Mobileye 5

- Technical Installation Guide -

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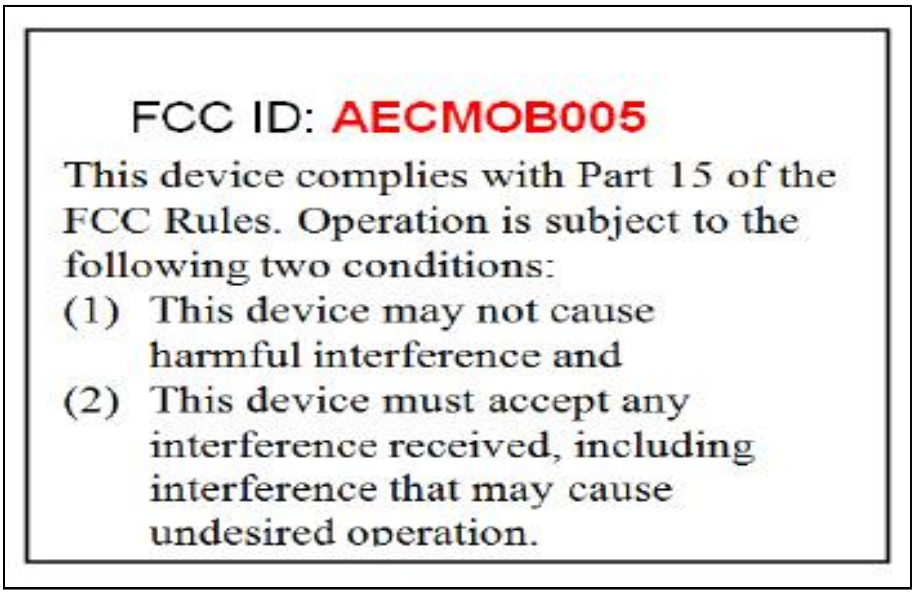

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1 Warnings

1.1 General

By Installing the Mobileye® 5® Driver Assistance System, you will be acknowledging and agreeing to operate Mobileye 5 in accordance with the Safety Instructions and Warnings set forth below. If you do not agree to these terms, please return Mobileye 5 to your dealer, in its original packing materials, within 30 days of purchase, for a full refund.

Mobileye 5 is a driver assistance system which is intended to alert drivers to certain potentially dangerous situations. It does not replace any functions drivers would ordinarily perform in driving a motor vehicle, nor does it decrease the need for drivers to stay vigilant and alert in all driving conditions, to conform to all safe driving standards and practices, and to obey all traffic laws, rules and regulations.

Mobileye 5 is not an automated driving system and it does not act as a substitute for any aspect of driver vehicle control or safe driving practices. Drivers are strongly cautioned not to rely on the Mobileye 5 as a substitution, to even the slightest degree, for the exercise of due caution in assuring that they are driving safely and avoiding accidents.

While Mobileye 5 represents a state of the art innovation in machine vision software and other technologies, it cannot and does not guarantee 100% accuracy in the detection of vehicles or driving lanes, nor in providing warnings of all potential road hazards. Mobileye 5 system's recognition and response capabilities. Accordingly, drivers should not rely on the Mobileye 5 to assure their driving safety, but rather should continue to rely on safe driving practices.

Drivers should exercise caution in using the Mobileye 5 Display Unit. Always maintain full concentration on the road at all times including while looking at the Mobileye 5 display

1.2 System Limitations

The Mobileye 5 is intended for paved roads, with clear lane markings.

The Mobileye 5 only detects fully visible rear ends of vehicles (Day and Night) and fully visible pedestrians and rear ends of Motorcycles (Day only). Therefore the detection of crossing, oncoming, and passing vehicles is not supported.

The Mobileye 5 does not guarantee 100% accuracy in the detection of vehicles or driving lanes, nor in providing warnings of all potential road hazards. In addition,

road, weather and other conditions can adversely affect the Mobileye 5 system's recognition and response capabilities.

Any conditions that form partial or full blockage of the camera's view will result in reduced or non-functionality of Mobileye 5. Always ensure clear camera view.

1.3 Installation and Safety Instructions

Mobileye 5 installation must be carried out by an Authorized Mobileye 5 Dealer or Installer.

The Mobileye 5 system should not be transferred between vehicles, other than by an Authorized Mobileye 5 Dealer or Installer.

The Mobileye 5 should only be operated with 12VDC~24VDC power.

Do not cover or obstruct the Camera Unit or Mobileye 5 Display and Control Unit.

Only proper tools are to be used.

Only L.E.D voltage tester or Digital Multi Meter should be used.

The use of light bulb voltage tester is prohibited.

Pay attention to unusual color cables for example: Yellow cable isolation belongs to air bags; two twisted wires usually belong to different sensors (digital).

Before disconnecting the battery or the radio connectors make sure to have the radio code.

Do not disconnect any plug or connector in the vehicle when the ignition switch is turned on.

2 Mobileye 5 Description

WARNING: The Mobileye 5™ system should be installed ONLY by Mobileye® Technologies Ltd. authorized personnel!

2.1 Mobileye 5 Components overview

The Mobileye **5** is based on the following elements:

- The **Mobileye 5** Main Unit and Connector Cable (Camera)
- The **EyeWatch** Display & Control Unit (Optional)

When receiving the Mobileye 5 please verify receiving & identify all the following components:

2.1.1 Mobileye 5 Main Unit & connecting cable (CAB000105)

The Mobileye 5 Main Unit contains the following components:
Camera unit, High-quality Audio Alert Buzzer, Mobileye Chip on Board system (SeeQ), Connector Cable.

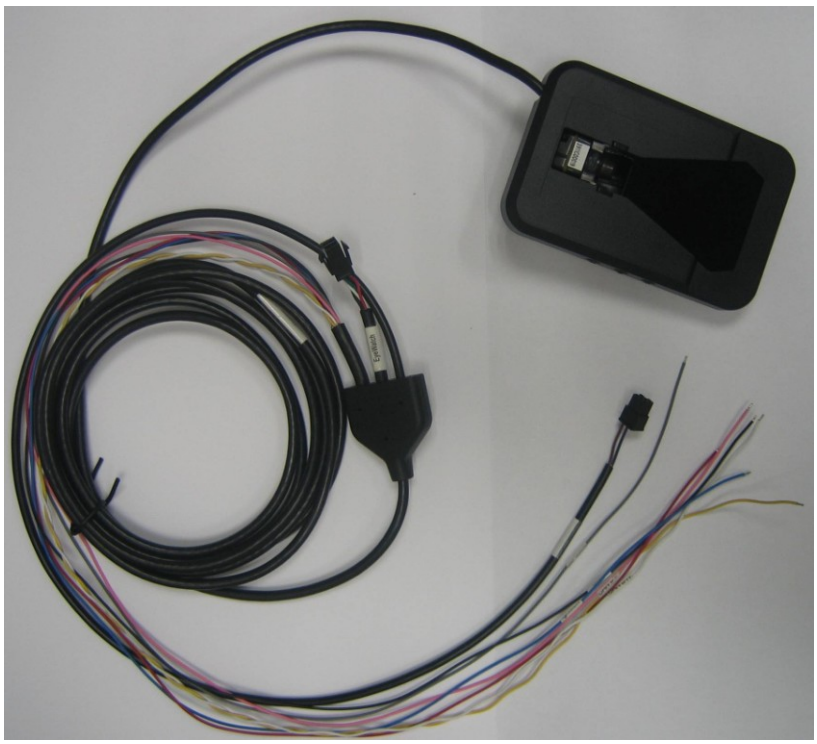


Figure 1: Mobileye 5 with connecting cable – Front view.

2.1.2 EyeWatch - Display & Control unit (CAB000087)

NOTE: The **EyeWatch** Display and Control Unit is sold as an optional add-on on certain Mobileye 5 models. Mobileye 5 can also be used with an Android based Bluetooth device (Smart Phone) for displaying Mobileye 5 Alerts.

Figure 2: EyeWatch Display and Control Unit with connecting cable

2.1.3 External Fuse Holder

The Mobileye 5 is supplied with an External Fuse Holder and a 2A Fuse for protection against short circuiting the vehicle electrical system.

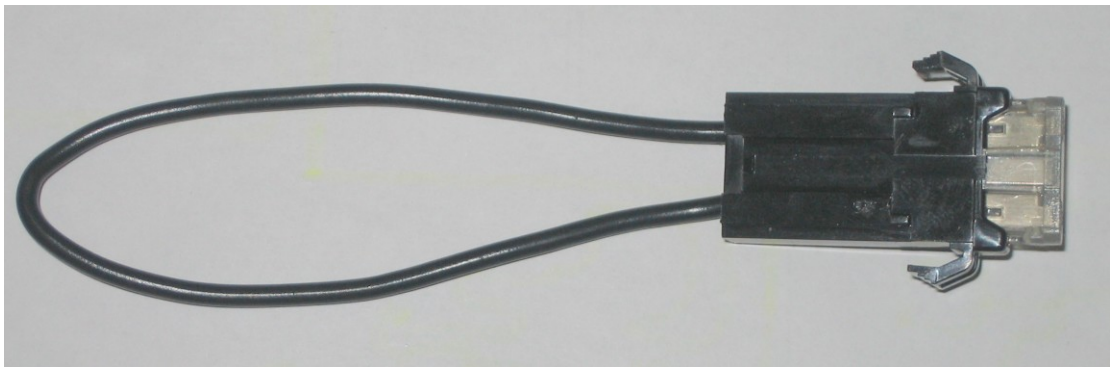


Figure 3: External Fuse Holder & 2A Fuse

2.1.4 3M VHB Surface Cleaner

The 3M VHB Surface Cleaner supplied with Mobileye 5 Cleans and degreases the Windshield surface to ensure optimum adhesion for 3M VHB Tape provided with the Mobileye 5 Main Unit.

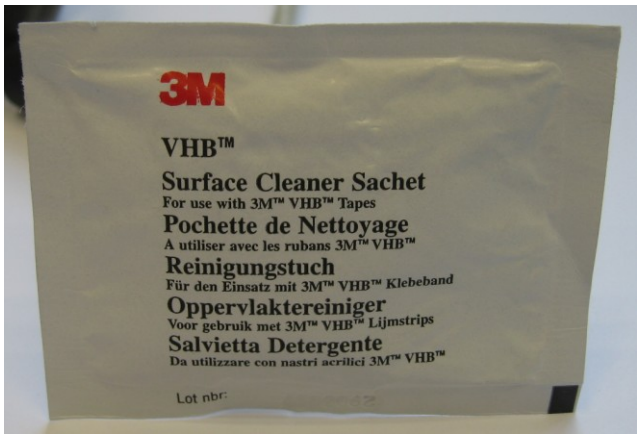


Figure 4: 3M VHB Surface Cleaner

2.1.5 Mobileye 5 Connection Scheme

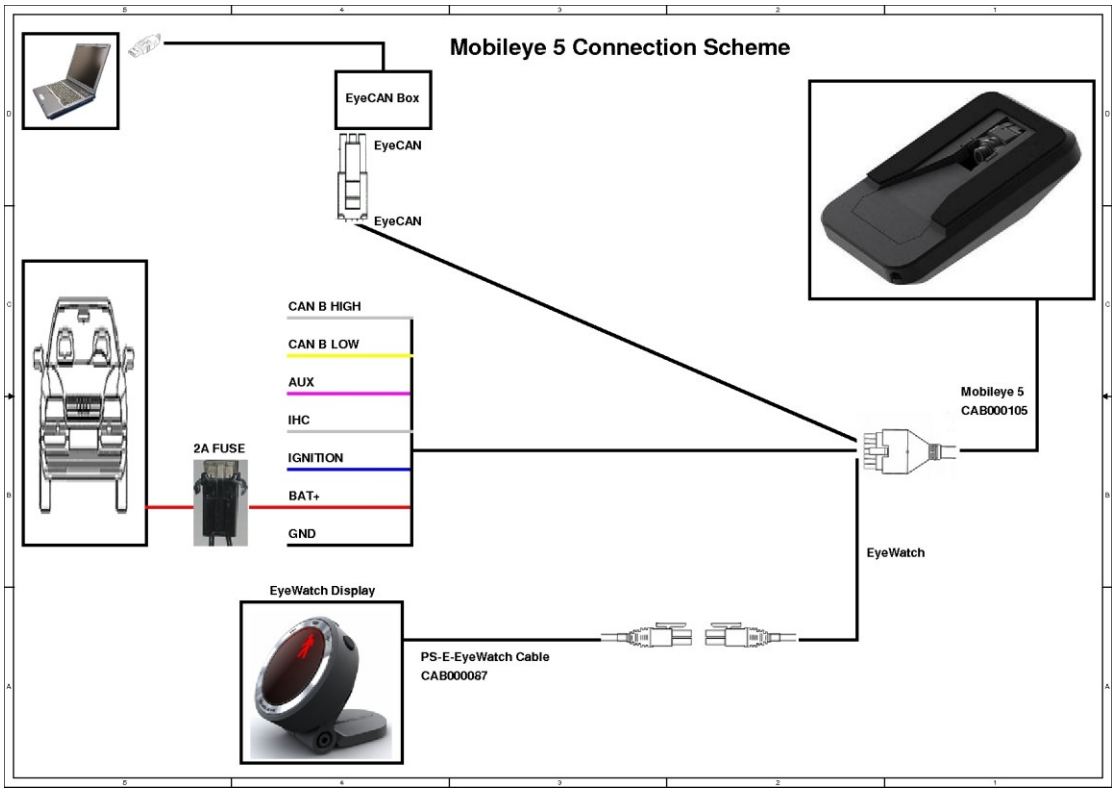


Figure 5: Mobileye 5 connection scheme with EyeCAN

2.2 Mobileye 5 Connections Description

The following paragraphs describe in detail the function of the cables and connections shown above.

2.2.1 Mobileye 5 Main unit connections

The Mobileye 5 main unit contains the camera, the Audio Buzzer and the main processor (EyeQ™). The Mobileye 5 main unit also contains volume control buttons.

The Mobileye 5 Main unit functions as a Universal Mounting Adapter for all vehicle's front windshield angles. It is attached to the vehicle's front windshield with the provided 3M double sided sticker.

The Mobileye 5 Connecting cable is split into a few various cables which are used to connect to the vehicle power source, to the vehicle CAN-bus, to the vehicle High-beams (for IHC) and to the Mobileye EyeWatch display and Control unit and Mobileye EyeCAN.

A detailed description of each Mobileye 5 connecting cable connections can be found in the table below:

Wire Name & Function	Wire color	Connector	Connection To
EyeCAN - (6 pin connector)	Black	P2	EyeCAN unit (for system calibration)
EyeWatch - (4 pin connector)	Black	J1	EyeWatch Display & Control unit
BAT+ (12/24V)	Red	-	Vehicle constant power (Battery)
GND	Black	-	Vehicle GND (BAT-)
Ignition (12/24V)	Blue	-	Vehicle Ignition signal
CAN B H	White	-	Vehicle CAN-bus (CAN High wire)
CAN B L	Yellow	-	Vehicle CAN-bus (CAN Low wire)
IHC – (Analog Output)	Gray	-	Vehicle High-beams via external Relay
AUX	Pink	-	*Future option*

Table 1: Mobileye 5 connecting cable connections

2.2.2 External Fuse Holder & 2A Fuse

The External Fuse Holder connection is as follows

1. Cut the fuse holder cable so that it creates 2 separate wires
2. Connect one end of the Fuse holder to the Vehicle Power source (12V/24V).
3. Connect one end of the Fuse wire to the Mobileye Power Cable (Red wire).

2.2.3 EyeWatch – Display & Control unit connection (optional)

The EyeWatch is supplied only on certain Mobileye 5 models. The EyeWatch is connected to the Mobileye 5 EyeWatch Female connector (J1) using the EyeWatch connecting cable Male connector (J1).

Wire Name	Wire color	Connector	Connection To
EyeWatch Cable (CAB000087)	Black	J1 - male	Mobileye 5 cable - EyeWatch connector
EyeWatch - (CAB000105)	Black	J1- female	EyeWatch Display & Control unit

Table 2: EyeWatch connections

2.2.4 EyeCAN – Mobileye CAN to USB interface

The EyeCAN is NOT part of the Mobileye 5 system. It is a tool which enables the installer to configure and calibrate the Mobileye 5 system during the installation. The Mobileye 5 EyeCAN Male connector (P2) is used for connection with the Mobileye EyeCAN Box Female connector labeled “CAN” (J5).

Wire Name	Wire color	Connector	Connection To
CAN (EyeCAN box connector)	Black	J5 - female	Mobileye 5 cable - EyeCAN connector
EyeCAN - (CAB000105)	Black	J1- Male	EyeCAN box connector labeled “CAN”

Table 3: EyeCAN connections

3 Mobileye 5 Installation

3.1 Electrical Vehicle Signals Requirements

Table 4 details the Mobileye 5 requirements regarding which vehicle signals are needed, and what their electrical attributes should be.

Please make sure the vehicle to-be-installed complies with these requirements

Item	Description	Value
Signals Cables	Car inputs	BAT+, GND, Ignition, High Beam, CAN-Bus (High/Low)
Voltages	Input	12 - 36VDC
	Current Load (full operation)	12v > 360mA, 24v > 180mA**
	Stand-by Current Load (Ignition off)	12v > 10mA, 24v > 10mA
	Power consumption	Nominal 5.2W

* A 12V vehicle has battery voltage of 13.7V and 24V vehicle has battery voltage of 27V.

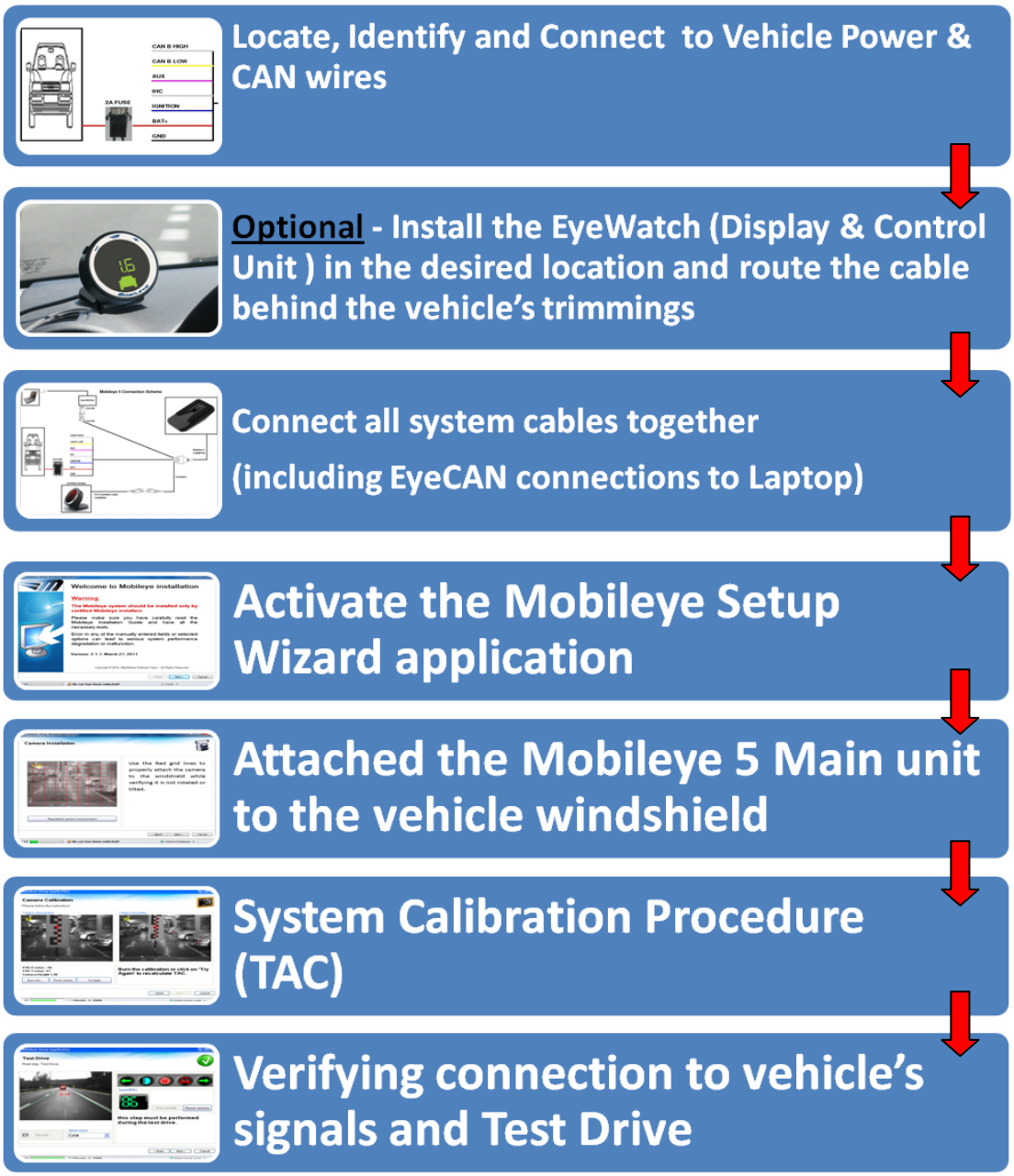
** The current consumption of the Mobileye 5 is depended on the vehicle system voltage (12 or 24V).

Additional Notes:

1. Mobileye 5 complies with automotive standard (ISO-7637-2) regarding voltage transients for all signals (input voltage and car signals).

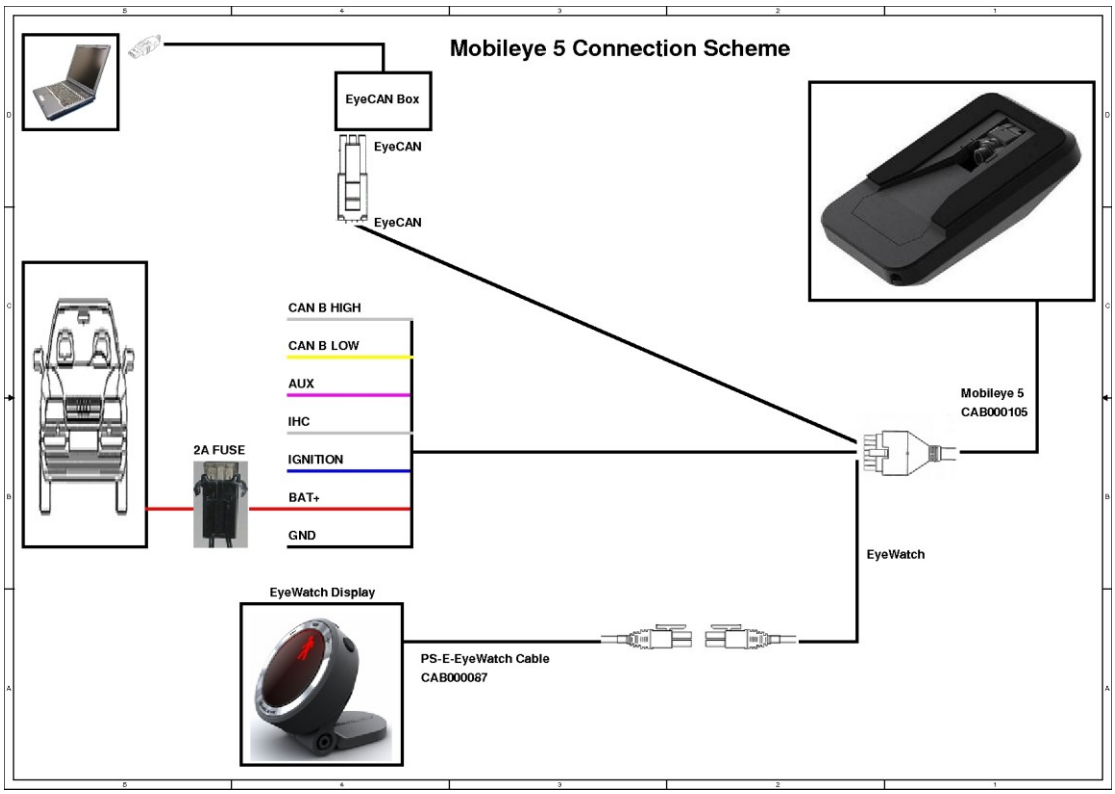
3.2 Mobileye 5 Installation Procedure

The following chart summarizes the main stages of the Mobileye 5 installation procedure:



3.2.1 Mobileye 5 Connection Scheme

Please ensure that you identify the Mobileye 5 cables according to diagram below. The paragraphs that follow will present the function of each cable, and then guide you through their actual connection procedures with the car signals.



3.2.2 Connecting to Vehicle Signals

<u>CAUTION</u>: Identifying the vehicle's electrical signals requires having the keys in the ignition in the ACC (Accessory) position or Ignition ON. Make sure the car headlights and/or any other power consuming devices are turned off during Mobileye 5 installation to prevent battery drainage.

1. Identify the wires in the vehicle that carry the required electrical signals (according to table below).
2. After identifying the required signals locations in the vehicle, pass the Mobileye 5 cable (CAB000105) behind the vehicle trimmings so that it reaches all vehicle signals (it is recommended to hang the Mobileye 5 Main

Unit on the rear view mirror or place it on the dashboard before passing the cable behind the vehicle trimmings).

3. Firmly connect the appropriate wire from the **Mobileye 5 (CAB000105)** to the identified vehicle signal.

   Each wire in the Mobileye 5 cable mentioned above has a unique color. Make sure to connect the correct vehicle signal to its appropriate wire according to Table 2-7.

Identified vehicle signal	Wire label	Wire color
Vehicle battery (Constant 12V~24V) **via 2A Fuse**	BAT+	Red
Ignition (12V~24V)	Ignition	Blue
Vehicle GND	GND	Black
CAN High	CAN High	White
CAN low	CAN low	Yellow

NOTE: Make sure the 2A fuse is kept easily accessible

NOTE: Wires' colors are not guaranteed. Always refer to the wires' labels

NOTE: Always check the Mobileye Internal Database for CAN-Bus availability before installation is started

4. Keep the Mobileye 5 EyeCAN and EyeWatch connectors easily accessible.

3.2.3 Installing the EyeWatch (optional)

1. Select the optimal location for the EyeWatch. The unit should be placed on the dashboard at a location which is in the driver's field of view and convenient for him to see when driving, and to allow him access to the controls while seating comfortably in the driver's seat (the EyeWatch mounting angle is adjustable by the installer, a Philips screw driver is required).
2. Clean the selected location with the provided 3M VHB Surface cleaner.
3. Attach the EyeWatch to the selected area (remove the protective cover from the adhesive tape).
4. Remove transparent protecting cover from the display surface

5. Insert the EyeWatch cable (CAB000087) behind the vehicle the trimmings so that it reaches the EyeWatch connector of the Mobileye 5 cable (CAB000105).

WARNINGS!

- The EyeWatch and Main Unit should be placed in a location that does not obstruct the driver's field of view.

- The EyeWatch should not be placed in front of air-bags operational space. The unit may prevent the air-bag from fully opening and/or may cause injury during air-bag activation.

- Attaching the EyeWatch on the Vehicle's windshield is not recommended (EyeWatch may overheat).

3.2.4 Installing the Mobileye 5 Main Unit (Camera)

3.2.4.1 Selecting the optimal location for the Main Unit:

Select the optimal location for the Main Unit. Please comply with the following requirements as incorrect positioning may affect the overall performance of the system.

- The Main Unit should preferably be placed at the top of the windshield (preferably at a height over 1.2 meter), in an area well covered by the windshield wipers.
- The Main Unit should be placed at approximately the center of the vehicle widthwise. If this is not possible it should be within the central third of the vehicle width. It should be noted that some car models have convex windshield (sideways), which intensifies the problem of an off-center installation.
- The validation to the windshield edges allows an offset up to 25cm only. The preferable position of the Main Unit is in the middle of the windshield. If this is not possible we allow up to 25 cm offset to one of the sides but no more so to not cause reduction in system performance.
- There should be no occlusions such as stickers or darkened windshield areas in front of the Main Unit.

- In tall commercial vehicles that do not have an engine hood occluding the field of view of the camera, the v Main Unit can be placed on the lower part of the windshield, while considering all of the above-mentioned requirements. In this case, you can modify the Main Unit cable to the "DOWN" position. “DOWN” means that after the Main Unit installation, the Main Unit cable exits the Main Unit downwards, instead of upwards (which is the case in the default “UP” position.

3.2.4.2 Attaching the Camera to the Windshield

1. Before starting the Main Unit installation, make sure that the car is not loaded with unusual heavy cargo that can tilt the orientation of the car body.
2. Make sure the vehicle is standing on a flat surface with no side or forward slope.

3. Clean the intended installation location on the windshield using the 3M VHB Surface Cleaner to remove oily or other remains.
4. Wipe the installation area on the windshield by thoroughly using a ***dry wipe*** (important since the 3M VHB Surface Cleaner that removes oily substances may leave marks on the windshield that will obstruct the camera’s field of view)

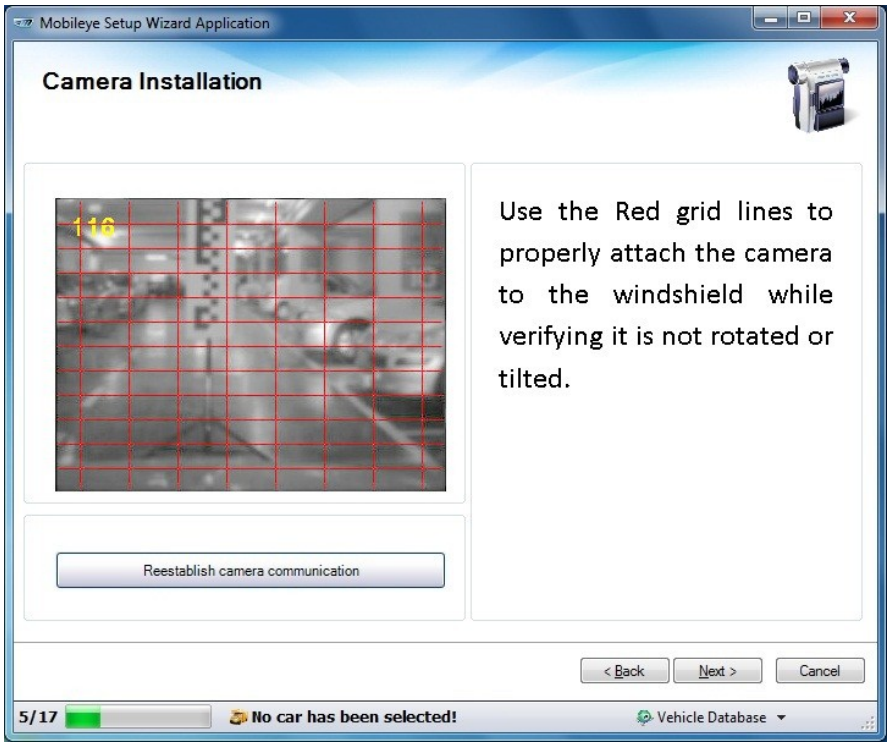
5. Connect the Mobileye 5 EyeCAN cable (6 pin male connector – CAB000105) to the EyeCAN Unit (6 pin Female connector labeled “CAN”).
6. Connect the EyeCAN unit USB connector to the Laptop Computer USB port.

Mobileye 5	EyeCAN	Laptop PC
Connector	Connector	Connector
6 pin male	6 pin Female	
	USB	USB

7. Power On the laptop computer.
8. Power on the Mobileye 5 system by turning on the vehicle ignition switch to ACC (Accessory) position.
9. Run the Mobileye Setup Wizard Application

NOTE: Chose the vehicle from the Internal Database in the Mobileye Setup Wizard application before continuing (see Appendix F for more details).

10. After connecting successfully, you should see the Camera image in the “Camera Installation” window of the Mobileye Setup Wizard.



11. Locate the “TAC Target” exactly in the middle of the vehicle’s front bumper

    (for cars – close as possible to the front bumper, for trucks – 1 meter away from front bumper)

12. Using the image feed (camera installation slide) start gluing the Camera from the top down, maintaining the horizontal lines in the scene ahead as the horizontal lines in the image window. When completed, firmly attach the camera to the windshield.

NOTE: Before attaching the Main Unit verify there is enough room to dismantle the Main Unit back covers using a small Philips screw driver.

NOTE: For Truck and Bus installations first remove the Mail Unit back covers, Slide the Camera Down the railing to Level 6 and then follow steps 5 to 12.

The image below shows the Main Unit (Camera) attached to the front windshield, typically behind the rear view mirror. The Green L.E.D on the back of the Main Unit indicates that the Mobileye 5 is receiving power.

Figure 1-10 Vision Sensor Unit located on the windshield behind the rear view mirror

NOTE: At the end of this process, all the system components are connected and all Mobileye 5 components are attached to the vehicle and connected to the Laptop PC

4 System Calibration Procedure

CAUTION: When Performing System Calibration DO NOT:

- **Disconnect the EyeWatch connection**
- **Move the laptop carelessly**
- **Turn off the vehicle or in any other way turn off power to the Mobileye 5 system**

4.1 Removing the Mobileye 5 Back Covers

In order to calibrate the Mobileye 5, the camera angle must be set prior to the calibration process. To access the camera adjustment screw there is a need to remove the Mobileye 5 Main Unit Back Covers.

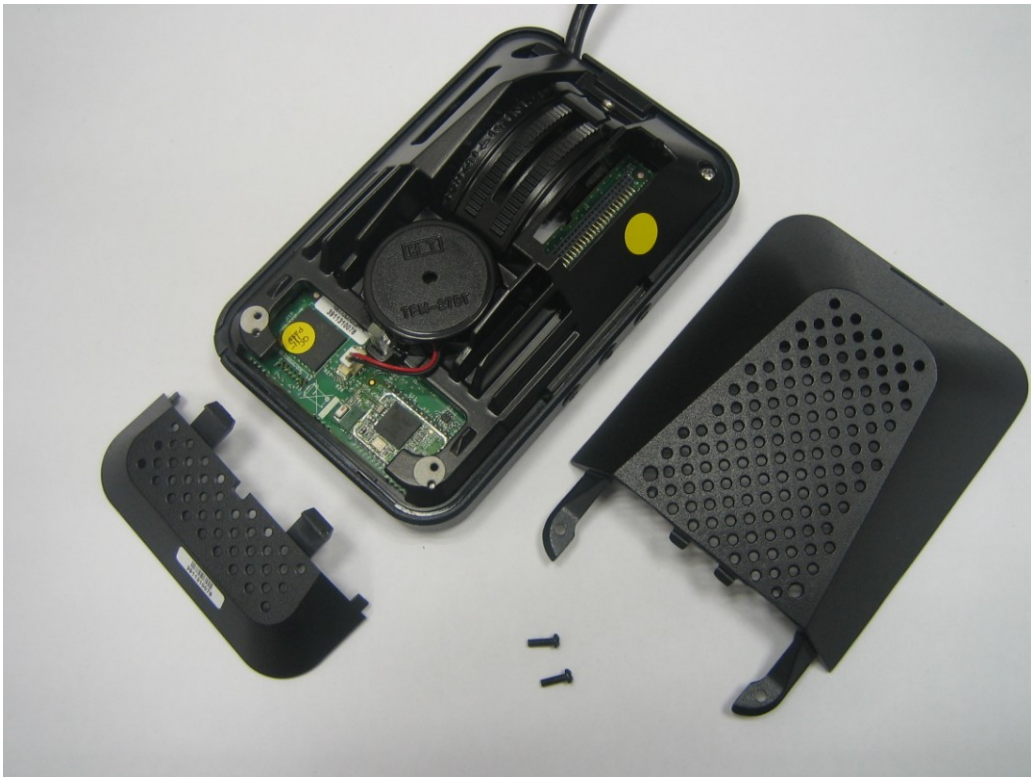
To remove the Main Unit Back Covers follow the below instructions:

1. Insert a small screw driver at the slightly larger circles at the right and Left ends of the lower part of the Main Unit Back Cover and press the bracket to release.

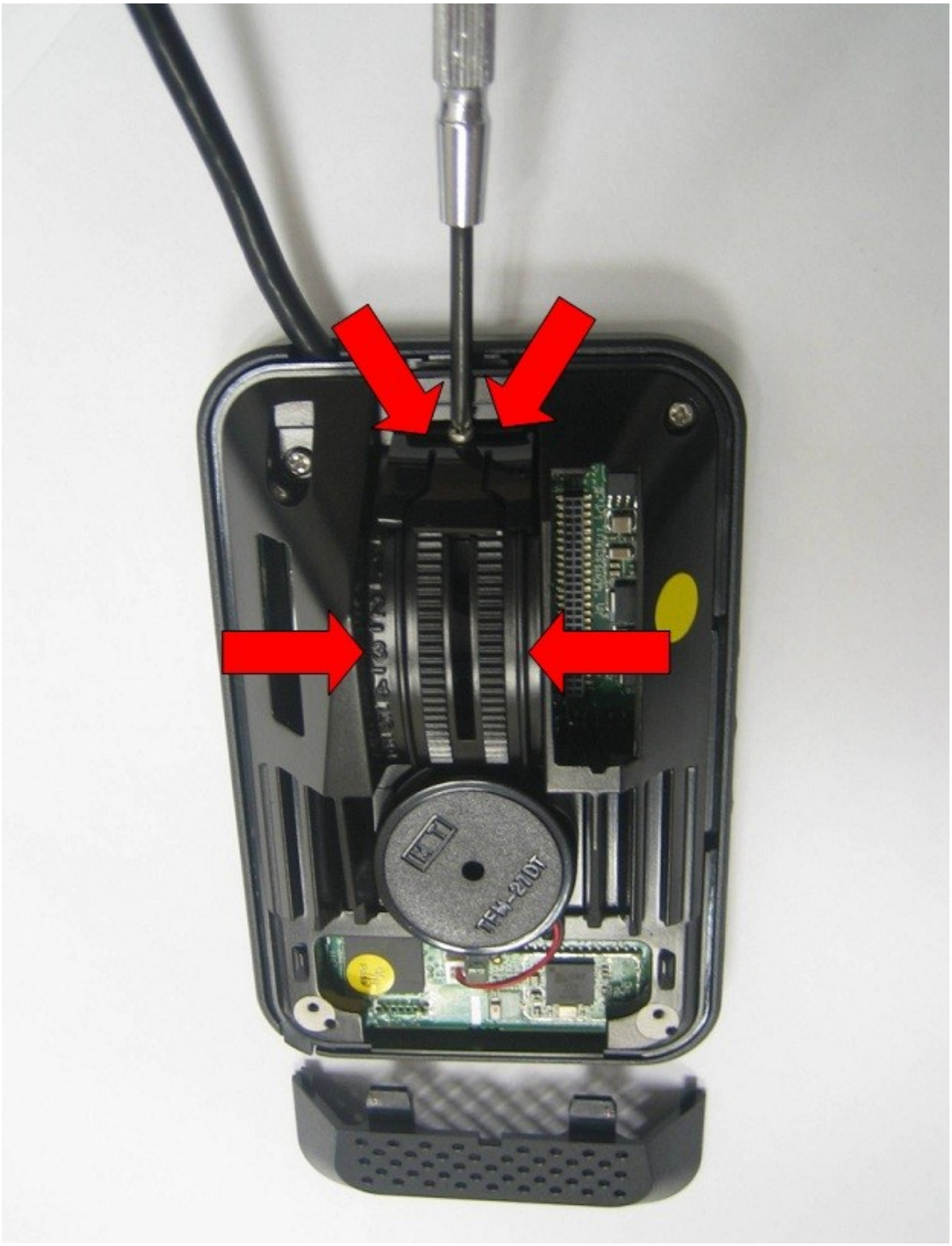
2. Once the 2 Brackets on the Left and Right side have been released pull the Lower Back Cover downwards and remove completely.

3. Un-screw the 2 small screws on the Left and Right sides to remove the Upper Back Cover.

4. Once the 2 screws have been removed, remove the Upper cover completely.



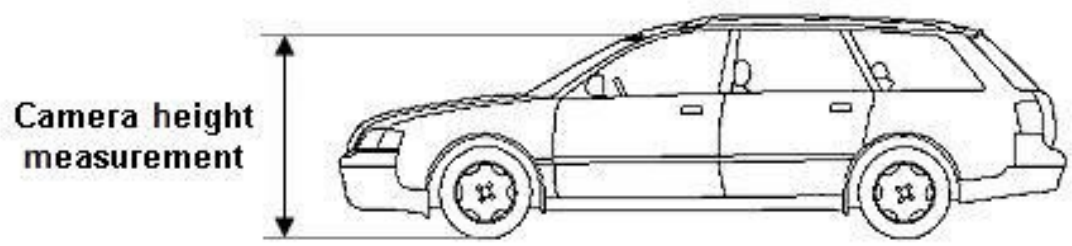
5. Now use the Camera adjustment screw to set the correct camera angle by releasing the screw a little and moving the Camera along the Camera Railing.



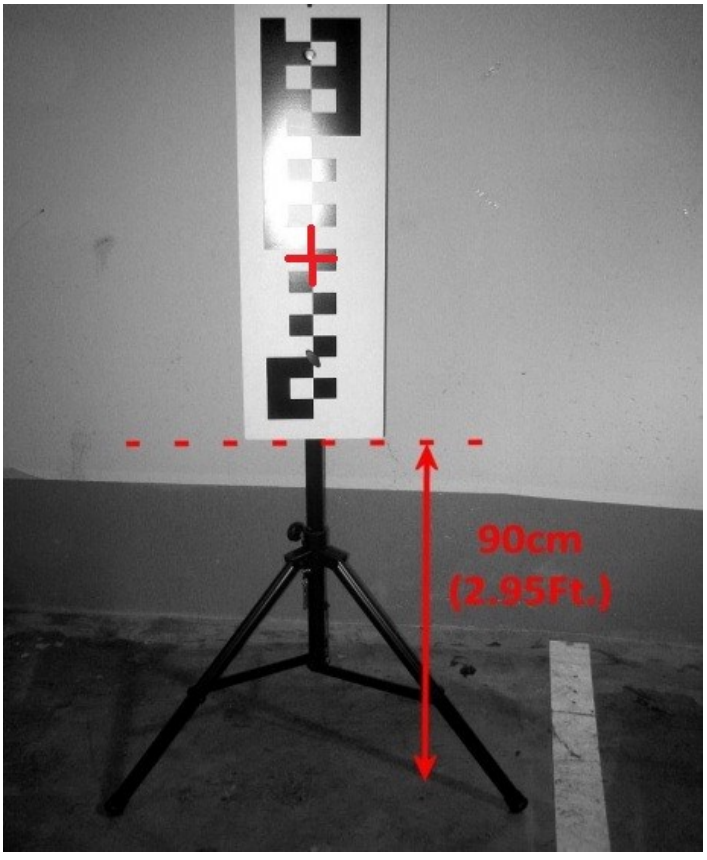
4.2 Adjusting the Camera Angle

To adjust the correct camera angle follow the below procedure:

1. Measure the Camera Height from the Ground Up using a measuring tape

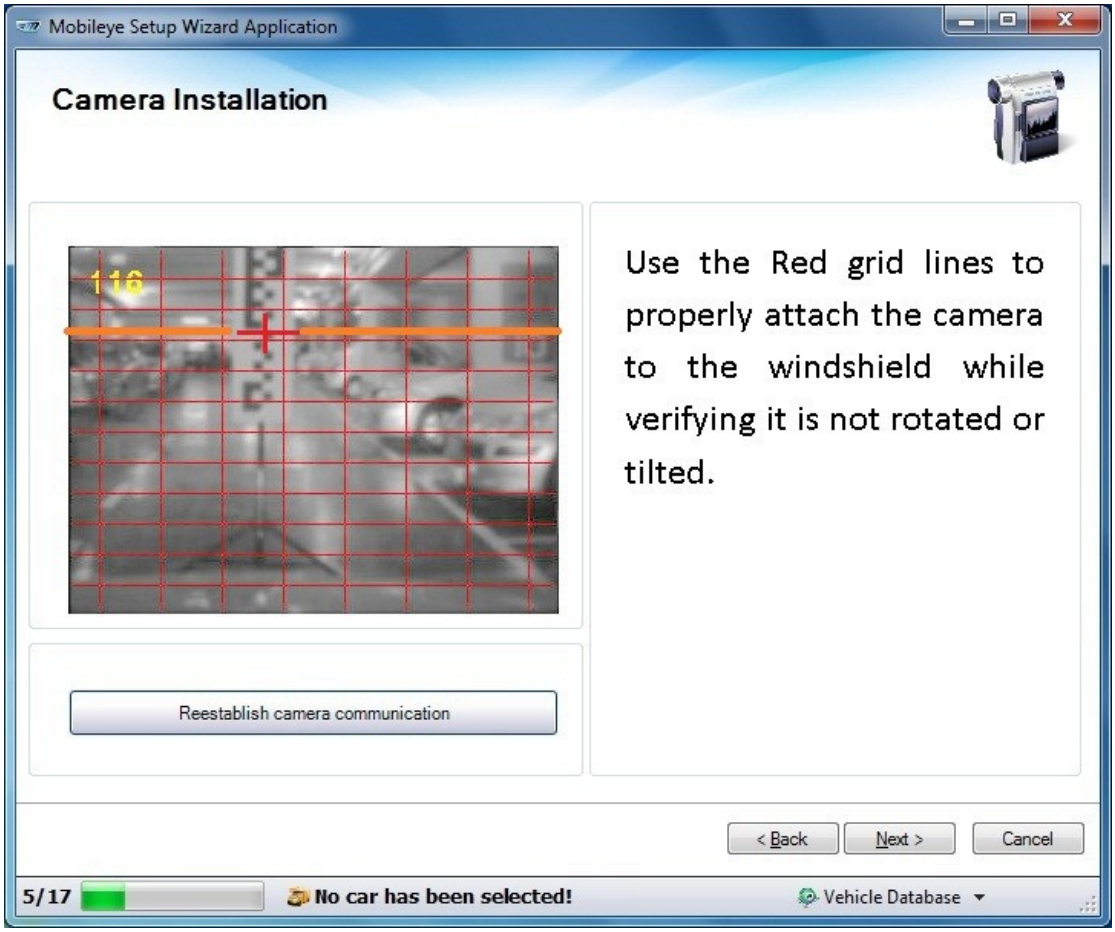


2. Using a piece of Isolation Tape (See Red Cross in below image), Mark the Camera Height you measured on the TAC Target.
   - When TAC is assembled and Open correctly the bottom part of the Checkered TAC Board should be 90 cm from the Ground.
   - Each Checkered Box in the TAC board = 5 cm



Red Cross represents Camera Height marked by Isolation tape at a Height of 1.32 cm

3. After marking the Camera Height on the TAC Target use the image feed (camera installation slide) to place the **Orange Camera Height Adjustment Line** on top of the Isolation Tape Marking. To do so moving the Camera Up or Down on the Camera Railing.



4. Once the Orange Camera Height Adjustment Line is parallel to the Isolation Tape Marking Lock the Camera Adjustment Screw and press next to continue.

NOTE: Do not re-connect the Main Unit Back Covers until the Calibration Process is completed.

4.3 Mobileye Setup Wizard – Calibration

Follow the Mobileye Setup Wizard Instructions to complete the Mobileye 5 Calibration Process.

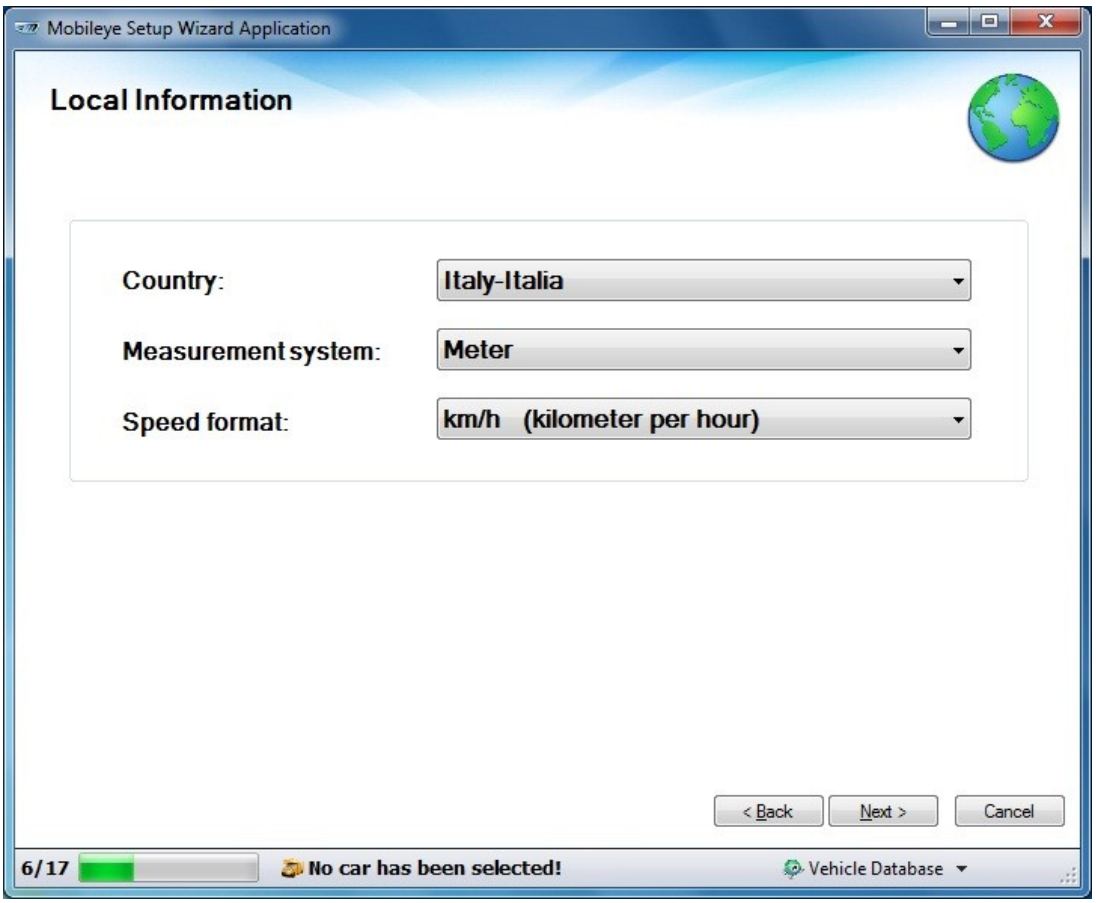
4.3.1 Local Information

In the "***Local Information***" slide please select the following:

a) Select the ***Country*** in which the installation is being done.

b) Select the ***Measurement system*** in which you choose to work in.

c) Select the ***Speed format*** in which you choose to work with (in accordance to the measurement system).

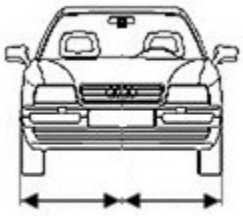


When done, click **"Next"**

4.3.2 Car Information

In the "***Car Information***" Slide, please enter the following:

a) **Vehicle Chassis num**
Enter the last 6 digits of the vehicle VIN number.

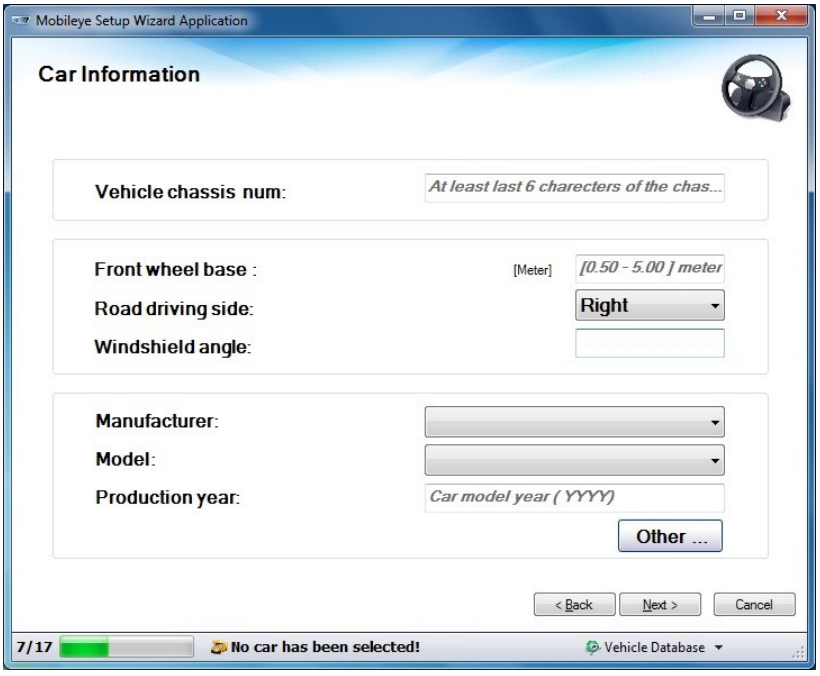

Front Wheel Base

b) **Front Wheel Base**
The distance between the outer edge of the Front Right wheel to the outer edge of the Front Left wheel).

c) **Road driving side**
Meaning the driving side of the road and not to the steering wheel side in the vehicle. For example, in the United Kingdom select "Left" and in the USA select "Right".

d) **Windscreen Angle**
As shown by the windscreen Angle measurement tools.

e) Insert the **Car Manufacture**, **Model**, and **Production Year**
Choose "**Other**" if the car is not in the automatic list and input the correct values.



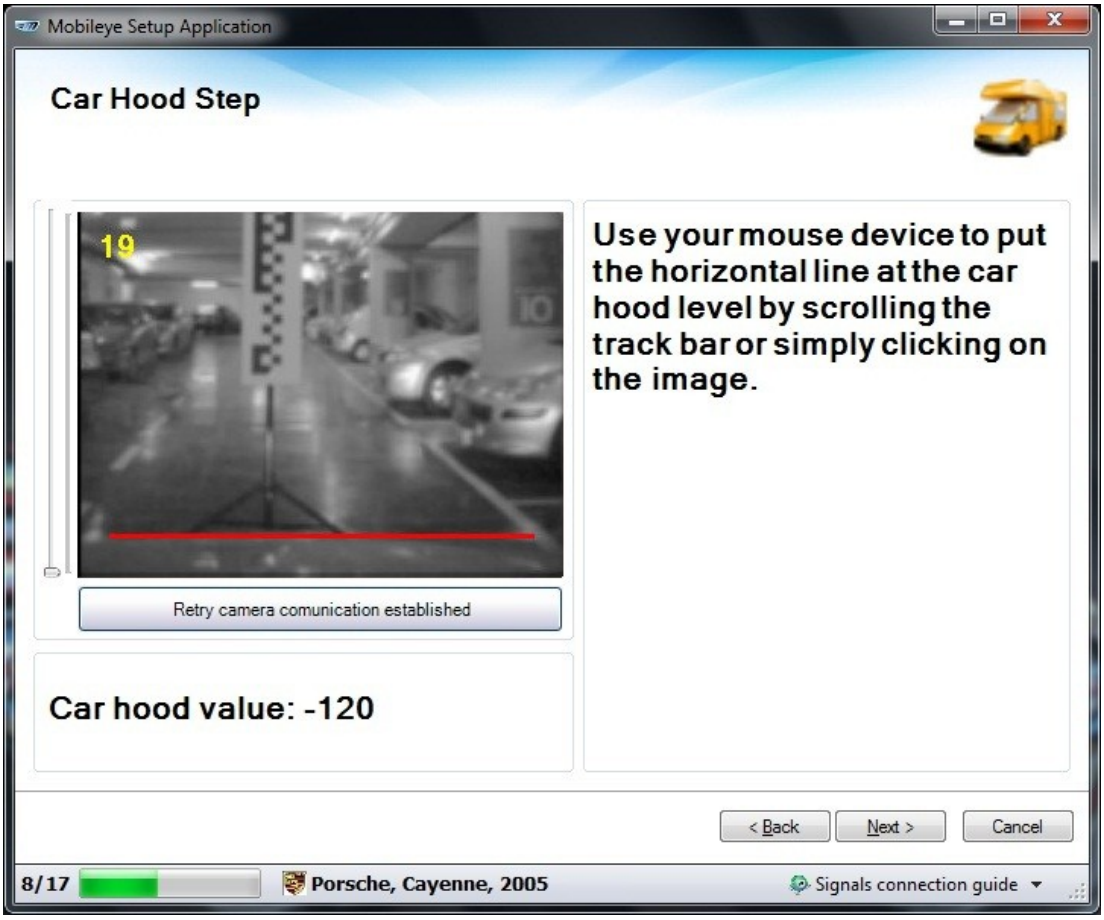
When done, click "**Next**".

4.3.3 Car Hood Step

NOTE: Perform car hood calibration only if there is a permanent obstruction to the camera's field of view by the car hood

Adjust car hood to exclude the car hood areas from being processed by moving the mark (Red Line) using the drag bar on the left side of the image, by clicking on the correct location in the image using the Mouse device or by using the keyboard arrows, until the cross is in the right position (see figure below).

If NO Car Hood is present in the image, Car Hood value should remain at the default value (-120).



Car hood alignment

When done, click "**Next**"

4.3.4 Actual Camera Position

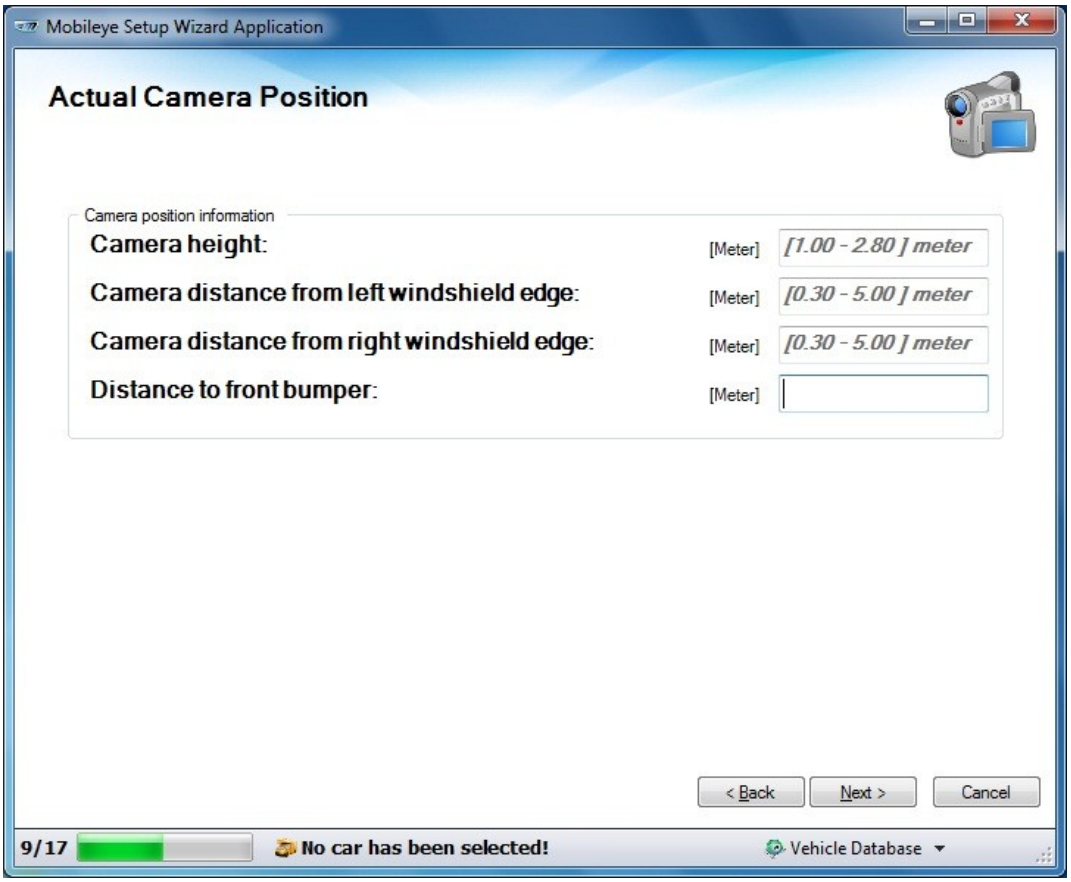
In the "***Actual Camera position***" slide set the following:

1. ***Camera height*** –
Enter the Camera height measured from the Ground Up

2. *Camera distance from Left windshield edge* –
Enter the lateral distance from the camera to the Left windscreen edge (M)

3. Camera distance from Right windshield edge –
Enter the lateral distance from the camera to the Right windscreen edge (m).

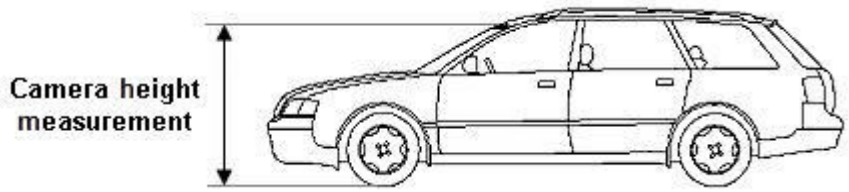
4. Distance To Front Bumper
The horizontal distance from the Camera to the front bumper of the vehicle.
For flat-nosed trucks and buses enter a minimum value of 0.1 m.



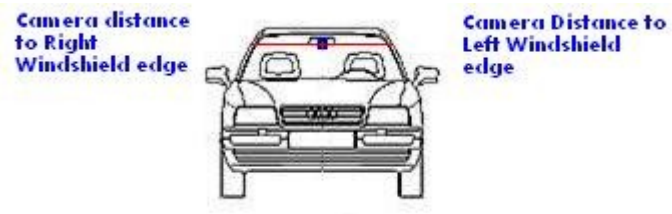
4.3.4.1 Camera Position Measurements

Measure the following dimensions using a measuring tape or any other appropriate measurement tool:

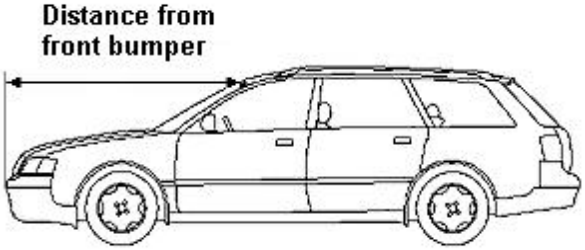
Camera Height from the ground:



Lateral distance from the camera to the right and left windshield edges:



Horizontal distance to the front end (i.e. end of front bumper) of the vehicle.
For example, this value should be 0.1cm for flat nosed trucks.



When done, click "**Next**"

4.3.5 Signals Source

- The Signal source slide informs you about the source of each signal.

- In Mobileye 5 the Signal Source will always be “CAN”

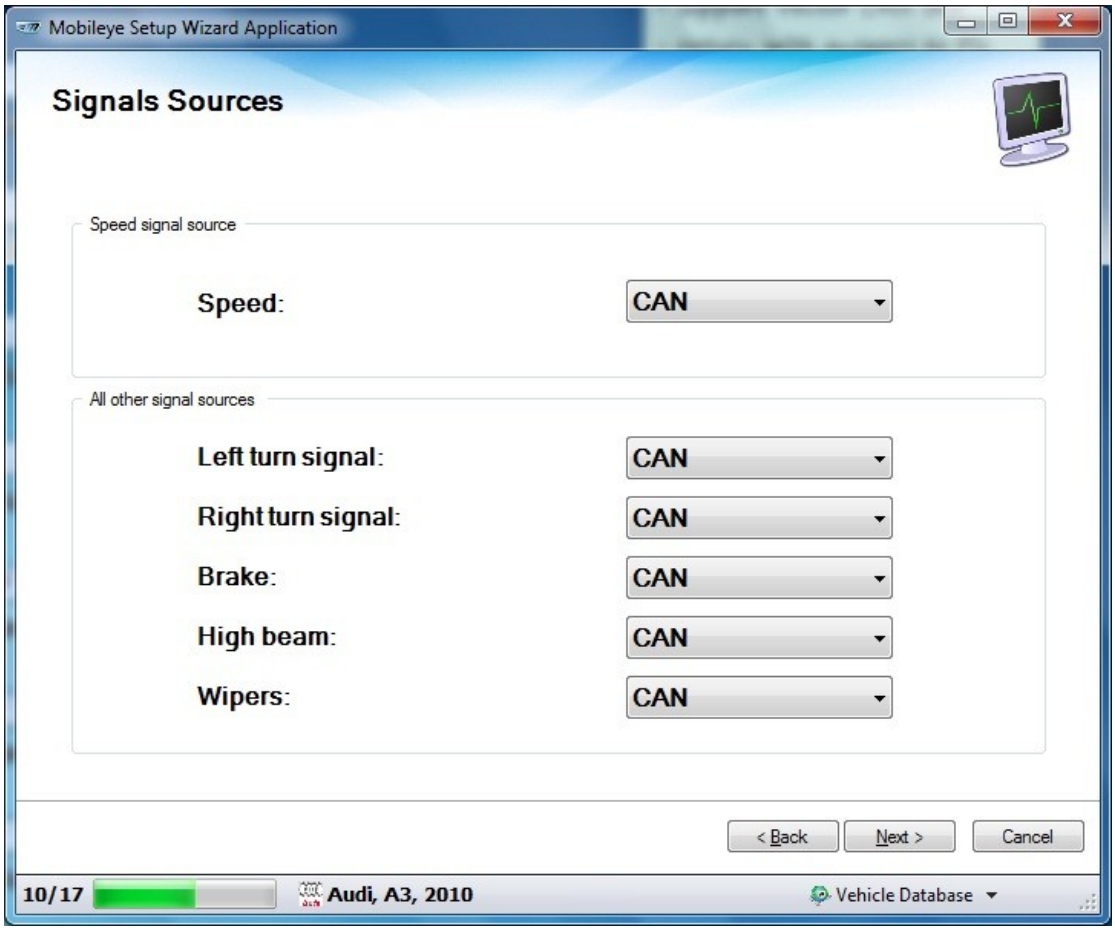
- Mobileye 5 cannot be configured to work with the vehicle’s Analog signals.

- CAN-Bus signals cannot be configured back to work with an Analog connection.

- A vehicle must be chosen from the CAN Database using the “Digital signals form”.

- Signals not available by CAN will be disabled.

- It is recommended not to make any changes if you followed the instructions in the Digital signals form” (CAN installation).

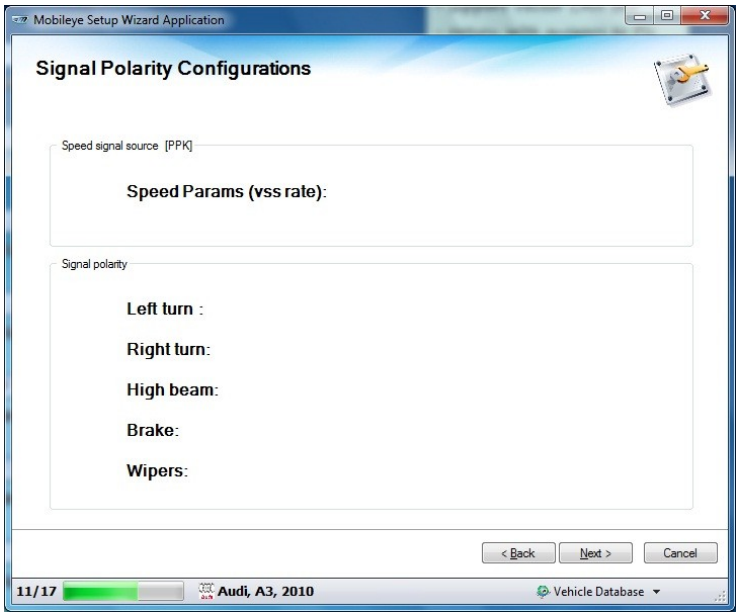


When done, click “**Next**”

4.3.6 Signals polarity Configuration

When performing a CAN installation this slide is not active (see image 1 below).

Click “Next” to continue



4.3.7 Camera Calibration

NOTE: Please perform this process while seated in the drivers seat

1. Locate the TAC Target exactly in the middle of the vehicle's front bumper, as close as possible to the bumper.

2. For Trucks and Buses with No Front Engine Hood (flat nose) locate the TAC Target exactly 1 meter from the middle of the vehicle's front bumper (verify exact middle position be using any flat 1 meter pole).

3. Click on “Calculate Close TAC”.

4. When the "Calculate Close TAC" is complete, an image of the close target with red dots will appear.

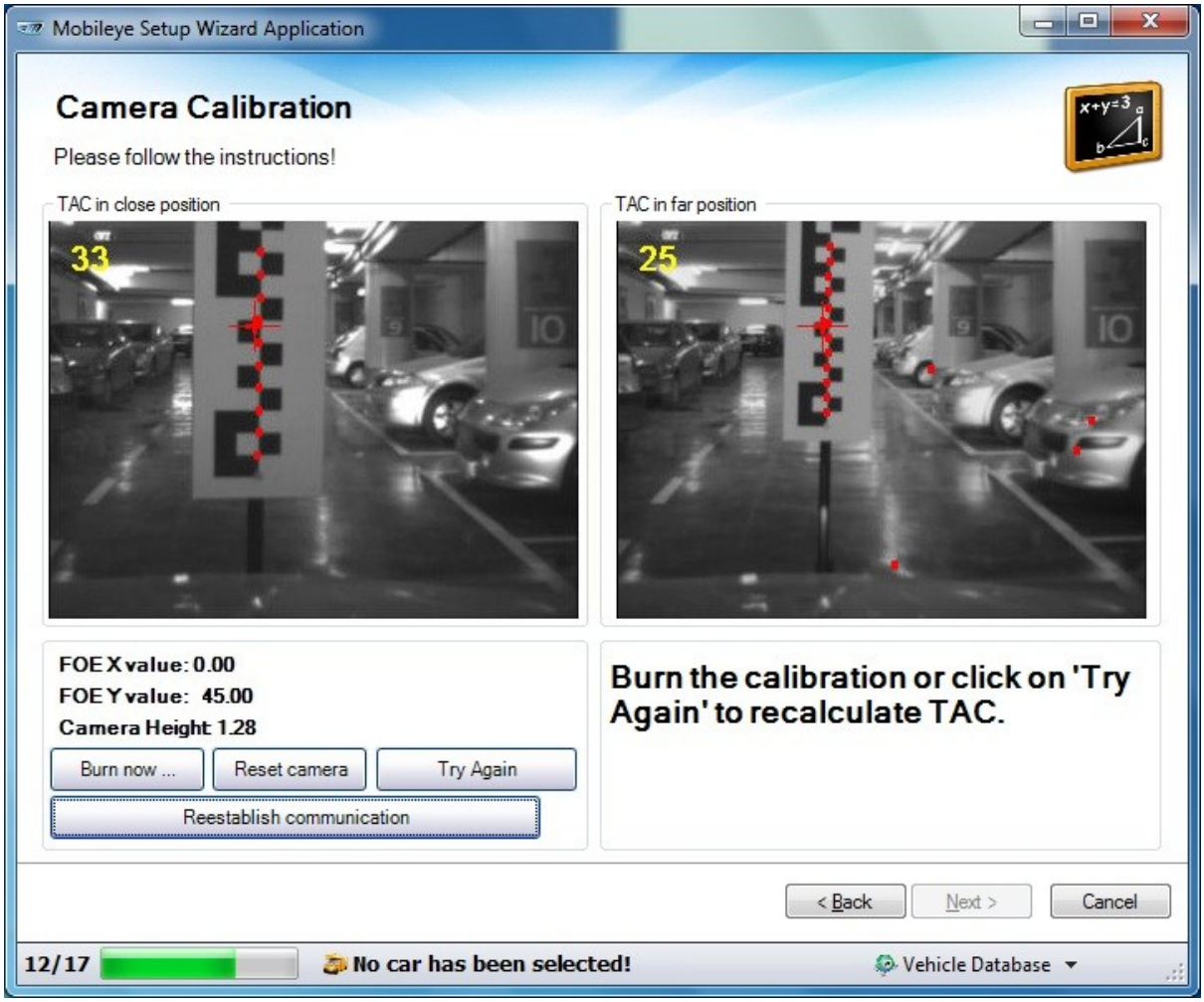
5. Now locate the TAC Target far from the front of the car (~1.0 m) and click on "**Calculate far TAC**".

6. For Trucks and Buses with No Front Engine Hood (flat nose) locate the TAC Target another 1 meter further away from the previous Close position.

7. When the "Calculate far TAC" is complete, you can see the F.O.E (Focus of Expansion) and Camera Height results at the bottom left corner of the slide.

8. If the Calculation did not succeed, try again by clicking on the "Try Again" button. If you still do not succeed please verify the TAC positioning (as instructed above).

9. If the calculation has succeeded click on "Burn Now".



10. When burning has been completed, click ‘Next’.

4.3.8 Signal Test & Configuration

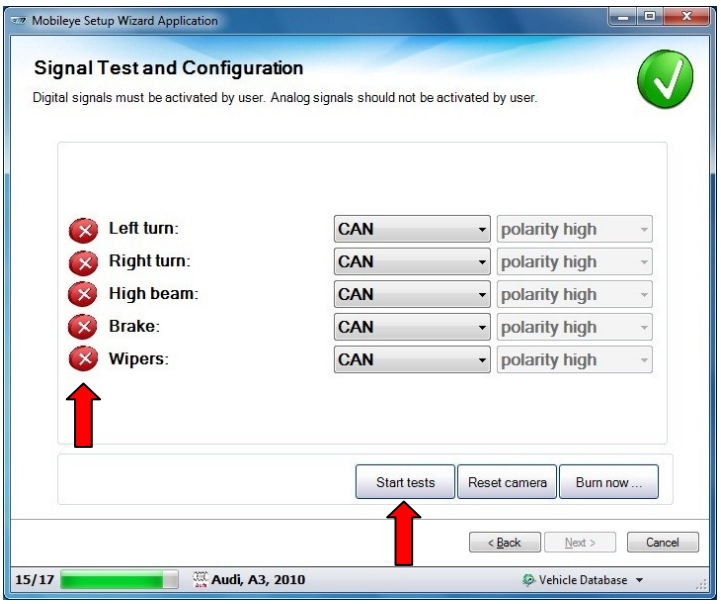
In this step you need to click on the "Start Test" button in order for the application to check the signals polarity.

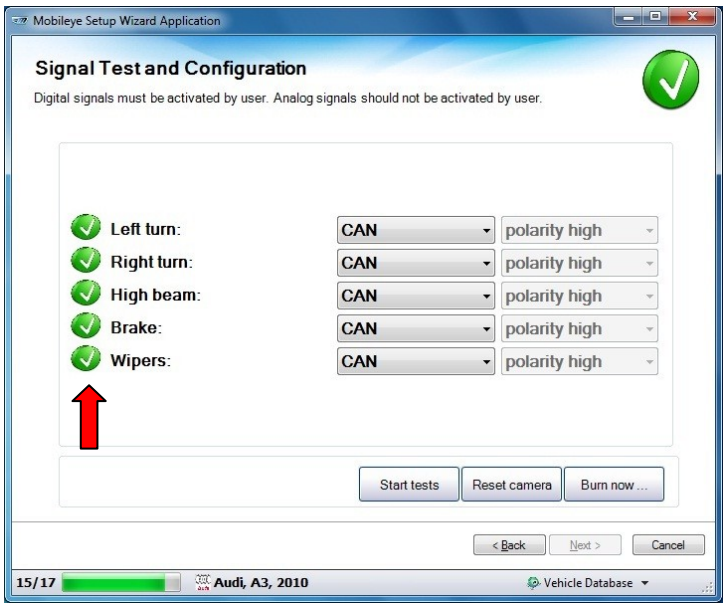
To check the signals polarity you need to activate the vehicle Signal.

Activation of the vehicle signals is done only after the Red Cross Icons appear on the Screen.

Once the Red Cross Icons appear you have 1 minute to activate all the vehicle signals and check the Red Crosses Icons turn into Green Check Icons.

Only when all signals are labeled with a Green Check Icon beside them, may you proceed to the next stage.





If the Signal Test has been successful, click "**Next**"

4.3.9 Test Drive

In the "Test Drive" Slide you need to verify the following:

1) Verifying Connection to Vehicle Signals

2) Verifying Speed Indication

4.3.9.1 Verifying Connection to Vehicle Signals

You must check the vehicles signals before leaving the installation site:

1. Turn on your vehicle left signal: the left signal indicator should turn Green.
2. Turn on your vehicle right signal: the right signal indicator should turn Green.
3. Press on the brake pedal: the brakes signal indicator should turn Red.

4. Turn on your vehicle High Beams signal: the High Beam signal indicator should turn Blue.

5. Turn on your vehicle Wipers signal: the Wipers signal indicator should turn Red/White.

4.3.9.2 Checking the speed indication while driving on the road:

1. Compare the speed indication between the Mobileye 5 system speed (as displayed in the laptop screen) to that of the host vehicle indicator.

2. Up to 5 km/h difference is allowed.

NOTE:

Please be aware that there is a 2 to 3 second delay between the vehicle speed to the speed indication in the Mobileye Setup Wizard application. Therefore, the Speed indication check should be done on the Highway when the vehicle is travelling at a steady speed of 80 km/h for duration of at least 5 seconds.

5 Appendix A

5.1 Parameter error significance and functionality implications

Camera height

The range measurement accuracy of the system is proportional to the camera height error. E.g., 1 cm error in camera height of 2.2 meters implies a ~0.45% error in range and headway measurement (insignificant).

Lateral distance to the front wheels

An error in this parameter will cause the warning to be moved by the same amount. For example, if the distance to right wheel is off by 1 cm then the warning will be issued with an error of 1 cm from the lane marking line (insignificant).

Distance to the front of the vehicle

The headway calculation subtracts this value from the camera-to-target distance. For example, an error of 10 cm in the distance of the vehicle bumper to the camera will result, for a target in the range of 30 meters, in a 0.33% error in range measurement. For European trucks this parameter can be assumed to be 0.