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TrafficEmbedded: How to start

A step by step guide to your very own intelligent traffic camera system.

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Thank you for purchasing TrafficEmbedded unit and joining the FLOW family of next-gen traffic analytic intelligence! You have purchased the most powerful and versatile traffic AI available - it is waiting in the box to be unleashed by your creativity.

We wish you an exciting journey towards a smoother and safer traffic of tomorrow. Let the traffic FLOW.

On behalf of the whole DataFromSky team



David Herman, CEO

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The difference between TrafficEmbedded and TrafficXRoads and why you need to know it

The TrafficEmbedded is essentially our product TrafficXRoads inside IP66 box designed for outdoor installation with the possibility of installing additional accessories and modules such as SDLC expander, LTE, 5G, LORA , I/O expander, V2X module or local data storage. To learn more about TrafficXRoads please refer to the product page: <https://datafromsky.com/trafficxroads/> As in terms of software and analytics setup it is the same. We will refer you to the TrafficXRoads manual if you would like to read more about the following:

- FLOW – connect and define traffic analytics – page 14
- Detection of traffic events (UDP, SDLC and I/O data communication) - page 18
- Reducing latency – page 30

You can download it here:

https://www.datafromsky.com/download/materials/FlowProducts/TrafficXRoads/Manual_TrafficXRoads.pdf

Unboxing

First things first - let's check all the bits and pieces that landed on your table. Depending on the selected configuration, you should be able to find the following:

- TrafficEmbedded unit
- Printed Manual
- Certificate with FLOW license key
- Cable glands and blindfolds
- Opening handle



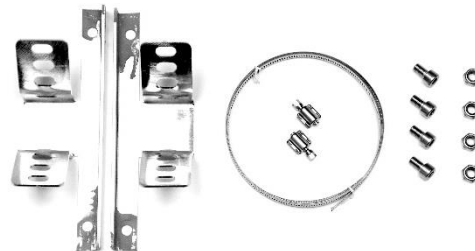
Optional accessories

- Power cord for mains powered configurations



Optional mounting accessories

- 2x mounting bracket
- 4x screw
- 4x self-locking nut
- 2m of attachment band
- 2x tightening buckle



Quick start

For start you need to connect:

- 12- 24V DC power source
 - o minimum 65W (100W recommended)
 - o red and yellow +
 - o black -
- Modem / your computer (LAN/WAN)
- IP Camera (PoE Ports)

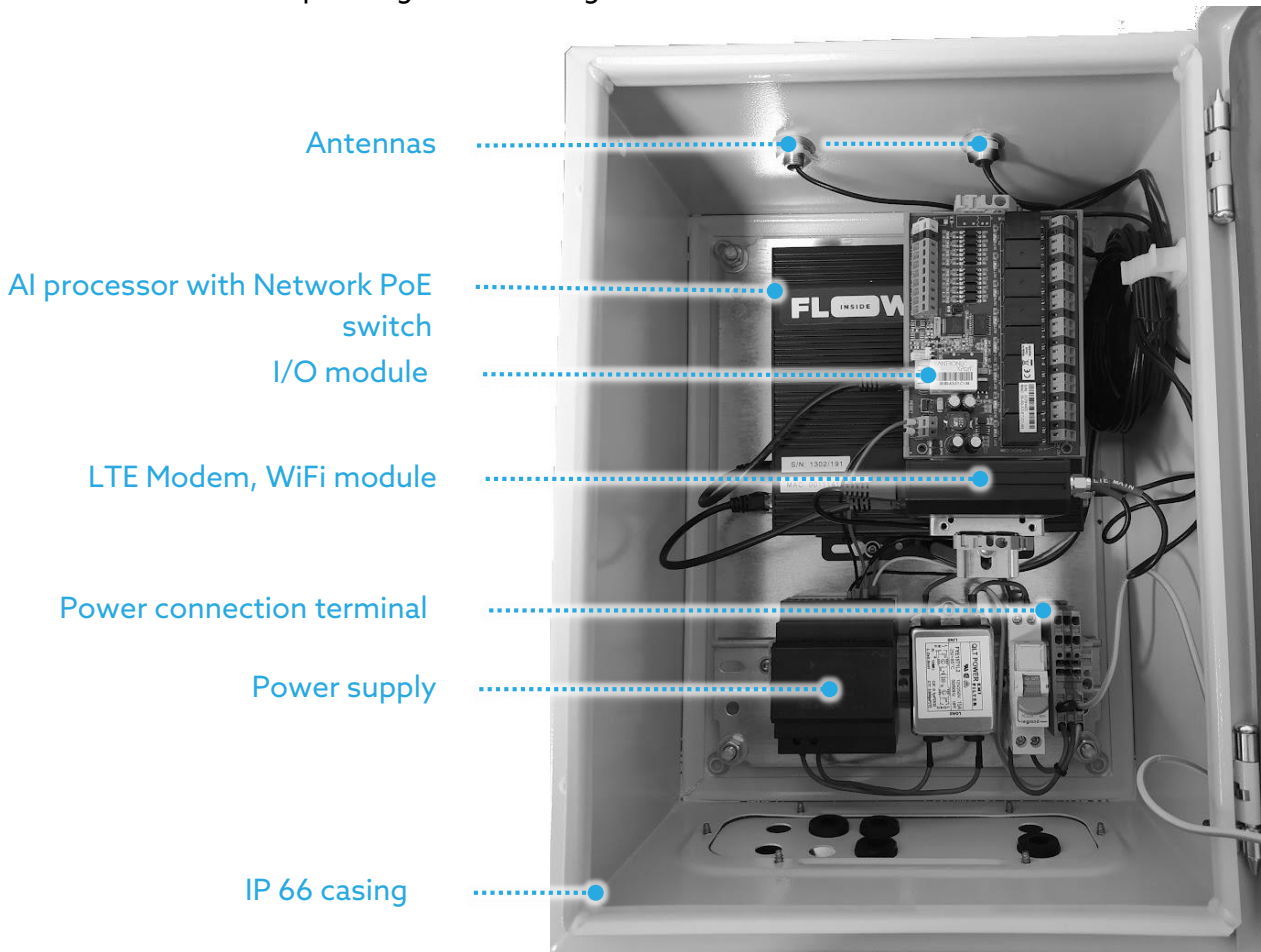
On your computer:

- Find IP of your TrafficEmbedded
 - o **Device default IP is 192.168.50.10**
 - o In case of DHCP server you can search IP via MAC address that is on top side of the device
- Login to web-admin console on the device on `https:\\deviceIP:8000` (<https://192.168.50.10:8000>) and configure as needed
Default login is "admin" and password is "admin01"
- Start your FLOW and click on *quick connect to FLOW device live stream tile* on the launch screen
- Connect via IP address
Default login is "admin" and password is "admin"
- Add cameras, interfaces and configure the analytics

Under the hood

The TrafficEmbedded unit is a rugged anti-vandal box with IP66 rating. Therefore, you can install it pretty much anywhere. Here's what you will find inside:

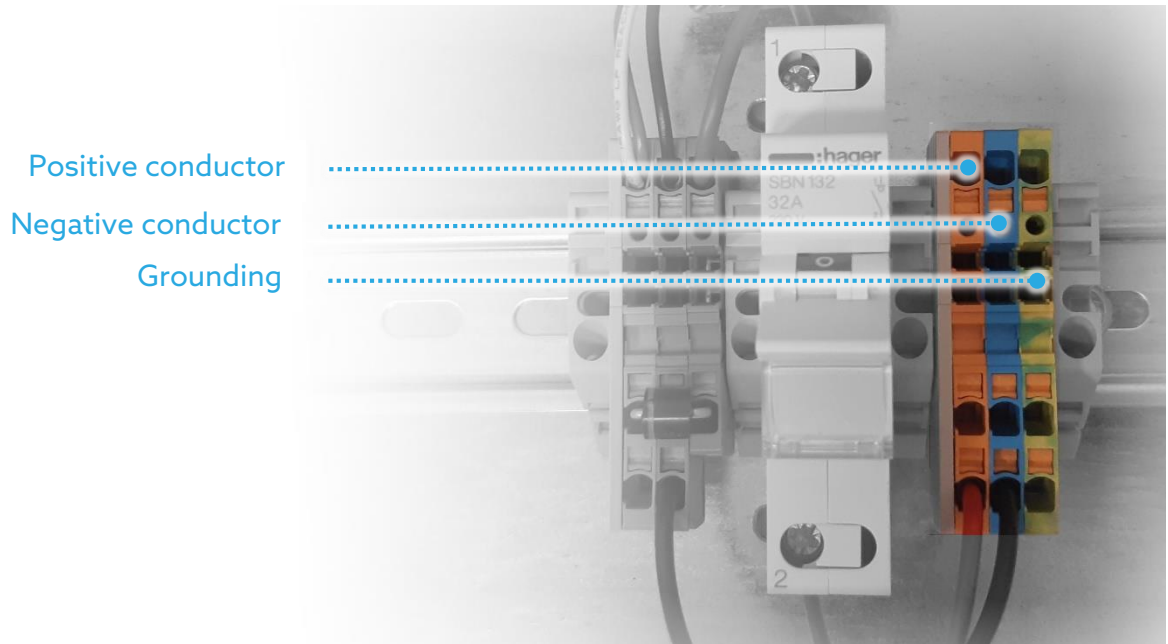
- TrafficXRoads processing unit
- Power supplies with DC or AC input - depending on the configuration
- Ethernet switch with PoE
- LTE modem and antenna - depending on the configuration
- I/O module - depending on the configuration



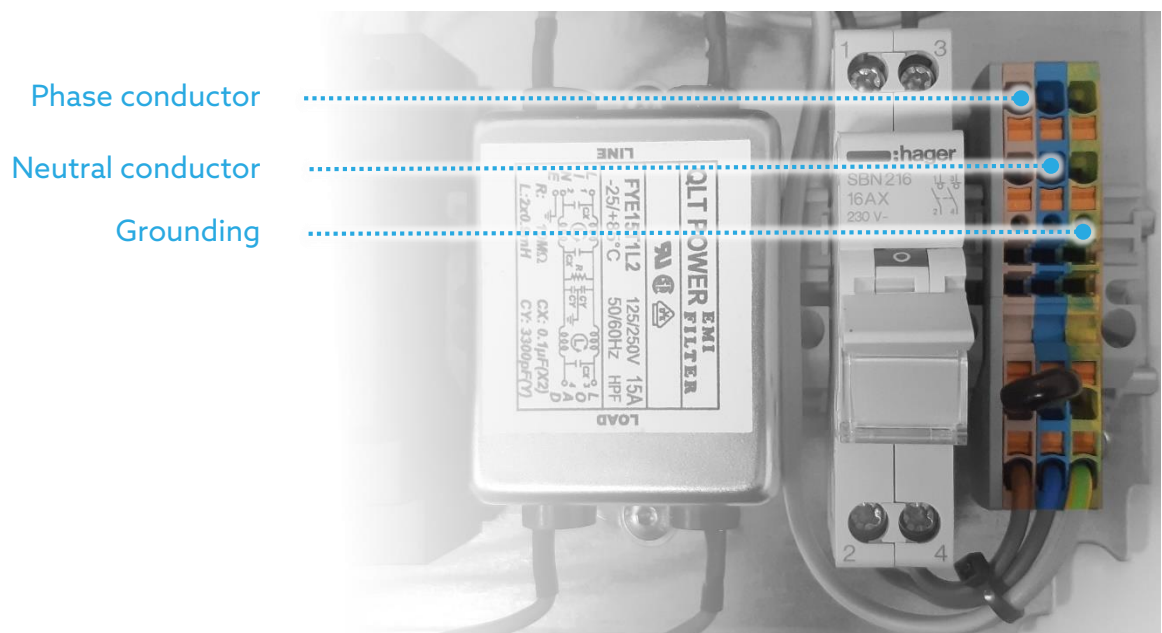
Powering TrafficEmbedded

The unit comes in two flavours:

- 12-24V DC powered version that is safe to be connected to the operating voltage by any technician and is safe to touch



- 100-230V AC mains powered version that needs to be connected by authorized personnel:



Please note that units with AC mains power supply need to be connected by a qualified electrician. Unauthorized manipulation poses health and life hazard!

Quick start guide

We encourage you to create a bench setup to familiarize yourself with TrafficEmbedded and test your network configuration in a controlled environment. The subsequent field deployment will be a piece of cake with the pre-configured system.

To do this we will need the following:

- Computer with Ethernet port and FLOW Insights installed.
Windows version can be downloaded here:
http://www.datafromsky.com/download/flow/demokit/FLOW_Demokit.exe
You can get Linux version or older FLOW versions here:
<https://datafromsky.com/flow-versions/>
- IP camera
- Appropriate power source



TrafficEmbedded is able to perform in a number of different topologies and setups (as described in the following sections), however, in this phase we will limit ourselves to the simplest configuration - we will connect the computer directly to the internal network of the TrafficEmbedded unit.

PoE ethernet ports 100MB
Connect IP camera here

Ethernet port 1GB
Connect computer/modem
here





Please note that the computer should not be connected to any other wired or wireless network in order to perform correctly in this setup.

We are now ready to power up the TrafficEmbedded unit – just connect it to the power supply. The unit will start automatically and boot the system. This operation can take up to 30 seconds.



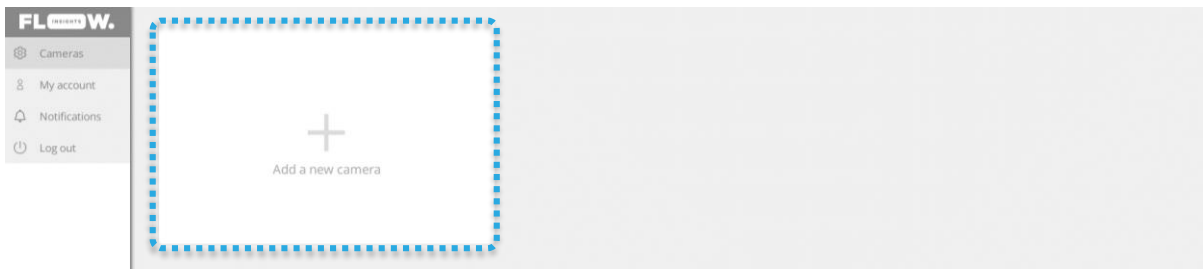
The FLOW block is set to the following default parameters:

- IP address: **192.168.50.10**
- Login: **admin**
- Password: **admin**

We will use these credentials to log into the unit:



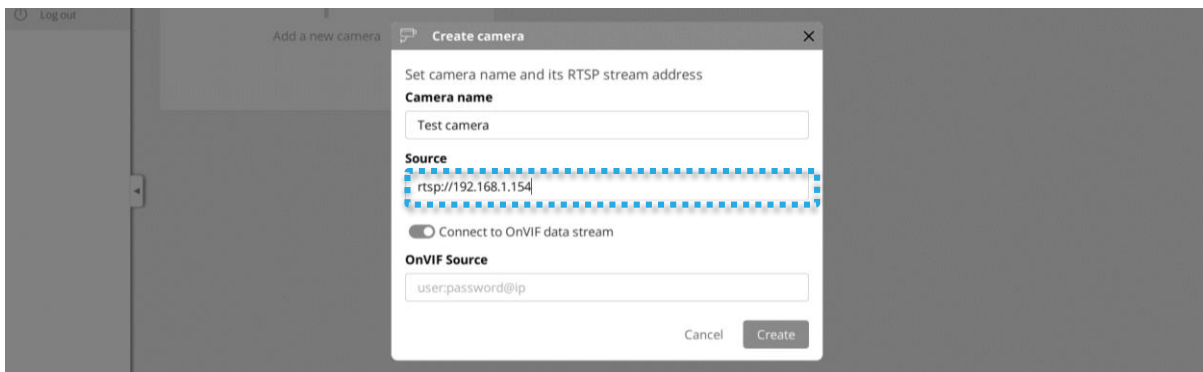
We are now communicating with the unit and can start configuring it. To start creating traffic analytics, we need to add a source camera stream.



The camera video source stream address and optional OnVIF source address are formatted in the following way:

- Video source: **rtsp://user:password@ip:port/path/file**
- OnVIF source: **user:password@ip**

The required information is camera specific and can be usually found in the camera user manual or in the web interface of the IP camera.



Detailed manual for adding IP cameras in your FLOW you can find here:

<https://intercom.help/datafromsky/en/articles/4719541-adding-ip-cameras-in-flow-insights>

Congratulations – you have successfully connected and configured your very first TrafficEmbedded setup. You are ready to enjoy the power of acclaimed DataFromSky traffic analytics. For more information on how to work with FLOW environment complete with tutorials and support, please visit our learning portal here:

<https://intercom.help/datafromsky/en/collections/2019942-datafromsky-flow>

TrafficEmbedded network configuration

For real field deployment, we need to configure both the internal and external networks of the TrafficEmbedded. TrafficEmbedded is very flexible and it can perform in a number of setups and topologies. First, let's describe the available components and default configuration:

- TrafficXRoads processor – with FLOW inside it allows up to 6 streams of traffic analytics to be processed simultaneously, with PoE switch for IP cameras and I/O module connection
- LTE modem – WAN, LTE, Wi-Fi connection, provides DHCP server service for the internal network (by default, the IP address range is 192.168.1.100-256); provides routing between internal and external networks
- I/O module – relay array which can be controlled by FLOW devices
- IP cameras – connected to the internal network and processed by TrafficEmbedded

Network settings

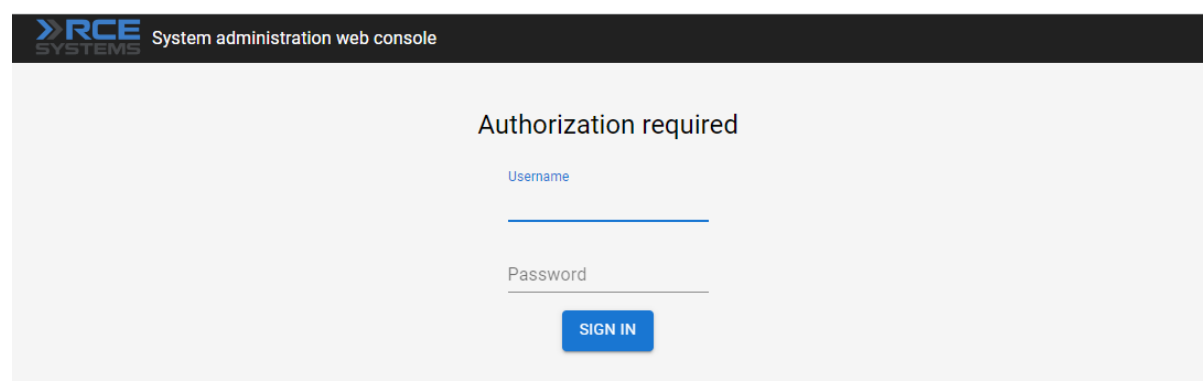
TrafficXRoads have default static IP address 192.168.50.10. If you have your TrafficEmbedded in configuration with Wi-Fi modem, default IP address is 192.168.1.10



If you have two more FLOW devices such as TrafficEmbedded, TrafficXRoads and/or TrafficCamera in same network, make sure they have different IP addresses. Otherwise you will be not able to login to your device.

The web administration interface allows you to configure network settings, VPN and do the reboot or factory reset of the unit. The web administration interface can be accessed using the URL: <https://192.168.50.10:8000> . To sign in, use the following default login credentials:

- **login: admin**
- **password: admin01**

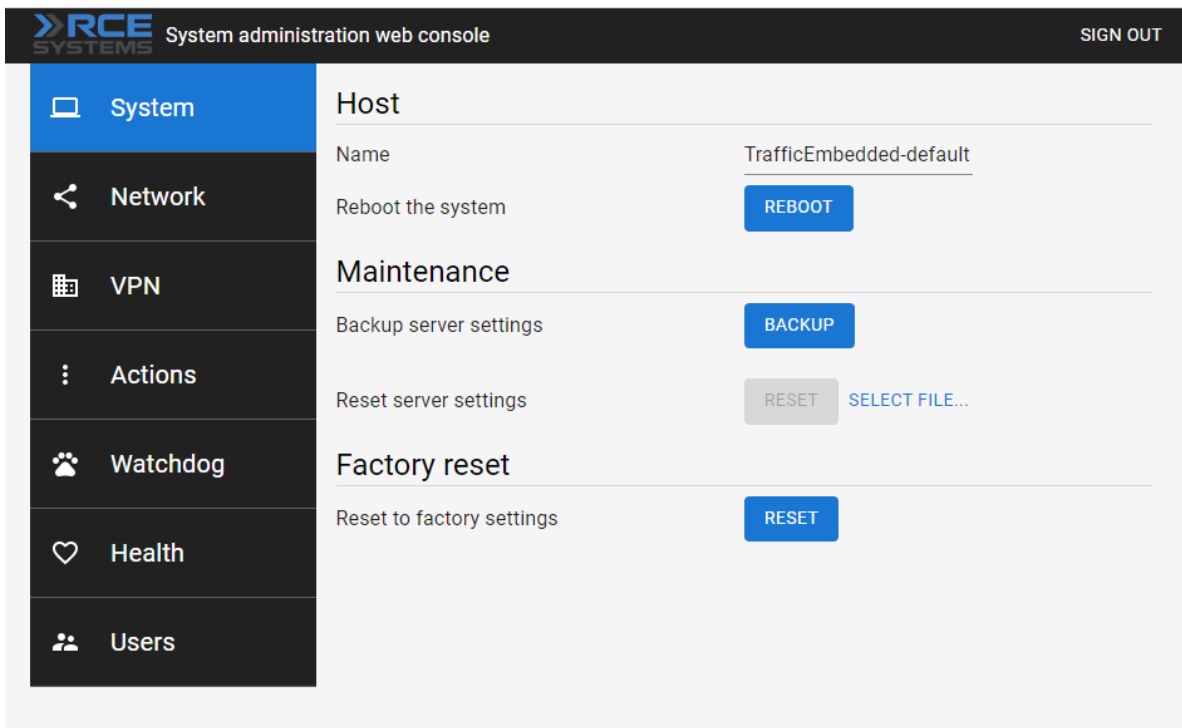




To be able to access to the web administration interface, your computer must be in the same network. Setup the appropriate IP address and subnet mask at your computer (for example 192.168.50.2/24 i.e. mask is 255.255.255.0).

System settings

After a successful login to the web console, the first tab that you see is the *System* tab. On this tab, you can change the name of the unit, do a reboot, backup settings of the web console or restore them if needed. It is possible to do "factory reset" here and restore the web console settings into the default state (including default IP address, names and passwords).



The screenshot displays the 'System administration web console' for RCE Systems. The left sidebar contains navigation links for System, Network, VPN, Actions, Watchdog, Health, and Users. The main panel shows the 'Host' configuration with the name 'TrafficEmbedded-default'. Under the 'Maintenance' section, there are options for 'Reboot the system' (with a REBOOT button), 'Backup server settings' (with a BACKUP button), and 'Reset server settings' (with a RESET button and a SELECT FILE... link). The 'Factory reset' section includes a 'Reset to factory settings' option with a RESET button.

Network settings

The set-up of the Ethernet interfaces is done in the *Network* tab. The unit has two physical Ethernet interfaces but both of them are under the same address (address bonding). In the web interface, the Ethernet interface is under the name *bond0*. In the top part of the tab you can see the chosen interface and its current state - whether the interface is enabled in the system and whether it is connected.

For the Ethernet Interface you can enable/disable the loading of IP address from the DHCP server and set up individual static IP addresses (up to 4) and DNS servers (up to 3).



We recommend using static IP addresses in real world deployments.

RCE SYSTEMS System administration web console
SIGN OUT

- System
- Network
- VPN
- Actions
- Watchdog
- Health
- Users

Interfaces

Interface: eth0

Operational State

Enabled: ● Yes

Link: ● Connected

DHCP

Enabled:

Gateway: 192.168.88.1

Assigned IP: 192.168.89.162/21

Static Addresses

IP Address 1: 192.168.50.10/22

IP Address 2: e.g. 192.168.122.2/24

IP Address 3: e.g. 192.168.122.2/24

IP Address 4: e.g. 192.168.122.2/24

Static Routes

Name	Destination	Gateway	Metric
Route 0	e.g. 10.0.0.0/8	e.g. 192.168.0.1	
Route 1	e.g. 10.0.0.0/8	e.g. 192.168.0.1	
Route 2	e.g. 10.0.0.0/8	e.g. 192.168.0.1	
Route 3	e.g. 10.0.0.0/8	e.g. 192.168.0.1	

DNS servers

DNS1: 1.1.1.1

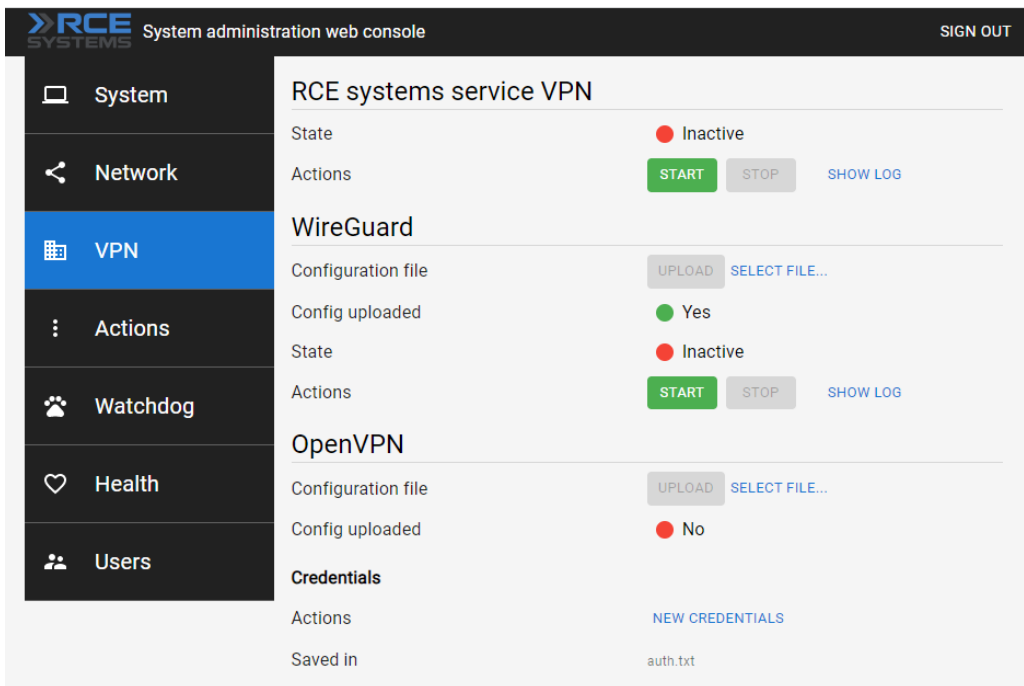
DNS2: e.g. 1.0.0.1

DNS3: e.g. 1.0.0.1

Virtual private networks

The unit has multiple preconfigured VPNs. These include a system service VPN using which the manufacturer can remotely access the unit. This VPN can be deactivated if needed. For the service VPN to work this VPN must be active, the unit must be connected to the internet and port 31228 UDP must be enabled (VPN connection to DataFromSky service VPN on 172.105.65.31).

The unit also has a Wireguard or OpenVPN client VPN network. These VPN networks can be configured by the user as needed. The configuration for both VPN networks is done by uploading a text configuration file according to the requirements of the specific VPN.



The screenshot shows the 'System administration web console' for RCE SYSTEMS. The left sidebar contains navigation options: System, Network, VPN (highlighted), Actions, Watchdog, Health, and Users. The main content area displays VPN settings:

- RCE systems service VPN**: State is Inactive (red dot). Actions: START (green), STOP (grey), SHOW LOG (blue).
- WireGuard**: Configuration file: UPLOAD (grey), SELECT FILE... (blue). Config uploaded: Yes (green dot). State: Inactive (red dot). Actions: START (green), STOP (grey), SHOW LOG (blue).
- OpenVPN**: Configuration file: UPLOAD (grey), SELECT FILE... (blue). Config uploaded: No (red dot). Actions: NEW CREDENTIALS (blue). Saved in: auth.txt.

Modem settings

Connect to modem via Wi-Fi connection. To find out default connection parameters for the Wi-Fi, please have a look at the LTE modem label:



Alternatively, you can connect your computer to TrafficXRoads via LAN cable. Access the LTE modem web interface at **192.168.1.1**

- Login: admin
- Password: Admin123

TrafficEmbedded is connected to the local network via a wired Ethernet connection. By default, with static IP lease 192.168.1.10 from modem DHCP.

Modem factory reset

In case of modem factory reset default login will be:

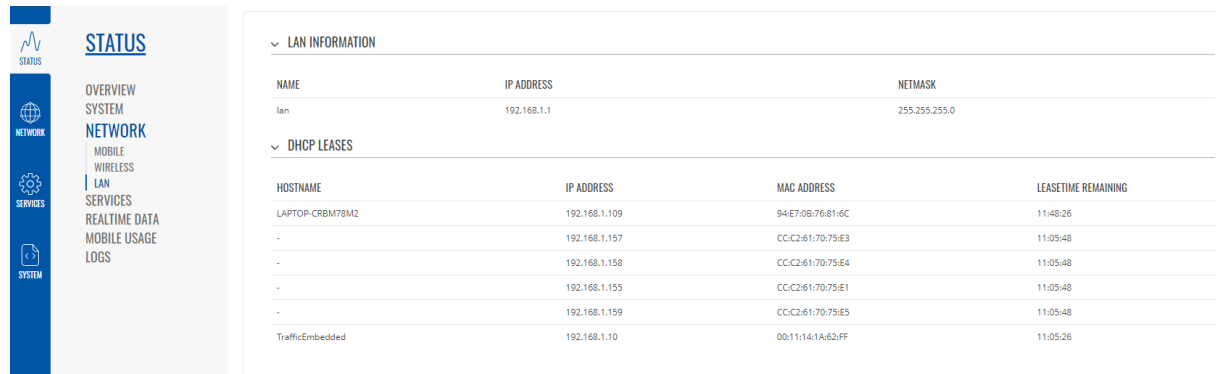
- Login: admin
- Password: admin01

It will be necessary to reset static lease and ports for full use of TrafficEmbedded

Static lease set

You can find IP address of all connected devices on **Status - Network - LAN**

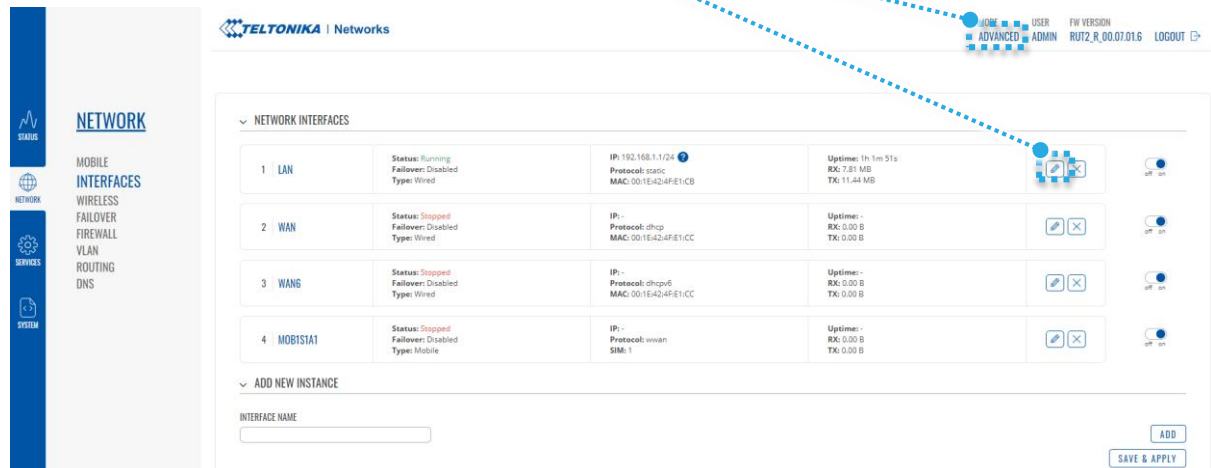
- copy MAC address of your TrafficEmbedded



NAME	IP ADDRESS	NETMASK
lan	192.168.1.1	255.255.255.0

HOSTNAME	IP ADDRESS	MAC ADDRESS	LEASETIME REMAINING
LAPTOP-CRBM78M2	192.168.1.109	94-E7-0B-76-81-6C	11:48:26
-	192.168.1.157	CC-C2-61-70-75-E3	11:05:48
-	192.168.1.158	CC-C2-61-70-75-E4	11:05:48
-	192.168.1.155	CC-C2-61-70-75-E1	11:05:48
-	192.168.1.159	CC-C2-61-70-75-E5	11:05:48
TrafficEmbedded	192.168.1.10	00:11:14:1A:62:FF	11:05:26

- change mode to advanced
- **Network - Interfaces -> edit LAN**



ID	NAME	Status	Failover	Type	IP	Protocol	MAC	Uptime	RXK	TXK	TX	Actions	On/Off
1	LAN	Running	Disabled	Wired	192.168.1.1/24	static	00:1E:A2:4F:E1:CB	1h 1m 51s	7.81 MB	11.44 MB		[Edit] [Delete]	On
2	WAN	Stopped	Disabled	Wired		dhcp	00:1E:A2:4F:E1:CC		0.00 B	0.00 B		[Edit] [Delete]	On
3	WANG	Stopped	Disabled	Wired		dhcpv6	00:1E:A2:4F:E1:CC		0.00 B	0.00 B		[Edit] [Delete]	On
4	MOB1STA1	Stopped	Disabled	Mobile		lwan	SIM: 1		0.00 B	0.00 B		[Edit] [Delete]	On

ADD NEW INSTANCE

INTERFACE NAME:

[ADD] [SAVE & APPLY]

- Add new instance -> set name "TrafficEmbedded" -> add
- Insert MAC address of your TrafficEmbedded
- Set IP address 192.168.1.10
- Save&Apply





Port set

The LTE modem provides port forwarding function between WAN port and the AI processor in this default scenario. You can set the following two rules in the **Network - Firewall - Port Forwards**:

- Name: FLOW8088 ; Port: 8088 ; internal IP address: "TrafficEmbedded" ; Internal port: 8088
- Name: FLOW5556 ; Port: 5556 ; internal IP address: "TrafficEmbedded" ; Internal port: 5556

Make sure to hit Save&Apply after setting each port.

▼ PORT FORWARDS

NAME	MATCH	FORWARD TO		
FLOW8088	IPv4-tcp, udp From any host in wan Via any router IP at port 8088	IP 192.168.1.10, port 8088 in lan	<input checked="" type="checkbox"/> off on	 
FLOW5556	IPv4-tcp, udp From any host in wan Via any router IP at port 5556	IP 192.168.1.10, port 5556 in lan	<input checked="" type="checkbox"/> off on	 

Thanks to these rules, you can connect to your TrafficEmbedded with FLOW Insights from the external network in the same way you would connect to it from the internal TrafficEmbedded network. Just type the LTE modem WAN IP address to the address bar in FLOW Insights and you are ready to go:



Please make sure to change the LTE modem login credentials - leaving the default values might compromise the security of your system.

Other options for connection to external network include Wi-Fi, GSM and LoRa. They are described in the following section.

Optional network configurations

Numerous alternative scenarios are viable to adapt to customer needs. Some of the topologies are:

- IP cameras can be connected via external rather than internal network in order to be able to work from long distances
- Several TrafficEmbedded units can be connected to internal network of a unit that provides data connectivity to external network
- TrafficEmbedded can be connected to an external network via GSM. Built-in LTE modem is available for this option. DataFromSky provides a dedicated VPN service in order to allow secure connection to the unit via GSM network.
- Wi-Fi connection to the external network. Default built-in Wi-Fi module can be configured in order to provide external network connectivity if it is not employed for the internal network connections. Alternatively, an optional Wi-Fi module can be added when wireless connectivity is required on both internal and external networks.
- LoRa external connectivity can be used where necessary. Just register the LoRa module to your LoRaWAN and you are ready to go. Please note that the limited bandwidth of LoRa does not allow for image and video streaming - only extracted analytics data can be transferred via this connection.

For assistance with alternative network configurations, please contact DataFromSky customer service.

Remote support

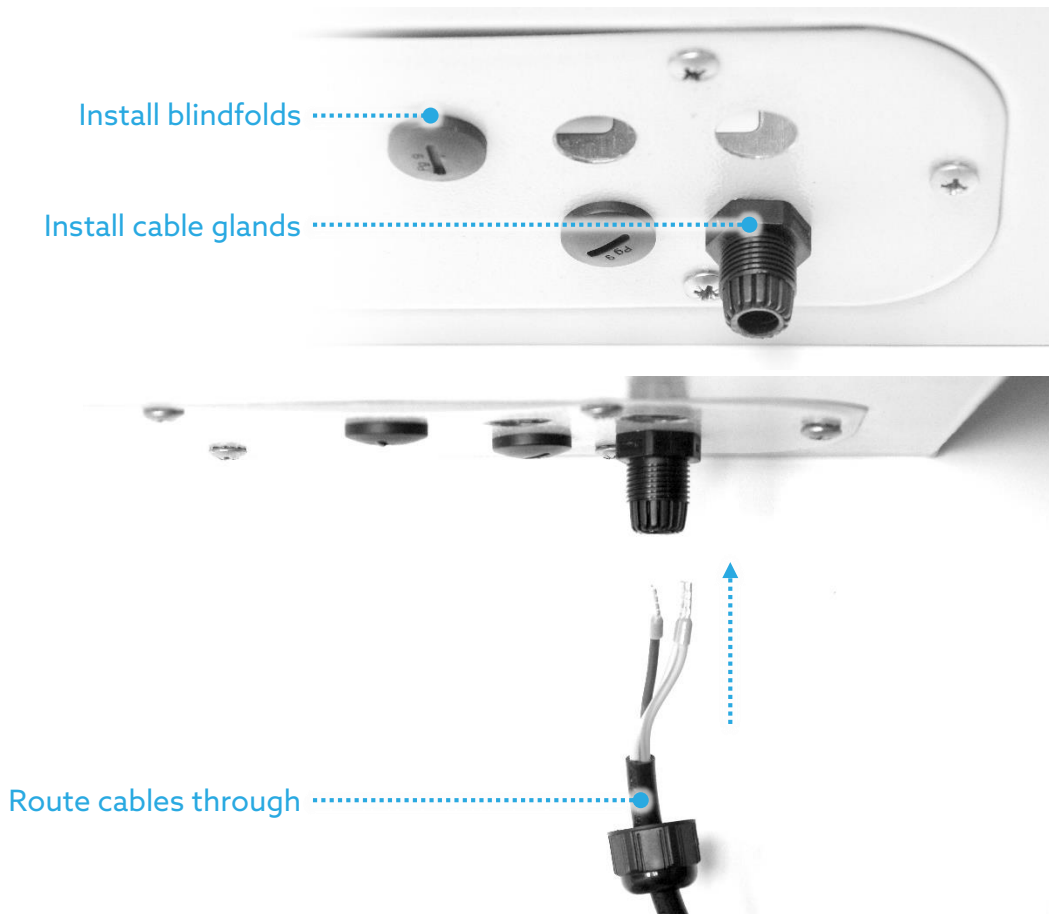
TrafficEmbedded unit is configured to contact DataFromSky service VPN network upon powering up. This connection allows for remote assistance with the installation and configuration of the unit when needed. The external network needs to be configured correctly in order to pass communication required for the remote support:

- Allow connections to **pvpn.rcesystems.cz** on **80** and **1195 UDP/TCP** ports

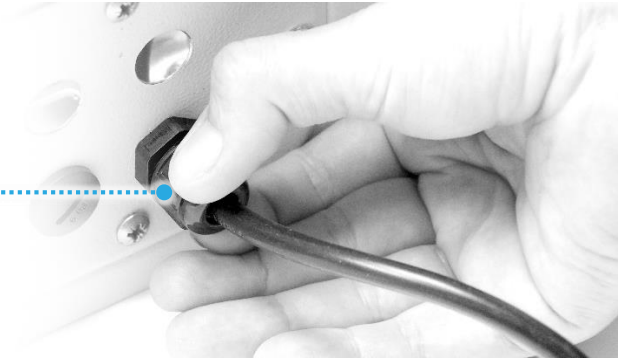
Field installation

TrafficEmbedded is prepared for permanent outdoor installation thanks to its rugged anti-vandal enclosure with IP66 rating. Here are a few points to observe in order to achieve a successful and long-lasting installation:

- Install the TrafficEmbedded unit and all connected cameras higher than 3m above ground in order to prevent unauthorized access to it.
- Use cabling certified for permanent outdoor use.
- Use appropriate cameras with matching IP rating. Consider deployment of anti-fog heating systems where climatic conditions might lead to condensation on the lens cover.
- Make sure to blindfold all unused opening in the TrafficEmbedded enclosure and tighten cable glands sufficiently to prevent any moisture penetration along the cable routing:

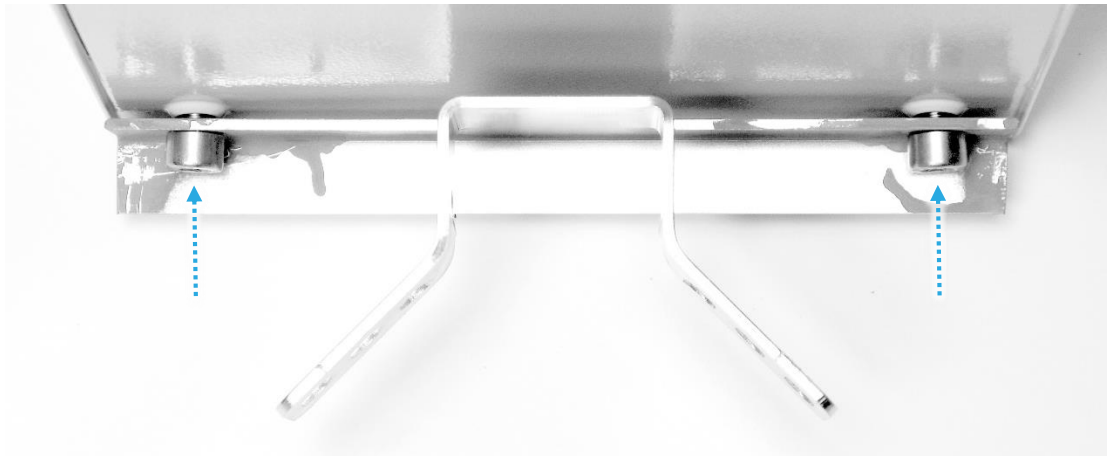


Tighten glands

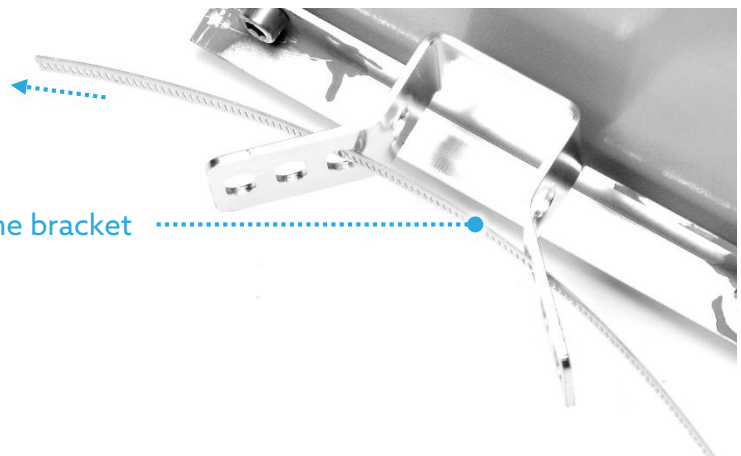


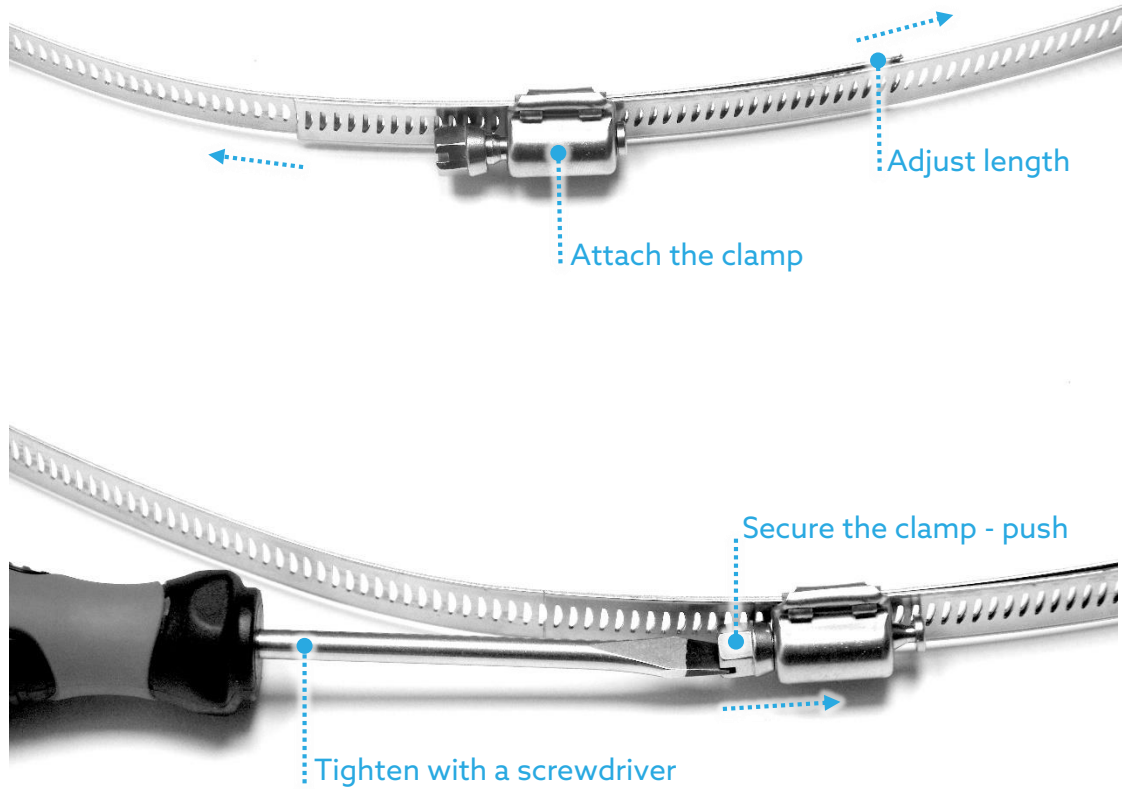
- Attach the unit securely to a mast or other permanent structure. Consider significant loads that might be imposed by strong winds, snow, etc. Optional mounting accessories can be employed for this task:

Attach the mounting bracket with supplied fasteners to the enclosure:



Route the band through the bracket





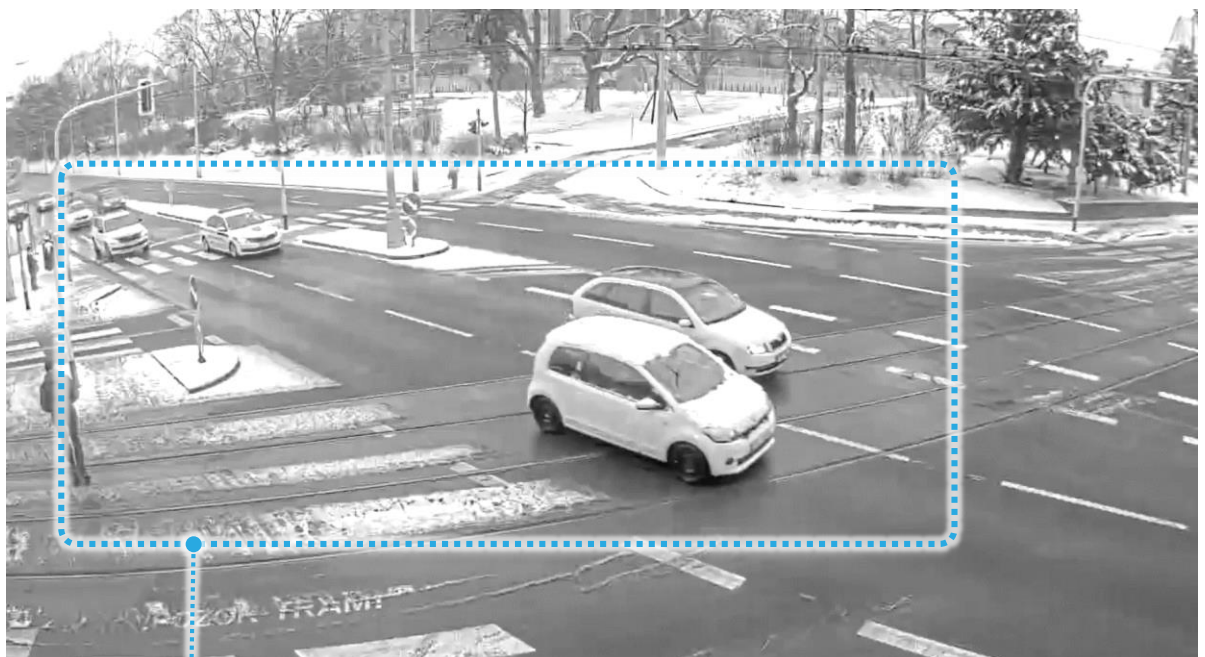
Intermittent power supply

TrafficEmbedded can perform in light mast installations where power supply is intermittent and limited to night hours. For this scenario, optional battery pack is offered by DataFromSky to ensure continuous operation of TrafficEmbedded during the periods with no external power supply. Please contact your DataFromSky sales representative to discuss appropriate battery size selection.

Camera framing

Camera positioning and framing are defining parameters for video stream quality which is the main driving factor of AI traffic analytics accuracy. Therefore, we do recommend to pay appropriate attention to fine-tuning of the acquisition geometry. Here are a few points to consider:

- Camera image center should be ideally identical with Region of Interest center
- Align the camera with horizon – avoid roll
- Tilt the camera to have ROI just a little bit below the centerline of the image
- There should be sufficient padding between the image borders and the ROI
- Incidence angle between the camera lens axis and the ground plane should be ideally 30-45 degrees in order to avoid reflections and dynamic occlusions
- The objects in ROI should be fully visible; at least 70 % of the object area should be visible to achieve high accuracy (be aware of dynamic/static occlusions)
- Do not capture the sky - the sun can have negative impact on video analytic (tilt the camera down if necessary)
- If possible, orient the camera perpendicular to the traffic flow or aligned with the flow, in the direction of travel - this will help to avoid reflections from vehicle lights in night scenes.
- If you need to reliably detect and track objects at night that are not well illuminated, using shorted exposure can will help with achieving good results.
- The minimum recommended resolution for TrafficXRoads and TrafficEmbedded is 544x320. If you want to read license plates reliably you should not have lower than Full HD resolution.



Region of Interest

Camera FPS

- The FPS should be set depending on the type of monitored scene.
- Type of monitored environment and recommended minimum detection FPS:
- Pedestrian movements – sidewalk, town square, bus stop (up to 7 km/h): 5 FPS
- Pedestrian and cyclist movements – bicycle path (up to 50 km/h): 10 FPS
- Traffic junction, city traffic (up to 75 km/h): 15 FPS
- Monitoring of district level road - (up to 150 km/h): 20 FPS
- Highway/motorway monitoring - (up to 200 km/h): 25 FPS

Accessories

Embedded can be equipped with a variety of accessories to improve its operating conditions range, communication capabilities, etc...

- 12V fan for better airflow in the traffic cabinet
- SDLC expander
- IO expander - 4/8/16 relays
- WD 2.5" Blue SATA SSD 1TB
- 4G module; Gemalto 4G-EU with Packing
- GPS module package
- AC Wifi module package (EMV1200/800/400 WiFi AC 5G WiFi module)
- V2X RSU

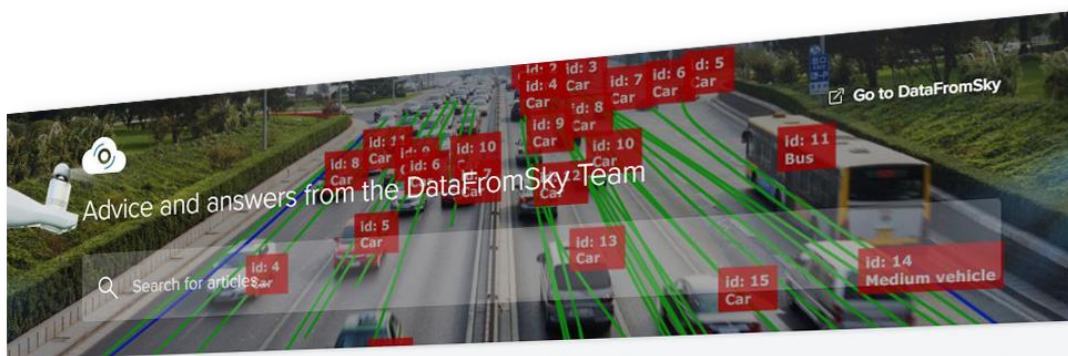
More about FLOW framework

FLOW framework is a complex system that supports a variety of hardware devices. FLOW currently runs on TrafficCamera, TrafficEmbedded, TrafficEnterprise and TrafficDrone (mobile processing unit). No matter the hardware requirements or use case you are able to work in the same system. The complete and up-to-date manual about all aspects of FLOW framework is available online at

<https://intercom.help/datafromsky/en/collections/2019942-flow-and-flow-insights>

where you can find a plethora of articles about the framework, how it works or how to set up the analytics for a variety of use-cases. As mentioned previously to learn how to set up video analytics, reduce camera latency and set up detection and communication using UDP, SDLC or I/O Relays refer to the TrafficXRoads Manual:

https://www.datafromsky.com/download/materials/FlowProducts/TrafficXRoads/Manual_TrafficXRoads.pdf



Advice and answers from the DataFromSky Team

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Id: 13 Car
Id: 14 Medium vehicle
Id: 15 Car

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You can use the search bar on the top to help you find what you are looking for.

Simplified signpost

Basic FLOW principles:

We suggest starting with the FLOW basics article:

- <https://intercom.help/datafromsky/en/articles/3773025-the-basics-of-flow-insights>

Data filtration - How to use FLOW filters and operators:

We also suggest reading some of the articles about the various types of filters such as the spatial filters article which is the most important one:

- <https://intercom.help/datafromsky/en/articles/3656473-spatial-filters-in-flow-insights>

Visualization - widgets and dashboards:

To learn everything, you need to know about widgets and data visualization please read this article:

- <https://intercom.help/datafromsky/en/articles/3666528-using-widgets-to-view-data-on-the-dashboard-in-flow-insights>

Tutorials - how to create:

The best way to learn FLOW is by applying it to a specific use-case making it easily understandable. Choose a specific use-case guide that you like and follow along:

- <https://intercom.help/datafromsky/en/collections/2019942-flow-and-flow-insights#use-case-tutorials-how-to-series>

Generic:

Some general guidelines that you may find useful on how to capture video can be found here:

- <https://intercom.help/datafromsky/en/collections/2232238-general-faq>

In case you have not found what you have been looking for please get in touch with us using the live chat or send us email to support@datafromsky.com.

Conclusion

This manual has covered the basic configuration of TrafficEmbedded unit. We went over the contents of the TrafficEmbedded package, Field installation, Camera framing, Power supply, Network setup, and Quick start guide.

FLOW has regular updates with new functions, performance improvements and bug fixes. Inside FLOW Insights you will be notified when new FLOW version is available, however please do not update FLOW Insights without updating the TrafficEmbedded unit first. If you would like to update the version of FLOW on your TrafficEmbedded unit please get in touch with us at support@datafromsky.com.

We hope you will enjoy TrafficEmbedded unit. If you have any kind of feedback, please reach out to us at info@datafromsky.com.