comark

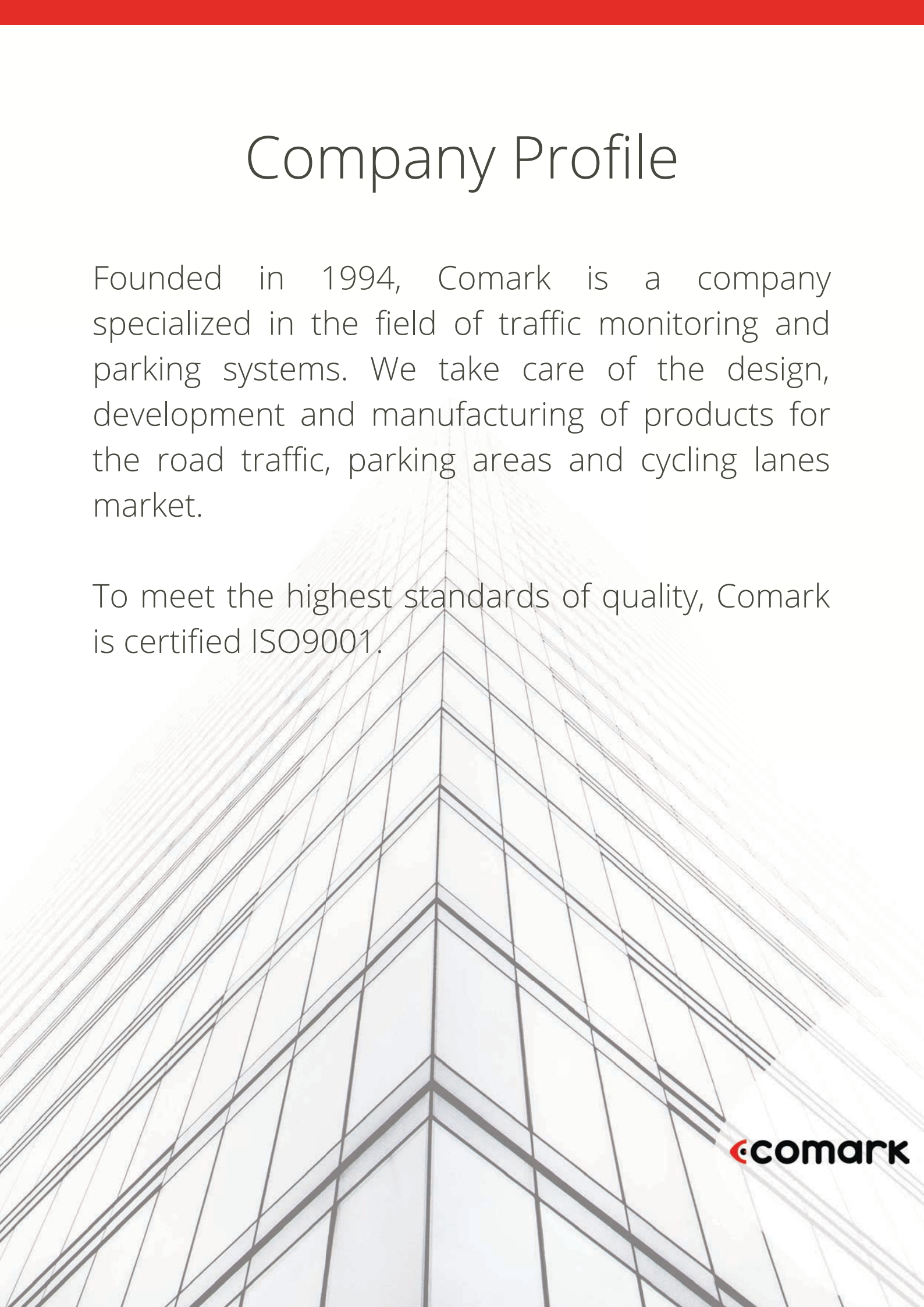
The HeArt of Traffic Detection

TRAFFIC CATALOGUE

Company Profile

Founded in 1994, Comark is a company specialized in the field of traffic monitoring and parking systems. We take care of the design, development and manufacturing of products for the road traffic, parking areas and cycling lanes market.

To meet the highest standards of quality, Comark is certified ISO9001.



Traffic

Traffic Monitoring
Couting & Classification
3D Profiling
Axle Counting
Over Height Vehicle Detection
Wrong Way Traffic Detection

Index

Traffic

Software

LSR2001
Laser Scanner

Accurate counting & classification with event trigger

LSR2001 is a sensor for vehicle detection based on the laser scanner technology. Compared to other technologies, this sensor is able to detect vehicles with high precision and resolution. LSR2001 is able to accurately measure vehicle profiles and is therefore the ideal tool for applications where precise vehicle classification is required. It is able to distinguish more than 20 classes of vehicles including:

- Motorcycles
- Cars
- Vans
- Trucks
- Lorries
- Articulated lorries
- Buses

The sensor has been designed, in both the mechanical and firmware side, to operate outdoor, even in adverse weather conditions. The firmware has in fact filters for rain and snow.

Oblique installation

The scanner optic is different from other products on the market, because it consists of two physically distinct areas for laser transmission and reception, making it particularly immune to the opacity produced by dust, water and pollution.

The sensor is equipped with a CPU that processes the signals received from the scanner to obtain all the data related to the transited vehicle. The communication with the sensor takes place via Ethernet line and it can be configured through simple and intuitive web pages.

Transversal installation

LSR2001
Laser Scanner

Accurate counting & classification with event trigger

Technology	Laser scanner
Emitted Light	905 nm not visible
Laser class	Class 1
Scan angle	96°
Scan period	16 ms
Transmission power	16 dB
Communication line	Ethernet
Power consumption	< 5 W
Power supply	12 ÷ 28 Vdc
Protection	IP65
Temperature range	LSR2001: -20°C ÷ +50°C LSR2001T: -40°C ÷ +60°C

Oblique

Transversal

	Oblique	Transversal
Counting	✓	✓
Speed	✓	○
Height	✓	✓
Vehicle class	✓	✓
Length	✓	○
Gap	✓	✓
Headway	✓	✓

APPLICATIONS

- Toll
- Traffic monitoring (ITS)
- Vehicle profiling
- Maximum height relief
- Vehicle classification
- Trigger for cameras

ACCESSORIES

- Mounting Brackets
- Environmental Protections
- Stainless Steel Casing
- Router
- CO1010 Control Unit

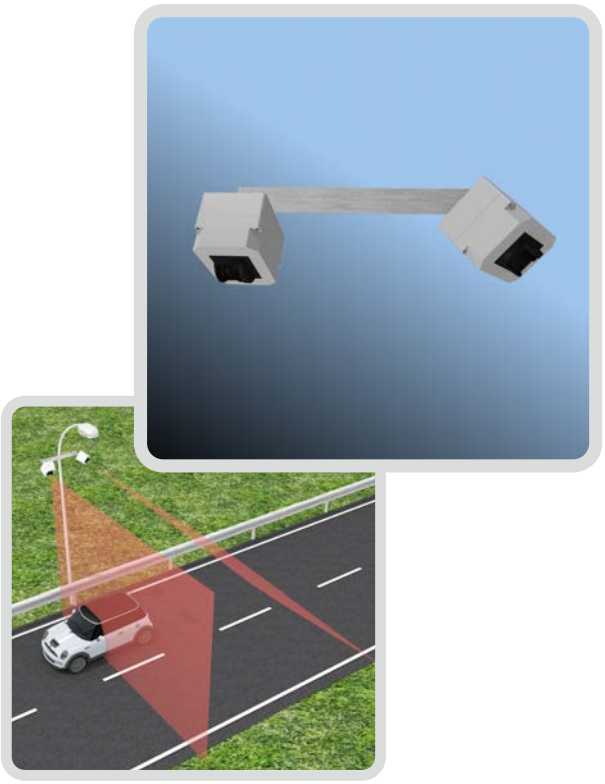
LSR2001 DOUBLE

Double Laser scanner

Up to 2 lanes detection, speed measurement from side of road

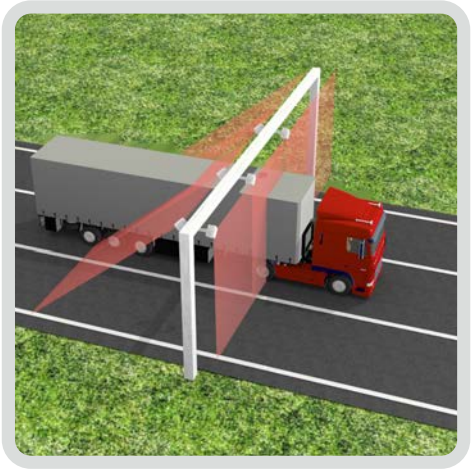
The LSR2001-DOUBLE sensor uses two lasers scanners to detect vehicles. Installed at the side of the road, its unique configuration permits to detect also the vehicle speed and lenght in 2 lanes. LSR2001-DOUBLE is able to accurately measure vehicle profiles and is therefore the ideal tool for applications where precise vehicle classification is required. It is able to distinguish more than 20 classes of vehicles including:

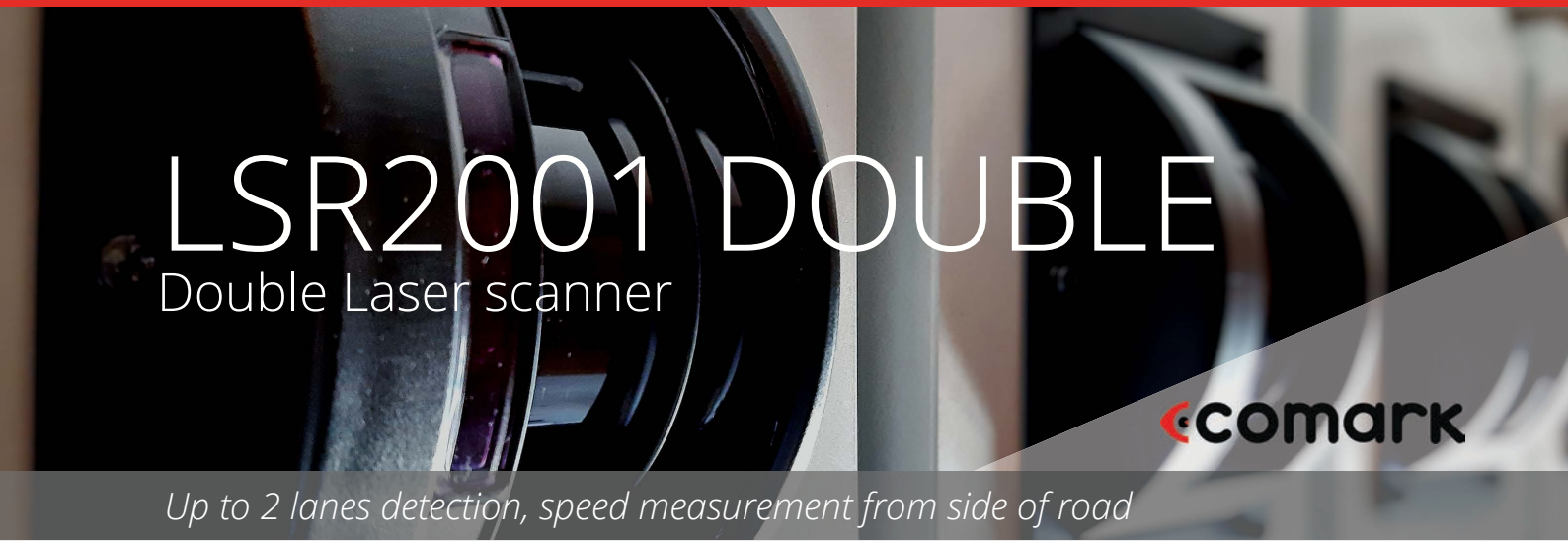
- Motorcycles
- Cars
- Vans
- Trucks
- Lorries
- Articulated lorries
- Buses



The LSR2001-DOUBLE is composed by a master and a slave sensor. The master, which contains the CPU, gets the data from the slave and combines it with its own data. The master sensor makes vertical scans and is mainly encharged of counting, classification and triggering. The slave is rotated to detect the vehicle at a certain distance from the master and it may be used, for example, to trigger a camera installed on the same pole. The orientation of the slave detector depends on the installation height of the detector.

Being a laser scanner, the detector can measure the vehicle's profile and their presence. For the said reasons it is very precise on classifying and counting vehicles even in "heavy" traffic conditions, stop & go and in queue presence.



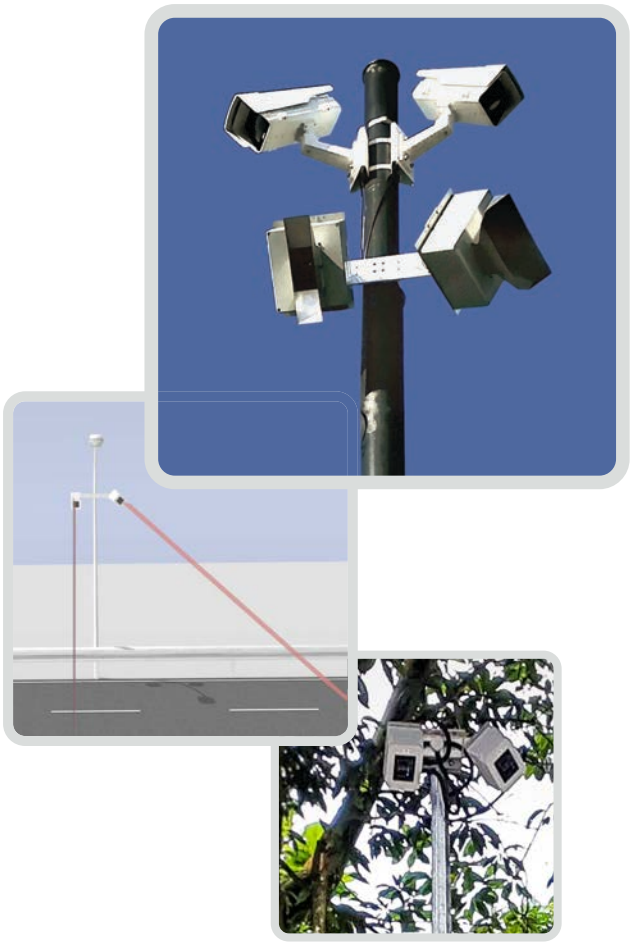


LSR2001 DOUBLE

Double Laser scanner

Up to 2 lanes detection, speed measurement from side of road

Technology	Double Laser scanner
Emitted Light	905 nm not visible
Laser class	Class 1
Max. detection range	20 m
Scan angle	96°
Scan period	16 ms
Transmission power	16 dB each sensor
Communication line	Ethernet
Power consumption	< 8 W
Power supply	12 ÷ 28 Vdc
Protection	IP65
Temperature range	LSR2001: -20°C ÷ +50°C LSR2001T: -40°C ÷ +60°C



LSR2001 DOUBLE

Counting	✓
Speed	✓
Height	✓
Vehicle class	✓
Length	✓
Gap	✓
Headway	✓
Traffic status	✓
Trigger for cameras	✓

APPLICATIONS

- Toll
- Traffic monitoring (ITS)
- Vehicle profiling
- Maximum height relief
- Vehicle classification
- Trigger for cameras

ACCESSORIES

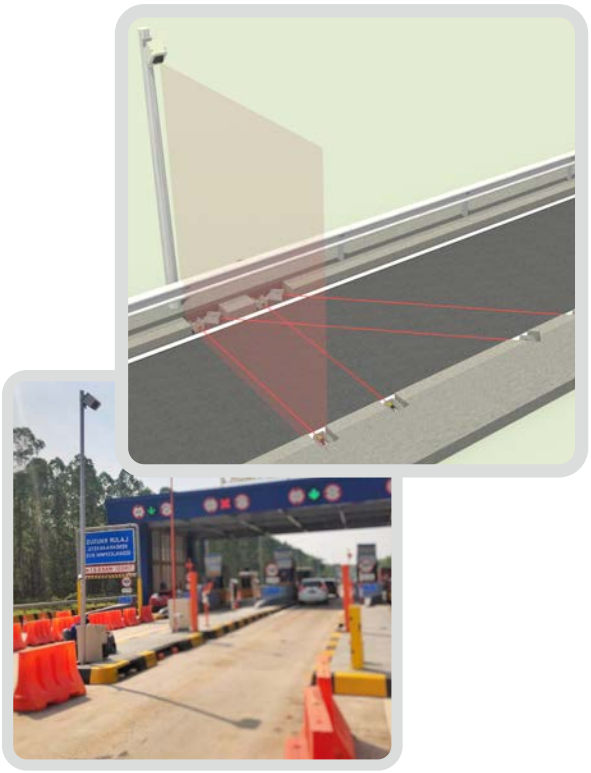
- Mounting Brackets
- Environmental Protections
- Stainless Steel Casing
- Router
- CO1010 Control Unit

LSR2001 AXLES

Laser + Photocells

Laser scanner accuracy with axle detection

The LSR-2001-AXLES sensor uses laser technology to detect vehicles and infrared photocells to detect axles. The emitted laser beam is used to scan on 1 plane on a 96° angle.
Along the plane the sensor detects 274 points and is able to precisely identify the profile of the vehicle.
The maximum sensing distance is 30 m and the emitted beam is on the infrared field, thus it is not visible.
The photocells couple consist of an emitter and a receiver and work on the infrared range. They are able to accurately detect the presence of axles thanks to the interruption of the emitted beam.



LSR-2001-AXLES is able to provide the speed and the length of the vehicle. Thanks to its laser scanner, the detector can measure the vehicles profiles and their presence. For this reason, it is very accurate in classifying and counting vehicles even in “heavy” traffic conditions, stop & go and in queue situations.

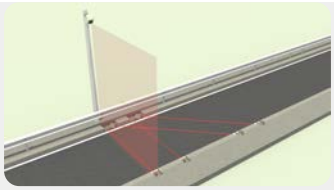
In order to create a complete set of data about the transit, the CPU collects the information both from the laser sensor and from the photocells.
LSR-2001-AXLES should be installed at toll stations or in places where there is a physical separation between adjacent lanes to install the photocells on the ground.
The detector has been designed both from the mechanical and firmware point of view to work outdoor with bad weather conditions.
The firmware has specific rain and snow filters.

LSR2001 AXLES

Laser + Photocells

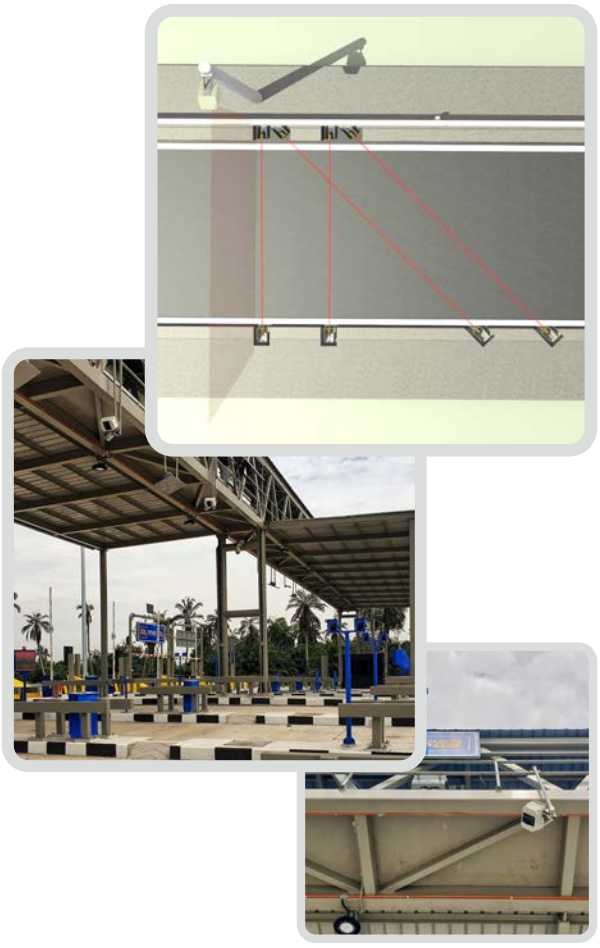
Laser scanner accuracy with axle detection

Technology	Laser scanner, time of flight measurement
Emitted Light	905 nm not visible
Laser class	Class 1
Max. Detection range	30 m
Scan angle	96°
Scan period	16 ms
Transmission power	16 dB
Communication line	Ethernet
Power consumption	< 5 W
Power supply	12 ÷ 28 Vdc
Photocells	Infrared
Protection	IP65 Laser, IP69 photocells
Temperature range	LSR2001: -20°C ÷ +50°C LSR2001T: -40°C ÷ +60°C



LSR2001 AXLES

- Axle detection ✓
- Counting ✓
- Speed ✓
- Lenght ✓
- Height ✓
- Vehicle class ✓
- Gap ✓
- Headway ✓
- Trigger for cameras ✓



APPLICATIONS

- Toll
- Traffic monitoring (ITS)
- Axle detection
- Maximum height relief
- Vehicle classification
- Trigger for cameras

ACCESSORIES

- Mounting Brackets
- Environmental Protections
- Stainless steel Casing
- Router
- CO1010 Control Unit

LSR21-I
Laser scanner

Presence detection with relay output

The LSR-21-I sensor uses laser technology to detect presence of vehicles in the detection area. The emitted laser beam is used to scan 4 planes at an angle of 96 °. The sensor detects 240 points along the plane and is able to accurately identify the vehicle profile. The maximum detection distance is 25 m. and the wave frequency of the beam is placed on the infrared and is therefore not visible.

The laser has two dry relays contacts that can be configured to be activated when an object is inside the detection area.
The configuration of the LSR21-I can be done through a remote controller.
Depending on the place of installation, the laser can be supplied with a detection distance of 5, 10 or 25 m.
The sensor is very easy to install and is light and small.
The IP65 degree of protection allows its use outdoors.

Technology	Laser scanner
Emitted Light	905 nm not visible
Laser class	Class 1
Max. Detection range	25 m
Scan angle	96°
Response time	40 ms
Transmission power	16 dB
Output	Relay
Power consumption	< 3 W
Power supply	12 ÷ 28 Vdc
Protection	IP65
Temperature range	-20°C ÷ +50°C

APPLICATIONS

- Vehicle presence detection
- People presence detection

LSR LASER
Summary

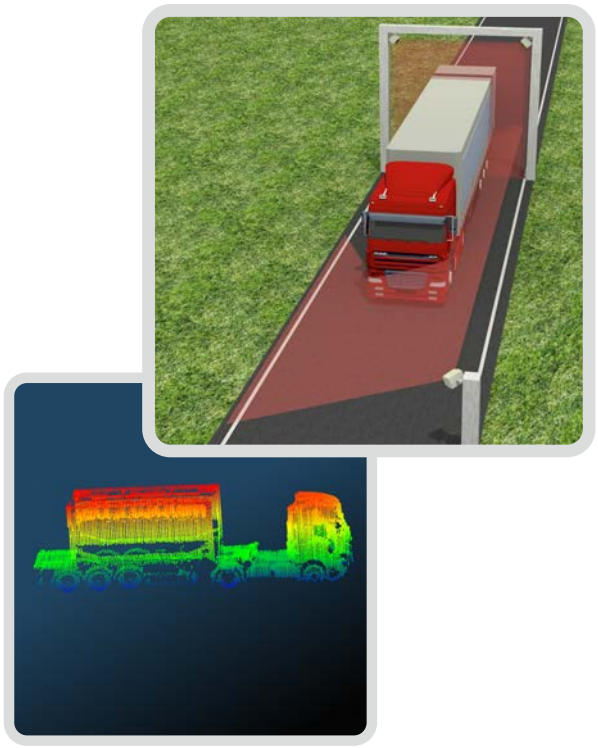
	Transversal	Oblique	Double	Axle	LSR21-I
					
Counting	✓	✓	✓	✓	✓
Vehicle class	✓	✓	✓	✓	○
Speed	○	✓	✓	✓	○
Height	✓	✓	✓	✓	○
Length	○	✓	✓	✓	○
Gap	✓	✓	✓	✓	○
Headway	✓	✓	✓	✓	○
Axle detection	○	○	○	✓	○
Traffic status	✓	✓	✓	✓	○
Trigger	✓	✓	✓	✓	✓
Direction of travel	○	✓	✓	✓	○
2 lanes detection	✓	○	✓	○	○
Roadside installation	✓	○	✓	✓	✓
Above lane installation	○	✓	○	○	✓

PROFILER

3D Profiler 3 Laser Scanners

3D vehicle dimensions measurement

The 3D profiling system can provide a high resolution 3D file of the vehicles and measure them in height, width and length.
The system is composed of 3 LSR2001 laser scanners: two are installed on the left and right sides of a gantry, the third one is installed on a side pole (or on a second gantry).
The first two lasers scan continuously both sides and the top of the vehicle, while the third one detects the position and movement. The result is a very accurate detection of: length, 3D shape, height, width, speed, profile and vehicle class.



The system is based on LSR2001 laser scanner, which has a scan angle of 96° with high definition. (274 measurements in 96° with an angular resolution of 0.35°).
One of the three LSR2001 sensors used in the profiling system acts as a master unit and combines the information given by the other two to create an accurate 3D profile of the vehicle.

The system provides a fully detailed "point cloud" 3D image, which can be used for further vehicle analysis. Thanks to the use of 3 laser scanners it is possible to have the complete profile of both sides and top of each vehicle.
The front laser scanner provides the vehicle position in real time, permitting a high precision lenght measuring, even in stop & go condition.

PROFILER

3D Profiler 3 Laser Scanners

3D vehicle dimensions measurement

Technology	Laser scanner (Lidar)
Emitted Light	905 nm not visible
Laser class	Class 1
Scan angle	96°
Scan period	16 ms
Transmission power	16 dB each sensor
Communication line	Ethernet
Power consumption	< 18 W
Power supply	12 ÷ 28 Vdc
Number of Lasers	3
Protection	IP65
Temperature range	LSR2001: -20°C ÷ +50°C LSR2001T: -40°C ÷ +60°C

3D Vehicle profile	✓
Single gantry	○
Both vehicle sides	✓
Counting	✓
Speed	✓
Lenght	✓
Height	✓
Width	✓
Stop & Go	○
Free Flow	○
Trigger for cameras	✓

ACCESSORIES

- Mounting Brackets
- Environmental Protections
- Stainless Steel Casing
- Router
- CO1010 Control Unit

APPLICATIONS

- Harbour trucks' analysis
- Custom borders vehicle analysis
- Traffic monitoring (ITS)
- Vehicle profiling
- Toll
- WIM
- Vehicle classification
- Trigger for cameras

PROFILER TT or LT

3D Profiler 2 Laser scanners single gantry

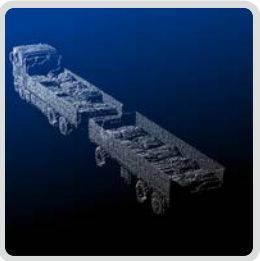
Vehicle height & width measurement

The 3D profiling system can provide a high resolution 3D file of the vehicles and measure them in height, width and length.
The system is composed of 2 LSR2001 laser scanners which has a scan angle of 96° with high definition. (274 measurements in 96° with an angular resolution of 0.35°), installed on a single gantry, and it can be delivered in 2 different versions:

- TT (transversal - transversal)
- LT (longitudinal - transversal)

PROFILER TT

PROFILER TT version is composed by 2 LSR2001 Laser scanners, installed on the left and right top sides of the lane. The system is able to deliver a high accuracy width and height measurement of each vehicle.



PROFILER LT version is also composed by 2 LSR2001 Laser scanners, installed one on the side (left or right) of the lane, and the second LSR2001 above the lane in central position. The system is able to deliver a high accuracy height and lenght measurement of each vehicle.

The system provides a fully detailed "point cloud" 3D image, which can be used for further vehicle analysis.

Both versions can be easily placed on a single gantry, making it ideal for those applications in which a reduced infrastructure installation is required. They are also suitable for applications with free flow traffic condition.

PROFILER LT

PROFILER TT or LT

3D Profiler 2 Laser scanners single gantry

Vehicle height & width measurement

Technology	Laser scanner
Emitted Light	905 nm not visible
Laser class	Class 1
Scan angle	96°
Scan period	16 ms
Transmission power	16 dB each sensor
Communication line	Ethernet
Power consumption	< 15 W
Power supply	12 ÷ 28 Vdc
Number of Lasers	2
Protection	IP65
Temperature range	LSR2001: -20°C ÷ +50°C LSR2001T: -40°C ÷ +60°C

PROFILER LT

PROFILER TT

	PROFILER TT	PROFILER LT
		
3D Vehicle profile	✓	✓
Single gantry	✓	✓
Both vehicle sides	✓	○
Counting	✓	✓
Speed	○	✓
Lenght	○	✓
Height	✓	✓
Width	✓	✓
Stop & Go	✓	✓
Free Flow	✓	✓
Trigger for cameras	✓	✓

ACCESSORIES

- Mounting Brackets
- Environmental Protections
- Stainless Steel Casing
- Router
- CO1010 Control Unit

APPLICATIONS

- Harbour trucks' analysis
- Custom borders vehicle analysis
- Traffic monitoring (ITS)
- Vehicle profiling
- Toll
- WIM
- Vehicle classification
- Trigger for cameras

✓ Feasible ○ Not Feasible ✓ Feasible with limitations

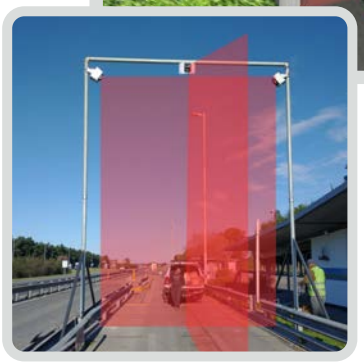
PROFILER LTT

3D Profiler Single Gantry 3 Laser Scanners

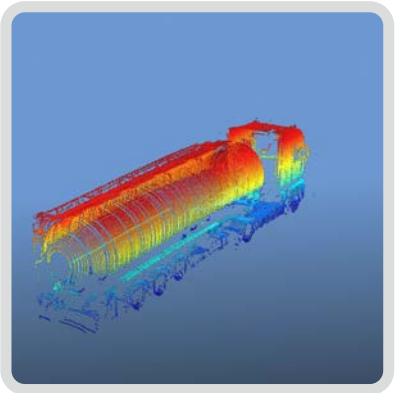
3D vehicle measurement with single gantry installation

The 3D profiling system can provide a high resolution 3D file of the vehicles and measure them in height, width and length.
The system is composed of 3 LSR2001 laser scanners installed on the same gantry, two of them on the left and right sides, and the third one above the lane in center position.
The first two lasers continuously scan both sides and the top of the vehicle, while the third one detects the position and movement. The result is a very accurate detection of: length, 3D shape, height, width, speed, profile and vehicle class.

The LSR2001 laser scanner has a scan angle of 96° with high definition. (274 measurements in 96° with an angular resolution of 0.35°).
One of the three LSR2001 sensors used in the profiling system acts as a master unit and combines the information given by the other two to create an accurate 3D profile of the vehicle.



The system provides a fully detailed "point cloud" 3D image, which can be used for further vehicle analysis. Thanks to the use of 3 laser scanners it is possible to have the complete profile of both sides and top of each vehicle.
The front laser scanner provides the vehicle position in real time, permitting a high precision lenght measuring, even in stop & go condition.



PROFILER LTT

3D Profiler Single Gantry 3 Laser Scanners

3D vehicle measurement with single gantry installation

Technology	Laser scanner
Emitted Light	905 nm not visible
Laser class	Class 1
Scan angle	96°
Scan period	16 ms
Transmission power	16 dB each sensor
Communication line	Ethernet
Power consumption	< 18 W
Power supply	12 ÷ 28 Vdc
Number of planes	3
Protection	IP65
Temperature range	LSR2001: -20°C ÷ +50°C LSR2001T: -40°C ÷ +60°C

3D Vehicle profile	✓
Single gantry	✓
Both vehicle sides	✓
Counting	✓
Speed	✓
Lenght	✓
Height	✓
Width	✓
Stop & Go	✓
Free Flow	✓
Trigger for cameras	✓

ACCESSORIES

- Mounting Brackets
- Environmental Protections
- Stainless Steel Casing
- Router
- CO1010 Control Unit

APPLICATIONS

- Harbour trucks' analysis
- Custom borders vehicle analysis
- Traffic monitoring (ITS)
- Vehicle profiling
- Toll
- WIM
- Vehicle classification
- Trigger for cameras

✓ Feasible ○ Not Feasible ✓ Feasible with limitations

PROFILER CO

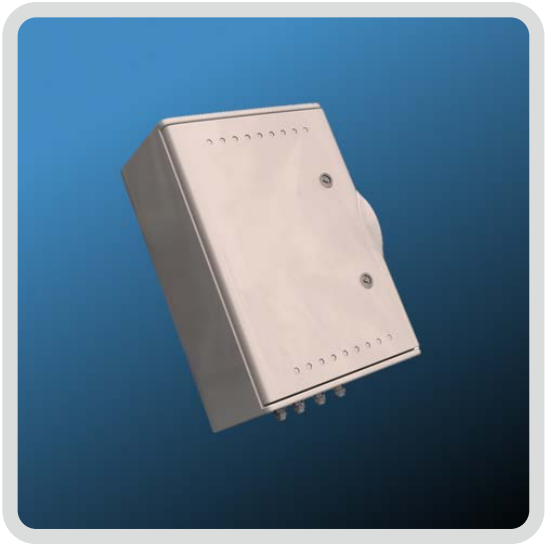
Control Unit for Profiler series

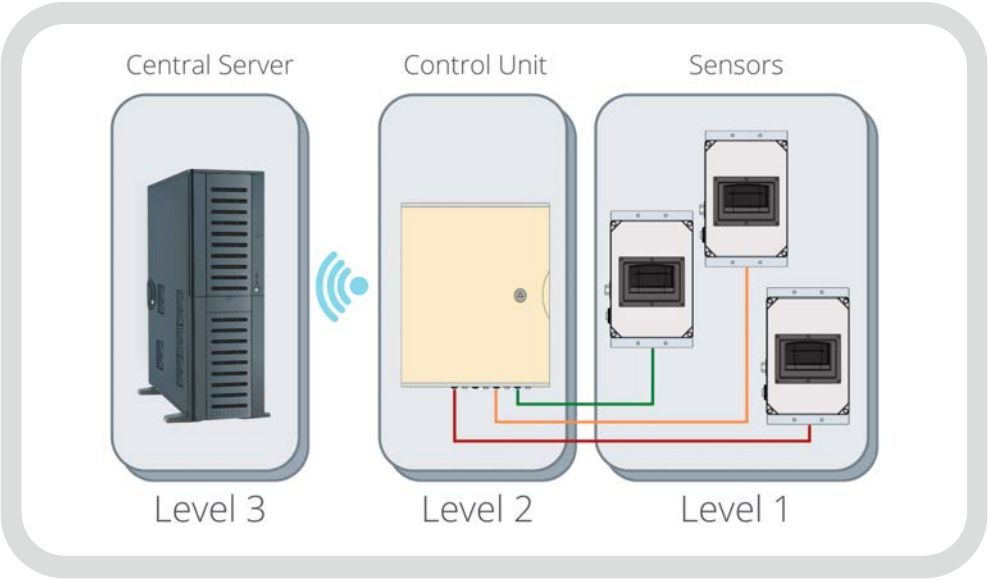
Data aggregation and communication with central software

PROFILER-CO Control unit has been specifically designed to house the power supply and power line protection hardware for each PROFILER system.

PROFILER-CO is composed by:

- External cabinet
- Power supply
- Power line protection
- 3G/4G Router (optional)





PROFILER
Summary

	3 LASERS	2 LASERS TT	2 LASERS LT	3 LASERS LTT
				
3D Vehicle profile	✓	✓	✓	✓
Single gantry	○	✓	✓	✓
Both vehicle sides	✓	✓	○	✓
Counting	✓	✓	✓	✓
Speed	✓	○	✓	✓
Lenght	✓	○	✓	✓
Height	✓	✓	✓	✓
Width	✓	✓	✓	✓
Stop & Go	✓	✓	✓	✓
Multiple vehicles	○	✓	✓	✓
Trigger for cameras	✓	✓	✓	✓

✓ Feasible ○ Not Feasible ✓ Feasible with limitations

MD01
Radar doppler

Speed and lenght measurement

The MD01 microwave sensor is a last generation radar doppler with digital signal processing. It is a very versatile sensor that can be installed both above the lane and at the side of the road to detect speed, count vehicles and classify them.
The "patch" may have different opening angles, depending on the application, in order to cover the entire width of the lane.
For an optimal performance and a good accuracy of the data it is recommended to install one MD01 per lane, but the sensor is able to detect vehicles even on two lanes (only for side installation) and to determine the direction of travel.
The antenna signals are analyzed by the internal microcontroller which, through digital signal processing techniques, provides the following transit data:

- Counting
- Length
- Classification in length
- Speed
- Gap
- Headway

Microwave technology, using the Doppler effect, is very accurate in detecting speed.
MD01 has two serial lines: one RS232 for connections up to 10-15 meters and one RS485 for long distance connections. It also has a "digital output" for a possible synchronization with cameras.

MD01
Radar doppler

Speed and lenght measurement

Technology	Radar doppler microwave
Frequency	24,15Ghz - K Band
Transmission power	16 dB
Opening angle	12°x25°
	9°x18°
Data line	RS232 & RS485
External dimensions	120x122 mm.
Weight	600/900 g.
Power consumption	120 mA max.
Power supply	12 Vdc
Temperature range	-20°C ÷ +50°C

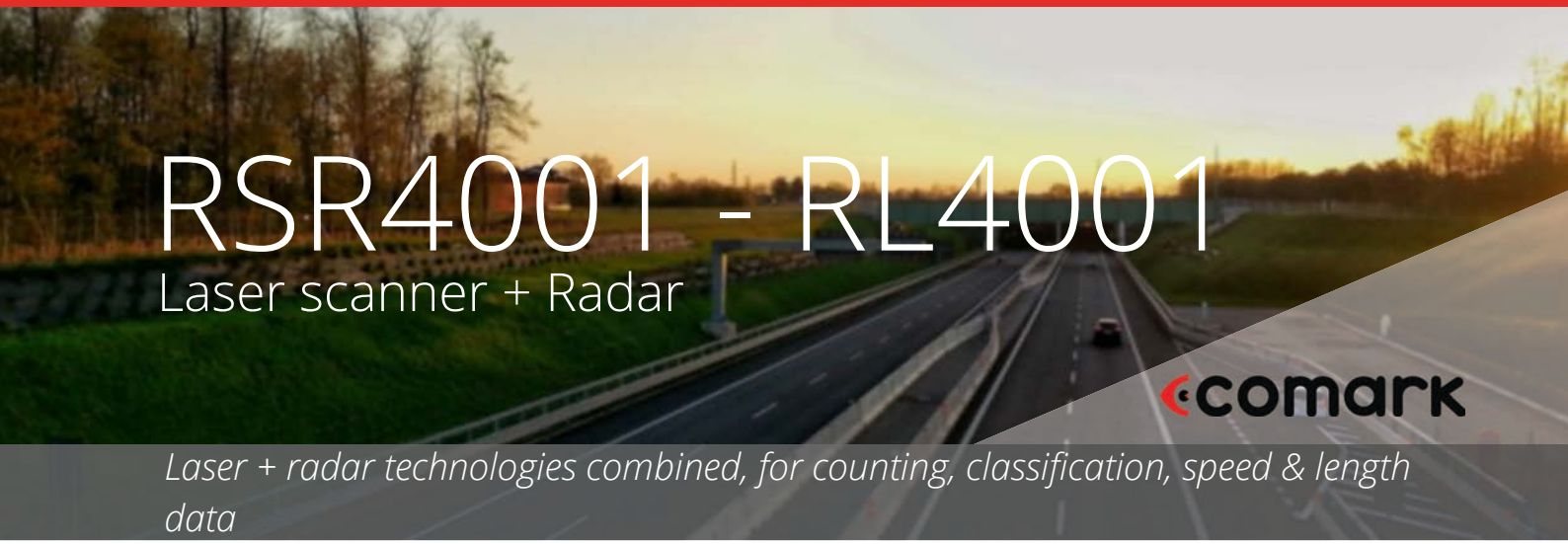
Counting	✓
Speed	✓
Vehicle class	✓
Length	✓
Gap	✓
Trigger for cameras	✓

APPLICATIONS

- Speed monitoring
- Traffic monitoring (ITS)
- Vehicle classification
- Trigger for cameras

ACCESSORIES

- Mounting Brackets
- CO1010 Control Unit



RSR4001 - RL4001

Laser scanner + Radar

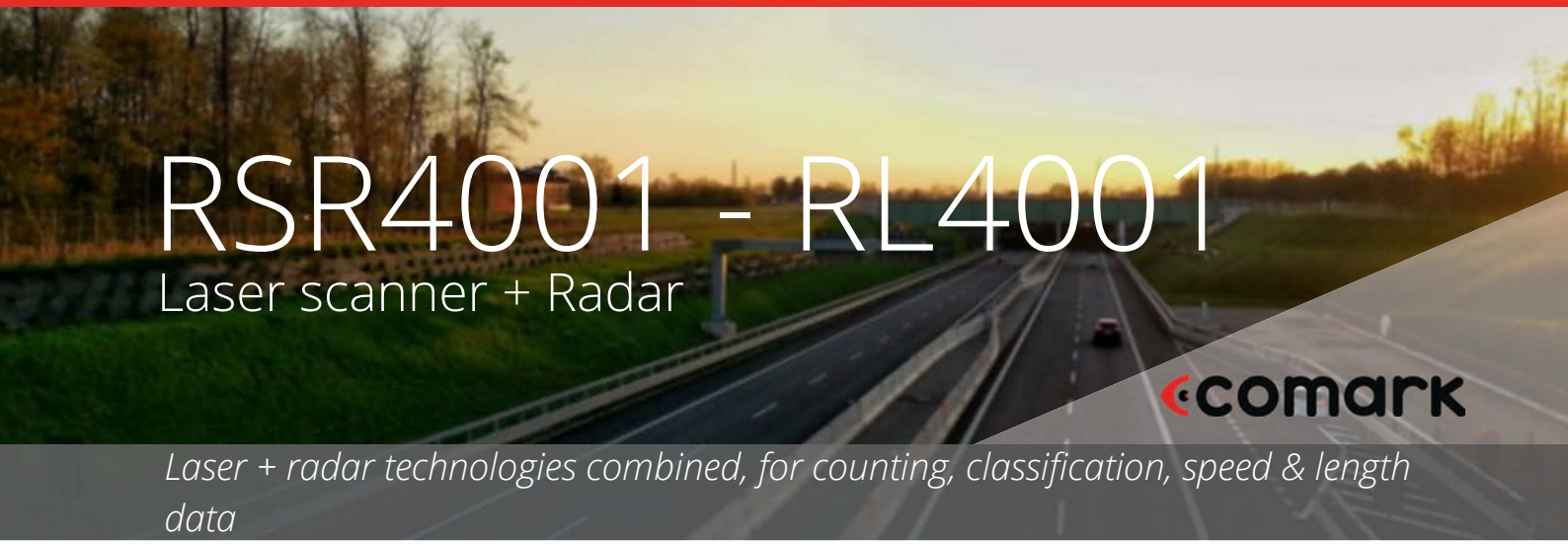
Laser + radar technologies combined, for counting, classification, speed & length data

RSR4001 and RL4001 are both vehicle detectors based on laser scanner and radar doppler technologies. The radar uses microwave technology and, in particular, the Doppler effect to measure the speed of vehicles with extreme precision. The laser scanner measures the profile of the vehicles allowing a precise classification of the transits.

RSR4001 is mounted in a single enclosure, while RL4001 is composed by the laser scanner and radar doppler in 2 different enclosures for a better orientation of each technology.
RSR4001 and RL4001 are able to distinguish up to 20 classes of vehicles including motorcycles, cars, vans, trucks, lorries, articulated lorries and, buses. The merge of two different technologies, enables the sensor to be very accurate and to measure all data about transit.
The sensor has been built both from the mechanical and firmware point of view to work outdoors even in adverse weather conditions. The firmware implements filters for rain and snow.
The scanner optics are made of two physically distinct areas for laser transmission and reception, making it particularly immune to the opacity produced by dust, water and pollution.
The microwave technology with the "patch" antenna and an opening angle of 9°x18° is very precise in the detection of speed.
The sensor is equipped with a CPU that processes the signals received from the scanner and the radar to obtain all the data related to the transited vehicle. Communication with the sensor takes place via an Ethernet line and the configuration can be performed using simple and intuitive web pages.

RSR4001

RL4001



RSR4001 - RL4001

Laser scanner + Radar

Laser + radar technologies combined, for counting, classification, speed & length data

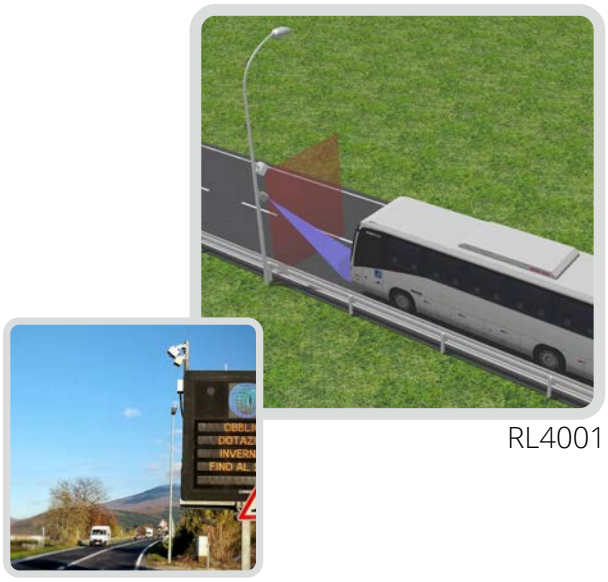
RSR4001 - RL4001

Technology 1	Laser scanner
Technology 2	Microwave radar
Emitted light	905 nm - not visible
Laser class	Class 1
Scan angle of laser	96°
Radar Frequency	24.15 Ghz - K Band
Communication line	Ethernet
Power consumption	< 6 W
Power supply	12 ÷ 28 Vdc
Protection	IP65
Temperature range	-20°C ÷ +60°C

RSR4001

APPLICATIONS

- Toll
- Traffic monitoring (ITS)
- Vehicle profiling
- Maximum height relief
- Vehicle classification
- Trigger for cameras



RL4001

ACCESSORIES

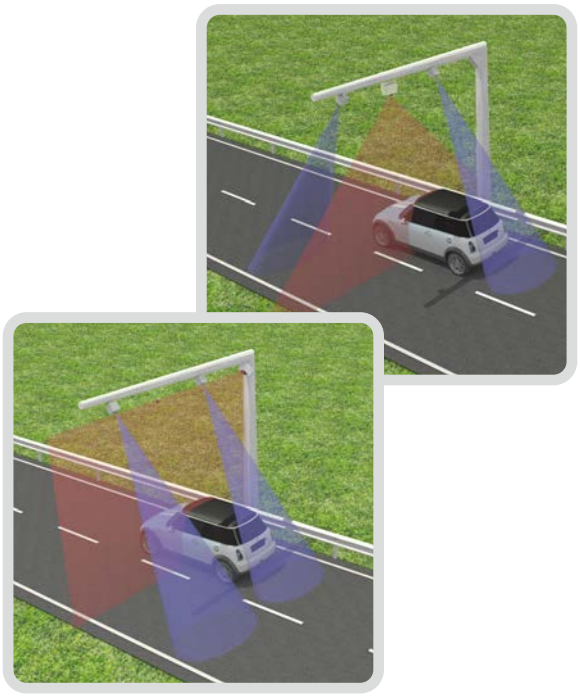
- Mounting Brackets
- Environmental Protections
- Stainless Steel Casing
- Router
- CO1010 Control Unit

RRL4001

Laser scanner + 2 Radar

Laser + radar technologies combined for 2 lanes detection

RRL4001 is a vehicle detector based on laser scanner and radar doppler technologies. Each unit is composed by n.1 Laser Scanner and n. 2 Radar doppler. Its unique configuration allows the RRL4001 to detect up to 2 lanes with high accuracy.
The radar uses microwave technology and, in particular, the Doppler effect to measure the speed of vehicles with extreme precision. The laser scanner measures the profile of the vehicles allowing a precise classification of the transits.
RRL4001 is composed by the laser scanner and 2 radar doppler, each one mounted on single enclosures for a better orientation of each technology.
RRL4001 is able to distinguish up to 20 classes of vehicles including motorcycles, cars, vans, trucks, lorries, articulated lorries and, buses. The use of two different technologies, enables the sensor to be very accurate and to measure all data about transit.
The sensor has been built both from the mechanical and firmware point of view to work outdoors even in adverse weather conditions. The firmware implements filters for rain and snow.
The scanner optics are made of two physically distinct areas for laser transmission and reception, making it particularly immune to the opacity produced by dust, water and pollution.
The microwave technology with the "patch" antenna is very precise in the detection of speed.
The sensor is equipped with a CPU that processes the signals received from the scanner and the radar to obtain all the data related to the transited vehicle. Communication with the sensor takes place via an Ethernet line and the configuration can be performed using simple and intuitive web pages.



RRL4001
Laser scanner + 2 Radar

Laser + radar technologies combined for 2 lanes detection

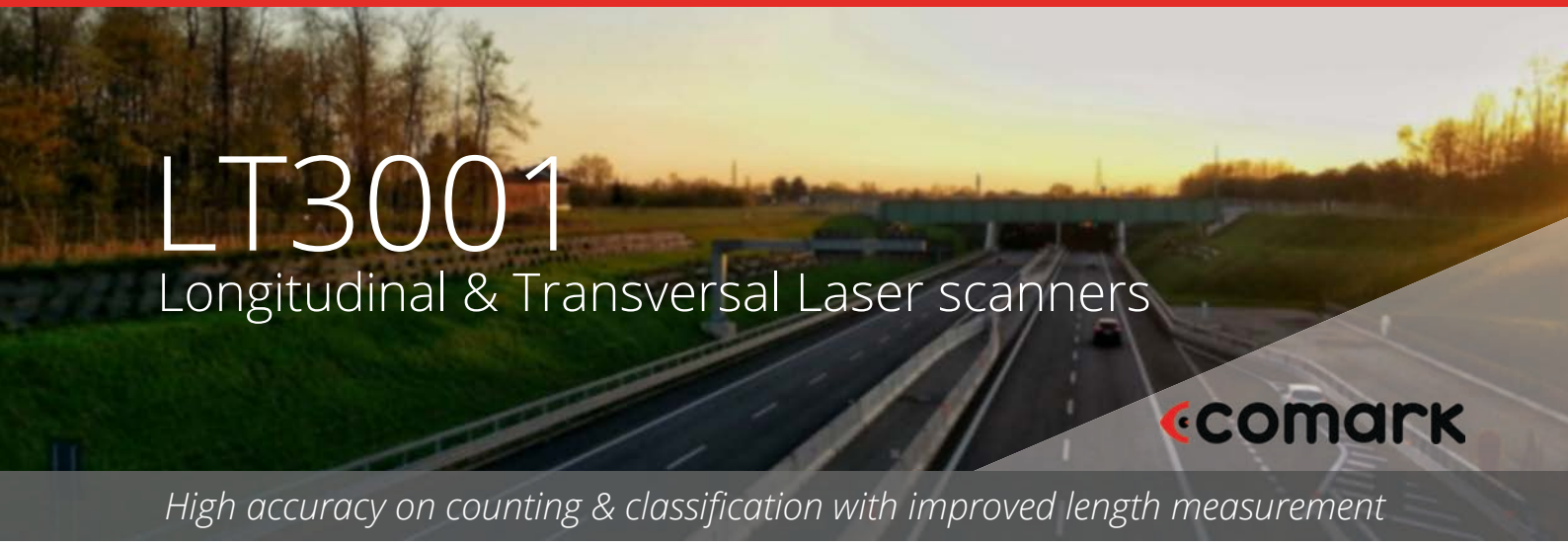
Technology 1	Laser scanner
Technology 2	Microwave radar
Emitted light	905 nm - not visible
Laser class	Class 1
Scan angle of laser	96°
Radar Frequency	24.15 Ghz - K Band
Radar angle	9° x 18°
Communication line	Ethernet
Power consumption	< 7 W
Power supply	12 ÷ 28 Vdc
Protection	IP65
Temperature range	-20°C ÷ +60°C

APPLICATIONS

- Toll
- Traffic monitoring (ITS)
- Vehicle profiling
- Maximum height relief
- Vehicle classification
- Trigger for cameras

ACCESSORIES

- Mounting Brackets
- Environmental Protections
- Stainless Steel Casing
- Router
- CO1010 Control Unit

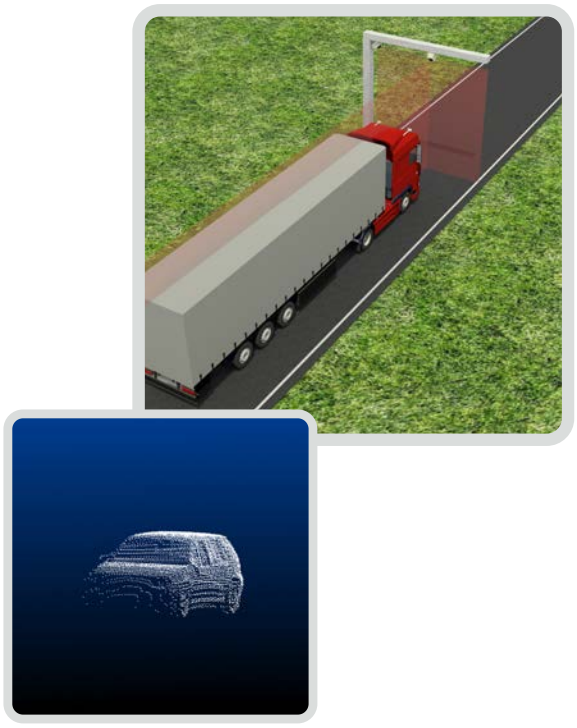


LT3001

Longitudinal & Transversal Laser scanners

High accuracy on counting & classification with improved length measurement

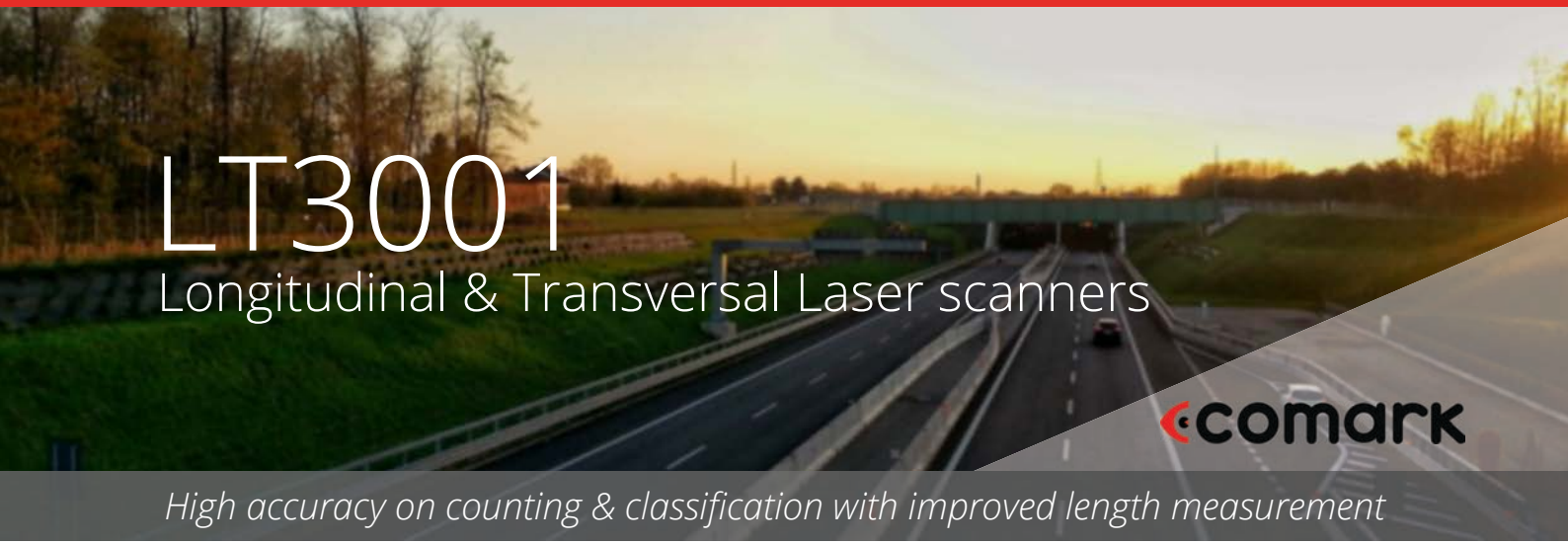
LT3001 is a vehicle detector based on 2 laser scanners. One scanner is installed on the middle of the lane and has the detection area parallel to the lane; the other is installed on the side of the lane and detects perpendicularly to the road.
The longitudinal laser tracks the vehicle as it moves along the lane and measures its position, speed and length.
The transversal scanner measures the width, height and profile of the vehicles providing an accurate classification of the transits.



LT3001 is able to distinguish more than 20 classes of vehicles including motorcycles, cars, vans, trucks, lorries, articulated lorries, buses.
The sensor has been built both from the mechanical and firmware point of view, to work outdoors even in adverse weather conditions. The firmware implements filters for rain and snow.

The scanner optic is made of two physically distinct areas for laser transmission and reception, making it particularly immune to the opacity produced by dust, water and pollution.

Each sensor is equipped with a CPU that processes the signals received from the scanner to obtain all the data related to the transited vehicle. One laser is configured as master and the other as slave and both work together as a single detector. Communication with the master sensor takes place via an Ethernet line and the configuration can be performed using simple and intuitive web pages.
In addition to the transit data, the LT3001 sensor also provides a file in 3D format to see the image of the transit from different perspectives.

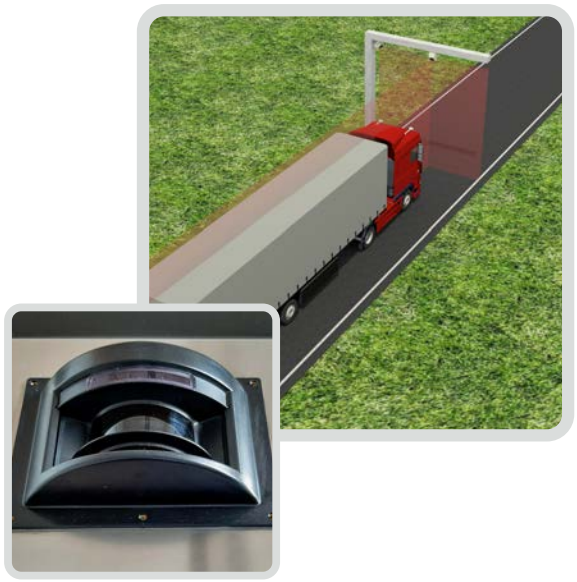


LT3001

Longitudinal & Transversal Laser scanners

High accuracy on counting & classification with improved length measurement

Technology	Laser scanner
Emitted Light	905 nm not visible
Laser class	Class 1
Scan angle	96°
Scan period	16 ms
Transmission power	16 dB
Communication line	Ethernet
Power consumption	< 5 W
Power supply	12 ÷ 28 Vdc
Protection	IP65
Temperature range	LSR2001: -20°C ÷ +50°C LSR2001T: -40°C ÷ +60°C

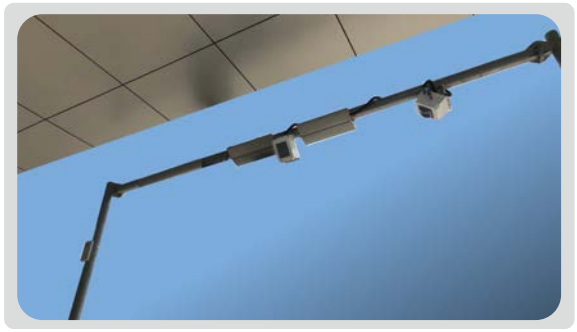


APPLICATIONS

- Toll
- Traffic monitoring (ITS)
- Vehicle profiling
- Vehicle classification
- Trigger for cameras

ACCESSORIES

- Mounting Brackets
- Environmental Protections
- Stainless Steel Casing
- Router
- CO1010 Control Unit



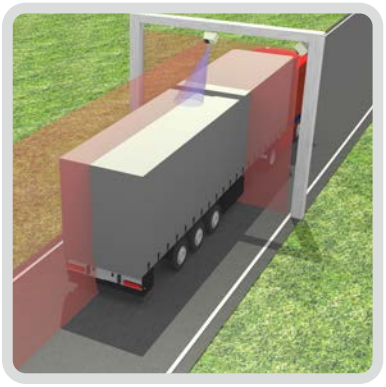
LTR5001

2 Laser scanner + Radar

Multiple technology for detection in all environmental conditions

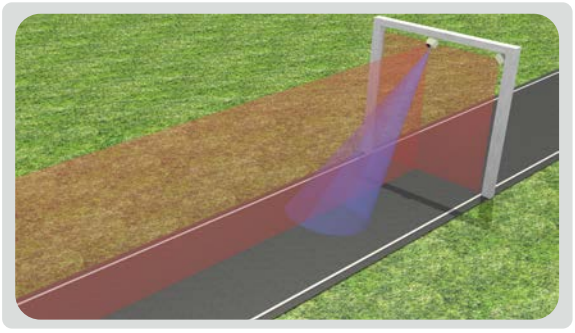
LTR5001 is a vehicle detector based on 2 laser scanners and 1 Micorwave Radar. One Laser scanner is installed along with the radar on the middle of the lane , and has the detection area parallel to the lane; the other Laser scanner is installed on the side of the lane and detects perpendicularly to the road.
The longitudinal laser tracks the vehicle as it moves along the lane and measures its position, speed and length; and is able to trigger an alarm when a vehicle reaches a distance from 0 up to 15 meters distance from the sensor. The radar Doppler is able to measure the speed of vehicles with extreme precision.
The transversal scanner measures the width, height and profile of the vehicles providing an accurate classification of the transits.

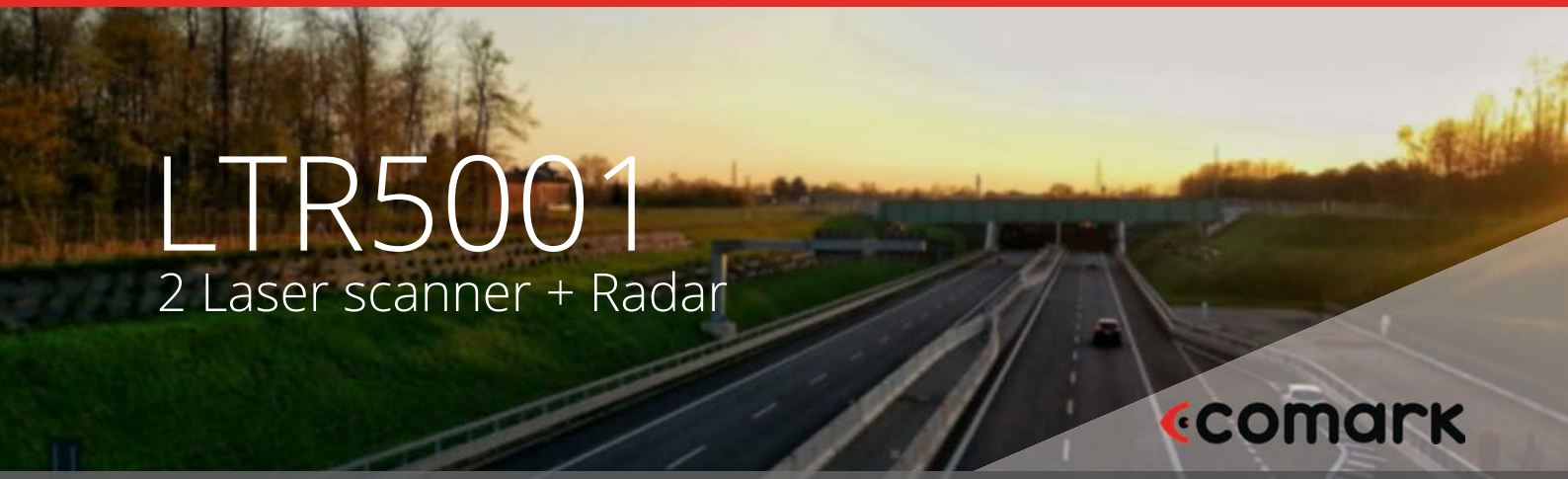
LTR5001 is able to distinguish more than 20 classes of vehicles including motorcycles, cars, vans, trucks, lorries, articulated lorries, buses.
The sensor has been built both from the mechanical and firmware point of view, to work outdoors even in adverse weather conditions. The firmware implements filters for rain and snow.



The scanner optic is made of two physically distinct areas for laser transmission and reception, making it particularly immune to the opacity produced by dust, water and pollution.

The sensor is equipped with a CPU that processes the signals received to obtain all the data related to the transited vehicle. Communication with the master sensor takes place via an Ethernet line and the configuration can be performed using simple and intuitive web pages.



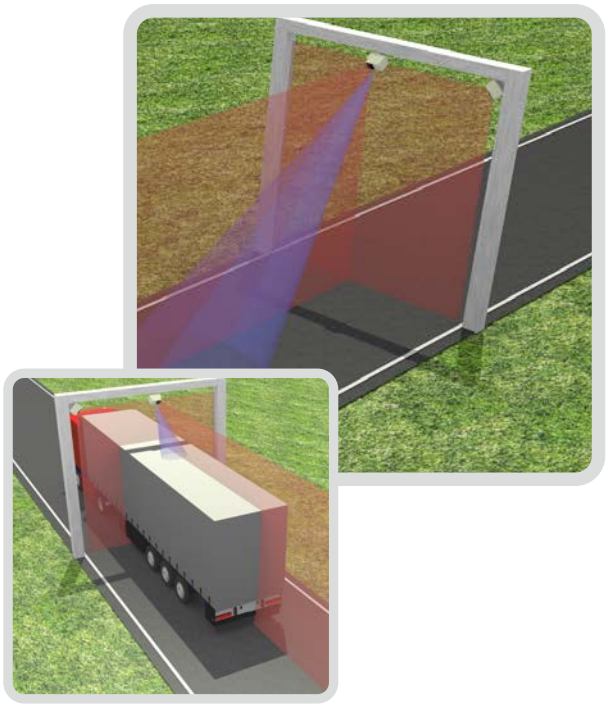


LTR5001

2 Laser scanner + Radar

Multiple technology for detection in all environmental conditions

Technology 1	Laser scanner
Technology 2	Microwave radar
Emitted light	905 nm - not visible
Laser class	Class 1
Scan angle of laser	96°
Radar Frequency	24.15 Ghz - K Band
Radar angle	9° x 18°
Communication line	Ethernet
Power consumption	< 11 W
Power supply	12 ÷ 28 Vdc
Protection	IP65
Temperature range	-20°C ÷ +60°C



ACCESSORIES

- Mounting Brackets
- Environmental Protections
- Stainless Steel Casing
- Router
- CO1010 Control Unit

APPLICATIONS

- Freeflow
- Toll
- Traffic monitoring (ITS)
- Vehicle profiling
- Maximum height relief
- Vehicle classification
- Trigger for cameras

RAM01
Over Height Vehicle Detection

Over height vehicle detection for soft applications

Infrastructure strikes are costly to both highway and road network operators; creating hours of delay and disruption and of course risking the lives of anyone directly or indirectly involved. Therefore, it is mandatory to have an accurate system that warns drivers in advance if their vehicles exceed the maximum height approaching overhead structure.

The RAM Series have been developed to prevent infrastructures strikes and collisions and therefore consequences to the drivers.

RAM01 is the entry level product of the RAM series, suitable mainly for indoor applications or simple outdoor applications.

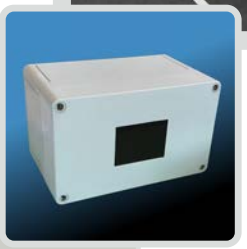
RAM01 is based on a single beam laser, with a high detection frequency (up to 1KHz) and a narrow angle to detect small objects. The light emitted (infrared light pulses) is reflected in order to be recognized by the receiver filtering the environmental light noises.

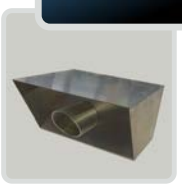
RAM01 is installed on the road's side and detect overheight vehicles on 3-4 lanes.

The over height detector is capable of operating during night and day and at temperature ranging from: –25°C to +60°C.

Compared to systems based on photocells with transmitter and receiver, the RAM series have the advantage of easy installation as they are placed at the road's side; and they don't need to collimate transmitter and receiver.

ALARM
RAM01 provides alarms in different ways when an over height vehicle is detected: relay contact; digital output.





ACCESSORIES

- Mounting Brackets
- Environmental Protections
- Stainless Steel Casing
- RAMCO Control Unit

Technology	Laser
Laser class	Class 1
Opening angle	0,5°
Detection Range	20 mt (15cm object)
Minimum width of object	15 cm
Maximum vehicle speed	100 km/h.
Data line	Ethernet
Alarm	Relay, D/O
Power supply	12 ÷ 28 Vdc
Protection	IP65
Temperature range	-25°C ÷ +60°C

RAM11
Over Height Vehicle Detection

Twin single-beam laser for over height vehicle detection

The RAM Series have been developed to prevent strikes and collisions against roads infrastructures such as bridges, tunnels, underpasses, etc. In fact, Infrastructure strikes are costly to both highway and road network operators; creating hours of delay and disruption. Therefore, it is mandatory to have an accurate system that warns drivers in advance if their vehicles exceed the maximum height approaching overhead structure.

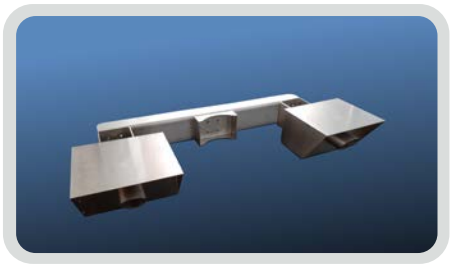
RAM 11 is based on two single beam lasers, with a high detection frequency (up to 1KHz) and a narrow angle to detect small objects.

The light emitted (infrared light pulses) is reflected in order to be recognized by the receiver filtering the environmental light noises. The lasers are positioned horizontally in order to detect the vehicle travel's direction. It is important to highlight that RAM11, compared to RAM01, strongly reduces false alarms.
RAM 11 is installed on the road's side and can detects overheight vehicle on 3-4 lanes.

Compared to systems based on photocells with transmitter and receiver, the RAM series have the advantage of easy installation as they are placed at the road's side; and they don't need to collimate transmitter and receiver.

The RAM11 is also able to provide the lane in which the overheight vehicle has travelled and operates under night and day conditions.

ALARM
RAM11 provides alarms in different ways when an over height vehicle is detected: relay contact; digital output.



ACCESSORIES
- Mounting Brackets
- Environmental Protections
- RAMCO Control Unit

Technology	Laser
Laser class	Class 1
Opening angle	0,5°
Detection Range	20 mt (10 cm object) 40 mt (15 cm object)
Minimum width of object	10 cm
Maximum vehicle speed	150 km/h.
Data line	Ethernet
Alarm	Relay, D/O
Power supply	12 ÷ 28 Vdc
Protection	IP65
Temperature range	-25°C ÷ +60°C

RAM20
Over Height Vehicle Detection

Wide detection area, up to 2 lanes detection with minimum false-alarms rate

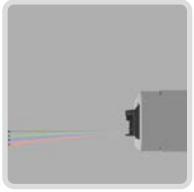
RAM20 is an accurate sensor that has been developed to detect overheight vehicles.
RAM20 is based on a laser scanner with 4 planes of detection, creating a wide detection area which helps avoiding false alarms; and an internal CPU that processes the signals received by the laser head to obtain all the data related to the overheight vehicle. The laser scanner has an internal heating system to avoid the moisture condensation on the optical lens. The light emitted (infrared light pulses) is reflected in order to be recognized by the receiver filtering the environmental light noises.

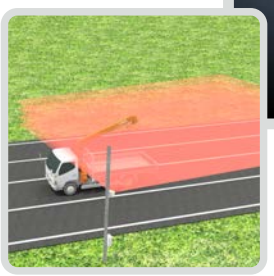
The RAM20 is also able to provide the lane in which the overheight vehicle is travelling and operates under night and day conditions. RAM20 can detect overheight vehicles on 2 lanes. In case of a 4 lanes road, it is possible to install two RAM20 systems, one on each side of the road.

Compared to systems based on photocells with transmitter and receiver, the RAM series have the advantage of easy installation as they are placed at the road's side; and they don't need to collimate transmitter and receiver.

VARIABLE MESSAGE SIGN
It is also possible to combine the laser detection with a variable message sign (VMS) to alert the driver about the potential danger.

ALARM
RAM20 provides alarms in different ways when an over height vehicle is detected: relay contact; digital output; software event (protocol).





ACCESSORIES

- Mounting Brackets
- Environmental Protections
- Stainless Steel Casing
- Router
- RAMCO Control Unit

Technology	Laser scanner
Laser class	Class 1
Scan angle	96°
Detection Range	20 mt
Minimum width of object	10 cm
Maximum vehicle speed	150 km/h.
Data line	Ethernet
Alarm	Relay, D/O, software
Power supply	12 ÷ 28 Vdc
Protection	IP65
Temperature range	RAM20: -20°C ÷ +50°C RAM20T: -40°C ÷ +60°C

RAM110
Over Height Vehicle Detection

Double technology for high accuracy counting & classification, up to 2 lanes detection, height measurement on all vehicles with double threshold

RAM110 is the highest level sensor for overheight vehicle detection, based on a laser scanner and a single beam laser. The RAM110 emitted light is reflected in order to be recognized by the receiver filtering the environmental light noises. The laser scanner is very accurate in measuring the height and detect the presence of a vehicle; while the single beam laser has a very high frequency and a narrow angle allowing the detection of objects of small dimensions even at 20 m. An internal CPU works in real time combining the data of both lasers and thus providing very accurate data. The algorithms are designed to detect small objects over the allowed height but to trigger the alarm only when the presence of a vehicle is detected, reducing the false alarm rate. Moreover, the system is also able to inform on which lane the vehicle is traveling. RAM110, installed on the side of the road, can detect over-height vehicles on 3 lanes. Compared to systems based on photocells with transmitter and receiver, the RAM series have the advantage of easy installation as they are placed at the road's side; and they don't need to collimate transmitter and receiver.

VARIABLE MESSAGE SIGN

It is also possible to combine the laser detection with a variable message sign (VMS) to alert the driver about the potential danger.

ALARM

RAM110 provides alarms in different ways when an over height vehicle is detected: relay contact; digital output; software event (protocol).

ACCESSORIES

- Mounting Brackets
- Environmental Protections
- Stainless Steel Casing
- Router
- RAMCO Control Unit

Technology	Laser Scanner + Single Beam Laser
Laser class (both)	Class 1
Opening angle	Laser scanner 96° Sinlge Beam Laser 0,5°
Detection Range	Laser Scanner 25-35 mt Single Beam Laser 50 mt
Frequency	Laser Scanner 60Hz Single Beam 500-2000Hz
Minimum width of object	50-100 mm
Maximum vehicle speed	150 km/h.
Data line	Ethernet
Alarm	Relay, D/O, software
Power supply	12 ÷ 28 Vdc
Protection	IP65
Temperature range	RAM110: -20°C ÷ +50°C RAM110T: -40°C ÷ +60°C

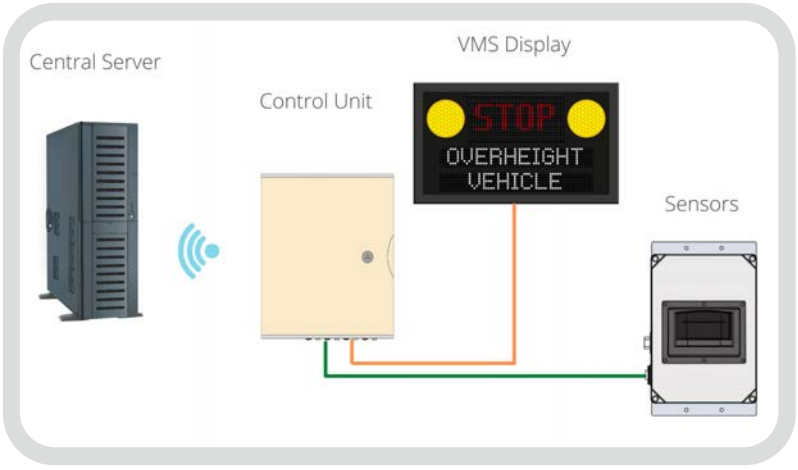
RAM-CO
Control Unit for Over Height sensors

Control unit for RAM products for power supply and relays output

Control unit RAM-CO has been specifically designed to be connected to the RAM series sensors and to process, archive and send the data received from them.

RAM-CO is composed by:

- External cabinet
- Power supply
- Power line protection
- Additional Power relay board (optional)
- 3G/4G Router (optional)
- Heating system (optional)



Over Height Vehicle Summary

	RAM01	RAM11	RAM20	RAM110
				
Over height detection	✓	✓	✓	✓
One side installation	✓	✓	✓	✓
Object distance	✓	✓	✓	✓
Laser Scanner	○	○	✓	✓
Single Beam Laser	✓	✓	○	✓
Counting	○	○	○	✓
All vehicles measuring	○	○	○	✓
Double height zones	○	○	○	✓
Vehicle class	○	○	○	✓
Direction of travel	○	✓	✓	○

BT100 Bluetooth Traffic Detector

BT200 Bluetooth & WiFi Traffic Detector

Traffic data collection through Bluetooth - WiFi detection

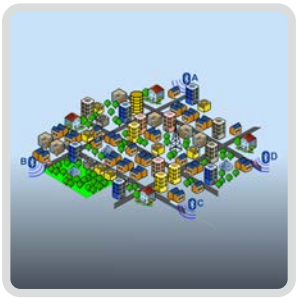
The BT100 sensor is able to detect Bluetooth signals of the devices nearby, while BT200 sensor is able to detect Bluetooth and Wifi signals. In detail, it detects the unique code that identifies the device's bluetooth. The complete system must be equipped with several BT100 or BT200 devices so that, on detection of the same code by two different units, the travel time is calculated. Knowing the distance between two units, the system is then able to calculate the average speed.

BT100 sensor

BT sensor series are based on a CPU, Bluetooth, and WiFi (only avaliable on BT200) transceivers to which it is possible to connect antennas with different features depending on the installation position.

BT sensor series are suitable for:

- Evaluation of the average travel time between two points of the network
- Evaluation of the average speed between two points of the network
- Creation of origin and destination matrix
- Detection of traffic status



BT200 sensor

SOFTWARE

The BT sensor series communicates with a central software through wired or wireless (3G/4G) line. BlueView is the Comark recommended software and it is able to provide:

- Units diagnostics
- Reports on travel time and average speed
- Report of Origin and Destination
- User management
- Map

BT100 Bluetooth Traffic Detector

BT200 Bluetooth & WiFi Traffic Detector

Traffic data collection through Bluetooth - WiFi detection

Technology	Bluetooth (BT100, BT200) WiFi (BT200)
Transmission frequency	Bluetooth 2,4 GHz Wifi 2,4 GHz
Dimensions	105 x 89 x 48 mm
Communication line	Ethernet
Power consumption	< 5 W
Power supply	8 or 28 Vdc
Temperature range	-20°C ÷ +50°C

APPLICATIONS

- Traffic monitoring (ITS)
- Data matrix creation
- Traffic status

ACCESSORIES

- CO1010BT Control Unit
- BLUEVIEW Software
- External antenna

CO1010BT

Control Unit for BT100 & BT200 sensors

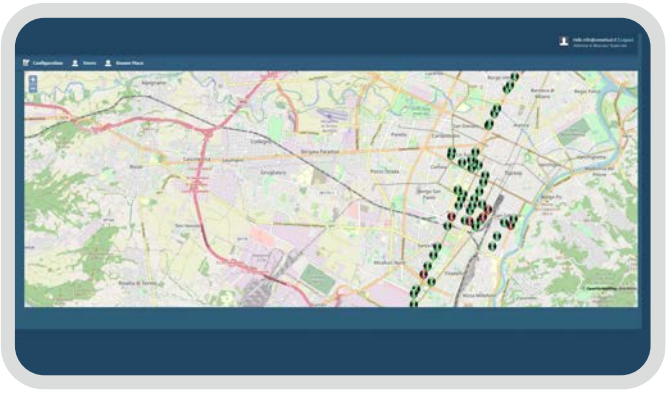
Control unit for BT products for outdoor applications

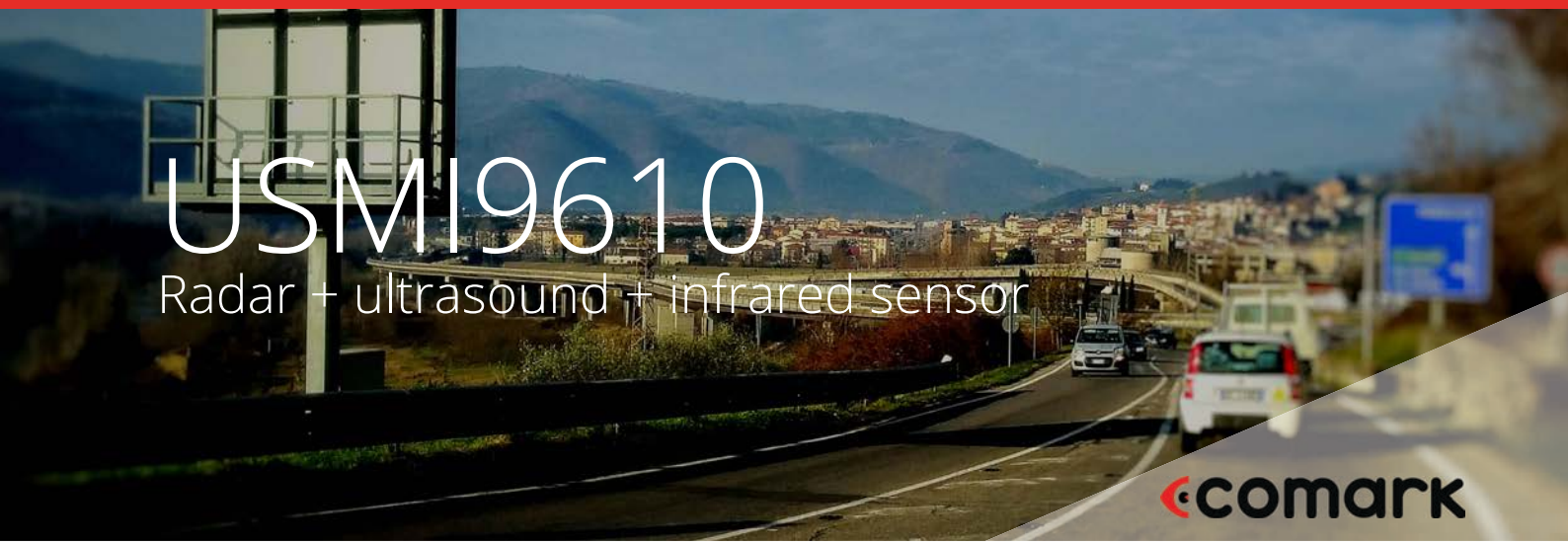
Control unit CO1010BT has been designed to house the BT series sensors for outdoor applications.

CO1010BT is composed by:

- External cabinet dimensions 430x325x185 mm or Internal cabinet dimensions 316x236x128 mm
- Power supply
- External antenna (optional)
- 3G/4G Router (optional)

With the addition of a 3G/4G router, CO1010BT can communicate with Comark's Blueview dedicated software or with other servers trough MQTT or NTCIP protocol.
In case of anomalies, a reset is automatically done.





USMI9610

Radar + ultrasound + infrared sensor

USMI9610 sensor detects vehicles using a combination of microwave radar, ultrasound and infrared technologies. The radar provides the system with the ability to accurately measure the length and speed of the vehicle using the "doppler" effect. Other functionalities, among which the counting of vehicles at low speed and the detection of vehicle's height are entrusted to the ultrasonic and infrared sensors.
The set of data collected allows, by using appropriate algorithms, to obtain an accurate classification of vehicles.

INSTALLATION

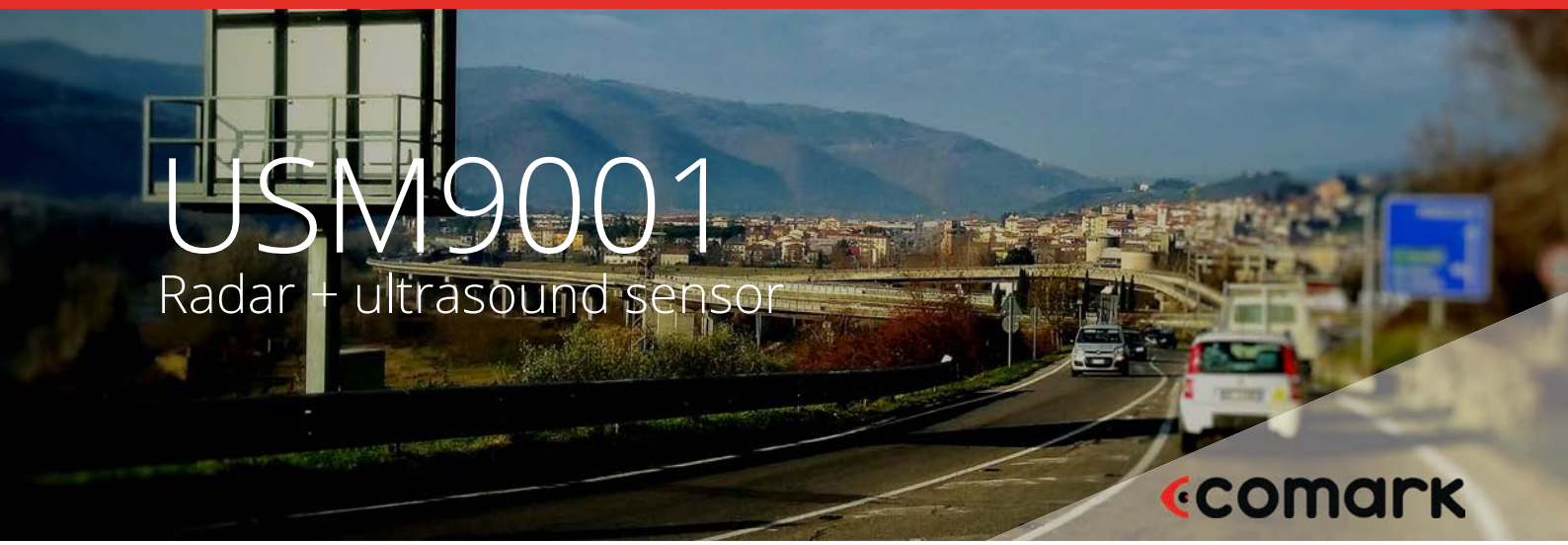
The triple technology sensors must be installed above the center of each lane and provide the following data:

- Counting
- Classification (8+1 classes)
- Height
- Length
- Speed
- Traffic status

ACCESSORIES

- Mounting Brackets
- CO1010 Control Unit

Technology 1	Microwave radar
Technology 2	Ultrasound
Technology 3	Infrared
Ultrasound Frequency	50 Khz
Radar Frequency	24.165Ghz - K Band
Data line	RS485
Weight	3,4 Kg.
Power consumption	< 2,5 W.
Power supply	12 Vdc
Temperature range	-15°C ÷ +50°C



USM9001

Radar + ultrasound sensor

USM9001 detects vehicles using the combination of microwave-radar and ultrasound technologies. The radar provides the system with the ability to accurately measure the length and speed of the vehicle using the "doppler" effect. Other features as vehicle counting at low speed and vehicle's height detection are also performed by the ultrasound sensor.
The set of data collected allows, by using appropriate algorithms, to obtain an accurate classification of vehicles.

INSTALLATION
Double technology sensors must be installed above each lane and the data provided are:

- Counting
- Classification (8+1 classes)
- Height
- Length
- Speed
- Traffic status

ACCESSORIES

- Mounting Brackets
- CO1010 Control Unit

Technology 1	Microwave radar
Technology 2	Ultrasound
Ultrasound Frequency	50 Khz
Radar Frequency	24.165Ghz - K Band
Data line	RS485
Weight	3,4 Kg.
Power consumption	< 2,5 W.
Power supply	12 Vdc
Temperature range	-15°C ÷ +50°C

US6003
Ultrasound sensor

US6003 uses ultrasound technology to detect vehicles. The sensor can measure vehicles' height and classify them (based on their height) in 3 classes (light vehicles, vans, heavy vehicles).
US6003 is a simple but accurate sensor, strong and suitable for outdoor environments.
The data provided are:

- Counting
- Classification (3 classes)
- Traffic status

VERSIONS

- US6003 series is produced in different versions:
- US6003-0 sensor with serial line output RS232 and RS485
- US6003-1 sensor: relay with one output
- US6003-2 sensor: relay with two outputs which allow to preset two heights

APPLICATIONS

- Counting and classification of vehicles based on height
- Detection of queues
- Vehicles' height measurement

INSTALLATION

Ultrasound sensors must be installed above the centre of the lane, at an height between 5-7 meters.

Technology	Ultrasound
Detection range	11 m.
Dimensions	130x110x110 mm
Weight	1 Kg.
Measurement period	30 - 80 ms.
Communication line	RS232 - RS485
Power consumption	<2W
Power supply	12 Vdc
Temperature range	-20°C ÷ +50°C

ACCESSORIES

- Mounting Brackets
- CO1010 Control Unit

CO1010

Control unit

Local data storage, communication with control server.

Control unit CO1010 has been designed to be connected to the sensors and to process, archive and send the data received from them.

FUNCTIONS

- Polling the sensors to receive the transit data
- Analysis of congruity on the data received
- Local data storage
- Data aggregation according to configurable periods
- Traffic status processing (stopped, slowed down, regular)
- Configuration of the unit and of the sensor through a web interface
- Sensor diagnostics
- Data communication with the Control Center trough Ethernet line or wireless 4G/5G

The connection to the central server is continuously monitored and, in case of transmition fault, the data is stored locally to be subsequently transmitted when the communication is restored.

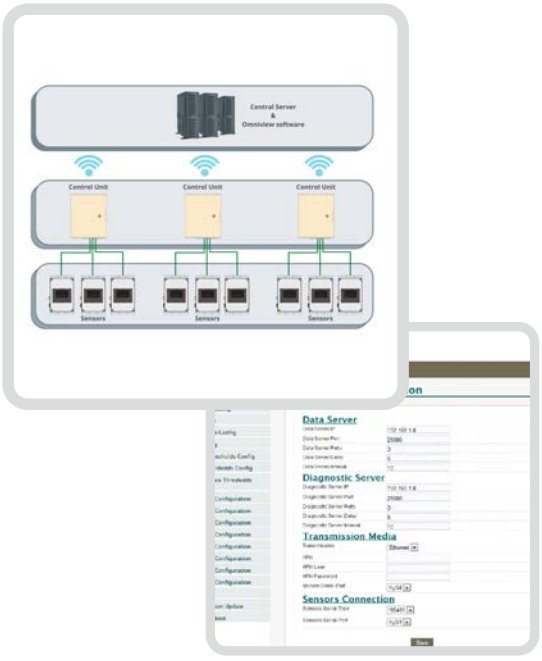
CPU

The heart of the control unit consists of an embedded CPU with Linux Embedded operating system and the COMARK Trafficlink software.

The CPU, the router and the sensors are controlled by a watchdog card that monitors the correct functioning of the equipment and in case of anomalies it makes a reset.

CO1010 is composed by:

- CPU
- Power supply
- Power switch and line Protection
- Sensors power distribution
- Communication distribution (ethernet switch or 485 multidrop)



ACCESSORIES

- Mounting Brackets
- 4G/5G Router
- Heating System

Software

Data Analytics
Diagnostics
Reports

OMNIVIEW
Software

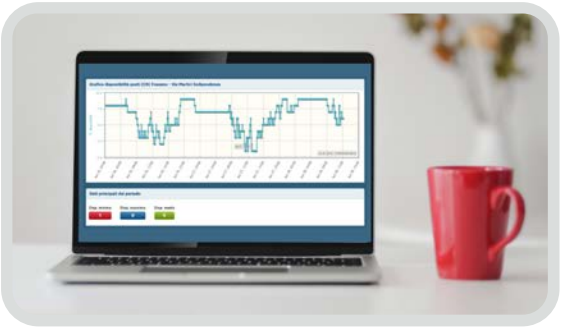
The Omniview software allows to manage and configure the control units and sensors in the field.
FUNCTIONS

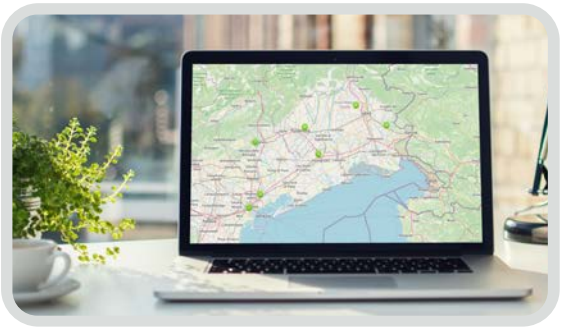
- Configuration of sensors and control units
- Data acquisition from devices in the field
- Storing data on the database
- Device diagnostics
- Processing and aggregation of data
- Creation of reports with graphics and tables
- Map with location of the stations
- Users management

REPORT (*)
The software offers an extensive list of reports for displaying data in various forms. For each of them it is possible to filter the data according to the location, the period and the lanes of interest.
Some of the reports available are:

- Display aggregated data
- Display individual transit
- Average daily traffic
- Speed/flow report

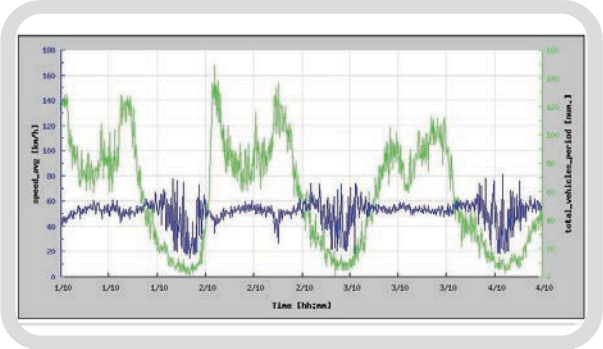
(*): Report possibilities will depend of each sensor's capability of data collection. Comark suggest to check always with the Customer Service the feasibility of reporting.





OMNIVIEW
Software

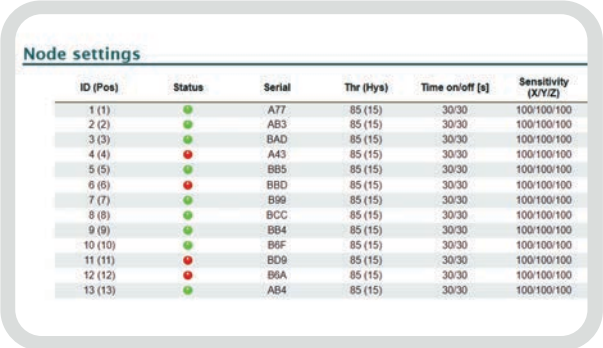
DIAGNOSTICS
TrafficView allows a real-time monitoring of the system status through the pages that show all devices with anomalies. In particular, it displays the status of the control units, sensors and communication.



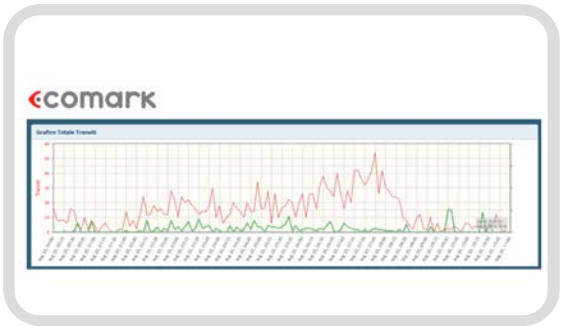
MAP
TrafficView also offers an interactive map view that allows to see the location of devices and monitor their status.

Depending of the application, Omniview software is composed by the following licenses:

- **Omniview Traffic**
- **Omniview Bluetooth**
- **Omniview Parking**
- **Omniview People**

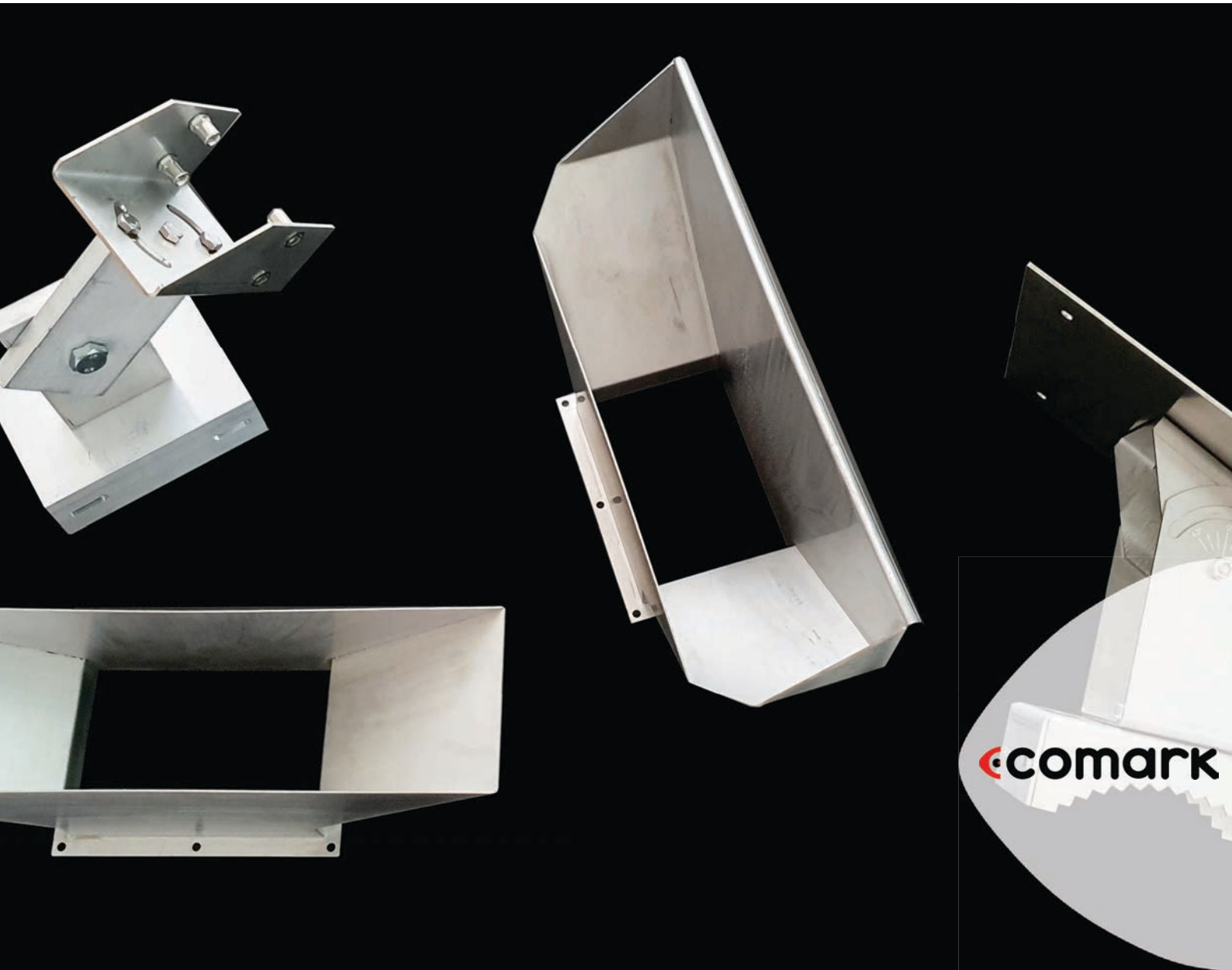


ID (Pos)	Status	Serial	Thr (Hys)	Time on/off [s]	Sensitivity (X/Y/Z)
1 (1)		A77	85 (15)	30/30	100/100/100
2 (2)		AB3	85 (15)	30/30	100/100/100
3 (3)		BAD	85 (15)	30/30	100/100/100
4 (4)		A43	85 (15)	30/30	100/100/100
5 (5)		BB5	85 (15)	30/30	100/100/100
6 (6)		BBD	85 (15)	30/30	100/100/100
7 (7)		B99	85 (15)	30/30	100/100/100
8 (8)		BCC	85 (15)	30/30	100/100/100
9 (9)		BB4	85 (15)	30/30	100/100/100
10 (10)		B6F	85 (15)	30/30	100/100/100
11 (11)		BD9	85 (15)	30/30	100/100/100
12 (12)		B6A	85 (15)	30/30	100/100/100
13 (13)		AB4	85 (15)	30/30	100/100/100



Accessories

Sensor Mounting Brackets
Environmental Protections



MOUNTING BRACKETS

BR TYPE 2

Suitable for US6003, USM9001, USMI9601, LSR2001, MD01; RL4001 and RSR4001 detectors

BR TYPE 4

Bracket with fine-tuning. Suitable for US6003, USM9001, USMI9601, LSR2001, RAM20, RAM110, MD01; RL4001 and RSR4001 detectors

JOINT

Joint for additional axle rotation, suitable for all brackets type

BR TYPE 3

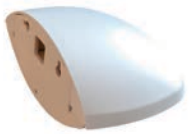
Suitable for LSR2001 DOUBLE System

BR TYPE X

Suitable for RAM11

MOUNTING BRACKETS

BR TYPE 10
Suitable for PEOPLE COUNTER



BR TYPE 5
Suitable for photocells

BR TYPE 6
Suitable for CO1010 pole mounting

BR TYPE 7
Suitable for CO1010 wall mounting

SAFETY KEY
Suitable for CO1010 cabinet door

ENVIRONMENTAL PROTECTIONS

CK01

Environmental Protection Standard for LSR2001 and RAM series

CK01-2

Environmental Protection snow for LSR2001 and RAM series

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