



# RSD6000

Opus Remote Sensing Device

Version 6000

The Opus RSD6000© is designed to remotely measure the tailpipe emissions of motor vehicles in real-world, real-driving conditions. The device is placed on the side of the road, emitting an invisible beam of ultraviolet (UV) and infrared (IR) light, which crosses the road and returns to a detector, which calculates the concentrations of the pollutants to CO<sub>2</sub> present in the exhaust plume of each vehicle passing in front of the measurement system. At the same time as the emissions emitted by the vehicle are measured, a digital video of the vehicle is captured. The RSD6000 automatically identifies the vehicle's license plate, it measures the vehicle's speed and acceleration and captures visual information from the vehicle, such as vehicle type, brand and model. In addition, the system records ambient parameters at the time of each measurement.

Each vehicle's emissions, kinetic conditions, license plate image and additional parameters are merged in less than a second to complete a measurement record, which can be sent via 4G/5G to the OPUS Data Hub in the Cloud for real-time collection and analysis. The RSD6000 is designed to measure the exhaust emissions of vehicles as they drive by in up to two lanes of traffic and can be deployed in portable or fixed setups.

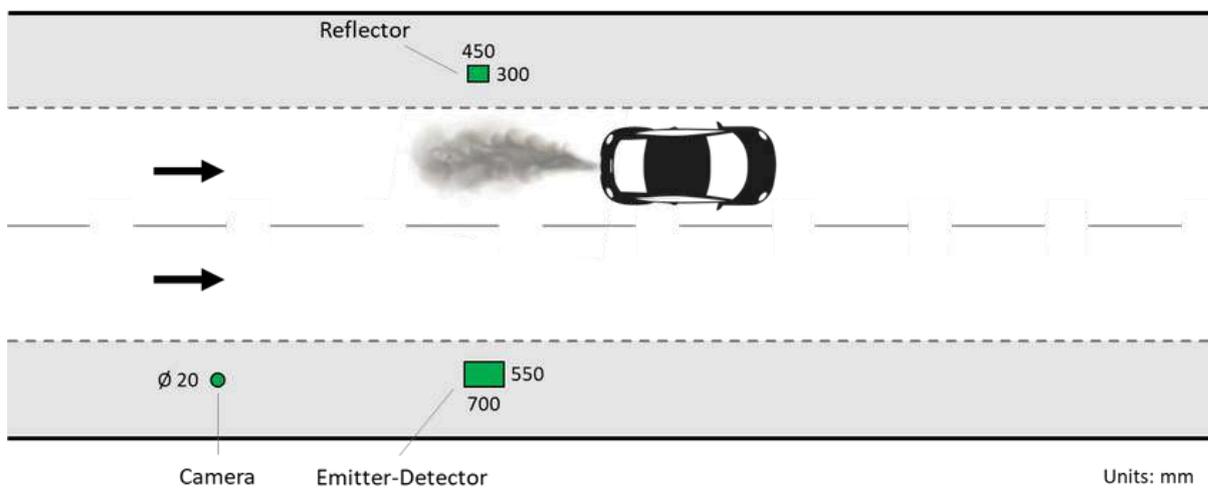
The RSD6000 measures the absorptions of the following species in the exhaust plumes of individual vehicles: carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), nitric oxide (NO), nitrogen dioxide (NO<sub>2</sub>), hydrocarbons (HC), ammonia (NH<sub>3</sub>) and particulate matter (PM) as opacity.



The above measurements lead to the automatic reporting of the pollutant concentrations relative to CO<sub>2</sub>: CO/CO<sub>2</sub>, NO/CO<sub>2</sub>, NO<sub>2</sub>/CO<sub>2</sub>, HC/CO<sub>2</sub> and NH<sub>3</sub>/CO<sub>2</sub>. It also provides the Smoke Factor (SF), to evaluate the vehicle's exhaust particulate matter emissions.

## FEATURES

- The most widely used instrument of its kind in the world. It operates under strict certifications and external validations.
- Cross-road open path. No elements on or above the road surface. Quick & easy setup.
- Easy deployment, operation and maintenance.
- Internal batteries for up to 20-hours autonomy.
- Real-time data transfer and high-emitter alerting.



SCU - SYSTEM CONTROL UNIT	
Power	36VDC - 56VDC (~48VDC nominal); <100 W
Size (W x H x D)	24.5 x 36.0 x 11.0 cm
Weight	4.0 kg
Beam Path	4 – 10 m between SDM and CCM
Operating System	Windows 10 pro
Processor	Intel I7-7700T 2.90 GHZ or greater
Wireless Connectivity	802.11g Wi-Fi
Cell Modem	4G/5G LTE / HSPA+ embedded Modem*



\* SIM or internet operating cost not included; to be provided by the customer.

SDM - SOURCE DETECTOR MODULE	
Power	36VDC - 56VDC (~48VDC nominal); <100 W
Size (W x H x D)	35.5 x 34.3 x 22.9 cm
Weight Beam Path	10.9 Kg
Length Operating	4 – 10 meters between SDM & CCM
Temperature	-7°C to +49°C [20°F to 120°F]
Storage Temperature	-20°C to 60°C [-4°F to 140°F]
Operating Humidity	0 to 95% (non-condensing)
Operating Altitude	-300 m to 3000 m [-1000 ft. to 10,000 ft.]
Warm-up Time	20 minutes
Data Transmission	Ethernet
Stands	(x3) regulable legs attached to a robust base stand to allow alignment with the CCM. These are only required for the manned configuration.



CCM - CORNER CUBE MIRROR	
Power	None. Passive element having only mirrors
Size (W x H x D)	20.7 x 30.4 x 20.0 cm
Weight	8.0 kg
Beam Path Length	4.6 – 9.0 meters between SDM & CCM
Stands	(x3) regulable legs screwed to the main casing to allow alignment with the SDM and provide it stability. These are only required for the manned configuration.



CAMERA - AXIS MODEL Q1786-LE	
Size (H x Diam)	Length: 38.6 cm / Ø: 14.7 cm
Weight	2.4 kg
Image Capture	Built-in JPG frame grabber
Connectivity	Power over Ethernet (POE)
Zoom Ratio	32x optical zoom
Sensitivity	CMOS. Size 1/1.8. Minimum illumination; 0.18 lux in color / 0 lux in B/W
Features	Fully controlled by software from the Remote Sensing Computer.
Protection	IP67 / IK10
Artificial Intelligence	It can include Opus Sensing Drive©, our proprietary GPU-kit for computer vision capabilities: automatic recognition of license plates, measurement of vehicle's speed and acceleration, automatic vehicle type recognition and estimation of vehicle's brand and model.
Mounting	Tripod, mounted on pole or disguised inside traffic barrel. Suitable for portable or fixed operation.



Optional peripheral in case of not using a camera with Opus artificial vision kit:

SAB - SPEED AND ACCELERATION BAR - Emitter-detector bar		
Lasers	Visible laser module is a 635 nm, 5.0mw Class IIIa laser	
Size (W x H x D)	91.4 x 5.1 x 15.3 cm [36 x 2 x 6 inches]	
Weight	4.5 Kg	
Power	Power over Ethernet (POE), < 20 Watts	
Beam Path	4.6 – 9.0 m between Emitter & Reflector Bars	
SAB - SPEED AND ACCELERATION BAR - Reflector bar		
Size (W x H x D)	91.4 x 5.1 x 51. cm [36 x 2 x 2 inches]	
Weight	1.8 kg	
Reflectors	(x2) acrylic retroreflectors laser compatible.	

#### Calibration and performance verification:

The SDM includes the Internal Cells Calibration System (ICCS), which allows the system to verify its performance regularly and automatically. The system executes the calibration process autonomously, sequentially placing sealed cells with different known concentrations of gases in the optical path of the system. The system compares the measured concentrations of each of the compounds against the known concentrations in each cell. This method allows regular verification that the RSD6000 is measuring to specification. The SDM also houses a gas dispenser for external audits using dry-gas cylinder, if desired.

#### Analytical accuracy:

- CO (%)  $\pm 0.1\%$  or  $\pm 10\%$  of the Certified Gas Sample.
- HC (ppm propane)  $\pm 100$  ppm or  $\pm 10\%$  of the Certified Gas Sample.
- NO (ppm)  $\pm 100$  ppm or  $\pm 10\%$  of the Certified Gas Sample.
- NO<sub>2</sub> (ppm)  $\pm 100$  ppm or  $\pm 10\%$  of the Certified Gas Sample.
- NH<sub>3</sub> (ppm)  $\pm 100$  ppm or  $\pm 10\%$  of the Certified Gas Sample.
- PM (%)  $\pm 1\%$ .
- Speed(km/h)  $\pm 1.6$  km/h (8 – 160 km/h)
- Acceleration (km/h/s)  $\pm 0.8$  km/h/second (8 – 160 km/h)

## Testing and certification:

- Since 1989, the RSD has been validated by different national or federal agencies worldwide.
- Since 2013, OPUS RSE is world's only ISO-17025 accredited company for the remote measurement of real-driving vehicle emissions.
- The RSD6000 meets the latest GEN2COVERS Specifications, the most demanding performance specifications for this type of technology.
- Dry exhaust gas mixtures are introduced into the RSD's beam path using RSD's built-in dispensing system or equipping electric vehicles with artificial tailpipe emissions systems.

## Deployment options:



The RSD6000 can be quickly deployed on the roadside in protective boxes, for quick and easy deployment. This configuration allows the RSD6000 to be easily transported and placed at a specific site without any prior preparation.

The system is set up in a few minutes and starts measuring autonomously. It can be picked up at the end of the day and placed at the same or another point, whenever desired.

The system can include batteries for up to 20 hours of continuous operation.



The RSD6000 can be housed in traffic cabinets, which are anchored to the sides of the road. This configuration requires an installation of the cabinets, but allows a fixed system to measure uninterrupted, 24/7, at a specific site.