

The logo for HydroMet, featuring a stylized white slash followed by the word "HydroMet" in a bold, white, sans-serif font.

/ HydroMet

User Manual

HailSens Edge

The KISTERS logo, consisting of a stylized white 'K' icon followed by the word "KISTERS" in a bold, white, sans-serif font. Below the name is the tagline "Empowering decisions of tomorrow" in a smaller, white, sans-serif font.

KISTERS
Empowering decisions of tomorrow

Table of Contents

I	Disclaimer	4
II	Glossary and Abbreviations	5
III	List of Symbols	6
IV	Scope of Delivery	7
V	Safety Instructions  	8
VI	Specific Safety Instructions  	9
Part I	Introduction	10
1.1	KISTERS HailSens Edge	10
1.2	KISTERS KIPTEC	11
1.3	HailSens Edge Main Components	11
Part II	Installation	14
2.1	Pole Mounting	14
2.2	Selecting a Suitable Installation Site	15
2.3	Electrical Bonding (Earth)	16
2.4	External Cable Connection	17
2.4.1	Connecting the Ethernet Cable	17
2.5	For Wireless Data Communication: Insert SIM Card	18
Part III	Configuration	20
3.1	Enabling of the Local Wi-Fi Hotspot for Configuration	20
3.2	Configuring HailSens Edge with HyComm	21
3.2.1	About HyComm	21
3.2.2	Initial Connection	22
3.2.3	Overview and Layout	23
3.2.4	Modem Status	24
3.2.5	Connection	25
3.2.6	Modbus TCP / RTU	38
3.3	Heartbeat Interval	40
Part IV	Operation	41
4.1	HailSens Edge: Electronics	41
4.2	HailSens Edge: Power Supply	41
4.3	Parameter Description	42
4.3.1	Heartbeat	42
4.3.2	Hail Event	43
4.3.3	Hailstorm Event	43
4.3.4	Modem Signal Strength / RSSI	43
4.4	HailSens Edge Communication Protocols	44
4.4.1	General Security Requirements	44
4.4.2	WMO First-Mile Protocol (MQTTs)	44
4.4.3	SFTP Data Transfer	44

4.4.4	HTTPS REST API (Legacy)	45
4.4.5	Modbus TCP (Ethernet Only)	45
Part V	Maintenance	46
5.1	Overall Visual Inspection	46
5.2	General Cleaning	46
5.2.1	Dos and Don'ts	46
Part VI	Troubleshooting	47
6.1	Power Supply	47
6.2	Connections	47
6.3	Environment	47
6.4	Mechanical Integrity	47
6.5	Device-Specific Steps	48
6.5.1	Restart	48
6.5.2	HailSens Configuration	48
6.5.3	Firmware and Software	48
6.5.4	Network Configuration	48
6.5.5	Contact KISTERS Support	48
Part VII	Repair	50
Part VIII	Technical Data	51
Part IX	Obligations of the Operator and Disposal	52
Part X	Regulatory and Compliance Information	53

I Disclaimer

The information provided in this manual was deemed accurate as of the publication date. However, updates to this information may have occurred.

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II Glossary and Abbreviations

Acronym	Description
A	SI unit symbol of the “ampere”, a unit of current intensity.
APN	APN, which stands for Access Point Name, refers to access points (gateways) that facilitate communication between the mobile data network and the cellular network or the Internet. Whenever a mobile phone or Internet of Things (IoT) device uses data, its mobile network operator (MNO) reads the APN. The APN (Access Point Name) must be entered in your device to access the mobile Internet when you are on the move.
AWG	American wire gauge
Comms	Abbreviation for communications; refers to data transmission and communication interfaces, protocols and technologies.
Mx	ISO metric screw thread sizes, specifying the nominal outer diameter of the screw, where x is the diameter in mm.
RJ45	RJ45 (registered jack number 45) is a standardized network interface that can be found on Ethernet or network cables.
SIM	SIM, which stands for Subscriber Identity Module, is a card with a chip that is used in mobile phone technology to identify the mobile phone and its unique mobile phone number on the network.
SMA	SMA, stands for SubMiniature version A and is a coaxial connector suitable for high frequency applications.
S/N	Serial number
URL	URL, which stands for Uniform Resource Locator, is used to refer to a specific type of address that is used to access IP devices or web sites.
USB	Universal Serial Bus, industry standard defining cables, connectors and communication protocols for serial data transmission between computers and devices. Micro-USB is a very small USB port.
V DC	Volts in direct current.
W	SI unit symbol of the “watt”, a unit of power.
WEEE	Waste Electrical and Electronic Equipment

III List of Symbols

Symbol	Meaning	Description
	Warning / Caution area	General caution symbol; used to indicate potential hazards or areas requiring particular attention.
	Warning: Consult the instruction manual before use.	Read the Installation and User Manual before use. Important safety and operating instructions must be read and understood to prevent injury or equipment damage.
	Protective conductor terminal	Earth connection for dissipation of electrostatic charges.
	CE marking	The product conforms to the applicable EU requirements for safety, health and environmental protection.
	FCC compliance mark	Indicates compliance with applicable FCC requirements, including EMC requirements.
	Waste Electrical and Electronic Equipment (WEEE) symbol	Do not dispose of this product with household waste. Dispose of it in accordance with applicable regulations for waste electrical and electronic equipment (WEEE).
	Cable cross-sectional area	The cable cross-sectional area is the cross-sectional area of the conductor, typically specified in square millimetres (mm ²). In North American applications, conductor size may alternatively be specified using American Wire Gauge (AWG).
	Electrostatic sensitive devices	Indicates that the device contains components that may be damaged by electrostatic discharge (ESD). Handle using appropriate ESD precautions.

IV Scope of Delivery

- Hail Sensor IoT (pre-mounted unit)
- Pole-mount bracket (pre-mounted)
- Power and Modbus connection cable, M12, 8-pin, 10 m
- Ethernet cable feedthrough
- Tools and accessories: open-ended spanner, Allen key, RJ45 protective cap, SMA antenna protective cap
- FAT document
- Quick Installation Guide

V Safety Instructions

The warnings used in this user manual classify the type and severity of a given hazard. The resulting hazard levels are marked in the user manual with the signal words CAUTION and WARNING in combination with a colour coding in yellow and orange:



CAUTION

- Warning of a hazardous situation with a **low** level of risk.
- The warning indicates the type and source of the hazard. If you do not follow the handling instructions listed here, the hazardous situation can lead to minor to moderate injuries.
- Specific instructions for avoiding the hazardous situation.



WARNING

- Warning of a hazardous situation with a **medium** level of risk.
- The warning indicates the type and source of the hazard. If you do not follow the instructions given here, the hazardous situation could result in death or serious injury.
- Specific instructions for avoiding the hazardous situation.

Note:

- Information to prevent malfunctions or damage to the HailSens Edge.
- Information to ensure the safety of the appliance.

-  Read the user manual including all operating instructions prior to installing, connecting and powering up the KISTERS HailSens Edge. The manual provides information on how to operate the product. The manual is intended to be used by qualified personnel, i.e. personnel that have been adequately trained, are sufficiently familiar with installation, mounting, wiring, powering up and operation of the product.
- Keep the user manual on hand for later reference!
- If you encounter problems understanding the information in the manual (or part thereof), please consult the manufacturer or its appointed reseller for further support.
- KISTERS HailSens Edge is intended to be used in hydrometeorological or environmental monitoring applications.
- Before starting to work, you have to check the functioning and integrity of the system.
 - Check for visible defects on the HailSens Edge, this may or may not include any or all of the following: mounting facilities, connectors and connections, mechanical parts, internal or external communication devices, power supplies or power supply lines, etc.
 - If defects are identified that could compromise operational safety, work must be stopped immediately. This applies to defects detected both before work begins and during operation.
- Do not use the KISTERS HailSens Edge in areas where there is a danger of explosion.
- The present user manual specifies environmental/climatic operating conditions as well as mechanical and electrical conditions. Installation, wiring, powering up and operating the KISTERS HailSens Edge must strictly comply with these specifications.
- Perform maintenance only when tools or machinery are not in operation.
- If guards are removed to perform maintenance, replace them immediately after servicing.
- Never make any electrical or mechanical diagnostics, inspections or repairs under any circumstances. Return the product to the manufacturer's named repair centre. You can find information on how to return items for repair in the relevant section of the KISTERS website.

VI Specific Safety Instructions



CAUTION

Electrical installation:

- The device operates using a low DC voltage. The electrical installation and connection must be carried out by qualified personnel only.

-  Read the user manual, including all operating instructions, before installing, connecting, and powering up the KISTERS HailSens Edge. The manual provides information on how to operate the product. It is intended for qualified personnel who have been adequately trained and are sufficiently familiar with the installation, mounting, wiring, powering up, and operation of the product.
- Keep the user manual on hand for later reference.
- If you encounter problems understanding the information in the manual, please consult the manufacturer or its appointed reseller for further support.
- KISTERS HailSens Edge is intended solely for use in hydrometeorological or environmental monitoring applications.
- Before starting to work, check the functioning and integrity of the system.
- Check for visible defects on the HailSens Edge, including mounting facilities, connectors and connections, mechanical parts, internal or external communication devices, power supplies, or power supply lines, etc.
- If defects are found that jeopardise operational safety, work must be stopped. This applies to defects found before starting to work as well as defects found while working.
- The user manual specifies environmental/climatic operating conditions as well as mechanical and electrical conditions. Installation, wiring, powering up, and operating the KISTERS HailSens Edge must strictly comply with these specifications.
- The ground stud must be permanently connected to an earth point. See [Electrical Bonding \(Earth\)](#) .
- Caution: The HailSens Edge is equipped with bird guards: subsequently children must be kept away from the device.
- Perform maintenance only when tools or machinery are not in operation.
- If guards are removed to perform maintenance, replace them immediately after servicing.
- Never make any electrical or mechanical diagnostics, inspections, or repairs under any circumstances. Return the product to the manufacturer's named repair centre. Information on how to return items for repair can be found on the KISTERS website.
- Disposal instructions: After taking the KISTERS HailSens Edge out of service, it must be disposed of in compliance with local waste and environmental regulations. The KISTERS HailSens Edge must never be disposed of in household waste.
- Inputs and outputs of the device are protected against electric discharges and surges (ESD). Do not touch any part of the electronic components. If you need to touch any part, please discharge yourself by touching grounded metal parts.
- Touching the cable or connector between the transducer plate and the electronic box may result in false readings.



WARNING

Do not open the device. Repairs must be performed by qualified KISTERS personnel only.

1 Introduction

Thank you for choosing our product. We hope you enjoy using the device.

KISTERS manufactures, sells, installs, and operates quality instrumentation, data loggers, and communication technology. Our products are designed with passion for environmental monitoring and with a deep understanding of the quality, accuracy, and robustness required by measurement practitioners in the field.

This User Manual will help you understand, install, and deploy the device. If you feel that any information is missing, incomplete, or confusing, please do not hesitate to contact us for further support.

1.1 KISTERS HailSens Edge

HailSens Edge is an advanced sensor system for monitoring hail events in real-time. The detection of hail impacts relies on impact energy measurement. HailSens Edge provides accurate, reliable results both quickly and automatically.

This document is the User's Manual for HailSens Edge. HailSens Edge is a modern IT-based monitoring device with local data storage and advanced communication capabilities. It is operated on 12 V DC. The sensor records individual hail impacts and measures the kinetic energy of each impact.

Apart from initial setup and periodic maintenance (once a year right before the hail season), HailSens Edge does not require any particular interaction or attendance. The device will only transmit data telegrams when hail impacts are detected. Furthermore, a heartbeat telegram is transmitted every six hours. Data telegrams contain data relevant to an individual hail pellet impact and additional sensor status information.

In typical setups, HailSens Edge will transmit data to the optional KISTERS datasphere, an online data management tool providing functionality ranging from data reception and storage to visualisation and alarming. Please contact your sales representative for details.



Figure 1 – KISTERS HailSens Edge sensor for real-time hail monitoring

1.2 KISTERS KIPTEC

KISTERS Edge sensors are based on KIPTEC, an embedded technology that integrates data processing, dynamic logging, telemetry and power management directly within the sensor. This enables conventional environmental sensors to operate as fully integrated, connected devices without the need for multiple separate components.

Manufactured in Germany, KIPTEC-enabled sensors provide more than 12 months of onboard data storage, event-based data transmission and store-and-forward functionality to help prevent data loss. The platform supports LTE Cat M1 and NB-IoT, over-the-air updates via KISTERS telemetry, and integration with existing systems using MQTT, HTTPS and SFTP. Security features include end-to-end encryption and TLS-based communication in accordance with applicable European requirements.

1.3 HailSens Edge Main Components

The basic components of the HailSens Edge electromagnetic current meter are illustrated in this chapter. The pictures show the exact position of each of the device components.

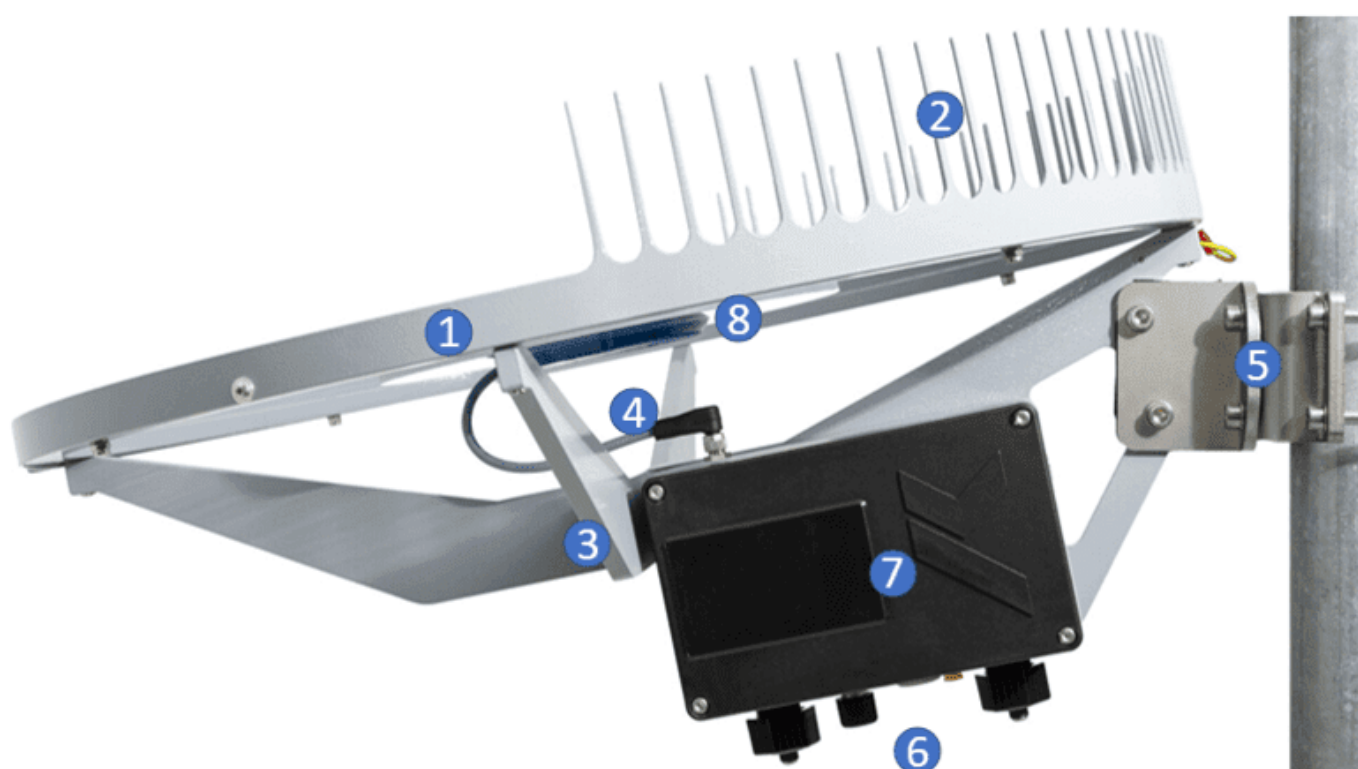


Figure 2 – HailSens Edge main components

- ① Transducer Unit
- ② Bird guard
- ③ Support
- ④ Signal cable between transducer and electronics
- ⑤ Pole mount bracket
- ⑥ Various connectors (for details refer to [Figure 3 – Bottom side of electronics board with input/output connectors](#) ¹²⁾)
- ⑦ Electronics box



Figure 3 – Bottom side of electronics board with input/output connectors

- ① Ethernet RJ45 plug
- ② M12 8-pin signal and power connector
- ③ Pressure compensation gland
- ④ SMA antenna connector
- ⑤ SIM card holder



Figure 4 – Earthstud on rear-side of electronics box

2 Installation

- **Step 1:** Unpack the HailSens Edge from its transport container.
- **Step 2:** Check completeness of the delivery.
- **Step 3:** To mount the HailSens Edge on a pole, see ch. [Pole Mounting](#) ¹⁴.
- **Step 4:** For wireless communication: insert data SIM and connect external antenna.
 - Unscrew the protective cap from the SIM card holder (see [Figure 3 – Bottom side of electronics board with input/output connectors](#) ¹²). Insert the SIM card. Put protective cap in place.
 - Connect LTE/LTE-M antenna. A suitable antenna must be installed/connected for all mobile applications. The antenna is not included in the scope of delivery.
- **Step 5:** Establish a proper ground connection. See ch. [Electrical Bonding \(Earth\)](#) ¹⁶ for details.
- **Step 6:** Insert the 8-pin connector. Ensure the proper wires are connected to a suitable power supply.
- **Step 7:** Download KISTERS HyComm configuration software. Establish a Wi-Fi connection and verify/edit the settings. For details, refer to ch. [Configuration](#) ²⁰.
- **Step 8:** The sensor starts working.

Note:

- Risk of damaging the sensor, the cable or the connector!
 - Always push or pull the connectors by the connector body, not by the cable.
 - All cables connections are via screw-in connectors. Unscrew the securing ring before pulling the connector.
 - Align the connector carefully before insertion to avoid bending the pins. When inserted, do not rotate the connector.



Do not connect or disconnect the transducer while the HailSens Edge unit is powered on.
Always connect the transducer before switching on the unit.

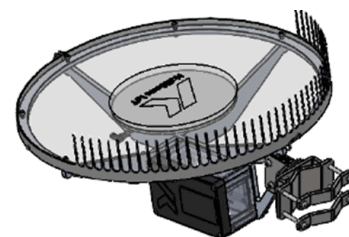
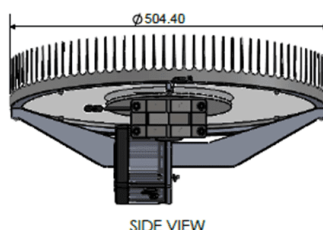
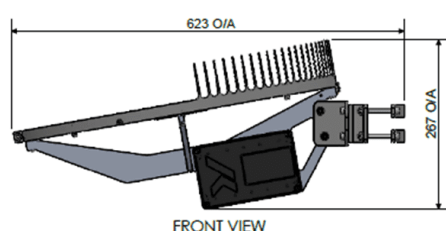


Figure 5 – Dimensions in mm

2.1 Pole Mounting

HailSens Edge is delivered with a pole-mount bracket and bolts and washers.

Pole-mount bracket:

- Standard pole-mount bracket: for poles with an outer diameter (OD) of 2 in to 3.5 in.
- Optional pole-mount bracket: for poles with an outer diameter (OD) of 4 in to 5 in.

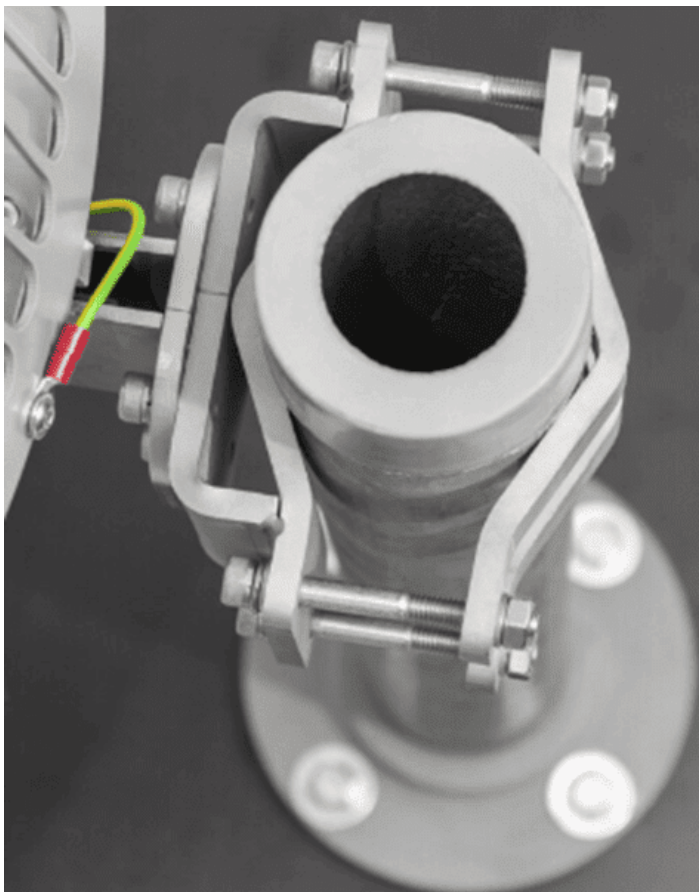


Figure 6 – HailSens mounted on a pole: top view

The HailSens unit is designed for pole mounting. The pole-mount bracket is pre-installed on the device.

- Remove the four screws and detach the two rear pole clamps from the mounting bracket.
- Position the HailSens unit at the desired location on the pole.
- Insert the four screws through the mounting bracket.
- Fit the two pole clamps over the protruding screw ends on the opposite side of the pole.
- Fit one washer and one nut to each screw.
- Tighten all nuts securely. Ensure that all fasteners are fully tightened so that the top-heavy device is securely supported and cannot move or slip.

2.2 Selecting a Suitable Installation Site

Installation considerations

When installing the Hail Sensor, observe the following requirements:

- Ensure that the sensor plate has an unobstructed view of the sky. Avoid nearby trees, tall buildings or other structures that may obstruct the sensing area.
- Avoid installation near overhead power lines, communication towers or other structures that may increase the risk of lightning strikes or electrical surges.
- Avoid locations that are exposed to exceptionally high wind loads.

Mounting recommendations

- For pole mounting, a mounting height of approximately 1 m above ground level is recommended.
- In hilly or mountainous areas, install the sensor plate approximately 2 m above ground level to reduce the risk of the sensor becoming obstructed by accumulated snow during winter.

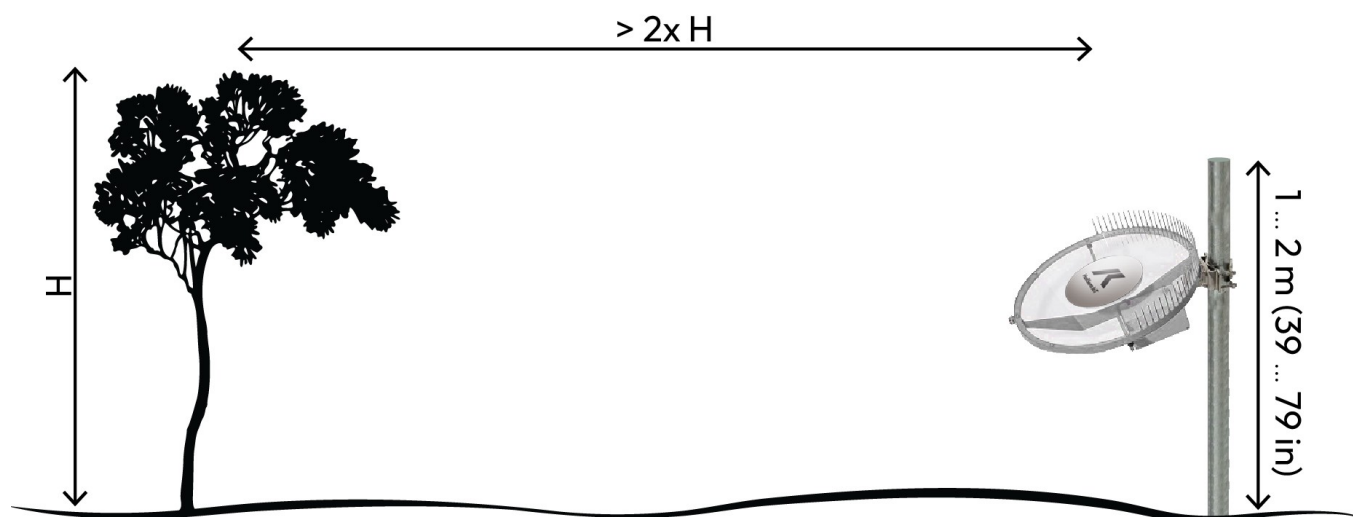


Figure 7 - HailSens installation and recommended clearance from large obstacles

2.3 Electrical Bonding (Earth)



WARNING

Potentially dangerous potential differences in the metallic and polycarbonate parts!

No, or incorrect grounding (bonding) may result in unexpected sensor behaviour (e.g. false hail event reports) and, in the worst case, damage to electronic components.

Lighting strikes may still result in irreversible damage to the electronics components.

The electronics box is equipped with an M6 earth stud. The position of the earth stud is shown in the [Figure 4 - Earthstud on rear-side of electronics box](#)¹³.

The sensor is designed for 12 V DC operation. Electrical bonding provides protection from potentially dangerous potential differences in the metallic parts. In addition, influence on the transducers is minimised, as potential electrostatic charges will be diverted to earth.

Recommendations



The symbol identifies the earth stub on the flip side of the electronics box.

Grounding cable cross-section

- Minimum specifications: Ø 2.5 mm² / AWG 14

Colour code

- In the absence of a globally accepted standard, only a few recommendations can be given.
- Never use a cable colour that can be confused with other wires!
- Compliance with International Electrotechnical Commission (IEC):
 - The protective earth (PE) conductor is green with a yellow stripe.
 - Note that IEC is mostly applied in Europe, many Asian countries and in almost all industrial systems.
- Compliance with US NFPA 70 National Electrical Code (NEC):
 - Equipment grounding conductor must be:
 - Green, or
 - Green with yellow stripes, or
 - Bare (uninsulated copper)
- Compliance with Canadian Electrical Code (CEC):

- Ground (bonding conductor) must be:
 - Green, or
 - Green with yellow stripe

Compliance with the regulations

- **Comply with local regulations:** Always comply with specific national or regional regulations.
- **Periodic inspections:** Periodic inspections and maintenance to ensure the integrity of the bonding and earthing system.
- **Qualified personnel:** Ensure that installations and inspections are carried out by qualified electricians familiar with local codes and standards.

Note: Regulations take precedence over manufacturer recommendations.

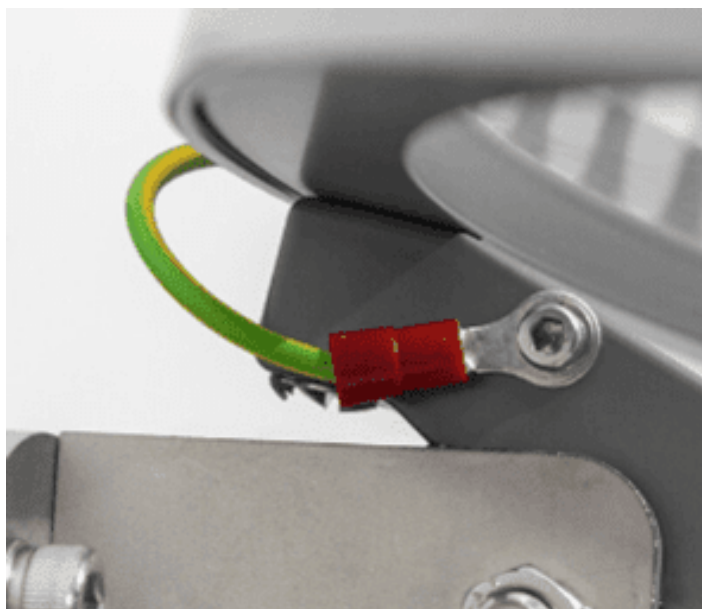


Figure 8 - Equipotential bonding

The equipotential bonding ensures that all conductive parts are at the same electrical potential, reducing the risk of electrostatic discharge and damage from lightning or electrical faults.

2.4 External Cable Connection

Connectors are provided for the connection of external cables. For the exact position of the connectors, refer to [Figure 3 – Bottom side of electronics board with input/output connectors](#)^[12].

- M12, 8-pin connector: power supply and Modbus RTU
- SMA connector: antenna connection
- RJ45 Cat 6 connector: Ethernet connection

Note: The pressure compensation gland automatically equalises pressure and helps regulate moisture inside the housing. It is **NOT** a connector or socket. A damaged pressure compensation gland may impair the protective function of the enclosure.

2.4.1 Connecting the Ethernet Cable

The Ethernet cable is required for wired Ethernet communication only.

HailSens Edge is equipped with a dedicated RJ45 female connector. To maintain the waterproof protection of the enclosure, the external RJ45 connection must be sealed either with the supplied protective cap or by connecting a cable using the waterproof cable feedthrough.

Two sealing components are supplied:

- **Protective cap:** The round protective cap is pre-installed and must be fitted when no Ethernet cable is connected. The Cat 6 RJ45 interface is designed as a waterproof and weather-resistant RJ45 pass-through connection.
- **Cable feedthrough:** A threaded cable feedthrough is provided for waterproof and dustproof installation of a Cat 6 Ethernet cable. For optimum sealing, use a Cat 6 cable with an outer diameter (OD) of 5.5 to 7 mm.

For installation, slide the components of the cable feedthrough onto the unterminated end of the Cat 6 cable. Then fit the tool-free RJ45 connector supplied with the HailSens to the cable end.

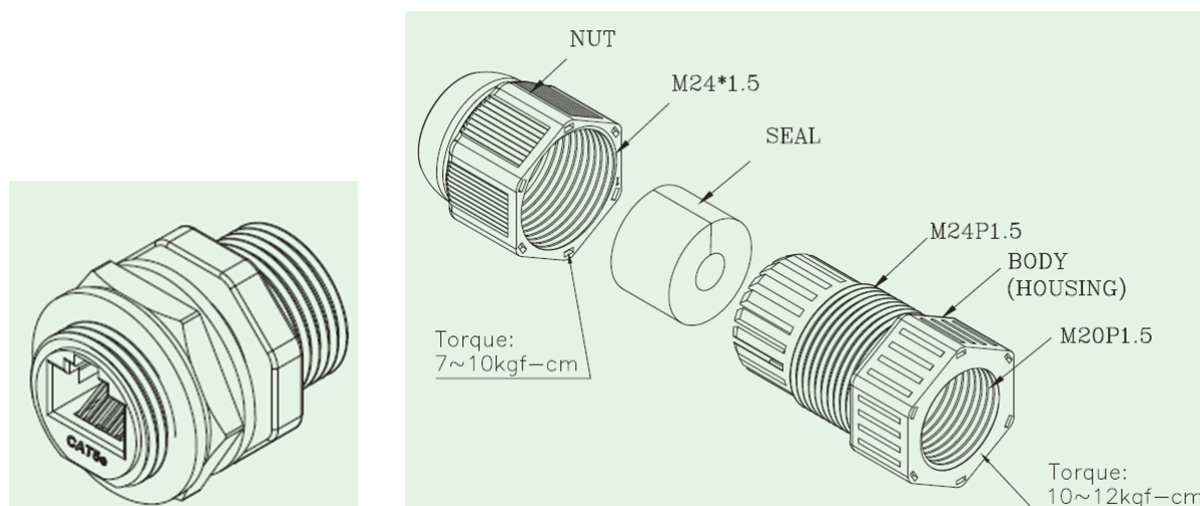


Figure 9 – Screw-Locking waterproof RJ45 jack coupler (left) + feedthrough (right)

Specifications	
Material	PC (nut, body); silicone (seal); PBT (SIM housing); C5191 (pin)
UL certificate	UL94V-0
Rated voltage	50 to 57 V AC (r.m.s.)
Rated current	0.5 A
Degree of protection	IP68 when mated, in accordance with IEC 60529
Operating temperature range	-40 °C to +85 °C

Insert the RJ45 plug into the waterproof Cat 6 RJ45 socket, then screw the waterproof protective sleeve onto the socket.

2.5 For Wireless Data Communication: Insert SIM Card

Pre-installation checks

Before installing the HailSens Edge at a monitoring site, it is recommended to verify the availability, signal strength and stability of the mobile network. Repeated connection attempts caused by an unstable network or frequent roaming may increase power consumption. Signal strength and network coverage should also be taken into account when selecting the appropriate antenna and antenna position.

The SIM card, antenna and antenna cable are optional accessories and can be purchased from KISTERS if required.

Note: In some regions, mobile network operators may restrict access for devices that have not been pre-approved or registered. Ensure that the selected network operator permits the use of the device without prior registration or qualification.

- A nano-SIM card must be inserted into the externally accessible SIM card slot.
- To locate the nano-SIM card holder, refer to [Figure 3 – Bottom side of electronics board with input/output connectors](#) ¹².
- Unscrew and remove the protective cap.
- Insert the nano-SIM card into the card holder.
- Refit and securely tighten the protective cap.
- Ensure that mobile data services are enabled for the SIM card.



Figure 10 - Nano-SIM card holder

Specifications	
Material	PC (nut, body), silicone (seal), PBT (RJ45 housing), C5191 (pin)
UL certificate	UL94V-0
Rated voltage	AC 125 V / DC 125 V
Rated current	0.5 A
Degree of protection	IP68 when mated, in accordance with IEC 60529
Operating temperature range	-40 °C to +85 °C
Nut tightening torque	1.57 to 1.77 N m (16 to 18 kgf·cm), unless otherwise specified in the drawing

3 Configuration

The configuration is divided into the following subsections:

- [Enabling of the Local Wi-Fi Hotspot for Configuration](#) ^[20]
- [Configuring HailSens Edge with HyComm](#) ^[21]
- [Heartbeat Interval](#) ^[40]

3.1 Enabling of the Local Wi-Fi Hotspot for Configuration

The local Wi-Fi hotspot can be enabled using any of the following methods:

- [Enable with Reed Switch/Magnet](#) ^[20]
- [Enable via Modbus](#) ^[21]
- [Enable via Power Cycle](#) ^[21]

Once the hotspot has been enabled, a beep indicates that the Wi-Fi hotspot is starting. It may take up to 60 seconds after the beep for the hotspot to become available.

To connect to the HailSens Edge:

- Click the Wi-Fi icon in your computer's taskbar.
- Select the Wi-Fi network (SSID) HSEYXXXXX, where HSEYXXXXX is the serial number of the HailSens Edge device.
- Wait until the computer is connected to the HailSens Edge Wi-Fi hotspot.
- Start HyComm to communicate with the device.
- When prompted, enter the initial password printed on the FAT document supplied with the device. The initial password is unique to each device.
- For security reasons, change the initial password to a secure password of your choice using HyComm.
- You can then connect the HailSens Edge to the local Wi-Fi network.

Note: It is strongly recommended to change the initial password to prevent unauthorised access to, or modification of, the sensor configuration.

Enable with Reed Switch/Magnet



Figure 11 - Trigger the reed switch

The HailSens is equipped with a reed switch that is actuated by placing a magnet close to the switch. The location of the reed switch integrated into the HailSens housing is shown in [Figure 11 - Trigger the reed switch](#) ^[20] and is also marked directly on the housing.

Enable via Modbus

To enable the local Wi-Fi hotspot on the HailSens device, write the value 1 to holding register 401 using function code FC06.

For further information, refer to the HyComm documentation, section Modbus TCP / RTU.

Enable via Power Cycle

The HailSens automatically enables its Wi-Fi hotspot during start-up. The hotspot can therefore be activated by power-cycling the device.

Automatic Disabling

When the HailSens Wi-Fi hotspot is active, power consumption is significantly higher than during normal operation. To minimise power consumption, the hotspot is automatically disabled after five minutes of inactivity. The hotspot is considered inactive when HyComm is not connected. As long as HyComm remains connected, the Wi-Fi hotspot stays active.

3.2 Configuring HailSens Edge with HyComm

The HyComm software is used for local communication between a computer and the HailSens Edge.

How to configure HailSens Edge with HyComm is explained in the following subsections:

- [About HyComm](#) 
- [Initial Connection](#) 
- [Overview and Layout](#) 
- [Modem Status](#) 
- [Connection](#) 
- [Modbus TCP / RTU](#) 

3.2.1 About HyComm

To configure the device, download the HyComm configuration software. You will need a computer with an USB port to connect the device with the computer on which the configuration software is installed.

Note: The first time you connect to the device, you will need access to the internet, as your computer might have to download/update additional USB drivers. Subsequent connections do require this.

Operating System	Download Link
Windows 7, 8, 10, 11 (x64)	HyComm.exe.zip

Functionality

- Device information overview
- Visualise stored measurement data
- Run integrations to automatically bind the device to **DATASPHERE** or other services
- Easy SDI-12 configuration for supported sensors
- Diagnose error messages related to sensors/manually trigger measurements
- Change the device's configuration:
 - Measured parameters
 - Measurement intervals
 - Etc.
- Save/load configuration files
- Perform firmware upgrades

3.2.2 Initial Connection

After enabling the Wi-Fi hotspot, establish a connection between the PC and the HailSens Edge using the Windows network settings. The unique Wi-Fi password is provided on the FAT certificate supplied with the HailSens Edge. When HyComm is started, it displays a list of supported device types.

To establish an initial connection to the HailSens Edge, follow the steps below:

- Select **HAILSSENS** to search for a HailSens unit connected via Wi-Fi.

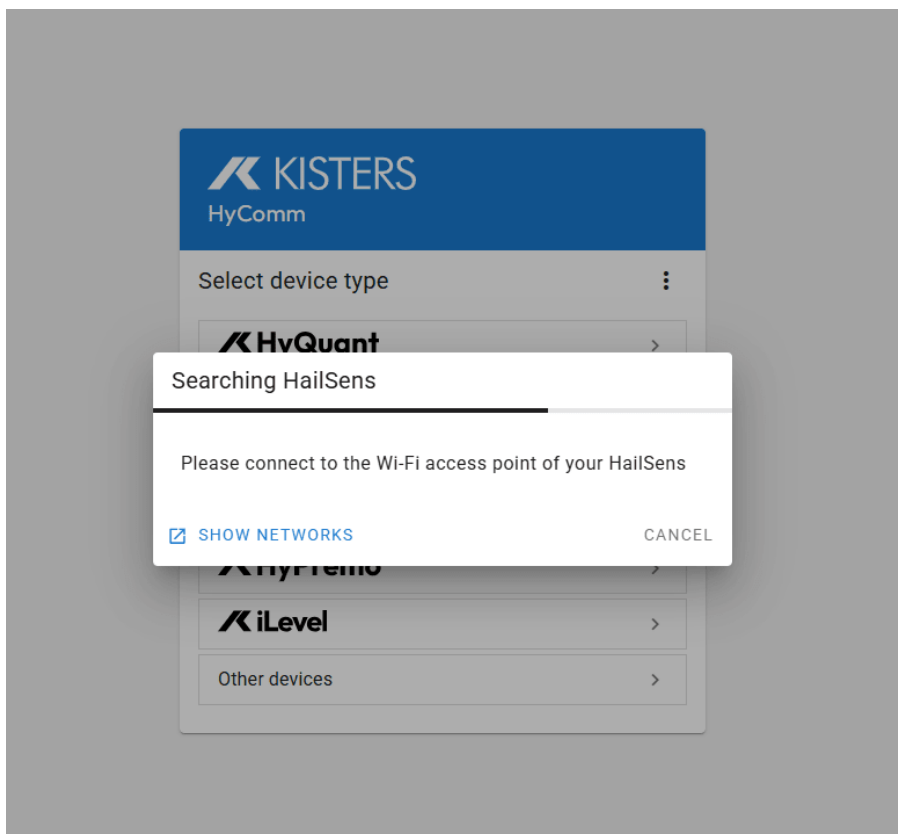


Figure 12 - HyComm prompting the user to enable the Wi-Fi access point

- Click **SHOW NETWORKS** to open the Windows network menu. Alternatively, click the network icon in the Windows taskbar to open the network menu directly.



Figure 13 - Windows taskbar network menu

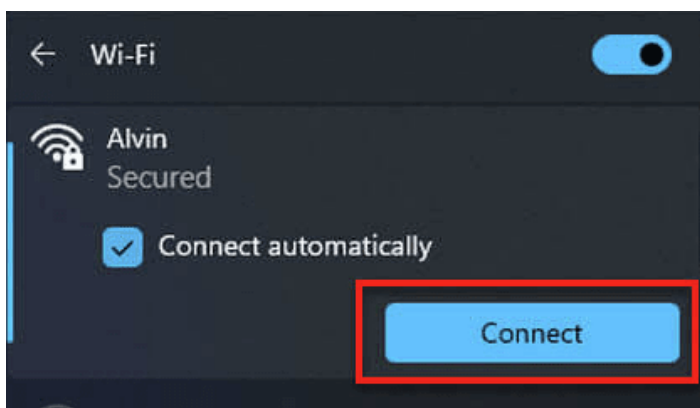


Figure 14 - Connecting to a Wi-Fi network in Windows 11 (dark mode)

- For security reasons, HyComm prompts the user to change the Wi-Fi password when connecting to the device for the first time.
Note: Record the new password and store it securely. Without the correct password, access to the device will not be possible.

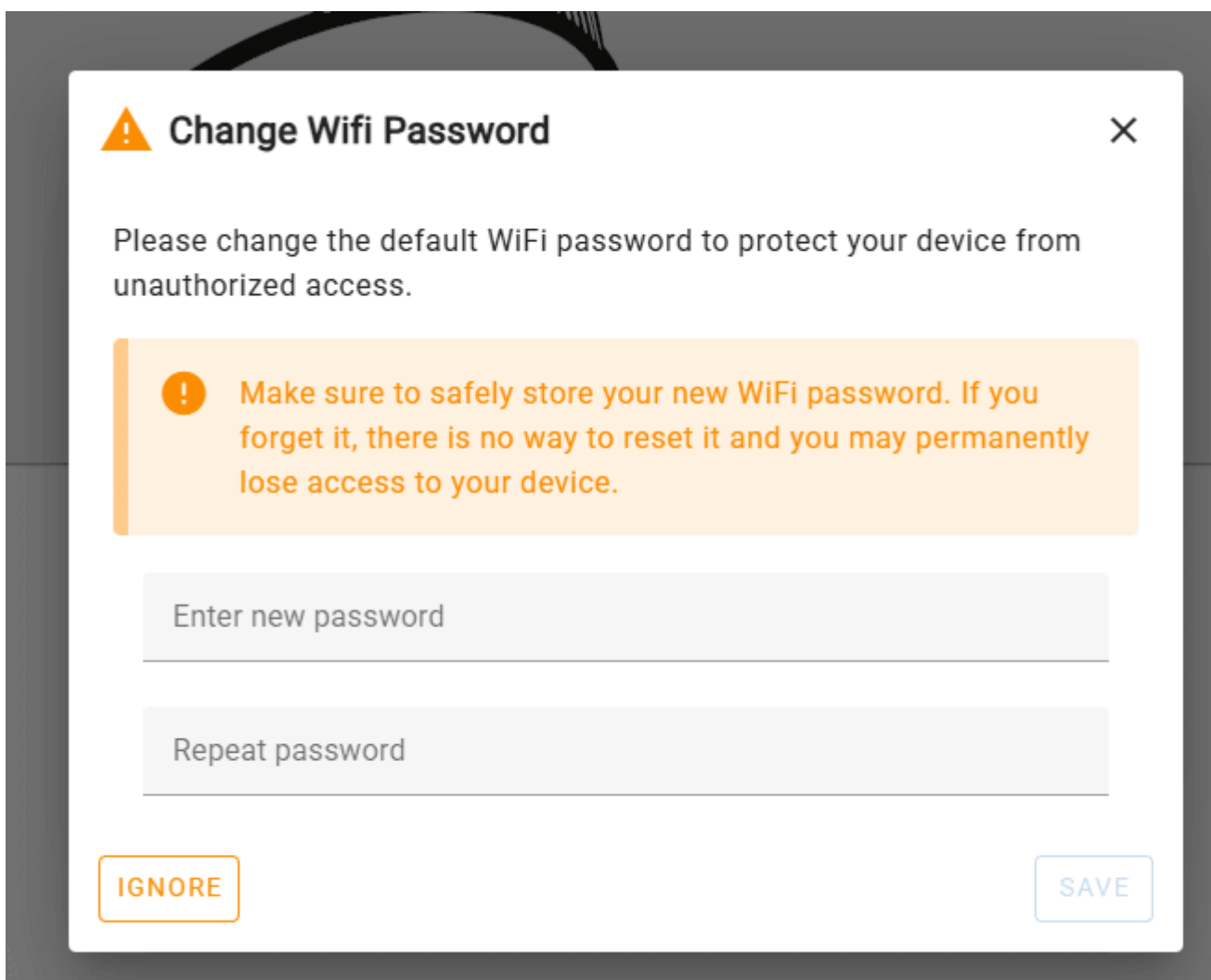


Figure 15 - Change Wi-Fi password

3.2.3 Overview and Layout

HyComm is divided into three main sections:

- Left: Sidebar for selecting menu items.
- Centre: Main display area showing the content of the selected menu item.

- Right: Live data view showing current device data.

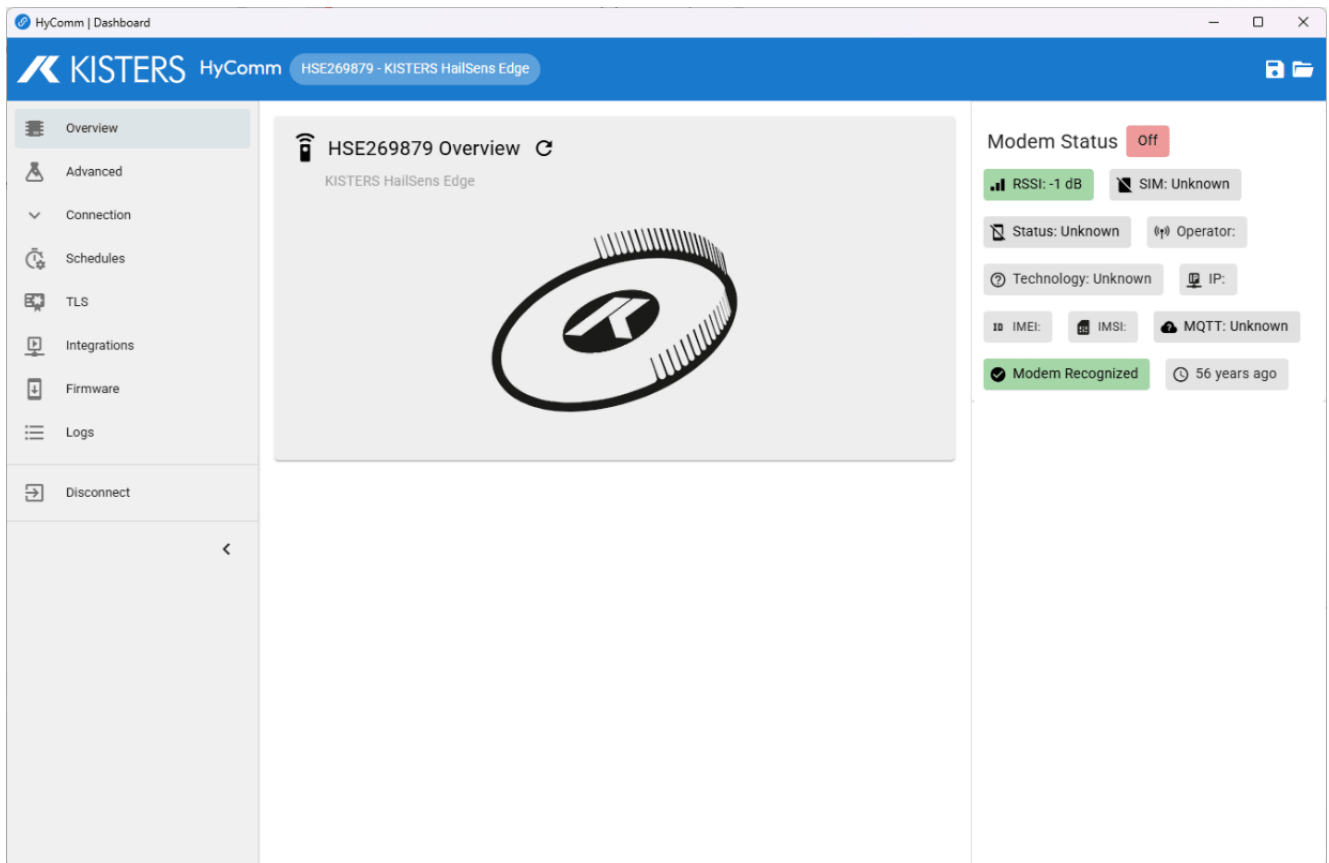


Figure 16 - HyComm main window for HailSens

3.2.4 Modem Status

The **MODEM STATUS** indicator in the live data section shows whether the modem is connected correctly or whether a connection issue is present.

- Example of a correctly connected modem:

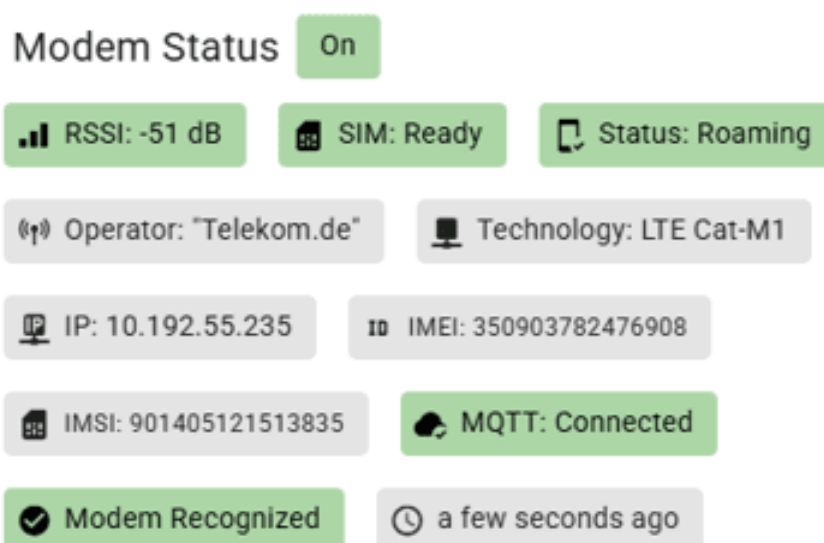


Figure 17 - Example of a correctly connected modem

- Example of a modem not registered on the selected network:

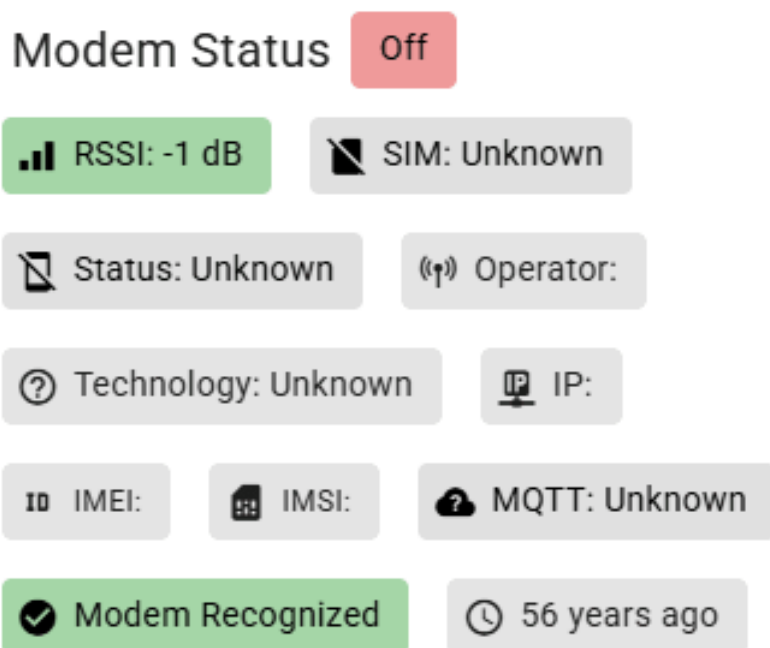


Figure 18 - Example of a modem not registered on the selected network

3.2.5 Connection

The **CONNECTION** view allows you to configure all connection-related parameters.

These are described in the following subsections:

- [SIM Card](#) ²⁶
- [Ethernet](#) ²⁹
- [Network](#) ²⁹
- [MQTT](#) ³⁰
- [Schedules](#) ³²
- [TLS](#) ³³
- [Firmware](#) ³⁴
- [Logs](#) ³⁷

3.2.5.1 SIM Card

KISTERS HyComm HSE-250002 - KISTERS HailSens Edge

SIM Configuration RESTORE SAVE

Access Point Name

APN: PIN:

APN Auth Type:

No username and password will be used for the SIM card.

Radio Access Technology

RAT Operational Mode:

GSM Configuration

GSM Bands:

GSM bands are specific radio frequencies used for mobile communication. Selecting the correct bands for your geographical region is crucial for ensuring a stable network connection.

LTE Configuration

LTE Technology:

Select Regional LTE Bands:

Choose a set of LTE bands optimized for your region

Select Regional LTE Bands

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46
47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88
89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121

Figure 19 - SIM card configuration dialogue

List of Available Settings

Parameter	Description
APN	Access Point Name as specified by the SIM card provider.
PIN	SIM card PIN. If the SIM card does not require a PIN, leave this field blank.
APN Authentication Type	Authentication method specified for the SIM card. Available options are NONE , PAP and CHAP .
RAT Operational Mode	Specifies the Radio Access Technology (RAT) used by the modem. Available options are: - Automatic - LTE only (4G) - GSM only (2G)
GSM Configuration	Select the supported 2G (GSM) frequency bands from the following options: - GSM 850/900/DCS 1800/PCS 1900 - GSM 900/DCS 1800

Parameter	Description
	• GSM 900/PCS 1900 • GSM 850/DCS 1800 • GSM 850/PCS 1900 • GSM 900/DCS 1800/PCS 1900 • GSM 850/900/DCS 1800/PCS 1900
LTE Technology	Select whether the modem should use LTE-M only, NB-IoT only, or which of the two technologies should be prioritised.
Regional LTE Bands	Select your region. This limits the available LTE bands to those supported in the selected region.

It is strongly recommended to configure both the LTE Technology and Regional LTE Bands settings. Otherwise, initial network registration may take considerably longer because the modem scans all supported frequency bands.

Note:

- The Reset Modem button is currently not supported and is reserved for future use.
- Depending on the mobile network and SIM card used, initial network registration may take several minutes.

Reset Modem

At the bottom of this dialogue, the **FACTORY RESET MODEM** button resets the modem's internal settings. This may be useful after inserting a new SIM card or when the modem needs to register with a network in a different region.

- To reset the modem, click **FACTORY RESET MODEM**.

KISTERS HyComm HSE-250002 - KISTERS HailSens Edge

None

No username and password will be used for the SIM card.

Radio Access Technology

RAT Operational Mode
Automatic

GSM Configuration

GSM Bands
GSM 850/900/DCS 1800/PCS 1900

GSM bands are specific radio frequencies used for mobile communication. Selecting the correct bands for your geographical region is crucial for ensuring a stable network connection.

LTE Configuration

LTE Technology
UNRECOGNIZED

Select Regional LTE Bands
Custom

Choose a set of LTE bands optimized for your region

Select Regional LTE Bands
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46
47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88
89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121
122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151
152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181
182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211
212 213 214 215 216 217 218 219 220 221 222 223 224

Manually select a collection of specific LTE Bands.

Reset Modem

Figure 20 - HyComm further modem/comms settings dialogue

- Confirm the modem reset when prompted.

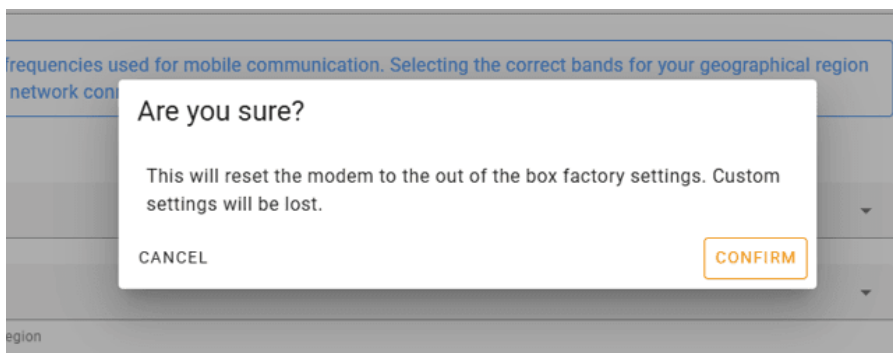


Figure 21 - HyComm prompting the user to confirm the modem factory reset

3.2.5.2 Ethernet

The Ethernet port supports the same communication protocols and file formats as the integrated wireless modem. In addition, Modbus TCP is available exclusively via the Ethernet interface.

The screenshot displays the KISTERS HyComm dashboard for device HSE269879 - KISTERS HailSens Edge. The left sidebar contains navigation options: Overview, Advanced, Connection, Ethernet (selected), SIM Card, Network, MQTT, Wifi, Schedules, TLS, Integrations, Firmware, Logs, and Disconnect. The main content area is titled 'Ethernet Configuration' and includes a 'RESTORE' button and a 'SAVE' button. The configuration is divided into two sections: 'Ethernet Enabled' (with a toggle switch) and 'IPv4 Configuration'. Under 'Ethernet Enabled', the 'Ethernet Power Mode' is set to 'Power On Demand'. The 'IPv4 Configuration' section shows 'DHCP Enabled' as a toggle switch. A blue information box states: 'DHCP is disabled. The IP address, subnet prefix length, and gateway must be manually configured on the device.' Below this, the IP Address is 192.168.100.2, Subnet Prefix Length is 24, and Gateway is 192.168.100.1. The right sidebar shows 'Modem Status' as 'Off' (red button). Other status indicators include RSSI: -1 dB, SIM: Unknown, Status: Unknown, Operator: Unknown, Technology: Unknown, IP: Unknown, IMEI: Unknown, IMSI: Unknown, MQTT: Unknown, and Modem Recognized (green checkmark). A clock icon indicates the modem was recognized 56 years ago.

Figure 22 - Ethernet configuration dialogue

3.2.5.3 Network

The default configuration described in the following section is suitable for most standard installations and normally does not require modification. However, when the device is operated in a private or restricted network, configuration changes may be required to ensure reliable connectivity.

Figure 23 - Network configuration dialogue

List of Available Settings

Parameter	Description
NTP Server	Specify an NTP server if the default server (pool.ntp.org) is not to be used.
DNS	Specify custom DNS servers if required.

3.2.5.4 MQTT

This section allows you to configure the remote data connection.

Note: For installations that transmit data to KISTERS Telemetry or KISTERS datasphere, the default settings normally do not require modification. Reconfiguration is only necessary when connecting the device to a different backend system.

Figure 24 - MQTT configuration dialogue

If KISTERS datasphere is not used, the device can transmit data to alternative endpoints. The communication protocol is based on standard technologies and can therefore be integrated into existing or newly developed backend systems. A detailed protocol specification is available on request.

The use of secure communication is strongly recommended. Three TLS modes are available:

Parameter	Description
TLS Disabled	TLS is disabled. Data is transmitted without encryption.
Server-side TLS	TLS is enabled with server authentication using a server certificate.
Mutual TLS (mTLS)	TLS is enabled with mutual authentication using both server and client certificates.

When TLS is enabled, server certificate validation can be enabled or disabled using the **TLS VALIDATION** setting.

At the bottom of this dialogue, the **TEST TRANSMISSION** button initiates a connection attempt to the configured backend. This function can be used to verify that the communication settings are correct.

See also the chapter [TLS](#) ³³.

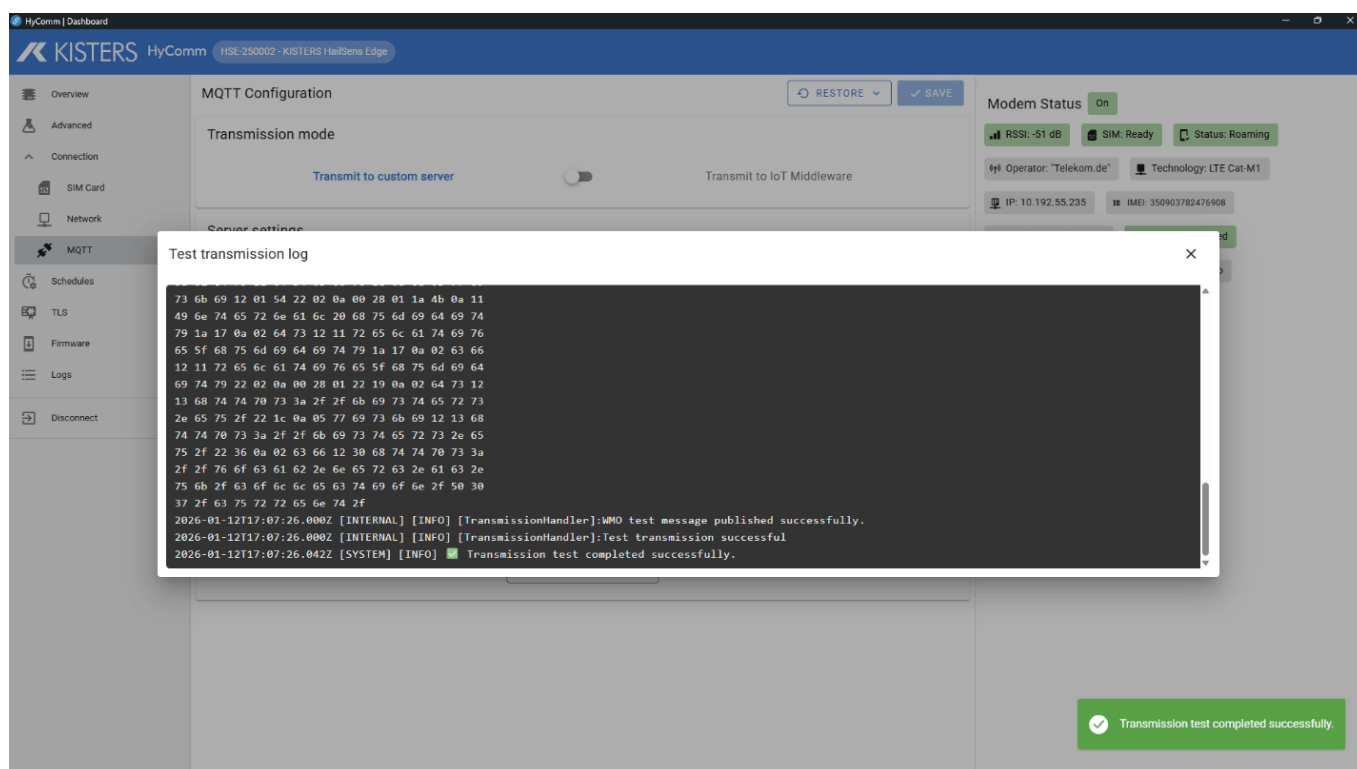


Figure 25 - MQTT and test transmission

3.2.5.5 Schedules

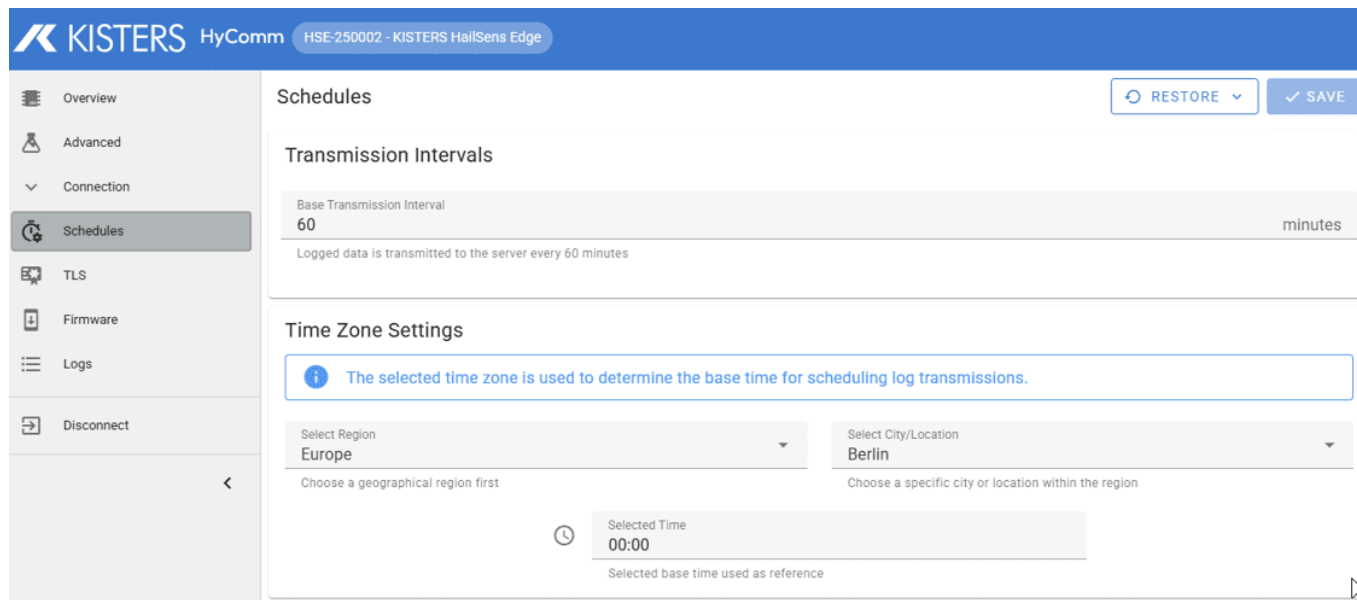


Figure 26 - Schedules configuration dialogue

Parameter	Description
Base Transmission Interval	Defines the transmission interval for the heartbeat message.
Time Zone	Defines the time zone used to determine the start time of the base transmission interval. By default, the first transmission of the day occurs at 00:00.

Parameter	Description
Selected Time	Allows a start time other than 00:00 to be specified for the first transmission.

3.2.5.6 TLS

Each HailSens Edge is supplied with a unique, pre-installed certificate for secure communication with KISTERS Telemetry. For integration with other backend systems, users can upload and activate their own certificates on the device.

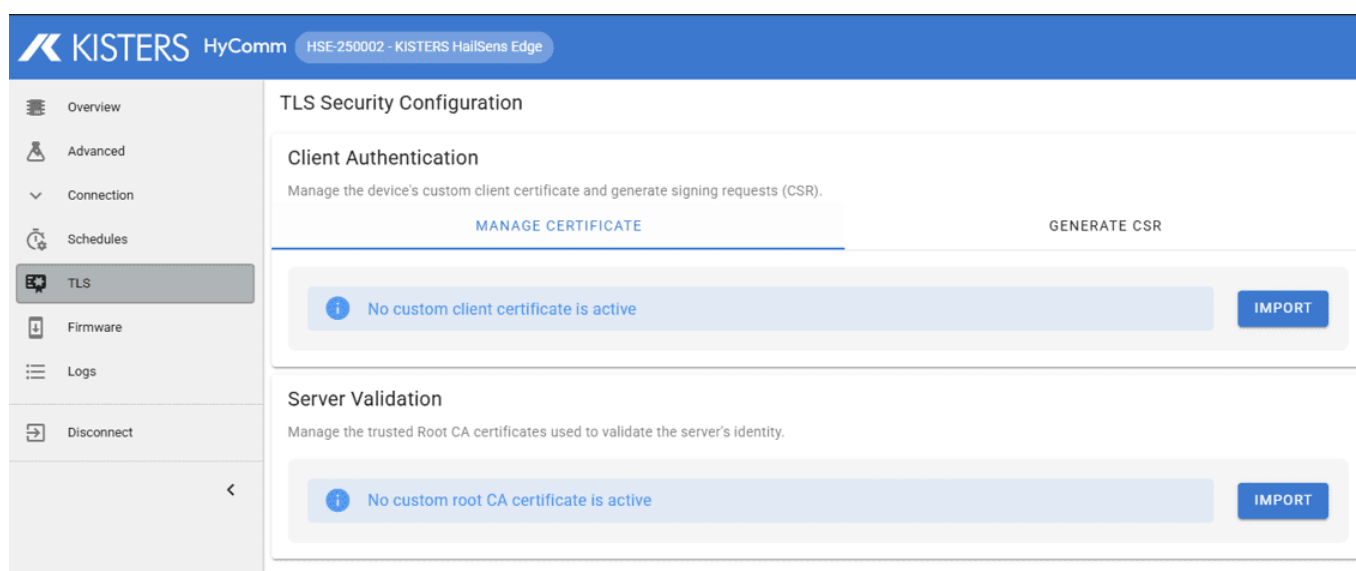


Figure 27 - TLS configuration dialogue

To obtain a certificate, a Certificate Signing Request (CSR) can be generated on the device. The CSR is created using the device's unique private key, which remains securely stored on the device and is not exposed during the certificate issuance process.

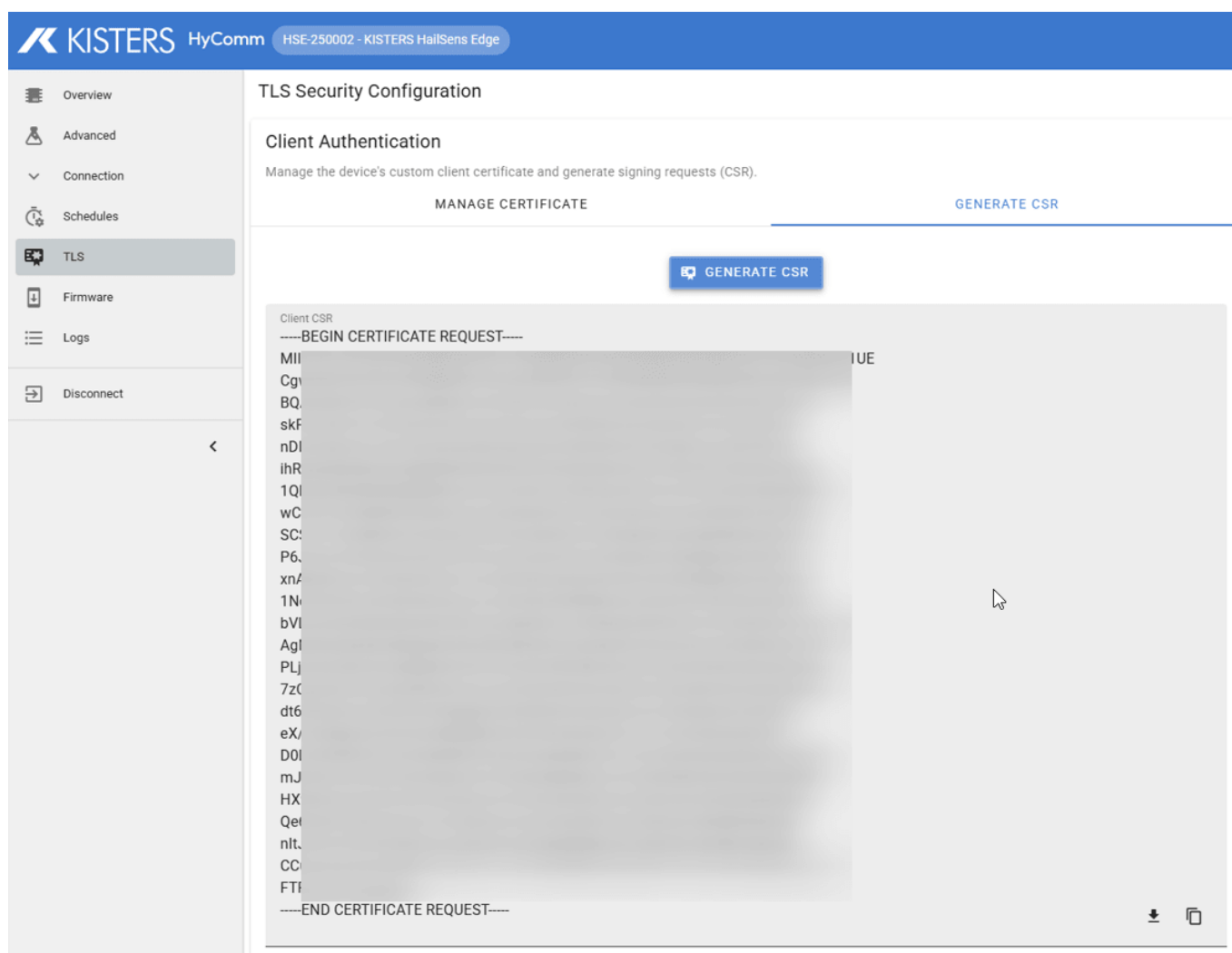


Figure 28 - TLS - Generating a certificate

3.2.5.7 Firmware

HyComm automatically checks for official firmware releases published by KISTERS. When a new firmware version is available, it is downloaded to the local computer running HyComm and presented to the user for installation. Firmware updates are not installed automatically. The user remains in control of whether and when an update is applied to the device. This prevents unintended updates and allows firmware installation to be scheduled at an appropriate time.

This is particularly important for devices installed at remote or difficult-to-access locations, where an unsuccessful update could require an on-site service visit. If the system is operating reliably, the user may postpone the update until a suitable maintenance window.

Once the firmware file has been downloaded, it is stored locally on the computer. The update can therefore be installed on the device without an active internet connection, which is particularly useful in locations with limited or unstable internet connectivity.

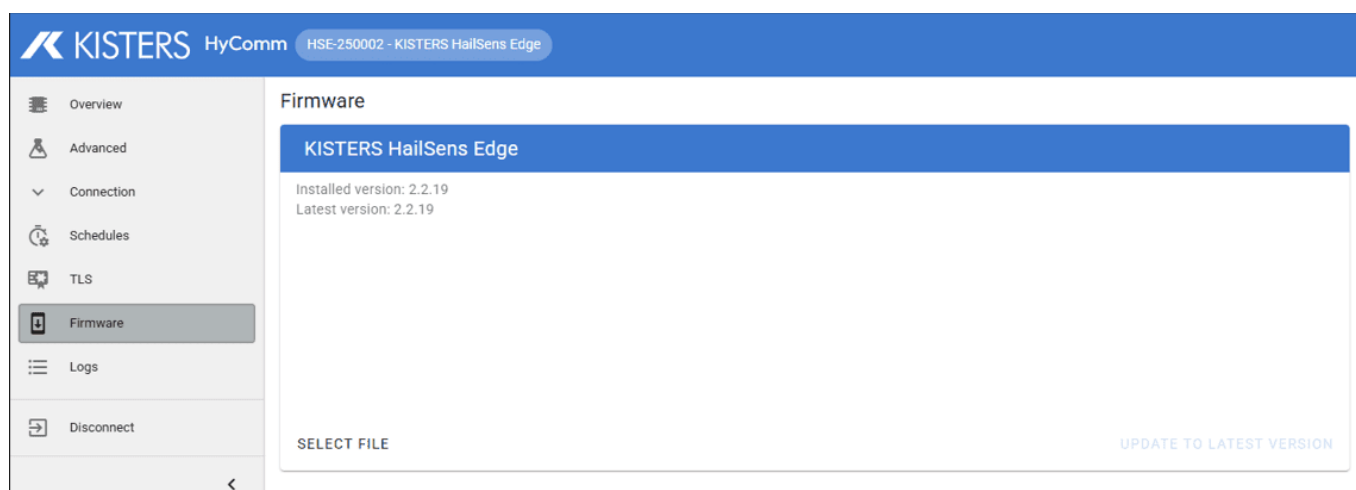


Figure 29 - Firmware configuration dialogue

3.2.5.7.1 Firmware Update

Whenever HyComm connects to a HailSens device, it automatically checks whether a newer firmware version is available than the version currently installed on the device. If an update is available, HyComm notifies the user. The update can be installed immediately or postponed.

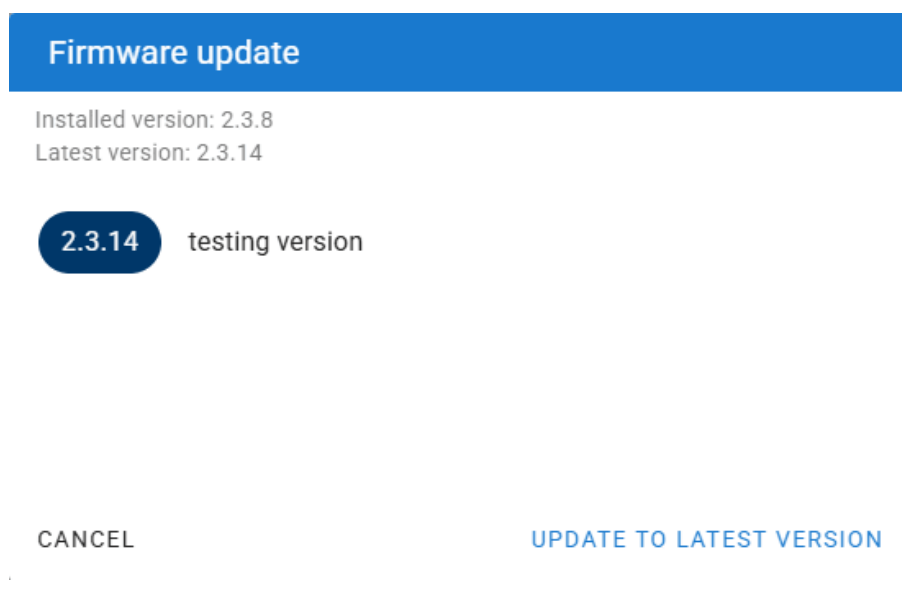


Figure 30 - Firmware update dialogue

- If the update is not installed during the initial connection, it can be started later from the **FIRMWARE** section by clicking **UPDATE TO LATEST VERSION**.

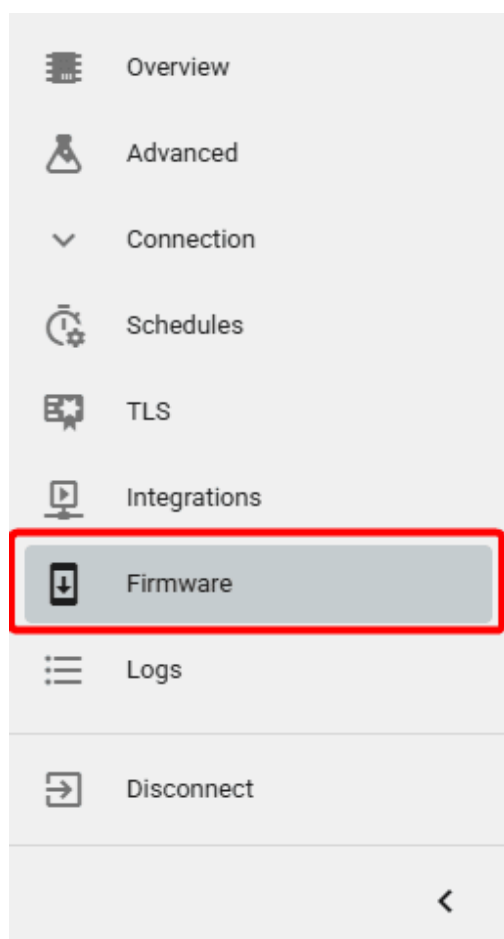


Figure 31 - Firmware update to latest version

- Once the update process has started, HyComm transfers the firmware to the device and displays the current update status and progress. The progress bar indicates the status of each individual update step.

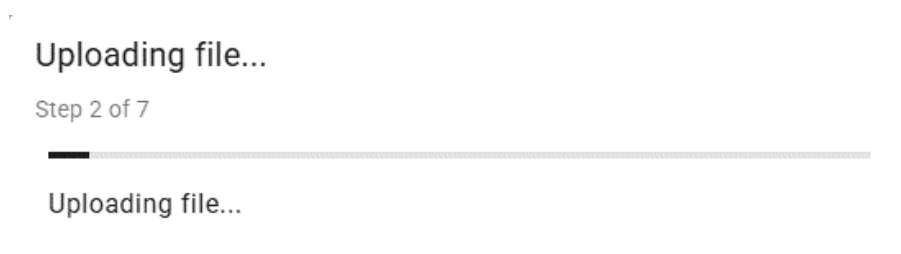


Figure 32 - Firmware update process

- During the update procedure, the device restarts automatically. This temporarily interrupts the Wi-Fi connection between the computer and the device. After the restart, reconnect the computer to the HailSens Wi-Fi hotspot using the Windows network settings, as described for the [Initial Connection](#).

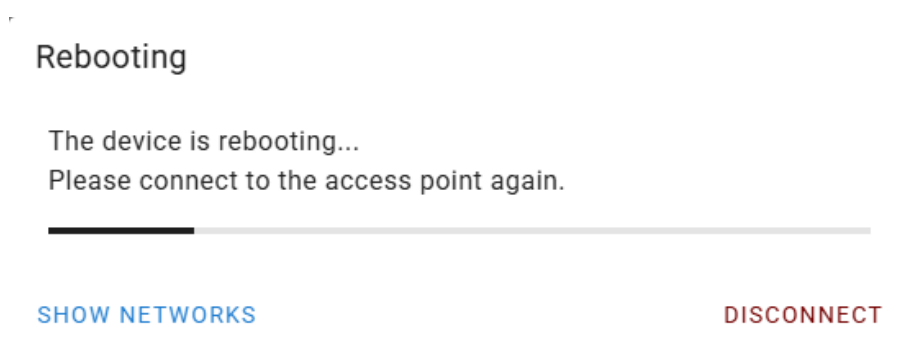


Figure 33 - Firmware update reboot

- When the device restarts, it emits an audible beep. The Wi-Fi network becomes available again after approximately 60 seconds.

Note: In some cases, the restart may take longer than 60 seconds. Allow sufficient time for the device to complete the restart process.

If the device does not restart correctly or the Wi-Fi network does not become available again after an extended period, power-cycle the device by switching the power supply off and on again.

After reconnecting to the device, verify that the firmware update was completed successfully in the **FIRMWARE** section.

Firmware

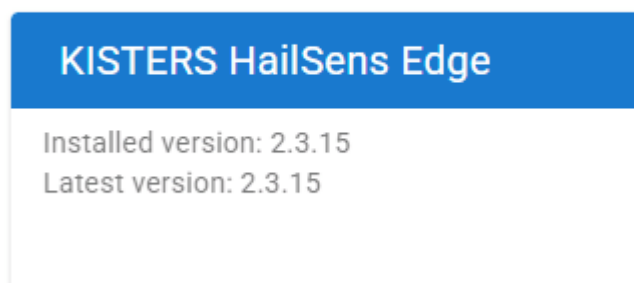


Figure 34 - Firmware version information

3.2.5.8 Logs

HyComm includes a log viewer that displays system messages and recorded device events. The log provides a chronological record of device activity and can be used for monitoring and troubleshooting.

The example screenshot shows typical log entries generated during operation. The highlighted area (red rectangle) shows the raw measurement data recorded for a detected hail impact. This data represents the detailed sensor output generated at the time the impact was detected.

KISTERS HyComm HSE-250002 - KISTERS HailSens Edge

Logs

```

energy": 7.3954748e-06,
"diameterMm": 1.14484191,
"vRef": 4.095,
"divider": 0.1,
"cala": 7,
"calb": 0.8747
}
2026-01-12T17:02:38.000Z [INTERNAL] [INFO] [HailStrom]:HailStrom start @1768237358
2026-01-12T17:02:38.000Z [INTERNAL] [INFO] [HailSens]:Write HailEvent to local broker
2026-01-12T17:02:38.000Z [INTERNAL] [INFO] [TransmissionHandler]:Modem not connected, starting modem
2026-01-12T17:02:38.000Z [MODEM] [INFO] [Modem]:Modem service starting...
2026-01-12T17:02:43.000Z [MODEM] [INFO] [ME310G1]:AT command <ATE0> timed out
2026-01-12T17:02:44.000Z [MODEM] [INFO] [ME310G1]:AT command <ATE0> timed out
2026-01-12T17:02:45.000Z [MODEM] [INFO] [ME310G1]:AT command <ATE0> timed out
2026-01-12T17:02:45.000Z [MODEM] [INFO] [ME310G1]:AT command <ATE0> timed out
2026-01-12T17:02:46.000Z [MODEM] [INFO] [ME310G1]:ME310G1 modem initialized on /dev/ttyUSB2
2026-01-12T17:02:46.000Z [MODEM] [INFO] [ME310G1]:SIM is ready
2026-01-12T17:02:47.000Z [MODEM] [INFO] [ME310G1]:ME310G1 modem initialized successfully
2026-01-12T17:02:47.000Z [MODEM] [INFO] [Modem]:Modem initialized, waiting for network registration...
2026-01-12T17:02:50.000Z [INTERNAL] [INFO] [HailSens]:Modem has signaled a connected event!
2026-01-12T17:02:50.000Z [INTERNAL] [INFO] [TransmissionHandler]:MQTT client not connected, starting connection
2026-01-12T17:02:50.000Z [MQTT] [INFO] [MqttClientAsync-IOTM]:Trying to connect MQTT Client Async for "tcp://192.168.4.1:1883"
2026-01-12T17:02:52.000Z [INTERNAL] [INFO] [TransmissionHandler]:MQTT client connected
2026-01-12T17:02:52.000Z [INTERNAL] [INFO] [TransmissionHandler]:Starting data transmission of 2 records
2026-01-12T17:02:52.000Z [MQTT] [INFO] [HailSens]:Trying to transmit 2 values for 2 record IDs
2026-01-12T17:02:52.000Z [MQTT] [INFO] [HailSens]:Send WMO Data as Proto
2026-01-12T17:02:52.000Z [INTERNAL] [INFO] [HailSens]:Successfully connected to iotm mqtt broker!
2026-01-12T17:02:52.000Z [INTERNAL] [INFO] [TransmissionHandler]:Transmission of 2 records successful
2026-01-12T17:07:06.000Z [INTERNAL] [INFO] [HailSens]:Processing HailSens Debug Data Event
2026-01-12T17:07:06.000Z [INTERNAL] [INFO] [HailSens]:Processing HailSens Hail Event : {
  "timestamp": 1768237625,
  "adcVolMV": 406,
  "energy": 9.53786366e-06,
  "diameterMm": 1.22002065,
  "vRef": 4.095,
  "divider": 0.1,
  "cala": 7,
  "calb": 0.8747
}
2026-01-12T17:07:06.000Z [INTERNAL] [INFO] [HailSens]:Write HailEvent to local broker
2026-01-12T17:07:06.000Z [INTERNAL] [INFO] [TransmissionHandler]:Starting data transmission of 1 records
2026-01-12T17:07:06.000Z [MQTT] [INFO] [HailSens]:Trying to transmit 1 values for 1 record IDs
2026-01-12T17:07:06.000Z [MQTT] [INFO] [HailSens]:Send WMO Data as Proto
2026-01-12T17:07:06.000Z [INTERNAL] [INFO] [TransmissionHandler]:Transmission of 1 records successful

```

Figure 35 - Logs dialogue

3.2.6 Modbus TCP / RTU

Modbus TCP and Modbus RTU use the same register map. Only register 401 is writable; all other registers are read-only.

Modbus Register	Internal Address	Type	Description	Data Range
1	0	int32	Hail count 5-50 mm	reset after read
3	2	float32	Max detected hail size	reset after read
5	4	float32	Min detected hail size	reset after read
7	6	int32	Hail count 5-10 mm	reset after read
9	8	int32	Hail count 10-15 mm	reset after read
11	10	int32	Hail count 15-20 mm	reset after read
13	12	int32	Hail count 20-25 mm	reset after read

Modbus Register	Internal Address	Type	Description	Data Range
15	14	int32	Hail count 25-30 mm	reset after read
17	16	int32	Hail count 30-35 mm	reset after read
19	18	int32	Hail count 35-40 mm	reset after read
21	20	int32	Hail count 40-45 mm	reset after read
23	22	int32	Hail count 45-50 mm	reset after read
25	24	int32	Hail count > 50 mm	reset after read
			spare	
141	140	float32	x-axis tilt angle	Range +-90°, Resolution: 0.1° [°]
143	142	float32	y-axis tilt angle	Range +-90°, Resolution: 0.1° [°]
145	144	float32	Internal temperature	
147	146	uint16	Internal humidity	
149	48	float32	Supply voltage	
			Spare	
161	160	uint16	Cellular technology	0: LTE-M 1: LTE 2: ETH
162	161	uint16	FW version major	
163	162	uint16	FW version minor	
164	163	uint16	FW version subminor	
165	164	uint16	Serial number [0 - 1]	
166	165	uint16	Serial number [2 - 3]	
167	166	uint16	Serial number [4 - 5]	
168	167	uint16	Serial number [6 - 7]	
169	168	uint16	Serial number [8 - 9]	
			Spare	

Modbus Register	Internal Address	Type	Description	Data Range
401	400	uint16	Enable Wifi	Write 1 to trigger the Wi-Fi hotspot Read 0: Wi-Fi not enabled 1: Wi-Fi enabled

3.3 Heartbeat Interval

The heartbeat interval defines how often the device transmits its periodic status message (see [Parameter Description > Heartbeat](#)^[42]). The heartbeat interval can be configured using the **BASE TRANSMISSION INTERVAL** parameter. If transmissions are required at a specific absolute time, the device timestamp (**SELECTED TIME**) can be configured accordingly.

Example

If the **BASE TRANSMISSION INTERVAL** is set to 720 minutes (12 hours) and the **SELECTED TIME** is set to 01:00, the device will transmit data twice per day, at 01:00 and 13:00.

The screenshot displays the 'Schedules' configuration page in the HyComm UI. The left sidebar lists navigation options: Overview, Advanced, Connection, Schedules (highlighted), TLS, Integrations, Firmware, Logs, and Disconnect. The main content area is divided into two sections: 'Transmission Intervals' and 'Time Zone Settings'. In the 'Transmission Intervals' section, the 'Base Transmission Interval' is set to 60 minutes, with a note stating 'Logged data is transmitted to the server every 60 minutes'. The 'Time Zone Settings' section includes a blue information box stating 'The selected time zone is used to determine the base time for scheduling log transmissions.' Below this, there are dropdown menus for 'Select Region' (set to Europe) and 'Select City/Location' (set to Berlin). A 'Selected Time' field is set to 00:00, with a note 'Selected base time used as reference'. The right sidebar shows the 'Modem Status' as 'Off' and lists various modem parameters: RSSI: -1 dB, SIM: Unknown, Status: Unknown, Operator: Unknown, Technology: Unknown, IP: Unknown, IMEI: Unknown, IMSI: Unknown, MQTT: Unknown, and a 'Modem Recognized' status with a timestamp of '56 years ago'.

Figure 36 - HyComm UI - Schedules

4 Operation

HailSens Edge devices are supplied pre-wired. For external cable connections, refer to [Figure 3 – Bottom side of electronics board with input/output connectors](#)¹².

The HailSens Edge is designed for unattended operation. Once correctly installed, powered and configured, the sensor operates autonomously and requires no routine user interaction.

The operation is divided into the following subsections:

- [HailSens Edge: Electronics](#)⁴¹
- [HailSens Edge: Power Supply](#)⁴¹
- [Parameter Description](#)⁴²
- [HailSens Edge Communication Protocols](#)⁴⁴

4.1 HailSens Edge: Electronics



WARNING

Do not open the device. Repairs must be performed by qualified KISTERS personnel only.

The HailSens Edge electronics are housed in a grey box mounted on the support arm beneath the transducer plate. The box contains all electronic components required for sensor operation. Do not open the box. All electrical connections are accessible via connectors on the outside of the box.

4.2 HailSens Edge: Power Supply

The nominal supply voltage is 12 V DC. For the full permissible voltage range, refer to the [Technical Data](#)⁵¹.

The sensor is supplied without a power supply. It may only be powered by an AC/DC power supply or a battery. The power source must be dedicated exclusively to the sensor and must not supply any other devices.

Only power supplies that comply with applicable national and local safety regulations and are suitable for the intended application and environmental conditions may be used.

The sensor is powered via the 8-pin M12 connector on the electronics box.



WARNING

To switch the device off, unplug the M12 8-pin connector.

It is recommended to connect pins 3 (green) and 4 (yellow) to a common ground.

Pin No.	Colour		Signal
1	White		VCC - DC supply voltage input
2	Brown		GND
3	Green		Not connected
4	Yellow		Not connected
5	Grey		RS-485 A
6	Pink		RS-485 B
7	Blue		Not connected
8	Red		Not connected

Table 1 – M12 8-pin connector pinout

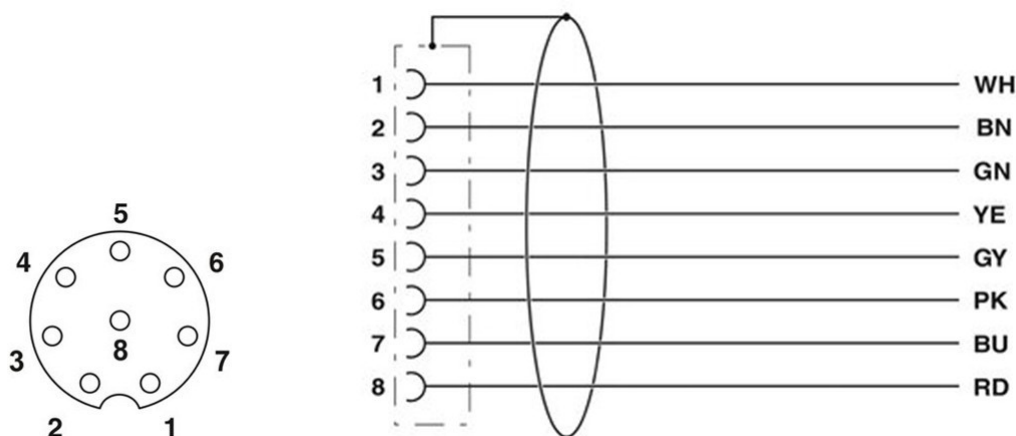


Figure 37 - M12 8-pin connector

4.3 Parameter Description

The following subsections describe the different parameters transmitted by the HailSens Edge.

- [HailSens Edge: Electronics](#) 
- [HailSens Edge: Power Supply](#) 
- [HailSens Edge Communication Protocols](#) 

4.3.1 Heartbeat

Due to the sporadic nature of hailstorms, the HailSens Edge cannot report hail measurements at regular intervals. For most of the time, no hail is detected and no event data is generated. When a hail event does occur, a comparatively large volume of measurement data is produced suddenly and over a short period of time, typically lasting only a few minutes, depending on the in-tensity of the event.

To allow the user to verify that the HailSens Edge is operating correctly during periods without hail activity, the device periodically transmits a regular heartbeat message.

longName	Description	Unit
Angle X	Inclination / Roll of the HailSens Edge	°
Angle Y	Inclination / Pitch of the HailSens Edge	°
Angle Z	Inclination / Yaw of the HailSens Edge	°
Supply voltage	Supply voltage of the HailSens Edge	V
Internal temperature	Temperature measured inside the electronics box	°C
Internal Humidity	Relative Humidity measured inside the electronics box	%

4.3.2 Hail Event

HailSens primarily measures the kinetic energy of hail impacts. An equivalent hailstone diameter is derived from this measurement using standard equations from meteorological literature. Detected impacts are aggregated into data messages that typically include a timestamp, kinetic energy, calculated diameter, and heartbeat information. One message may contain data from multiple hail impacts.

longName	Description	Unit
Diameter	Diameter of the hailstone	mm
Energy	Kinetic energy of the hailstone	J

4.3.3 Hailstorm Event

As hailstorm events are not formally defined, the HailSens applies an internal logic to determine the start and end of a hailstorm event. A hailstorm event flag is used for this purpose. The flag is set to "1" upon detection of the first hail impact and is reset to "0" if no further impacts are detected within five minutes. The timestamp of the associated log entry corresponds to the timestamp of the last detected impact.

longName	Description	Unit
Hailstorm event flags	Flag indicating if a hailstorm is ongoing 0: no hailstorm 1: hailstorm ongoing	-

4.3.4 Modem Signal Strength / RSSI

longName	Description	Unit
RSSI	Signal strength of the cellular modem connection	dBm

4.4 HailSens Edge Communication Protocols

The device supports multiple communication protocols for data transmission and system integration. Unless otherwise specified in the relevant protocol description, the communication protocols are available via both the internal wireless modem and the Ethernet interface for wired IP communication.

Any exceptions or interface-specific limitations, such as the availability of Modbus TCP, are described in the corresponding protocol sections.

- [HailSens Edge: Electronics](#) 
- [HailSens Edge: Power Supply](#) 
- [Parameter Description](#) 

4.4.1 General Security Requirements

The general security requirements are divided into the following subsections:

- [Mutual TLS \(mTLS\)](#) 
- [Network and IT Security Considerations](#) 

4.4.1.1 Mutual TLS (mTLS)

All IP-based communication interfaces of the device are secured using mutual TLS (mTLS) with TLS 1.3. The device and the remote server authenticate each other using individual digital certificates. Only trusted certificates issued by an authorised certificate authority (CA) shall be used. Certificates can be installed on the device using [HyComm](#) 

Communication between the device and the remote server is encrypted to protect data against unauthorised access, interception and manipulation. The operator shall ensure appropriate certificate lifecycle management, including certificate provisioning, renewal and revocation.

4.4.1.2 Network and IT Security Considerations

The operation of communication protocols may be affected by IT security settings within the target network environment.

Network security mechanisms, such as firewalls, intrusion detection or prevention systems, proxy servers and access control policies, may restrict or prevent communication between the device and external systems. The responsible IT administrator shall configure and enable the network permissions required for data transmission, including access to the relevant TCP/IP ports and communication endpoints.

If the required network access is not available, functionality may be limited or unavailable. This may affect, for example:

- data transmission via REST API or Modbus TCP;
- communication with external servers or control systems; and
- remote configuration functions, including over-the-air (OTA) updates and parameterisation.

If OTA functionality is required, the operator shall ensure that the necessary communication paths remain available.

For detailed information on required ports, protocols and network configuration, contact KISTERS.

4.4.2 WMO First-Mile Protocol (MQTTs)

The sensor supports the WMO First Mile protocol using MQTT over TLS for secure, near-real-time data transmission. The protocol enables standardised exchange of meteorological observations and provides:

- encrypted communication using TLS 1.3;
- mutual authentication using device and server certificates; and
- reliable, low-latency data transmission.

4.4.3 SFTP Data Transfer

The device supports file-based data transfer via SFTP, with measurement data provided in MIS file format. SFTP provides confidentiality and data integrity during transmission.

The interface supports:

- secure file transfer over SSH using key-based authentication;
- periodic or event-driven data uploads; and
- integration with file-based data processing systems.

4.4.3.1 MIS File Format

The device supports the export of measurement data in MIS file format. The MIS format is a structured, text-based file format used for exchanging environmental and meteorological measurement data between sensors, data loggers and backend systems.

Typical characteristics include:

- an ASCII-based text structure for human-readable data and straightforward processing;
- a record-oriented structure in which each record represents a measurement set or time-stamped observation;
- delimited fields containing measured values, timestamps and metadata;
- device identifiers, timestamps and sensor values arranged in a predefined order; and
- optional header sections containing information about the file structure, station identification or configuration parameters.

4.4.3.2 ZRXP File Format

The device supports the export of measurement data in ZRXP file format. The ZRXP format is a structured, text-based data format used for exchanging time series data in environmental and hydrological data management systems.

Typical characteristics include:

- an ASCII-based text structure for human-readable data and straightforward processing;
- a time-series-oriented structure representing sequences of time-stamped measurement values;
- delimited records, with each record representing a single observation consisting of a timestamp and measured value;
- metadata such as station identifiers, parameter codes, units and quality indicators; and
- header sections containing information about the data context, source and configuration.

The format is designed for the efficient exchange of measurement time series between data loggers, sensors and backend systems, particularly in hydrological and meteorological applications.

Note: The ZRXP file format will be available from Q3 2026. Contact KISTERS for details.

4.4.4 HTTPS REST API (Legacy)

For backward compatibility, the device provides a legacy HTTPS REST API. Access to the API shall be restricted to authenticated and authorised clients.

The interface supports:

- retrieval and transmission of measurement data via HTTPS requests;
- integration with existing REST-based systems; and
- secure communication using mutual TLS (mTLS) with TLS 1.3.

4.4.5 Modbus TCP (Ethernet Only)

The device supports Modbus TCP communication.

- Modbus TCP is available exclusively via the Ethernet interface and is intended for local network integration and interoperability with industrial control systems.
- As Modbus TCP does not provide built-in encryption or authentication, it shall only be used within trusted and appropriately protected network environments.
- The operator shall implement suitable network security measures, such as network segmentation, firewalls or secure gateways, to reduce the risk of unauthorised access.

5 Maintenance



WARNING

Do not open the device. Repairs must be performed by qualified KISTERS personnel only.

The entire design of the HailSens Edge has been with an eye on limiting maintenance efforts.

- The transducer plate is tilted 10°. This dual function ensures that hailstones are washed off the plate to prevent dampening of the transducer plate and that rain washes debris off the plate.
- The powder-coated sensor body is weather resistant.
- Inlets and outlets are through standard connectors. If properly used, no room is left for insects to intrude into the sensor body.
- The unit does not need any consumables and has no moving mechanical parts.
- Nevertheless, it is recommended that the sensor is visually inspected during routine site visits.
- Check all cables for proper connection and the absence of broken links.
- Ensure that the transducer plate is free from cracks.
- Verify that the bird guard is properly in place with no parts of the mounting ring higher than the transducer plate, except for the upper spikes (bird guard function). It is especially important that the low end remain free to ensure that debris and hailstones are washed off the transducer plate.

The maintenance is divided into the following subsections:

- [Overall Visual Inspection](#)  46
- [General Cleaning](#)  46

5.1 Overall Visual Inspection

During site visits, inspect the sensor for mechanical damage.

- Check that all cables are properly connected and that no mechanical strain is applied to cables, leads or wires.
- Pay particular attention to the 8-pin M12 connector and its cable. The HailSens is powered via this cable.
- The sensor electronics box is equipped with an earth stud. Check that the earth stud is securely connected either to an earth electrode or to an electrically conductive part of the mounting pole. For further information, refer to the section [Electrical Bonding \(Earth\)](#)  16.
- Visually inspect the transducer plate for cracks, splits or other visible damage. Any visible cracking, including cracks located within the plate material, may affect measurement performance. If damage is detected, the transducer unit must be replaced.

Spare parts can be ordered separately:

HailSens Transducer - Spare Part. Article Number: MON11_SMATRSCHSTRDCR

5.2 General Cleaning

Cleaning is only required when systems are either installed in polluted or dusty environments.

- Cleanse the system when clear marks of dirt are seen.
- Thoroughly pre-rinse with warm water to loosen and wash away surface material, grit and grime.
- Using a moist non-abrasive sponge, gently wash with a mild diluted soap or detergent.
- Rinse thoroughly with lukewarm clean water. To prevent water spots, thoroughly dry the glazing with a dry soft cloth.

5.2.1 Dos and Don'ts

- Do not use abrasive cleaners.
- Do not use high alkaline cleaners (high pH or ammoniated).
- Do not leave cleaners sitting on polycarbonate (transducer plate) for periods of time; wash off immediately.
- Do not apply cleaners under direct sunlight or at elevated temperatures.
- Do not clean the polycarbonate transducer plate with any unapproved cleaners. When in doubt, seek guidance.
- Using scrapers, squeegees, razors or other sharp instruments may permanently scratch the polycarbonate transducer plate.

6 Troubleshooting



WARNING

Do not open the device. Repairs must be performed by qualified KISTERS personnel only.

The troubleshooting is divided into the following subsections:

- [Power Supply](#) ⁴⁷
- [Connections](#) ⁴⁷
- [Environment](#) ⁴⁷
- [Mechanical Integrity](#) ⁴⁷
- [Device-Specific Steps](#) ⁴⁸

6.1 Power Supply

- Ensure that the device is properly connected and receiving power.
- Check the power supply or battery.
- Disconnect the power cable and measure the voltage between pins 1 and 2 of the 8-pin M12 connector. The measured voltage must be within the supply voltage range specified in the [Technical Data](#) ⁵¹.

Pin No.	Colour		Signal
1	White		VCC - DC supply voltage input
2	Brown		GND

Table 2 – Power supply measurement points for voltmeter – pins 1 and 2

6.2 Connections

- Verify that all cables, including power and data cables, are securely connected.
- Inspect all cables and connectors for visible signs of damage.

6.3 Environment

Check the operating environment of the HailSens and ensure that the temperature and humidity are within the specified operating ranges. Refer to [Technical Data](#) ⁵¹ for the applicable limits.

6.4 Mechanical Integrity

- Transducer plate: Visually inspect the transducer plate for cracks, splits or other visible damage. Any visible cracking, including cracks located within the plate material, may affect measurement performance. If damage is detected, the transducer unit must be replaced.
Spare parts can be ordered separately: HailSens Transducer - Spare Part. Article Number: MON11_SMATRSCHSTRDCR
- Ensure that the bird guard is correctly positioned. In particular, check that the mounting ring is flush with the underside of the transducer plate. If the ring protrudes above the plate surface, it may obstruct the removal of debris and hailstones and may result in inaccurate measurements during a hail event.

6.5 Device-Specific Steps

The device-specific troubleshooting is divided into the following subsections:

- [Restart](#) 
- [HailSens Configuration](#) 
- [Firmware and Software](#) 
- [Network Configuration](#) 
- [Contact KISTERS Support](#) 

6.5.1 Restart

- If the previous steps have not provided a solution to the unexpected behaviour of the HailSens, it may be necessary to perform a power cycle on the unit.
- **Note:** Although the data is stored in a memory that retains the data in the event of a power loss, it is always advisable to take precautions:
- Save all hail data and configuration settings before power cycling the HailSens.
 - KISTERS support can assist in saving the data either locally (using a computer running HyComm properly connected via USB-B port) or remotely (only for HailSens devices wired to the Internet via Ethernet connection).
 - To proceed, disconnect the HailSens from power, switch off the external power supply, etc. Wait for approximately 20 seconds before re-powering.

6.5.2 HailSens Configuration

- Enable the Wi-Fi hotspot on the HailSens device. Connect your computer to the Wi-Fi hotspot and start HyComm to verify the device settings.
- For mobile network communication, check that all APN settings are correct and comply with the mobile network operator's requirements.

6.5.3 Firmware and Software

- Ensure that the device firmware is up to date. Follow the manufacturer's instructions when installing firmware updates. HyComm automatically detects available updates, downloads them to the local storage of your computer and prepares them for installation. As the device user or operator, you remain in control of whether and when firmware updates are installed.
- Check that any companion software, such as KISTERS datasphere or your own application receiving data from the HailSens, is up to date and correctly configured.

6.5.4 Network Configuration

- **Wireless - Private APN:** Verify the complete data transmission path, including the APN settings, IP endpoints and server-side software components.
- **Wired:** Check the Ethernet connection and ensure that the required ports are open and that the firewall configuration permits communication with the sensor.
- **Overall:** Verify that the network settings comply with the device requirements. Check for IP address conflicts that could prevent the device from communicating correctly.

6.5.5 Contact KISTERS Support

If the above steps do not resolve the problem, contact KISTERS customer support for further assistance.

When contacting support, provide the following information where applicable:

- a detailed description of the problem and the troubleshooting steps already performed;
- current photographs of the site installation;
- the communication method used by the device, i.e. mobile network or Ethernet;
- for mobile network communication, the relevant APN settings;
- for Ethernet communication, a description of the network setup, including:
 - whether the HailSens is connected directly to a modem/router;
 - whether the HailSens is connected via a network switch; and
 - the relevant IT security and firewall settings;
- a step-by-step description of how the problem occurs, where possible;

- representative sample data; and
- screenshots of the relevant sensor settings.

Providing complete and accurate information will help customer support diagnose the problem more efficiently.

7 Repair

KISTERS precision instruments and data loggers are produced in quality-controlled processes. All KISTERS production and assembly sites in Australia, New Zealand and Europe are ISO 9001 certified. All equipment is factory tested and/or factory calibrated before it is shipped to the client. This ensures that KISTERS products perform to their fullest capacity when delivered.

Despite KISTERS most rigorous quality assurance (QA), malfunction may occur within or outside of the warranty period. In rare cases, a product may not be delivered in accordance with your order.

In such cases KISTERS' return and repair policy applies. For you as a customer, this means the following:

- Contact KISTERS using the Repair Request Form and the Declaration of Contamination made available online:

Region (Language)	Download Link
Asia-Pacific (English)	Repair Request Form (APAC) Declaration of Contamination (APAC)
Europe, the Middle East and Africa (English)	Repair Request Form (EMEA) Declaration of Contamination (EMEA)
Germany (German)	Repair Request Form (DE) Declaration of Contamination (DE)

In response you will receive a reference number that must be referenced on all further correspondence and on the freight documents accompanying your return shipment.

- Please provide as much information and/or clear instructions within the return paperwork. This will assist our test engineers with their diagnosis.
- Please do not ship the goods prior to obtaining the reference number. KISTERS will not reject any equipment that arrives without reference number; however, it may take us longer to process.

Custom requirements for items sent to KISTERS for warranty or non-warranty repairs: Check with your national customs/tax authorities for details, processes and paperwork regarding tax exempt return of products. Typically, special custom tariff codes are available (such as HS Code = 9802.00) that verify the item is being returned for repair and has no commercial value. Please note that the customs invoice / dispatch documents should also clearly state: "Goods being returned to manufacturer for repair – No Commercial value". It is mandatory to have any returned goods accompanied by a commercial invoice on headed paper. KISTERS reserves the right to charge the customer for time spent rectifying incorrect customs documents.

Note: Please ensure that your goods are packed carefully and securely. Damage that occurs during transit is not covered by our warranty and may be chargeable.

8 Technical Data

Measured parameter(s)	Kinetic energy [J] Derived pellet equivalent diameter [mm]
Measurement range	0.005 J to 28 J Lower detection level: ≥ 5 mm (hail pellets according to WMO)
Accuracy	Kinetic energy and pellet equivalent diameter: $\pm 10\%$ (according specific mass density on ice and spherical model)
Data transmission	Communication interfaces ▪ Wireless: integrated IP data modem with SMA antenna connector ▪ Wired Ethernet: RJ45 connector ▪ Wired serial communication: Modbus RTU over RS-485 ▪ Mobile communication: LTE-M using the WMO First Mile protocol over MQTT Configurable heartbeat interval Event-based transmission of measurement data; multiple events can be included in a single message
Local communication	Wi-Fi
Housing	Aluminium housing with thermoplastic lid
Supply voltage	10 to 30 V DC
Power consumption	▪ Idle: 0.25 W max. ▪ Low-power standby mode between hail events, with no continuous measurement or data transmission. The device activates immediately upon the first impact, ensuring that no event data is lost. Periodic heartbeat transmissions (e.g. every 6 hours) confirm continued system availability. ▪ Peak (LTE-M): 1.7 W max. ▪ Peak (2G fallback): 5 W max.
Operating temperature range	Deployment, operating and storage temperature: -25°C to $+70^{\circ}\text{C}$ Calibrated measurement range: 0°C to $+70^{\circ}\text{C}$ Relative humidity: 0% to 100% RH
Degree of protection	IP66
Dimensions	▪ Transducer plate (round): diameter 500 mm (19.685 in) ▪ Mounting: maximum pipe outer diameter (OD): 95 mm (3¾ in)
Weight	6 kg net

9 Obligations of the Operator and Disposal

When disposing of the units and their accessories, the applicable local regulations regarding environment, disposal and occupational safety must be observed.

Before dismantling

- Electrical Devices:
 - Switch off the units.
 - Disconnect electrical appliances from the power supply, regardless of whether the appliances are connected to the mains or to another power source.
- Mechanical devices:
 - Fix all loose components. Prevent the device from moving independently or unintentionally.
 - Loosen mechanical fastenings: Please note that appliances can be heavy and that loosening the fastenings may cause them to become mechanically unstable.

Disposal

Operators of old appliances must recycle them separately from unsorted municipal waste. This applies in particular to electrical waste and old electronic equipment.

Electrical waste and electronic equipment must not be disposed of as household waste!

Instead, these old appliances must be collected separately and disposed of via the local collection and return systems.

Integrated or provided batteries and accumulators must be separated from the appliances and disposed of at the designated collection point. At the end of its service life, the lithium-ion battery must be disposed of according to legal provisions.

EU WEEE Directive

As players in the environmental market, KISTERS AG is committed to supporting efforts to avoid and recycle waste. Please consider:

- Avoidance before recycling!
- Recycling before disposal!



This symbol  indicates that the scrapping of the unit must be carried out in accordance with Directive 2012/19/EU. Please observe the local implementation of the directive and any accompanying or supplementary laws and regulations.

10 Regulatory and Compliance Information

EU

Technology	Maximum Rated Output Power	Notes
Wi-Fi 2.4 GHz	15.0 dBm EIRP (average)	Includes up to 2 dB FCC/ISED-based tune-up tolerance. Country-specific EIRP may vary.

Wi-Fi is active only during configuration and local data download. No Wi-Fi transmission occurs during normal operation.

US / Canada

Technology	Maximum Rated Output Power	Notes
Wi-Fi 2.4 GHz	21.5 dBm EIRP (average)	Includes up to 2 dB FCC/ISED tune-up tolerance.

RF Exposure statement

This equipment complies with FCC and ISED radiation exposure limits set forth for an **uncontrolled environment**.

To ensure compliance:

- This equipment **should be installed and operated with a minimum distance of 20 cm** between the radiator and any body part of nearby persons.
- This transmitter **must not be co-located or operated in conjunction with any other antenna or transmitter**.

Failure to observe these guidelines may result in non-compliance with Canadian RF exposure regulations.

Compliance statement

This device complies with Part 15 of the FCC Rules and with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

1. this device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. l'appareil ne doit pas produire de brouillage, et
2. l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Changes or modifications made to this equipment not expressly approved by KISTERS AG may void the FCC authorization to operate this equipment.

FCC certified modules

This product contains FCC-certified modules:

- FCC ID: 2ASYV-KIS-SHLK1
- FCC ID: RI7WE866C6

These radio modules have been certified separately and comply with the requirements of FCC Part 15.

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