



 **comark**

The HeArt of Traffic Detection

Product Catalogue

Company Profile

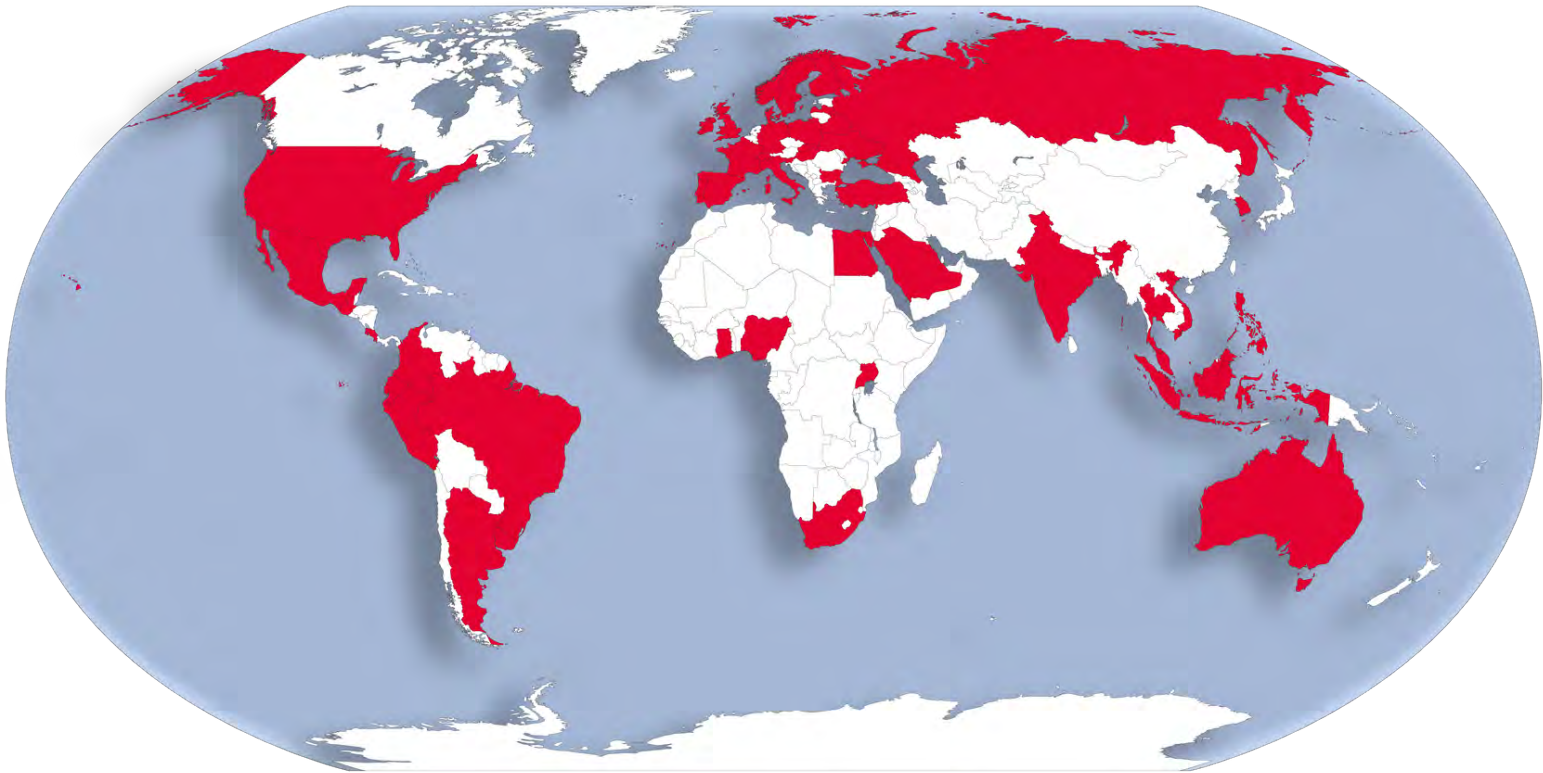
Founded in 1994, Comark is a company specialized in the field of traffic monitoring and parking systems. We take care of the design, development and manufacturing of products for the road traffic, parking areas and cycling lanes market.

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



Global Presence

Nowadays Comark is present in over 45 countries, across 6 continents with a well-developed sales network.



Portfolio



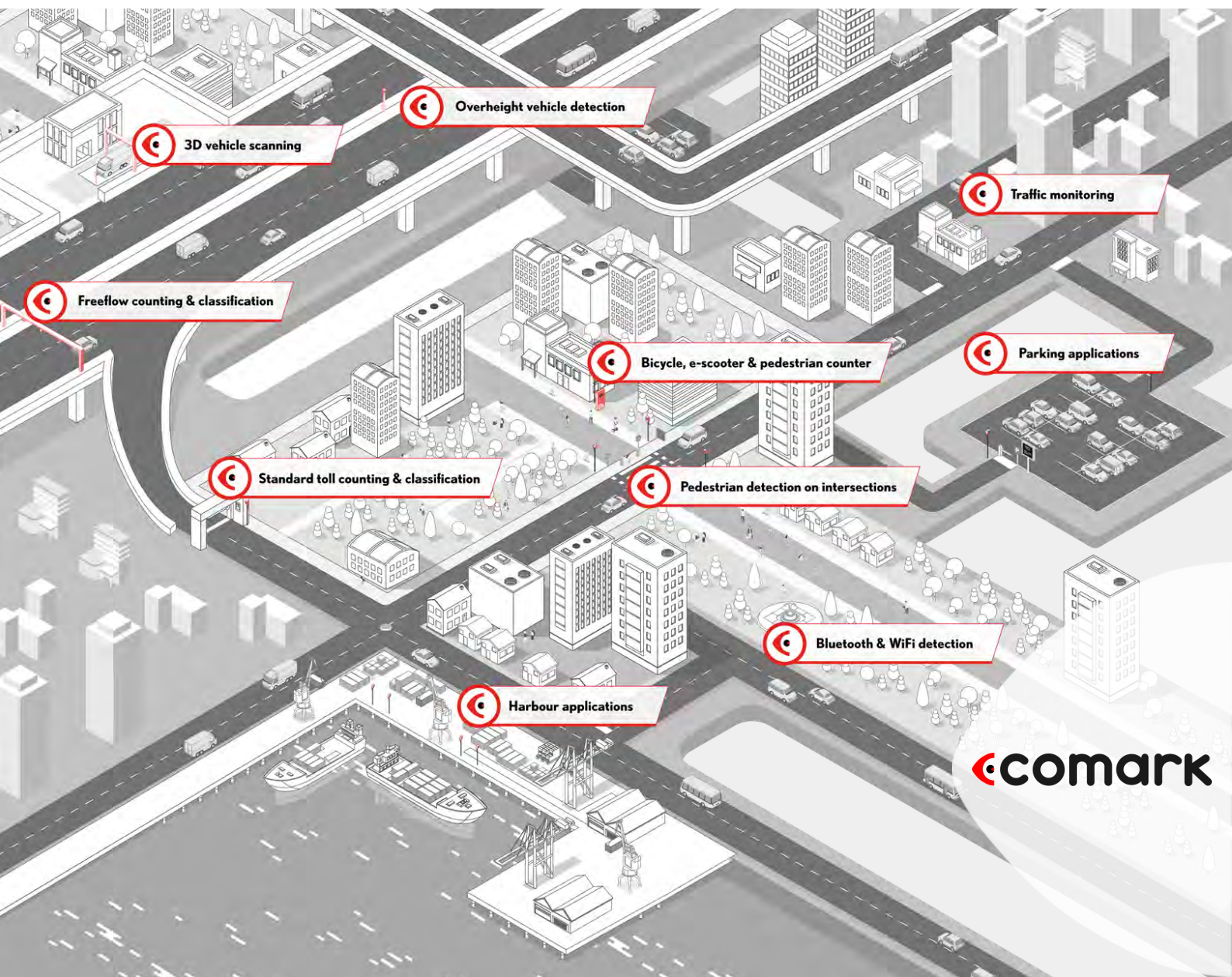
Traffic



Smart City



Parking



Index



Traffic

LSR2001 Laser Scanner	p. 7
LSR2001 Double Laser Scanner	p. 9
LSR100	p. 11
LP20	p. 13
LT3001 - PROFILER LT	p. 14
PROFILER 3 Lasers	p. 15
PROFILER 3 Lasers LTT	p. 17
MD01 Radar Doppler	p. 20
RSR4001 - RL4001 Laser + Radar	p. 21
LT3001 Laser Scanner	p. 23
LTR5001 Laser Scanner + Radar	p. 25
LSR 3D	p. 27
RAM11	p. 29
RAM20	p. 30
RAM110	p. 31
BT100 Bluetooth Traffic Detector	p. 33
USMI9610	p. 35
CO1010	p. 36



Smart City

BIKECOUNT200 Totem	p. 38
LSR2001BC Bicycle, e-scooter & Pedestrian Data Collection	p. 39
LSR 3D	p. 41



Parking

LSR2001 PARK	p. 44
LOMAG Wireless Magnetic Detector - LOGAT Wireless Gateway	p. 45



Software

OMNIVIEW Control Software	p. 48
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Applications

Traffic Counting & Classification	p. 7 - 10; 13; 20 - 28; 35
Classification for Toll Collection System	p. 7 - 10; 14; 21 - 28
Traffic Monitoring	p. 7 - 28; 33 - 36
Free flow Tolling	p. 23 - 26
3D Vehicle Scanning	p. 14 - 18
Over-Height Vehicle Detection	p. 29 - 31
3D Lidar for Freeflow tolling, High speed WIM or Highway monitoring	p. 27
Vehicle Speed Detection	p. 20
Average Speed, Travel Time, Source / Destination	p. 33
Wrong Way Driving Detection	p. 9; 33
Access Regulations & Urban Road Charging Schemes	p. 13; 39 - 41
Cycling and Pedestrian data collection	p. 38 - 39
3D Lidar Intersection monitoring	p. 41
Parking applications	p. 44 - 46



Traffic

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



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.

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.



Oblique installation



Transversal installation

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Pag. 7

LSR2001

Laser Scanner

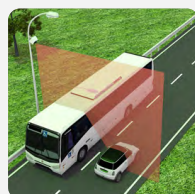


Accurate counting & classification with event trigger

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

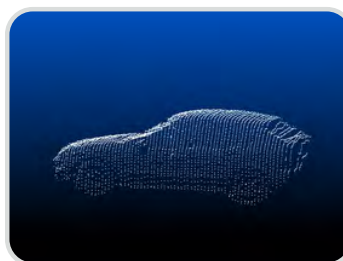


Oblique



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

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Pag. 8

LSR2001 DOUBLE

Double Laser scanner



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

The LSR2001-DOUBLE sensor uses two laser scanners to detect vehicles. Installed at the side of the road, its unique configuration permits to detect also the vehicle speed and length in 2 lanes.

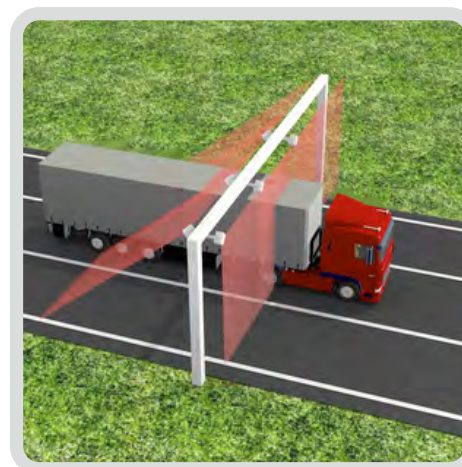
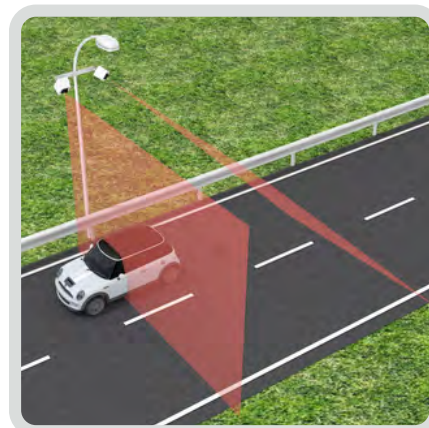
LSR2001-DOUBLE is able to accurately measure vehicle profiles and is therefore the ideal tool for applications where precise vehicle classification is required.

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.



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Pag. 9

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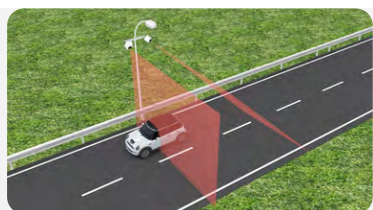
LSR2001 DOUBLE

Double Laser scanner



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



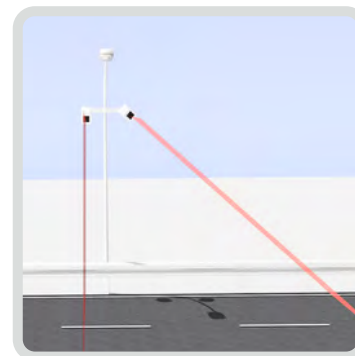
LSR2001 DOUBLE

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
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Pag. 10

LSR100

Laser scanner



Presence detection with relay output

The LSR100 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.

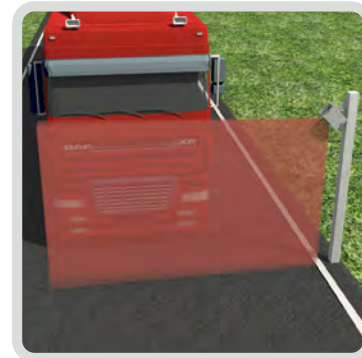
The laser has two dry relays contacts that can be configured to be activated when an object is inside the detection area.

The configuration of the LSR100 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





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Pag. 11

LSR LASER Summary

	Transversal	Oblique	Double	LSR21-I
				
Counting	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Vehicle class	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Speed	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Height	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Length	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Gap	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Headway	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Traffic status	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Trigger	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Direction of travel	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
2 lanes detection	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Roadside installation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Above lane installation	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

LP20

Compact Laser detector



Compact yet powerful sensor

The LP20 detector is the perfect solution for those applications in which a compact yet powerful detector is needed. LP20 is small and easy to install on a pole for permanent or temporary applications.

The detector is able to count and classify pedestrians, bicycles and e-scooters if installed on cycle lanes; and to detect motorcycles, cars, vans and trucks if installed on a traffic road.

LP20 detector is based on n. 2 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.

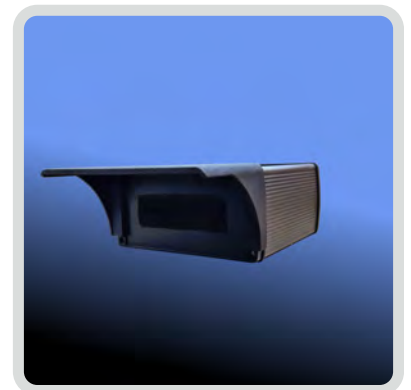
The detector is equipped with an embedded CPU, and its classification method is based on the analysis of the shape of the object passing by the detection area.

The detector is capable to create aggregated data (1 min to 1 day package) with the following information:

- Time;
- Traffic Count;
- Classification;
- Speed;
- Sense of travelling.

It is possible to configure 2 lanes or zones, and transit activation / deactivation time. The sensor detects traffic on 1 lane with high precision, and on 2 lanes with possible obscuring traffic on the second lane. To mitigate the effect of bad weather, the detector is equipped with a mid-intensity rain filter.

LP20 is very easy to set up through web configuration and it can deliver alarms throughout the following outputs: n.2 D/O, n. 2 relays.



Laser type	Lidar Technology
Technology	Single beam Laser
Emitted Light	905 nm not visible
Laser class	Class 1
Scan angle	3°
Scan period	1 ms
Power supply	12 Vdc
Detection range	15 mt
Power consumption	3.5 W
Protection	IP65
Output	D/O, relay
Temperature range	-10°C ÷ +40°C

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Pag. 13

LT3001 - PROFILER 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 LT3001 - PROFILER LT 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°).

The two laser scanners are installed on a single gantry: one LSR2001 is installed on the side (left or right) of the lane, and the second LSR2001 above the lane in central position. This kind of system is able to deliver a high accuracy height and length measurement of each vehicle.

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



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

- Feasible
- Not Feasible
- Feasible with limitations



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

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

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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).

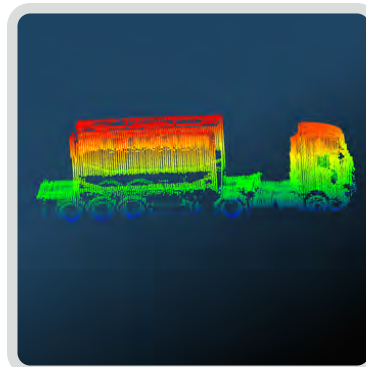
The first two lasers scan continuously both sides and the top of the vehicle, while the third one detects the position and movement. The result is a very accurate detection of: length, 3D shape, height, width, speed, profile and vehicle class.

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 length measuring, even in stop & go condition.



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Pag. 15

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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
- Length
- 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

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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.

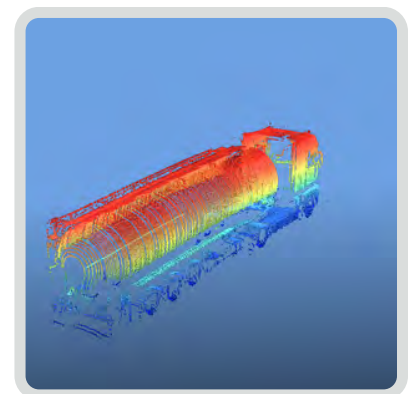
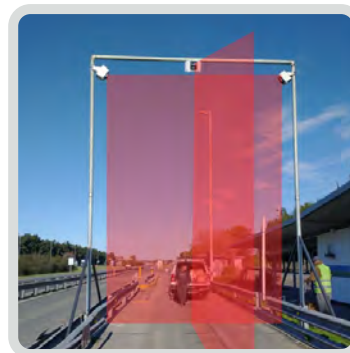
The first two lasers continuously scan both sides and the top of the vehicle, while the third one detects the position and movement. The result is a very accurate detection of: length, 3D shape, height, width, speed, profile and vehicle class.

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 length measuring, even in stop & go condition.



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Pag. 17

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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
- Length
- 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

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PROFILER Summary

	3 LASERS	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

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Pag. 19

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MD01

Radar doppler



Speed and length 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 traffic data through RS232 or RS485. The Md01 is also equipped with digital output for a possible synchronization with cameras.



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

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

APPLICATIONS

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

ACCESSORIES

- Mounting Brackets
- CO1010 Control Unit

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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.

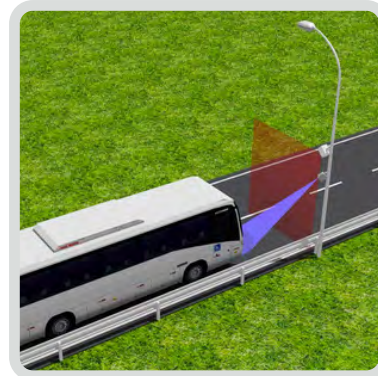
The scanner optics are made of two physically distinct areas for laser transmission and reception, making it particularly immune to the opacity produced by dust, water and pollution.

The microwave technology with the "patch" antenna and an opening angle of $9^{\circ} \times 18^{\circ}$ 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



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Pag. 21

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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

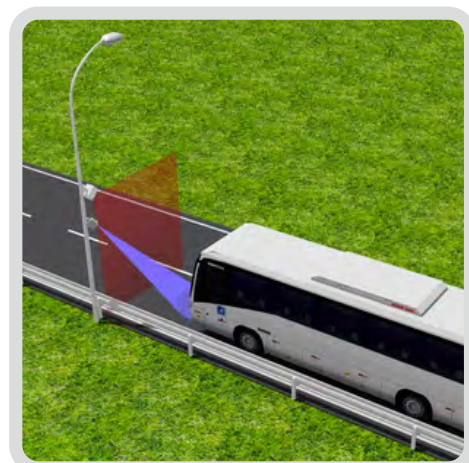
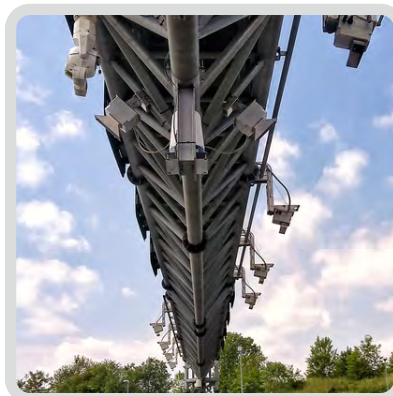
APPLICATIONS

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



ACCESSORIES

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



RL4001

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Pag. 22

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.

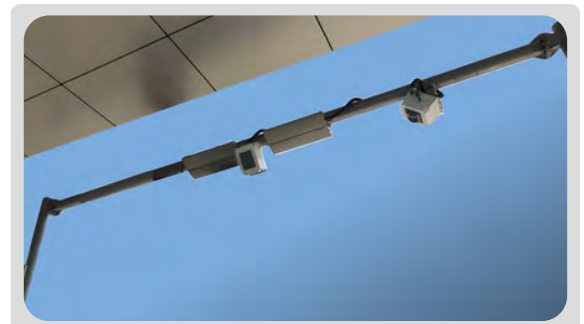
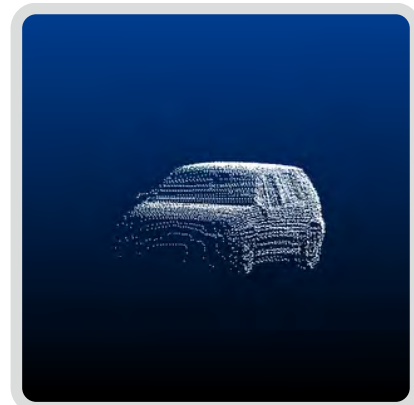
LT3001 is able to distinguish more than 20 classes of vehicles including motorcycles, cars, vans, trucks, lorries, articulated lorries, buses.

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.



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Pag. 23

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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



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Pag. 24

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 Microwave 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.

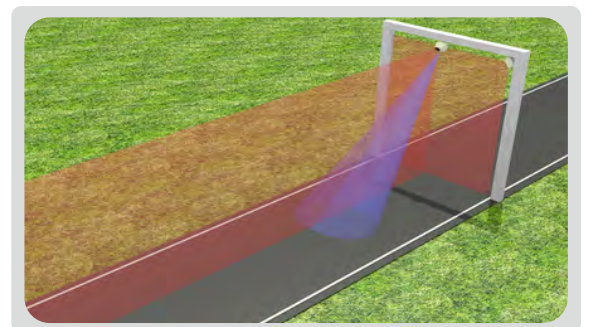
The transversal scanner measures the width, height and profile of the vehicles providing an accurate classification of the transits.

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.



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Pag. 25

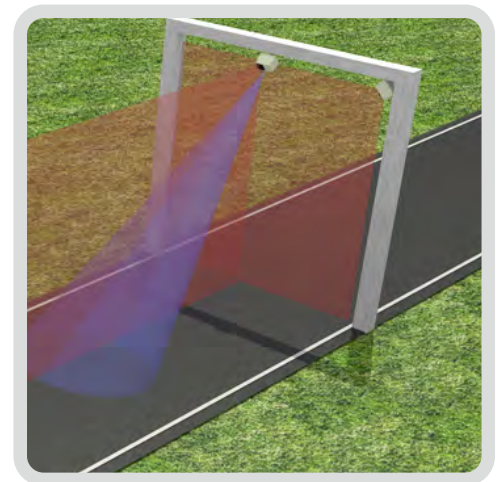
LTR5001

2 Laser scanner + Radar



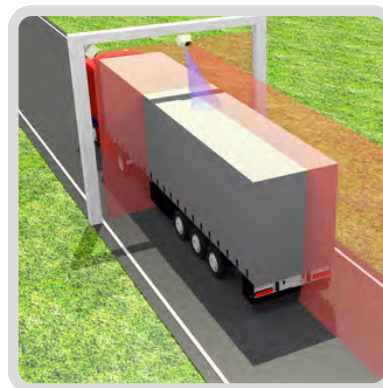
Multiple technology for detection in all environmental conditions

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



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Pag. 26

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LSR3D

3D LIDAR



3D Lidar for Freeflow tolling, High Speed WIM or Highway monitoring

LSR3D can be used with great performances in Freeflow tolling applications. By installing the 3D lidars on a gantry or pole it is possible to monitor the vehicles upcoming on different lanes and track them from 50 m. or even 150 / 300 m.

It is then possible to:

- Trigger LPR (License plate) cameras at any distance within the Lidar range (10 to 150 m. from gantry)
- Count the vehicles on each lane
- Detect the dimensions of the vehicles
- Classify vehicles basing on dimension
- Track the vehicles for lane changes or between lanes transit

With the LSR3D it is also possible to monitor different sections of an highway to detect if any vehicle is stopped in a lane and need assistance or if there is a wrong way driving vehicle, thus increasing the level of safety.

In HSWIM (High Speed WIM) projects, the LSR3D is the ideal solution for the measurement of the dimensions (height, width and length) of the vehicles and to trigger the ANPR cameras. It is also possible to detect critical behaviours for the Weighing system like changes on speed or passing in the middle of two lanes.



Technology sensor	3D Lidar
LPU	Embedded Linux PC
Laser class	Class 1
Horizontal angle	60° - 360°
Vertical angle	6° - 32°+
Range	30 m. - 300 m
Communication line	Ethernet
Power consumption	Depends on nr of Lidars
Power supply	12 ÷ 28 Vdc
Protection	IP65+
Temperature range	Depends on Lidar

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LSR3D

3D LIDAR



3D Lidar - Configuration and integration

The LSR3D must be considered as a system that has to be configured for each type of site and application. Depending on the area to be monitored and the data to be provided, it is necessary to define the type and quantity of Lidars, the type of LPU, the communication between the different units.

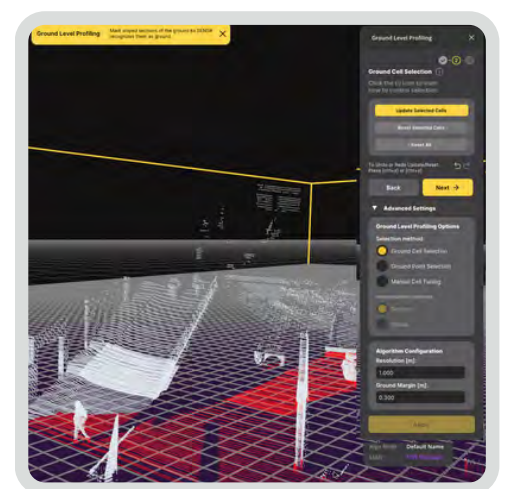
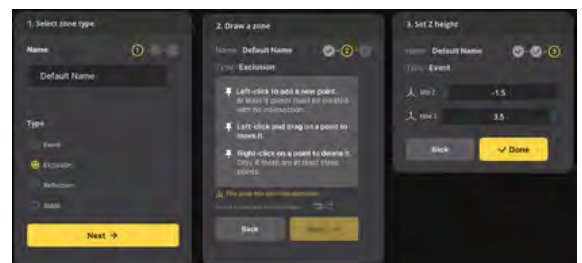
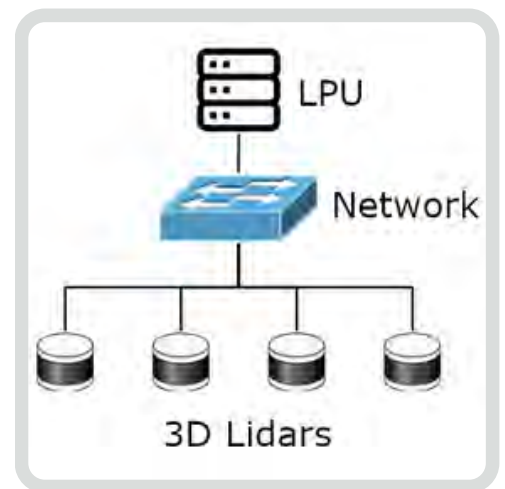
The Architecture of the LSR3D system is composed by the LPU with the software and by the 3D Lidars connected to the local network.

The modules and licensing of the 3dLink software depends on the information to be provided and on the number of Lidars connected.

An SDK is provided to configure the system with:

- Calibration of the sensor
- Registration of different Lidars into one scene
- Ground profiling
- Zones setting
- Event settings
- Statistics

The integration with the LSR3D system is possible through the use of SDK, API and protocol. Data generated by the events are sent in JSON format via Websocket



APPLICATIONS

- ITS statistics
- Vehicle, pedestrians and bicycles counting
- Intersection or Roundabout monitoring
- Traffic light timing for vehicles and pedestrians
- C-ITS, connected vehicles

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RAM 11

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.

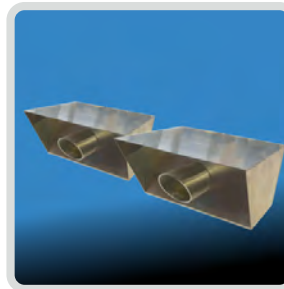
The light emitted (infrared light pulses) is reflected in order to be recognized by the receiver filtering the environmental light noises. The lasers are positioned horizontally in order to detect the vehicle travel's direction.

RAM 11 is installed on the road's side and can detect 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.

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



ACCESSORIES

- Mounting Brackets
- Environmental Protections
- CO1010 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

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Pag. 29

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.

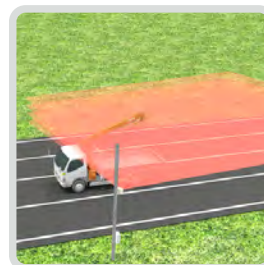
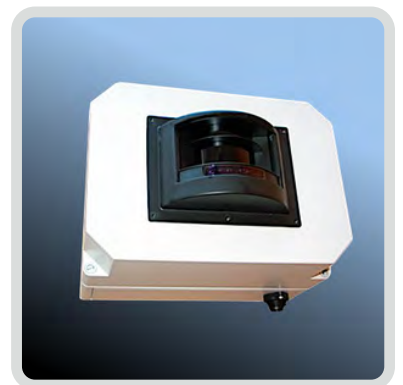
RAM20 is based on a laser scanner with 4 planes of detection, creating a wide detection area which helps avoiding false alarms; and an internal CPU that processes the signals received by the laser head to obtain all the data related to the overheight vehicle. The laser scanner has an internal heating 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.

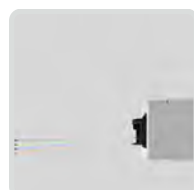
It is also possible to combine the laser detection with a variable message sign (VMS) to alert the driver about the potential danger.

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
- CO1010 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

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Pag. 30

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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.

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

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
- CO1010 Control Unit

Technology	Laser Scanner + Single Beam Laser
Laser class (both)	Class 1
Opening angle	Laser scanner 96° Single 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




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Pag. 31

Over Height Vehicle Summary

	RAM11	RAM20	RAM110
			
Over height detection	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
One side installation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Object distance	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Laser Scanner	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Single Beam Laser	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Counting	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
All vehicles measuring	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Double height zones	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Vehicle class	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Direction of travel	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

BT100

Bluetooth Traffic Detector



Traffic data collection through Bluetooth

The BT100 sensor is able to detect Bluetooth signals of the devices nearby. In detail, it detects the unique code that identifies the device's bluetooth. The complete system must be equipped with several BT100 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.

BT sensor series are based on a CPU and Bluetooth transceiver to which it is possible to connect antennas with different features depending on the installation position.

BT sensor series are suitable for:

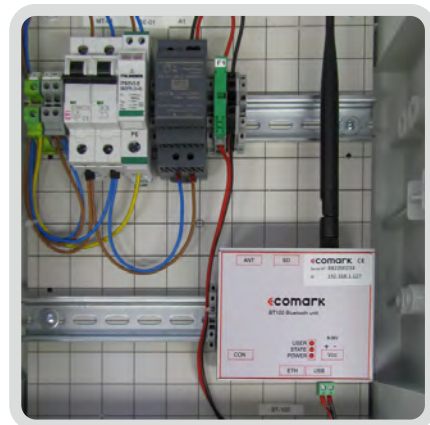
- Evaluation of the average travel time between two points of the network
- Evaluation of the average speed between two points of the network
- Creation of origin and destination matrix
- Detection of traffic status

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 sensor



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Pag. 33

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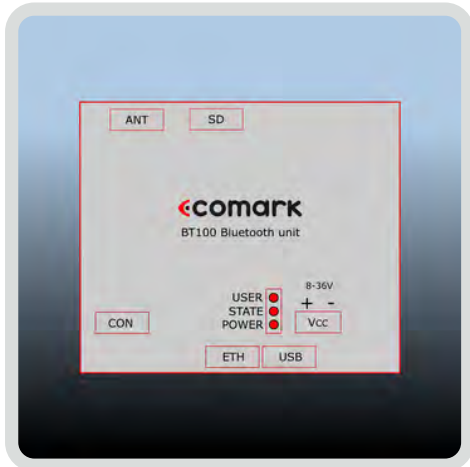
BT100

Bluetooth Traffic Detector

comark

Traffic data collection through Bluetooth

Technology	Bluetooth
Transmission frequency	Bluetooth 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

- CO1010 Control Unit
- BLUEVIEW Software
- External antenna



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Pag. 34

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USMI9610

Radar + ultrasound + infrared sensor

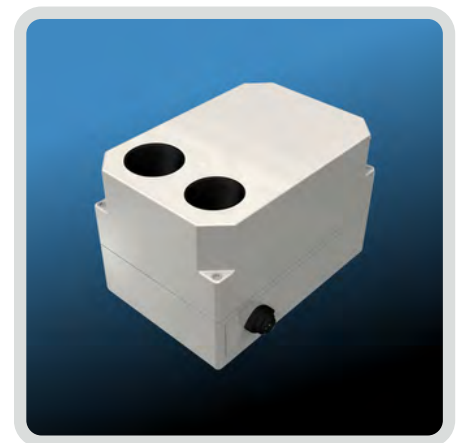


Triple technology sensor

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.

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	-30°C ÷ +60°C

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Pag. 35

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.

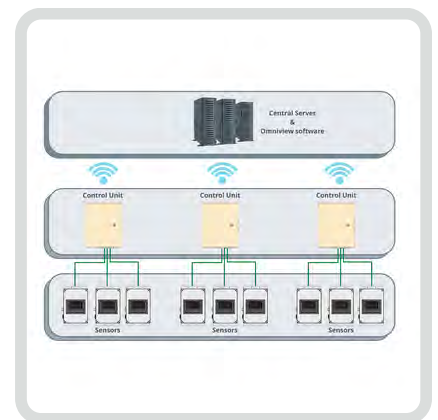
- Polling the sensors to receive the transit data
- Analysis of congruity on the data received
- Local data storage
- Data aggregation according to configurable periods
- Traffic status processing (stopped, slowed down, regular)
- Configuration of the unit and of the sensor through a web interface
-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



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

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



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Pag. 36

Smart City

Bicycle, e-scooter & Pedestrian data collection
Bike counter Totem
Intersection Monitoring



BIKECOUNT200

LED display

Bike counter Display

comark

The BIKECOUNT200 displays the data collected by the LSR2001BC detector.

The BIKECOUNT200 is available in 2 different models:

- BIKECOUNT200 totem
- BIKECOUNT Display

On both models, the structural part consists of a frame in powder-coated extruded aluminum and polycarbonate surfaces on which the reflective film with screen printing is applied, equipped with a variable message area with white LED technology capable of displaying two lines of data (for example, annual transits and daily transits).

The electronic parts for managing the display, the CPU for communicating with the sensor and the control center, are placed inside.

At the control center it will be possible to check the statistical data on the transits and the diagnostics of the various BIKECOUNT200 installed.

It is possible to customize the layout of BIKECOUNT200 both on the screen printing part, with specific writings and images, and on the the display part. It is in fact possible to add additional variable message areas where to write, for example, information to users.

Furthermore, the BIKECOUNT200 totem model can be produced in both single-sided and double-sided versions, that is, with screen printing and variable message area visible from both directions.



BIKECOUNT200 Display



BIKECOUNT200 Display



BIKECOUNT200 Totem

ACCESSORIES

- Additional 2 LED data lines
- Router
- Double-sided display

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Pag. 38

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LSR2001BC

Laser technology



Bike, e-scooter & pedestrian counter

The LSR2001BC detector uses the laser technology to detect bicycles, e-scooters and pedestrians. The emitted laser beam is used to scan on 4 parallel planes at an angle of 96 °. For each plane the sensor detects 274 points and is able to accurately identify the profile of the bicycle, e-scooter or person.

The laser detector is able to:

- Count bicycles, e-scooters, pedestrians
- Discriminate between Bicycles, e-scooter and pedestrians
- Detect the transit direction

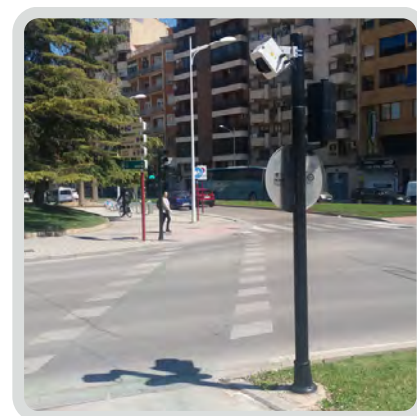
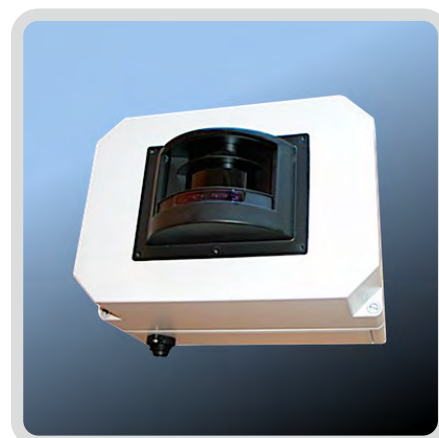
Opposed to other simpler counting systems, the sensor LSR2001BC is very accurate in detecting bicycles, e-scooters and pedestrians; even in case of groups. The sensor performs continuous scans across the width of the cycle path and is able to discriminate individual bicycle even if very close to each other.

Another important feature is the ability to distinguish between pedestrians, e-scooters and cyclists analyzing the profile.

The sensor must be installed on a pole at the side of the cycle path at a height between 2 to 5 meters. The sensor is equipped with an adjustable bracket which allows the precise orientation.

The detector has been designed by both the mechanical and the firmware point of view to work outdoors even with adverse weather conditions. The firmware implements filters for rain and snow.

The sensor is equipped with a CPU that processes the signals received from the scanner to obtain all the data related to transit. The communication with the sensor can be done through Ethernet line. The configuration through the Ethernet line can be carried through the use of simple and intuitive web pages.



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Pag. 39

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LSR2001 BC

Laser technology

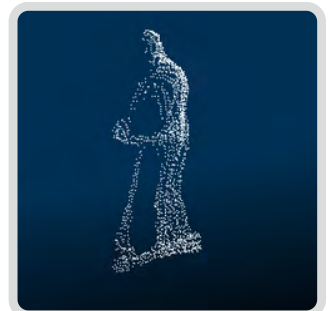
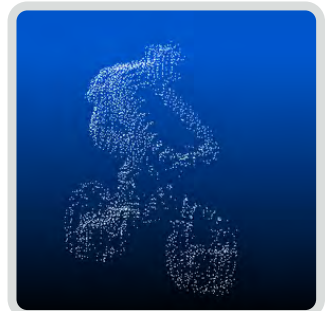
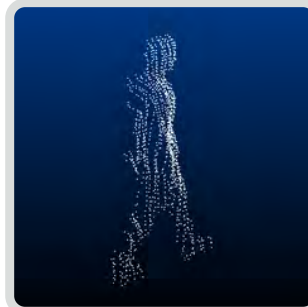


Bike, e-scooter & pedestrian counter

Technology	Laser scanner
Number of planes	4
Points per plane	274
Emitted Light	905 nm not visible
Laser class	Class 1
Range	30 mt
Scan angle	96°
Scan frequency	16 m sec
Power supply	12 ÷ 28 Vdc
Protection	IP65
Temperature range	LSR2001: -20°C ÷ +50°C LSR2001T: -40°C ÷ +60°C



Counting	✓
Classification bicycle/e-scooter/pedestrian	✓
Multiple lanes detection	✓
Detection of groups	✓
Transit direction	✓
Occupancy time	✓



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

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LSR3D

3D LIDAR

COMARK

3D Lidar traffic monitoring system

LSR3D is COMARK solution for 3D Lidar vehicle detection and traffic monitoring. 3D Lidar is the new technology that creates a point cloud image (3D image) of the detection area with accurate positioning of all the objects in the 3 dimensions. It works in a similar way to Camera video analytics but with the great advantage of having accurate depth information. Another important advantage compared to camera systems is the independence from environment lighting, thus providing high performance during day and night.

The system is composed by a 3D Lidar and a LPU (Local processing unit) with the software.

There are different 3D lidars available, with different performances, angles and ranges of detection:

- Range (Short - up to 50 m.; Middle - up to 150 m.; Long - up to 300 m.)
- Angle (from 60° to 360°)
- Vertical and horizontal resolution
- Frame rates

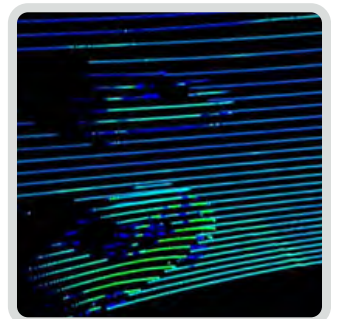
The LPU (Local processing unit) is a powerful embedded PC with integrated GPU (Graphical processing unit) needed to run the Artificial Intelligence (AI) algorithms. Different versions of LPU are available depending on the number of 3D Lidars connected and the type of application.

The LPU embeds the 3DLink software which analyzes the data received from the Lidar detecting, measuring and tracking all the vehicles and people.

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



3D sensors monitoring an intersection



Tracked vehicles in intersection

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Pag. 41

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LSR3D

3D LIDAR



3D Lidar Intersection monitoring

LSR3D is a great solution because it can monitor a wide area and provide a lot of useful information at the same time. As an example, it is possible to monitor the different roads of an intersection and check the length or number of vehicles stopped at the traffic light as well as get the counting and "origin-destination" of vehicles or detect the pedestrian and bicycles waiting or crossing a road.

It is possible to set zones and events to detect wrong way vehicles or people jaywalking or crossing out of crosswalks and more.

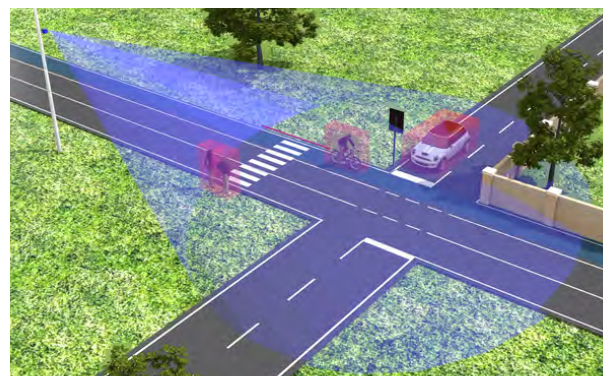
By monitoring a wide area instead of a section of the road, LSR3D is able to track the vehicles and people and follow them to get more information about their speed, class, dimension, route and behaviour.

The system is able to:

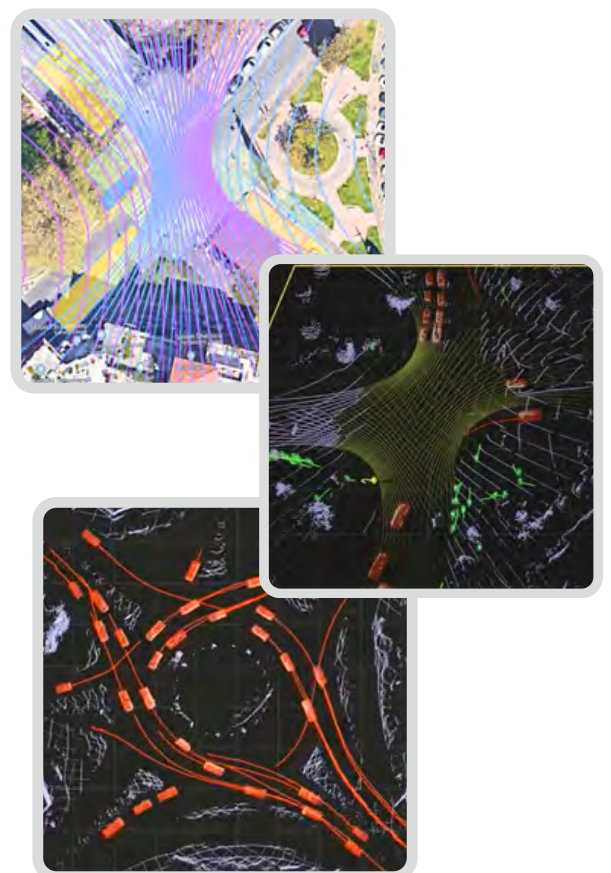
- Count vehicles in all roads and lanes
- Count vehicles and pedestrians in cycle lanes or crosswalks or jaywalking
- Classify pedestrian, bike or vehicle (vehicles classified by length)
- Detect the dimensions of the vehicles
- Create origin-destination between zones in the monitored area
- Illegal stop, Illegal U-turn or Wrong Way
- Near miss or Accident
- Overspeed
- Traffic jam
- Trigger ANPR cameras

An important feature of LSR3D is the possibility to use different 3D Lidars and "register" them in a single LPU to create a single, wider and more detailed scene.

By using 2 or 4 Lidars in an intersection or roundabout it is possible to have the complete scene at high resolution and without occlusion problems between vehicles.



3D Lidar intersection monitoring



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Parking

LSR2001 PARK Laser Scanner Detector
LOMAG-01 Wireless Magnetic Detector
LOGAT-01 Wireless Gateway



LSR2001 PARK

Laser Scanner



Vehicle detection, counting in & out direction

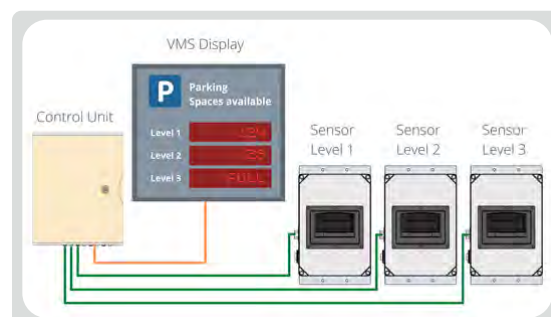
The LSR2001PARK detector uses the laser technology to detect vehicles that enter and/or exit a parking area. The emitted laser beam is used to scan on 4 parallel planes at an angle of 96 °. For each plane the sensor detects 274 points and is able to accurately identify the profile of vehicles.

The laser detector is able to:

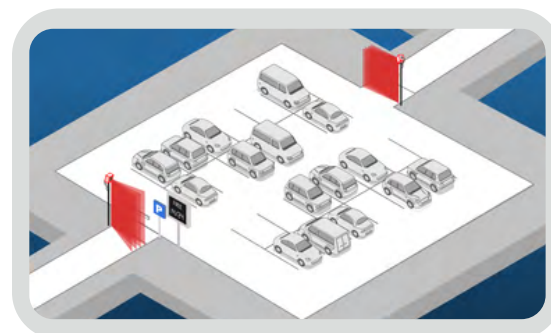
- Count vehicles
- Detect the transit direction
- Trigger an alarm when a vehicle is detected

Opposed to other simpler counting systems, the sensor LSR2001PARK is very accurate in detecting vehicles. The sensor performs continuous scans across the width of the parking entrance or exit.

The sensor must be installed on a pole at the side of the parking entrance or exit at a height between 2 to 5 meters. The sensor is equipped with an adjustable bracket which allows the precise orientation.



Technology	Laser scanner
Number of planes	4
Points per plane	274
Emitted Light	905 nm not visible
Laser class	Class 1
Range	30 mt
Scan angle	96°
Scan frequency	16 m sec
Power supply	12 or 24 Vdc
Protection	IP65
Temperature range	LSR2001: -20°C ÷ +50°C LSR2001T: -40°C ÷ +60°C



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Pag. 44

LOMAG-01 LOGAT-01

Wireless Magnetic Detector Wireless Gateway



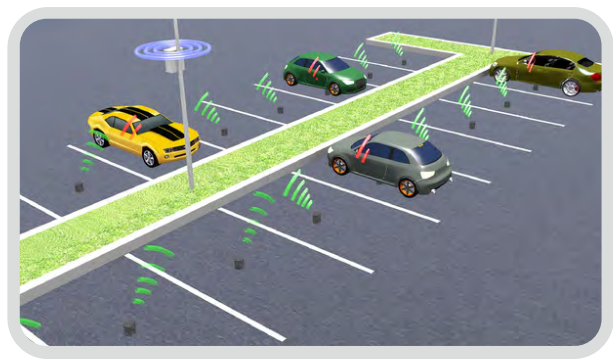
Single parking place, static detection

LOMAG-01

The LOMAG sensor is based on the earth magnetic field detection which is modified when a vehicle passes by. It can be used to count and detect the vehicle's presence in roads and parking lots. The detectors have to be installed under the ground at a maximum depth of 15 cm.

People and other objects (that don't interfere with the magnetic field) are not detected. The detector is equipped with Lithium batteries and can achieve 5-8 years autonomy depending on the number of transmissions to be done.

A unique feature of the LOMAG sensor is given by the possibility of setting the sensitivity of each of the three axes allowing the detection area to be adapted to the parking's space (dimension) area. The algorithms of the sensor are designed to continuously detect the presence of vehicles and to filter magnetic interference of any kind.



LOGAT-01

The configuration of the sensor can be done through the LOGAT Lora gateway. It is possible to configure the sensor output (digital presence or analog magnetic value on the three axes), sensitivity and communication period. Wireless networks are formed around a Gateway, which acts as the wireless network master device, and one or more Nodes (magnetic detectors). The communication between gateway and magnetic detectors is based on the Lora technology which is long range and low power. The gateway communicates with a maximum of 80 wireless detectors (depending of the parking layout). The data received from the detectors can be retrieved on the gateway using Modbus protocol on a RS485 line. The LOGAT gateway has also several digital outputs that can be used to show the status of some detectors.



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LOMAG-01

Wireless Magnetic Detector

LOGAT-01

Wireless Gateway



Single parking place, static detection

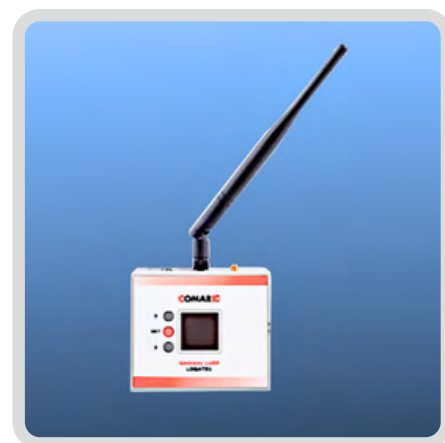
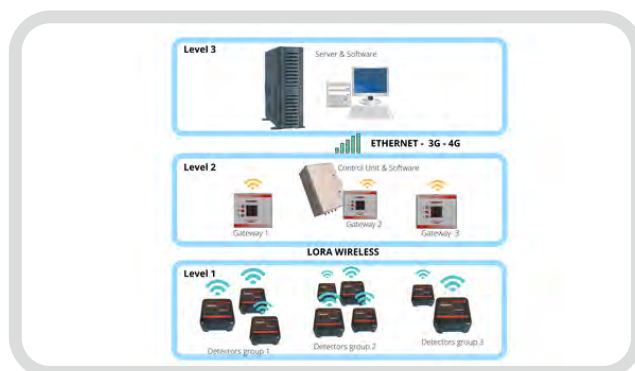
LOMAG-01

Axes number	3
Transmission frequency	868,5 Mhz
Power autonomy	5-8 years
Weight	1 Kg.
Power supply	1 or 2 Lithium batteries
Communication distance	100 mt
Protection	IP68
Dimensions	50(h) x80x90 mm
Temperature range	-20°C ÷ +50°C



LOGAT-01

Antenna connection	SMA, 50 Ohms
Transmission frequency	868,5 Mhz
Radio power	14 dBm
Weight	0,5 Kg.
Power supply	12V
Communication distance	100 mt.
Communication bus	RS485
Connector	19 pins
Dimension	106 x 96 41 mm.
Interface	Display, buttons
Operating temperature	-20°C ÷ +50°C



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Pag. 46

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Software

Data Analytics

Diagnostics

Reports



OMNIVIEW

Software



Reports and diagnostic data

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

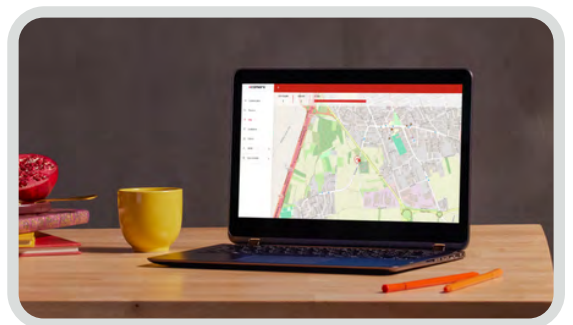
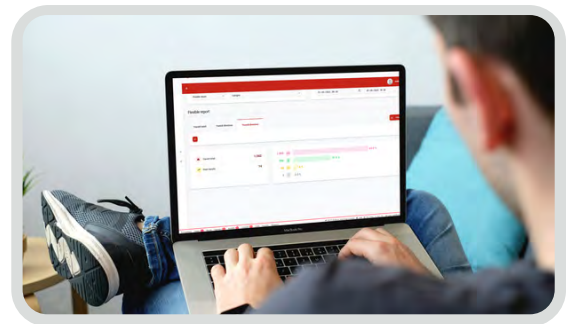
REPORT (*)

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.



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Pag. 48

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OMNIVIEW

Software



Reports and diagnostic data

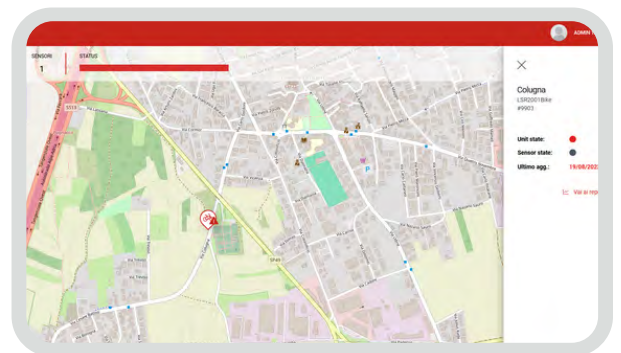
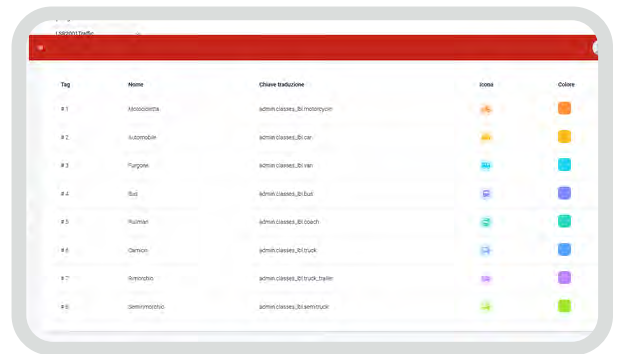
DIAGNOSTICS

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.

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**

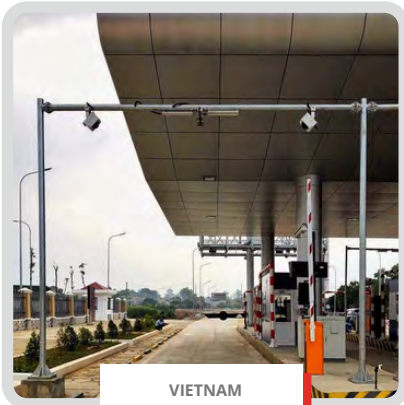


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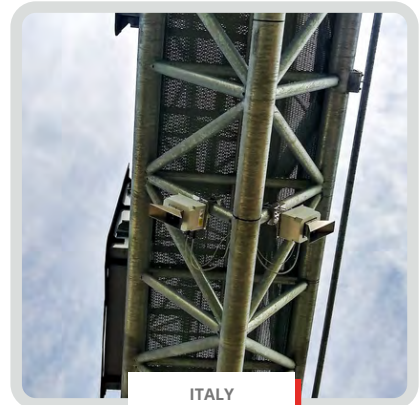
Comark Worldwide



VIETNAM



UNITED ARAB EMIRATES



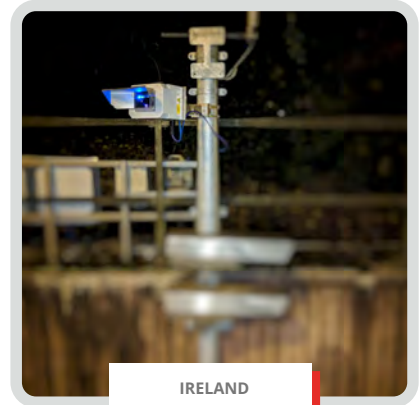
ITALY



BRAZIL



INDONESIA



IRELAND



MALAYSIA



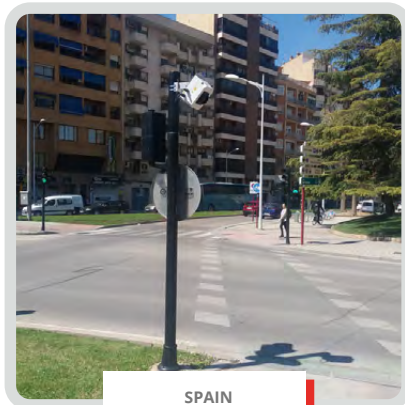
SOUTH KOREA



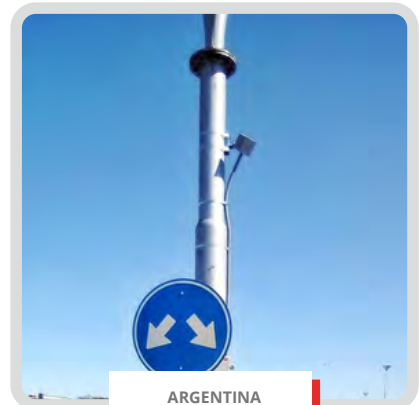
RUSSIA



ITALY



SPAIN



ARGENTINA

Comark srl

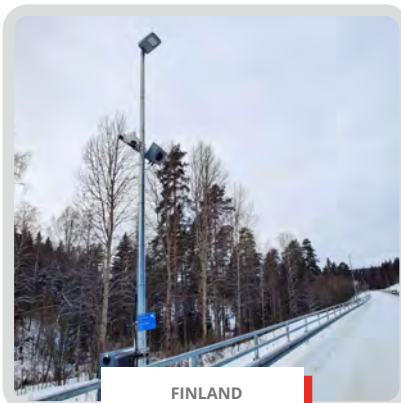
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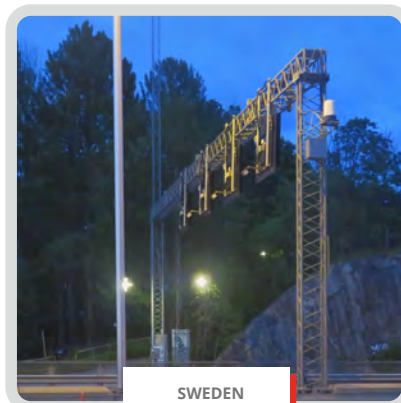
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UKRAINE



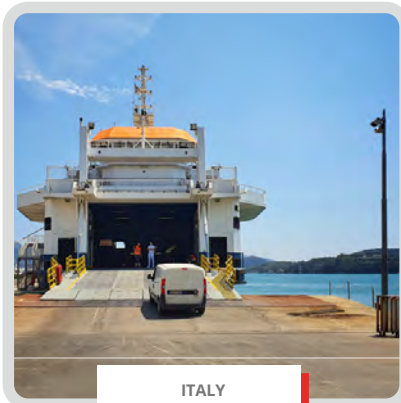
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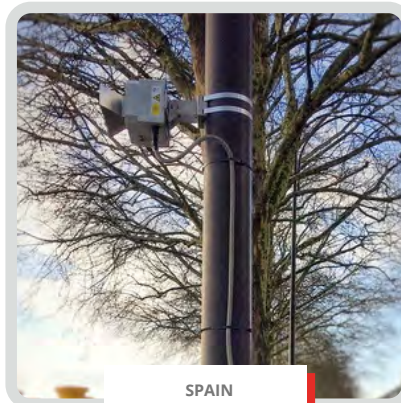
SWEDEN



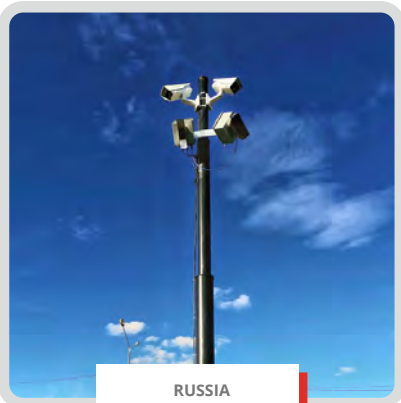
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ITALY



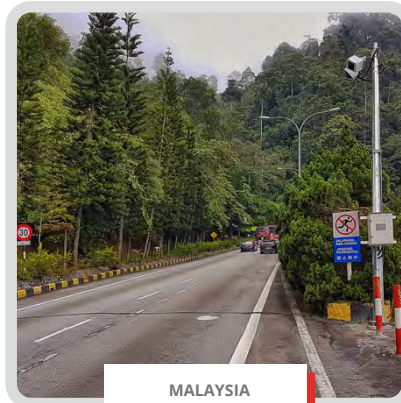
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RUSSIA



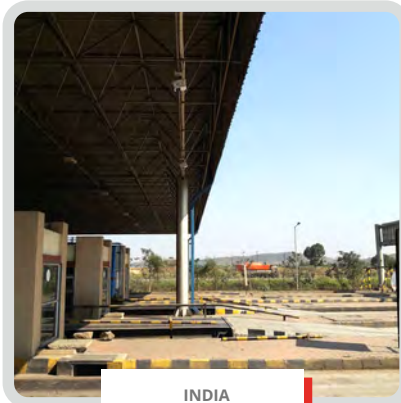
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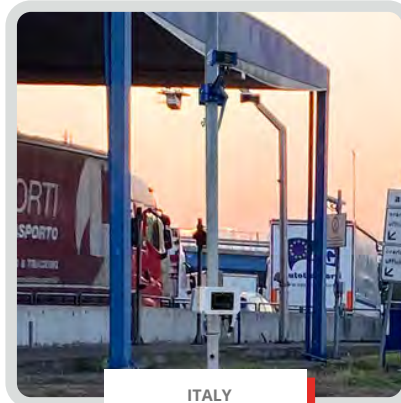
MALAYSIA



ARGENTINA



INDIA



ITALY

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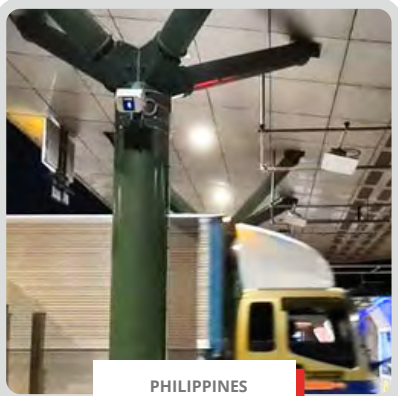
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Pag. 51

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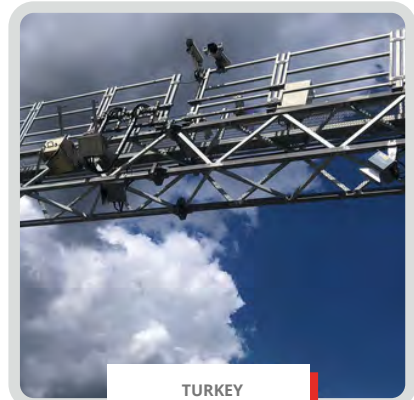
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PHILIPPINES



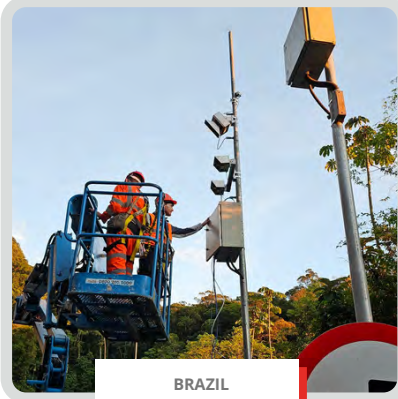
ECUADOR



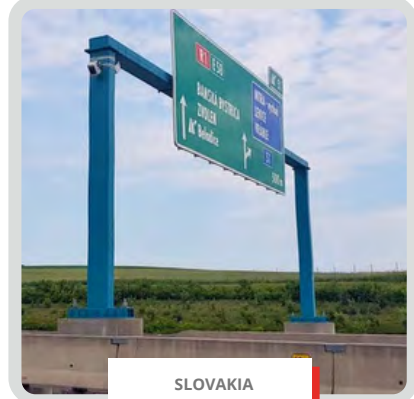
TURKEY



ITALY



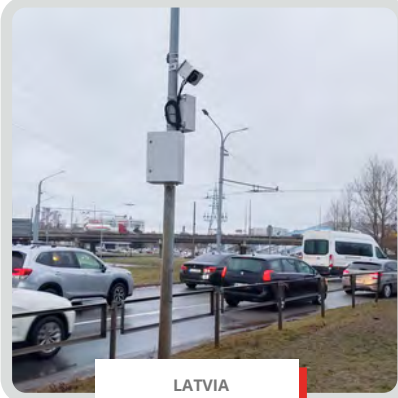
BRAZIL



SLOVAKIA



THAILAND



LATVIA



FINLAND



SLOVENIA



GERMANY



ITALY

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