OHD

Object Detection System

SICK
Sensor Intelligence.

Described product

OHD

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
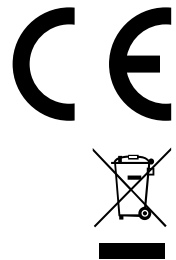Erwin-Sick-Str. 1
79183 Waldkirch
Germany

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	TDC-E (Telematic Data Collector) - Gateway systems	8027311	www.sick.com/8027311
Operating instructions	LMS5xx 2D LiDAR sensors	8013796	www.sick.com/8013796

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.

2.2 Intended use

The OHD recognizes and alerts you to vehicles of excess height. This is intended to prevent infrastructure such as bridges and tunnels from being breached by vehicles. It also checks that the legal height limits are adhered to.

The OHD is used in front of tunnels and bridges, at airports and at border controls.

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

2.5 Cybersecurity

Overview

To protect against cybersecurity threats, it is necessary to continuously monitor and maintain a comprehensive cybersecurity concept. A suitable concept consists of organizational, technical, procedural, electronic, and physical levels of defense and considers

suitable measures for different types of risks. The measures implemented in this product can only support protection against cybersecurity threats if the product is used as part of such a concept.

You will find further information at www.sick.com/psirt, e.g.:
- General information on cybersecurity
- Contact option for reporting vulnerabilities
- Information on known vulnerabilities (security advisories)

3 Product description

3.1 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.

3.2 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.

For many products, 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

3.3 Product characteristics

3.3.1 Design and function

Design

Figure 2: Function example

System components
- LMS511 LiDAR sensor
- Controller TDC
- TEMS software

Function

- Detection of vehicles with excess height and alarm triggering if necessary
  - to prevent damage, e.g. to bridges and tunnels
  - for monitoring compliance with legal height restrictions

- For vertical mounting: Three heights configurable for alarm output

3.3.2 System components

3.3.2.1 LMS511 2D LiDAR sensor

Overview

Figure 3: LMS511

The LMS511 is a non-contact optical distance measurement sensor in standalone or network operation based on a 2D-LiDAR sensor.

Complementary information

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

3.3.2.2 Controller TDC-E

Overview

Figure 4: TDC-E

The TDC-E with pre-installed software is the system controller.

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

Complementary information

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

3.3.3 Interfaces and data output

Overview
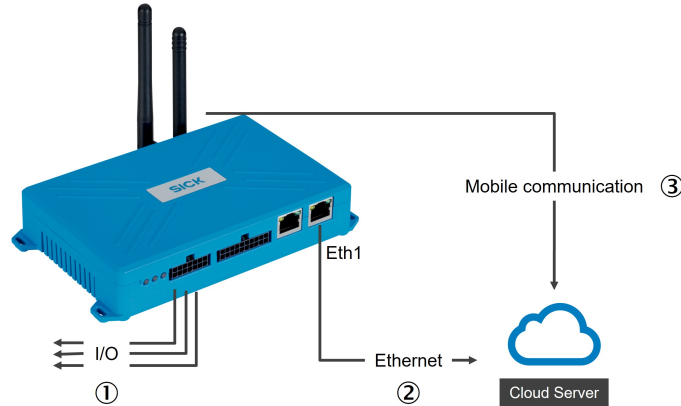
Figure 5: Interfaces and data output

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

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

③ **Wireless communication**
- MQTT messages
- E-mail
- SMS (with activated SIM)

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. The data can be used for analysis and long-term monitoring and, if the data connection is sufficient, for alerting.

Connecting the interfaces

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

Further topics

- "Plug-in MQTT", page 28
- "SMS plug-in", page 29
- "SMTP plug-in", page 30
- "Plug-in TDC-E IO (I/O interface)", page 32

4   Project planning

4.1   General system requirements

Overview

The sensor is mounted on a vibration-free mast, boom or gantry.

Prerequisites

- Vibration-free mast, boom or gantry for mounting the sensor
- Stable gantry secured against torsion with sufficient load-bearing capacity to accommodate the 2D LiDAR sensors
- Unobstructed view of the measuring range from the 2D LiDAR sensors
- Straight and level passage
- Optional: I/O line for processing the signal by the user 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 sensor and TDC (according to technical data)

4.2   Coordinate system

The 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.
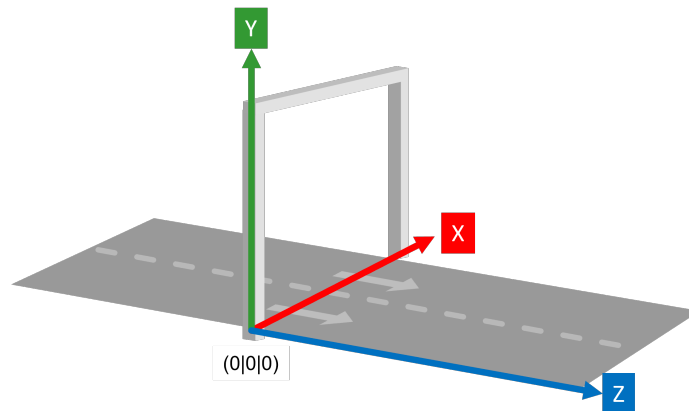
Figure 6: Coordinate system of the location

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   Mounting variations

Overview

The sensor can be mounted in three different ways.

- Vertically centered above the roadway
- Vertical lateral
- Horizontally parallel to the roadway

Prerequisites

Vertical mounting

- The LMS must be mounted at a height of at least 5 m and at least 1 m higher than the maximum expected vehicle height.

Vertical mounting
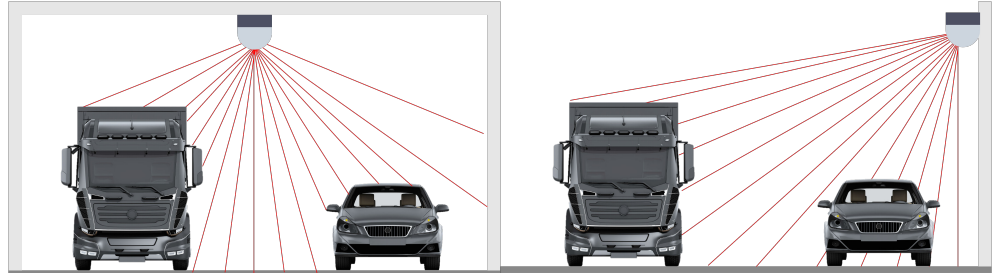
- Height detection
- Option to set up to 3 alarm levels

Horizontal mounting parallel to the roadway

- Side mounting at the maximum permissible height
- only detection of whether overhead object YES/NO; advantage: tracking when passing through, somewhat more accurate
- Covering 2-3 lanes (max. 15 m)
- Possibility to track an object

5   Mounting

> **ℹ NOTE**
> Information is included in the operating instructions for the components.

5.1   Mounting instructions

Important information

> **⚠ WARNING**
> **Secure sensors against falling**
>
> ► Secure the components mounted above the lane against falling, e.g. with a chain or rope.

> **❗ NOTICE**
> **Risk of damage to devices during mounting**
>
> ► Mount the sensors in such a way that they are protected from dirt and damage.
> ► Ensure that the field of view of the sensors is not restricted.
> ► Ensure that the connector plugs can be inserted and removed easily.
> ► Avoid excessive shock and vibration to the sensors.

> **ℹ NOTE**
> ► Mount the sensors according to the specification and technical drawing to ensure that they can detect the vehicles correctly.
> ► Observe the detailed drawings and technical data in these operating instructions and in the operating instructions for the components.

5.2   Mounting the system controller

Important information

> **❗ NOTICE**
> Do not mount the device in the vicinity of transformers or other power units.

> **ℹ NOTE**
> The device must not be opened. The hard drive is already integrated.

Prerequisites

- The system controller is usually mounted in the control cabinet, ideally in the vicinity of the higher-level controller.
- The device does not have any active cooling. Recommendation: For optimum heat dissipation inside the control cabinet, mount the device on a metal plate.
- In order to accommodate the leads and wiring, there must be enough terminals available.

Procedure

► Mount the system controller in a suitable location inside the control cabinet.
► Use the threads or holes on the system controller to do so, depending on the device version.

5.3 Mounting accessories for 2D-LiDAR sensor LMS511

Weather protection hood

To protect the housing of the LiDAR sensors against the effects of the weather, we recommend fitting a weather protection hood. To protect the rear of the LMS511 with the weather protection hood fitted against the effects of the weather, it is also recommended that a plate is fitted to cover the housing of the device.

The weather protection hood additionally protects the LiDAR sensor against direct sunlight on the housing of the LiDAR sensor (overheating) and largely against glare from sunlight or other light sources.

Mounting

Suitable mounting kits for installing the LMS511 LiDAR sensors (with or without weather protection hood) can be obtained from SICK AG.

Requirements when using other brackets:

- Stable mounting bracket that enables adjustable alignment of the LiDAR sensor in the X and Y axes
- 4 M6 screws for the LMS511, screw length depends on the wall thickness and the bracket used

Alignment aid

The alignment aid helps to localize the laser beam. The better and more precisely the sensors are aligned, the more accurate the vehicle data will be.

Additional accessories

> **NOTE**
> Accessories (e.g. mounting equipment, plug connectors and cables) are listed at sick.com.

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.

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

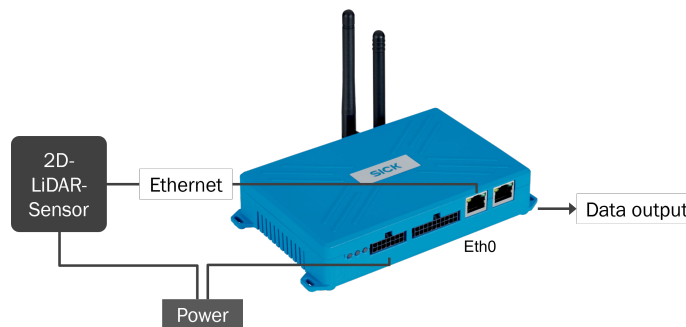*Figure 7: Connection overview*

⚠️ **NOTICE**
► Do not lay cables freely suspended.
► If possible, lay cables inside masts.

6.2.1 Electrical installation LiDAR sensor

ⓘ **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.

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
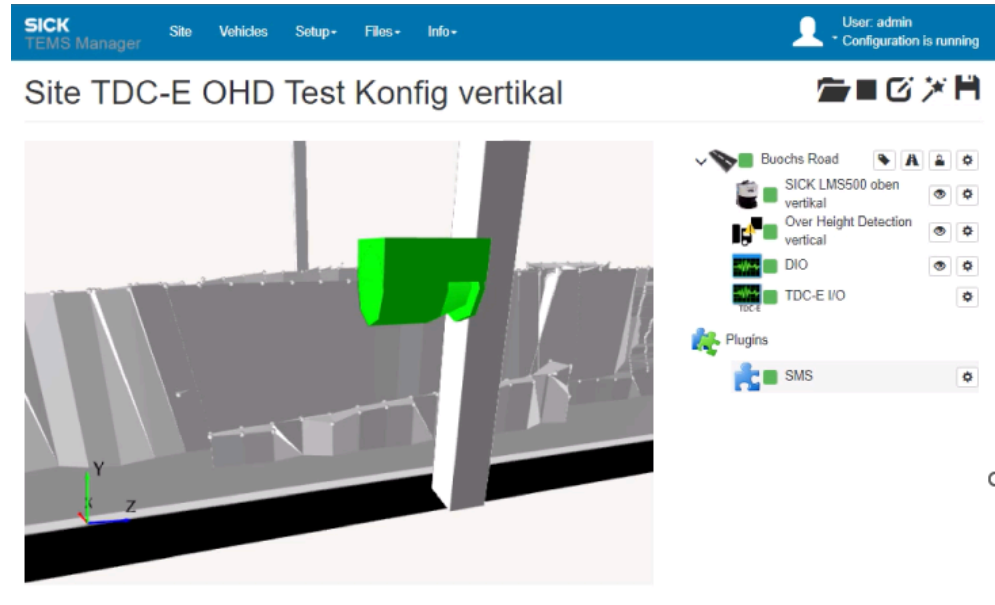
Figure 8: TEMS Manager home page

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**.
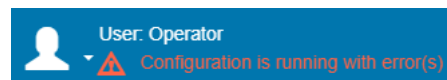
Figure 9: Display of a fault

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
Setup	• Contains administrative functions, depending on authorization, e.g: o User management o Updates
Files	• Access to: o Log files of the system o Data o Configuration o Licenses

Working range	Description
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. • Either start the configuration or open it in edit 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 editing mode. • The system parameters can be changed in edit mode. • Click on the blue-colored symbol to exit edit mode. • 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.
💾	**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** • All changes made to the system parameters in edit mode are reset after a confirmation prompt. The navigation tree will then be completely blank.

Symbol	Description
	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)

- o   Direction of travel
- o   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

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   Loading the configuration file:

Overview

The site configuration with the essential system parameters is 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.

8.1.4   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.

8.1.5 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.

8.1.5.1 Specifying the measurement site designation

Procedure

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

8.1.5.2 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.

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.

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.

8.1.5.3 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.

8.1.6 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.

Procedure

▶ In the navigation tree for the device, click on the **Show live data output of the system component** symbol for the device.

👁

▶ Depending on the module, click on **Raw measuring points** or click on **Detected Over Height Points**/**Height Limits**.

✓ The unfiltered raw data of the sensor is shown in the live display of the TEMS Manager.

▶ To hide the measuring points again, click on the field of the selected measuring points again.

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

8.1.7 LMS module

Overview

The **LMS** module collects and transmits the data from the LMS to the controller.

The module defines the orientation of the LMS.

Additional information on parameters/Relevant parameters

Parameter	Description
ContaminationLevelError	Contamination value above which a warning or error is issued.
ContaminationLevelWarning	
FrequencyAndResolution	The faster the scanning, the less accurate the angle

8.1.8 Module Over Height Detection

Overview

The module **Over Height Detection** evaluates the measured parameters and recognizes whether a vehicle exceeds a certain maximum height.

The monitored room and the overheight threshold are defined in the module.

ℹ **NOTE**
The module uses the orientation (horizontal or vertical) to recognize which parameters are relevant and are processed.

Additional information on parameters/Relevant parameters

Parameter	Description
BoxMaxX	Parameter for setting the region of interest (ROI).
BoxMaxY	• ROI must be set logically correct (e.g. no negative box)
BoxMaxZ	• ROI must be within the field of view of the LMS.
BoxMinX	
BoxMinX	
BoxMinX	
BoxForegroundMinY	Parameters for suppressing unevenness in the floor

Parameter	Description
BypassFloorFinder	So as not to take the floor into account Only relevant for horizontal setup.
FixProfiles	Automatically shifts the z-position of the profiles to compensate for the speed. Only relevant for vertical setup.
FloorTolerance	Height of a point in [mm] below which it is considered part of the floor. Used to determine the limit of a vehicle.
HeightLimits	Defined heights above which a vehicle is detected as "overheight". List separated by commas, heights in mm. In the horizontal setup, this value is always the height at which the LMS is mounted.
MaxClusterPointDistance	Maximum number of points (for stationary objects so that they are not permanently detected)
MaxFloorSigma	Standard deviation (for jumps, so as not to be considered part of the floor)
MinCalculatedY	Discard everything that is smaller than the value . The value must not be greater than the overheight alarm, otherwise everything would be blanked out. Only relevant for vertical setup.
PointThreshold	Threshold value for the number of points required for a profile to be considered valid. Lower numbers mean interference (e.g. birds)
PreserveOverheightVisualizationPoints	How long (in mm) the points are displayed for visualization in the TEMS Manager. 0 = deactivated (points may not be visible if the query interval does not match the overheight detections)
TrackingToleranceX	Loss of tracked object => as new object with new evaluation
TrackingToleranceY	
TrackingToleranceZ	

8.1.9 Data output

Overview

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

8.1.9.1 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.

8.1.9.2 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

8.1.9.3 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.
- ► 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:
  o **RulesDefinition**
  o **MqttHost**
  o **MqttPort**
  o **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.

Further topics

• Plug-in MQTT

8.1.9.4   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

8.1.9.5 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.
▶ 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:
  o **Username**
  o **Password**
  o **RulesDefinition**
  o **DefaultReceivers**

Further topics

• SMS plug-in

8.1.9.6 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

8.1.9.7   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.
▶ 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**

[1]   Information available from your e-mail provider

Further topics

- SMTP plug-in

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

Overview

The plug-in **TDC-E IO** controls the output of the output 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.

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.

Further topics

- Configuring the TDC-E IO plug-in

8.1.9.9 **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.
▶   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.

Further topics

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

8.1.10 **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.

8.1.11 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 37

8.1.12 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.

8.1.13 Work area Vehicles

Overview

In the work area **Vehicles**, the last recorded vehicles are listed in a table.

Displayed data
- Time of recording
- Determined vehicle category with pictogram
- Monitored lane
- Speed
- Vehicle dimensions

Configuration options
- Column selection by clicking on the symbol:

🔧

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

8.1.13.1 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 50 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.

8.1.13.2 Retrieving detailed information

Overview

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

Procedure

Show detail page

▶ Click on the respective vehicle line.

Range	Description
Information	Measured values of the vehicle
3D model	

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

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 of the object
	Frame display
	Point display

Measurement of the 3D model
- The 3D model can be measured.
- To do this, a box is mounted and placed around the model.
- The dimensions for the height, length and width of the box are displayed.
  - ► To move the box and thus only measure one area of the vehicle, double-click on the box.
  - ✓ The edges of the box are activated.
  - ► Move the edge along the corresponding axis.
  - ✓ The displayed box size is updated.

  ⓘ **NOTE** | The dimensions of the box are decisive. There is no specific zero point.

8.1.14 User Management

8.1.14.1 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** .

8.1.14.2 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.

ℹ️ **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.

ℹ️ **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.

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

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.

ℹ️ **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**	**Measure**
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.

2D LiDAR sensors		
Display	**Meaning or possible cause of error**	**Measure**
viewing window yellow	Viewing window slightly dirty.	▶ Clean the viewing window as soon as possible.
viewing window red	Viewing window heavily soiled.	▶ Clean the viewing window immediately.
Yellow housing	Viewing window slightly dirty. The viewing window of the 2D LiDAR sensor is yellow.	▶ Clean the viewing window.
Red housing	Viewing window heavily soiled.	▶ Clean the viewing window.
	No or insufficient supply voltage of the sensor.	▶ Check the voltage supply.
	Ethernet connection to the sensor interrupted.	▶ Check the Ethernet connection.
	Sensor heater not connected or temperature too low.	▶ Check the heating connection.
	Sensor is defective.	▶ Note the error display on the 7-segment display of the 2D-LiDAR sensor!

Modules without devices
The symbol is green if the module is running correctly. A red symbol is used to visualize faulty links, for example.

Plug-ins (Disk Storage)		
Display	**Meaning or possible cause of error**	**Measure**
Plug-in red	Insufficient memory available on the hard drive.	▶ Check the storage capacity of the hard disk.
	Directory does not exist on the hard disk.	▶ Check directory.
	Hard disk not available.	▶ Check connection.

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.

👁

▶ Show details and condition.

⚙

10.2.2 Error analysis via log files

Overview

All TEMS Recorder operations are logged on the system controller.

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

Further topics

10.2.3 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.

10.3   Fault indications of the components

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

11 Disposal

Procedure

► Observe the applicable local and statutory environmental regulations and guide-lines for the disposal of industrial and electrical waste.

► Always dispose of unusable devices in accordance with national waste disposal regulations.

► Do not dispose of batteries, accumulators, if present, or electrical or electronic devices with household waste.

12 Technical data

12.1 Dimensional drawings

> **ℹ NOTE**
> Information is included in the operating instructions for the components.

12.2 Data sheet

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

Features

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

Mechanics and electronics

Mounting position	• Vertical • Horizontal (parallel to the roadway)
Housing dimensions	
LMS511	160 mm x 155 mm x 185 mm
TDC	162 mm x 32 mm x 101 mm
Supply voltage	
LMS511	24 V DC (9 V DC … 36 V DC)
TDC	24 V DC (9 V DC … 36 V DC)
Pivoting angle	horizontal or vertical
Aperture angle	90° … 190°

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.
Minimum object size	horizontal setup: • 100 mm at a distance of 5 m • 250 mm at a distance of 15 m vertical setup: • 250 mm at 30 km/h • 500 mm at 120 km/h
Measurement accuracy	± 30 mm
Scanning range	max. 15 m

Interfaces

Output data	- Height value for - horizontal: scanner position - vertical: highest measured value - Time - Lane assignment - Direction of travel - Speed - Validity status

Ambient data

Ambient temperature, operation	- 20 °C ... + 65 °C[1]
Ambient temperature, storage	-40 °C ... +85 °C
Enclosure rating	
LMS511	IP65 (according to DIN EN 60529) IP67 (according to DIN EN 60529)
TDC	IP20 (according to DIN EN 60529)

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

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