OPERATING INSTRUCTIONS

AOS Radar WWD

Object Detection System

Wrong-way driver detection

SICK
Sensor Intelligence.

Described product

AOS Radar WWD

Described software versions

Software	Function	Version
TEMS Info interface	Software for recording and processing measurement data	≥ 3.x
TEMS platform	Software	≥ 3.x

Manufacturer

SICK AG
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Germany

Legal information

Original document

This document is an original document of SICK AG.

Contents

1 About this document

1.1 Information on the operating instructions

Read these operating instructions carefully before starting any work in order to familiarize yourself with the product and its functions.

The operating instructions are an integral part of the product and should remain accessible to the personnel at all times. When handing this product over to a third party, include these operating instructions.

These operating instructions do not provide information on the handling and safe operation of the machine or system in which the product is integrated. Information on this can be found in the operating instructions for the machine or system.

1.2 Target group

This document is intended for persons who project plan, install, commission, operate and maintain the product.

1.3 Further information

You can find the product page with further information via the SICK Product ID:
pid.sick.com/{P/N}/{S/N}
(see "Product identification via the SICK product ID", page 9).

The following information is available depending on the product:

- This document in all available language versions
- Data sheets
- Other publications
- CAD files and dimensional drawings
- Certificates (e.g., declaration of conformity)
- Software
- Accessories

1.4 Related applicable documents

Related applicable documents from SICK

Document	Title	Part number	Source
Operating instructions	RMS1000 (Model RMS-A) Radar sensors	8026118	www.sick.com/8026118
Quickstart	RMS2000	8028332	www.sick.com/8028332
Technical information	RMS2000 Regulatory Compliance Information	8027932	www.sick.com/8027932
Operating instructions	TDC-E (Telematic Data Collector) - Gateway systems	8027311	www.sick.com/8027311

1.5 Symbols and document conventions

Warnings and other notes

DANGER
Indicates a situation presenting imminent danger, which will lead to death or serious injuries if not prevented.

WARNING
Indicates a situation presenting possible danger, which may lead to death or serious injuries if not prevented.

CAUTION
Indicates a situation presenting possible danger, which may lead to moderate or minor injuries if not prevented.

NOTICE
Indicates a situation presenting possible danger, which may lead to property damage if not prevented.

NOTE
Highlights useful tips and recommendations as well as information for efficient and trouble-free operation.

Instructions to action

► The arrow denotes instructions to action.

1. The sequence of instructions is numbered.
2. Follow the order in which the numbered instructions are given.

✓ The tick denotes the results of an action.

2 Safety information

2.1 Basic safety notes

Please observe the safety notes and the warnings listed here and in other sections of this product documentation to reduce the possibility of risks to health and avoid dangerous situations.

CAUTION
Failure to observe the relevant work safety regulations may lead to physical injury or cause damage to the system.

Health hazards as a result of high-frequency electromagnetic radiation

The defined exposure limit values must be observed during operation.

In order to limit human exposure to electromagnetic fields, suitable safety distances must be maintained during both short-term and long-term work in the radiation range of the antenna.

Country-specific features that must be taken into account when operating the device can be found in the publication "Regulatory Compliance Information", which is enclosed with the product.

2.2 Intended use

The AOS radar uses a radar sensor to identify vehicles driving against the permitted direction of travel. If a wrong-way driver is reliably detected in a defined monitoring area, a digital signal is sent to the user system via the I/O interface. In addition, the measurement data of the detected vehicles can be called up via a cloud server in the form of MQTT messages.

The product must only be used within the limits of the prescribed and specified technical specifications and operating conditions at all times.

Incorrect use, improper modification or manipulation of the product will invalidate any warranty from SICK; in addition, any responsibility and liability of SICK for damage and secondary damage caused by this is excluded.

2.3 Improper use

Impermissible use

- As a safety component as defined in the relevant applicable safety standards for machines, e.g. Machinery Directive.
- Detection of persons and animals
- Detection of transparent items

Impermissible ambient conditions

- Explosion-hazardous area

2.4 Qualification of personnel

Any work on the product may only be carried out by personnel qualified and authorized to do so.

Qualified personnel are able to perform tasks assigned to them and can independently recognize and avoid any potential hazards. This requires, for example:

- technical training
- experience
- knowledge of the applicable regulations and standards

3 Product description

3.1 Product identification via the SICK product ID

SICK product ID

The SICK product ID uniquely identifies the product. It also serves as the address of the web page with information on the product.

The SICK product ID comprises the host name pid.sick.com, the part number (P/N), and the serial number (S/N), each separated by a forward slash.

The SICK product ID is displayed as text and QR code on the type label and/or on the packaging.

Figure 1: SICK product ID

3.2 Scope of delivery

NOTICE

- ► After delivery, inspect the product for transport damage and report any such damage immediately.
- ► Check that the delivery includes all components listed on the delivery note.

3.3 Product characteristics

Overview

The system consists of:

- Telematic Data Collector TDC
- RMS
- TEMS software

Figure 2: System components

3.4 System components

3.4.1 Radar sensor RMS

Overview

The radar sensor consists of a radar antenna and a control device. The radar sensor emits electromagnetic waves. If these hit a moving object within the radar sensor's field of view, the radar waves are reflected back to the sensor. The control device processes the radar signals received and forwards all measured values to the Telematic Data Collector.

Complementary information

NOTE
Detailed information can be found in the operating instructions for the component.

3.4.2 Telematic Data Collector

Overview

The Telematic Data Collector TDC with pre-installed TEMS software is the system controller.

Tools pre-installed on the device at the factory allow commissioning using a web-based interface and system extensions.

The TDC receives all measured values from the radar sensor, evaluates them for the defined monitoring area (region of interest) and uses the data to determine the speed and direction of movement of the detected object. Objects moving in the opposite direction are signaled to the connected user system via the I/O interface.

The TDC also supports the transmission of measurement data as MQTT messages via Ethernet or mobile radio.

Complementary information

NOTE
Detailed information can be found in the operating instructions for the component.

3.5 Functionality

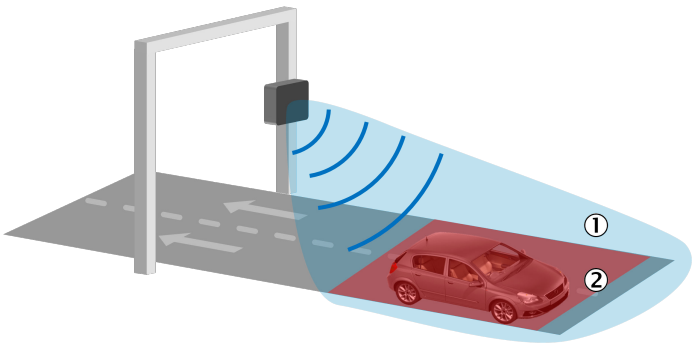

Figure 3: System setup

① Field of view of the radar sensor
② Defined monitoring area (region of interest)

Recommendation: Mount the radar sensor against the correct direction of travel so that the radar waves exit in the direction of travel of the wrong-way driver. A system with a radar sensor oriented in the opposite direction is still functional.

A monitoring area (region of interest) is defined by the software in the radar sensor's field of view.

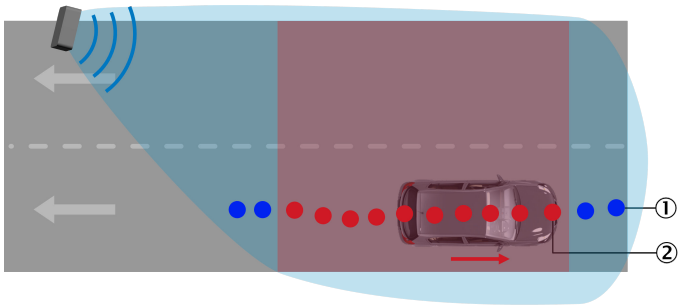

Figure 4: Object points of the trajectory

① Measurement points in the field of view of the radar sensor

② Measuring points in the defined monitoring area

If the radar sensor detects an object within the field of view, the positions of the returned radar signals are forwarded to the TDC. Depending on the setting, all measuring points in the field of view can be evaluated.

Tracking begins with the detection of objects in the sensor's field of view and ends when they leave the field of view. This also includes, for example, shadowing caused by objects between the sensor and the object or signal noise caused by external electromagnetic sources.

Object positions are output as a trajectory. Every object point of the trajectory has a time stamp, the exact position of the coordinate system and the speed. Based on the trajectory, the expected direction of travel is compared with the actual direction of travel in the final step. The actual direction of movement of the vehicle is output as the result.

4 Project planning

4.1 General system requirements

Overview

The radar sensor is mounted on a vibration-free pole, gallows or portal.

Prerequisites

- Vibration-free mast, gallows or portal for mounting the RMS
- Straight and level passage
- I/O line for processing the wrong-way driver signal by the customer system
- Optional: Ethernet cable for retrieving MQTT messages
- Optional: SIM card for the output of MQTT, e-mail or SMS messages via mobile radio
- Voltage supply for RMS and TDC (according to technical data)

4.2 Coordinate system

The radar sensor is positioned in a three-dimensional coordinate system. The zero point in the road coordinate system is always exactly at the outer edge of the road at ground level.

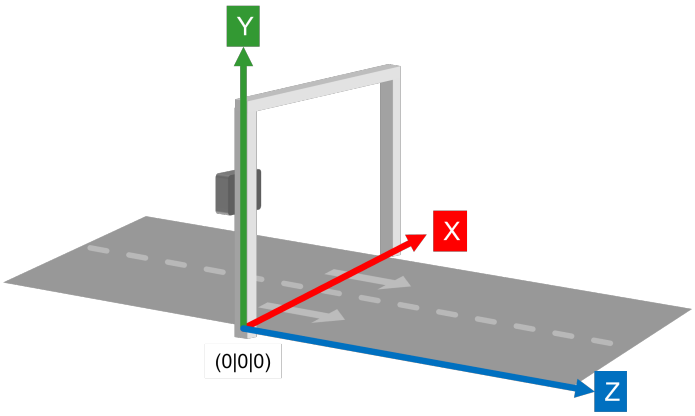

Figure 5: Coordinate system of the location

x-axis	The X-axis (horizontal) points to the right and left of the lane.
y-axis	The Y-axis (vertical) points upwards perpendicular to the road surface.
z-axis	The Z-axis (movement axis) points in the direction of travel.

4.3 RMS alignment

Overview

The viewing range of the RMS is determined by:

- Maximum scanning range
- Mounting height
- Angle to the road
- Aperture angle

NOTE

Recommendation: Mount the radar sensor against the correct direction of travel so that the radar waves exit in the direction of travel of the wrong-way driver.

Pivoting angle and horizontal aperture angle

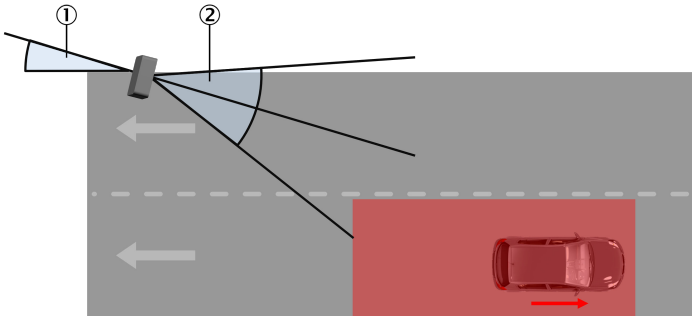

Figure 6: Pivoting angle and horizontal aperture angle

① **Pivoting angle**
- Recommendation: 0 °

② **Horizontal aperture angle**

Tilt angle and vertical aperture angle

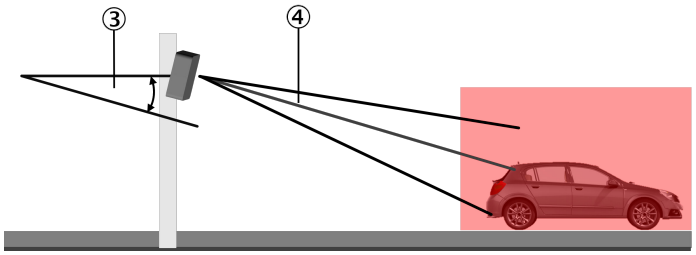

Figure 7: Tilt angle and vertical aperture angle

③ **Tilt angle**
- Depending on the mounting height of the RMS

④ **Vertical aperture angle**
- Not adjustable
- Take the vertical aperture angle into account when defining the monitoring area.

5 Mounting

NOTE
Information is included in the operating instructions for the components.

6 Electrical installation

6.1 Important information

DANGER
Danger from electrical voltage

Risk of electrical shock. Contact will result in death, burns or shock.

- ► Electrical work may only be performed on the system by qualified specialist personnel.
- ► Before working on electrical components, observe the five safety rules:
  - Disconnect
  - Secure against being switched back on.
  - Ensure that there is no voltage.
  - Ground and short-circuit.
  - Cover or enclose live parts in the vicinity

WARNING
Risk of injury and damage caused by electrical current

Due to equipotential bonding currents, incorrect earthing can lead to the following dangers and faults: Voltage is applied to the metal housing, cable fires due to cable shields heating up, the product and other devices become damaged.

- ► Generate the same ground potential at all grounding points.
- ► Ground the equipotential bonding via the functional ground connection with a low impedance.

NOTE
Observe the circuit diagram provided during commissioning.

6.2 Connection overview

The system components are supplied with power separately.

RMS and TDC-E are connected to each other via an Ethernet cable.

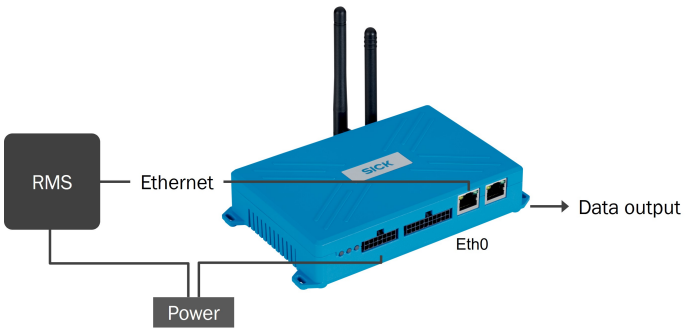

Figure 8: Connection overview

NOTICE

- ► Do not lay cables freely suspended.
- ► If possible, lay cables inside masts.

NOTICE

► Take lightning protection measures when entering and leaving the control cabinet.

6.2.1 Electrical installation of RMS

NOTE

Detailed information can be found in the operating instructions for the component.

6.2.2 Electrical installation of TDC

NOTE

Detailed information can be found in the operating instructions for the component.

6.3 Interfaces and data output

Overview

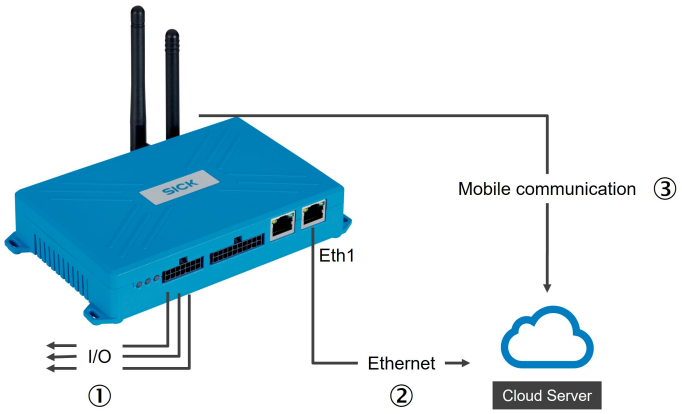

Figure 9: Interfaces and data output

① I/O
- Output of the wrong-way driver signal to the user system
- System status
- Functionality of the system (heartbeat)

② Ethernet interface
- TCP/IP (TEMS Info Interface)
- MQTT messages
- E-mail
- SMTP

③ Wireless communication
- MQTT messages
- E-mail
- SMTP

Table 1: Ethernet interfaces and IP addresses of the TDC as delivered

Ethernet interface	Description	IP address
Eth0	• Internal interface for the sensor	192.168.0.100
Eth1	• Interface for data output via Ethernet • Configuration interface	192.168.1.100 DHCP

NOTE
Data transmission via mobile radio requires a SIM card from the country-specific telecommunications provider.

MQTT messages

An MQTT message broker can be used to retrieve data from the system in the form of configurable MQTT messages. MQTT messages can contain both information on the system status and measurement data of an object (e.g. the object positions of the generated trajectory with time stamp and speed as well as the direction of movement). The data can be used for analysis and long-term monitoring and, if the data connection is good enough, for alerting.

Connecting the interfaces

NOTE
Information is included in the operating instructions for the components.

Further topics

- "Plug-in MQTT", page 32
- "SMS plug-in", page 34
- "SMTP plug-in", page 35
- "Plug-in TDC-E IO (I/O interface)", page 36

7 Commissioning

7.1 System start

Procedure

► Connect the voltage supply.
✓ The system starts up automatically when the voltage supply is connected.
► Check the operational status of the components by looking at the display elements.

7.2 Preparing the configuration computer

Overview

The TDC is configured using a computer that is connected to the TDC via Ethernet. An Internet browser is used to access the TEMS Manager or the user interface of the TDC-E Device Manager.

After a successful boot process, both TEMS Manager and Device Manager are running.

Procedure

► Ensure that the configuration computer is in the address range of the TDC.
► Connect the configuration computer to the TDC via Ethernet connection **Eth1** .

Further topics

- Interfaces and data output

7.3 Opening the TEMS Manager

Prerequisites

- Web browser available in the current version on the client computer
- Browser supports HTML5 and WebGL

Procedure

► Open the browser on your computer.
► Call up the TEMS Manager with the following URL:
`http://192.168.1.100:56000`
✓ Once the connection to the TDC has been established, the TEMS Manager web interface opens.

8 Operation

8.1 TEMS Manager

8.1.1 User interface

Overview

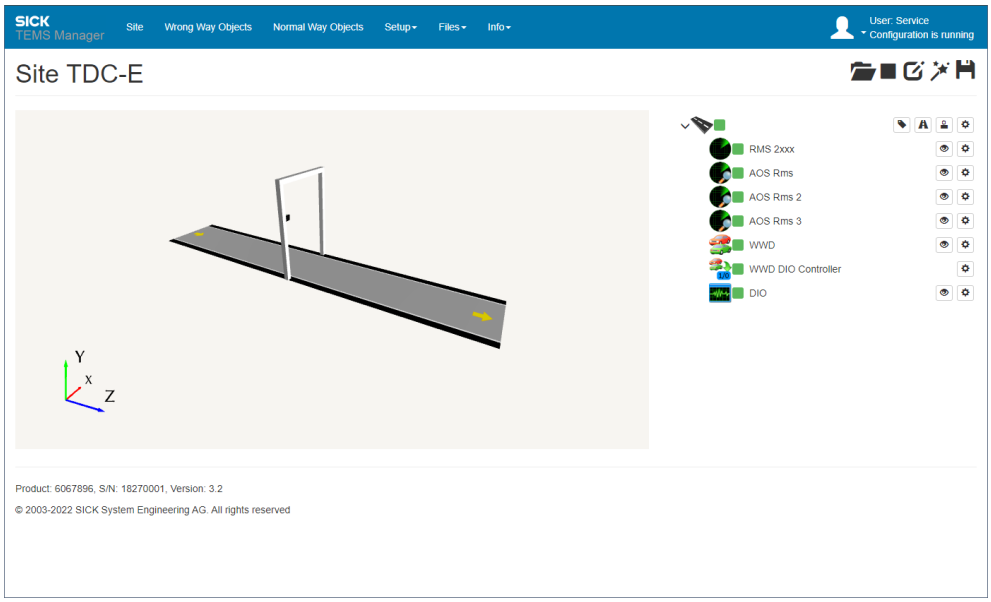

*Figure 10: **TEMS Manager** home page*

Menu bar

The menu bar containing the main workspaces is visible in every working context.

The right-hand side of the menu bar shows the logged-in users and the operating status. The **Configuration is running** message indicates proper operation of the system. In the event of a system fault, a red exclamation mark is displayed in the work area **Site**.

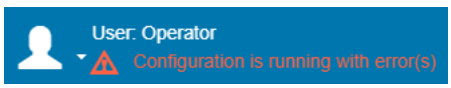

Figure 11: Display of a fault

Table 2: Functions of the workspaces

Working range	Description
Site	• Visualization of the measurement location in live display • Display of the system parameters and the current system status
Wrong Way Objects	• Display of measurement results of vehicles for which a movement in the opposite direction of travel was determined • Display takes place during operation
Normal Way Objects	• Display of measurement results of vehicles for which a movement in the permitted direction of travel was determined • Display takes place during operation
Setup	• Contains administrative functions, depending on authorization, e.g: o User management o Updates

Working range	Description

Files	• Access to:
	  ○ Log files of the system
	  ○ Data
	  ○ Configuration
	  ○ Licenses

Info	• Information about the TEMS Recorder • Documentation • Downloads

User menu

The user icon opens a menu with the following functions:

Table 3: User menu

Function	Description
Reset Site Settings	• Reset all display settings (zoom, rotation in 3D displays, tabular displays, etc.) to default values. • This function is helpful if the 3D scenery has been adjusted so that the portal is no longer visible in the live display.
Language	• Selection of the user interface language
Edit Profile	• Change user name. • Change password.
Logout	• Log out current user.

Toolbar

Table 4: Functions of the toolbar above the navigation tree

Symbol	Description
	Load a site configuration for starting or editing • Load configuration file into the TEMS Manager. • Optionally start the configuration or open it in editing mode. • Required authorization: `AuthorizedClient` or higher
	Start site configuration • Start the currently open configuration. • A red number in the icon indicates that the configuration is faulty. • Faulty configurations cannot be started.
	Stop the current site configuration • Stop the running configuration in measuring mode. • Required authorization: `AuthorizedClient` or higher
	Edit site configuration • Switch to Edit mode. • The system parameters can be changed in editing mode. • To exit Edit mode, click the blue icon. • Required authorization: `AuthorizedClient` or higher
	Standortkonfigurations-Assistenten starten • Open the configuration wizard in the current location configuration. • The site configuration can be edited and stored in the wizard.

Symbol	Description
	Save the current site configuration • Download the current location configuration from the browser. • The configuration that is saved in the file can help SICK Support to resolve fault situations quickly.
	Reset site configuration • Resets all the changes that have been made to the system parameters in editing mode, but only after you confirm the prompt. The navigation tree will then be completely blank.
 	Undo / Redo • Undo last change • Redo last change
	Restart site configuration • Restart site configuration to apply the changes

Navigation tree

Table 5: Functions in the navigation tree

Symbol	Description
	Show live data output of the system component
	Show Details
	Links between system components or software modules (input and output data)
	Add System component
	Input data
	Output data

Reopening home page

Clicking on the program name reloads the TEMS Manager and the home page with the **Site** workspace appears again.

Responsive presentation

The TEMS Manager display format automatically adjusts to the size of the screen. On a smartphone or tablet, the content is arranged from top to bottom.

The individual workspaces can be called up with the menu icon.

8.1.2 Work area Site

Overview

The work area **Site** is divided into two parts.

Live display (left)

- Visualization of the measurement location
  - Road
  - Lane(s)
  - Direction of travel
  - System components with installation location and status display
- Display of the vehicles detected by the system as a 3D model
- Display of the raw measurement data supplied by the sensors
- Display of the calculated object points of the trajectory

Navigation tree (right)

The navigation tree on the right-hand side contains all software modules of the measurement location for which an adjustment to the measurement location must be made. The presentation is in a hierarchical structure.

Plug-ins

In the lower area, plug-ins for processing the measured values, vehicle data and status information can be selected and configured.

8.1.3 Starting the location configuration wizard

Overview

The software modules are selected using a wizard. The selected modules are then adapted to the measurement location in a subsequent step.

Procedure

► To start the wizard for selecting the location configuration, click on the Site configuration wizard icon.

✓ The site configuration wizard opens.

In the left-hand area, or at the top if the screen is smaller, the **Summary** shows the pages that must be run through depending on the selected components. Pages for which an entry has already been made are marked with a tick.

The settings for the selected page are made in the right or bottom area.

If no location configuration has been created yet, the **New location** option is selected.

NOTE
The hard shoulders are also regarded as a lane. At least two lanes are preset in the wizard. If only one lane is to be monitored, the hard shoulder must be explicitly deactivated.

8.1.4 Loading the configuration file:

Overview

The site configuration with the essential system parameters can be defined in an XML configuration file.

This configuration file can be loaded into the TEMS Manager. There, the parameters can then be adapted to the conditions of the respective measuring site.

Prerequisites

- Required authorization: `AuthorizedClient` or higher

Procedure

NOTE
If a configuration is loaded while another configuration is running, the system will automatically stop the current configuration. The new configuration is loaded and started. System operation is paused during this process.

Loading the site configuration

► Click on the **Load a site configuration for starting or editing** icon.

► Select the configuration file with the location configuration.
► Click on the **Start site configuration** button.
✓ The configuration is loaded in TEMS Manager.
✓ The site configuration is transferred from the file to the TEMS Recorder and started.

8.1.5 Saving configuration file

Overview

To be able to resolve fault situations quickly, SICK Support often needs to have the current configuration file for the measurement site. This file can be saved onto the hard drive of a computer.

NOTE
The site configuration can be stored while a configuration is running. The process for saving a site configuration does not affect the current system status.

Prerequisites

Procedure

► In the toolbar, click on the **Save the current site configuration** icon.

✓ The download dialog box of the browser opens right away.
► Specify the desired location for the configuration file.
  - The site configuration is saved as an XML file.
    Contents of the file, among other data:
    - IP addresses of the sensors
    - Mounting position and marking of the sensors
    - Definition and marking of the software modules

Complementary information

The XML file with the site configuration can also be edited directly, e.g. to adjust the names of the software modules or the position of the system components. Then the file must be loaded into the TEMS Manager.

8.1.6 Displaying system parameters and status

Overview

Authorization	Description
Operator	Show parameters
AuthorizedClient or higher	Edit parameters

Procedure

Opening the detail window

► Expand navigation tree.
► For a module or system component, click on the **Show Details** icon.

✓ The detail window opens.
The parameters displayed depend on the permissions of the logged-in user.

8.1.7 Displaying measurement points

Overview

The measuring points determined in the sensor's field of view can be shown in the live display while the configuration is running. This can help to limit errors when starting the configuration.

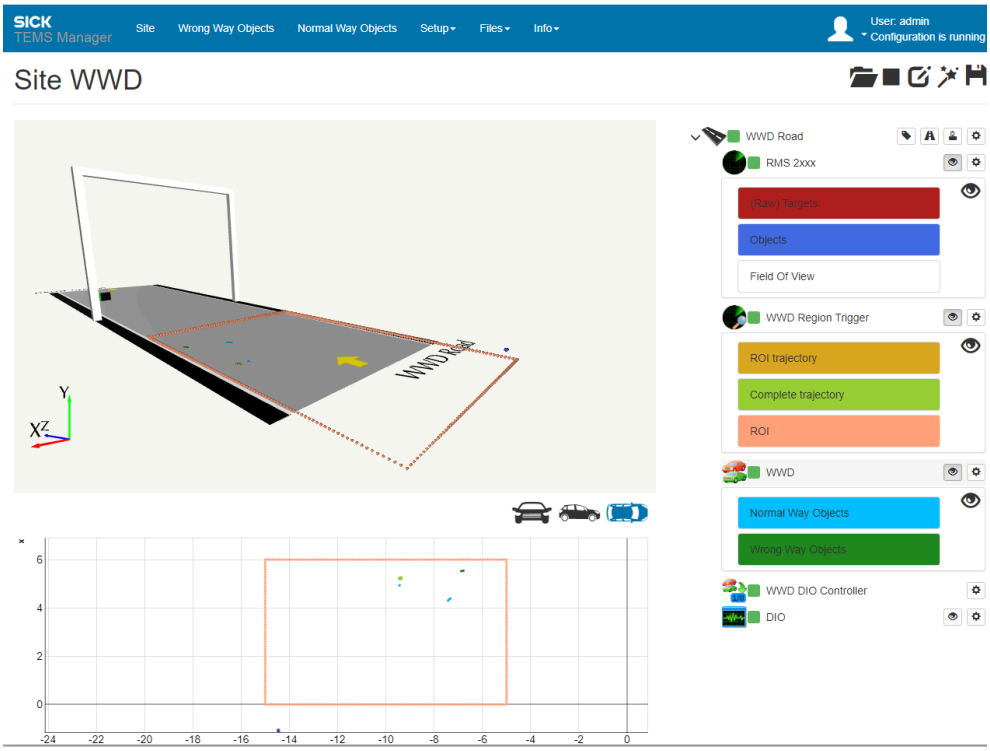

Figure 12: Display of the measuring points

Procedure

► In the navigation tree at sensor level, click on the **Show live data output of the system component** icon.

► Click on **(Raw) Targets**.
► To display the tracked object points in the monitoring area, click on **Objects**.
✓ The unfiltered raw data of the sensor is shown in the live display of the TEMS Manager.
► To display the geometry of the monitoring area, click on **Field Of View**.
► To hide the measuring points again, click on the field of the selected measuring points again.

ⓘ **NOTE** | The color values displayed are random and have no meaning.

8.1.8 Adjusting system parameters

Overview

Values and designations that can be changed are underlined in blue.

Prerequisites

- Required authorization: `AuthorizedClient` or higher

Procedure

► Click on the **Edit site configuration** icon.

► Work through the hierarchical structure of the navigation tree from top to bottom when editing the system parameters.

NOTICE
The link symbol shows links to other modules:

Changes to these links can impair the function of the system.

8.1.8.1 Specifying the measurement site designation

Procedure

► Click on the current designation of the measurement location below the header.
► Enter designation.
► Confirm with Enter.

8.1.8.2 Configuring the lanes, lane width, and direction of travel

Overview

The number and width of lanes and the direction of travel must be adapted to the actual situation.

The side strips are also listed as a lane. If the monitoring area is set accordingly, these can be monitored in the same way as the regular lanes.

NOTE
Recommendation: Also monitor the hard shoulder, as wrong-way drivers can drive along it.

The naming of the road and lanes is optional and has no influence on the system. However, naming can become important when information from different installations is processed together.

Procedure

Adjust the number and width of lanes

► Adjust the values underlined in blue (number, lane width and direction of travel).
► Confirm with Enter.

Set the direction of travel in the live display

► Adjust the display to the direction of travel.
With the **Normal** setting, the arrow points from the top left to the bottom right.
► Confirm with Enter.

NOTE
If the road is configured with the existing lanes, the right and wrong-way drivers are assigned to a lane. The display of the direction of travel improves the overview in the live display and helps with configuration, as it reflects the actual status.

Customizing designations

Customizing the name of the street

► Click on the blue highlighted street name in the navigation tree.
► Enter name.
► Confirm with Enter.

Customizing the naming of the lanes

► In the navigation tree at street level, click on the **Edit road configuration** icon.

✓ An input line appears underneath the road per lane.
► In the navigation tree, click on the lane name highlighted in blue.
► Enter name.
► Confirm with Enter.

8.1.8.3 Signing the configuration

Overview

A signature can be used, for example, to document that a configuration has been checked and approved. The signature is a type of encrypted signature that is generated when the configuration is saved and written to the configuration file.

Information contained in the signature, among other things:

- Configuration computer
- Registered user
- Date saved

Once a configuration has been signed it cannot be changed without removing the signature. This makes it possible to reliably check whether the configuration has been changed (e.g. after commissioning).

Procedure

► In the navigation tree at the top level, click on the **Sign this location configuration** icon.

✓ Two input fields appear.
► Enter the name of the person who has released the configuration.
► Comment on the release via a corresponding note.
✓ The signature information is supplemented by a date field. The Name, Notes and Date fields are deactivated after signing and can no longer be changed. The **Sign this location configuration** icon is displayed in green.
► Close the area by clicking on the icon again.

8.1.9 Module RMS2xxx: Configure radar sensor

Overview

The module **RMS2xxx** receives and processes all measurement data within the radar sensor's field of view.

The parameters of the module **RMS2xxx** determine the exact mounting position of the radar sensor in the coordinate system.

NOTE
The network parameters of the radar sensor are preset by loading the configuration file and do not need to be adjusted.

Rough alignment using the grid (optional)

The sensor components can initially be aligned in the graphical representation of the live display:

► Click on a component in the live display.
► Click on the component again and keep the mouse button pressed.
✓ A grid is displayed as an orientation aid.
► Rotate the measurement location in the live display to switch between displaying the grid in the X direction and Z direction
► Move the component to the desired level.

Precise alignment

► To determine the exact position of the sensor components, in the navigation tree at the level of a sensor component, click on the **Edit the position of the system component** icon.

✓ The input lines appear. They contain default values or, if applicable, the position values of the rough alignment.
► Set position and angle. If necessary, adjust the view to clearly see the effect of the input in the live display.

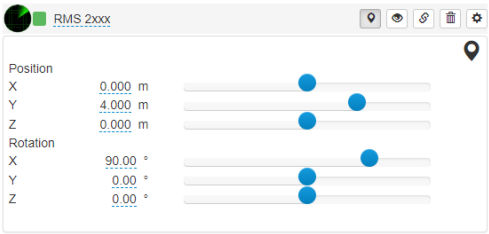

Figure 13: Definition of position and rotation

Position X, Y and Z	Positioning according to the respective axis - 10.000 m ... + 10.000 m
Rotation X, Y and Z	Rotation around the respective axis - 180.00° ... + 180.00°

8.1.10 Module WWD Region Trigger

Overview

The **WWD Region Trigger** module processes the measuring points transferred by the **RMSxxxx** module and creates trajectories for RMS objects.

The following parameters are defined in the module:

- Monitoring area (region of interest)
- Minimum speed of the evaluated vehicles
- Minimum length of the trajectory
- Minimum number of measuring points

If the measurements do not provide the desired results, the status messages and log files can provide information on the extent to which the parameters need to be adjusted.

Further topics

- see "Error analysis using the status messages", page 46

8.1.10.1 Configuring the WWD Region Trigger module

Prerequisites

- The module **WWD Region Trigger** is added.
- The region of interest must lie completely within the sensor's field of view. Consider the aperture angle, mounting position and maximum scanning range of the radar sensor.

Procedure

Defining the region of interest

NOTE
Recommendation: Define the region of interest using the location configuration wizard.

► At the level of the module **WWD Region Trigger**, click on the **Show Details** icon.

► In the area **ROI Assistant**, adjust the polygon points.
► If necessary, change the order using drag-and-drop.
► If the hard shoulder is to be monitored, include it in the polygon.
Object tracking is set by default.
► Click on **Save & Close**.
The geometry can be shown in the live display (see "Displaying measurement points", page 24).

A module that has not yet been configured **WWD Region Trigger** is marked red with a number. The marking indicates which parameters or input data and output data still need to be defined.

Selecting the trigger method

► In the navigation tree at module level **WWD Region Trigger**, click on the link symbol.

► Select at least one of the three trigger methods as the output target. To do this, click on the plus symbol next to the desired trigger method.

► Select the software module for further data processing.

Linking WWD Region Trigger with the sensor

► In the navigation tree at module level **RMS2xxx**, click on the link symbol.

► In the **WWD Region Trigger** area, click on the plus icon.

► Select module **WWD Region Trigger**.

Further topics

- "Monitoring area (region of interest)", page 29
- "Trigger methods", page 29

8.1.10.2 Monitoring area (region of interest)

Overview

The monitoring area (region of interest) is placed in the field of view of the radar sensor and defined in the TEMS Manager via a series of points. A point is determined by its coordinates on the road. The dimensions of the region of interest are defined as a sequence of points.

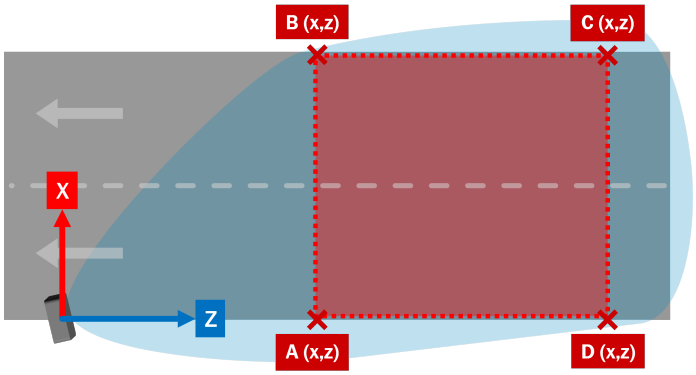

Figure 14: Dimensions of the region of interest

Further topics

- "Configuring the WWD Region Trigger module", page 28

8.1.10.3 Trigger methods

Overview

For the **WWD Region Trigger** module, at least one of the three trigger methods must be selected.

- **AfterRoiTrajectory**
- **CompleteTrajectory**
- **ImmediateRoiTrajectory**

AfterRoiTrajectory

AfterRoiTrajectory outputs a trajectory when the detected vehicle has left the ROI and when the set parameters such as minimum length of the trajectory and number of measuring points are met.

If the vehicle does not meet the parameters when leaving the ROI, these parameters are compiled outside the ROI before being output.

If the vehicle has left the ROI and can no longer be seen by the sensor, the trajectory is also output.

CompleteTrajectory

CompleteTrajectory outputs a trajectory if the detected vehicle is no longer seen by the sensor for a certain period of time. This can occur before, inside or outside the ROI.

ImmediateRoiTrajectory

ImmediateRoiTrajectory outputs a trajectory when the detected vehicle enters the ROI and when the set parameters such as minimum length of the trajectory and number of measuring points are met.

If the vehicle does not meet the parameters when it enters the ROI, these parameters will continue to be compiled within the ROI before being output.

If the vehicle has entered the ROI and can no longer be seen by the radar, the trajectory is also output.

8.1.11 WWD module

Overview

The parameters of the **WWD** module define the expected direction of travel in the monitoring area.

The **WWD** module evaluates the trajectory received from the **AOS RMS** module. The expected direction of travel is compared with the actual direction of travel. The actual direction of movement of the vehicle is output as the result.

NOTE
The expected direction of travel is not related to a lane, but to the defined monitoring area. The monitored area can be placed regardless of the lanes and can therefore be outside lanes or cross several ones. Since the direction of travel may not be clear by looking at the lane, it must be specified separately in relation to the road coordinate system.

Procedure

► At the **WWD** module level, click on the **Show Details** icon.

► In the **ExpectedDrivingDirectionZ** parameter, set the Z direction to + 1 or - 1.
The Z-direction corresponds to the Z-direction of the road coordinate system as shown in the live view.
► In the parameters **MaxValidSpeed** and **MinValidSpeed**, specify the maximum and minimum vehicle speed for a valid wrong-way driver evaluation.

Measurements of vehicles whose speed is above or below this are marked as invalid.

► Click on **Save & Close**.

8.1.12 Module WWD DIO Controller

Overview

In the module **WWD DIO Controller**, the output is defined via digital IOs.

Prerequisites

- The module **DIO** is added.
- The module **WWD DIO Controller** is added.

Procedure

WWD DIO Controller

► In the navigation tree at module level **WWD DIO Controller**, click on the link symbol.

► At the output **DioValues**, click on the plus symbol and link the module **DIO**.

WWD

► Click on the link symbol in the navigation tree at the **WWD** module level.

► At the output **VehicleData** or **WwdObjectInfo**, click on the plus symbol and link the module **WWD DIO Controller**.

DIO

► At the level of the module **DIO**, click on the **Show Details** icon.

► Activate the slider for the parameter **Enabled**.

► Set **DIO_A** to **DIO_F** to **Output**.

► Click on **Save & Close**.

► At the level of the module **WWD DIO Controller**, click on the **Show Details** icon.

► In the area **Parameter**, define the desired alarms.

NOTE

If the setting options in the module **WWD DIO Controller** are not sufficient, the plug-in **TDC-E IO** is required.

Further topics

- Plug-in TDC-E IO (I/O interface)

8.1.13 Data output

Overview

The data output is configured in the TEMS Manager via plug-ins, with the exception of the I/Os.

8.1.13.1 Adding plug-ins

Procedure

► Switch to Edit mode.

► In the navigation tree, click on **Add Plugin**.

► Select the desired plug-in from the list of available plug-ins.
✓ The plug-in appears in the navigation tree.
A red mark on the plug-in indicates that the setup is incomplete.
► At the plug-in level, click on the **Show Details** icon.

Complementary information

The plug-in provides a predefined rule set that must be adapted to the application.

8.1.13.2 Plug-in MQTT

Overview

MQTT is a client-server message protocol based on the publish/subscribe principle. Communication takes place via a central distributor, the so-called MQTT Message Broker. Each message sent by a client contains a topic with the data. Within the system, the plug-in **MQTT** takes on the role of the publisher. Each MQTT client that wishes to receive the messages for the topic must subscribe to them on the message broker and log in to the MQTT broker.

The plug-in **MQTT** can be used to retrieve information on the system status and measurement data via MQTT messages. The MQTT messages must be configured accordingly.

Design

- **MainTopic**
  - **subtopic1**
  - **subtopic2**
  - ...

You can either subscribe to topics individually or collectively.

MainTopic/subtopic2 only receives data that is published under **subtopic2** .

MainTopic/# subscribes to everything published in **MainTopic** or in any of the topics below.

Prerequisites

- Access to the selected platform is permitted in the network.
- Modem is switched on or WLAN connection is established.
- For connection via mobile radio:
  - SIM card is inserted and connected to the provider's service.
  - SIM card can connect to the Internet (mobile data is active).

Further topics

- Configuring the MQTT plug-in

8.1.13.3 Configuring the MQTT plug-in

Procedure

Customizing the rule set

► Stop the current configuration.

► In the work area **Files**, click on **Configuration**.
► Click on the cogwheel icon for the corresponding rule set. **Mqtt_VehicleData_Wwd**
► In the lower area, switch to the **File** tab.
► Click on **Download**.
► Rename downloaded file.
► Open the file in an editor.
► Customize MQTT topics.

```
[...]
<Joints>
    <Joint Id="RecorderState" Address="/RecorderState" />
    <Joint Id="RecordedData" Address="/RecordedData" />
</Joints>
[...]
```

► Save file.
► In the work area **Files**, return to **Configuration**.
► Upload the customized file.
► To return to the configuration, click on the **Site** button.

Adjust parameters

► Switch to Edit mode.

► At the plug-in level, click on the **Show Details** icon.

► Enter parameters:
  - **RulesDefinition**
  - **MqttHost**
  - **MqttPort**
  - **TLSProtocol**

Complementary information

Table 6: Included rule sets

Name Title	Description
MQTT Plugin Rules Default MQTT Default Rules	Topic RecorderState • Provides information on the system status. • Information is provided at regular intervals. Topic RecordedData • Describes the preparation of incoming vehicle data in JSON format. • Data is provided exactly when a measurement has taken place. **NOTE** | The MQTT messages are published for the topics as soon as a new RecorderState or a new RecordedData event occurs.

Name Title	Description
Mqtt_VehicleData_Wwd MQTT WWD Base Config	Topic RecorderState • Provides information on the system status. Topic RecordedData • Provides measurement data of a vehicle with direction of travel, wrong-way driver status and speed.
Mqtt_Wwd_With_Trajectory MQTT WWD Trajectory Config	Topic RecorderState • Provides information on the system status. Topic RecordedData • Provides measurement data of the basic configuration as well as object positions of the generated trajectory with time stamp and speed.

Further topics

- Plug-in MQTT

8.1.13.4 SMS plug-in

Overview

The **SMS** plug-in can be used to receive information on the system status and measurement data via SMS.

Prerequisites

- Modem is switched on.
- SIM card is inserted and connected to the provider's service.
- SIM card can send SMS.

Further topics

- Configuring the SMS plug-in

8.1.13.5 Configuring the SMS plug-in

Procedure

Customizing the rule set

► Stop the current configuration.

► In the work area **Files**, click on **Configuration**.
► Click on the cogwheel icon for the corresponding rule set.
SmsPluginRules_Wwd_Example
► In the lower area, switch to the **File** tab.
► Click on **Download**.
► Rename downloaded file.
► Open the file in an editor.
► Customize recipient phone number for the alarm types.
Recommendation: Customize the recipient telephone number both in the TEMS Manager in the plug-in and in the rule set.

```
[...]
<ValueScript>
    [...]
        { Receiver: "4912312345678", Text: string }
        [...]
```

```
</ValueScript>
[...]
```

► Save file.
► In the work area **Files**, return to **Configuration**.
► Upload the customized file.
► To return to the configuration, click on the **Site** button.

Adjusting parameters

► Switch to Edit mode.

► At the plug-in level, click on the **Show Details** icon.

► Enter parameters:
  - **Username**
  - **Password**
  - **RulesDefinition**
  - **DefaultReceivers**

Further topics

- SMS plug-in

8.1.13.6 SMTP plug-in

Overview

The **SMTP** plug-in can be used to receive information on the system status and measurement data by e-mail.

Prerequisites

- Access to the selected platform is permitted in the network.
- Modem is switched on or WLAN connection is established.
- For connection via GSM:
  - SIM card is inserted and connected to the provider's service.
  - SIM card can connect to the Internet (mobile data is active).

Further topics

- Configuring the SMTP plug-in

8.1.13.7 Configuring the SMTP plug-in

Procedure

Customizing the rule set

► Stop the current configuration.

► In the work area **Files**, click on **Configuration**.
► Click on the cogwheel icon for the corresponding rule set. **SmtpPluginRules_Wwd_Example**
► In the lower area, switch to the **File** tab.
► Click on **Download**.
► Rename downloaded file.
► Open the file in an editor.

► Customize sender and recipient email addresses for the alarm types.
Recommendation: Customize the sender and recipient email addresses in both the TEMS Manager in the plug-in and in the rule set.

```
[...]
<ValueScript>
    [...]
        string sender = "abcdef@ghi.ch";
        string receiver = "abc@def.ch";
        [...]
</ValueScript>
[...]
```

► Save file.
► In the work area **Files**, return to **Configuration**.
► Upload the customized file.
► To return to the configuration, click on the **Site** button.

Adjusting parameters

► Switch to Edit mode.

► At the plug-in level, click on the **Show Details** icon.

► Enter parameters:
  - **DefaultReceiver**
  - **DefaultSender**
  - **DefaultSubject**
  - **RulesDefinition**
  - **SmtpServer**[1)]
  - **SmtpServerPort**[1)]
  - **SmtpUser**
  - **SmtpUserPassword**

Further topics

- SMTP plug-in

8.1.13.8 Plug-in TDC-E IO (I/O interface)

Overview

The **TDC-E IO** plug-in controls the output of the wrong-way driver signal via a digital I/O interface of the TDC-E to the user system. System status and heartbeat can also be output via this plug-in.

The **TDC-E IO** plug-in basically activates all digital interfaces of the TDC-E.

NOTE
If the setting options in the **WWD DIO Controller** module are not sufficient, the **TDC-E IO** plug-in is required.

Prerequisites

- DIO module is configured and activated.
- DIO transmitter or receiver is connected to the DIO.
- Configuration file is loaded (see "Loading the configuration file:", page 23). This means that the plug-in **TDC-E IO** is already created.

1) Information available from your e-mail provider

Further topics

- Configuring the TDC-E IO plug-in
- Module WWD DIO Controller

8.1.13.9 Configuring the TDC-E IO plug-in

Procedure

Customizing the rule set

► Stop the current configuration.

► In the work area **Files**, click on **Configuration**.
► Click on the cogwheel icon for the corresponding rule set.
TDCE I/O Plugin Rules Default
► In the lower area, switch to the **File** tab.
► Click on **Download**.
► Rename downloaded file.
► Open and edit the file in an editor.
► Save file.
► In the work area **Files**, return to **Configuration**.
► Upload the customized file.
► To return to the configuration, click on the **Site** button.

Example

An application example for an additional rule is a wrong-way driver detection in a tunnel, which can be completely blocked by a traffic light. If the red traffic light signal is applied to an input of the TDC, correct drivers who ignore the red light can also be output as 'wrong-way drivers' via a digital output.

Further topics

- Plug-in TDC-E IO (I/O interface)

8.1.14 Start configuration

► Click the **Start location configuration** icon.

✓ A progress bar is displayed to visualize the start of configuration.

If the configuration cannot be started:

► Check the correct voltage supply to the system components, the network connectivity and the IP addresses.
► Ensure that the system components have been mounted in accordance with the specifications.
► Check the position and alignment of the system components in the TEMS Manager. The position and alignment must match the actual conditions.

8.1.15 Displaying operational readiness

Overview

- If all system components are shown in green in the live display after the configuration has been successfully started, they are ready for operation.
- In the navigation tree, the operational readiness of the modules and system components is visualized by a green marker.
- A gray icon signals that a device status is currently unknown.
- When the configuration starts, the sensor components remain red until a connection has been established. Depending on the network connectivity, this can take up to two minutes.

NOTE
A permanent red display of a sensor component can be caused by an incorrect IP address of the component. The problem could also be caused by a missing or inadequate voltage supply or poor network connectivity.

Further topics

- "Troubleshooting", page 44

8.1.16 Verification of proper measurement operation

Commissioning is completed with a test run. The test run must ensure that the vehicles are continuously recorded and that the system components work correctly and provide plausible measured values.

The test run can only take place if the configuration of the location has been successfully completed and all software modules and system components are displayed with a green marker in the navigation tree.

8.1.16.1 Display of vehicles with measured values

Overview

In the working areas **Normal Way Objects** and **Wrong Way Objects**, the last recorded vehicles are listed in a table while the TEMS Manager is connected to the TEMS Recorder.

Displayed data

- Time of recording
- Direction of travel
- Monitored lane
- Number of individual measurements
- Length and width of the trajectory

Configuration options

- Column selection by clicking on the icon:

- Sequence according to sort setting
- Number of vehicles displayed
- Filtering of the displayed vehicles by entering a character string

8.1.16.2 Saving vehicle data

Overview

The measured values of vehicles can be saved on a local hard disk via the list display of the vehicles. The vehicle data together with the log files and the location configuration are helpful for error analysis.

NOTE
The last 200 measured vehicles or 5 MB of data are displayed in the TEMS Manager and can be saved accordingly.

Procedure

► To save the data of an **individual** vehicle, click on the Save icon on the right-hand side of the list.

► To save **all** vehicles currently listed in the TEMS Manager to a local hard disk, click on the **Save all vehicles** icon in the toolbar.

8.1.16.3 Retrieving detailed information

Overview

A detailed page with further information (3D model and measurement results) can be called up for each vehicle.

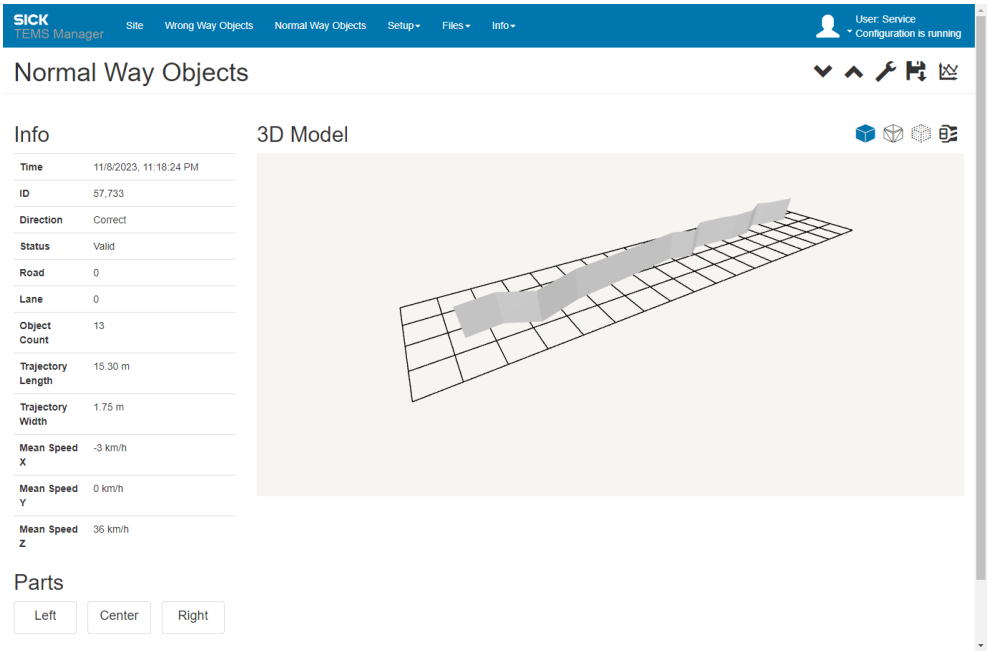

*Figure 15: Detail page **Normal Way Objects***

Procedure

Show detail page

► Click on the respective vehicle line.
The details page appears in the same browser window.

Range	Description
Information	Measured values of the vehicle
3D model	Calculated trajectory in 3D view

► To return to the vehicle list, click in the menu on the work area **Normal Way Objects** or **Wrong Way Objects.**

Symbol	Description
	• Switch to the detailed display of the next or previous vehicle without returning to the list of vehicles
	• Configure detail page and visibility of data
	• Back up vehicle data locally
	Time-position-speed diagram • Visualize determined measuring points of the trajectory in a temporal reference

Complementary information

Representation of the 3D model

- The 3D model can be rotated, moved, zoomed in and out in the same way as the graphical representation of the location.
- The display of the 3D model can be selected:

 Surface

 Frame display

 Point display

Measurement of the 3D model

- The 3D model can be measured. For this purpose, a box is mounted that can be placed around the model. The dimensions for the height, length and width of the box are displayed.

8.1.17 User Management

8.1.17.1 Creating a user

► Log in as a user with the authorization **Service** or higher.
► In the work area **Setup**, select the **User Management** function in the work area.
► Click on **Create user**.
► Enter user name. Note that it is case-sensitive.
► Enter password and repeat.
► Click on **Save**.
✓ The newly created user is added to the list of users.
► Assign the required authorization to the user by clicking on **Operator**, **AuthorizedClient or Service** .

8.1.17.2 TEMS default passwords

NOTICE

► Change the standard passwords during initial commissioning!

User	Default password
Operator	operator123X.
AuthorizedClient	client123X.
Service	service123X.

8.2 TDC Device Manager

NOTE
Detailed information can be found in the operating instructions for the component.

9 Maintenance

9.1 Visual control

DANGER
Risk of fatal electric shock if the insulation on the cables is damaged!

- ► Check the **electrical installation** regularly. Defects such as loose connections or scorched cables must be rectified immediately.
- ► Make sure that all **cable connections** are secure.
- ► Check the **fittings** on the devices and inside the control cabinet and, if necessary, tighten them.
- ► Unscrew the **plug connections** and check for moisture and traces of corrosion.

NOTE
Plug connectors that have been damaged by corrosion must be replaced straight away. Corroded plug connectors can have a major impact on the sensor' performance.

- ► Check the stability of the brackets for cracks and other damage.
- ► Check the fittings once a year.

9.2 Cleaning

Contamination of the sensor can impair the measurement behavior. Sensors must be cleaned regularly.

NOTE
Information is included in the operating instructions for the components.

9.3 Exchanging components

Important information

Faulty or damaged components must be dismantled and replaced with new or repaired components.

NOTE
After replacing a component, the measurement location must be updated.

Further topics

- Updating the measuring location after replacing RMS
- Updating the measuring location after replacing TDC

9.3.1 Updating the measuring location after replacing RMS

Overview

The replacement device has the same IP address as the defective radar sensor and can be used immediately.

9.3.2 Updating the measuring location after replacing TDC

Procedure

- ► Connecting the configuration computer with Ethernet interface Eth1

Establishing a connection

► Connect to the TEMS Manager.
► Log in to the TEMS Manager as a user with the authorization `AuthorizedClient` or higher.

Loading the site configuration

► Click on the **Load a site configuration for starting or editing** icon.

► Select the configuration file with the location configuration.
► Click on the **Start site configuration** button.
✓ The configuration is loaded in TEMS Manager.
✓ The site configuration is transferred from the file to the TEMS Recorder and started.

► Start the TDC Device Manager.
► Configure the user interface and, if necessary, the mobile phone settings.

10 Troubleshooting

10.1 Important information

WARNING
Danger in the event of malfunction

Cease operation if the cause of the malfunction has not been clearly identified!

► If errors cannot be clearly identified and not safely eliminated, shut down the system.

NOTE

If an error cannot be resolved with the help of the information provided in this section, contact your local SICK subsidiary.

For a quick response to your inquiry you will need the following information:

- Exact name of the system component
- Firmware version
- Log files
- Configuration file(s)

10.2 Error analysis at system level

10.2.1 Error analysis in the TEMS Manager

Overview

In the event of system faults, the TEMS Manager basically differentiates between **warnings** and **errors**:

- **Warning**: System is still ready for operation. However, the cause of the fault must be eliminated as quickly as possible.
- **Error**: System is basically still ready for operation. However, correct function is no longer guaranteed.

Warnings and errors are visualized at all levels.

Warnings and errors at a lower level affect the levels above.

Visualization icons

System components are color-coded in the live display to visualize errors and warnings.

In the navigation tree, green, yellow or red icons indicate the operational readiness of the system components and modules.

Table 7: Coloring of errors and warnings

Labels	Description
Green	System component ready for operation
Yellow	**Warning** type fault
Red	**Error** type fault ► For details, move the mouse over the red icon of the system component.
Gray	Current state unknown (e.g. during initialization of the system)

10.2.1.1 Error analysis at location level

A site error is displayed if there is an error (red symbol) on at least one of the subordinate levels.

Warnings have no effect on the location level.

Errors at the location level are visualized in the menu bar.

Displays when the system is not ready for operation

- Work area **Site** is displayed in red.
- A red exclamation mark is displayed.
- Note text appears: **Configuration is running with error(s).**

10.2.1.2 Error analysis in the navigation tree

Road		
Display	**Meaning or possible cause of error**	**Troubleshooting**
Road red	**Error** in an underlying level	► Check which component is causing an error in the live display or in the navigation tree.
Street yellow	**Warning** in an underlying level	► Check which component is causing a warning in the live display or in the navigation tree.

Radar sensor RMS		
Display	**Meaning or possible cause of error**	**Troubleshooting**
Red housing	No or insufficient supply voltage of the sensor.	► Check the voltage supply.
	Ethernet connection to the sensor interrupted.	► Check the Ethernet connection.
	Sensor is defective.	► Replace device.

Software modules without devices
The symbol is green if the module is running correctly. A red symbol is used to visualize the incorrect linking of modules, for example.

Plug-ins		
Display	**Meaning or possible cause of error**	**Troubleshooting**
Plug-in **TDC-E IO** red Plug-in **MQTT** red	Rule could not be applied to an object.	► Check rule file.
	Connection to the TDC-E Hardware Manager not possible.	► Check connection settings.

10.2.1.3 Error analysis in editing mode

A faulty configuration is visualized in editing mode by error numbers in the navigation tree. The numbers indicate the number of errors or warnings.

Moving the mouse over the error number opens a window with details.

Display	**Description**	
Red numbers	Error	Faulty configurations cannot be started.
Yellow numbers	Warning	If there is a warning, it is possible to start the configuration.

10.2.1.4 Detailed analysis of the error situation

By visualizing the filtered measurement data, the system fault can be further narrowed down and analyzed.

► Display measuring points (see "Displaying measurement points", page 24).

► Display details and status of the system component.

► If necessary, display measuring points of the trajectory.

10.2.2 Error analysis via log files

Overview

All TEMS Recorder operations are logged on the TDC.

It is often necessary to send the current log files to support SICK support in error analysis.

Further topics

- "Download of log files", page 47

10.3 Fault indications of the components

NOTE
Information is included in the operating instructions for the components.

10.4 Error analysis using the status messages

Overview

In the work areas **Wrong Way Objects** and **Normal Way Objects**, status messages are displayed in the table. These status messages can help with troubleshooting.

Status message	Meaning or possible cause of error	Parameter	Module
Valid	All requirements are met.	-	-
Incomplete trajectory	Tracking of the vehicle is shorter than specified.	**MinTrajectoryLengthMm**	**WWD** **WWD Region Trigger**
Few objects	Tracking does not have enough contiguous measuring points.	**MinObjectAppearances**	**WWD**
Too slow	Vehicle falls below the minimum speed.	**MinValidSpeed**	**WWD** **WWD Region Trigger**
Too fast	Vehicle exceeds the maximum speed.	**MaxValidSpeed**	**WWD**
Warning steep angle	Trajectory of the vehicle is too oblique to the direction of travel.	**SteepAngleWarningAngle**	**WWD**
Error steep angle	Trajectory of the vehicle is much too oblique to the direction of travel.	**SteepAngleErrorAngle**	**WWD**

10.5 Download of log files

Overview

All operations of the system are logged and stored in log files. A new file is created for each day. These files help SICK support with error analysis.

Download options

- Download via the **Logs** workspace and then send as an attachment to an e-mail
- Download via FTP (status logs are stored in the `/logs` directory)

Log type	Description
Recorder	Logs of all actions of the system
RecorderAudit	List of all login operations and changes to user rights.

NOTE
The system automatically deletes any log files older than three months.

Procedure

Displaying the list of log files

► Use the menu bar to open the **Files/Logs** work area.
  - Both log types are listed in a tree structure.
  - The logs are sorted by month and date.
  - The right-hand side of the window shows an excerpt of each logged entry.

Updating list manually

► To manually update the list of log entries, click on the icon:

Updating list automatically

► To automatically update the list of log entries and add new log entries continuously, click on the icon:

Filtering by log entry type

► To filter the list by the **Debug**, **Info**, **Warning** and **Error** types, click the corresponding button(s).

Setting level of detail

A different level of detail can be defined for the log entries of the **Recorder** log type.

► To switch to editing mode:

► Expand navigation tree.
► Select a module or system component in the navigation tree.
► To display details:

► In the **DebugLogLevel** drop-down menu, select the required level of detail (**Quiet**, **Normal**, **Detailed** and **Diagnostics**).

NOTE
Selecting a higher log level can affect the performance of the system during operation.

► To start site configuration:

✓ All system actions are now written to the log file of the **Recorder** type with the set level of detail.

Sending log files

► Mark log file of the corresponding log type in the list.
► Click the **Download log file** icon in the toolbar.

► Save log files in the desired directory.

11 Decommissioning

NOTICE

Disposal of batteries, electrical and electronic devices

- In accordance with international directives and regulations, batteries, accumulators, and electrical or electronic devices must not be disposed of with household waste.
- The owner is obligated to dispose of the devices at the end of their service life via the appropriate public disposal points.
- This icon on the product, packaging, or in this document indicates that a product is covered by these provisions:

NOTICE

The applicable local and statutory environmental regulations and guidelines for the disposal of industrial and electrical waste must be observed.

The following assemblies may contain substances that need to be disposed of separately:

- **Electronics**: Capacitors, accumulators, batteries
- **Displays**: Liquid in the LC displays

12 Technical data

12.1 Data sheet

NOTE
Further information can be found on the homepage www.sick.com.

Features

Variants	• Europe, Middle East, Africa, Asia Pacific • America • Japan

Mechanics and electronics

Mounting position	Above or next to the roadway (0.4 m ... 5 m)
Housing dimensions	
RMS2xxx	34 mm x 97 mm x 96 mm (RMS2xxx)
TDC	162 mm x 32 mm x 101 mm (TDC-E)
Supply voltage	
RMS2xxx	9 V DC ... 32 V DC
TDC	24 V DC (9 V DC ... 36 V DC)
Pivoting angle	< 20°
Aperture angle	± 60° horizontal (adjustable) ± 4° vertical

Performance

Operational readiness	300 s Warm start via the TDC-E Device Manager: All applications are shut down first. The operating system and containers are then restarted.
Driving speed	10 km/h ... 200 km/h
Scanning range	150 m

Interfaces

Output data	• Time • Lane assignment • Trajectory • Direction of travel • Speed • Validity status • Wrong-way driver alarm via TCP/IP, I/Os or mobile radio

Ambient data

Ambient temperature, operation	- 20 °C ... + 65 °C[1]
Ambient temperature, storage	- 40 °C ... + 85 °C
Enclosure rating	
RMS2xxx	IP67

TDC	IP20 (according to DIN EN 60529)

1 Recommendation: Protect the sensor from direct sunlight with a weather canopy to prevent overheating.

12.2 Dimensional drawings

NOTE
Information is included in the operating instructions for the components.

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