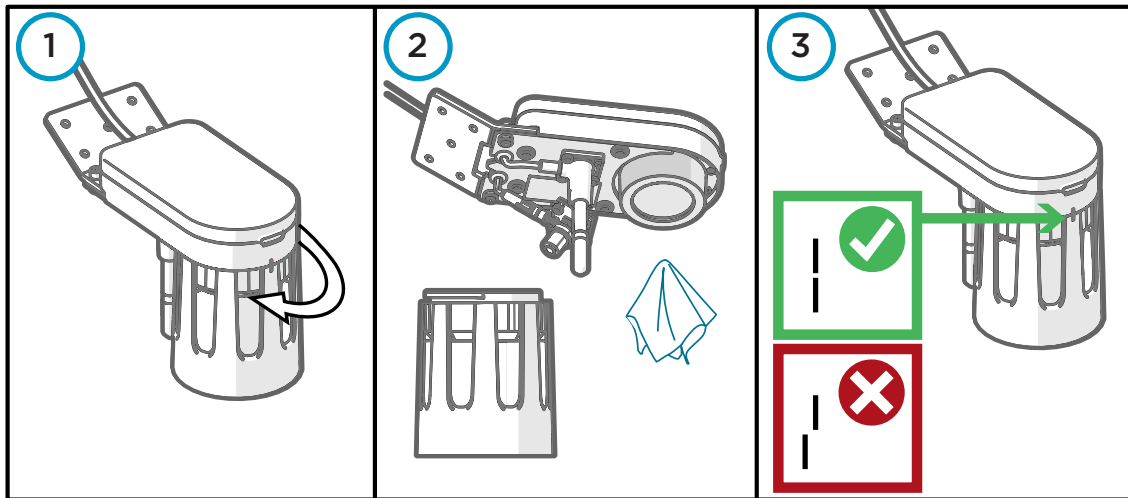
## Calibration overview



MD30 calibration is a 3-step process. Make sure that you complete all the steps before starting to use MD30 for the first time.



## Calibration step 1: window cleaning



- ▶ 1. Remove the hood by turning it counterclockwise.
- 2. Apply glass cleaner on the window of the surface state sensor. Clean with a soft, lint-free cloth. Clean also the hood.
- 3. Attach the hood to the body by turning the hood clockwise. Make sure that the markings in the hood and sensor body are aligned.

## Calibration step 2: plate reference

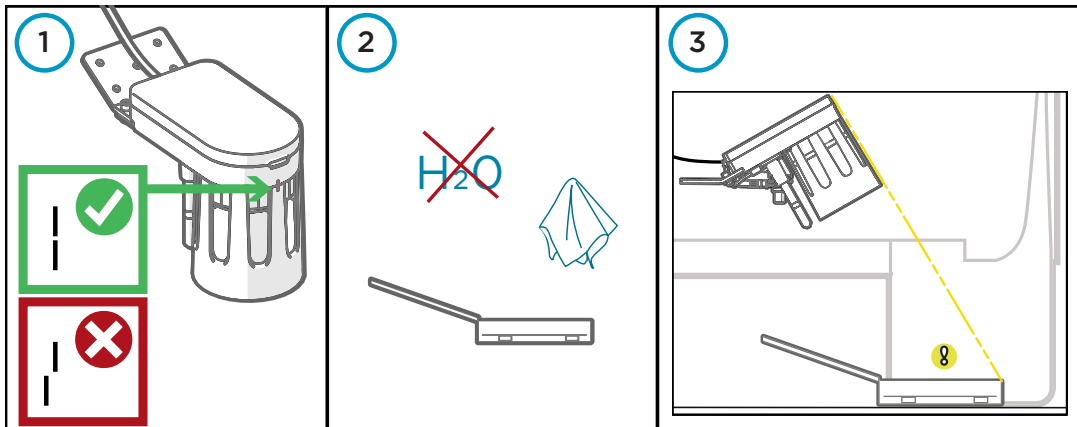
The reference setting is performed using the reference plate.

Requirement	Description
Mobile sensor placement	Installed on vehicle
Vehicle position	At a standstill
Reference plate surface	Dry, no condensation
Conditions, indoors	Clean and dry space
Conditions, outdoors	No precipitation or fog

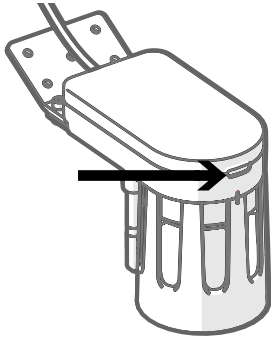
Plate adjustment minimizes the effects caused by different installation heights and differences between individual mobile sensors. Repeat this procedure when changing the installation position.

**CAUTION!** Keep the reference plate container closed when not in use. Handle the reference plate with care and keep it clean. Avoid scratching the surface. The reference plate is made of optically reflective material.

1. Check that the markings in the body and hood are aligned.
2. Open the reference plate container. Check that the reference plate is clean and dry. If it is not, carefully remove the dirt.
3. Place the reference plate as shown.



- 4. Check that the mobile sensor is powered and operational (green LED in the mobile sensor is blinking).



- 5. Check that the sensor is not reporting errors. Use the `SEND DATA` request, and check the unit status information and error bits from the `SEND DATA` response.

```
SEND DATA
```

- 6. Give the following command and parameter:

```
SET REFERENCES PLATE
```

This changes reference value parameters `0x50`, `0x51`, and `0x52` (1 parameter for each laser).

- When started, changes status bit 1 (reference setting ongoing) to `1` = ongoing.
- When finished, changes back to `0` = not ongoing.

The adjustment takes typically 30 seconds.

- 7. Check that plate adjustment was successful. Use the `SEND DATA` request, and check the unit status information from the `SEND DATA` response.

```
SEND DATA
```

The command was successful if status bits 10 - 13 (reference setting interrupted due to . . .) all have value `0` (no error).

If the adjustment is not successful, repeat the procedure.

## Calibration step 3: dry road reference

Sensor needs a reference of how local dry road looks like. The reference setting is performed while driving on the most common road surface type in the road network. This optimizes the sensor performance on the road type in question.

Do one of the following:

- Option A: drive on local dry road with the most common surface type.
- Option B: use factory coefficients temporarily before local dry road becomes available.
- Option C: copy local dry coefficient values from another sensor.

### Option A: driving on local dry road

Drive on dry road for 30 seconds to get an average reference from local road.

Requirement	Description
Mobile sensor location	Installed on vehicle
Vehicle position	Moving
Surface state	Completely dry road surface
Surface condition	Old asphalt; avoid newly laid asphalt
Surface material	Prefer asphalt over concrete unless concrete is the most common surface material in the area of interest

Recommended for first-time use of sensor and first adaptation for the specific road surface type.

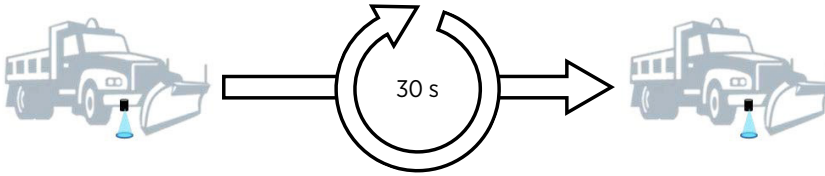
- ▶ 1. Select a location where the road surface type is representative of the most commonly existing surface type in the area of interest.
2. Check that the sensor is reporting data and there are no errors.  
Use the **SEND DATA** request, and check the unit status information and error bits from the **SEND DATA** response.

```
SEND DATA
```

3. Give the following command and parameter:

```
SET REFERENCES ROAD
```

4. Drive for a minimum of 30 seconds on dry road.



This changes road coefficient parameters 0x53, 0x54, and 0x55 (1 parameter for each laser).

- When started, changes status bit reference setting ongoing to 1 = ongoing.
- When finished, changes back to 0 = not ongoing. The action takes typically 30 seconds.

The command was successful if sensor if status bits 10 ... 13 (reference setting interrupted due to...) all have value 0 (no error).

5. Check that the sensor is not reporting errors.  
Use the SEND DATA request, and check the unit status information from the SEND DATA response.

**SEND DATA**

6. To read road coefficients, give the following command and parameters:

**GET PARAMETER 0x53 0x54 0x55**

Write down the coefficients to use later on with another sensor.  
If the adaptation was not successful, repeat the procedure.

## Option B: using factory coefficients

Recommended to use factory default coefficient values if typical local dry road is not available and the values cannot be copied from another sensor for which dry reference has already been done.

- ▶ 1. Check that the sensor uses the following co-efficient values: **3.696**, **3.729**, and **3.664**  
Use the following message:

**GET PARAMETER**

If not, give the values for the 3 parameters (Road coefficient, laser 1, laser 2, and laser 3). Use the following message:

**SET ROAD COEFFICIENTS**

## Option C: copying coefficient values from another sensor

The sensor to which you are copying the values:

- Must have plate reference done
- Must be used in the same area as the sensor from which you copy the values

Recommended to copy dry road coefficient values from one sensor to another when dry road reference has been done on a similar road surface before and surface coefficients are known.

- ▶ 1. Check the values from a sensor that you are using in the same area. Use the following message:

```
GET PARAMETER
```

The requested parameters are 0x53, 0x54, and 0x55.

2. For the sensor that you want to calibrate, give the values for the 3 parameters (Road coefficient, laser 1, laser 2, and laser 3). Use the following message:

```
SET ROAD COEFFICIENTS
```

# Product dimensions

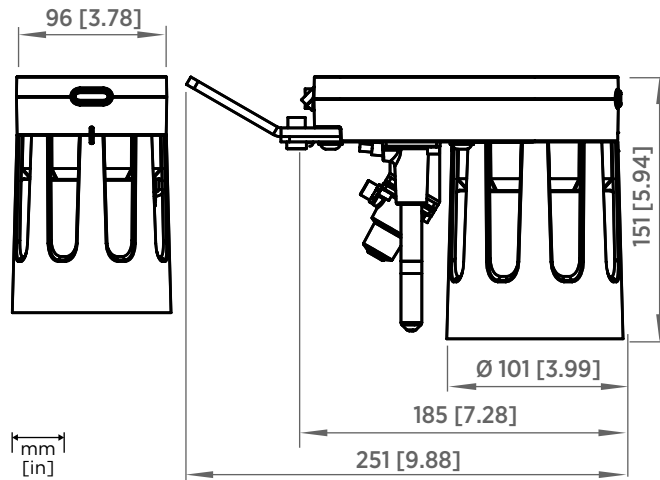


Figure 2 Mobile sensor dimensions

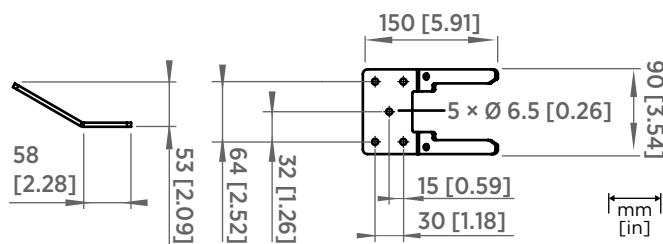


Figure 3 Mounting bracket dimensions

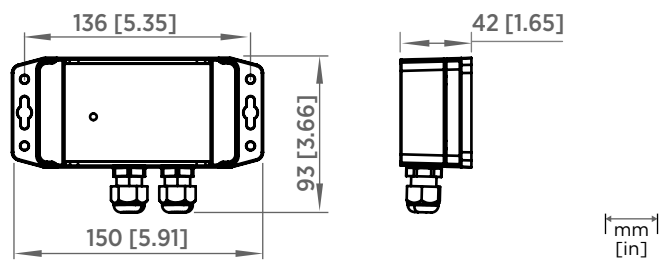


Figure 4 Bluetooth module enclosure dimensions (BM10)

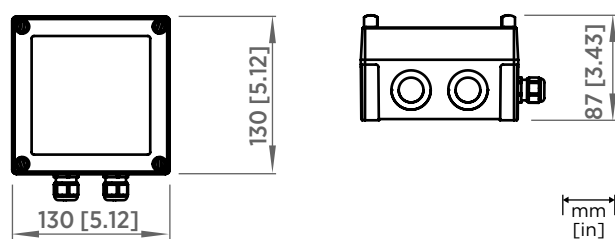


Figure 5 Bluetooth module enclosure dimensions (BM10-NA)