OPERATING INSTRUCTIONS

TDC-E (TELEMATIC DATA COLLECTOR)

Gateway systems

SICK
Sensor Intelligence.

Product described

Product name: TDC-E (Telematic Data Collector)

Document identification

Title: TDC-E (Telematic Data Collector) operating instructions
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Manufacturer

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Legal notes

Subject to change without notice

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Contents

1 About these operating instructions

Please read this chapter carefully before you begin working with this documentation and the **T**elematic **D**ata **C**ollector gateway system (TDC for short).

1.1 Software versions

Software	Version	Creation date
Docker	17.06.0	May 24, 2018
OS image (Linux)	Yocto 2.4 (Rocko)	May 24, 2018
Portainer (TDC-E Device Manager)	1.15.2 (1.0.2)	May 24, 2018
picoStratus	1.2.1.2	May 24, 2018
HWManager	1.0.1.9	May 24, 2018
SRT	1.0.0.1	May 24, 2018
Node-RED	0.17.5	May 24, 2018

Table 1: Software versions

1.2 Purpose of this document

These operating instructions are designed to give **technical personnel** instructions on the safe mounting, parameterization, electrical installation, commissioning, operation, and maintenance of the gateway system as well as on the connection and configuration of the sensors.

These operating instructions do **not** provide information on how to operate vehicles or machines into which the individual devices of the gateway system have been or are going to be integrated. More information on this can be found in the customer documentation.

1.3 Target group

These operating instructions are intended for people integrating the devices of the gateway system into a vehicle or machine, and people performing initial commissioning, operation, and maintenance.

They are also intended for the planners and integrators of the customer system, as well as the operating entity with responsibility for it.

Target group	Activities
Entity operating the customer system	
System user	Operating the system: → The system user reports faults to the system manager.
System manager	Mounting, electrical installation, maintenance, and replacement of system components. → The system manager submits support requests to SICK.
SICK	
SICK service technician	Commissioning, configuration, and support.

Table 2: Target group

1.4 Information depth

These operating instructions contain information about the following topics related to the gateway system:

- System description
- Mounting
- Electrical installation
- Commissioning
- Operation
- Maintenance and care
- Fault diagnosis and troubleshooting
- Technical data and dimensional drawings

1.5 Abbreviations used

API	Application Programming Interface
APN	Access Point Name = network operator's point of access to the GPRS data network
CAN bus	Controller Area Network = serial bus system
GSM	Global System for Mobile Communications = technical wireless standard for digital radiotelephony
GPRS	General Packet Radio Service = the name of the packet-based service for transmitting data over GSM networks
GPS	Global Positioning System = global navigation satellite system used for position determination
LAN	Local Area Network
MQTT	Message Queue Telemetry Transport = open messaging protocol for transmitting telemetry data between devices in the form of messages
SIM	Subscriber identity module = chip card for cell phones
TDC	Telematic Data Collector = system for collecting and transmitting telemetry data
WLAN	Wireless Local Area Network
WPAN	Wireless Personal Area Network = short-distance wireless technology

1.6 Symbols used

Note Notes provide information about the features of a device, application tips, or other useful information.

► **Action** Instructions requiring specific action are indicated by an arrow. Carefully read and follow the instructions for action.

2 On safety

This chapter provides information that concerns your own safety as well as the safety of the system operator.

▶ Please read this chapter carefully before you begin working with the gateway system.

2.1 Qualified safety personnel

The gateway system must only be commissioned and maintained by properly qualified safety personnel.

A person is considered qualified safety personnel if he/she

- Has sufficient skills in the field of the respective equipment based on his/her technical training and experience **and**
- Has been instructed by the manufacturer on system operation and all applicable safety guidelines **and**
- Is familiar with all relevant country-specific occupational safety regulations, work safety regulations, guidelines, and generally accepted technical rules and standards (e. g., DIN standards, VDE regulations, country-specific rules) to such an extent that he/she is able to evaluate the safe condition of the power-driven machinery **and** he/she
- Has access to and has read the operating instructions.

2.2 Intended use

The TDC-E gateway system is a system that receives and processes sensor data, and then forwards these data to a higher-level infrastructure (cloud server or local server). The system functions can be extended via the integrated applications or by adding user-defined applications.

Consequently, the TDC-E is designed for sensor-controlled monitoring tasks, vehicle tracking, working time management, and access control, or for telemetry applications. The integrated GPS and WPAN sensors also enable outdoor and indoor location finding.

The gateway system uses one or more TDC-E devices to collect data. The devices feature all the standard interfaces for integrating sensors.

The sensor data received can be transmitted to the cloud via the mobile network or via a LAN/WLAN or WPAN connection. This can take place in the SICK online portal or on a customer server. The SICK online portal is a platform for visualizing sensor data via a web-based user interface. This makes it a very convenient solution for monitoring tasks.

In addition to the MQTT transmission protocol, OPC UA and JSON are also supported.

2.3 General safety notes and protective measures

2.3.1 Safety notes and symbols

The following safety and hazard notes concern your own safety, the safety of third parties, and the safety of the devices. You should therefore observe them at all times.

DANGER

Denotes an immediate hazard that may result in severe to fatal injuries.

The symbol shown on the left-hand side of the note refers to the type of hazard in question (the example here shows a risk of injury resulting from electrical current).

WARNING

Denotes a potentially dangerous situation that may result in severe to fatal injuries.

The symbol shown on the left-hand side of the note refers to the type of hazard in question (the example here shows a risk of damage to the eye by laser beams).

WARNING

Denotes a potentially dangerous situation that may result in minor personal injury or possible material damage.

NOTE

Denotes a potential risk of damage or functional impairment of the device or the devices connected to it.

This symbol refers to supplementary technical documentation.

2.3.2 General safety notes

WARNING

Safety notes

Observe the following to ensure the safe use of the gateway system as intended.

- The notes in these operating instructions (e.g., regarding use, mounting, or installation) must be observed.
- All official and statutory regulations governing the operation of the gateway system must be complied with.
- National and international legal specifications apply to the installation and use of the system, to its commissioning, and to recurring technical inspections, in particular:

  - Work safety regulations and safety rules

  - Any other relevant safety provisions
- The checks must be carried out by qualified safety personnel or specially qualified and authorized personnel, and must be recorded and documented to ensure that the tests can be reconstructed and retraced at any time.
- These operating instructions must be made available to the operator of the system in which the components of the gateway system are used.
- The gateway system operator must be instructed by qualified safety personnel and read the operating instructions.

2.3.3 Potential hazardous points

DANGER

Risk of injury and damage caused by electrical current

Electrical voltage can cause severe personal injury or death by electric shock.

- ▶ Electrical installation work may only be carried out by electrically qualified persons.
- ▶ Be sure to disconnect the power supply before attaching or detaching any electrical connections.
- ▶ Only connect the system to a voltage source that meets the technical requirements.
- ▶ National and regional regulations must be complied with.
- ▶ Safety requirements relating to electrical systems must be complied with.

NOTE

Claims under the warranty rendered void

If the device is opened, any warranty claims against SICK AG will be void.

- ▶ Do not open the device housing.

2.4 Protecting the environment

The components of the gateway system have been designed to minimize their impact on the environment. They consume very little energy.

Always act in an environmentally responsible manner at work. For this reason, please note the following information on disposal.

Disposal after final decommissioning

- Always dispose of unusable or irreparable devices in accordance with the relevant national waste disposal regulations.
- Remove the plastic parts and send the aluminum housing of the TDC-E for recycling.
- Dispose of all electronic assemblies as hazardous waste. The electronic assemblies can be easily removed.

Note SICK AG does not take back devices that are unusable or irreparable.

3 System description

This chapter describes the layout and operating principle of the gateway system, in particular the interaction of the different components.

Note

- Always read this chapter before you start mounting, connecting, and commissioning the components of the gateway system.

3.1 Scope of delivery

The gateway system utilizes the TDC-E100 or TDC-E200 device variants. The TDC-E200 device variant has an additional connection for a GPS antenna.

Fig. 1: TDC-E gateway system device variants

The device is delivered with a preinstalled SIM card for operation in EU countries. The scope of delivery also includes a GSM antenna, a WLAN and WPAN antenna, a GPS antenna (TDC-E200 only), and a voltage supply cable. Additional cables can be ordered as accessories.

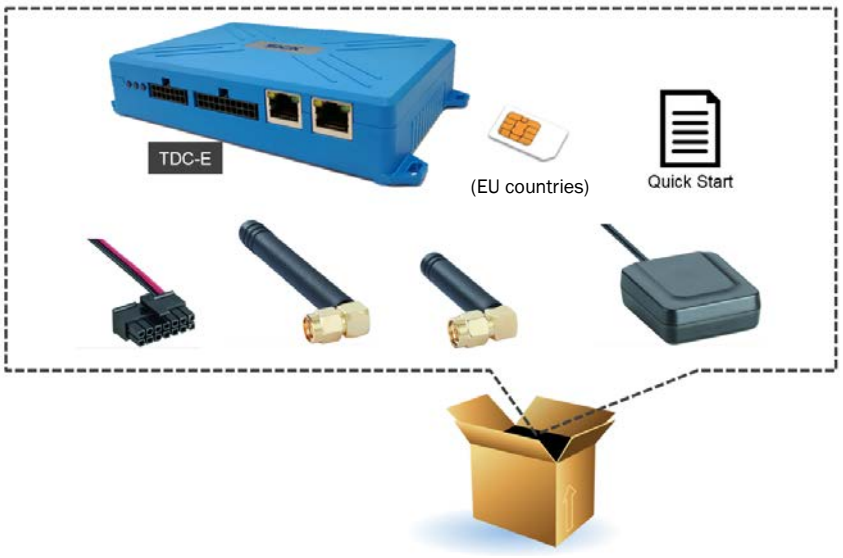


Fig. 2: TDC-E gateway system scope of delivery

Quantity	Part no.	Description
1 TDC-E gateway system consisting of:		
n	6066438 6067899 6067537	▪ TDC-E100R2 or ▪ TDC-E100EU or ▪ TDC-E100R6
n	6068463	▪ GSM antenna
n	6068474	▪ WLAN/WPAN antenna
n	6068473	▪ Voltage supply cable
n	8022507	▪ Quick Start guide including download link for the operating instructions, system documentation, and interface descriptions
and/or		
n	6067896 6067898 6067536	▪ TDC-E200R2 or ▪ TDC-E200EU or ▪ TDC-E200R6
n	6068463	▪ GSM antenna
n	6068474	▪ WLAN/WPAN antenna
n	6067023	▪ GPS antenna
n	6068473	▪ Voltage supply cable
n	8022507	▪ Quick Start guide including download link for the operating instructions, system documentation, and interface descriptions

Table 3: TDC-E gateway system scope of delivery

The scope of delivery includes a Quick Start guide to help with initial commissioning. The Quick Start guide also contains a download link for the operating instructions, system documentation, and interface descriptions.

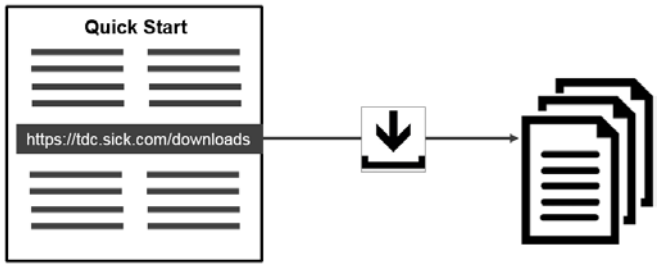


Fig. 3: Quick Start guide including download link for system documentation

NOTE

Thorough inspection for completeness and damage

It is recommended that you carefully check for and report transport damage of any kind as soon as possible after receiving the system.

Also verify that the delivery includes all components listed on the delivery note.

- ▶ Report any incomplete or damaged deliveries to Customer Service.
- ▶ Always document the damage by taking photographs.

Accessories (optional)

Preassembled cables can be purchased for connecting the sensors and devices to the TDC-E devices.

Fig. 4: Additional connecting cables (optional)

Part no.	Description
6068472	14-pin Microfit male connector with 14 color-coded open-ended wires for connecting: ▪ Voltage supply (2 wires) ▪ Digital inputs and outputs ▪ Analog inputs
6068471	20-pin Microfit male connector with 20 color-coded open-ended wires for connecting: ▪ Additional digital inputs and outputs ▪ RS-485/422, RS-232, SSI, 1-Wire serial interfaces ▪ CAN

Table 4: Additional connecting cables (optional) – part numbers

A rail bracket is available for mounting the TDC-E on DIN mounting rails.

Fig. 5: DIN mounting rail bracket (optional)

Part no.	Description
6069266	DIN rail bracket for mounting the TDC-E

Table 5: DIN mounting rail bracket (optional)

Spare parts

Part no.	Description
6068475	SIM card (for operation in EU countries)

Table 6: Spare parts

3.2 Functional principle of the TDC-E

3.2.1 TDC-E as a data collector

The TDC-E can be used to collect sensor data and sensor events. When functioning in this capacity, it offers all the standard interfaces required to integrate sensors, machines, and devices. It can process digital, analog, and CAN bus-based signals, as well as serial signals and Ethernet-based ones.

These external sensor data are supplemented by data from the TDC-E's factory-installed movement, position, and temperature sensors.

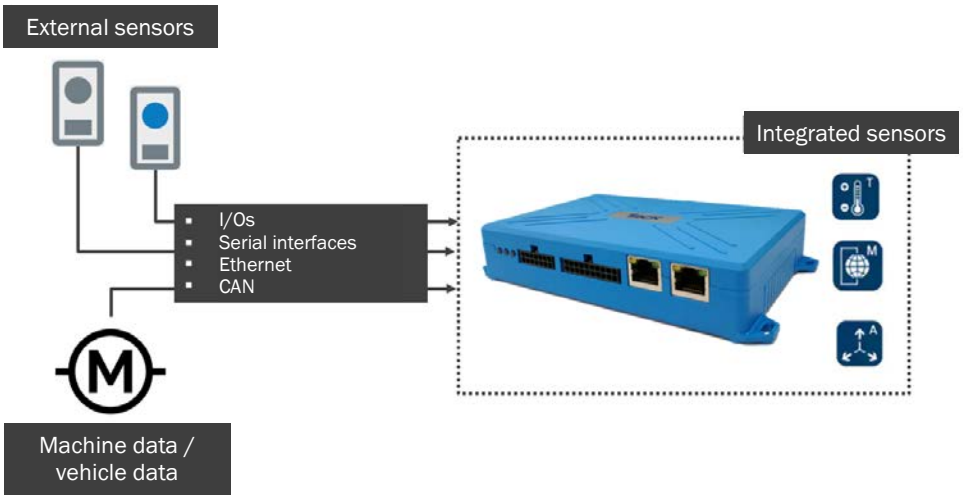


Fig. 6: TDC-E as a data collector

3.2.2 TDC-E as a location-finding tool

Device type TDC-E200 features additional factory-installed sensors that can be used as an indoor or outdoor location-finding solution.

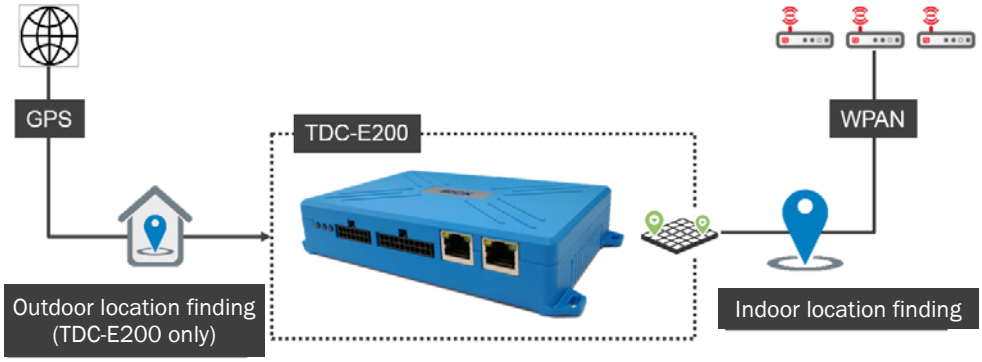


Fig. 7: TDC-E as a location-finding tool (TDC-E200 only)

Outdoor location finding based on **GPS** data is only possible with the TDC-E200 device variant. In this case, the movement data of the TDC-E are output together with the received GPS data. A GPS antenna is included with delivery of the TDC-E.

The WPAN sender is another component that is only installed on the TDC-E200 device variant to enable **indoor location finding** in an industrial environment. The position is determined between the sender and multiple receivers. To pinpoint the exact location of an object, it is necessary to have at least three receivers (trilateration).

3.2.3 TDC-E as a data transmission tool

3.2.3.1 Data transmission methods

Data can be communicated to the cloud services via a cellular network (3G), Ethernet, WLAN, and WPAN. The TDC-E transmits the sensor data received to the SICK cloud server or to a customer server.

There is an API interface integrated into the TDC-E that allows the data to be transferred to all leading business applications (ERP, CRM OMD, BI, etc.). The programming interface makes it possible to access the data of the TDC-E and the connected sensors.

With the aid of the Linux-based Docker containers, a web service for alarm and notification management can be implemented in the TDC-E (see also chapter *3.2.4 Extending the TDC-E with tools and customer applications*).

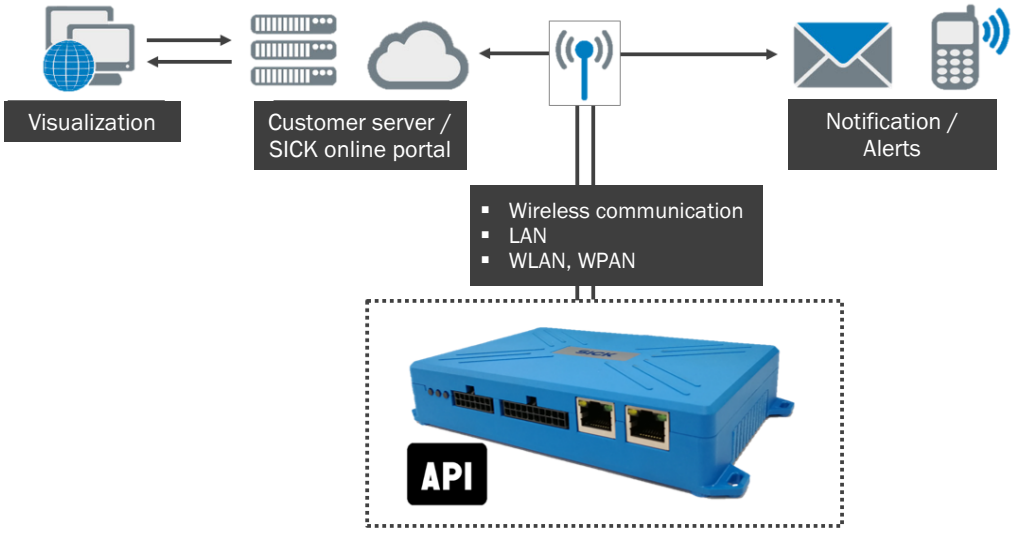


Fig. 8: Data transmission methods

3.2.3.2 Data transmission protocols

Data are usually transmitted using the MQTT protocol. MQTT is a special messaging protocol that relies on the publish/subscribe principle. This involves setting up **topics** on the user side. Certain clients make messages available based on these topics (in the role of a publisher) and these are then retrieved by other clients (in the role of a subscriber).

According to this principle, communication takes place via a central distribution list called the MQTT message broker. Each message sent by a client contains a **topic** with the data. Each MQTT client that wishes to receive the messages for the topic must subscribe to them on the message broker.

Whenever new messages arrive, the broker then notifies the clients that are interested in receiving them. This process ensures efficient communication between the nodes. Each client is only aware of the message broker, not the other nodes.

It is the TDC-E that assumes the publisher role within the system. It uses the MQTT protocol to send topics containing sensor data within a defined structure. The cloud service is the data subscriber within this context. Thanks to the defined topic structure, this service is able to retrieve the messages and carry out further processing on them.

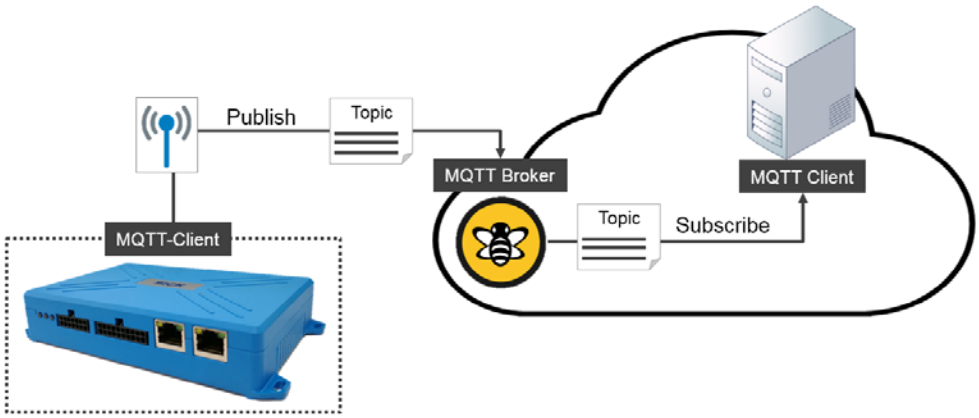


Fig. 9: MQTT data protocol

Note In addition to the MQTT transmission protocol, OPC UA and JSON are also supported.

3.2.3.3 Permanent data transmission

TDC-E devices are connected to a permanent voltage supply (e.g., a vehicle battery). As a result, they are always online. It does not matter whether the vehicle/machine on which they are installed has been started up.

This makes data transmission possible even if a vehicle's engine is not running. This means, for example, that the very act of starting an engine or machine could be transmitted and evaluated as a signal, subject to there being an appropriate connection to the TDC-E.

Data storage in offline mode

In cases where data transmission is not possible, the data received from the connected sensors are stored in the internal memory of the TDC-E device. Depending on the number of connected sensors, the memory can store up to 14 GB of sensor data.

If the device is not being supplied with voltage, no sensor data can be stored.

Note

When there is no space left on the internal memory card, the TDC-E will be forced to overwrite the data. Please note that regular overwriting can detrimentally affect the service life of the memory card and – in turn – that of the TDC-E.
Please also note that when the remaining capacity of the memory bank reaches < 1 GB, it will not be possible to store any more data from customer applications, and the Node-RED and picoStratus applications will be stopped.

As soon as the TDC-E devices are back online, the stored sensor data are automatically transmitted to the SICK online portal. If you are using your own server (a "customer server"), the data can be retrieved once the connection has been restored.

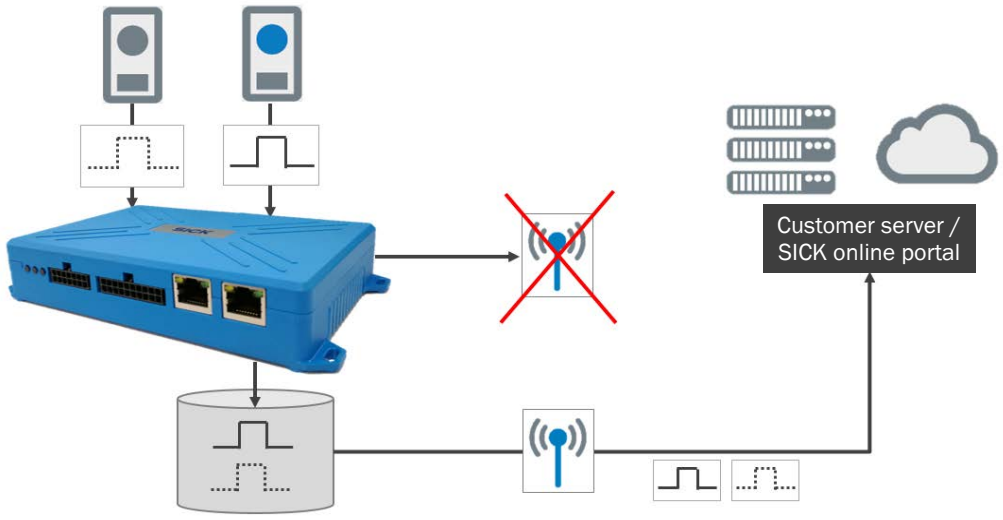


Fig. 10: Data storage in offline mode

If the data connection remains unavailable for a prolonged period, the data in the internal device memory are overwritten using the FiFo principle (first in – first out). This means that the data that were stored first will also be overwritten first.

3.2.4 Extending the TDC-E with tools and customer applications

The Linux operating system that has been preinstalled on the TDC-E is based on a powerful ARM processor and utilizes Docker container technology. Docker is a tool that makes it easier to create, deploy, and execute applications by using containers. A container does not just hold the application itself but also all of the resources required by the application during runtime.

The TDC-E comes with five preinstalled applications.

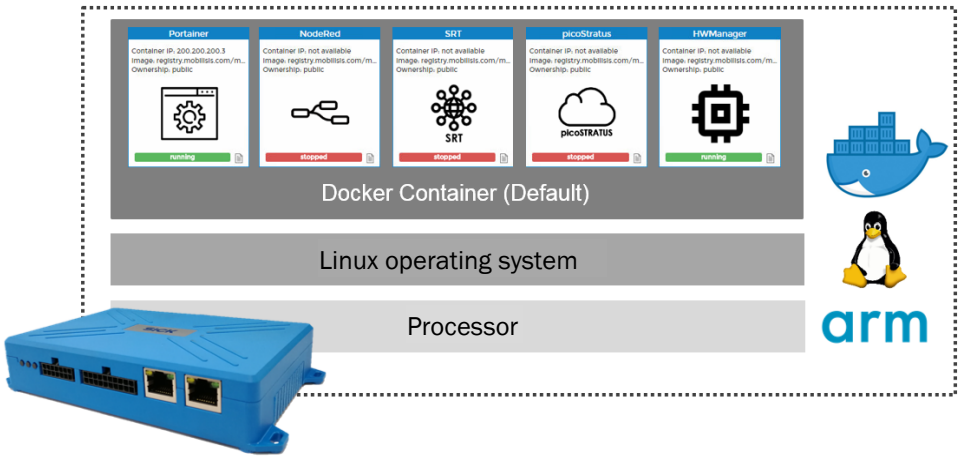


Fig. 11: Docker container technology on the TDC-E

Configuring data transmission with Node-RED

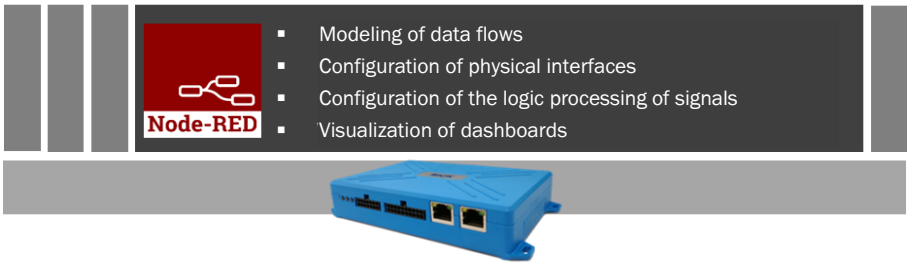


Fig. 12: Docker container technology – Node-RED

The preinstalled **Node-RED** application is a programming tool for interconnecting hardware devices, APIs, and online services. It offers a browser-based editor that can be used to model data flows on a graphical user interface. This allows you to custom-configure how TDC-E device data and sensor data are transmitted.

Even TDC-E activities such as the following can be reported to the customer server via Node-RED: establishment of the voltage supply, dialup into the mobile network, or an active LAN/WLAN connection.

Node-RED can also be used for the visualization of a dashboard on the TDC-E.

Configuring data transmission with picoStratus

Fig. 13: Docker container technology – picoStratus

The preinstalled **picoStratus** application is a type of middleware for reading and writing variables, events, and methods from/to Ethernet-enabled sensors from SICK.

Setting up alarm and notification management

Thanks to the container technology, the gateway system can be rapidly extended by adding customer-specific applications. This involves loading the application into a container as a compiled image file and executing it immediately.

Fig. 14: Docker container technology – Customer applications

For example, a web server can be implemented in a Docker container for the purpose of configuring a method of alarm and notification management that is specific to a particular device. Input signals can be processed so that they trigger real-time alarms in the form of SMS messages or the sending of e-mails. This enables a rapid response to line-voltage or data-connection failures.

Customer applications are likewise used to configure the connection of fuel sensors.

3.3 The SICK online portal

Within the gateway system, the SICK online portal acts as the central processing and visualization platform for the sensor data supplied.

Components of the SICK online portal

The SICK cloud server receives and stores the sensor data transmitted by the respective TDC-E.

Data are visualized in real time via a web-based user interface. The sensor data can be accessed from any computer or mobile device by logging into the portal page.
All commonly used web browsers are supported.

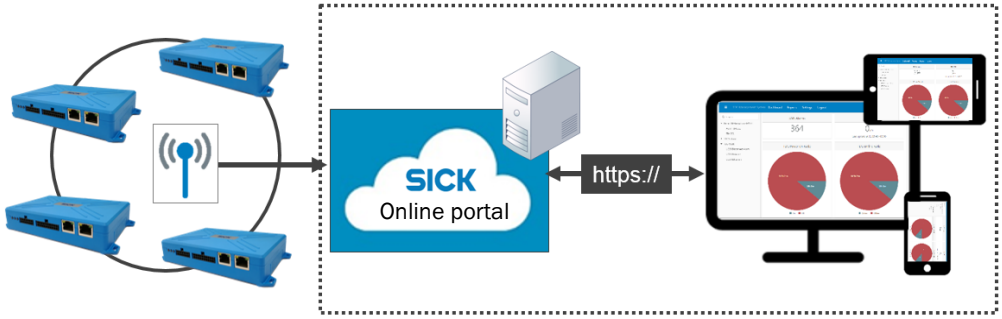


Fig. 15: Components of the SICK online portal

Multi-client capability and access rights

The multi-client capability of the cloud solution ensures that the SICK online portal is capable of serving multiple clients on the same server, and that each client is only able to see and edit its own data.

The SICK online portal is accessed in the browser by entering the URL of the cloud server and logging in with a username and password.

At client level, the SICK online portal supports various user levels with corresponding access rights to the sensor data and program functions.

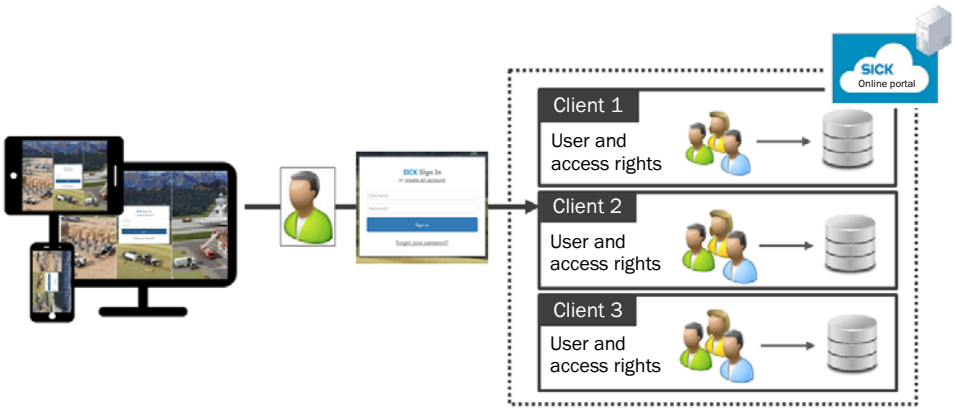


Fig. 16: Multi-client capability and access rights in the SICK online portal

Visualization and monitoring

The way the data is presented graphically in the SICK online portal makes for effective monitoring of vehicle activities, fuel levels, or suspicious movements or collision hazards in the vicinity of vehicles and machines.

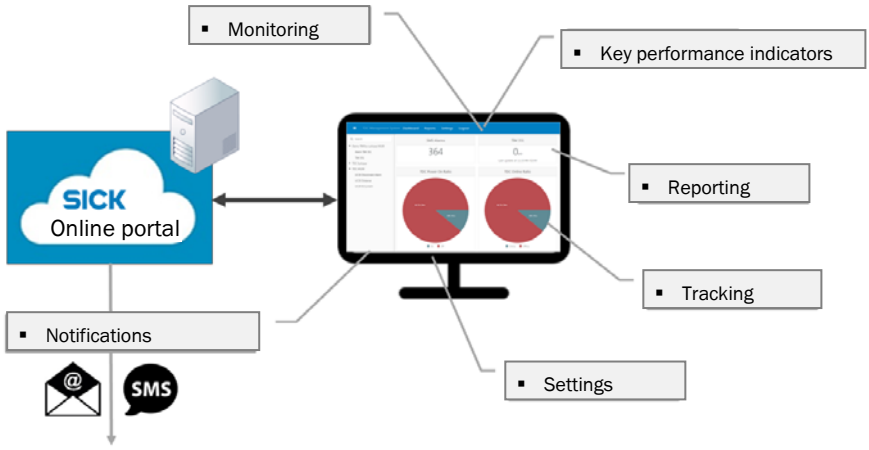


Fig. 17: Visualization of sensor data and monitoring in the SICK online portal

The information is summarized in the form of KPIs to facilitate decisions, enable you to control and monitor implemented measures, or allow internal and intracompany comparisons.

There is a comprehensive reporting system to help you analyze and evaluate sensor data collected over a longer period of time. You can also define your own reports.

In addition to the device-specific alarm management offered by the TDC-E, the SICK online portal also has its own notification system. This generates messages in accordance with freely definable rules and makes them available to specific users/user groups in the portal's notification panel.

The notifications that are automatically generated by the system can also be sent as an e-mail or SMS message via the SICK online portal's integrated e-mail server.

3.4 Status indicators on the TDC-E

The TDC-E100 and TDC-E200 devices each have three status LEDs to indicate the current operational status.

Fig. 18: TDC-E100/TDC-E200 status indicators

The LEDs have the following meanings:

LED	Meaning
Green	Permanently OFF: The device is switched off.
	Permanently ON: The device is switched on but has not been booted up.
	▪ HEARTBEAT (intermittent flashing at a rate of 2x per second): The device has been successfully booted up. The containers are not yet ready for operation. ▪ HEARTBEAT (intermittent flashing at a rate of 1x per second): The device is ready for operation.
Yellow	The yellow and red LEDs can be configured. The modes available in the current version are ON, OFF, and HEARTBEAT (= FLASHING).
Red	

Table 7: TDC-E100/TDC-E200 status indicators

4 Mounting

If possible, the TDC-E should be mounted close to the battery so it can be connected to the voltage supply or close to the electrical installation so that the peripheral devices can be connected.

Note

- ▶ Mount the TDC-E so that it is protected from dirt and mechanical damage.

4.1 Inserting a SIM card (countries outside of the EU)

If the TDC-E is operated in conjunction with the SICK cloud in an EU country, the factory-installed SIM card can be used for data transmission.

If you are operating the device in a country outside of the EU, you will need to insert the SIM card from your telecommunications provider.

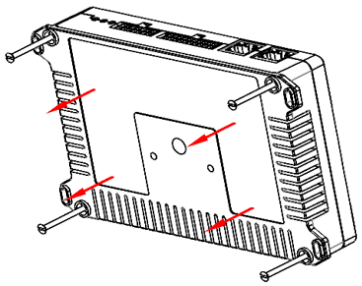
Note

Only use M2M SIM cards.

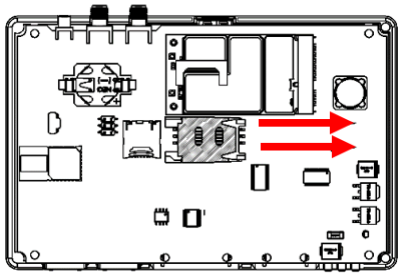
WARNING

Only insert the SIM card when the device is switched off.

- ▶ Make sure that the device is switched off.
- ▶ Unscrew the plastic cover on the bottom of the device and remove it.

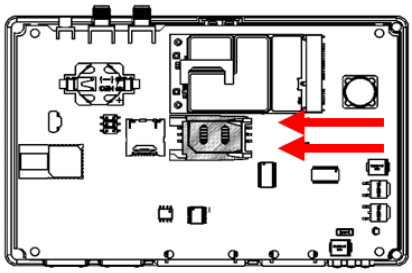


- ▶ Slide the plastic cover of the SIM card holder to one side. There is an indicator arrow on the holder.



- ▶ Remove the factory-installed SIM card for EU operation.

- Insert the SIM card from your telecommunications provider into the card holder with the contacts facing down.



- Slide the plastic SIM cover back into place and lock it.
- Reattach the housing cover to the bottom of the device and screw it tight.
- Set up the APN in the configuration interface (see *6.5.3 Mobile* section *GPRS data for applications in countries outside of the EU*).

4.2 Mounting the device

4.2.1 Mounting on a plate

Use the mounting holes on the bottom of the device to mount it.

Fig. 19: Mounting on a plate

- Securely attach the device using four M3 fillister head screws.

4.2.2 Mounting on DIN mounting rails

To mount the TDC-E on a DIN mounting rail, use the mounting rail bracket with mounting hardware that is available as an accessory.

Adjusting the mounting rail bracket to the housing dimensions

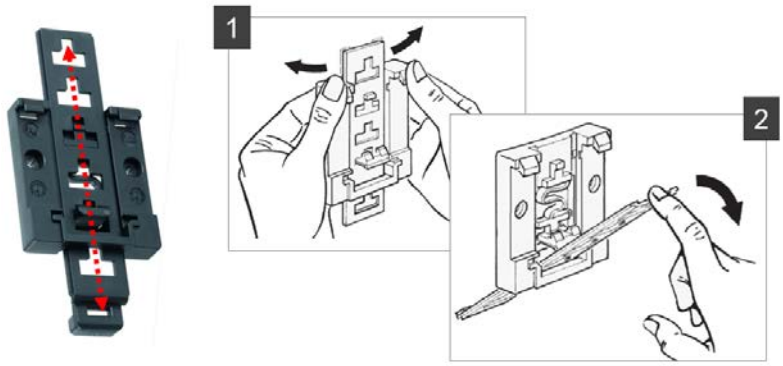


Fig. 20: Mounting on a mounting rail – Adjusting the mounting rail bracket

- ▶ Move the bar of the mounting rail bracket into the appropriate position and click it into place.
- ▶ While clicking the bar out of one position and into another, gently bend the top section of the base with your hands.
- ▶ At the same time, push the actuating bar forward. This will avoid damaging the lug in the bar guide.

Attaching the mounting rail bracket to the mounting rail

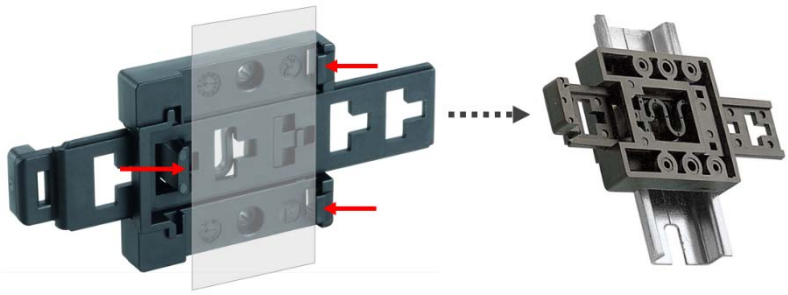


Fig. 21: Mounting on a mounting rail – Attaching the mounting rail bracket to the mounting rail

- ▶ Attach the mounting rail bracket to the mounting rail via the lugs, making sure it audibly engages.

Mounting the TDC-E on the mounting rail bracket

- ▶ Place the TDC-E on the bar and use the mounting holes on the mounting rail bracket to screw it on.

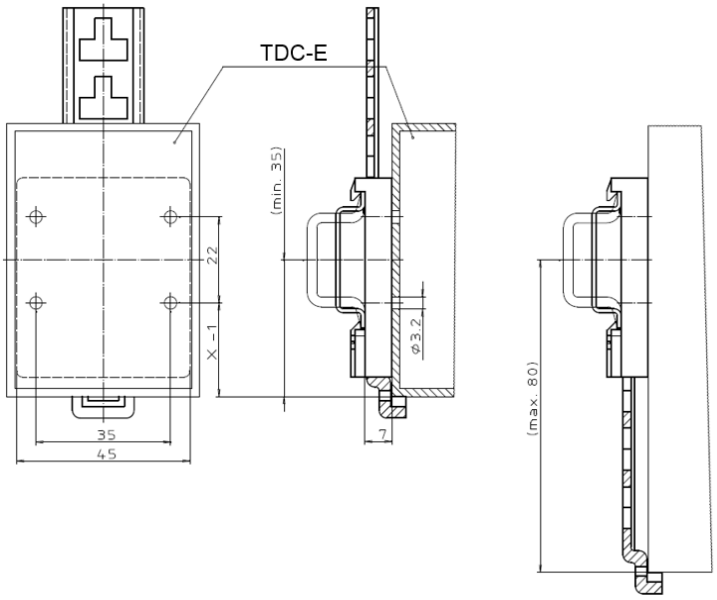


Fig. 22: Mounting on a mounting rail – Mounting the TDC-E on the mounting rail bracket

5 Electrical installation

DANGER

Risk of injury and damage caused by electrical current

Electrical voltage can cause severe personal injury or death by electric shock.

- Electrical installation work may only be carried out by electrically qualified persons.
- Be sure to disconnect the power supply before attaching or detaching any electrical connections.
- Only connect the system to a voltage source that meets the technical requirements.
- National and regional regulations must be complied with.
- Safety requirements relating to electrical systems must be complied with.

5.1 Connecting the TDC-E

5.1.1 Connection overview

Front

Fig. 23: Connections at the front

No.	Meaning
1	14-pin connector ▪ Voltage supply ▪ Digital inputs and outputs ▪ Analog inputs
2	20-pin connector ▪ Additional digital inputs and outputs ▪ RS-485/422, RS-232, SSI, 1-Wire serial interfaces ▪ CAN
3	*Eth0* for connecting Ethernet-enabled sensors and a configuration PC Default IP address: 192.168.0.100
4	*Eth1* for sending data via a LAN Default IP address: 192.168.1.100

Back

Fig. 24: Connections at the back

No.	Meaning
1	MCX female connector for connecting the GPS antenna (TDC-E200 only)
2	SMA female connector for connecting the GSM antenna
3	SMA female connector for connecting a WLAN or WPAN antenna
4	USB 2.0 port, e.g., for connecting external storage media

For details of the pin assignments, please refer to chapter *10.4 TDC-E pin assignments* in the appendix.

Connection notes

The gateway system is delivered with a 14-pin Microfit male connector as standard. Two cables have been routed out of this male connector at the factory so that the device can be connected to the voltage supply.

With this male connector variant, you can only connect Ethernet-enabled sensors to the TDC-E.

Two other male connectors with preconfigured cables are available as optional accessories.

In the case of the 14-pin Microfit male connector, the cable assembly has 14 color-coded open-ended wires for connecting:

- Voltage supply (2 wires)
- Digital inputs and outputs
- Analog inputs

In the case of the 20-pin Microfit male connector, the cable assembly has 20 color-coded open-ended wires for connecting:

- Additional digital inputs and outputs
- RS-485/422, RS-232, SSI, 1-Wire serial interfaces
- CAN

Note There is a pin assignment diagram for the connections on the bottom of the TDC-E device.

5.1.2 Connecting to the voltage supply

The connection must ensure a permanent voltage supply. If the TDC-E is installed in a vehicle, we recommend connecting it to the vehicle battery.

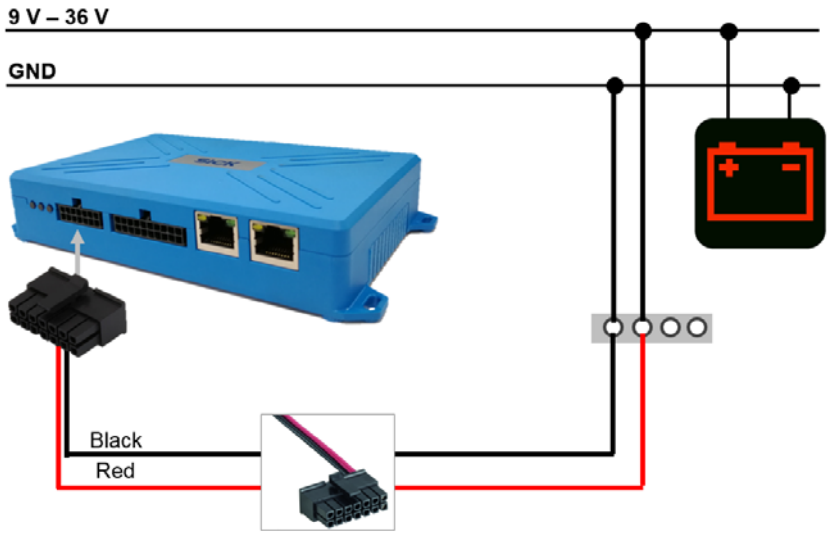
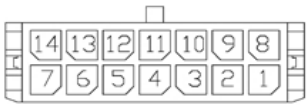


Fig. 25: Connecting the TDC-E to the voltage supply

- ▶ Plug the Microfit male connector at the end of the connecting cable into the 14-pin female connector on the TDC-E.
- ▶ Use the red and black wires of the connecting cable to connect the TDC-E to the voltage supply.



PWR

Pin	Wire color	Connection
14	Red	VIN (9 V–36 V voltage supply)
7	Black	GND for voltage supply

Table 8: Connecting the TDC-E to the voltage supply

5.1.3 Connecting digital sensors

Digital sensors are usually connected to the TDC-E via two digital inputs. For this, please use the preassembled 14-pin Microfit male connector that is available as an accessory.

The sensors are supplied with voltage by a separate voltage source.

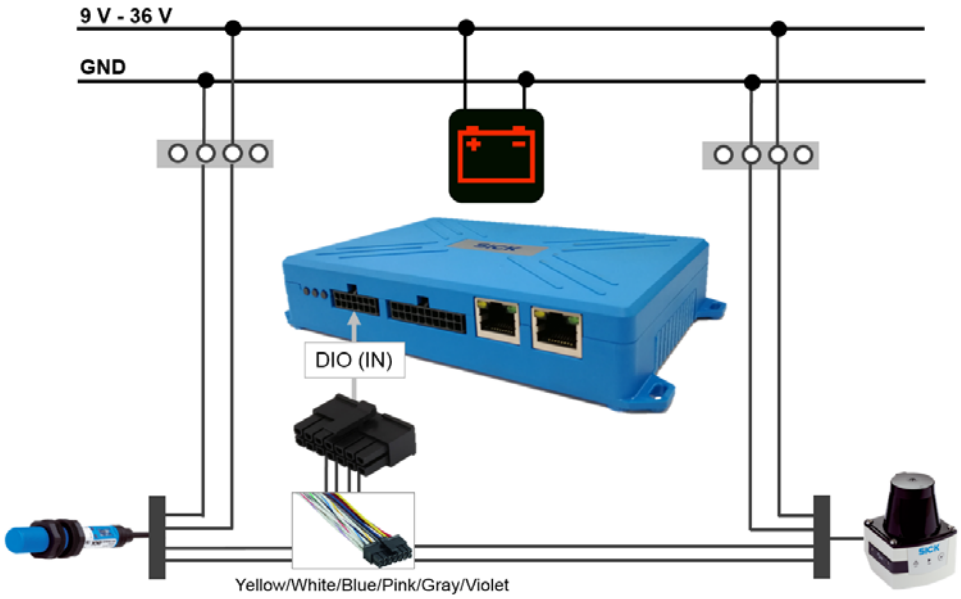
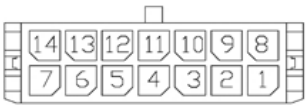


Fig. 26: Connecting digital sensors

Connecting to digital inputs

- Connect the TDC-E to the connecting cable of each sensor via two input wires of the 14-pin Microfit male connector using an adapter.



Inputs

Pin	Wire color	Connection
13	Yellow	DIO_A
6	White	DIO_B
12	Blue	DIO_C
5	Pink	DIO_D
11	Gray	DIO_E
4	Violet	DIO_F

Table 9: Connecting digital sensors

Connecting to the voltage supply

- Connect sensors to a separate supply voltage

5.1.4 Connecting sensors via the Ethernet interface

Sensors with an Ethernet interface are connected to the Ethernet port on the TDC-E.

The sensors are supplied with voltage by a separate voltage source.

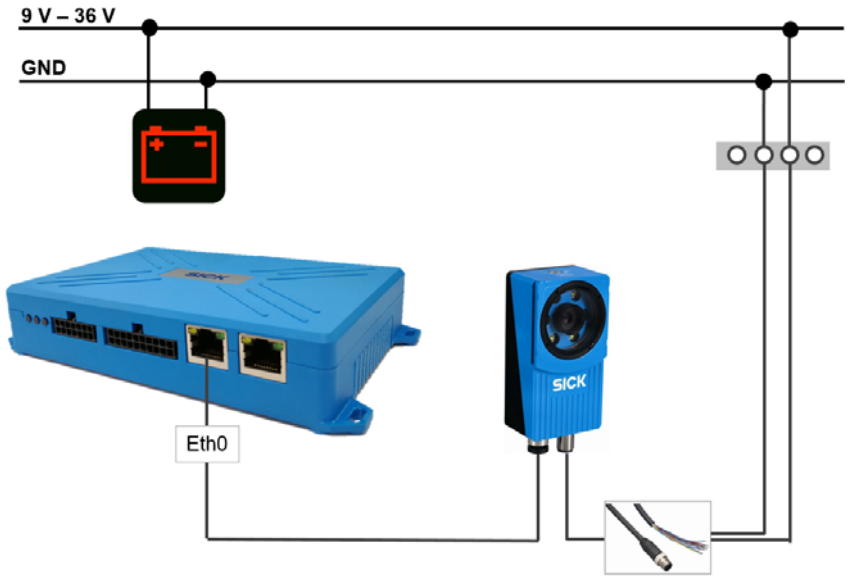


Table 10: Connecting sensors via Ethernet

- ▶ Connect sensor to either of the Ethernet interfaces.
- ▶ Connect sensors to a separate supply voltage

5.2 Screwing on the GSM or WLAN/WPAN antenna

The GSM and WLAN/WPAN antennas are not premounted at the factory. They must be screwed on before commissioning the devices.

Fig. 27: Screwing on the GSM or WLAN/WPAN antenna

- ▶ Hold the device firmly with one hand.
- ▶ Attach the antenna to the relevant SMA antenna connection on the TDC-E.
- ▶ Screw the antenna onto the device antenna connection by turning it clockwise.

5.3 Connecting a GPS antenna

The GPS antenna is usually installed in the driver's cab with a clear line of sight in the upward direction or in the roof area of the vehicle.

Professionally route the connecting cable inside the vehicle in accordance with the antenna mounting location. Connect the antenna to the TDC-E200 device using the Cinch male connector.

Note The TDC-E100 device is not capable of providing any GPS information. Therefore, there is no connection for a GPS antenna.

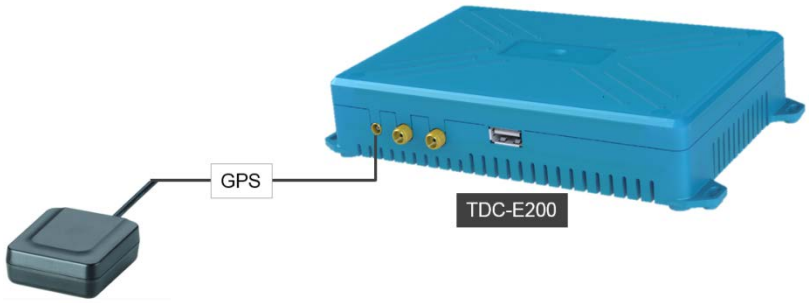


Fig. 28: Connecting the GPS antenna

- ▶ Plug the Cinch male connector at the end of the connecting cable into the MCX female connector on the TDC-E200.

6 Commissioning

6.1 Starting the TDC-E

▶ Establish the voltage supply for the TDC-E.

The operating system and Docker containers start up.

- The device is delivered with five preinstalled applications. When a cold start is performed, a device that is still in this original state will be ready for operation after approx. 120 s.

  If additional containers have been created by the customer, the start-up time will increase accordingly.
- When a warm start is performed via TDC-E Device Manager (see also chapter *6.4.3 Performing a remote restart*), all applications are shut down first. The operating system and containers are then restarted.

  A warm start takes approx. 180 s.

▶ Check the operational status of the TDC-E by looking at the status indicators.

6.2 Preparing for configuration

The TDC-E is configured via a computer that has a web browser installed and is connected to the TDC-E via Ethernet. We recommend using Google Chrome.

The *TDC-E Device Manager* configuration software that is installed on the TDC-E is started via the Ethernet connection. The configuration software has a browser-based interface and offers a convenient way of setting up the system.

Fig. 29: Connecting the TDC-E terminal device to the browser

On delivery, the two Ethernet interfaces on the TDC-E have the following IP addresses:

Component	Default IP address	Port (for calling TDC-E Device Manager)
Eth0	192.168.0.100	9000
Eth1	192.168.1.100	9000

Notes

▶ Make sure that the configuration PC is in the number range of the device components.

▶ If necessary, change the IP address of the configuration PC.

▶ Connect the computer to the TDC-E via the **Eth0** Ethernet port.

6.3 Starting TDC-E Device Manager

6.3.1 Logging in

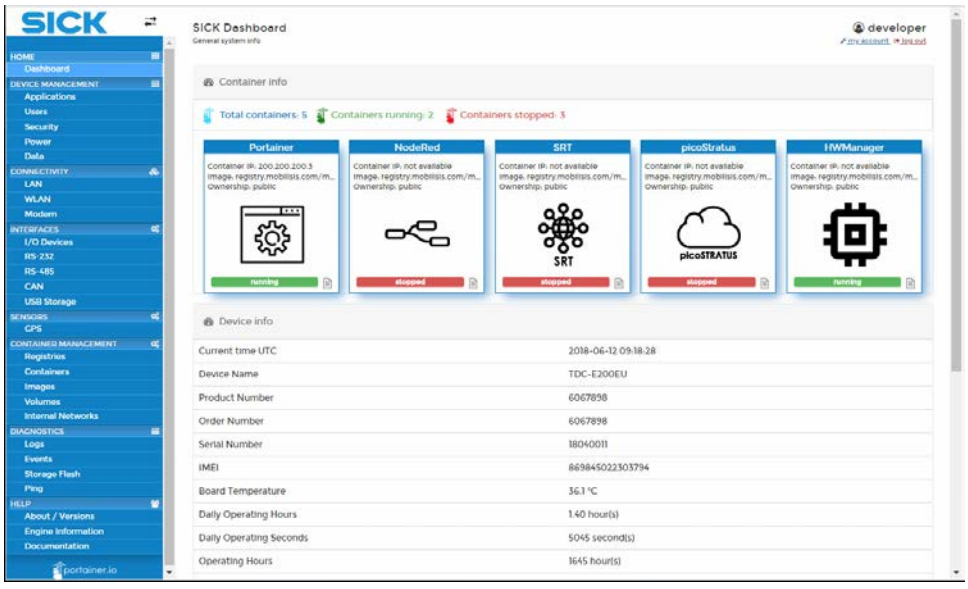
- ▶ Start the web browser on the connected computer.
- ▶ Start the configuration interface by entering the following URL:
  http://192.168.0.100:9000
  The login window opens.

- ▶ For configuration and commissioning, log in at the **developer** user level.

User levels For more information on the user levels, see chapter *10.3 User levels and authorizations*.

6.3.2 The configuration interface

The configuration interface in TDC-E Device Manager is divided into three areas.

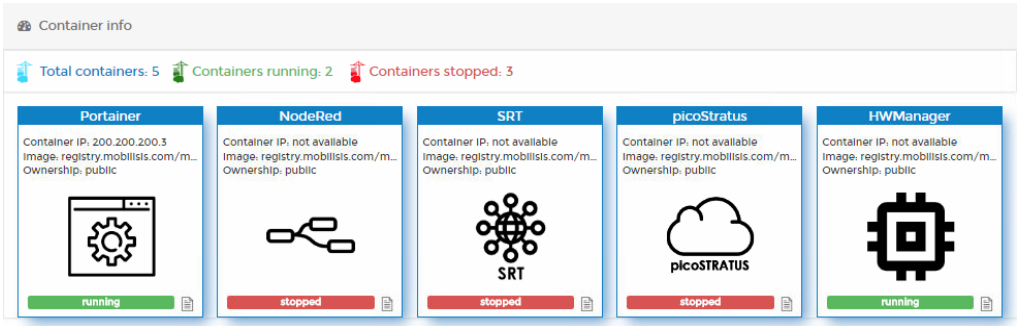


- The top right-hand corner shows which user is logged in. This user can change their password here and log out of TDC-E Device Manager.
- The area on the left contains the different TDC-E Device Manager functions in a tree structure.
- The area on the right is for inputting data according to the function selected. Once the program has started, this area becomes the dashboard.

Tip We recommend working through the settings from top to bottom.

6.3.3 Dashboard

The dashboard visualizes the applications installed on the TDC-E along with the data connections that are currently in use.



The following applications are preinstalled on the TDC-E inside containers:

- **Portainer**: A graphical user interface for interacting with and managing the TDC-E. You can also use TDC-E Device Manager to manage your own application containers.

  TDC-E Device Manager remains activated at all times.
- **Node-RED**: A programming tool for interconnecting hardware devices, APIs, and online services. It offers a browser-based editor that can be used to model data flows on a graphical user interface. This allows you to custom-configure how sensor data are transmitted to the connected servers.

  Node-RED is deactivated by default.
- **SRT**: Contains SICK SOPAS runtime. This software can be used in conjunction with the SICK SOPAS Engineering Tool called SOPAS ET to set up a basic configuration for the TDC-E and analyze the device's status.

  SRT is deactivated by default.
- **picoStratus**: Middleware for subscribing to variables, events, functions, and methods of SICK SOPAS devices and forwarding them to higher-level protocols such as HTTP REST and MQTT.

  picoStratus is deactivated by default.
- **HWManager**: An application service that provides a REST API for interacting with the TDC-E.

  HWManager remains activated at all times.

Note The temperature sensor installed inside the TDC-E supplies temperature values continuously so that any impending risk of the TDC-E overheating can be detected in good time.

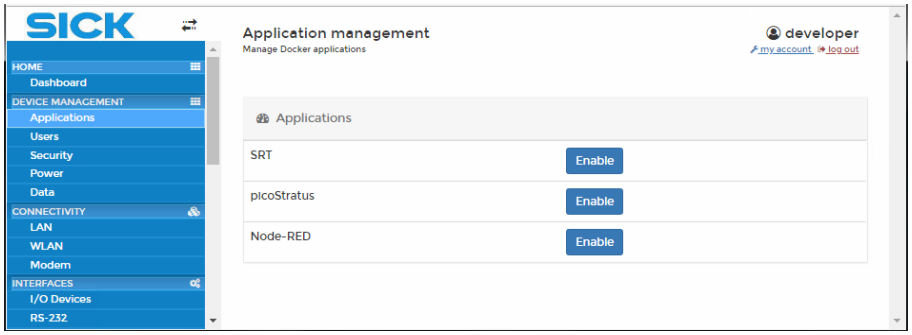
The current device temperature is displayed in the **Device Info** area.

6.4 Device settings

6.4.1 Activating preinstalled applications

The TDC-E complies with stringent safety standards. For this reason, the device is delivered with the **SRT**, **Node-RED**, and **picoStratus** applications deactivated. These have to be activated manually.

► In the tree, click on **DEVICE MANAGEMENT → Applications**.



► Click on **Enable**. The applications will be loaded.

6.4.2 User settings

The TDC-E comes with three default users that have the following user levels assigned to them: **client**, **service**, and **developer**. For details of the rights associated with each individual user role, please see chapter *10.3 Benutzerlevel und Berechtigungen*.

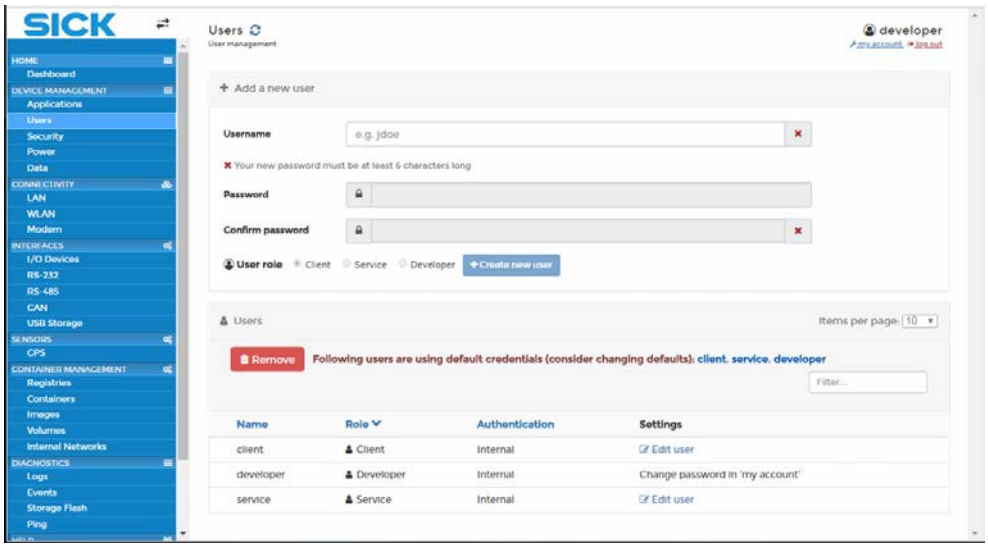
In addition, you can create new users and assign any of the three available user levels to them.

NOTE

We recommend changing the passwords for the three default user levels.

Changing the passwords for the default user levels

► In the tree, click on **DEVICE MANAGEMENT → Users**.



► In the **Users** area, click on **Edit user** in the **Settings** column and change the password. Enter and confirm the new password.

Creating new users

- In the **Add a new user** area, enter the username, and assign and confirm the password.

Note

- Usernames must conform to the industry standard and so cannot contain delimiters/separators, etc.

- Under **User role**, assign one of the user roles: **Client**, **Service**, or **Developer**.
- Click on **Create new user**.

The new user is added to the table at the bottom.

Deleting users

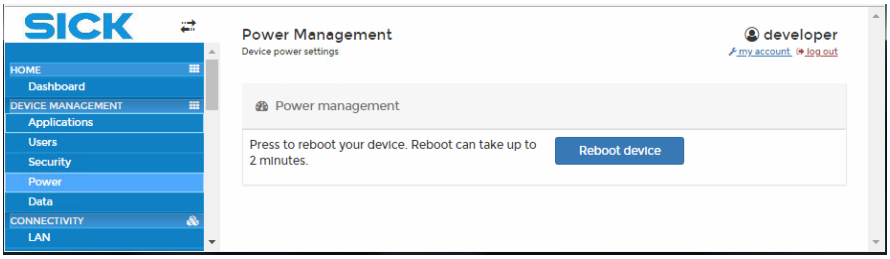
You can only delete users that have been created since delivery.

- To do this, select the relevant user line by checking the box.
- Then click on **Remove**.

6.4.3 Performing a remote restart

The TDC-E device can be rebooted remotely.

- In the tree, click on **DEVICE MANAGEMENT → Users**.



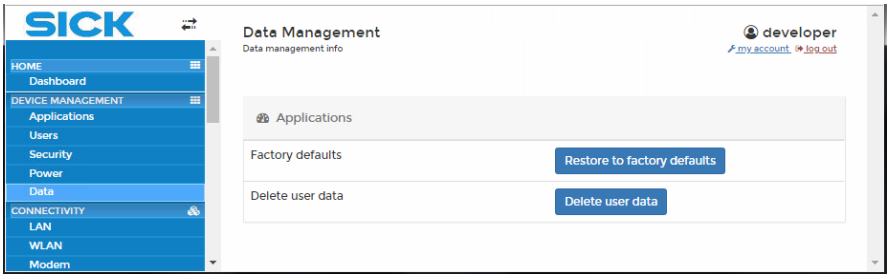
- Click on **Reboot device**.

  A warm start takes approx. 180 s.

6.4.4 Resetting the device to its factory settings

The factory settings for the TDC-E are stored inside the device and can be restored at any time. This means that you can discard all the changes that have been made to the settings since delivery.

- In the tree, click on **DEVICE MANAGEMENT → Data**.



- Click on **Restore to factory defaults** to restore the factory settings.

  This resets/deletes all the settings and parameter settings that have been made via TDC-E Device Manager, Node-RED, or picoStratus. It also deletes all the containers that have been created by the customer, along with all the applications and data inside them.

- **Delete user data** deletes all the data contained within customer applications. However, the applications themselves are retained.

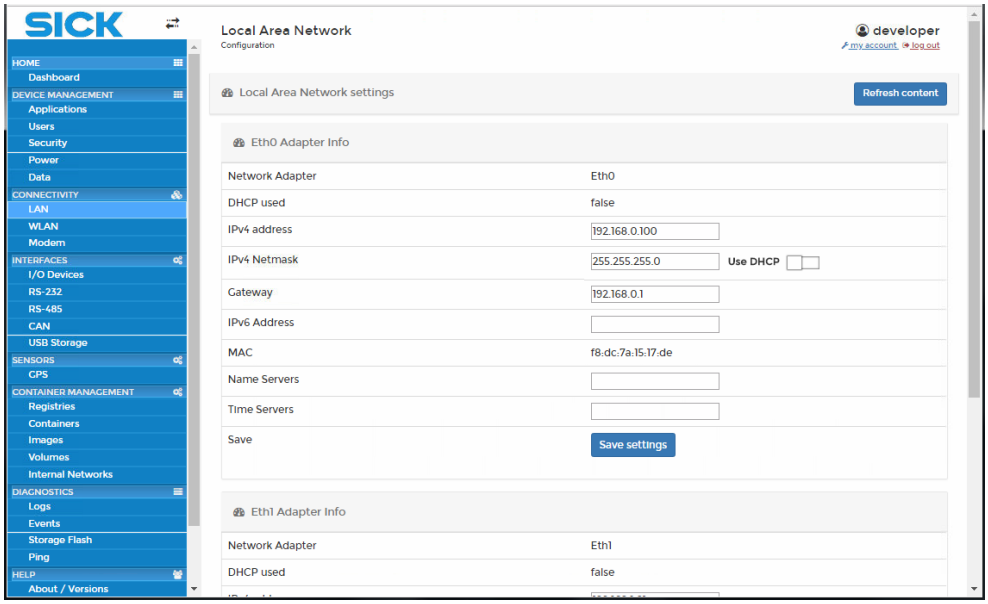
  The **Delete user data** function does not include the settings and parameter settings that have been made via TDC-E Device Manager, Node-RED, or picoStratus.

6.5 Connection settings

6.5.1 LAN

Configure the IP addresses of the two Ethernet interfaces.

- In the tree, click on **CONNECTIVITY → LAN**.

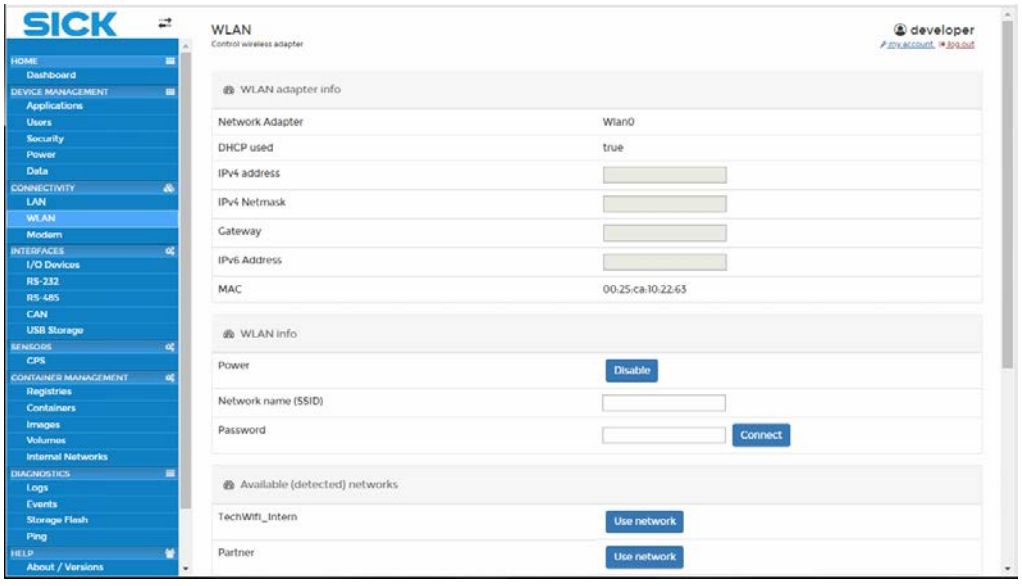


- In the **Eth0/Eth1 Adapter Info** areas, specify the static IP address and subnet mask.
- Add the gateway's IP address if you wish to establish a connection outside of the target network.
- Confirm your entries with **Save settings**.

6.5.2 WLAN

TDC-E has an interface for connecting to wireless networks.

- In the tree, click on **CONNECTIVITY → WLAN**.
- Use the button in the **WLAN Info** area to activate the connection.



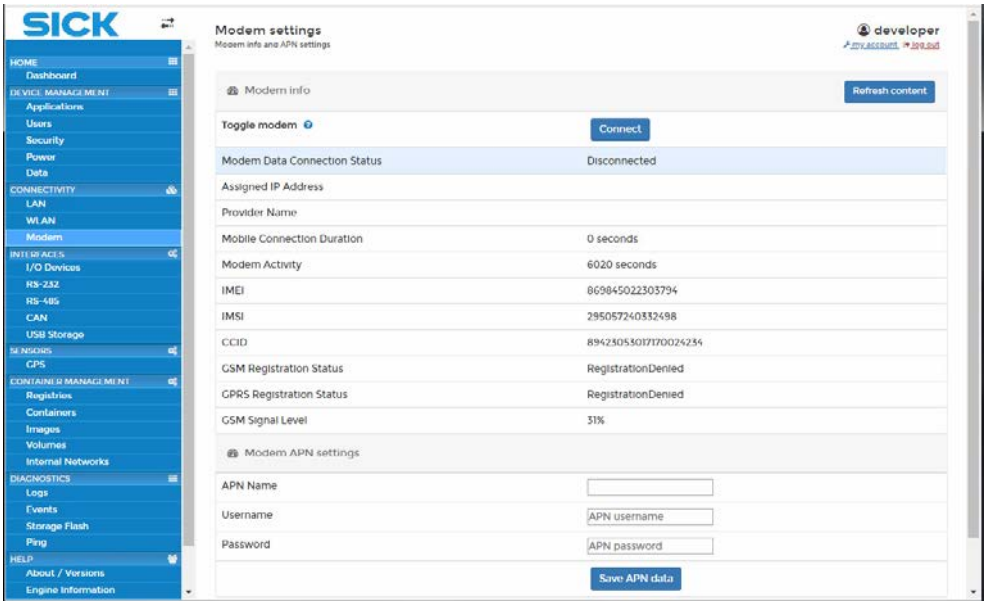
- ▶ Click on one of the networks listed under **Available (detected) networks**. The network will be transferred into the **Network name (SSID)** field.
- ▶ Enter the password.
- ▶ Press **Connect**. The WLAN adapter information fields will be completed automatically.

Note If the connection is interrupted during operation, the TDC-E will attempt to re-establish the connection automatically. When the device is restarted, the WLAN will be connected automatically using the last SSID if there is no Ethernet connection available.

6.5.3 Mobile

Specify how the SIM card should connect to the SICK or customer server.

- ▶ In the tree, click on **CONNECTIVITY → Mobile**.
- ▶ Click on **Connect** to activate the connection.



Access data for applications in EU countries

If you are using the TDC-E in an EU country, the access data for the SICK server will have been stored automatically. You do not need to enter any data in the **Modem APN settings** area. The username and password for the access point are not displayed.

Do not change the content of the fields.

Note **Refresh content** restores the access data for the SICK cloud.

GPRS data for applications in countries outside of the EU

If you are using the TDC-E in a country outside of the EU, you must configure the SIM card from your country-specific telecommunications provider once you have inserted it. You must complete the fields in the **Modem APN settings** area accordingly.

The telecommunications provider in the relevant country will have to be provided with certain information in advance. Among other things, the telecommunications provider will need to know the IP address of the SICK server.

Once the telecommunications provider has this information, they will be able to supply the APN (**A**ccess **P**oint **N**ame) together with the username and password.

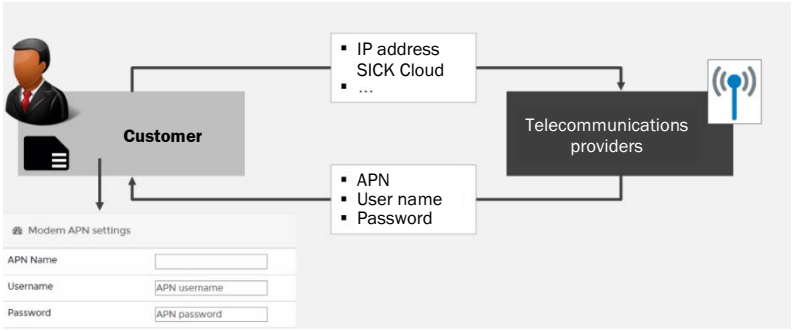


Fig. 30: Requesting mobile connection data for applications in countries outside of the EU

▶ Once your telecommunications provider has sent the information back to you, enter it in the fields in the **Modem APN settings** area.

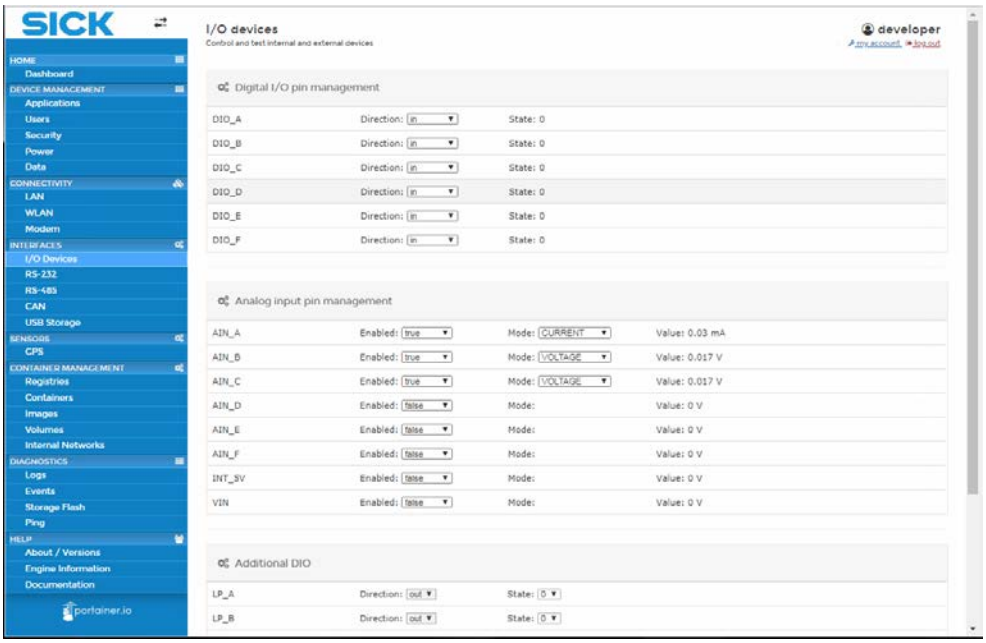
▶ Confirm the access data by clicking on **Save APN data**.

6.6 Interfaces

6.6.1 Interfaces for digital/analog sensors

Getting started

- In the tree, click on **INTERFACES → I/O Devices**.

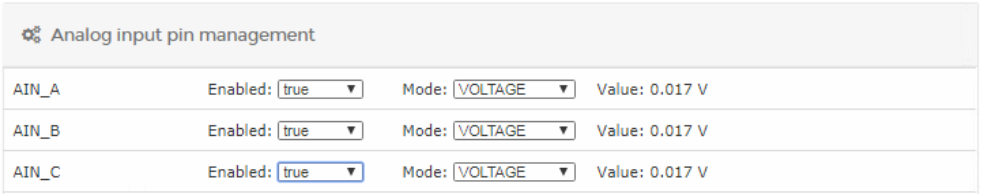


Digital inputs/outputs

- In the **Digital I/O pin management** area, click inside the **Direction** field and configure the interfaces for use as digital inputs or outputs.

Analog inputs

- In the **Analog input pin management** area, click inside the **Enabled** field for an input and activate it by setting it to **true**.
- Use the **Mode** field to specify the signal type. The analog signal can be supplied as a voltage (**VOLTAGE** entry) or as an electrical current (**CURRENT** entry).

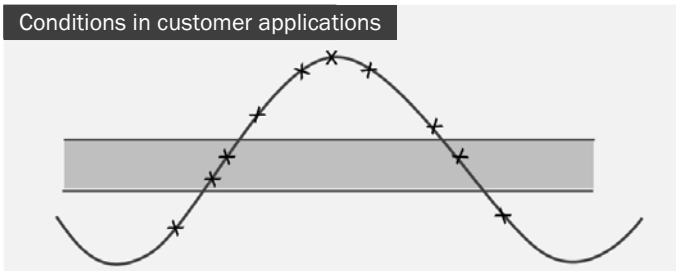


Note The currently applied voltage or currently supplied electrical current is displayed under **Value**.

Analog signals can assume any values within a given range. Conditions can be defined for these values in the Node-RED or customer-specific applications for transmitting the signal to the cloud and/or for triggering real-time alarms.

For example, you can specify that the signal value should only trigger an action if it falls within a defined range.

Conditions in customer applications



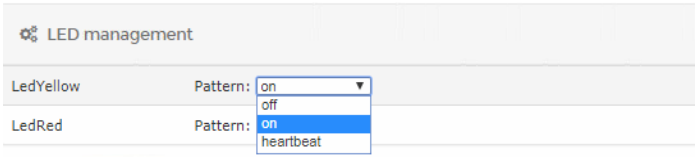
Additional digital inputs/outputs

Additional digital inputs and outputs can be configured via the **Additional DIO** area.

LED management

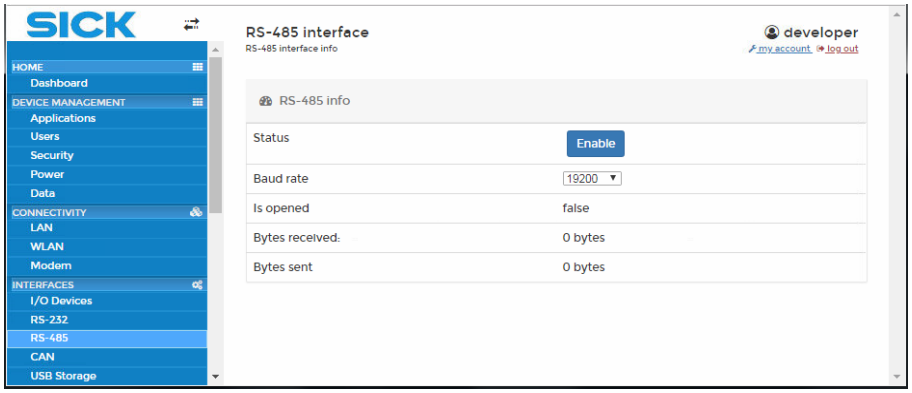
In the **LED management** area, you can activate yellow and red LEDs on the TDC-E. The modes available for both LEDs are **off**, **on**, and **heartbeat** (intermittent flashing).

The conditions for the selected LED behavior are defined using Node-RED or a customer-specific application.



6.6.2 Serial interfaces

- In the tree, click on **INTERFACES → RS-232** or **RS-485**.
- Activate the serial interface in the tree by clicking on **Enable**.
- Set the baud rate.

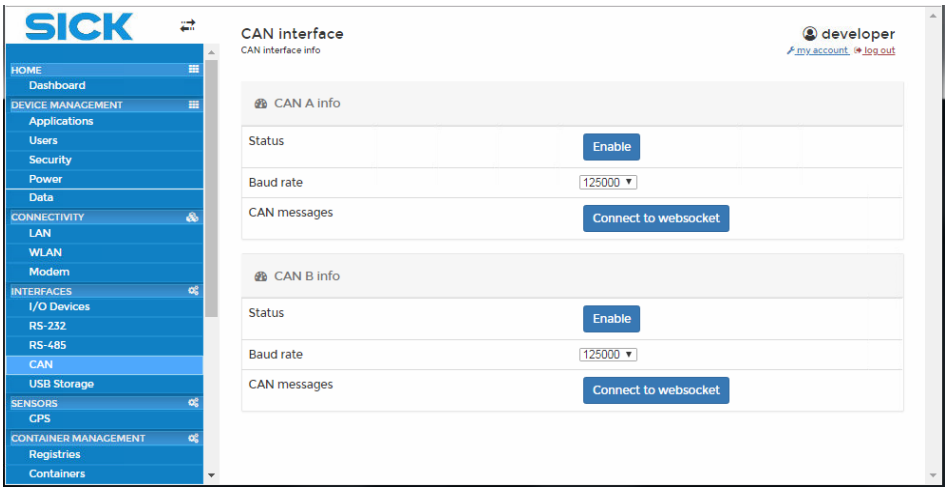


6.6.3 CAN interface

The two CAN interfaces on the TDC-E can also be used to connect fleet management systems. Fleet management systems are interfaces that can be used to retrieve vehicle data from the vehicle CAN bus.

The kinds of tasks handled by a fleet management system include: detecting the positions of vehicles, measuring vehicle downtime, tracking routes, and monitoring fuel data, as well as collecting and processing the diagnostic data that is continuously recorded throughout a journey. The system also handles customer-specific road-toll statements and analyzes journeys from a business perspective.

- In the tree, click on **INTERFACES → RS-232** or **RS-485**.
- Activate the CAN interface to which the vehicle data are to be transmitted. To do this, click on **Enable**.
- Set the baud rate.
- Connect to the CAN network.



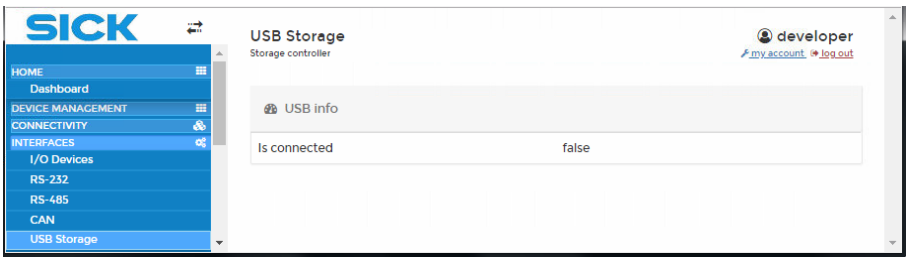
NOTE

For information on how to integrate your fleet management system, please contact your SICK sales partner.

6.6.4 USB interface

The USB interface can be used to connect an external storage medium, for example.

- In the tree, click on **INTERFACES → USB**.
- The screen shows whether a storage medium is connected to the USB interface.



6.7 Internal sensors

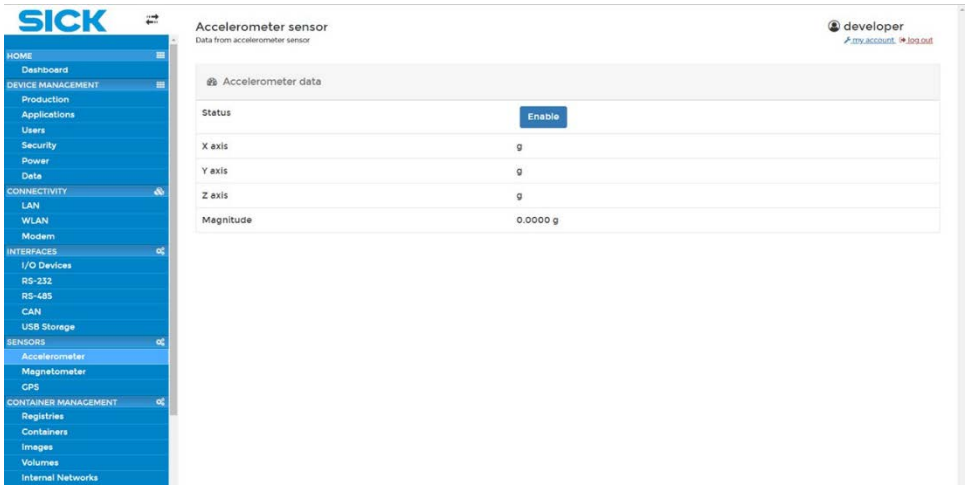
Note The factory-installed TDC-E sensors (thermometer, accelerometer, and magnetometer) are intended for diagnostic purposes.

6.7.1 Acceleration sensor

The acceleration sensor (accelerometer) continuously detects coordinates and quantities for the X-, Y-, and Z-axes (values in g=9.81 m/s^2). The sensor has to be activated.

The sensor data can be retrieved and analyzed using Node-RED or a customer application.

- ▶ In the tree, click on **SENSORS** → **Accelerometer**.
- ▶ Activate the sensor.

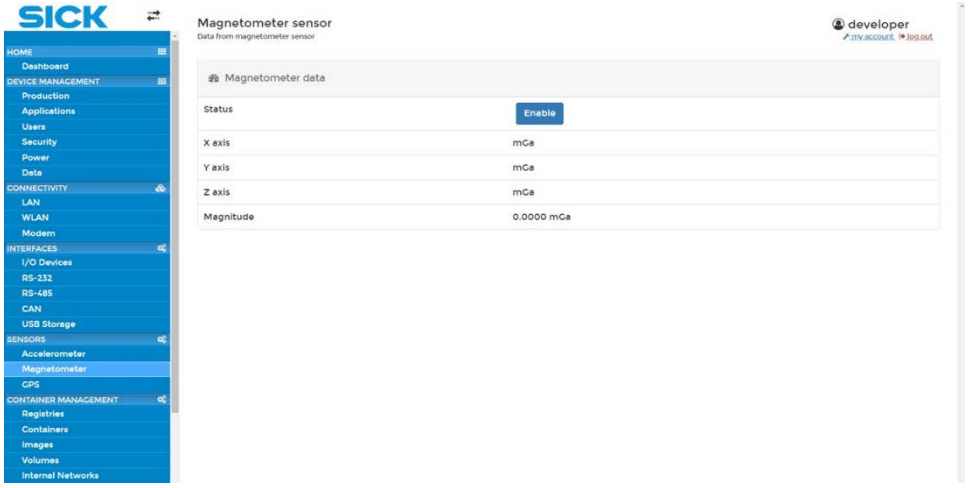


6.7.2 Position sensor

The position sensor (magnetometer) continuously detects coordinates and quantities for the X-, Y-, and Z-axes (values in milligauss [mG]). The sensor has to be activated.

The sensor data can be retrieved and analyzed using Node-RED or a customer application.

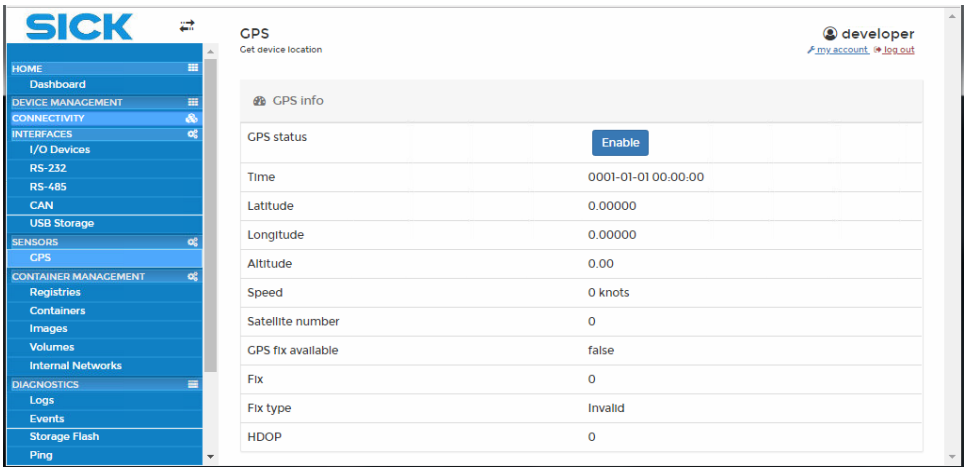
- ▶ In the tree, click on **SENSORS** → **Magnetometer**.
- ▶ Activate the sensor.



6.7.3 GPS

TDC-E200 type devices have a GPS sensor installed. The sensor has to be activated.

- In the tree, click on **SENSORS → GPS**.
- Activate the GPS sensor by clicking on **Enable**.



Note Please refer to the **HDOP** parameter in the **GPS info** area for a measure of the geometric quality of a GPS satellite configuration in the sky. HDOP is a factor in determining the relative accuracy of a horizontal position. The smaller the DOP number, the better the geometry.

6.7.4 WPAN

TDC-E200 type devices have a WPAN sender installed.

This supports WPAN standard IEEE 802.15.3.

Configuration via TDC-E Device Manager is not yet possible but will be introduced in a later software release.

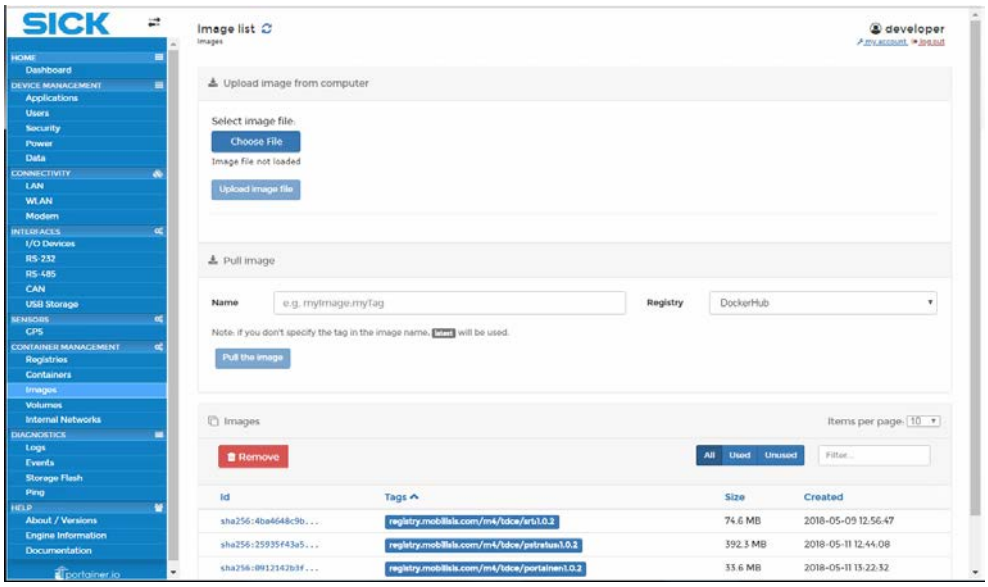
6.8 Implementing customer applications

Thanks to the container technology, the gateway system can be rapidly extended by adding customer-specific applications. This involves loading the application into a container as a compiled image file and executing it immediately.

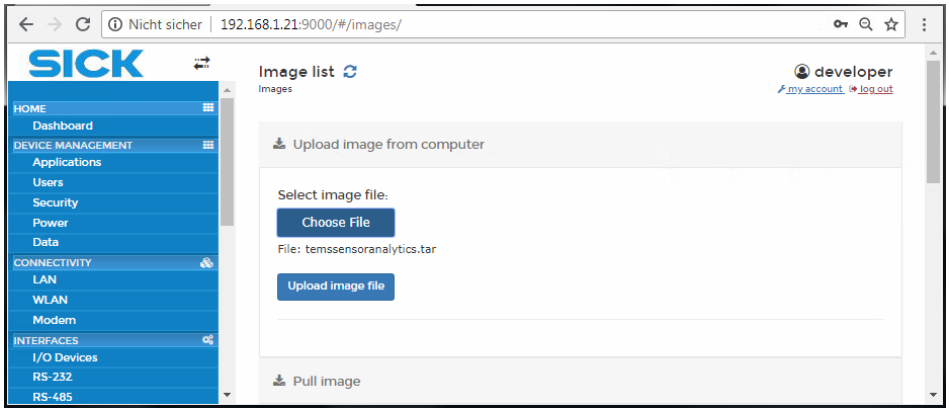
6.8.1 Uploading an image file

The first step is to upload the image from which the Docker container is to be derived in TDC-E Device Manager. The image file is usually in *tar* format.

- In the tree, click on **CONTAINER MANAGEMENT → Images**. This displays the list of image files that are already being used in TDC-E Manager.



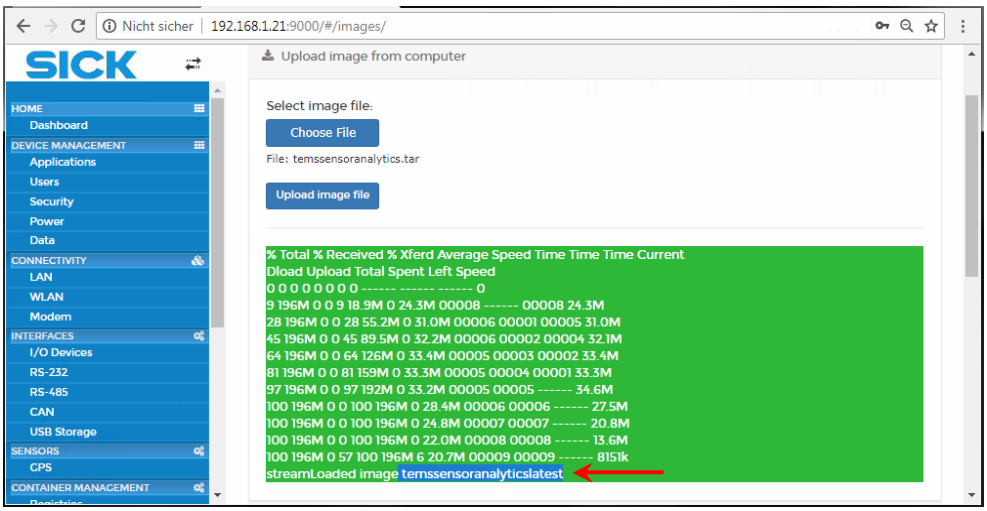
- In the **Upload image from computer** area, click on **Choose File**.
- In the next window, select the *tar* file and confirm your choice by clicking on **Open**. The selected file will be displayed in TDC-E Device Manager.



- Click on **Upload Image file**. The file will be uploaded and saved in the Docker engine of the TDC-E.

A message with a green background will appear in TDC-E Device Manager if the upload process was successful.

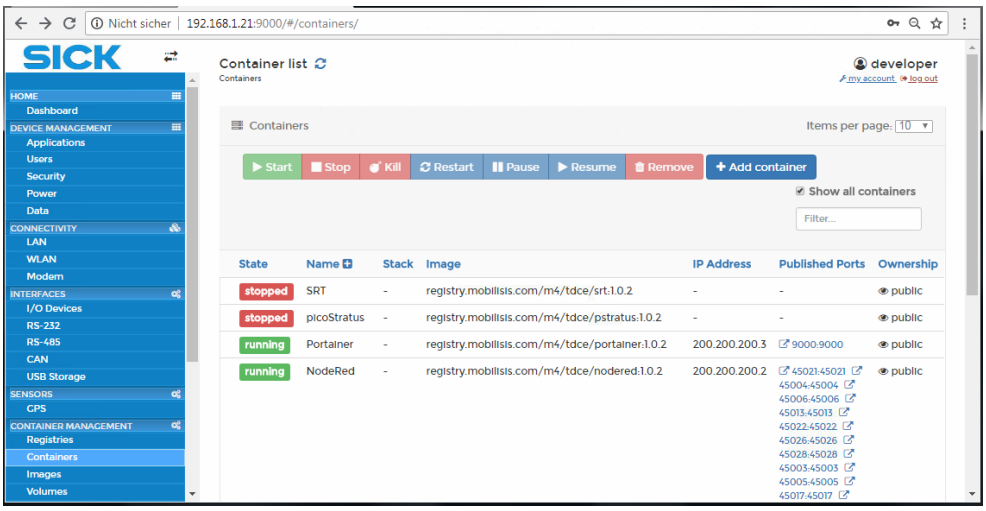
► Note down the name of the image (see arrow) or select it and copy it to the clipboard.



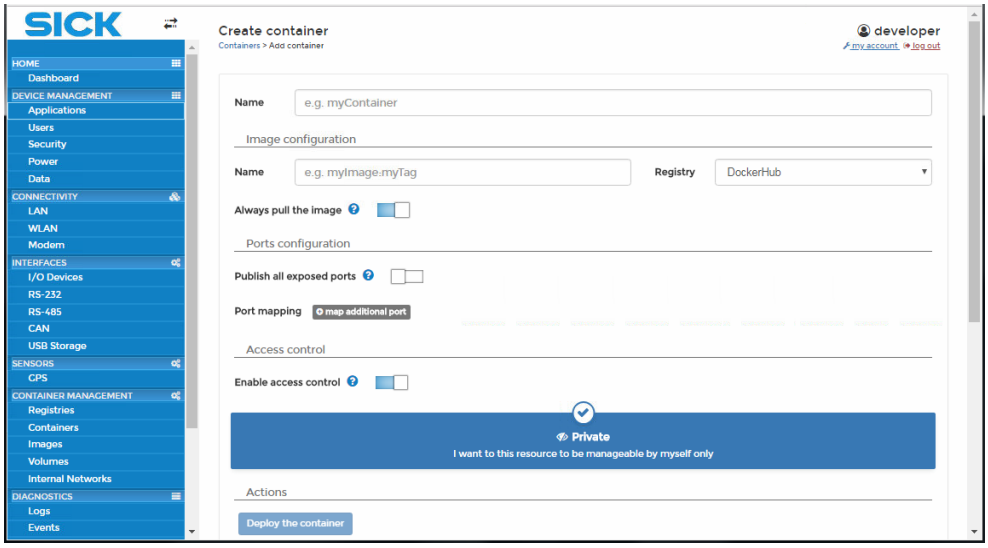
6.8.2 Deriving a container from the image file

The second step is to derive a container from the uploaded image.

► In the tree, click on **CONTAINER MANAGEMENT → Containers**.

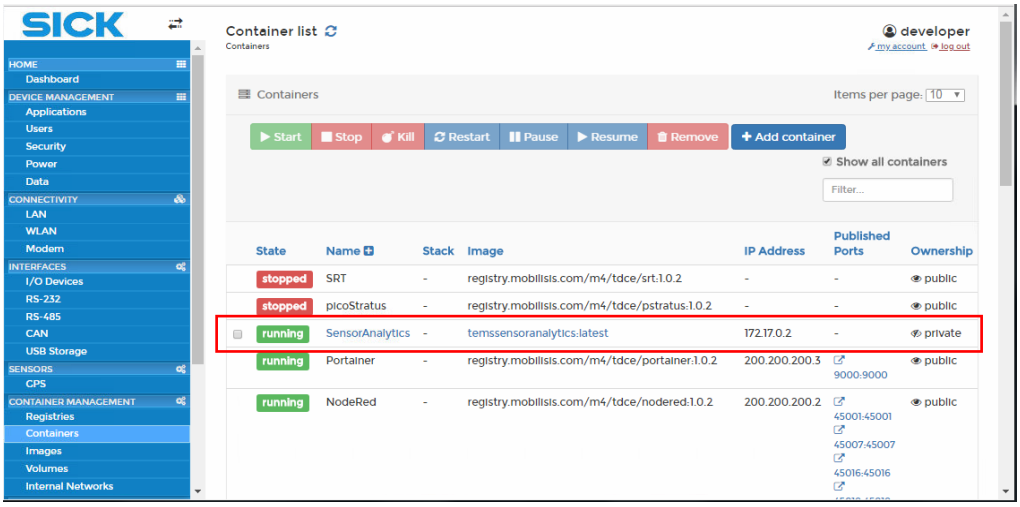


- Click on **Add container** in the action bar at the top of the screen. This opens a new window for creating the container.

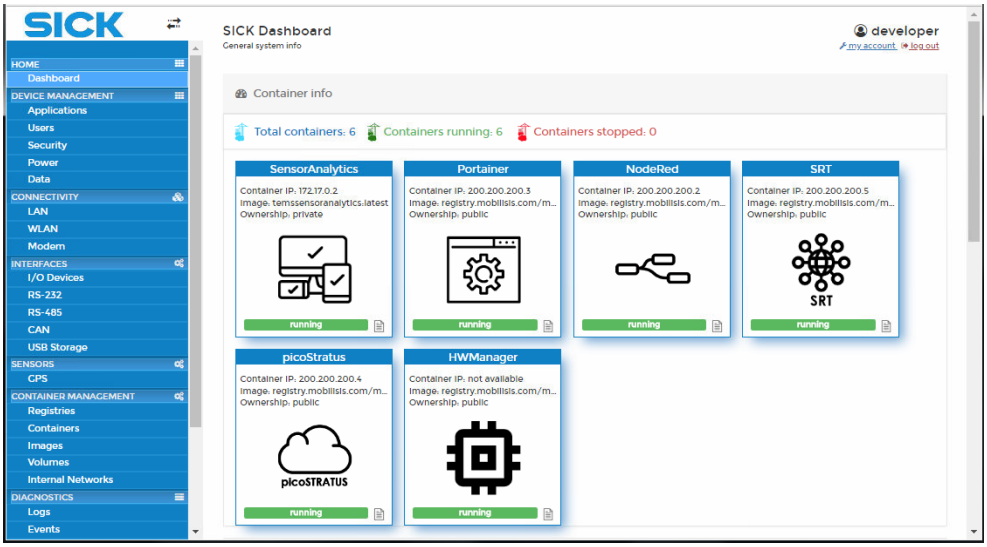


- Select a name for the container in the **Name** field, e.g., *SensorAnalytics*.
- In the **Image configuration** area, enter the exact name of the uploaded image and append the suffix *:latest* to this name, e.g., *temssensoranalytics:latest*.
- In the **Actions** area, click on **Deploy the container**.

You will receive a message if the container has been created successfully. The container will appear in the list of containers. It will be started automatically.



Dashboard The container is displayed in the dashboard together with the uploaded application.



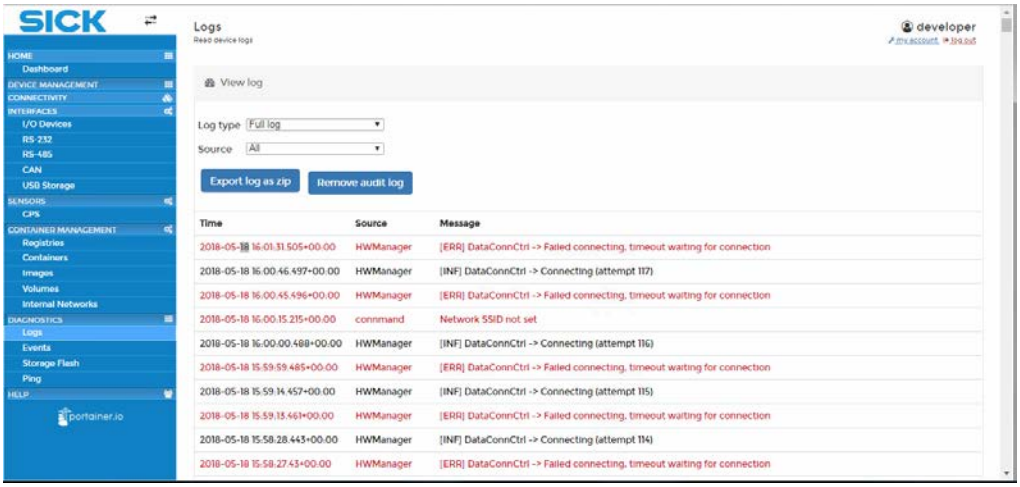
6.9 Fault diagnosis

6.9.1 Logs

All actions executed by the TDC-E are logged. The logs consist of audit logs (which are stored permanently) and general logs (which only remain in the memory bank until the next restart operation is performed).

In the event of errors, First Level Support can use the log as the basis for troubleshooting.

- In the tree, click on **DIAGNOSTICS → Logs**.
- Select the log type via the **Log type** field.
- Narrow the log down to the relevant TDC-E component via **Source**.



Note Audit logs contain information about logins to TDC-E Device Manager and about configuration changes.

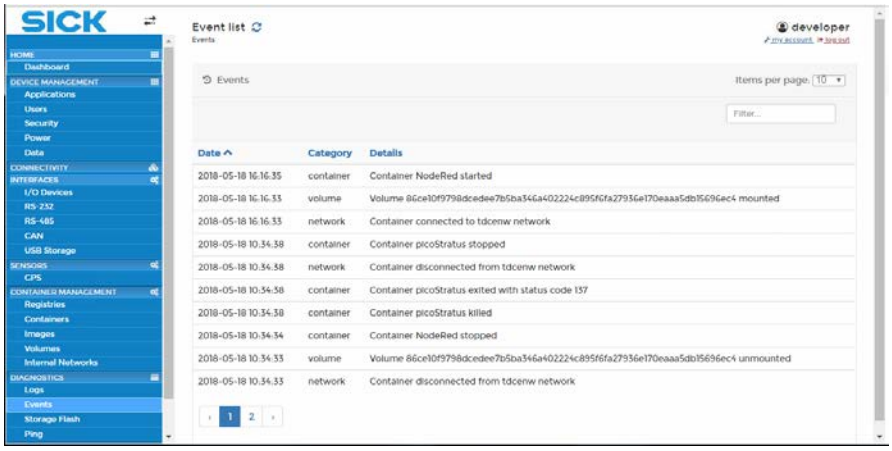
- To export a log, click on **Export log as zip**.
- To delete a log, click on **Remove audit log**.

Note You can only perform the delete operation if you are logged in with the **Developer** user role.

6.9.2 Events

Events are used to log actions involving Docker containers.

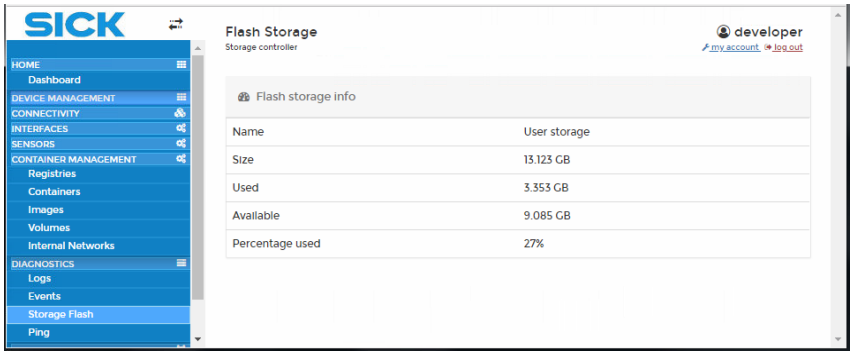
► In the tree, click on **DIAGNOSTICS → Events**.



6.9.3 Displaying the available storage space

TDC-E Device Manager tells you how much internal storage space is available.

► In the tree, click on **DIAGNOSTICS → Storage Flash**.



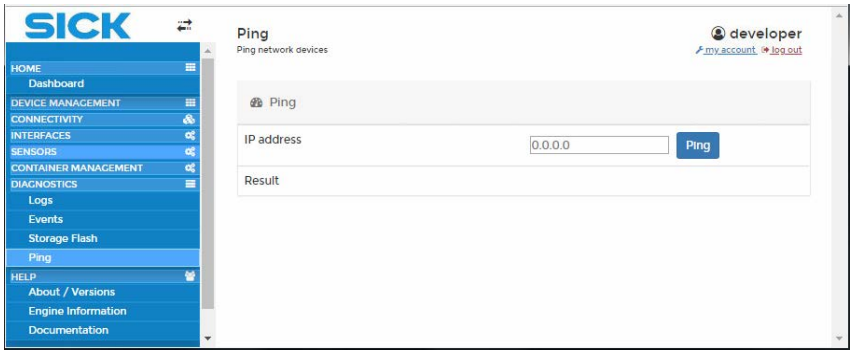
6.9.4 Checking the network connection

TDC-E Device Manager has a ping function for testing the network connectivity of TDC-E devices. You can use it to check the availability of all the devices that are connected to the TDC-E via Ethernet.

► In the tree, click on **DIAGNOSTICS → Ping**.

► Enter the IP address of the device that is connected to the TDC-E.

► Click on **Ping**.



7 Configuring the data connections

7.1 Using the HWManager API

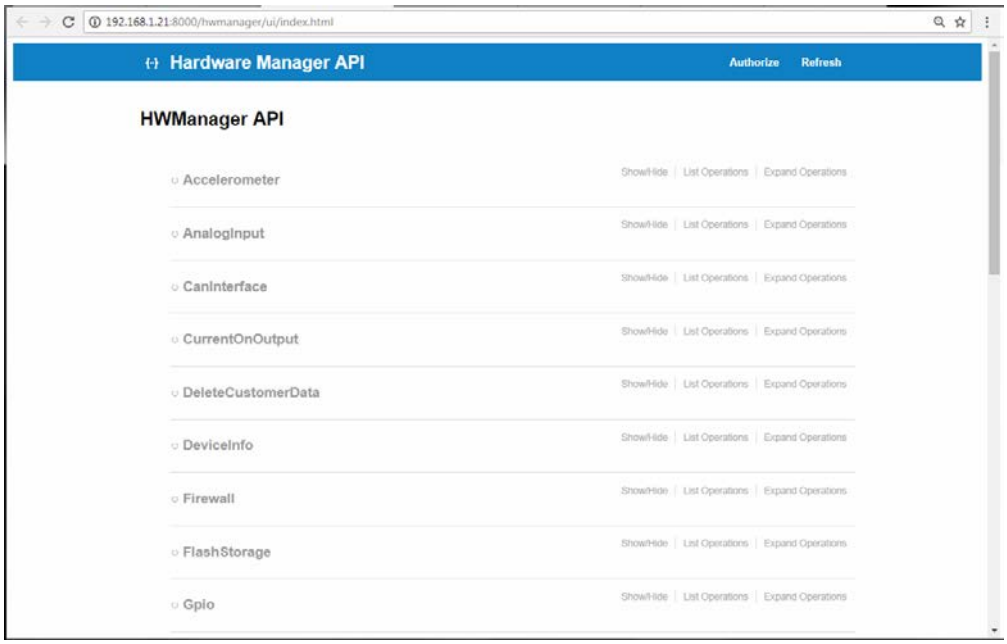
The HWManager application service is preinstalled in TDC-E Device Manager and provides a REST API for interacting with the TDC-E. The URL requests in JSON format can be copied to the clipboard and utilized in user-defined containers. The requests are automatically converted into the language of Node-RED as well. They can be imported into Node-RED for the purpose of modeling data flows.

Example In the example below, we are going to generate a JSON structure that retrieves the current status of the I/O interfaces.

Calling up the documentation for the HWManager API

- On the dashboard, click on the **HWManager** container.
- In the tree, select **HELP → Documentation**. Then click on **Hardware Manager API → Open**.

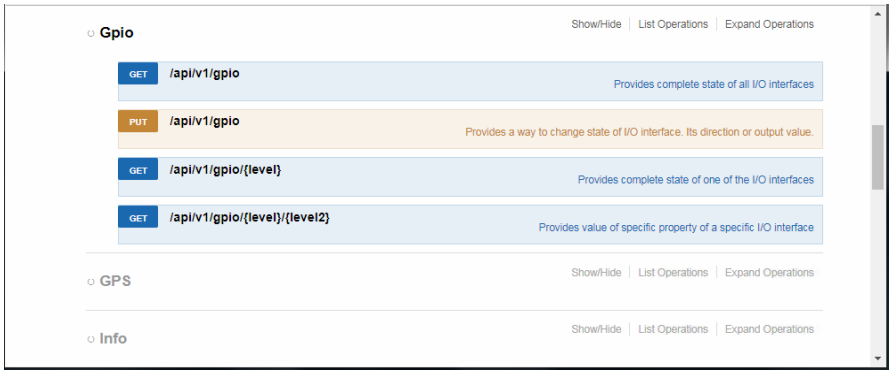
The list contains all the interfaces that you can address in the TDC-E. You can use these interfaces to retrieve TDC-E device data as well as data from the internal and external sensors.



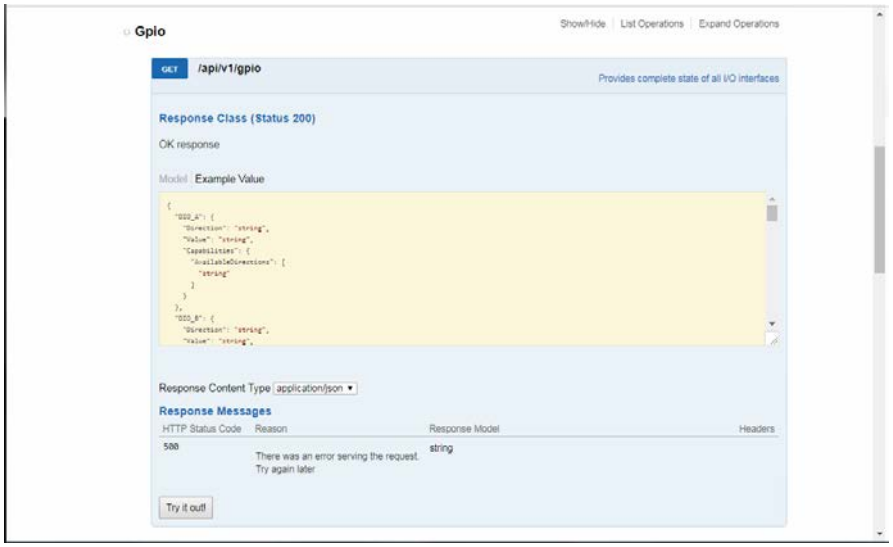
Note Before the HWManager API can be used, authentication and authorization usually have to be completed using the same user data as in TDC-E Device Manager. However, authentication and authorization are not required for the majority of GET requests.

Selecting a GET request

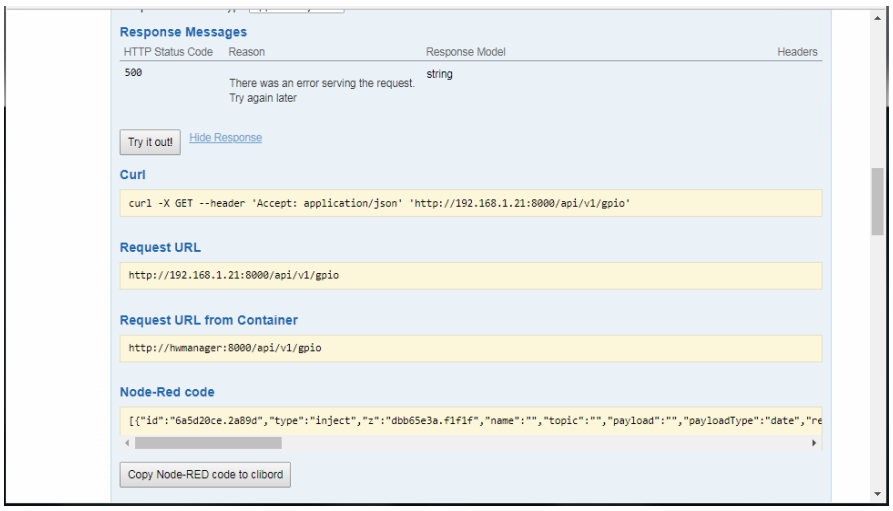
▶ To gain access to the GPIO interfaces in the list, click on **Gpio**.



▶ Open the desired GET request. To do this, click on **Get** or the explanatory text.



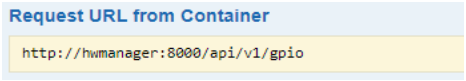
▶ In the **Response Messages** area, click on **Try it out**. The response to the GET request is output in JSON format.



Using the URL request for customer applications

In customer-specific applications, you should use the URL requested from the container for the generated HTTP REST API request.

► Copy the URL from **Request URL from Container** to the clipboard.



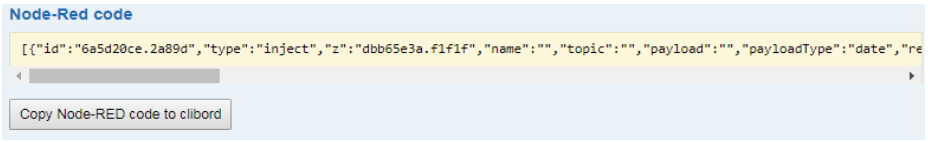
Note For security reasons (firewall), HWManager does not use the external IP address. Instead, it relies exclusively on the local one, which is *http://hwmanager:8080/api/v1/gpio* in this example.

Using a request in Node-RED

Use the Node-RED code derived from the HTTP REST request for data retrieval in Node-RED.

► Click on the **Copy Node-RED code to clipboard** button.

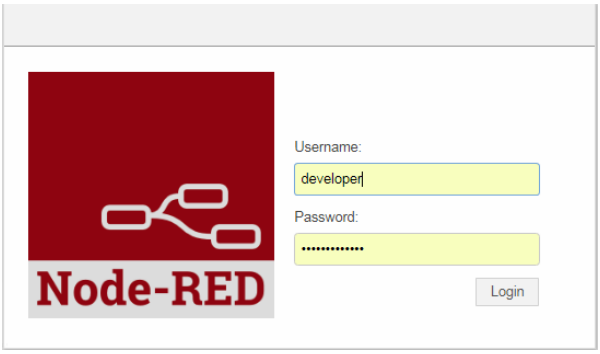
The Node-RED code will be copied to the clipboard. From here, it can be imported into a Node-RED flow (see below).



7.2 Configuring data transmission with Node-RED

7.2.1 Starting Node-RED

- On the dashboard, click on the **Node-RED** container.
- For security reasons, Node-RED requires the user to log in again. Authentication and authorization are carried out using the same user data as in TDC-E Device Manager.

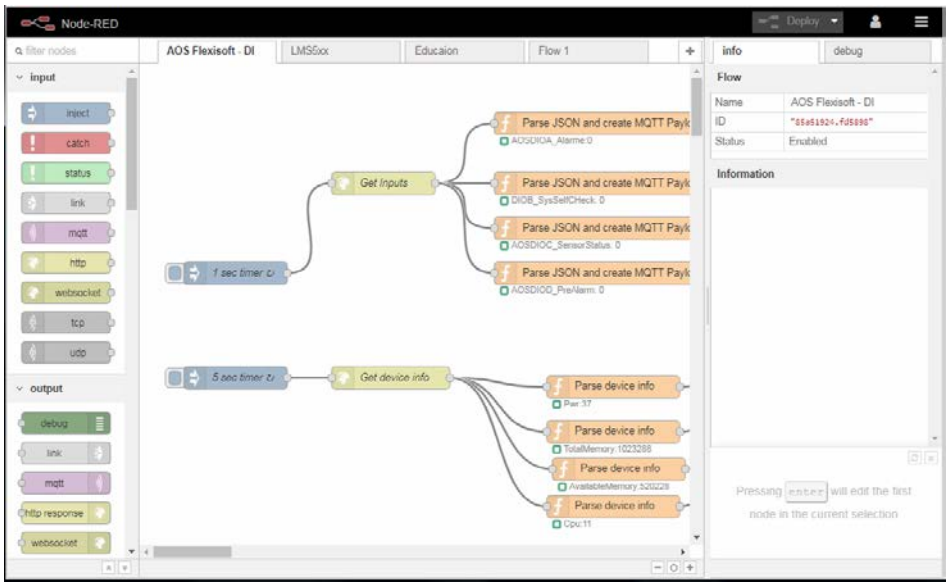


Note Node-RED has its own user management system, which is not synchronized with the one in TDC-E Device Manager/HWManager. The default users from TDC-E Device Manager (client, service, developer) have already been set up for you in Node-RED. Any additional Node-RED users must be created manually using the Node-RED user management system.

- Confirm your login data with **Login**. Node-RED starts in a new browser tab. The most recently configured flow is displayed.

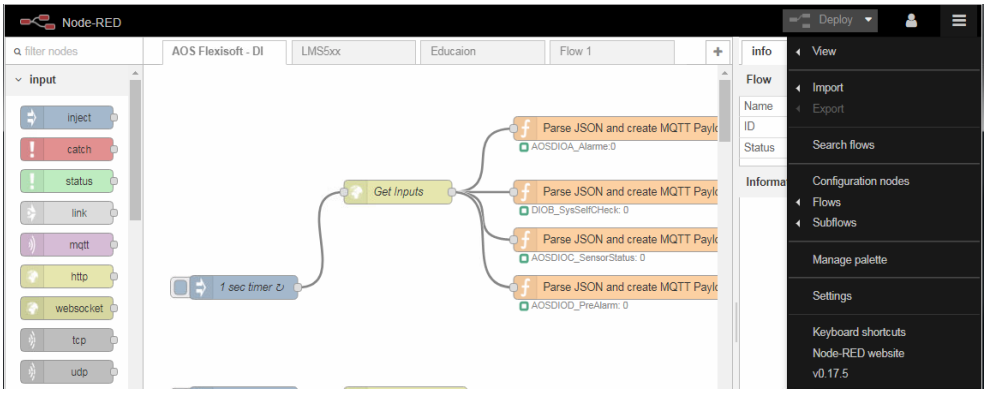
The left-hand area of the window contains a list of process nodes. You can drag and drop these to the central area, where they can be used to model data flows. The area on the right provides detailed information about the individual process nodes.

The flows are shown in the central area in the form of tabs.



Opening the menu

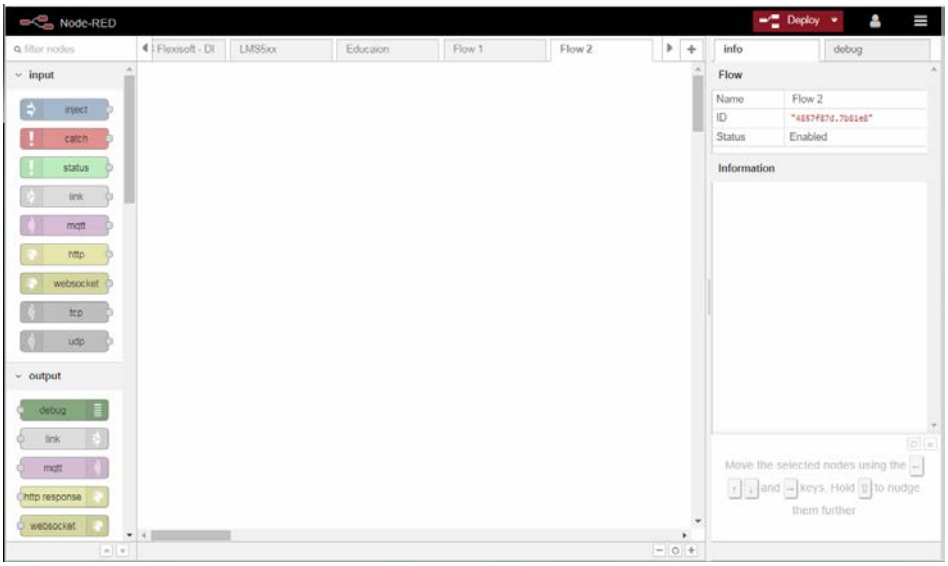
▶ Click on the contents icon in the menu bar at the top of the screen. This opens the menu containing the Node-RED functions.



7.2.2 Generating a flow from the HTTP requested in the HWManager API

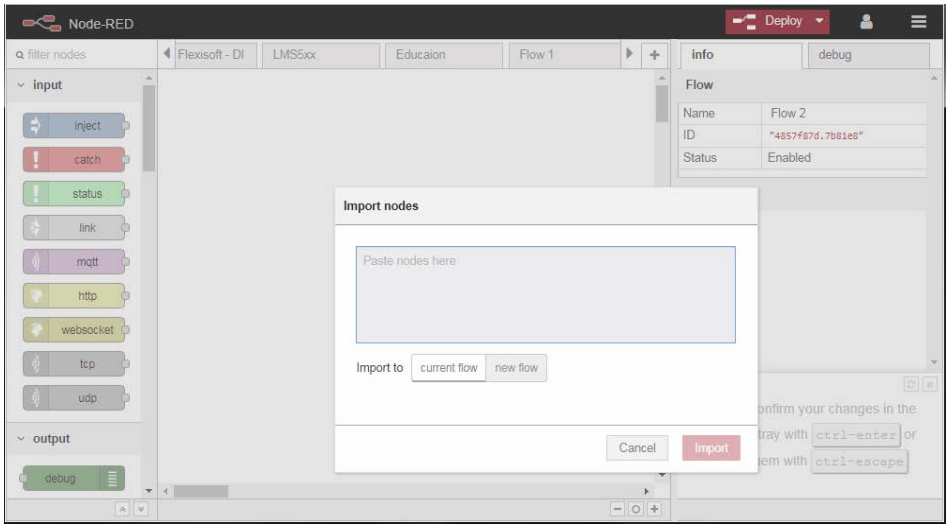
The following example shows how to generate a Node-RED data flow using a JSON structure from the HWManager API.

▶ Click on the plus icon in the tab bar. A new flow is created.

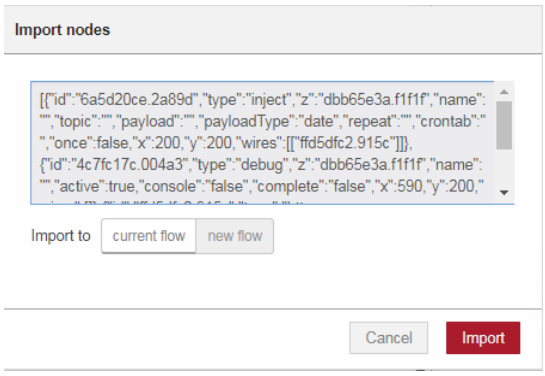


Note To change the name of a flow, double-click on the relevant tab.

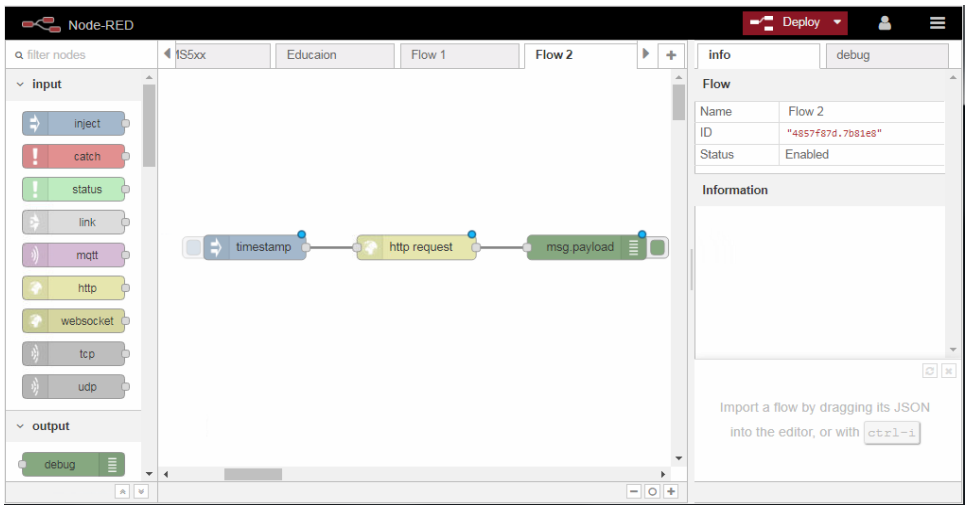
▶ Click on the contents icon and select **Import → Clipboard** from the menu.



▶ Paste the code into the **Import nodes** window from the clipboard.



▶ Click on **Import**. The code will be imported into the flow and will appear on the graphical user interface within an appropriate Node-RED data flow.

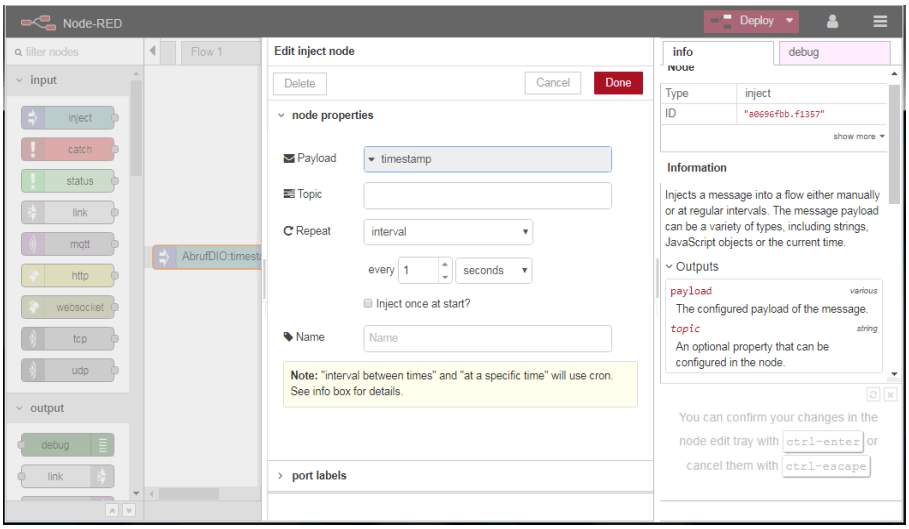


7.2.3 Activating and deploying a flow

The flow is edited by double-clicking on the individual nodes and then deployed.

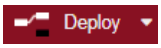
Activating data retrieval

- In the example, double-click on the **timestamp** node and activate data retrieval from the I/O interfaces.
- Use the **Repeat** box to define the retrieval interval.

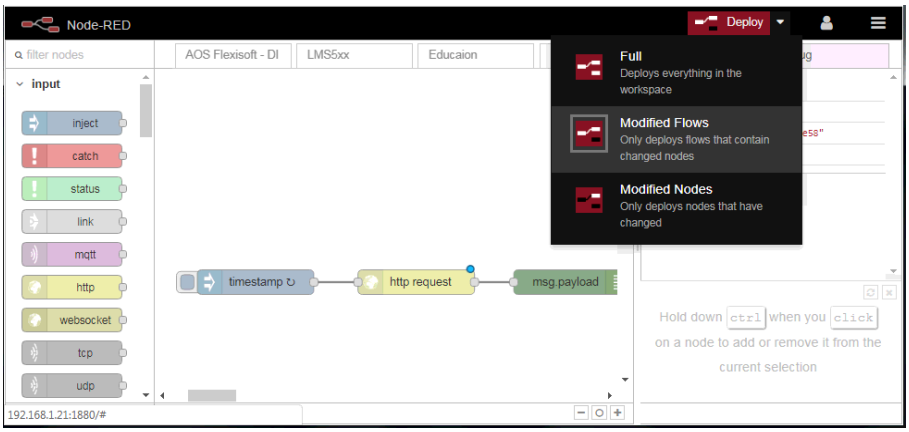


- In the **Name** field, adjust the name of the node according to how you want it to be displayed in the Node-RED data flow.
- Confirm your entries by clicking on **Done**.

Deployment

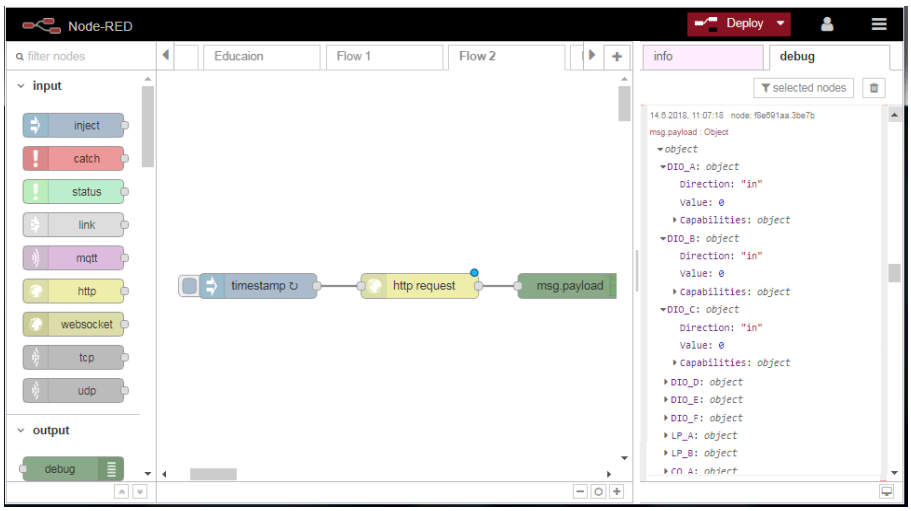


- Click on **Deploy** in the toolbar and select **Modified Flows**.



Displaying received messages

- In the info area on the right, switch to the **debug** tab.
- Where applicable, use the **selected nodes** field to narrow the messages down to a specific flow.

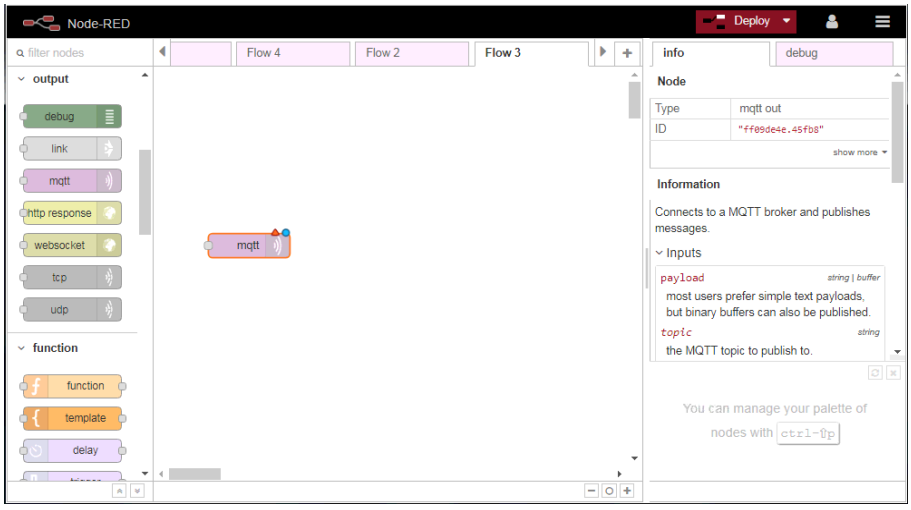


7.2.4 Configuring the MQTT interface in Node-RED

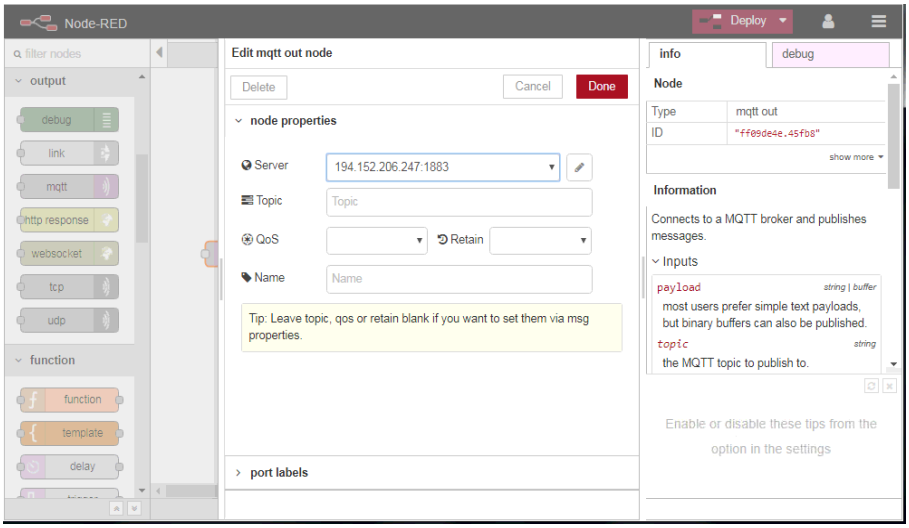
If data from Node-RED requests are to be output to a customer server, you must configure the MQTT interface in Node-RED.

Note If you wish to use the SICK cloud, the MQTT interface is configured automatically and so you do not need to do anything.

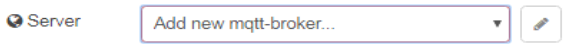
- Click the plus icon to create a new flow.
- Go to the process nodes listed under **output** and drag the node called **mqtt** into the central area.



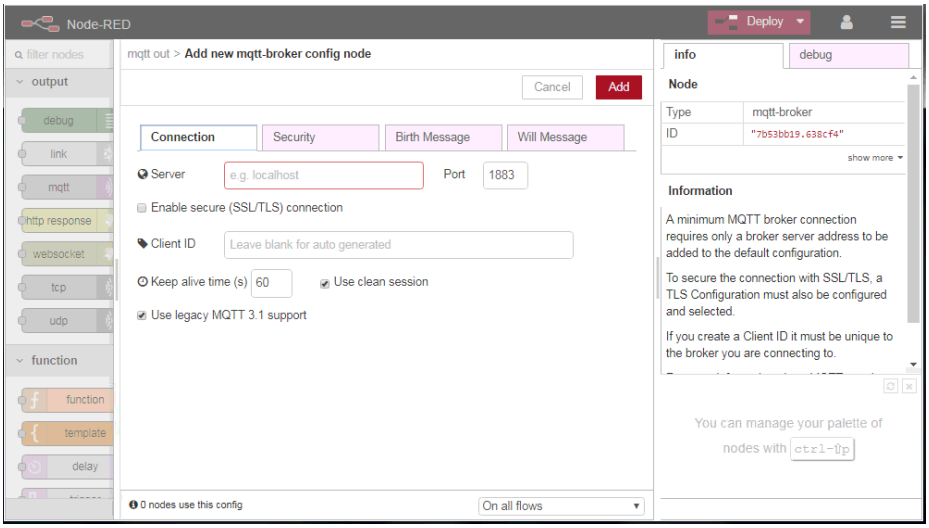
- Double-click on the node to open the editing window.



- Click inside the **Server** field and select the **Add new mqtt-broker** entry.



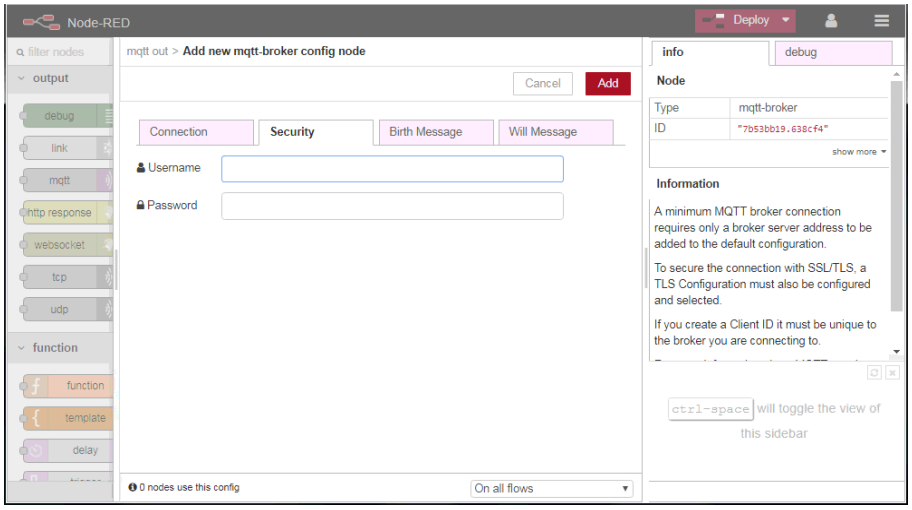
- Click on the pencil icon.



- Use the **Connection** tab to enter the MQTT access data to enable access from a customer server.

  To do this, enter the IP address in the **Server** field and then the port of the MQTT broker that is installed on the customer server.

- Switch to the **Security** tab and enter the username and password for logging into the MQTT broker.



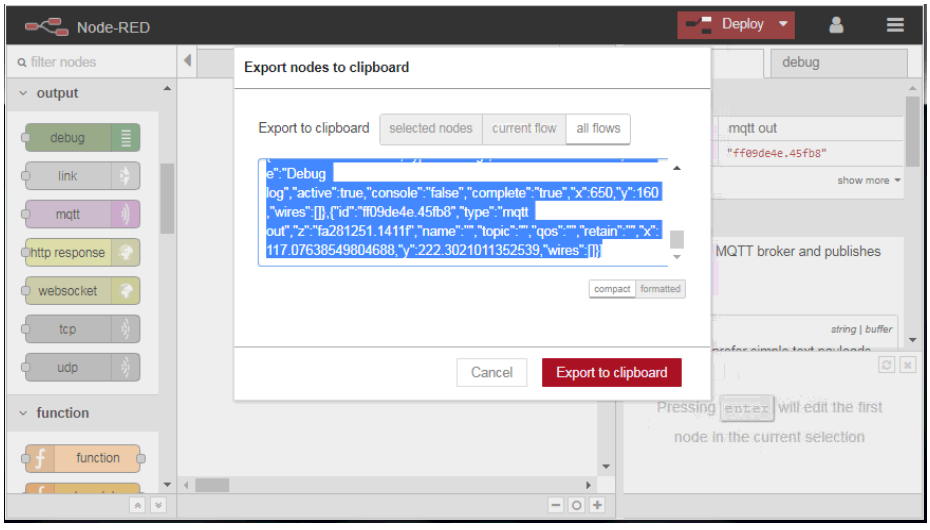
- Confirm your entries by clicking on **Done**.
- Deploy the flow.

7.2.5 Exporting Node-RED configurations

All the data flows that have been created in Node-RED can be exported to a text file. They can then be re-imported into the Node-RED application if required.

This process allows you to import the Node-RED configuration if a TDC-E component is replaced.

- Select any nodes in Node-RED to activate the export function.
- Click on the contents icon and select **Export → Clipboard** from the menu.
- In the window, click on **all flows**.



- Click on **Export to clipboard**. The code of all the created data flows will be copied to the clipboard.
- Paste the contents of the clipboard into a text file and save it.

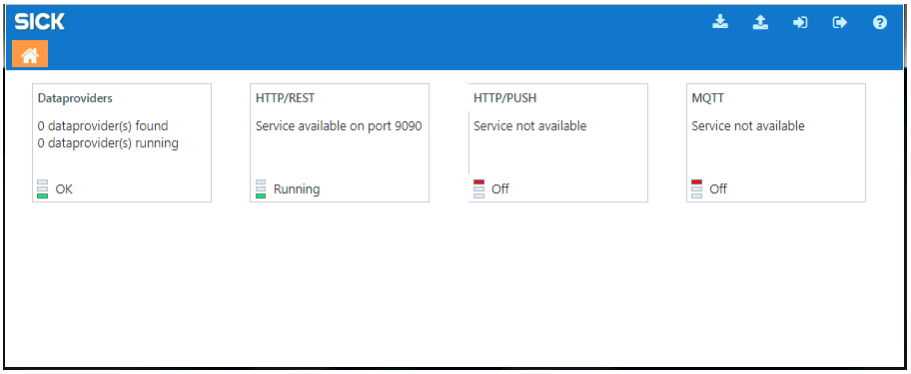
7.3 Configuring data transmission with picoStratus

7.3.1 Starting picoStratus

▶ On the dashboard, click on the **picoStratus** container. picoStratus will open in a separate browser tab.

All the SICK sensors that are connected and running will be displayed under **Dataproviders**. A data provider is described by its device driver. In the case of SICK sensors, this is the SOPAS device description file.

In this example, no sensors have been found yet.



7.3.2 Using SOPAS to export device driver files from sensors

The SOPAS device description files can be read out from the connected sensors with the SOPAS configuration tool and then imported into picoStratus.

Installing SOPAS

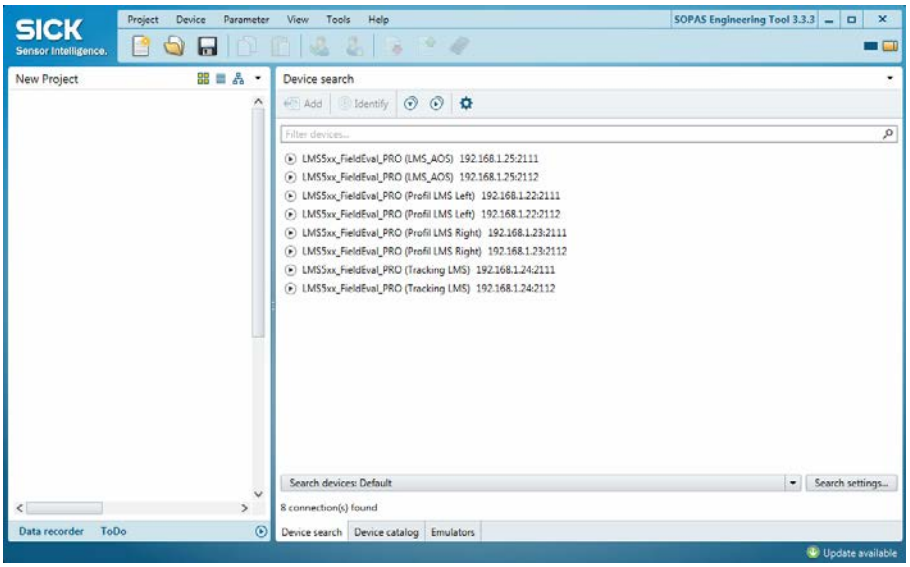
▶ Download the latest version of SOPAS ET from www.sick.com and install it on the computer that is connected to the TDC-E via Ethernet.

Starting the device search

▶ Start SOPAS via the desktop icon or the Windows Start menu.

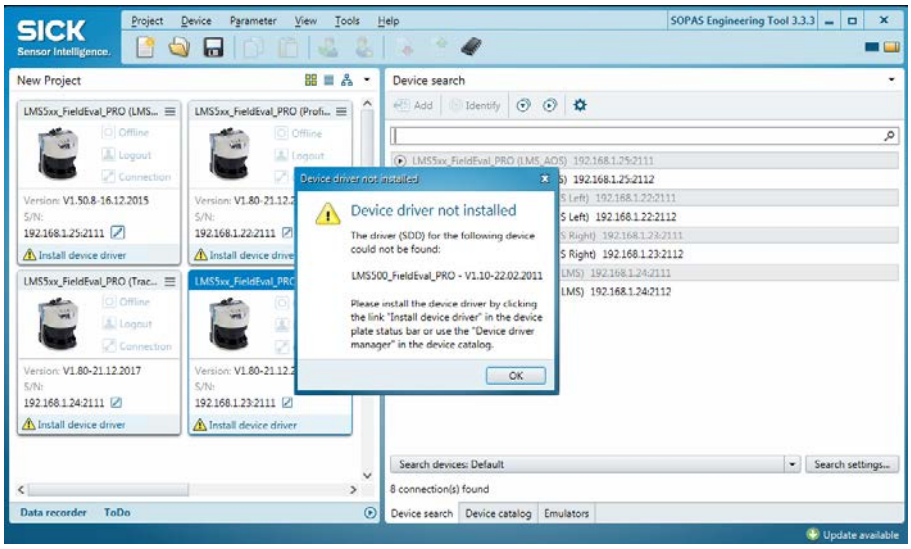
▶ A new **project** is automatically created in SOPAS. One or more sensors are combined and edited in a single project.

▶ Click on the **Search devices:Default** button to establish a connection to the physically connected sensors.

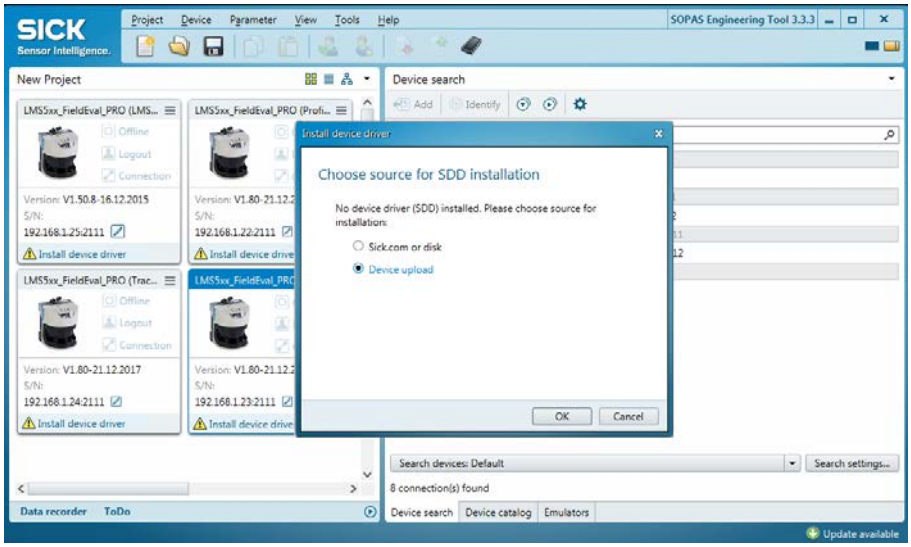


Transferring sensors into the SOPAS project

- In the list, select the sensors with port number **2111**.
- Click on **Add**. The sensors are transferred to the project, where they are displayed as tiles.
- A message window will appear to inform you that the device drivers for the sensors are not yet known in the SOPAS project.

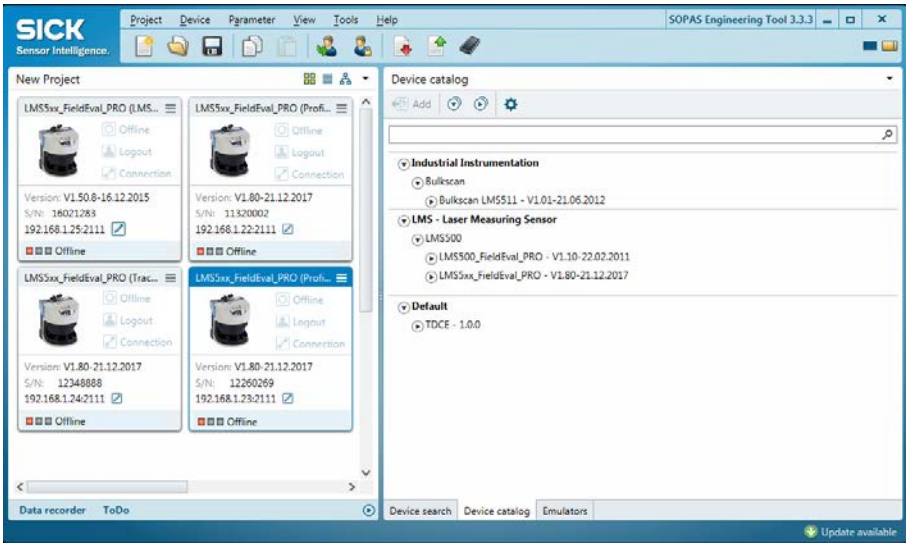


- Confirm the message with **OK**.
- On the relevant tile, click **Install device driver** and then install the device driver in SOPAS by selecting the **Device upload** option.

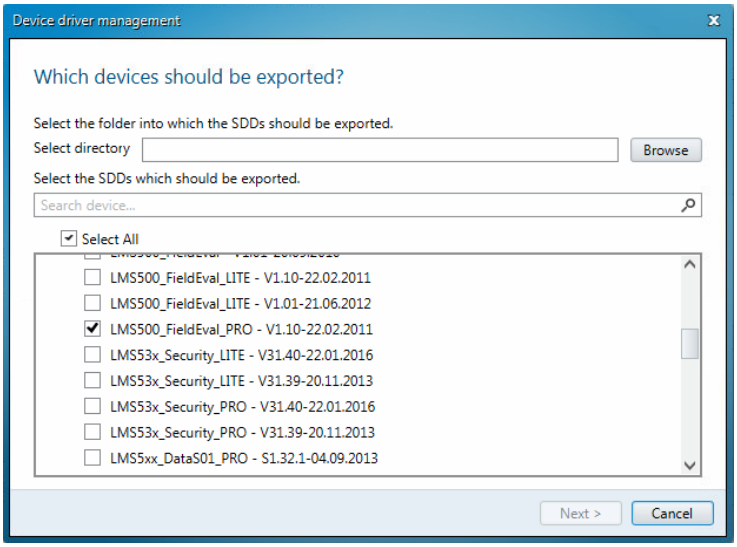


Exporting drivers from sensors

▶ Switch to the **Device catalog** tab on the right-hand side.

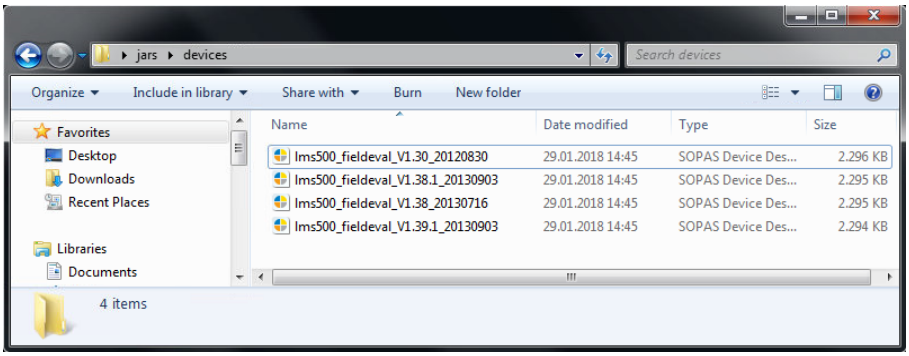


▶ Right-click on the sensor and select the **Export** entry from the context menu.



▶ Select the export directory and then perform the export by clicking on **Next** and **Finish**.

▶ The device driver files will be saved in the specified directory.

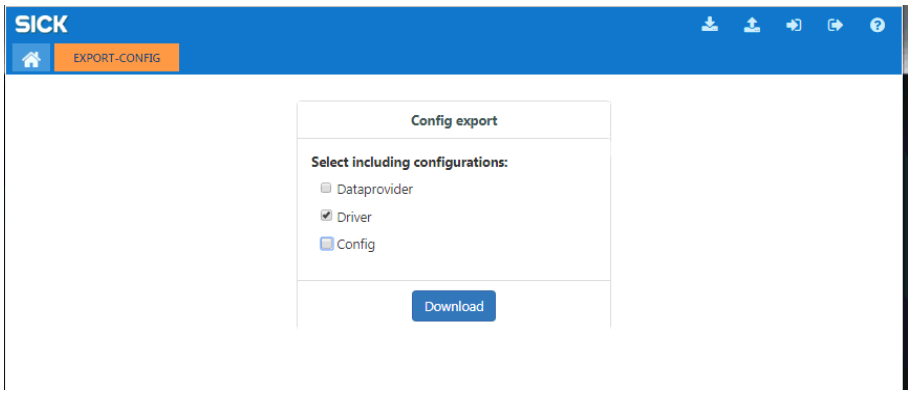


7.3.3 Entering the IP addresses in manualIP.txt

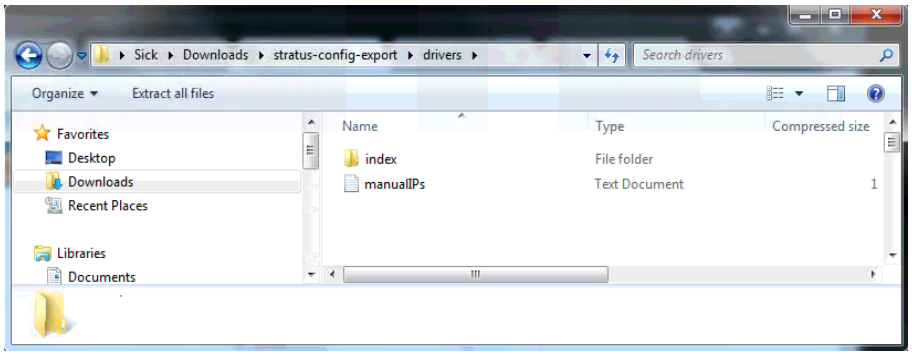
A txt file is also required to import the device driver files into picoStratus. In this txt file, you must enter the IP addresses of the sensors from SICK that are connected via Ethernet.

This txt file already exists in picoStratus. You need to export it from picoStratus in order to enter the IP addresses manually. Once you have added the IP addresses of the sensors, you then have to re-import it into picoStratus together with the device driver files.

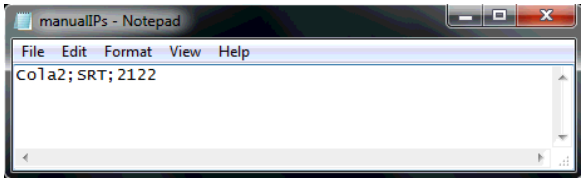
- Click on the Export icon in the picoStratus toolbar.



- Choose the **Driver** option.
- Click on **Download**. The txt file is placed inside the computer's Downloads directory, where it can be found under **\drivers** inside the **stratus-config-export.zip** zip file.

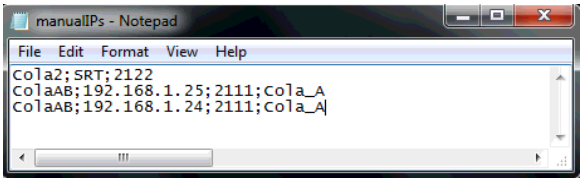


- Open the **manualIPs.txt** file in the editor.
- Do not change the first line, which reads *Cola2; SRT;2122*. These details are needed to search for a TDC-E SRT container instance, i.e., for Cola2 on port 2122.



- Enter the IP addresses of the sensors from which data are to be retrieved using the TDC-E.

  SICK sensors address the ColaA dialect on port 2111. This means that *ColaAB;192.168.1.1;2111;Cola_A* must be added to the *manualIPs.txt* file for a sensor with the IP address 192.168.1.24.

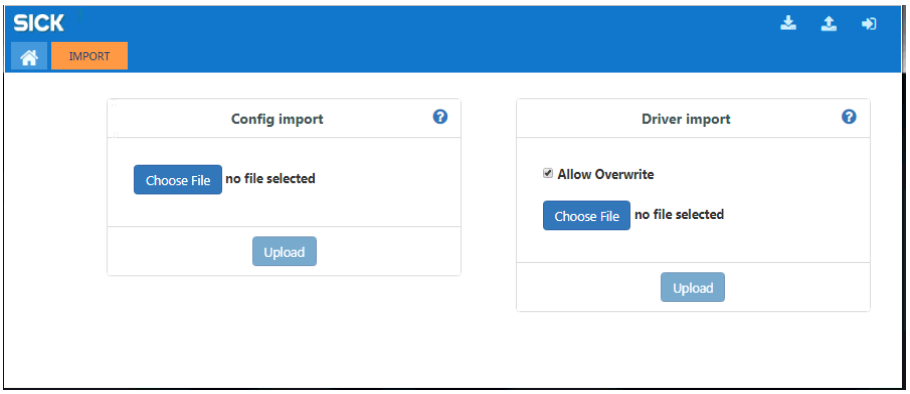


- Save the txt file.

7.3.4 Importing device drivers and IP addresses into picoStratus

The next step is to import the device driver files and the text file containing the IP addresses into picoStratus.

- Click on the Import icon in the toolbar.
- Check the **Allow Overwrite** box so that the default *manualIPs.txt* text file in picoStratus will be overwritten.

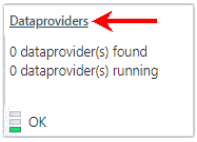


- In the **Driver import** area, click on **Choose File** and upload the files in the **stratus-config-export** zip file.

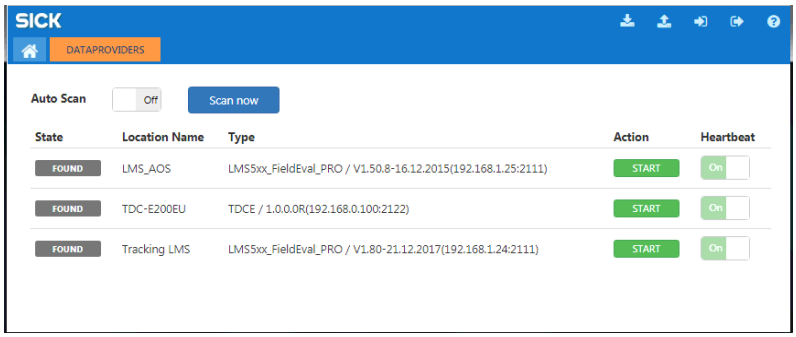
7.3.5 Scanning the sensors

Once the device drivers and the *manualIPs.txt* file have been imported, a data provider scan must be performed.

- Click on the Home icon to switch back to the picoStratus homepage.



- Click on **Dataproviders**.
- On the **DATAPROVIDERS** tab, click on **Scan now**.



The scanning process can last up to two minutes (depending on the search space). It will then take another 20 s or so for the sensors and the TDC-E to appear on the **DATAPROVIDERS** tab.

- Activate the sensors. To do this, click on **START** under **Action**.

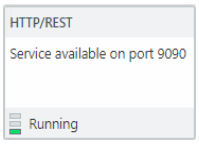
Note

- Leave the **Auto Scan** option deactivated because it places heavy demands on the TDC-E.

7.3.6 Activating the HTTP REST interface

Before sensor data can be retrieved from picoStratus via the HTTP REST interface, you must enable access accordingly.

- ▶ Click on the Home icon to switch back to the picoStratus homepage.



- ▶ Click on **HTTP/REST**.
- ▶ Set the **HTTP/Rest interface** switch to **ON**. A list of available data providers appears together with the URLs for retrieving the data.

- ▶ Click on a URL. The HTTP-REST API is displayed for the default SOPAS variables. These are the same for all SOPAS devices.

The following call returns the firmware version of the sensor:

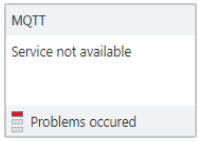
Note In order to retrieve sensor data correctly, picoStratus requires a **mapping file** for each sensor. These files have to be requested from SICK Service. When requesting them, you must specify which parameters, variables, and events are to be read out. Once the mapping files have been created by SICK Service, they can be imported into picoStratus.

7.3.7 Configuring the MQTT interface in picoStratus

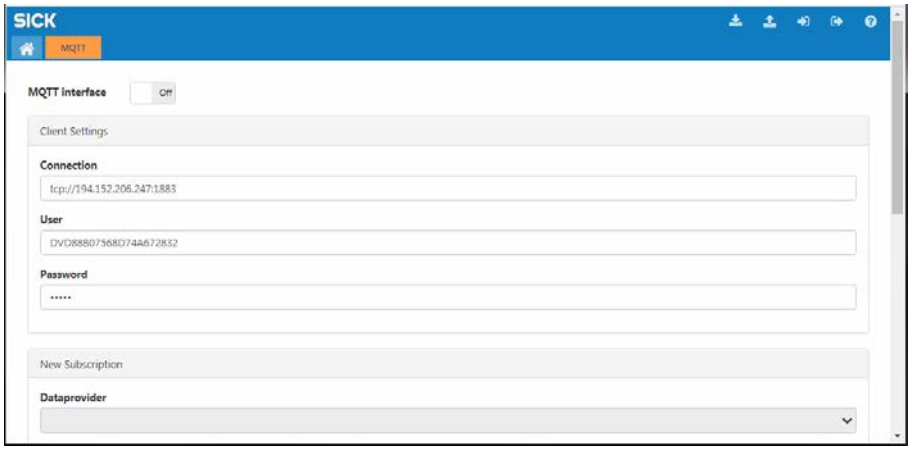
Before sensor data can be retrieved using the MQTT data protocol, you must enable access to the MQTT interface.

The following example demonstrates the procedure for retrieving a sensor's serial number via MQTT.

▶ Click on the Home icon to switch back to the picoStratus homepage.



▶ Click on **MQTT**.



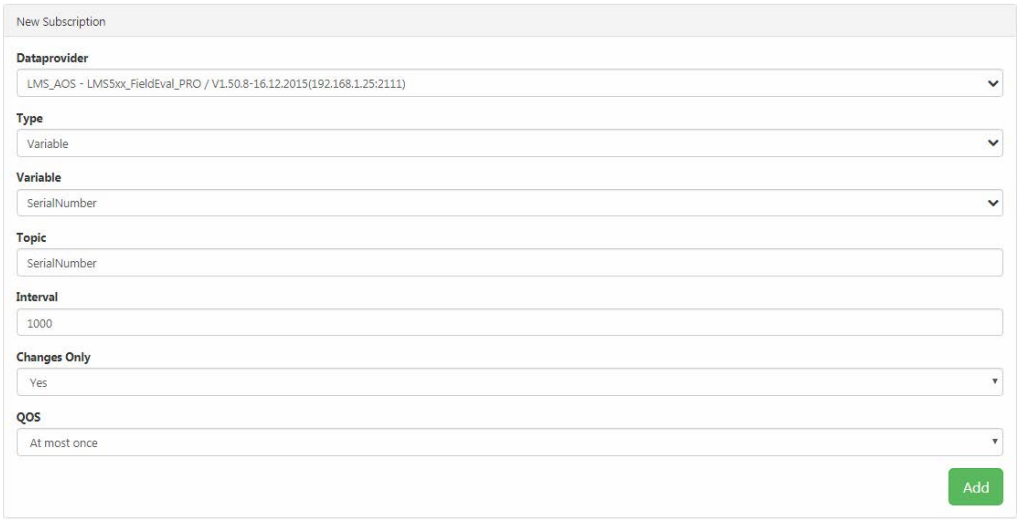
▶ Set the **MQTT interface** switch to **ON**.

Client settings

In the **Client Settings** area, you must enter the MQTT access data to enable access from a customer server.

1. In the **Connection** field, enter the IP address and port of the MQTT broker that is installed on the customer server.
2. Enter the username and password for logging into the MQTT broker.

Selecting a sensor



▶ Under **Dataprovider** in the **New Subscription** area, select the sensor whose data are to be accessed.

▶ Select the **Variable** entry in the **Type** field and then select **SerialNumber** from the list of variables.

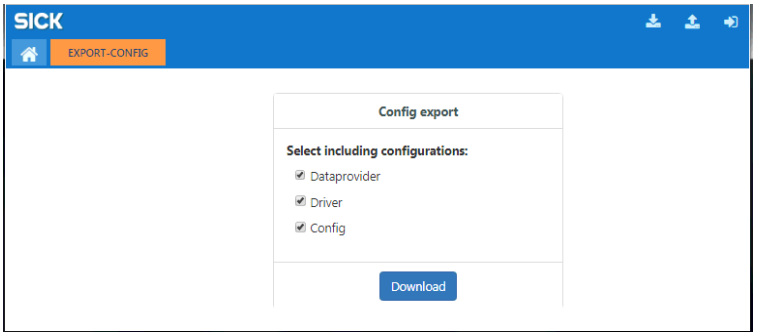
- In the **Topic** field, specify the name of the topic that is to be used for subscribing to the MQTT message on the broker.
- Complete the process by clicking on **Add**. The subscription for the **SerialNumber** topic is listed in the **Current Subscriptions** area.

7.3.8 Exporting the picoStratus configuration

All the variables, events, and methods that have been created in PicoStratus can be exported to a zip file and subsequently re-imported if necessary.

This process allows you to import the picoStratus configuration if a TDC-E component is replaced.

- Click on the Export icon in the toolbar.



- Select the **Dataprovider**, **Driver**, and **Config** options.
- Click on **Download**. The **stratus-config-export.zip** zip file now contains three directories called **cfg**, **dataprovider**, and **drivers**, which have the relevant files inside them.

8 Monitoring

8.1 Setting up a customer account for the SICK online portal

Before you can use the SICK online portal and log into it, you must first register with SICK. There are several stages to the registration process:

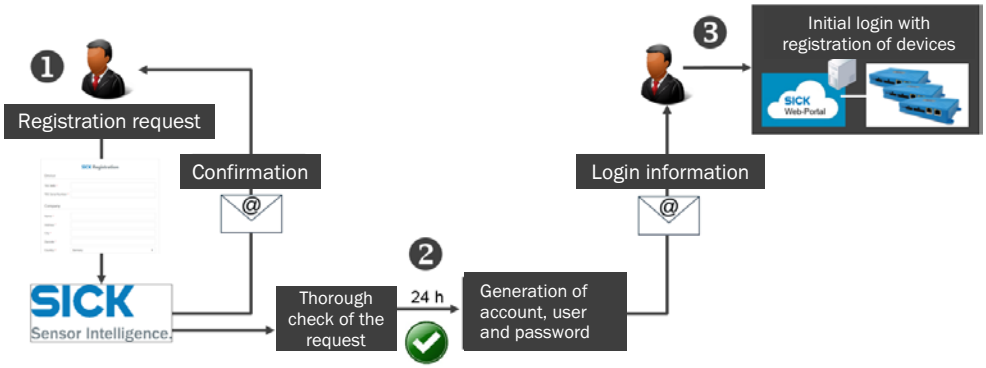


Fig. 31: Setting up a customer account for the SICK online portal (flowchart)

1. You request a new customer account. When registering, you must specify one of the TDC-E devices that you have purchased plus the name of your company and the username.

   You will receive a confirmation e-mail right away to tell you that your access will be set up within the next 24 hours.
2. Once the customer account has been set up on the SICK site, you will receive another confirmation e-mail containing the login credentials for the new account.
3. Log into the SICK online portal for the first time and register all the TDC-E devices that you have purchased.

8.1.1 Requesting a customer account

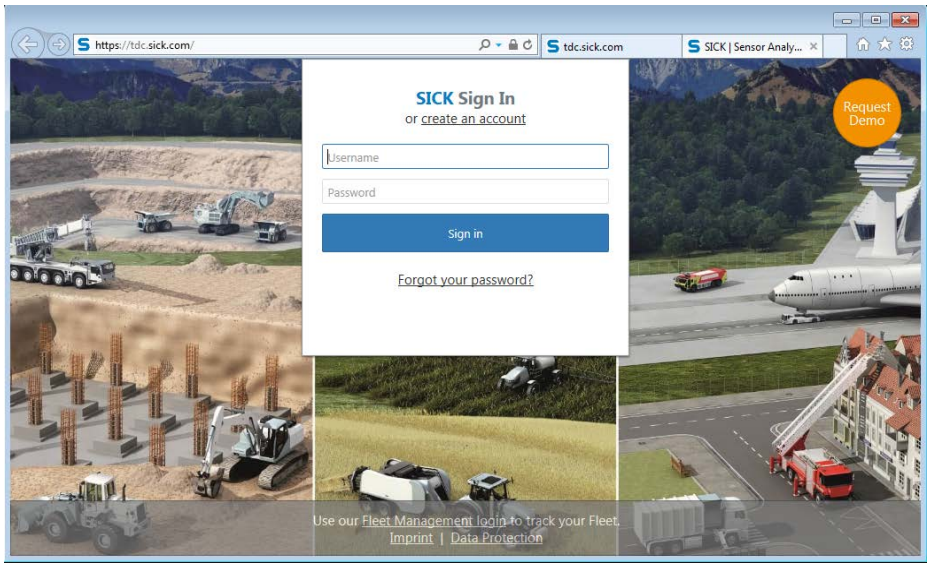
The first step is to request a new customer account via the SICK online portal.

Getting started

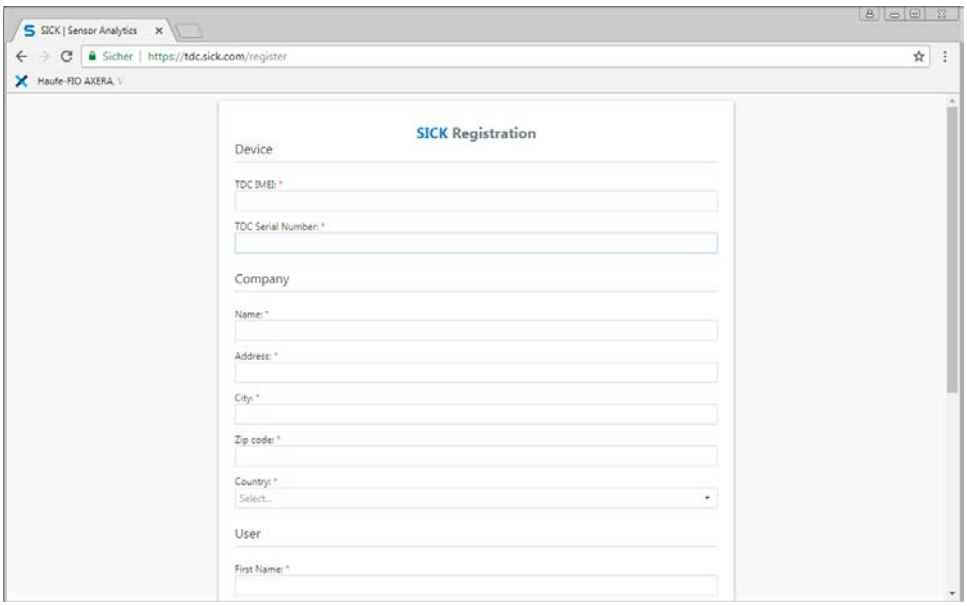
▶ Start the registration process by entering the following URL in your browser:

https://tdc.sick.com

The login window opens.



▶ Click on the **create an account** link. This will take you to the **SICK Registration** window.



Entering the device information

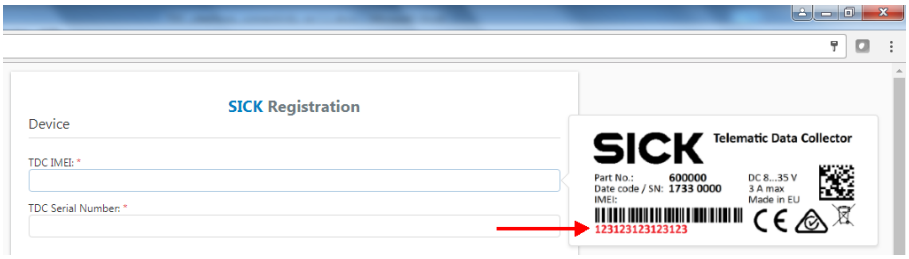
To request a customer account, you only have to register one device even if you have purchased several. The other devices will be entered via the SICK online portal at a later point.

▶ Under **Device**, enter the IMEI of one of the purchased TDC-E devices.

The IMEI is a unique number that identifies the device and is used to verify your status as a customer. When you exit the field, the IMEI is checked for correctness.

Tip

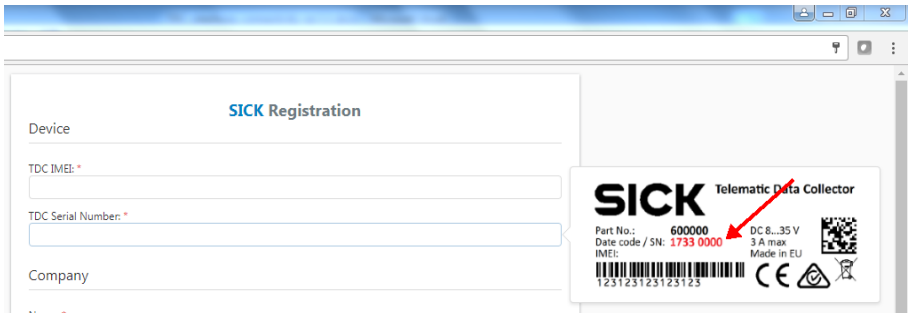
The IMEI can be found in your ordering information or on the type label. If you move your cursor over the field, an input help box will appear. The number highlighted in red font shows you where to find the IMEI on the type label.



The number shown in the box is merely an example. It is not a real IMEI.

▶ Under **TDC Serial Number**, enter the serial number of the TDC-E.

The serial number can be found on the type label. Once again, an input help box will appear if you move your cursor over the field.



Entering the company and user data

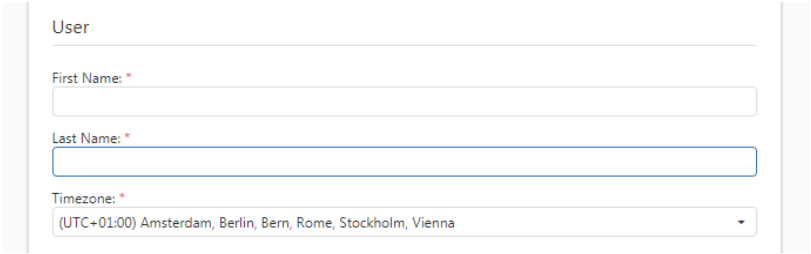
▶ Next, provide details of the company and user. The user that you specify here will be subsequently set up in the SICK online portal as the user with administrator rights.

Specifying the time zone

As a basic principle, the gateway system saves all measured values from the sensors in UTC. UTC stands for Universal Time Coordinated and offers a standardized system for calculating and stating the time anywhere in the world.

When UTC is used as the reference time, each time zone can be determined based on the extent to which it differs from another. The difference between a time zone and UTC is specified in the format: UTC +/- x hours.

The UTC time zone of the browser is preassigned to the field. In the example, this is **UTC+1.00 (Amsterdam, Berlin ...)**.



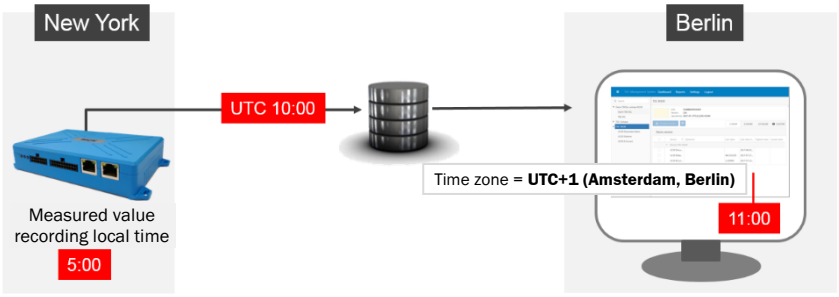
With this setting, an offset of UTC+1 hour (winter time) or UTC+2 hours (summer time) will be applied to all measured values that are displayed in analyses in the SICK online portal. If you were to select **UTC-5:00 Eastern Time (US & Canada)** as the time zone here, the offset would be UTC-5.

▶ Therefore, please consider carefully which local time you want your monitoring system to use when displaying sensor values. Then, change the suggested time zone accordingly.

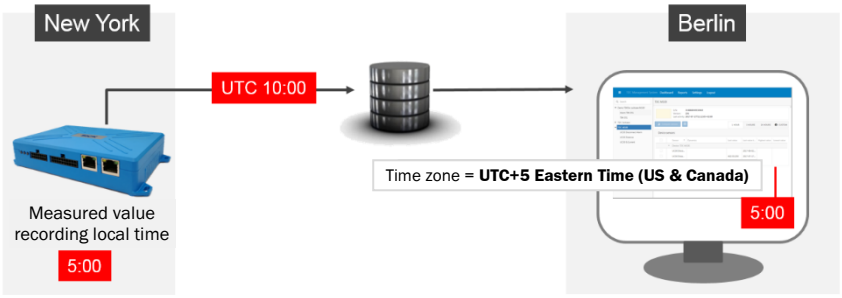
Example

A sensor detects a measured value in **New York** at 5 a.m. **local time**. The measured value is saved in UTC time, which is 10 a.m.

- For a user in Germany, a time stamp of 11 a.m. (UTC+1) is applied to the measured value in that user's analyses because the time zone for Germany is **UTC+1.00 (Amsterdam, Berlin ...)**.

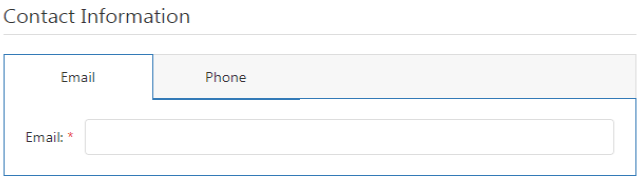


- However, if the user based in Germany always wants to see when the measured values were actually detected in New York according to local time there, the time zone must be changed to **UTC-5:00 Eastern Time (US & Canada)** accordingly.



Specifying contact information

▶ Under **Contact Information**, enter the e-mail address that is to receive the confirmation e-mail containing the login credentials.

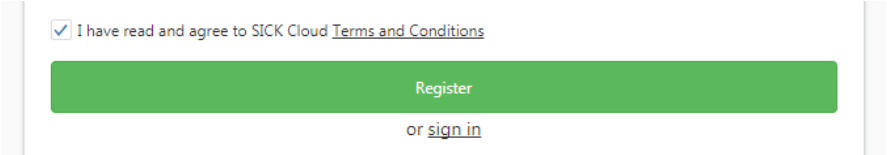


Note

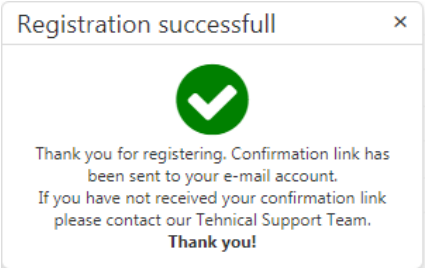
On the **Phone** tab, you can also enter two phone numbers.

Submitting your registration request

- Read and confirm the terms and conditions for the SICK cloud.
- Click on **Register**.



- If the IMEI you have entered matches a device that is known to have been ordered, the registration request will be submitted. You will see a message to this effect.



Confirmation e-mail

An automated confirmation e-mail is sent to the e-mail address specified on the registration form.

- Click the **Confirm** link included in this e-mail.

  You will see a message indicating that the registration request will be processed on the SICK website within the next 24 hours.

8.1.2 Notification of new customer account

If all the details are present and correct, the corresponding customer account will be created with a user and a password.

An automated e-mail containing the login credentials will be sent to the e-mail address specified on the registration form.

8.2 Configuring Sensor Analytics

Sensor Analytics is the central platform of the SICK online portal. It allows you to monitor the connected sensors from SICK on the basis of characteristic values. All the information from the connected sensors is prepared accordingly so that it includes a time stamp and GPS information.

To begin with, the management platform is empty. This means that you have to create one or more dashboards for your monitoring system. This involves specifying which sensor data are to be analyzed there on the basis of telemetry elements. The KPIs are displayed by means of widgets.

If you are using several TDC-E devices, the first step is to make them known to the management platform.

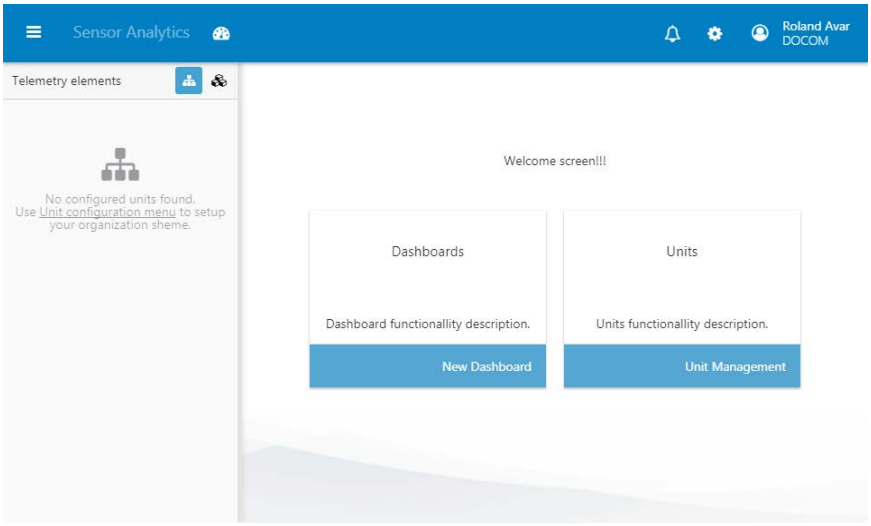
8.2.1 Logging into Sensor Analytics

Log into Sensor Analytics.

Getting started

- Enter the following URL in your browser: **https://tdc.sick.com**

  The login window opens.
- Enter the username and password that were sent to you via e-mail.
- Click on **Sign in**. The SICK online portal opens on the **Sensor Analytics** page.



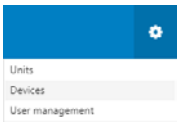
The menu bar at the top contains the main workspaces of the management platform. This bar remains visible in all working contexts.

The right-hand side of the menu bar shows the name of the logged-in user. The user icon allows you to display the user data and log out of Sensor Analytics.

8.2.2 Registering additional TDC-E devices

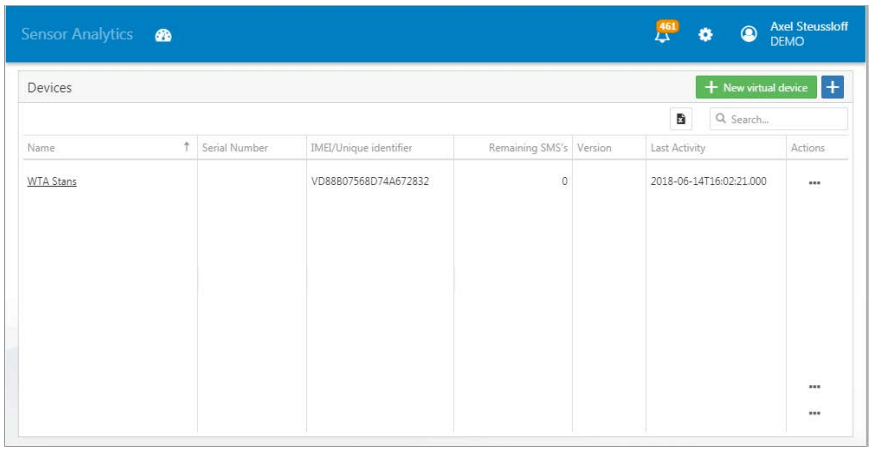
Only one TDC-E is currently registered on the Sensor Analytics platform. This is the device that you entered when creating the customer account (for further information on this, refer to *8.1 Setting up a customer account for the SICK online portal*).

If you have purchased additional TDC-E devices and want to monitor them via the platform, you will need to register these on the platform as well.

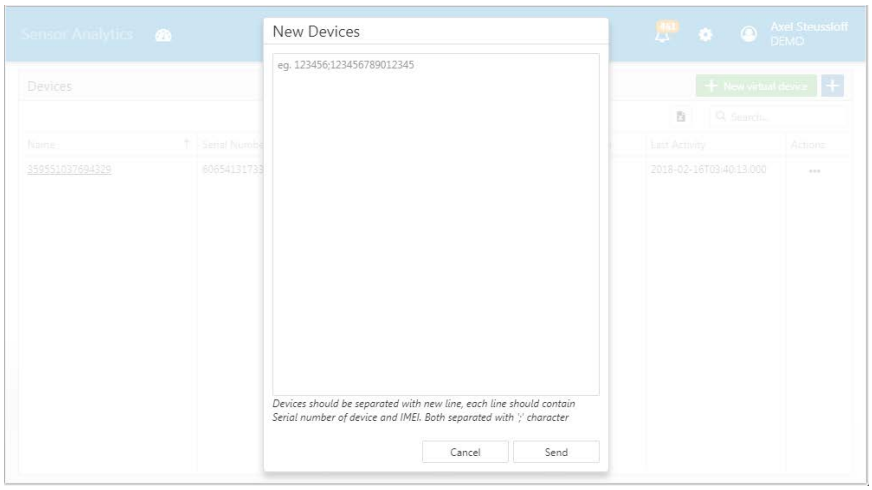


▶ In the menu bar, click on the gear icon and select the **Devices** entry.

The list of registered TDC-E devices opens. It will include the device that was entered at the registration stage (for further information on this, refer to chapter *8.1.1 Requesting a customer account*).



▶ Click on the plus icon in the window. The **New devices** window opens.



▶ Register the purchased TDC-E devices via their serial numbers and IMEI identifiers.

Tip

You do not need to enter the data manually. After making your purchase, you will have received an electronic document with a list of the serial numbers and IMEI identifiers for your purchased devices. For convenience, use this to enter the data.

▶ Copy and paste the entries from the list into the **New devices** window.

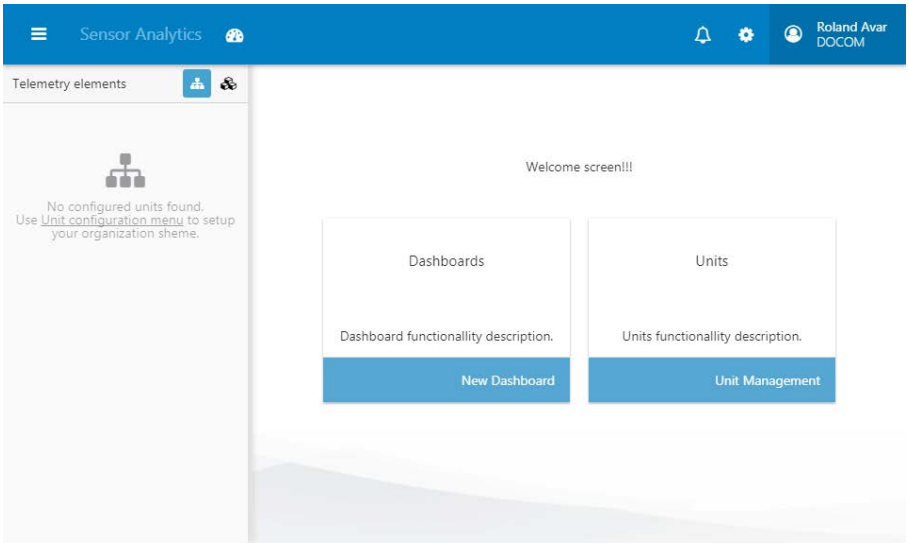
▶ Complete the device registration process by clicking on **Send**.

8.2.3 Configuring the dashboard

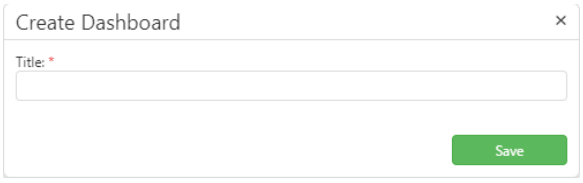
8.2.3.1 Creating a dashboard

Use the homepage of the Sensor Analytics platform to create a dashboard. In principle, you can also create several dashboards on the TDC platform.

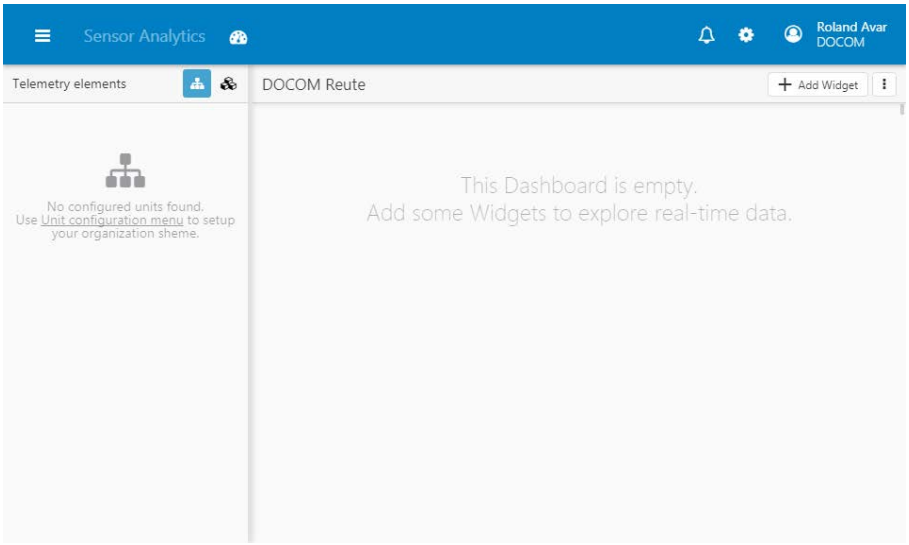
- ▶ Switch to the homepage. To do this, click on **Sensor Analytics** in the menu bar.



- ▶ In the **Dashboards** area, click on **New Dashboard**.



- ▶ Enter a meaningful name for the dashboard (e.g., the name of a TDC-E location).
- ▶ Click on **Save**. The dashboard will open but it will still be empty.



The dashboard layout is as follows:

- The left-hand side is where all the telemetry elements will be listed later on, i.e., the elements that you want to monitor and analyze on the dashboard.
- The right-hand side is where you define the contents of the monitoring system via specific widgets.

8.2.3.2 Creating telemetry elements

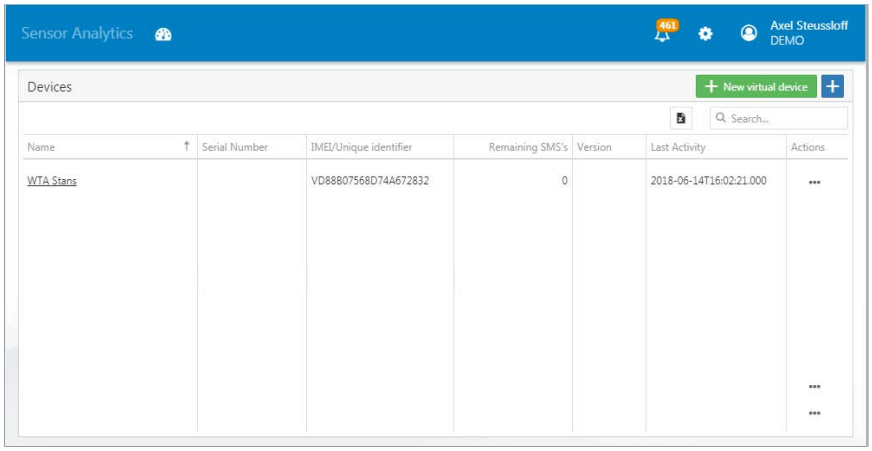
On the SICK online portal, the telemetry elements are the counterparts of the MQTT topics configured in Node-RED or picoStratus.

Each MQTT topic that is to be analyzed in the SICK cloud must be set up as a telemetry element in the cloud.

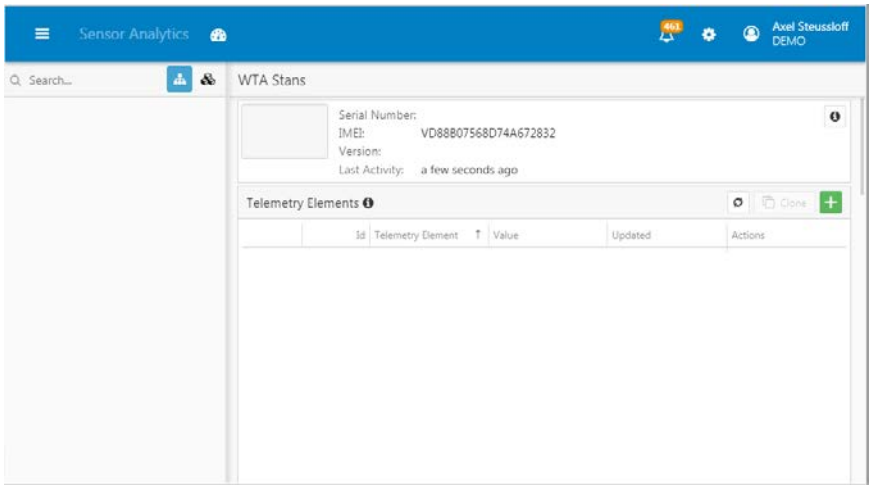
Note You can only create telemetry elements if you are logged in with Admin rights.

Creating a telemetry element

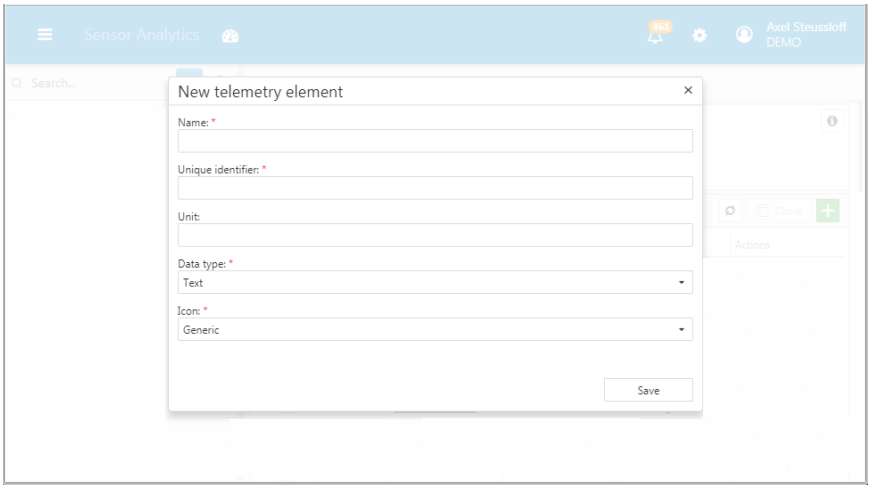
▶ In the menu bar, click on the gear icon and select the **Devices** entry.



▶ Open the TDC-E device by clicking on its name. So far, no telemetry elements have been defined in the cloud for the TDC-E device. The list is empty.



- Click on the plus icon. The **New telemetry element** window opens.

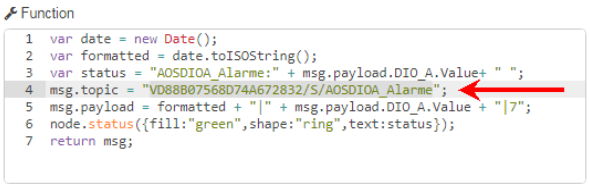


Configuring a telemetry element

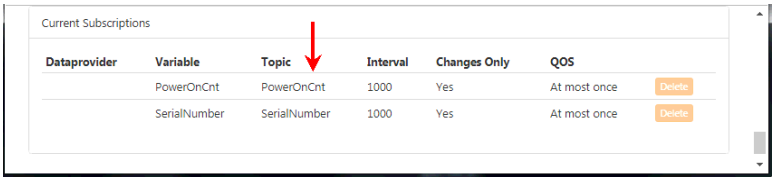
- Enter a name of your choice for the telemetry element in the **Name** field.
- Enter the name of the MQTT topic in the **Unique identifier** field. The name must be identical to the topic name in Node-RED or picoStratus.

Note

In Node-RED, you can identify the topic name by opening a node for editing. The name must be entered in accordance with the defined topic structure: *IMEI/S/TopicName*.

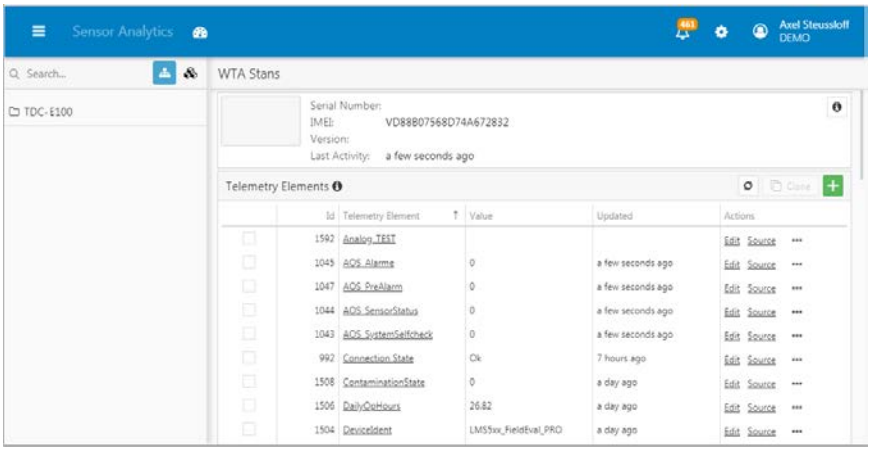


In picoStratus, the names can be found in the topic list of the MQTT interface. These should be entered in the portal exactly as they appear in the list.



- Enter the type of data to be retrieved in the **Data type** field. In the case of analog sensors, you should select the **numeric value** data type, for example.
- Do not change the default entry for the **Icon** field from **Generic**.
- Save the telemetry element by clicking on **Save**.
- Create and configure any further telemetry elements by following the procedure just described.

The **Uploaded** column shows the values that have been retrieved from the connected TDC-E.



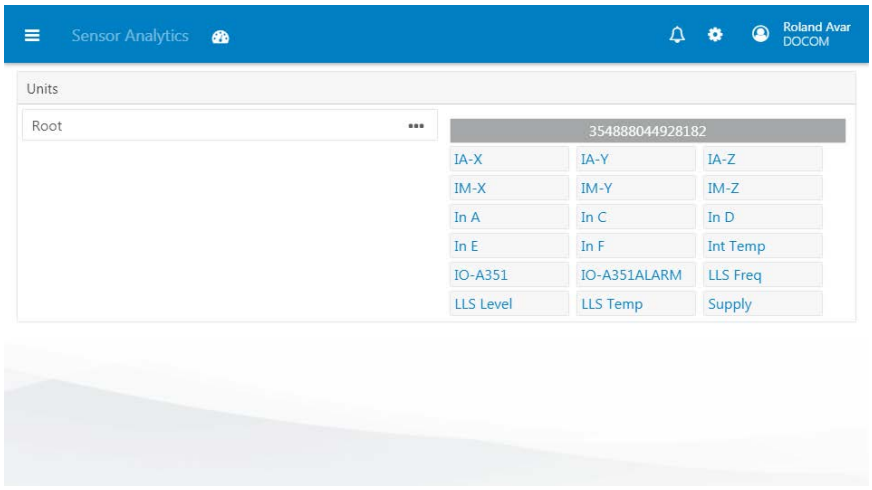
8.2.3.3 Defining the structure for displaying telemetry elements on the dashboard

Units allow you to define a tree structure for displaying the telemetry elements.

Getting started

- ▶ Switch to the homepage of the management system. To do this, click on **Sensor Analytics** in the menu bar.
- ▶ In the **Units** area, click on **New Unit**.

  All the TDC-E devices will be listed together with the telemetry elements that have been created in Sensor Analytics. In the example below, only one TDC-E has been registered on the Sensor Analytics platform.



Defining the structure

Use the left-hand side of the window to define the desired structure for listing the telemetry elements on the dashboard.

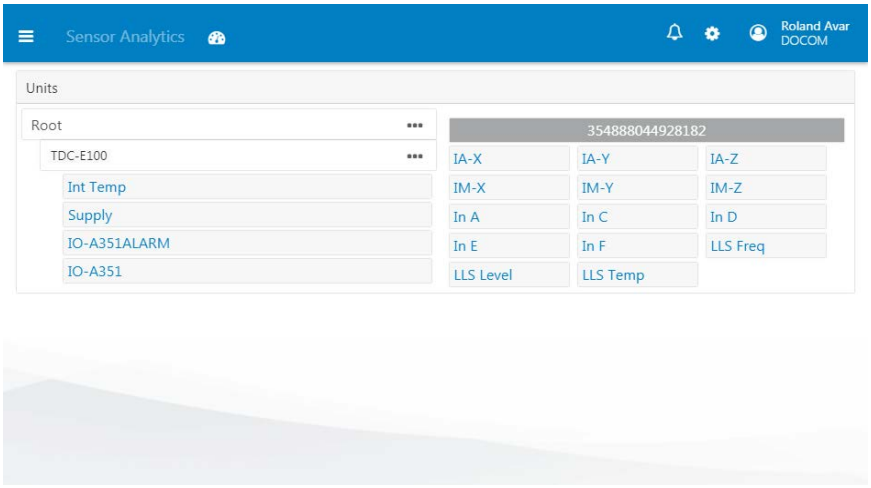
▪▪▪

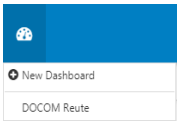
▶ Click on the icon consisting of three dots and select the **Add Unit** entry. An extra level will be created below the Root level.

▶ Enter a meaningful name for the level (e.g., the name of the TDC-E100).

Assigning telemetry elements

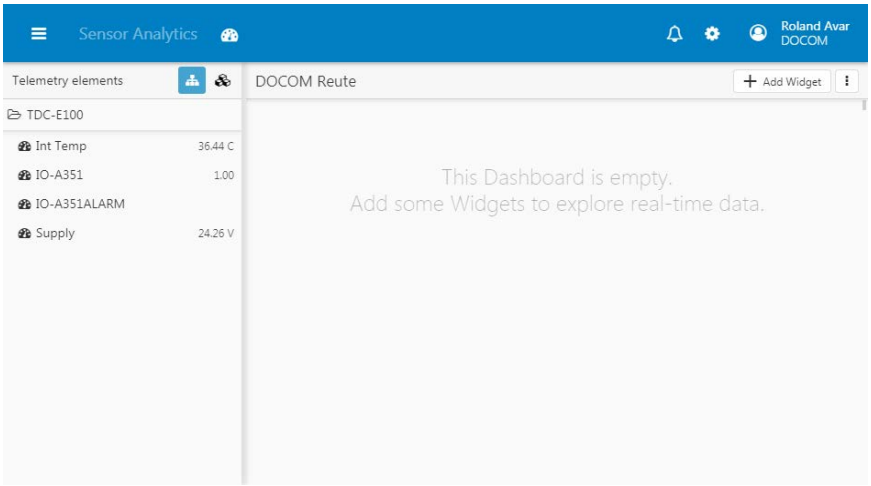
▶ On the right-hand side, the telemetry elements are displayed under the relevant TDC-E. Move these telemetry elements across to the required level of the structure by dragging and dropping.





▶ Switch back to the dashboard. To do this, click on the speedometer icon in the menu bar and select the dashboard you have just created.

The telemetry elements that you transferred across will now be listed in the defined structure on the left-hand side.



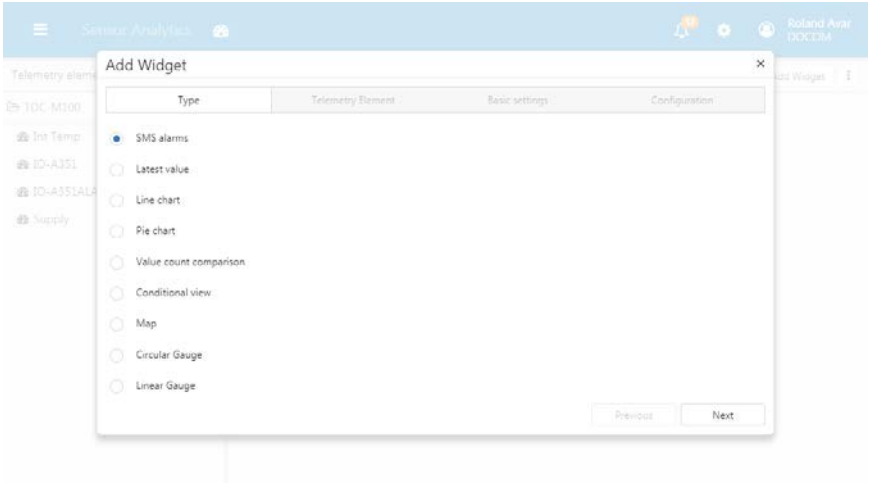
8.2.4 Visualizing KPIs on the dashboard via widgets

On the dashboard, data are visualized in the form of widgets. Technically speaking, a widget is a graphical window that represents a link to a telemetry element.

The widgets can be positioned wherever you like in the window and scaled to the required size. There are different types of widget according to the type of data involved.

- Click on **Add Widget** in the dashboard toolbar.

  The **Add Widget** window opens.



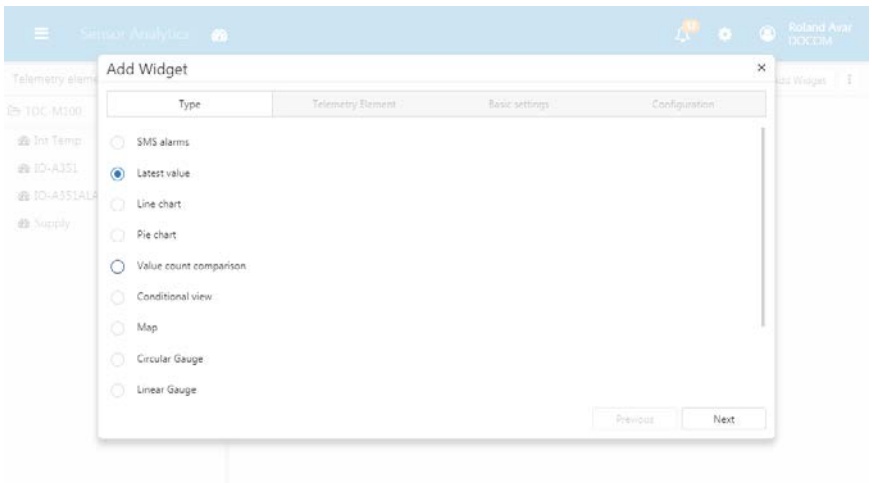
The window is divided into four tabs. You can work through these by clicking on **Next** just as if you were following a wizard.

- On the **Type** tab, specify the type of widget to be used.
- On the **Telemetry Element** tab, assign the required telemetry element.
- On the **Basic settings** tab, specify the name of the widget and, where applicable, add a detailed description.
- Specify further details on the **Configuration** tab according to the widget type (e.g., define your filter settings and analysis periods).

8.2.4.1 Adding a KPI for sensor data

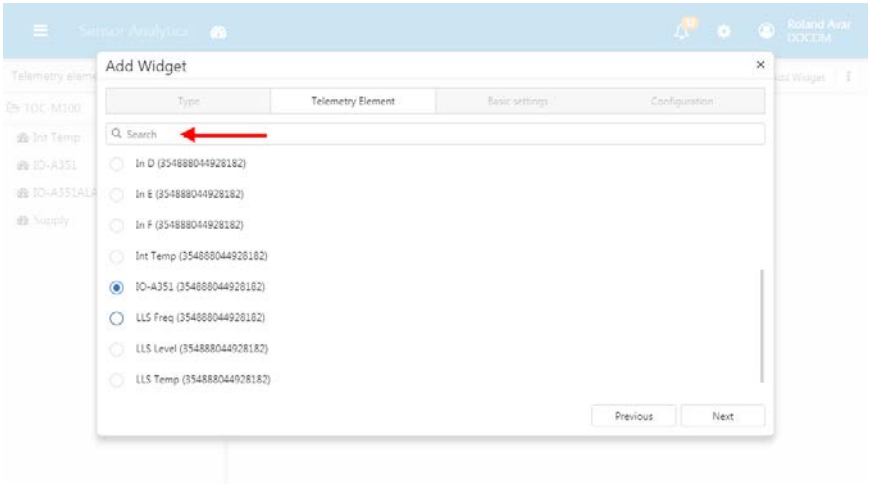
The widget described below is used to visualize a sensor value. From the value, you can quickly see whether a sensor is functioning correctly and supplying measurement data.

- On the **Type** tab, specify **Latest value** for the widget type.



- On the **Telemetry Element** tab, select the telemetry element to be visualized in the widget.

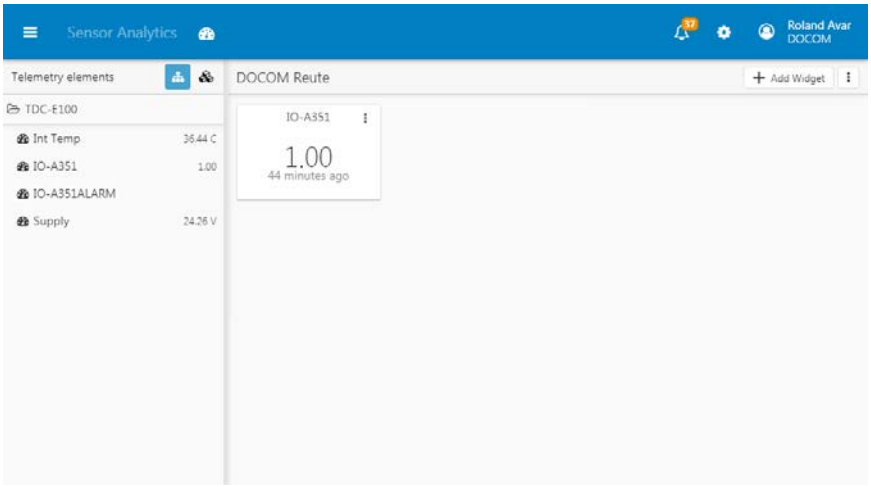
  All the telemetry elements are listed by name with the IMEI of the associated TDC-E in brackets.



Note

- If there are lots of telemetry elements, use the search field to narrow down the list.
- On the **Basic settings** tab, enter a name for the widget.
- On the **Configuration** tab, specify whether an icon should be displayed in the widget for widgets of type **Latest value**.
- Complete the widget creation process by clicking on **Save**.

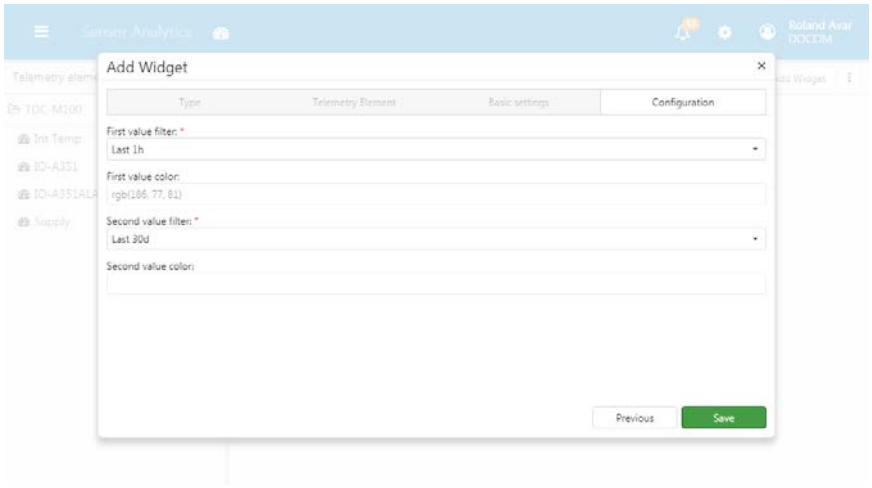
  The widget is displayed on the dashboard. In the example below, it shows the most recent measured value from a digital sensor.



8.2.4.2 Adding a KPI for alarms

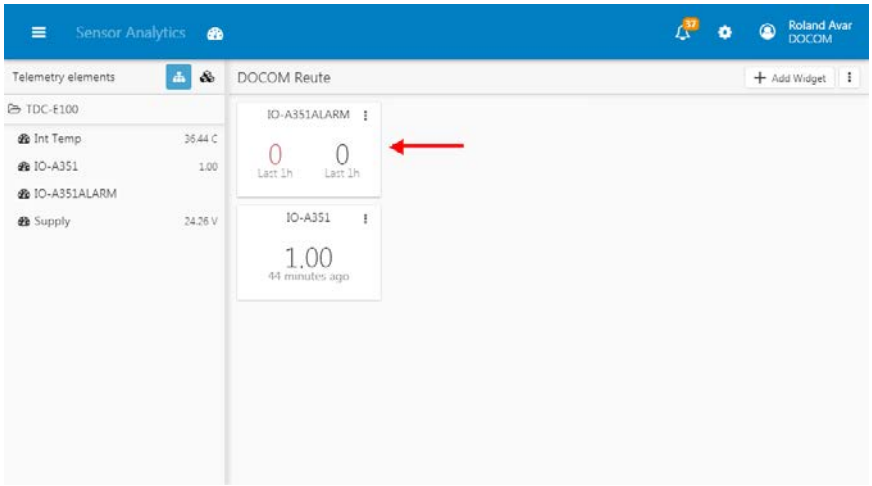
The widget below shows how often a sensor has triggered a real-time alarm in the form of an SMS message.

- On the **Type** tab, specify **SMS alarms** for the widget type.
- On the **Telemetry Element** tab, select the telemetry element that has been configured for triggering alarms in TDC-E Manager.
- On the fourth tab called **Configuration**, specify the period within which alarms are to be analyzed and displayed in the widget. The **First value filter** and **Second value filter** fields allow you to analyze two different periods.

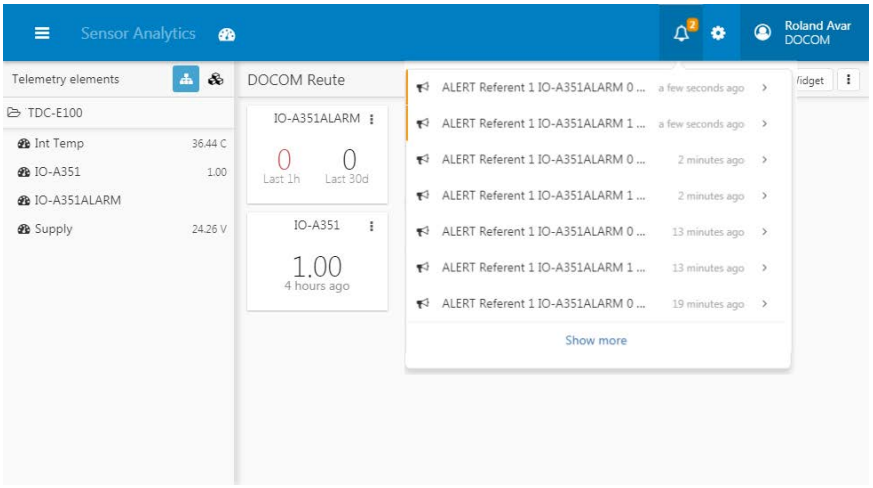


- Complete the widget creation process by clicking on **Save**.

  The widget shows how many alarms have occurred in the last hour (**Last 1 h** entry in the **First value filter** field) and how many have occurred in the last 30 days (**Last 30 d** entry in the **Second value filter** field).



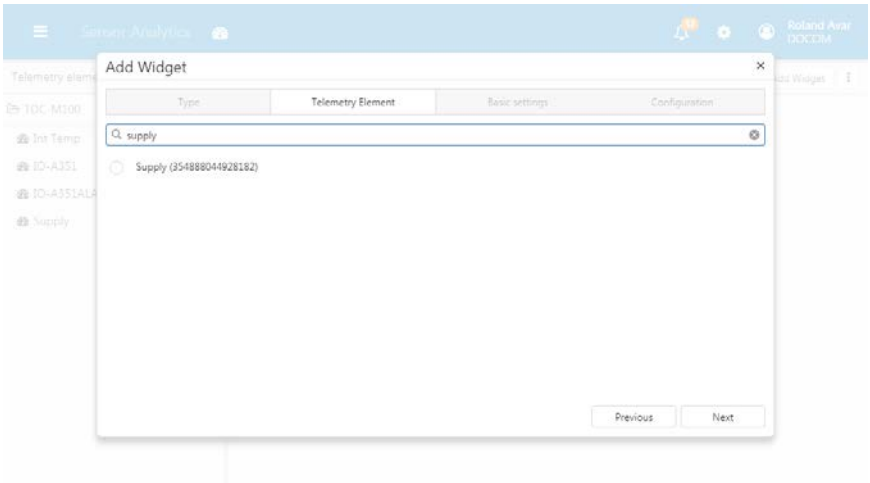
Clicking the bell icon in the menu bar displays a list of all SMS alarms.



8.2.4.3 Adding charts

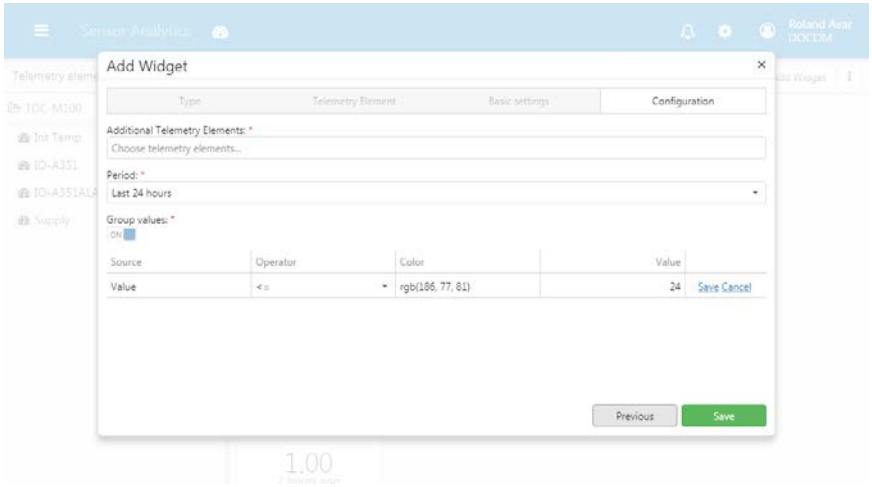
Widgets can also contain pie charts that allow you to document that the TDC-E is operating correctly, for example. In the example below, we are going to create a widget for visualizing the voltage supply of a TDC-E device. The information is supplied via a request in Node-RED.

- On the **Type** tab, specify **Pie chart** for the widget type.
- On the **Telemetry Element** tab, select the telemetry element that has been configured for transmitting the voltage currently present on the TDC-E.



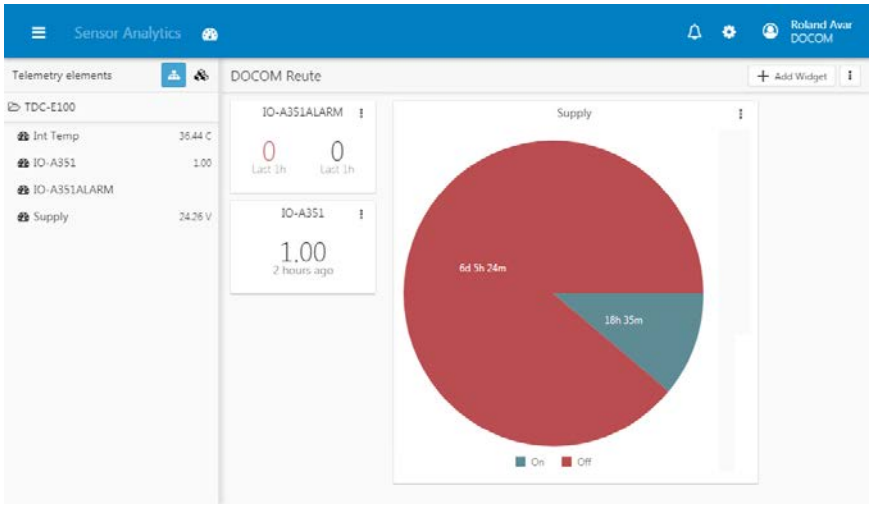
- On the **Configuration** tab, use the **Period** field to specify the period that you want to analyze, e.g., the last 24 hours.

  Use the table at the bottom to enter the value that the sensor should provide. To enter the value, click on **Edit**. Select the required operator and enter the anticipated value in the **Value** column (in this example: 24 V).



- Complete the widget creation process by clicking on **Save**.

  The chart shows the operational readiness of the TDC-E over the past 24 hours. Here, you can quickly see how long the TDC-E went without a voltage and was not ready for operation as a result.



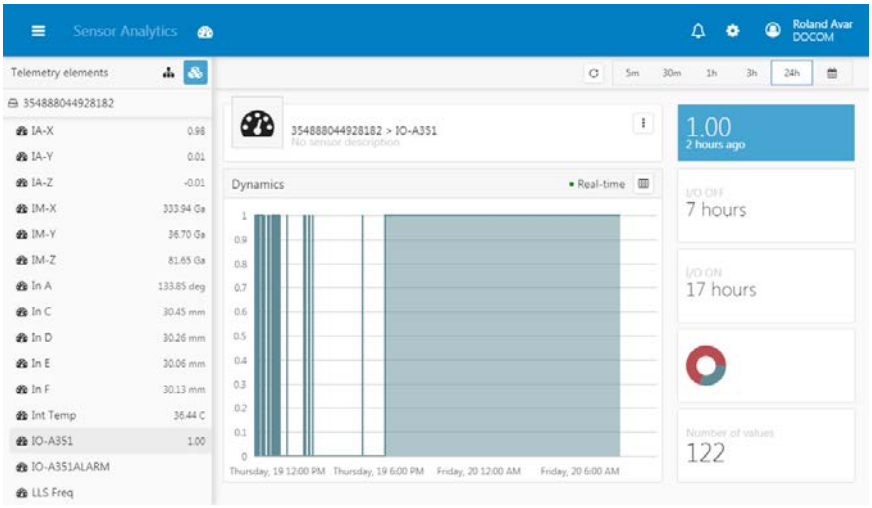
8.2.5 Analyzing sensor data in detail

You can use the list of telemetry elements on the left-hand side of the dashboard to display and analyze detailed information about the connected sensors.

You can select the telemetry element from the structure defined for your dashboard or from a list of all the telemetry elements configured for the TDC-E. Use the two icons above the list to switch between the two views.

- ▶ Click on the **Show devices view** icon. All the telemetry elements for the registered TDC-E will be displayed.
- ▶ Select the telemetry element in the list (in this example: a digital sensor).

The signal states supplied by the sensor can be analyzed for different time periods. In addition, you can also define your own time window.



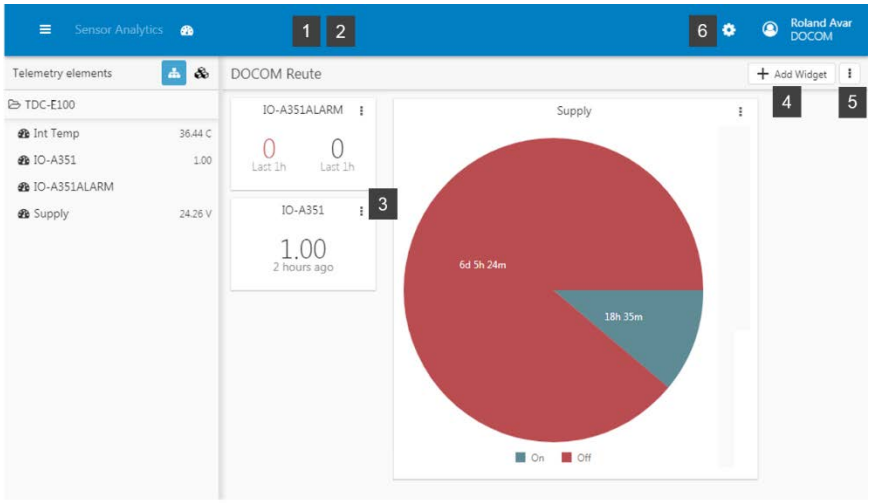
The calendar icon allows you to compare two time periods.

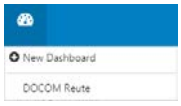
- ▶ If you need more space to analyze the data on the screen, collapse the list of telemetry elements by clicking on this menu icon.

8.2.6 Administering the management platform

In Sensor Analytics, you can create multiple dashboards for visualizing your sensor data. You can also add extra widgets to a dashboard at any time. Once widgets have been placed on a dashboard, they can be edited or deleted. Similarly, extra TDC-E devices can be added.

This chapter will provide you with a brief overview of the editing options.





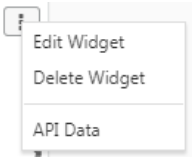
Adding an extra dashboard

▶ In the menu bar, click on the speedometer icon and select **New Dashboard**. The **Create Dashboard** window will open.

Opening a dashboard

▶ In the menu bar, click on the speedometer icon and select the dashboard you want from the list of created dashboards. The dashboard opens with the widgets showing.

Editing widgets



There is an Edit icon on each widget.

- Select **Edit Widgets** to open a widget, e.g., for the purpose of changing a filter setting or an analysis period.
- To remove a widget from the dashboard, select **Delete Widget**.

Note

Adding a widget

▶ In the menu bar, click on **Add Widget** to add an extra widget to the dashboard.

Deleting a dashboard

▶ Click on the icon for editing the dashboard and select the **Delete Dashboard** command.

Adding extra TDC-E devices

▶ In the menu bar, click on the gear icon and select the **Devices** entry (for further information on this, refer to chapter *8.2.2 Registering additional TDC-E devices*).

8.3 Working with fleet management

8.3.1 Position display

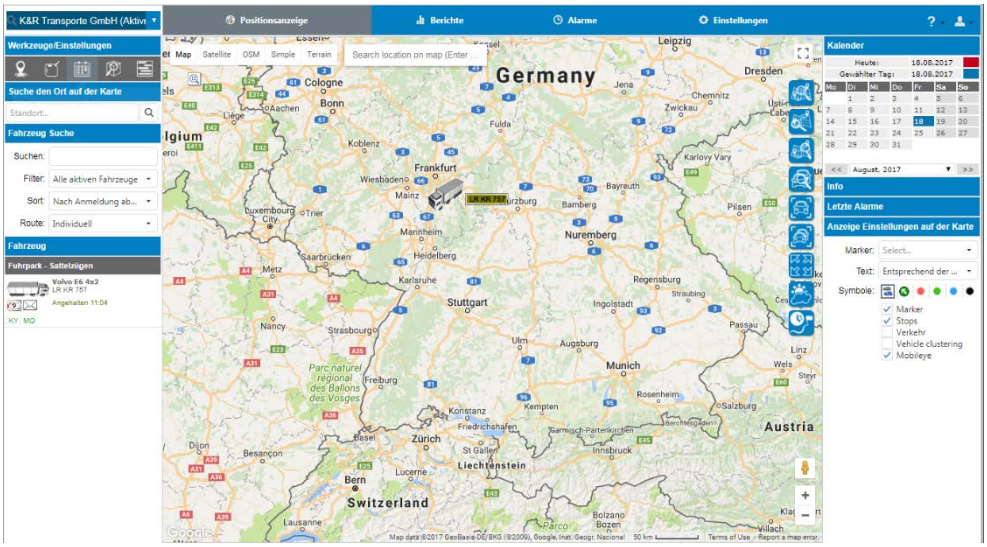
The **fleet management** platform is mainly used for detecting the positions, determining the downtime, tracking the routes, and monitoring the fuel data of vehicles. It provides a wealth of information about the vehicles in your fleet. You open the fleet management platform from Sensor Analytics.

The next chapter concentrates on some of the main analysis types and the basic navigation principle.

Getting started

▶ Click on the fleet management icon in the menu bar of the SICK management system. The fleet management platform will open in a new tab.

At the top of the window, there are several tabs to guide you through the various aspects of fleet management. When you open up fleet management, the **Position display** tab will be active.



Once open, the Position display tab has the following structure:

- On the bottom left, you will find a list of **all** the **vehicles** in your fleet. The vehicles will have the names that you assigned to the corresponding MQTT topic in TDC-E Device Manager.

  Above that, you will see input fields for conducting a specific **Vehicle search**.

  The icons in the **Tools/Settings** area at the top can be used to open a list with detailed information on the vehicles.

- The middle section will initially show the current locations of all vehicles on a **Google Maps map**. Once a vehicle has been selected, the map can be used to track its route.

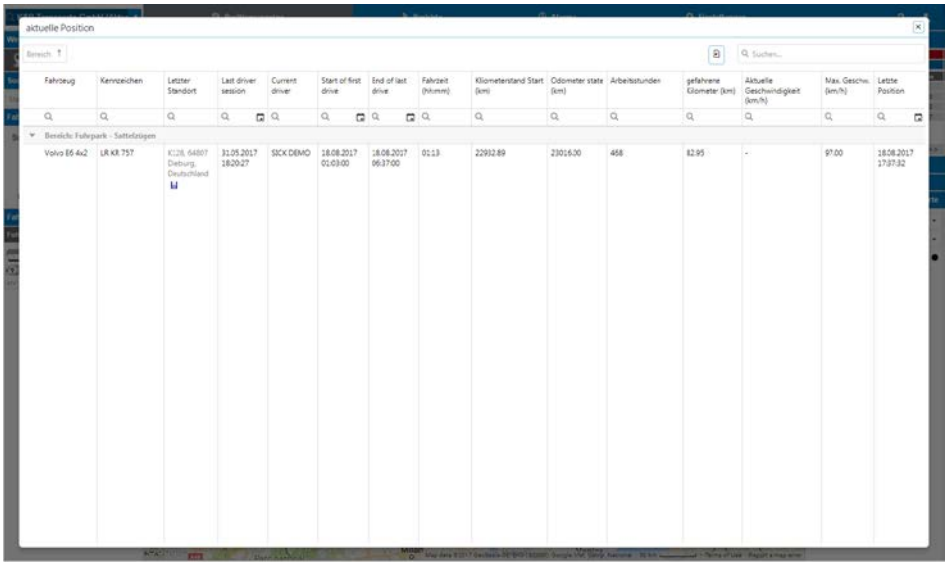
  The map can be panned in the window using the mouse. Use the icons on the map to change the view.

- The **Calendar** on the right-hand side can be used to narrow the time frame down to specific days. The area underneath this provides further **detailed information** according to which working context has been selected.

8.3.2 Displaying the vehicle list containing detailed information

► In the **Tools/Settings** area, click on the **Current position** icon.

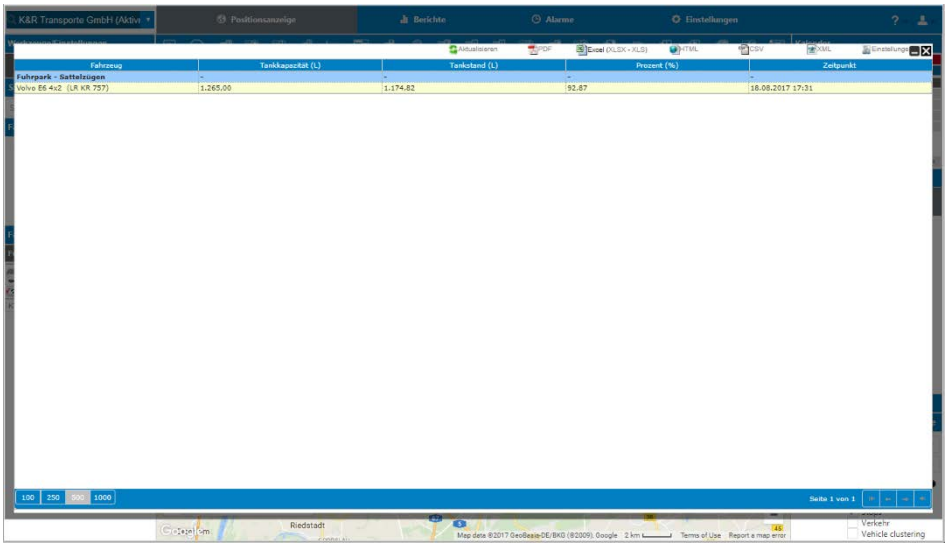
The list containing detailed information on all vehicles will open. Each vehicle is displayed on a separate line along with details of the current vehicle position, the driver, and the journey times for the last trip. The list also contains other vehicle data, such as the total kilometer reading from the odometer, the number of kilometers traveled, and the maximum speed. Vehicle data are read out of the vehicle's CAN bus if fleet management has been configured in TDC-E Device Manager.



8.3.3 Displaying current vehicle fuel levels

► Click on the **Current fuel level** icon in the **Tools/Settings** area on the left-hand side.

This opens a list for monitoring fuel data. Here, you can view each vehicle's tank capacity and its current fuel level in liters/as a percentage.



8.3.4 Retrieving information about a specific vehicle

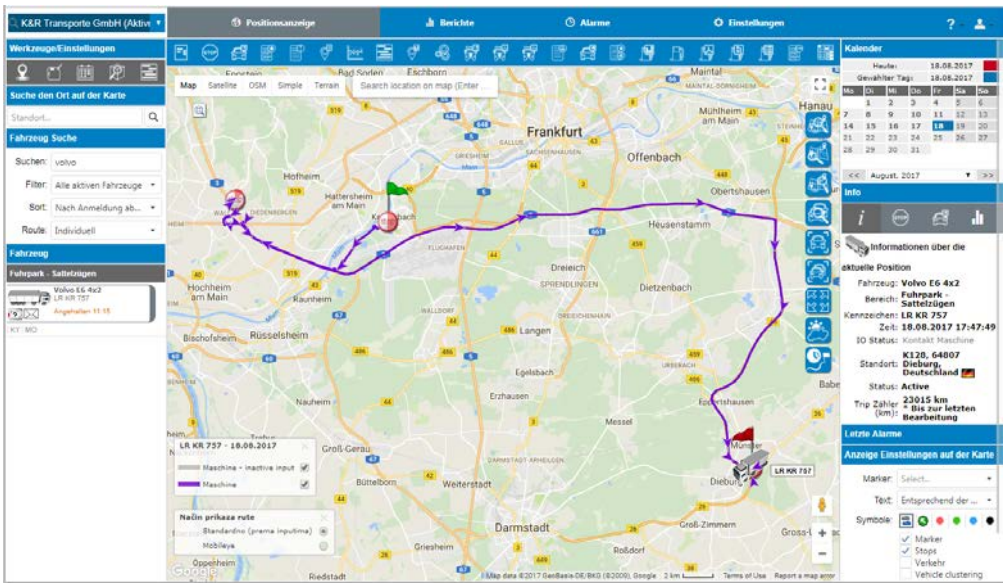
The Position display initially shows all the vehicles in the fleet.

There are two ways to narrow this down so that only the data for one vehicle are displayed:

- Select the vehicle in the **Vehicle list** on the bottom left.
- Identify the vehicle you want using the **Vehicle search** function.

Retrieving route information for a vehicle

As soon as you select a vehicle, the Position display changes.

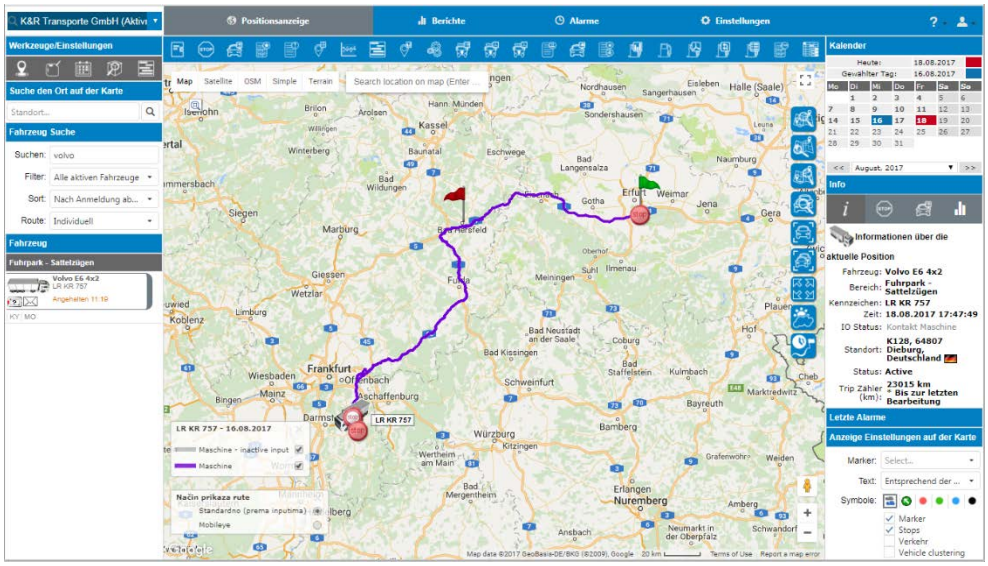


- A **toolbar** containing a set of predefined reports for the selected vehicle appears under the **Position display** tab.
- The **map** now shows the route last traveled by the vehicle.
- The **Info** area on the right-hand side contains information on the selected vehicle's current location. The event last sent by the TDC-E device is displayed. This allows you to see at a glance whether the TDC-E is functioning correctly.

  If the fleet management system has been configured in TDC-E Device Manager (for further information on this, refer to chapter *6.6.3 CAN interface*), the current kilometer reading is retrieved from the vehicle's CAN bus and displayed here.

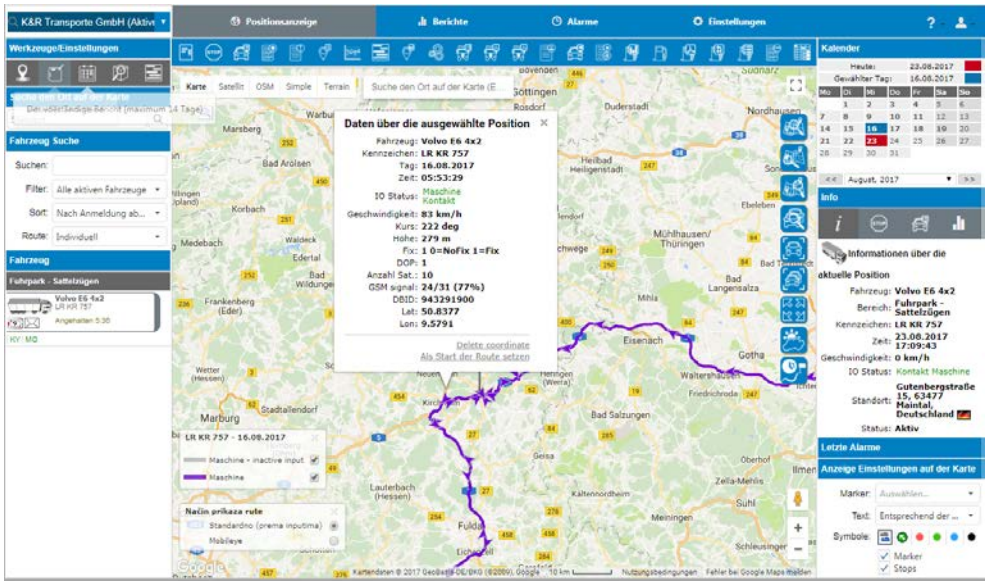
Displaying a route

- Use the calendar on the top right to select the day for which you want the vehicle's route to be displayed on the map.



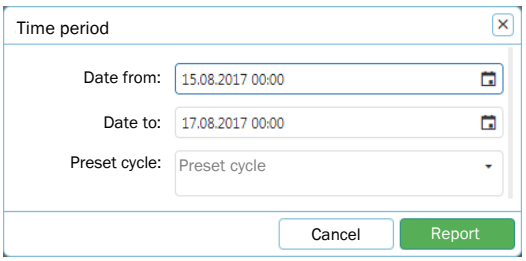
Displaying details on a selected position

- Click on a position anywhere along the route. This opens a popup window containing details of the selected position.



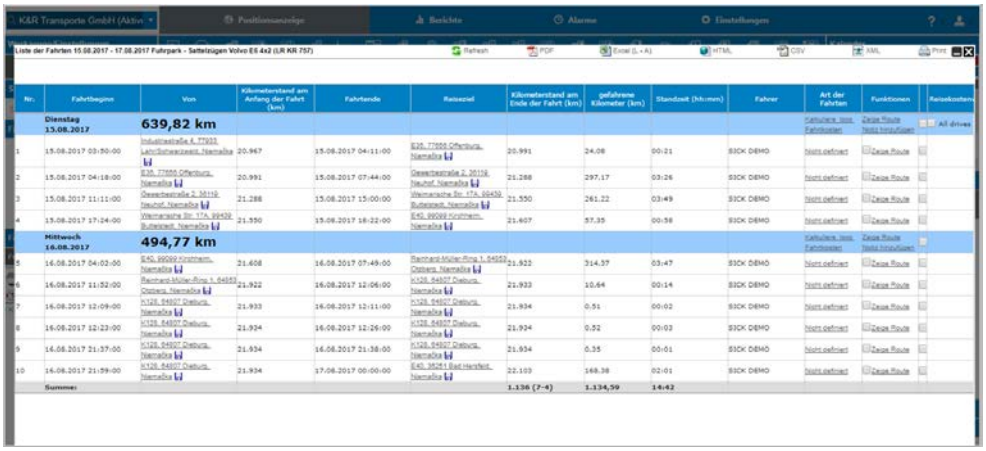
Displaying a list of journeys

- Click on the **List of journeys** icon in the Position display toolbar to show the movements of a vehicle over a given period of time.
- Enter the time period.



- Click on the **Report** button. The list of journeys will be generated and displayed in a separate window.

  Among other things, the list shows the starting point and destination of each journey, the kilometer reading at the end of the journey, and the number of kilometers traveled.



8.3.5 Retrieving fuel consumption information

Determining fuel consumption is absolutely vital for successful fleet management.

Displaying consumption in a graph

Fuel consumption is displayed as a graph, meaning that you can quickly spot any signs of unusual activity.

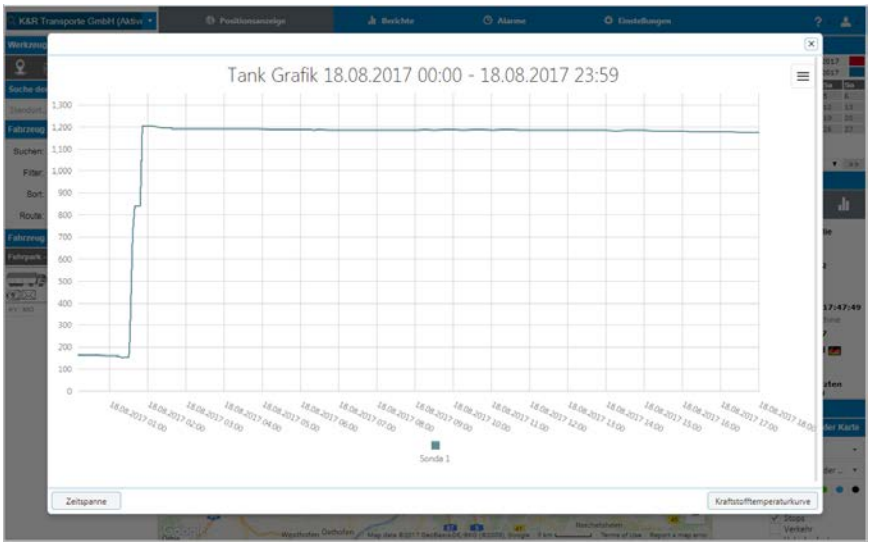
- On the Position display tab, select the vehicle and the day for which fuel consumption information is to be visualized.
- Click on the **Fuel graph** icon in the Position display toolbar.

  A graph that shows a steady fall indicates regular fuel consumption.

Note

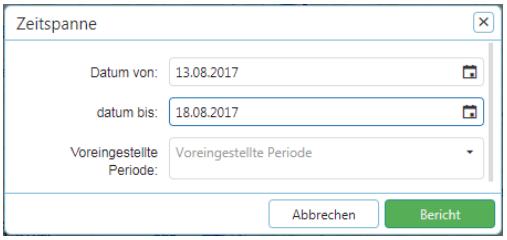
A dramatic drop within a short period of time could be a sign that fuel is being stolen.

When the vehicle is refueled, there will be a sudden jump in the level in a short space of time.



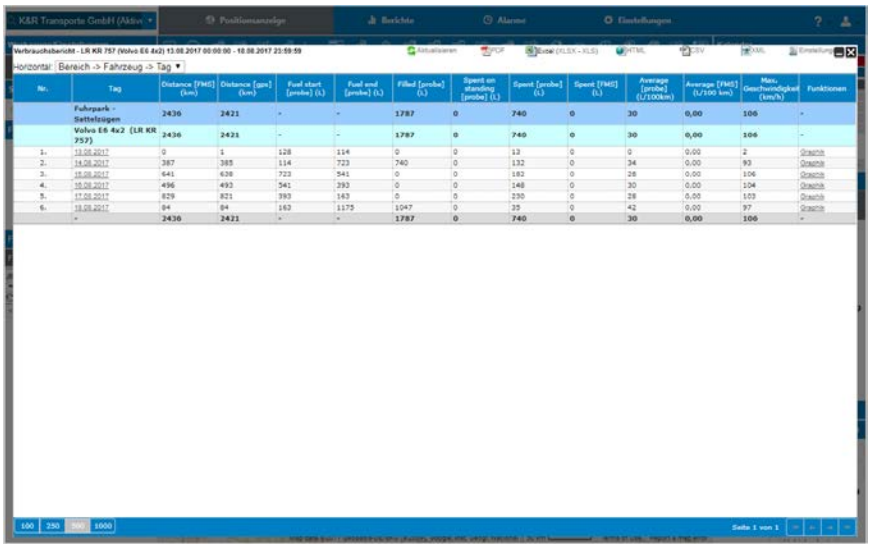
Generating a consumption report for a specific period

- On the Position display tab, select the vehicle for which a consumption report is to be generated.
- Click on the **Fuel** icon in the toolbar.
- Specify the period of time to be covered by the consumption report.



- Click on the **Report** button. The fuel consumption information for the vehicle will be displayed on a separate line for each day of the period.

  Among other things, the list shows the number of kilometers traveled on that day, the fuel level at the beginning and end of a journey, and the amount of fuel consumed. By referring to the speed information as well, you can quickly see whether the fuel consumption information is plausible.

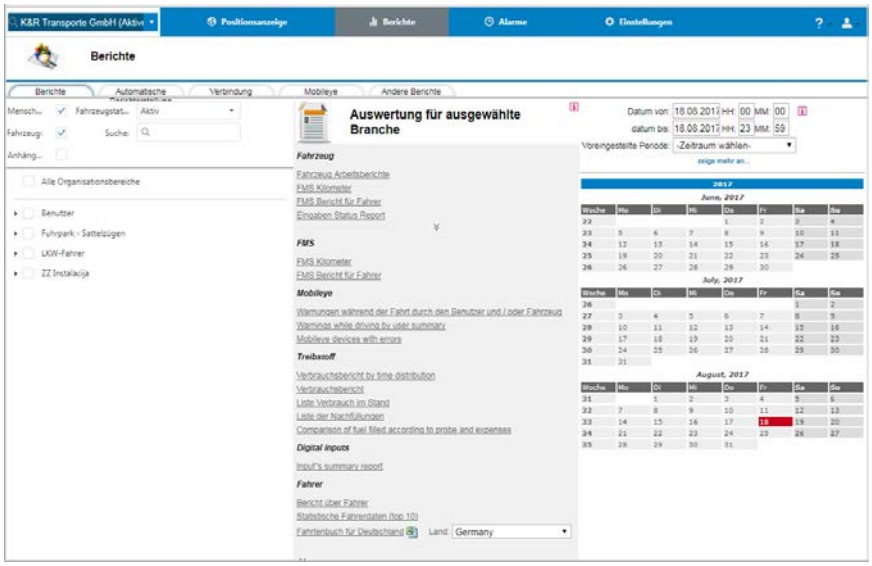


8.3.6 Analyzing the number of kilometers traveled

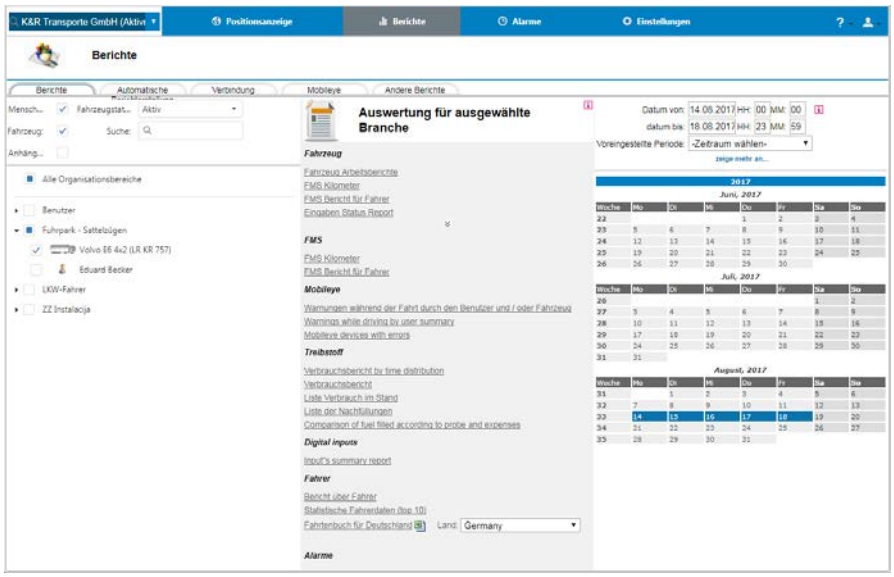
The **Reports** tab contains reports that can be used for longer-term analyses across all areas. The vehicle data in the reports can – for example – be narrowed down to specific drivers or vehicles.

The following example illustrates how to analyze the number of kilometers traveled by a vehicle each day.

- Switch to the **Reports** tab.

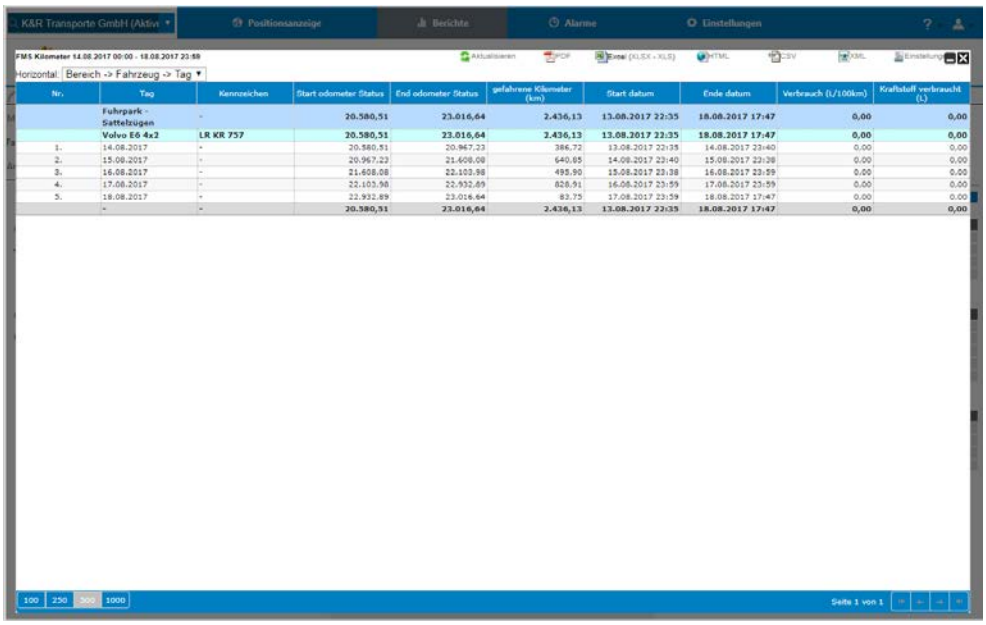


- On the left-hand side, select the area(s) to be analyzed. To do this, expand the tree structure containing the areas and check the boxes for users, vehicles, or drivers.
- On the left-hand side, specify the analysis period. To do this, complete the date fields/select the predefined periods at the top or select the period in the calendar while holding down the mouse button. Days can be selected so that they span different months.



- Select the report you want in the central area (in this example, the report being opened is called **FMS kilometers**).

  This report contains the number of kilometers traveled each day together with the start and end date of each trip, as well as the fuel consumption.


K&R Transporte GmbH (Aktiv)
Positionsanzeige
Berichte
Alarme
Einstellungen
FMS Kilometer 14.08.2017 00:00 - 18.08.2017 23:59
Aktualisieren
PDF
Excel (XLSX - XLS)
HTML
CSV
XML
Einstellung
Horizontal: Bereich -> Fahrzeug -> Tag
Nr.
Tag
Kennzeichen
Start odometer Status
End odometer Status
gefahrene Kilometer (km)
Start datum
Ende datum
Verbrauch (l/100km)
Kraftstoff verbraucht (L)
Fuhrpark - Sattelzügen
20.580,51
23.016,64
2.436,13
13.08.2017 22:35
18.08.2017 17:47
0,00
Volvo E6 4x2
LR KR 757
1. 14.08.2017
2. 15.08.2017
3. 16.08.2017
4. 17.08.2017
5. 18.08.2017
100
250
500
1000
Seite 1 von 1

9 Maintenance

9.1 Maintenance during operation

Perform the following checks at regular intervals:

Checking plug connectors

- Unscrew the sensor plug connectors and check the male contacts for moisture and traces of corrosion.

⚠ WARNING

Plug connectors damaged by corrosion

Corroded plug connectors can significantly impair the performance of the sensor.

- Replace any damaged plug connectors immediately.

Checking cables

- Regularly check the electrical installation. Check that all cable connections are securely attached.

⚠ WARNING

Loose connections or scorched cables

- Defects such as loose connections, scorched cables, or cables with damaged insulation must be corrected immediately.

Checking screw connections

- Make sure that the screw connections are secure.

Cleaning the TDC-E

The devices are maintenance-free. No maintenance is required to ensure proper operation.

Recommendation

Depending on the operating environment, we recommend removing dust from the housing.

9.2 Replacing components

NOTE

Claims under the warranty rendered void

- Do not open the TDC-E housing.

9.2.1 Replacing a TDC-E

Defective devices must be replaced immediately.

In the case of Node-RED and picoStratus configurations, the replacement device is configured by importing backup files (for further information on this, refer to chapters *7.2.5 Exporting Node-RED configurations* and *7.3.8 Exporting the picoStratus configuration*.

You can order the TDC devices under the following part numbers:

Part no.	Device
6066438	TDC-E100R2
6067899	TDC-E100EU
6067537	TDC-E100R6
6067896	TDC-E200R2
6067898	TDC-E200EU
6067536	TDC-E200R6

Table 11: Part numbers for the TDC-E replacement devices

Detaching the connecting cables

- Undo all plug or clamp connectors on the TDC-E and remove the connecting cables from the device.
- Unscrew the WLAN/WPAN antenna from the device.
- Remove the GPS antenna (TDC-E200 only).

Replacing the device

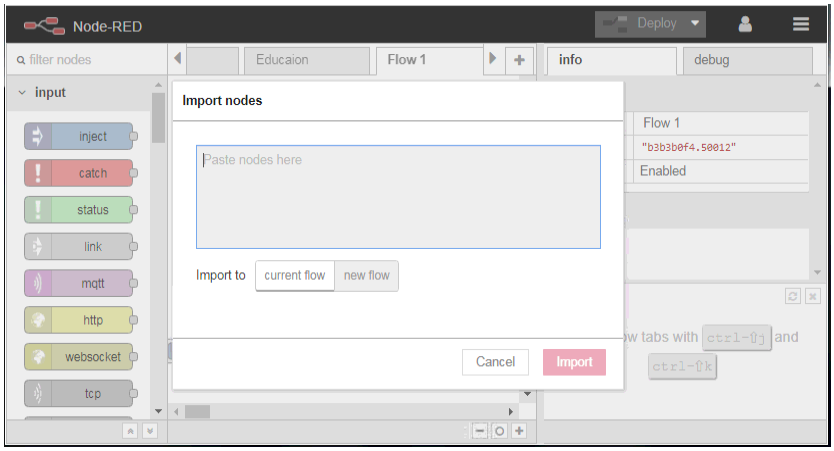
- Remove the defective device.
- Install the replacement device as described in chapter *4 Mounting*.
- Reconnect all cables and antennas as described in chapter *5 Electrical installation*.

Preparing for configuration

- Connect the computer to the **Eth0** Ethernet interface and start TDC-E Device Manager (see chapter *6.3 Starting TDC-E Device Manager*).

Importing a Node-RED configuration

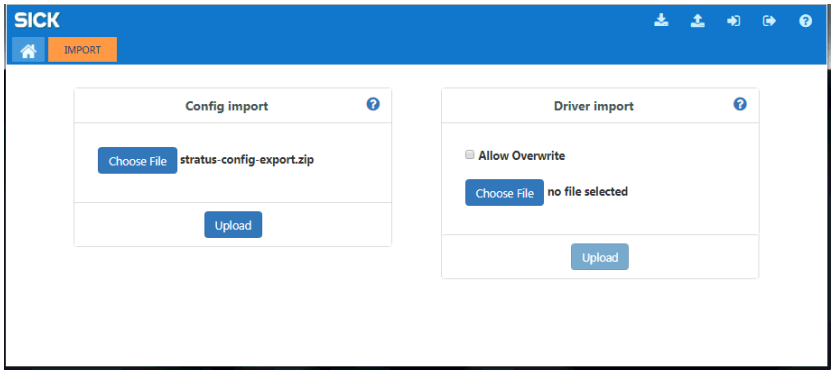
- ▶ Start Node-RED via the dashboard.
- ▶ Select **Import → Clipboard** from the Node-RED menu.



- ▶ Open the text file that contains the backup and copy the contents to the clipboard.
- ▶ Paste the contents of the clipboard into the import window.
- ▶ Click on **Import**.

Importing a picoStratus configuration

- ▶ Start picoStratus via the dashboard.
- ▶ Click on the Import icon.
- ▶ Under **Config import**, select the **stratus-config-export.zip** backup file.



- ▶ Click on **Upload**.
- ▶ Perform a data provider scan and start the sensors.

Subsequent work

- ▶ Re-enter the settings in the TDC-E Device Manager tree.
- ▶ Re-install customer applications.

9.2.2 Replacing connected sensors

Defective sensors must be replaced immediately.

- After replacing the component, connect the replacement device to the TDC-E.

Preparing for configuration

- Connect the computer to the **Eth0** Ethernet interface and start TDC-E Device Manager (see chapter *6.3 Starting TDC-E Device Manager*).

Importing a picoStratus configuration

- Assign exactly the same address to the SICK replacement device as was assigned to the defective sensor.
- Then, import the picoStratus configuration. To do this, follow the same procedure as when replacing the TDC-E.

10 Appendix

10.1 Technical data

	TDC-E100	TDC-E200
Features		
Product category	Gateway and cloud solutions	
Application	▪ Remote management of sensors and machines ▪ Process monitoring and diagnostics in factory and logistics automation ▪ Fleet management ▪ Generation of statistics and forecasts	
Tasks	▪ Condition monitoring ▪ Stock monitoring ▪ User-defined real-time alarms	
Features		
Sensor	Acceleration sensor, magnetometer, thermometer	
Internal processor	1 GB, DD3, dual-core Cortex-A7 with Cortex-M4 co-processor	
Internal memory	16 GB	
Operating system	Linux Yocto Rocko	
User interface	TDC-E Device Manager	
Connectivity	Cellular network (3G), WLAN, WPAN, LAN, M2M SIM card, EU 27 +2 [1)]	
Mobile network	TDC-Ex00EU ▪ UMTS: 900/2,100 MHz ▪ GSM/EDGE: 850/900/1,800/1,900 MHz TDC-Ex00R2/TDC-Ex00R6 ▪ UMTS: 900/2,100 MHz, +R115: W115	
Integrated SIM card	✓, TDC-Ex00EU only	
Alarm output	Push notification or user-defined action	
[1)] Belgium, United Kingdom, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovak Republic, Spain, Sweden, Switzerland, Cyprus		

Interfaces		
GPS Protocol Electrical connection	-	✓ Satellite-based supplemental system L1 C/A: WAAS, EGNOS, MSAS, GAGAN GPS, GLONASS, BeiDo, Galileo MCX
Modem Data transmission rate Protocol	✓, 3G HSPA+ 5.76 Mbit/s ... 14.4 Mbit/s HSPA+/UMTS quad-band 850/900/1,900/2,100 MHz GSM/GPRS quad-band 850/900/1,800/1,900 MHz	
Ethernet Data transmission rate Electrical connection	✓ (2) 10 Mbit/s ... 1,000 Mbit/s RJ45	
WLAN Data transmission rate Electrical connection	✓, dual band, 2.4 and 5 GHz module (IEEE 802.11 b/g/n) (80 Mbit/s ... 100 Mbit/s), 20–40 MHz SISO and 20 MHz 2 x 2 MIMO at 2.4 GHz for high throughput Device interface	
WPAN	✓, IEEE.802.15.1, IEEE.802.15.4	✓, IEEE.802.15.1, IEEE.802.15.4 IEEE.802.15.3
Serial Electrical connection	✓, RS-232, RS-422, RS-485, SSI, 1-Wire Microfit (20-pin)	
CAN bus Data transmission rate Protocol Electrical connection	✓ (2) 1 Mbit/s, adjustable J1939, CANopen Microfit (20-pin)	
USB Electrical connection	✓, USB2.0 USB 2.0 A male connector	

Inputs/outputs I/O	 6 analog inputs (configurable, current and voltage), 8 digital inputs/outputs (configurable)
Optical indicators	3, LED, status indicators
Configuration interface	Web interface

Mechanics/electronics	
Supply voltage	24 V DC (9 V DC ... 36 V DC)
Housing dimensions (W x D x H)	162 mm x 32 mm x 101 mm
Weight	230 g
Mounting	In vehicle or control cabinet
Housing color	Light blue (RAL 5012)
Housing material	Polyamide (PA6)
Enclosure rating	IP20 (acc. to DIN EN 60529)

Ambient data	
Ambient temperature, operation	-20 °C ... +70 °C
Ambient temperature, storage	-40 °C ... +85 °C
Impact load	IEC 60068-2-27
Electromagnetic compatibility (EMC) [1)]	EN 303446-1 EN 55032 EN 55024 EN 61000-3-2 EN 61000-3-3
Product safety	EN 60950-1
Radio equipment approval	EN 301511 V12.5.1 (2017)

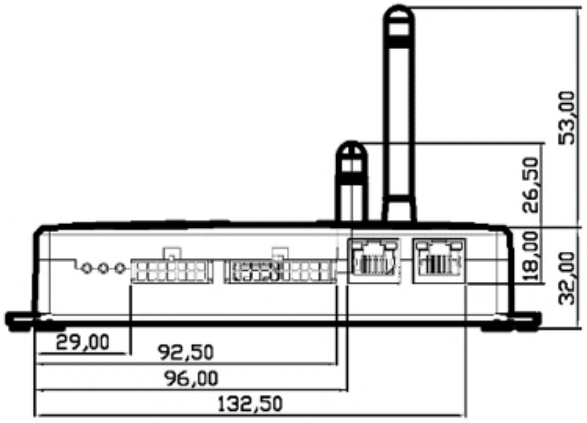
[1)] To ensure electromagnetic immunity in industrial environments, observe the following points:

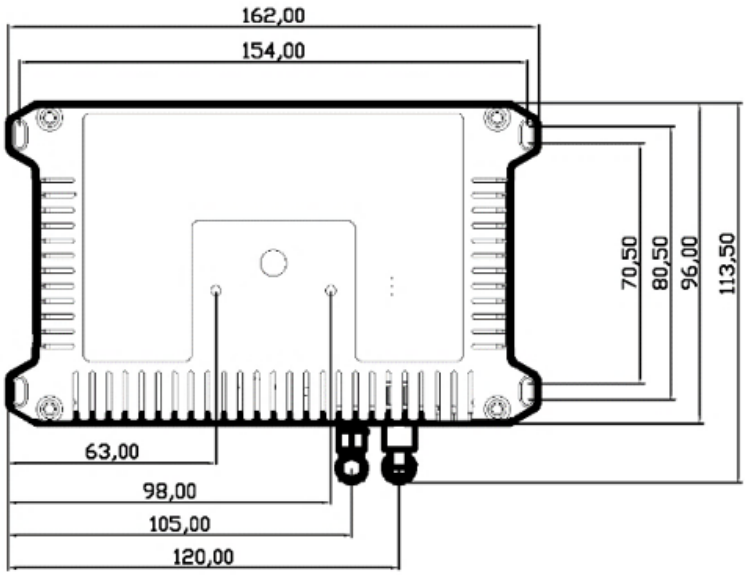
- Use cables that are shielded at both ends.
- The RS-232 interface has been tested/is compliant for (unshielded) cable connections < 3 m.
- The USB interface has been tested for direct connection (e.g., memory stick).
- 1-Wire is not designed for industrial environments. 1-Wire has been tested for simple industrial environments.

General advice	
Description	The gateway system networks sensors, machines, and IoT platforms for collecting and preprocessing local sensor and process data.
Scope of delivery	TDC-Ex00EU with mobile communication (EU 27 +2, M2M SIM card) including connecting cables and operating instructions

Table 12: TDC-E100/TDC-E200 data sheet

10.2 Dimensional drawings





10.3 User levels and authorizations

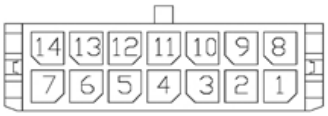
Three different user levels are available for working in the web-based configuration interface: **Client**, **Service**, and **Developer**.

The following authorizations are assigned to each user level:

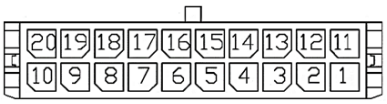
User level	Login	Description
Level 1 Username Password	 *client* *client*	Permitted to view all TDC-E settings and states, containers, and interfaces. Not permitted to make any changes that affect the operational status of the TDC-E.
Level 2 Username Password	 *service* *servicelevel*	Has the following rights: ▪ Change IP addresses ▪ Change DIOs ▪ Connect/disconnect modem ▪ Start/stop Node-RED, picoStratus, and customer containers View Docker stats (RAM, CPU) Not able to stop/start HWManager, SRT, and Portainer
Level 3 Username Password	 *developer* *tdceDeveloper*	Has the following rights: ▪ Change IP addresses ▪ Change DIOs ▪ Connect/disconnect modem ▪ Start/stop Node-RED, picoStratus, and customer containers ▪ Add/remove own containers (start, stop, deployment) ▪ Not able to stop/start HWManager, SRT, and Portainer

Table 13: User levels and authorizations

10.4 TDC-E pin assignments



Group	Pin	Name	Description
PWR	14	VIN	TDC-E supply voltage: 9 V–36 V DC
	7	GND	Ground
DIO	13	DIO_A	Digital input/output – Channel A
	6	DIO_B	Digital input/output – Channel B
	12	DIO_C	Digital input/output – Channel C
	5	DIO_D	Digital input/output – Channel D
	11	DIO_E	Digital input/output – Channel E
	4	DIO_F	Digital input/output – Channel F
AIN	10	AIN_A	Analog input – Channel A
	3	AIN_B	Analog input – Channel B
	9	AIN_C	Analog input – Channel C
	2	AIN_D	Analog input – Channel D
	8	AIN_E	Analog input – Channel E
	1	AIN_F	Analog input – Channel F



Group	Pin	Name	Description
ADDITIONAL DIO	20	L+_A	Used as a digital output
	10	CQ_A	Digital input
ADDITIONAL DIO	19	L+_B	Used as a digital output
	9	CQ_B	Digital input
GND	18	GND	Ground
	8	GND	Ground
+5 V DO	17	5V	5 V digital output
1-WIRE	7	1W	1-WIRE
RS-232	16	TX	Cable for sending data
	6	RX	Cable for receiving data
	15	CTS	Clear to send
	5	RTS	Request to send
RS-485/ RS-422/ SSI*	14	Y/CLK+	RS-485/422/SSI data cable
	4	Z/CLK-	RS-485/422/SSI data cable
	13	A/DATA+	RS-485/422/SSI data cable
	3	B/DATA-	RS-485/422/SSI data cable
CAN A	12	CANH_A	CAN high – Channel A
	2	CANL_A	CAN low – Channel A
CAN B	11	CANH_B	CAN high – Channel B
	1	CANL_B	CAN low – Channel B
* Configurable/RS-422 available in API			

RS-485/RS-422 pin assignment

- Half-duplex mode: The transceiver relies on the Y and Z pins in both send and receive mode.
- Full-duplex mode: In receive mode, the transceiver uses the A and B pins; in send mode, it uses the Y and Z pins.

10.5 Description of the MQTT and REST API

The TDC-E gateway system supports MQTT and REST APIs for simple and complex data handling processes on the cloud platform.

- The MQTT API is used to publish data from the devices. These data are stored on the cloud server and can be subsequently requested using REST APIs.
- REST services provide access to all sensor and device data sent to the platform.

10.5.1 MQTT API

The TDC-E gateway system uses MQTT as the protocol for device communication.

With the aid of an MQTT library and compatible clients, you can publish and subscribe to topics, and send and receive data.

10.5.1.1 Connection details

► How to establish a connection to the MQTT broker:

Host	194.152.206.247
Port	1883
Username	D<DEVICE_ID> E.g., D359551037664835 The device ID may be represented by the IMEI number or by a unique device identifier.
Password	The password is generated on the basis of the device's IMEI number and a special signature key. For a description of how to implement the password generation method in C#, please refer to the information further below. Signature: ASCII code '68790CD960494F7CBB0AE3F130A9841C'

Password generation method

```
public string GeneratePassword(string imei)
{
     byte [] token = System.Text.Encoding.ASCII.GetBytes(imei +
System.Configuration.ConfigurationManager.AppSettings["SignatureKey"])
;
     uint password = 0;

     try
     {
         for (int i = 0; i < token.Length; i++)
         {
             unchecked /// in case of overflow just let it wrap around
0
             {
                  password += (uint) ((i +1) * token[i]);
             }
         }
     }
     catch (Exception e)
     {
         Logger.Log("[ERROR] " + e.ToString());
     }
         return password.ToString();
     }
```

10.5.1.2 The MQTT API sensor value

The MQTT API sensor value allows devices to send simple numerical or textual data to the cloud platform. The device ID represents the IMEI number or unique identifier provided by the platform.

Each sensor has its own unique identifier, which must be assigned to it. This unique identifier is then used in the MQTT topic for the purpose of publishing data.

Topic	<DEVICE_ID>/CX/<DATA_STORE_ID> E.g., 66BDDE57849842EB8339/CX/Bosch7506A
Payload	<DateTime>|<Value>|<Unit> E.g., 2017-11-08T09:31:39.8703239Z|1.60|m/s The payload text is delimited by means of vertical dash marks ▪ UTC time in the format yyyy-MM-ddTHH:mm:ss.fff ▪ Value (floating-point number, integer values, or text) ▪ Unit (°C, m, m/s, sec, etc.)

This is the easiest way to send sensor data to the cloud platform.

Note

► Remember to create the TDC-E and sensor on the cloud platform in advance.

10.5.1.3 Complex data structures

Complex data structures have to be created on the cloud platform. All the data required to send JSON data to a specific data store are available here.

As soon as the data store has been created, its ID starts being used in the MQTT topic to send messages to the MQTT broker together with the device ID for publishing. Once again, the device ID can take the form of the IMEI number of the actual device or a unique identifier provided by the cloud platform.

Topic	<DEVICE_ID>/S/<SENSOR_UNIQUE_IDENTIFIER> E.g., 17A28C1DA2704BF88F7D/S/AngleY

Payload	The payload can be any type of JSON object that does not contain array properties.
	The complex data structure also supports nested objects.
	
	{
	"ts":"2018-01-26T10:30:00.000
	000+01:00",
	"x":78613,
	"y":155582,
	"o":-1620,
	"q":5,
	"xx":6014,
	"xy":348,
	"yy":9229,
	"oo":518,
	"dr":0,
	"ir":75,
	"mdm":130
	}

10.5.2 REST API

REST API offers various APIs for requesting simple and complex data sent by sensors or devices. For example, it allows you to request data from a particular sensor or from a device plus a data store that has received data from this device.

Each API request must conform to the API's authentication schema; otherwise, the API will return the status 401 UNAUTHORIZED.

Base server URL

```
http://tdcapi.sick.com/
```

10.5.2.1 Bearer authentication

The API relies on bearer authentication, which means that each API method call must contain an authorization header with a token. The token can be obtained via the `auth/1/session` API.

Example authorization header

```
Authorization: Bearer 8106717a-e9fd-44a6-ac47-89a4391de4c7
```

10.5.2.2 Authentication | POST auth/1/session

This API performs the user login and returns the token used for bearer authentication.

Example request URI(s)

```
/auth/1/session
```

Request

```
{
      "Username":"api@test.hr",
      "Password":"!Test123"
}
```

Responses

```
HTTP status code 200 - application/json
```

Returns a newly created token

Example

```
{
      "SessionKey": "044b54f9-773d-49a9-955a-b2279d19dabf"
}
```

```
HTTP status code 400
```

This is returned if the username and password do not match.

10.5.2.3 Devices | GET api/1/devices

This API makes all devices visible to the logged-in user.

Example request URI(s)

```
/ap1/1/devices
```

Responses

```
HTTP status code 200 - application/json
```

Returns an array of devices

Example


```
[
     {
         "Id": 21588,
         "Name": "Bosch demo",
         "SerialNumber": "",
         "Version": "",
         "Imei": "66BDDE57849842EB8339",
         "LastActivity": "0001-01-01T00:00:00",
         "Sensors": [
             {
                  "Id": 848,
                  "Name": "IndoorPosition",
                  "UniqueIdentifier": "IndoorPosition",
                  "Configuration": {
                      "PhysicalUnit": "",
                      "IsValueText": false,
                      "DecimalRound": 0,
                      "ActionId": 1,
                      "SignalKindId": -1
                  },
                  "DeviceId": 21588,
                  "SectorId": -1,
                  "TypeId": 1,
                  "Status": {
                      "Id": 0,
                      "Name": "Sensor OK"
                  }
             }
         ],
         "SimCard": {
             "Id": 0
         },
         "Image": "TDC-M.png",
         "RemainingSmss": 0
     }
]
```


```
HTTP status code 401
```

This will be returned if the user is not authorized to use this resource.

10.5.2.4 Sensor data | GET api/1/sensors/{id}/data

This API requests sensor data within a relative time period.

Example request URI(s)

```
/api/1/sensors/831/data?fromNow=3h
```

Request

Request parameters		
Parameter	**Type**	**Description**
`fromNow`	String	Minutes, hours, days, or weeks E.g., 3 m, 1 h, 2 d, 1 w m – minutes, h – hours, d – days, w – weeks

Responses

```
HTTP status code 200 - application/json
```

Returns an array of sensor data

Example

```
[
      {
          "Time": "2017-05-17T07:05:21+02:00",
          "Value": "899"
      },
      {
          "Time": "2017-05-17T07:05:31+02:00",
          "Value": "899"
      },
      {
          "Time": "2017-05-17T07:05:41+02:00",
          "Value": "900"
      }
]
```

```
HTTP status code 401
```

This will be returned if the user is not authorized to use this resource.

10.5.2.5 Sensor data | GET api/1/sensors/{id}/data

This API provides sensor data within a specific time period.

Example request URI(s)

```
/api/1/sensors/831/data?from=2017-12-
26T00%3A00%3A00%2B02%3A00&to=2017-12-27T00%3A00%3A00%2B02%3A00
```

Request

Request parameters		
Parameter	**Type**	**Description**
`from`	String	Date and time value with offset in ISO 8601 format
`to`	String	Date and time value with offset in ISO 8601 format
The offset value indicates the extent to which the time value deviates from UTC.		

Responses

```
HTTP status code 200 - application/json
```

Returns an array of sensor data

Example

```
[
     {
         "Time": "2017-05-17T07:05:21+02:00",
         "Value": "899"
     },
     {
         "Time": "2017-05-17T07:05:31+02:00",
         "Value": "899"
     },
     {
         "Time": "2017-05-17T07:05:41+02:00",
         "Value": "900"
     }
]
```

```
HTTP status code 401
```

This will be returned if the user is not authorized to use this resource.

10.5.2.6 Data store | GET api/1/datastores

This API provides a list of user-defined data stores in the system.

Example request URI(s)

```
/api/1/datastores/
```

Responses

```
HTTP status code 200 - application/json
```

Returns an array of data stores

Example


```
[
     {
         "Id": 1,
         "UniqueIdentifier": "Bosch7506A",
         "Name": "Bosch JSON",
         "Columns": {
             "ts": {
                  "Id": 1,
                  "Name": "timestamp",
                  "DataMapping": "ts",
                  "DataStoreId": 1,
                  "ColumnType": 1
             },
             "x": {
                  "Id": 2,
                  "Name": "pose x_mm",
                  "DataMapping": "x",
                  "DataStoreId": 1,
                  "ColumnType": 3
             },
             "y": {
                  "Id": 3,
                  "Name": "pose y_mm",
                  "DataMapping": "y",
                  "DataStoreId": 1,
                  "ColumnType": 3
             }
         },
         "Sensors": {
             "848": {
                  "Id": 848,
                  "ObjectId": 21588,
                  "CompanyId": 4275,
                  "DataStoreId": 1,
                  "Data": {
                      "Mapping": {
                          "IndoorPositionX": "x",
                          "IndoorPositionY": "y"
                      }
                  }
             }
         },
         "DbTableName": "sick.data_store_data_bosch7506a"
     }
]
```


```
HTTP status code 401
```

This will be returned if the user is not authorized to use this resource.

10.5.2.7 Device data | GET api/1/devices/{id}/data

This API identifies device data from the specified data store that were sent within a specific time period.

Example request URI(s)

```
/api/1/devices/21588/data?dataStoreId=1&from=2017-11-
07T10%3A00%3A00%2B02%3A00&to=2017-11-08T13%3A00%3A00%2B02%3A00
```

Request

Request parameters		
Parameter	**Type**	**Description**
dataStoreID	Integer	ID of the data store
from	String	Date and time value with offset in ISO 8601 format
to	String	Date and time value with offset in ISO 8601 format
The offset value indicates the extent to which the time value deviates from UTC.		

Responses

```
HTTP status code 200 - application/json
```

Returns an array of device data

Example

```
[
     {
         "ts": "2017-11-07T12:48:56.597432Z",
         "x": 9.841,
         "y": 11.854,
         "o": -1.581,
         "q": 100,
         "xx": 0.098547,
         "xy": 0.023588,
         "yy": 1.161307,
         "oo": 0.000086,
         "dr": 0,
         "ir": 58,
         "mdm": 0.327
     },
     {
         "ts": "2017-11-07T12:48:57.955297Z",
         "x": 9.829,
         "y": 11.454,
         "o": -1.642,
         "q": 100,
         "xx": 0.012427,
         "xy": 0.007787,
         "yy": 0.11129,
         "oo": 0.000564,
         "dr": 0,
         "ir": 70,
         "mdm": 0.226
     }
]
```

```
HTTP status code 401
```

This will be returned if the user is not authorized to use this resource.

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