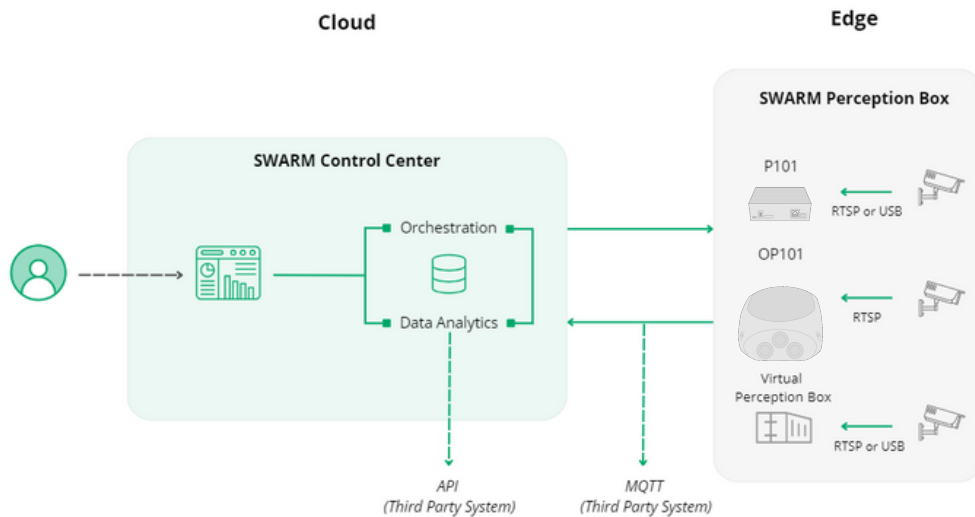
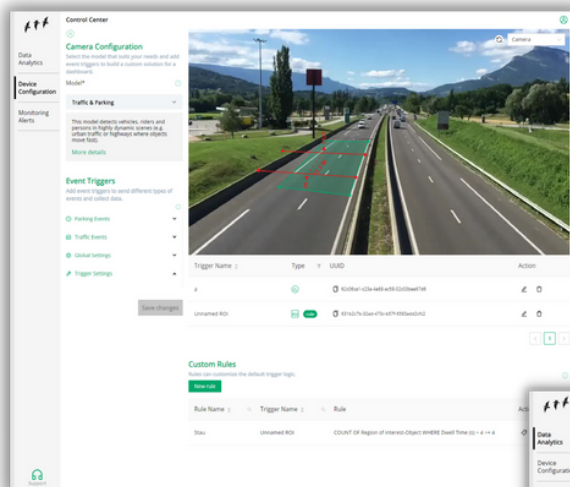


SWARM Perception Architecture: Overview



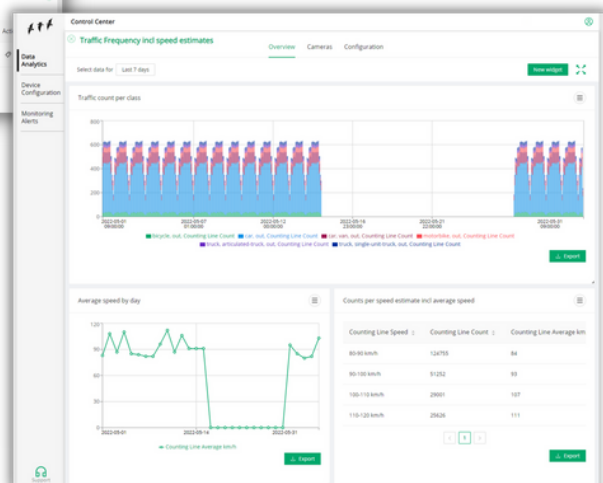
The **SWARM Perception Platform** consists of two major components: The SWARM Control Center in the cloud and the SWARM Perception Boxes on the edge. Together they provide:

- Management and configuration of the edge devices
- Real-time video analytics and event analysis
- Data Analytics and visualization



(1) The SWARM Control Center allows a straightforward camera configuration. The model, in this example *Traffic & Parking*, can be easily chosen from a drop down menu, before event triggers can be set directly in the camera frame. If needed, custom rules can be activated for the trigger logic.

(2) Data is aggregated and analyzed automatically. Various predefined widgets provide real-time and historical insights. API calls to further integrate information in third party platforms are included.



The SWARM Control Center (SCC) is a cloud based platform* providing one web interface for orchestration, Data Analytics and visualization.

Data Analytics & Visualization

The SWARM Control Center supports users with a wide range of integrated features and options:

- Simple data compression and aggregation
- Integrated historic data analysis
- Real-time capacity figures of parking areas
- Support of data exports in csv format
- Easy creation of dashboards for traffic or parking scenes with all needed information and parameters (*i.e. GPS coordinates for visualizations in the respective time zone*)
- Numerous sorting options for dashboards (*i.e. list view, map view, grouping function*)
- Access to predefined widget types with the ability to filter and segment by various parameters
- Selection from numerous visual representations (*i.e. bar chart, pie chart, table*)
- Parking space capacity and adjustment of the current utilization level at any time
- Setting of maximum parking time to detect parking violators
- No limit on the amount of configured event triggers (e.g. virtual loop, vehicle presence, etc.)

Data retention: For SWARM Perception Boxes with active Swarm Perception Subscription (SPS) the respective data is stored and accessible for 30 days. To extend this time to three years, the additional Swarm Data Subscription (SDS) is needed.

Traffic Insights	Parking Insights	Advanced Traffic Insights
Specific class detection	Long-term trends	Custom rules (i.e. queue length detection, unexpected class, etc.)
Turning counts	Single-space occupation	Safety analysis
Speed detection	Multi-space occupation	Journey time calculation
Virtual loop counting with direction of travel	Capacity analysis	Traffic type distinction (commute, transit, visit)**
Vehicle presence Recognition	License Plate Reading (LPR) with configurable data retention/deletion	License Plate Reading (LPR) anonymized

*: based on Microsoft Azure **: coming soon

Orchestration & Configuration

The SWARM Control Center offers a variety of features and options to support users with the perfect handling:

- **Configuration and calibration**
 - Configuration of all basic and advanced edge video analytics features
 - Configuration of event rules for contextual data
 - Assisted track and live calibration for more accurate configurations
 - Multi role support (viewer, configurator, admin, super admin)
- **Monitoring**
 - Real-time runtime device health monitoring
 - Configurable alerts
- **Maintenance**
 - Centralized over-the-air software updates for Swarm Perception Boxes
 - Automatic platform update
 - Quick access to device logs
 - Reboot option for all devices

Edge: SWARM Perception Box Software

Video Analytics

Object detection and classification in 12+1 standardized traffic classes and subclasses:

- **Car**
 - Car with subclass *van*
 - Car with subclass *car with trailer*
- **Truck**
 - Truck with subclass *single unit truck*
 - Truck with subclass *articulated truck*
 - Truck with subclass *truck with trailer*
- **Bus**
- **Motorbike**
- **Bicycle**
- **Person**
- **Scooter**
- **Tram**
- **Other**

Optional: Object **detection** for **persons only for indoor usage**

<i>Counting Lines (CL)</i>	Easy counting of objects when objects cross a configured line in two directions
<i>Origin-Destination Zones (OD)</i>	Provide traffic flow information when objects enter and leave configured zones
<i>Region of Interest (RoI)</i>	Provides the number of objects in a specified region
<i>Single-/Multispace Parking</i>	Dedicated Parking <i>RoI</i> for single and multispace parking capacities
<i>Virtual Door</i>	Improved <i>Counting Line</i> for person detection
<i>Speed Estimation</i>	Each <i>Counting Line</i> supports a speed estimate. Output km/h as parameter within the created <i>Counting Line</i> events
<i>Custom Rules</i>	Customization of event triggers: from simple adjustments to count only bicycles at a given <i>Counting Line</i> to more complex rules to monitor crosswalks by combining <i>RoI</i> status with <i>CL</i> crossings
<i>Automated Number Plate Recognition (ANPR)</i> <i>License Plate Reading (LPR)</i>	Support of all European license plates. Can be utilized for LPR and country classification. License plate data retention time can be configured in compliance with the respective data privacy regulation (e.g. GDPR).

Note: Our settings offer an unlimited usage of event triggers within one stream configuration.

Edge: SWARM Perception Hardware

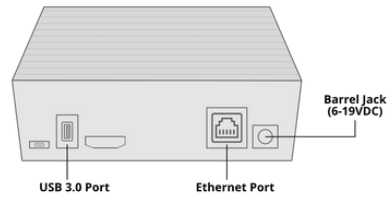
Product Datasheet

Category	P101 For indoor and cabinet use	OP101AC For outdoor use	OP101DC For outdoor use
General			
# of IP camera streams	1 to 4 (depends on use case)	1 to 2 (depends on use case)	1
Video source	IP/RTSP (H264) USB (UYVY, YUY2, YVYU)	IP/RTSP (H264)	
Event format	JSON		
Message output support	SWARM Control Center API Third Party MQTT Broker		
Interfaces	1x Gigabit Ethernet port	2x Gigabit Ethernet with IEEE802.3at PoE+ support for cameras	1x Gigabit Ethernet with IEEE802.3at PoE+ support for cameras
Power supply	6-19VDC (barrel connector 5.5 mm x 2.5 mm)	External junction box, 230VAC	9-24VDC (power plug delivered with junction box), Reverse polarity protected
Power consumption (on load without camera)	<12W	<15W	<15W
Network			
Connectivity	Gigabit Ethernet	4G/LTE modem	
Mechanical			
Mounting options	DIN Rail Mount	Pole mounting kit	
Weight	448 grams	2310 grams	2040 grams
Dimensions	110 mm x 89 mm x 36 mm	225 mm x 205 mm x 112 mm	
Material	Metal	Polycarbonate	
Environmental			
Ingress Protection Rating	-	IP66 UV resistant	
Operational temperature	-10°C to +50°C	-20°C to +50°C	
Support			
Advanced replacement	Optional		
Warranty	One year		
Operating system	Maintenance through SWARM Control Center		

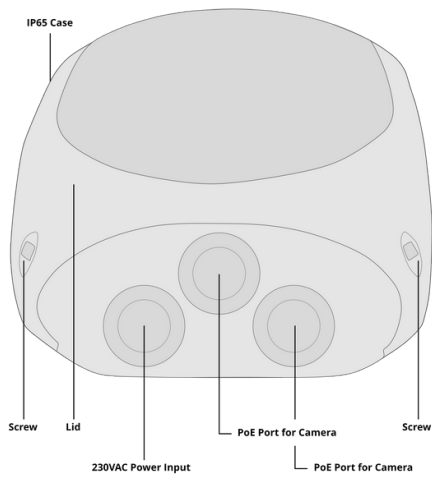
SWARM Perception Boxes

Diagrams

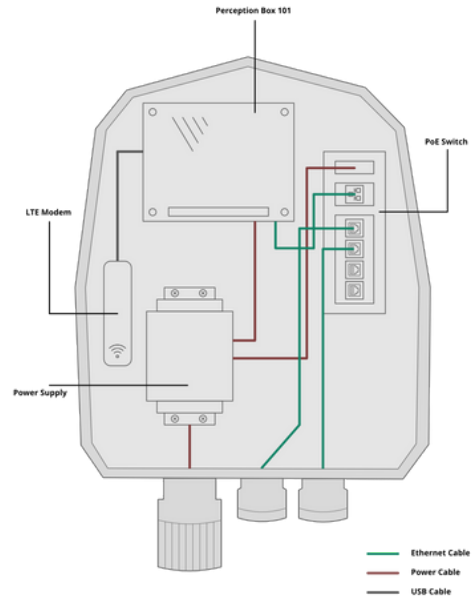
P101 Exterieur



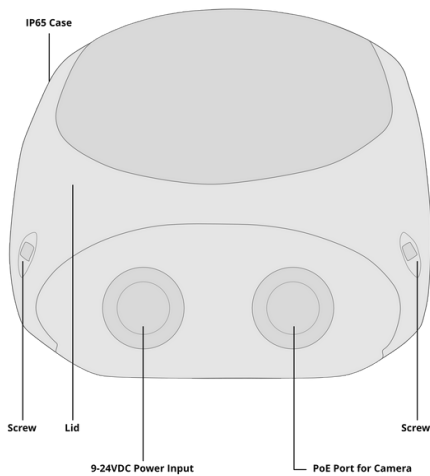
OP101AC Exterieur



OP101AC Interieur



OP101DC Exterieur



OP101DC Interieur

