



Free Flow Profiler

THE BENCHMARK FOR AUTOMATED MEASUREMENT
OF VEHICLES

Profiling systems

SICK
Sensor Intelligence.

FLEXIBLE VEHICLE MEASUREMENT UNDER FREE-FLOW TRAFFIC CONDITIONS

Whether toll collection, over height detection or traffic management: the size, number and classes of vehicles are detected around the world for various reasons. SICK has been providing expert support in the field of traffic management systems for decades – with solutions that are always designed to the specific task.

With the Free Flow Profiler, SICK has developed a system for high-precision vehicle measurement which detects vehicles across multiple lanes in free-flow traffic. The vehicles are measured using fully automated, eye-safe 2D LiDAR sensors. In addition, the modular structure of the system enables optional upgrading of the system functions to add components for vehi-

cle classification, axle counting, or the detection of overheated vehicle parts. This makes the Free Flow Profiler flexible and ideal for use in tolling systems, especially when loading cars onto ferries or trains, and for verifying dimension regulations.

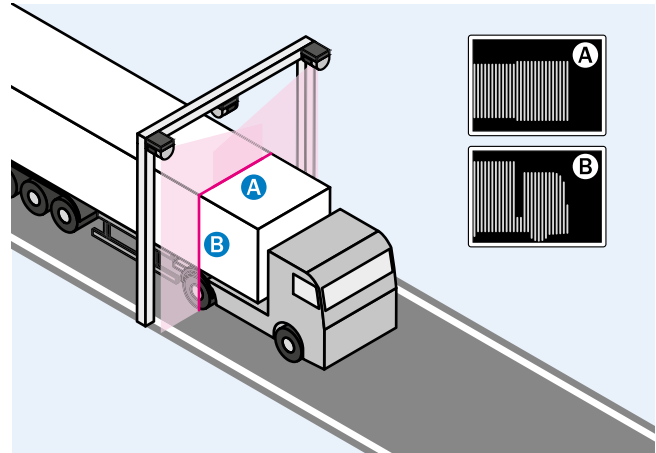


MEASURING IN THREE STEPS

In its basic version, the Free Flow Profiler consists of three 2D LiDAR sensors which are mounted on a measuring gantry above the road and scan the vehicles using a time-of-flight process: When a target object reflects the laser beams from the sensors, they determine the position of the object using the distance and angle parameters. For the subsequent calculations, the sensors immediately transmit the collected data to the central processing unit, the Traffic Controller FPS. The measuring process is divided into the following three steps:

The profile of the vehicle is detected

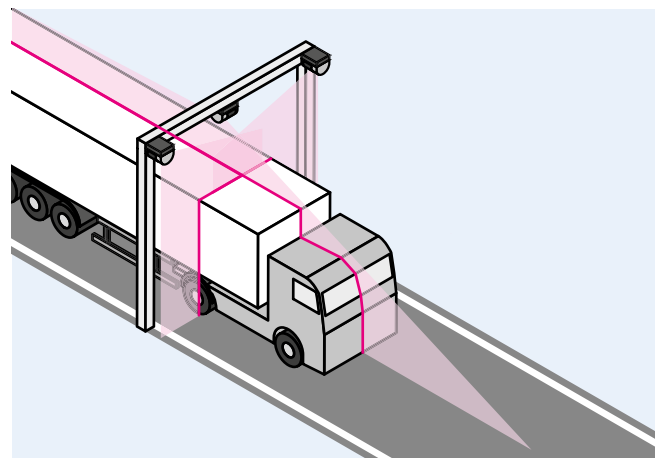
Two 2D LiDAR sensors mounted above to the road scan the upper contour and the side contour of a vehicle as it passes through. The movement of the vehicle produces a point cloud made up of 2D profile sections.



The profile of the vehicle is detected.

The length of the vehicle is measured

A third 2D LiDAR sensor is located above the road in the middle of the lane. This sensor scans the front and roof of the vehicle as it approaches, transmitting the position of the individual 2D profile sections. The movement of the vehicle thus produces a 3D point cloud.



The length of the vehicle is measured.

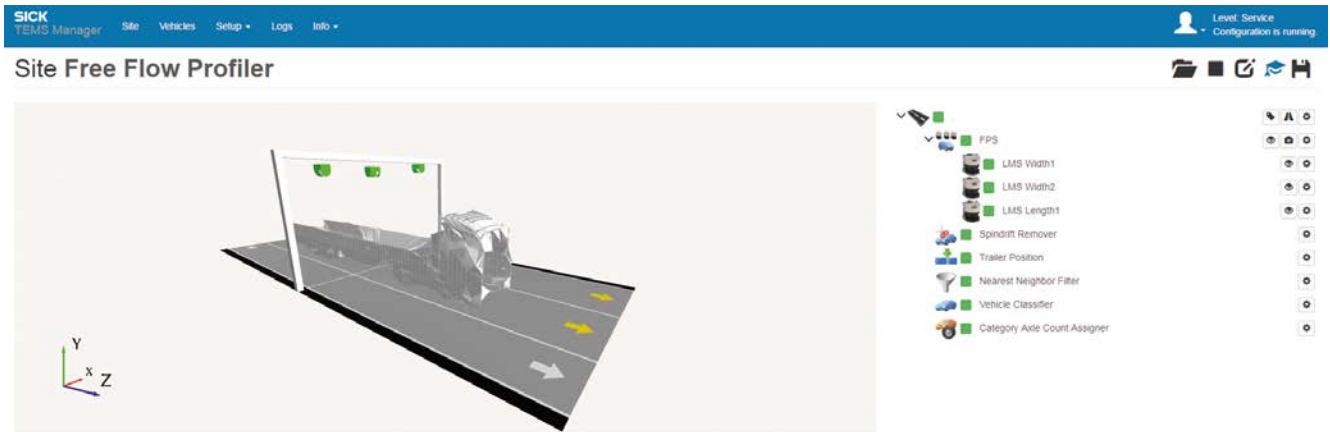
Calculating the vehicle dimensions

All three 2D LiDAR sensors are connected to the Traffic Controller FPS, which is the central processing unit of the measuring system. The Traffic Controller FPS receives and filters the incoming sensor data and calculates the vehicle dimensions. It provides the vehicle and system information via an Ethernet interface.

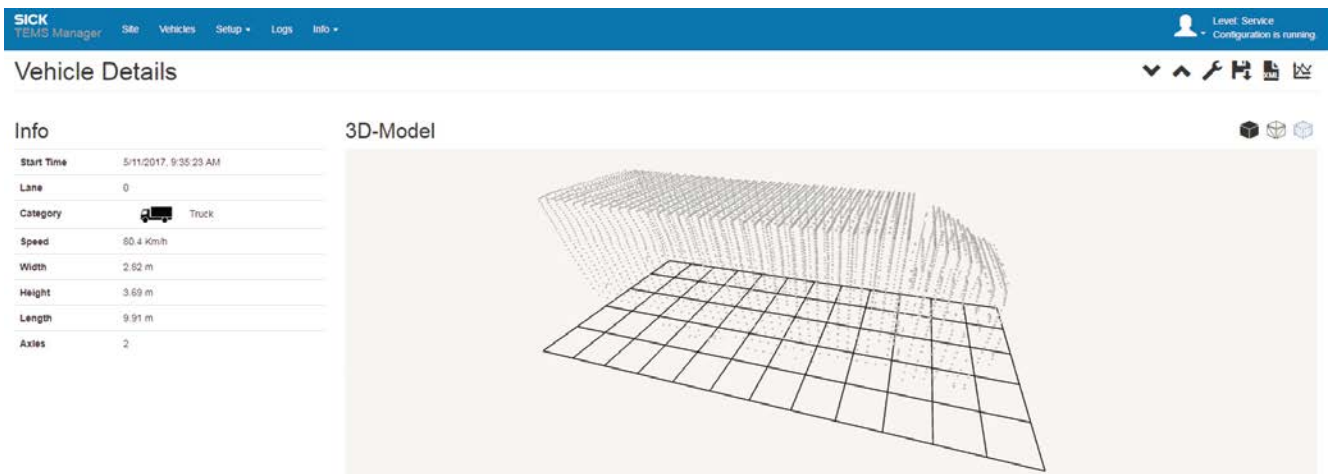
FROM THE ROAD TO THE SYSTEM

The TEMS Manager Web – the system’s user interface – immediately provides the data collected by the Free Flow Profiler. The user interface is web-based, system-independent, and no additional software is required for configuration and operation.

Thanks to the configuration wizard, the Free Flow Profiler is quick and easy to set up and can be individually adapted to local conditions. It visualizes the vehicles as a 3D point cloud immediately after they have passed under the measuring gantry. In addition, the web server automatically stores the 3D profiles and vehicle data of the last 50 detected vehicles. The data can also be accessed remotely using this web server.



Live view of the system via the web-based TEMS Manager.



The web server stores detailed vehicle data of the last 50 detected vehicles.

THE SYSTEM GROWS WITH ITS TASKS

Free Flow Profiler can be adapted individually to the local conditions and requirements. The basic system can be expanded with additional 2D LiDAR sensors based on the number of lanes that must be scanned.



Depending on the number of lanes, the system is individually adapted.

Axle counting

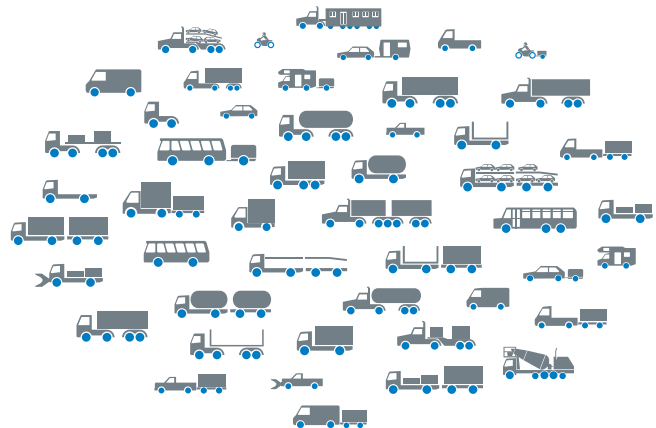
As an option, axle counting is also possible by using of 2D LiDAR sensors mounted on the road side. Axle counting is used e.g. for toll collection.



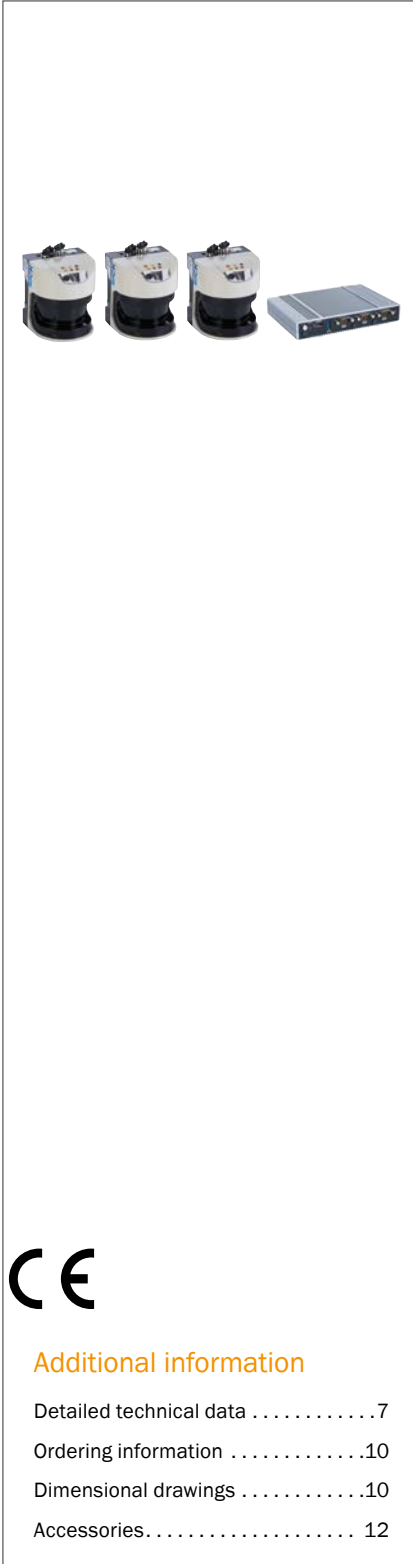
Axle counting using 2D LiDAR sensors mounted on the side of the road.

Vehicle classification

Another optional function is the classification of passing vehicles. The system identifies them by their shape and sorts them into up to 30 defined vehicle classes. Depending on the region of use and customer requirements, the system can also determine specific vehicle classes.



THE BENCHMARK FOR AUTOMATED MEASUREMENT OF VEHICLES



Product description

The Free Flow Profiler measures and classifies vehicles at free-flow traffic conditions. The vehicles are scanned up to 75 times a second using eye-safe 2D LiDAR sensors. The measurement data recorded is used to generate a 3D model of each vehicle. This 3D model is the basis for fully-automated vehicle length, width and height measurement.

All types of vehicles can be measured non-stop with the Free Flow Profiler. In addition, the modular structure of the Free Flow Profiler allows simple upgrading of the system functions to include additional components, be it for vehicle classification, axle counting and/or the detection of overheated vehicle parts.

At a glance

- Automated and precise measurement, even in bad weather
- Remote access to the Free Flow Profiler via a web browser
- Event logging and monitoring of the Free Flow Profiler system status
- Communication of measured vehicle data via TCP/IP interface

Your benefits

- Vehicle measurement and classification at free-flow traffic conditions
- Vehicle length, width, and height measurement, even over several lanes
- Can be upgraded flexibly to include additional functions
- Easy commissioning by means of the installation wizard and simple operation
- Web-based configuration and user interface
- Data storage directly in the customer system via FTP or UNC transmission
- Data history of the last 50 vehicles detected can be displayed automatically



Additional information

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→ www.sick.com/Free_Flow_Profiler

For more information, simply enter the link or scan the QR code and get direct access to technical data, CAD design models, operating instructions, software, application examples, and much more.



Detailed technical data

The exact device specifications and performance data of the product may deviate from the information provided here, and depend on the application in which the product is being used and the relevant customer specifications.

Free Flow Profiler

General notes

Items supplied	2D LiDAR sensor LMS511 SE (3 x) Traffic Controller FPS including software USB stick with TEMS info sample client, source code for TEMS info sample client, TEMS analyzer and operating instructions
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Features

Field of application	Measurement of vehicles and objects in motion Verification of compliance with vehicle dimension regulations Optimization of the loading process for ferries and car trains (RoLa) Basis for a size-based toll or payment system
Number of covered lanes	Up to 4 lanes at best performance Max. 9 sensors per system
Integrated application	Vehicle measurement Toll systems Verification of compliance with vehicle dimension regulations Optimization of the loading process
Scanner design	LMS511 SE
Vehicle data	Vehicle dimensions Vehicle class Driving direction Lane assignment Confidence level for all vehicle datas 3D point cloud
Sensor	2D LiDAR sensor
Classification system	Europe, Asia, North America
Amount of vehicle classes	Up to 30 classes
Recommended distance between max. vehicle height and sensor	≥ 1 m
Recommended vehicle distance	0.6 m at v < 30 km/h 2.2 m at v < 120 km/h
Calibration	Automatic
Stop-and-go functionality	Yes
Scanning frequency	75 Hz, for LMS Width 35 Hz, for LMS Length
Max. range with 10 % reflectivity	40 m
Aperture angle	190°, per LMS511 SE
Laser class	1, eye-safe (IEC 60825-1:2014)
Heating	✓
Internal computer	Traffic Controller FPS ✓
Internal memory	32 GB

Performance

Counting accuracy	99.8 %
Classification accuracy	98 % (For TLS8+1 classes)
Length measurement accuracy	± 400 mm at v < 30 km/h (± 2σ) ± 1,000 mm at v < 120 km/h (± 2σ)

Width measurement accuracy	± 50 mm at v < 30 km/h (± 2σ) ± 100 mm at v < 120 km/h (± 2σ)
Height measurement accuracy	± 30 mm at v < 120 km/h (± 2σ)
Minimum object size	1 m x 0.6 m x 0.6 m (L x W x H)
Maximum object size	32 m x 3.5 m x 5 m (L x W x H)
Minimum detectable object	190 mm x 130 mm x 130 mm < 30 km/h 525 mm x 130 mm x 130 mm < 120 km/h

Interfaces

Output data	Vehicle data
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Mechanics/electronics

Installation position	Overhead or at the side
Installation height	5 m ... 8 m, at least 1 m higher than the maximum vehicle height Angle between LMS and vehicle > 15°

LMS511 SE

General notes

Description	Configured 2D LiDAR sensor for profiling systems used for traffic applications. Complete specifications can be found under the standard resolution LMS511-10100 PRO (1046135).
Note on use	The sensor does not constitute a safety component as defined by relevant legislation on machine safety.

Features

Field of application	Outdoor
Version	Mid Range
Resolution power	Standard Resolution
Light source	Infrared (905 nm)
Laser class	1, eye-safe (IEC 60825-1:2014)
Aperture angle	190°
Heating	Yes
Amount of evaluated echoes	5
Fog correction	Yes

Interfaces

Ethernet	✓
Function	Host
Data transmission rate	10/100 MBit/s
Protocol	TCP/IP, OPC
Optical indicators	5 LEDs (Additional 7-segment display)

Mechanics/electronics

Electrical connection	4 x M12 round connector
Supply voltage	24 V DC (19.2 V DC ... 28.8 V DC)
Power consumption	22 W, + 55 W heating (typical)
Housing color	Gray (RAL 7032)
Enclosure rating	IP67 (EN 60529, Section 14.2.7)
Protection class	III (EN 60529, Section 14.2.7)

Weight	3.7 kg
Dimensions (L x W x H)	160 mm x 155 mm x 185 mm

Ambient data

Object remission	2 % ... > 1,000 % (reflectors)
Electromagnetic compatibility (EMC)	EN 61000-6-2:2005, EN 61000-6-3 (2007-03)
Vibration resistance	EN 60068-2-6 (1995-04)
Shock resistance	EN 60068-2-27 (1993-03), EN 60068-2-29 (1993-04)
Ambient operating temperature	-40 °C ... +60 °C
Storage temperature	-40 °C ... +70 °C
Ambient light immunity	70,000 lx

Traffic Controller FPS

General notes

Note on use	Receipt and filtering of sensor data Processing for vehicle data Output of vehicle and diagnostic data via the user interface
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Features

Field of application	Indoor
Internal memory	32 GB

Interfaces

Optical indicators	LED status and function display
Ethernet	✓ (2)
Function	Operator interface, sensor interface
Data transmission rate	1 Gbit/s, for each interface
Protocol	TEMS Info Interface (TCP/IP Interface) WCF TEMS Manager (configuration software)
Electrical connection	Connector LAN 1 (RJ45) for operator interface, connector LAN 2 (RJ45) for sensor interface
NTP synchronization	✓

Mechanics/electronics

Supply voltage	24 V DC (9 V DC ... 25 V DC)
Power consumption	10 W (typical)
Enclosure rating	IP20
Weight	0.7 kg
Housing dimensions (W x D x H)	180 mm x 121.2 mm x 33 mm
Fixing	Screwable

Ambient data

Electromagnetic compatibility (EMC)	EN 55024, EN 55022 Class A
Ambient temperature operation	-20 °C ... +60 °C
Ambient storage temperature	-40 °C ... +80 °C

Ordering information

Free Flow Profiler

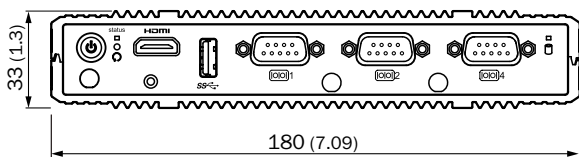
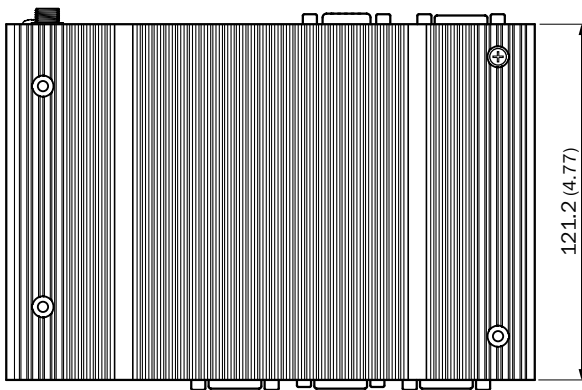
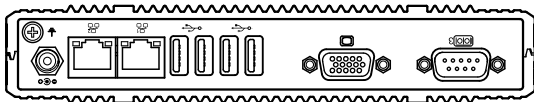
Integrated application	Items supplied	Type	Part no.
Vehicle measurement Toll systems Verification of compliance with vehicle dimension regulations Optimization of the loading process	2D LiDAR sensor LMS511 SE (3 x), Traffic Controller FPS including software, USB stick with TEMS info sample client, source code for TEMS info sample client, TEMS analyzer and operating instructions	FPS503	1088784

LMS511 SE

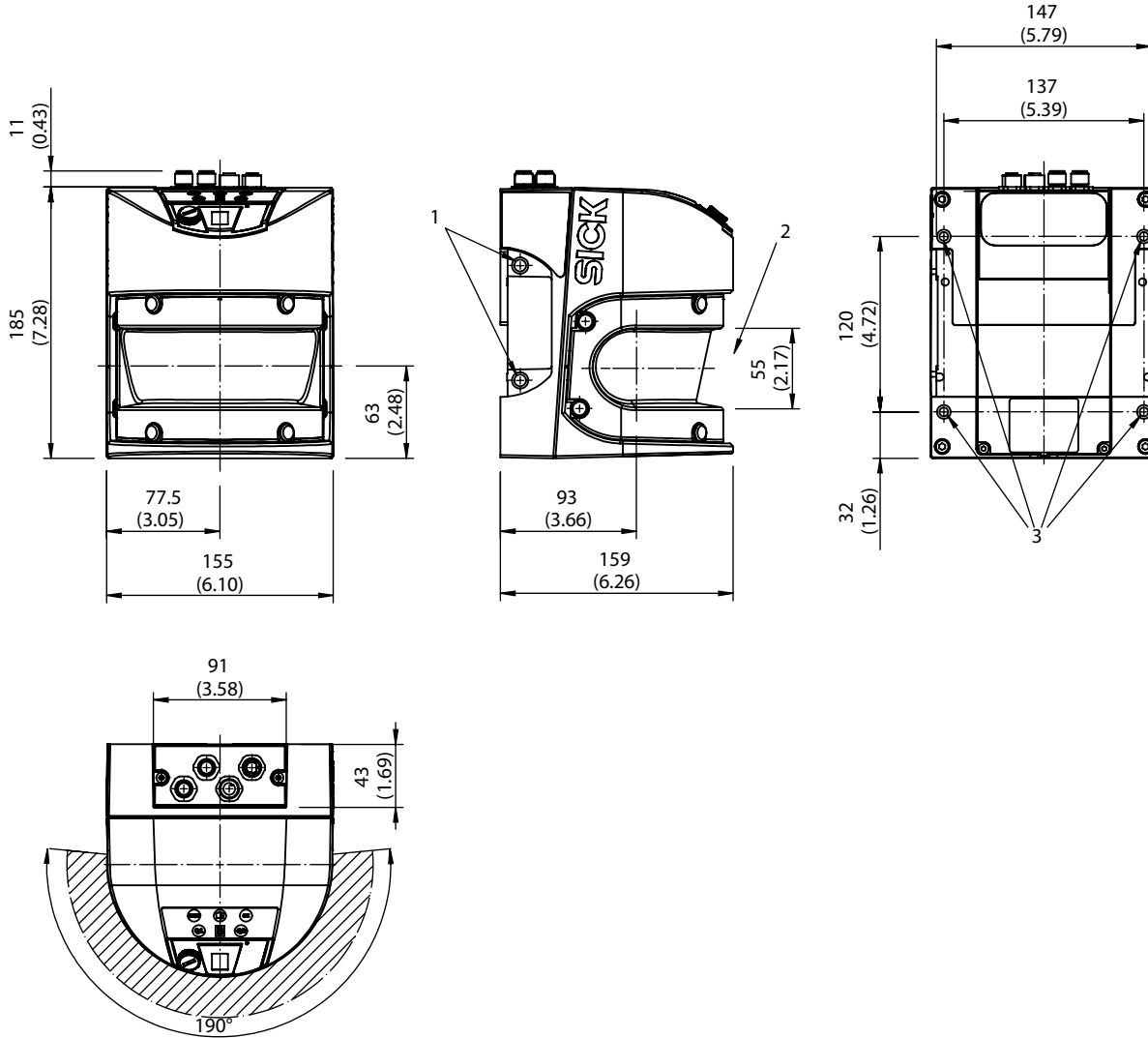
Type	Part no.
LMS511 SE	1091458

Dimensional drawings (Dimensions in mm (inch))

Traffic Controller FPS



LMS511 SE




- ① 4 screw holes M8 x 9
- ② Do not block front screen
- ③ 4 screw holes M6 x 8






Accessories

Mounting systems

Device protection (mechanical)



	Brief description	Type	Part no.	FPS503	LMS511 SE	Traffic Controller FPS
	Protection hood	Protection cover	2056850	-	●	-
	Weather hood (180°), vertical mounting	Weather hood	2063050	●	●	-

Mounting brackets and plates




	Brief description	Type	Part no.	FPS503	LMS511 SE	Traffic Controller FPS
	Mounting bracket for LMS5xx (for retrofitting, if 2018303 is already in use)	Mounting bracket	2059271	-	●	-
	Mounting kit for wall-mounting (adjustment bracket), steel, zinc coated	Mounting kit	2018303	-	●	-
	Mounting bracket for direct mounting, from the rear, on wall or machine, not adjustable	Mounting kit 1	2015623	●	●	-
	Mounting bracket for rear mounting on wall or machine, adjustable longitudinal and lateral axes, only in conjunction with mounting kit 1 (2015623)	Mounting kit 2	2015624	●	●	-
	Mounting bracket for rear mounting on wall, floor, or machine, adjustable longitudinal and lateral axes, only in conjunction with mounting kit 1 (2015623) and 2 (2015624)	Mounting kit 3	2015625	●	●	-

Connection systems

Modules and gateways


	Brief description	Type	Part no.	FPS503	LMS511 SE	Traffic Controller FPS
	Indoor Ethernet-Switch, 8 ports, operating temperature range 0 °C ... +55 °C	Ethernet switch	6033013	●	-	-
	Outdoor Ethernet-Switch, 8 ports, operating temperature range -40 °C ... +75 °C	Ethernet switch	6043482	●	-	-


Plug connectors and cables

	Brief description	Type	Part no.	FPS503	LMS511 SE	Traffic Controller FPS
	4-wire, 5 m	DOL-1204-G05MACO	6054495	●	●	-
	4-wire, 10 m	DOL-1204-G10MACO	6054494	●	●	-
	4-wire, 20 m	DOL-1204-G20MACO	6050687	●	●	-
	3 m	Ethernet data cable	6026083	●	-	●
	4-wire, 5 m	SSL-2J04-G05MACO	6054493	●	●	-
	4-wire, 10 m	SSL-2J04-G10MACO	6054492	●	●	-
	4-wire, 20 m	SSL-2J04-G20MACO	6050685	●	●	-

Further accessories

Test and monitoring tools

	Brief description	Type	Part no.	FPS503	LMS511 SE	Traffic Controller FPS
	Scan finder, receiver to localize infrared scans	Scan-Finder LS-80L	6020756	●	●	-

	Type	Part no.	FPS503	LMS511 SE	Traffic Controller FPS
	LMS511 SE	1091458	●	-	-

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Our comprehensive and versatile LifeTime Services are the perfect addition to the comprehensive range of products from SICK. The services range from product-independent consulting to traditional product services.



- 
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 Safe and professional
- 
Product and system support
 Reliable, fast, and on-site
- 
Verification and optimization
 Safe and regularly inspected
- 
Upgrade and retrofits
 Easy, safe, and economical
- 
Training and education
 Practical, focused, and professional

SICK AT A GLANCE

SICK is a leading manufacturer of intelligent sensors and sensor solutions for industrial applications. With more than 8,000 employees and over 50 subsidiaries and equity investments as well as numerous agencies worldwide, we are always close to our customers. A unique range of products and services creates the perfect basis for controlling processes securely and efficiently, protecting individuals from accidents and preventing damage to the environment.

We have extensive experience in various industries and understand their processes and requirements. With intelligent sensors, we can deliver exactly what our customers need. In application centers in Europe, Asia and North America, system solutions are tested and optimized in accordance with customer specifications. All this makes us a reliable supplier and development partner.

Comprehensive services round out our offering: SICK LifeTime Services provide support throughout the machine life cycle and ensure safety and productivity.

For us, that is “Sensor Intelligence.”

Worldwide presence:

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