

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

/ HydroMet

User Manual

HailSens IoT

The KISTERS logo, consisting of a white stylized 'K' symbol 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

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I Disclaimer

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

This manual does not include all of the details of design, production, or variation of the equipment nor does it cover every possible situation which may arise during installation, operation or maintenance. KISTERS shall not be liable for any incidental, indirect, special or consequential damages whatsoever arising out of or related to this documentation and the information contained in it, even if KISTERS has been advised of the possibility of such damages.

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II Glossary + 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.
Comms	Techno-babble for data transmission/communication.
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.
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.
Vdc	Volts in direct current.
W	SI unit symbol of the “watt”, a unit of power.

III Scope of Delivery

- Hail Sensor IoT (pre-mounted unit)
- Pole mounting bracket (pre-mounted)
- Power connection cable M12 4-pin (10 m)
- Tools: open-ended wrench, Allen key, RJ45 protection cap, SMA antenna cap
- FAT document
- Quick Installation Guide

IV Safety Instructions

- Read the user manual including all operating instructions prior to installing, connecting and powering up the KISTERS HailSens IoT. 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 IoT 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 IoT, 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 found that jeopardize the operational safety, work must be stopped. This is true for defects found before starting to work as well as for defects found while working.
- Do not use the KISTERS HailSens IoT 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 IoT 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.



Disposal instructions: After taking the KISTERS HailSens IoT out of service, it must be disposed of in compliance with local waste and environmental regulations. The KISTERS HailSens IoT is never to be disposed in household waste!



Inputs and outputs of the device are protected against electric discharges and surges (so-called ESD). Do not touch any part of the electronic components! If you need to touch any part, please discharge yourself, i.e. by touching grounded metal parts.

V Specific Safety Instructions

- As an electrically powered system, HailSens IoT requires to be earthed. This is necessary to provide a reliable means to safely conduct the voltages resulting from electrical static charges to ground. HailSens that are not earthed may suffer from a number of effects such as: malfunctioning or damaged electronics, false positives (event recorded when there was no hail), etc.
- Electrical charges can be discharged through the human body when touching HailSens devices if they are not earthed!
-  HailSens IoT is equipped with a bird guard exposing metal spikes. Wear gloves and safety glasses while installing the sensor.
- Pinch points: Caution when mounting the device! Do not put your fingers between the pole mount bracket and the pole.

1 Introduction

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

This document is the User's Manual for HailSens IoT. HailSens IoT is a modern IT-based monitoring device with local data storage and advanced communication capabilities. It is operated on 12 Vdc. 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 IoT 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 IoT 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.

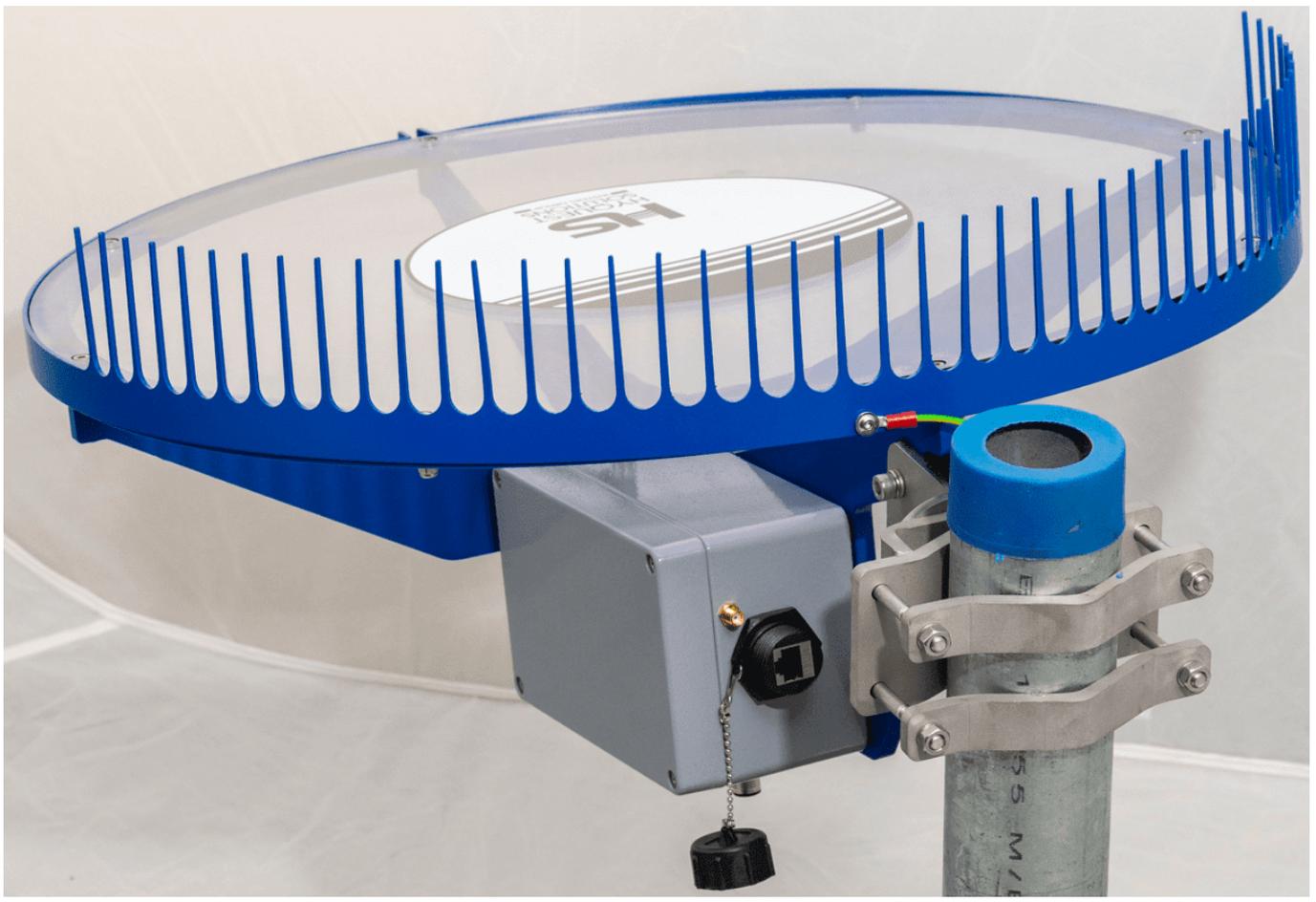


Figure 1 - HailSens IoT

2 Installation

1. Unpack the HailSens IoT from its transport container.
2. Check completeness of the delivery.
3. Mount the HailSens IoT.
4. For wireless communication: insert data SIM.
 - Undo the four screws to open the cover of the electronics box.
 - Insert the SIM card in the SIM card holder.
 - Refit the cover and ensure the seal is properly and fully seated. Apply controlled force to tighten the four screws. **Note:** To avoid damaging the seal, do not use excessive force.

Note: An LTE antenna must be installed/connected for all mobile applications. The antenna is not included in the scope of delivery.
5. Power up the HailSens IoT.
6. Check the HailSens configuration/settings and make the required changes.
 - For details, refer to [Part III Configuration](#) ⁽¹⁵⁾.

Note: To access the configuration menu locally, open the cover of the electronics box and connect your laptop to the processing board using a USB cable. Using the USB connection requires the installation of a USB driver ([Part III Configuration](#) ⁽¹⁵⁾).
7. The sensor starts working

2.1 HailSens IoT: Mechanical Dimensions

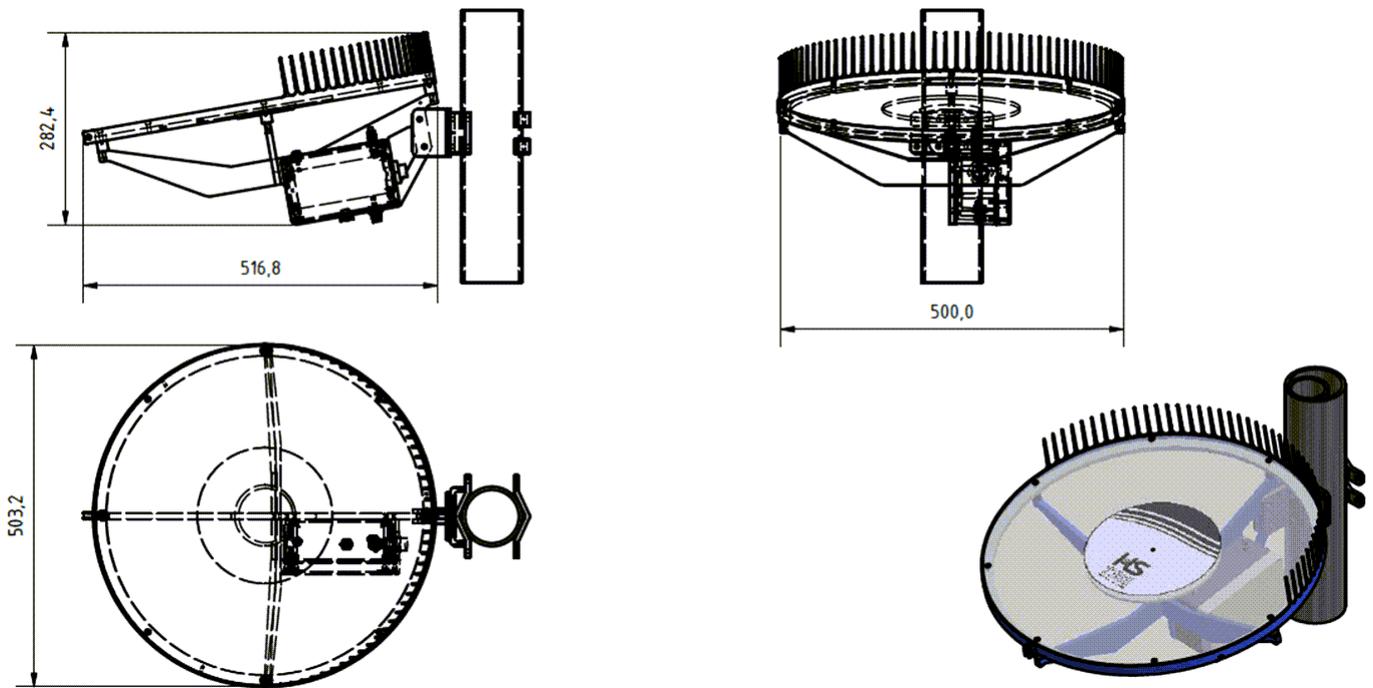


Figure 2 - Dimensions in mm

2.2 Pole Mounting

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



Figure 3 - HailSens IoT Pole Mount Bracket with Bolts and Washers

Pole mount bracket:

- The standard pole mount bracket supplied with each sensor is designed for poles with an outer diameter (OD) between 2" and 3.5".
- Optionally available: pole mount bracket for 4" ... 5" poles (OD).



Figure 4 - Pole-Mount Bracket mounted on a Pole

2.3 Selecting a suitable installation site

When the Hail Sensor is installed, the following should be considered:

- Avoid obstruction to sensor plate (i.e. clear areas are required no trees, close high-rise, etc.)
- Avoid nearby power line and communication towers (i.e. anything that could attract lightning and surges)
- Avoid high wind areas

Recommendations:

- Pole mounting: recommended mounting height is roughly 1 m above the ground.
- In hilly terrain or in mountainous areas, the sensor plate should be at 2 m above the ground. This is to avoid cluttering in snow during the winter period.

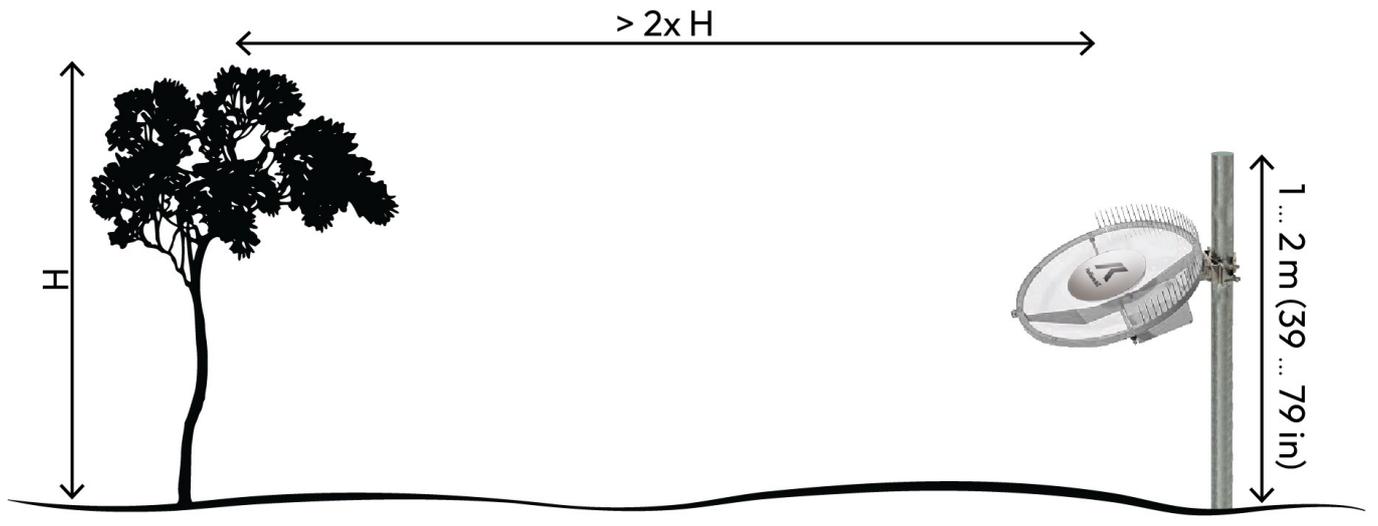


Figure 5 - HailSens installation and recommended distance from large obstacles

2.4 Electrical Bonding (Earth)

The electronics box is equipped with an M6 earth stud. The position of the Earth stud is shown in the following figure.

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

Note:

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

Recommendations

- Grounding cable - minimum specifications: $\varnothing 2.5 \text{ mm}^2$ / AWG 14
- Recommended colour code: green-yellow or bare green

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 6 - HailSens Earth stud / grounding

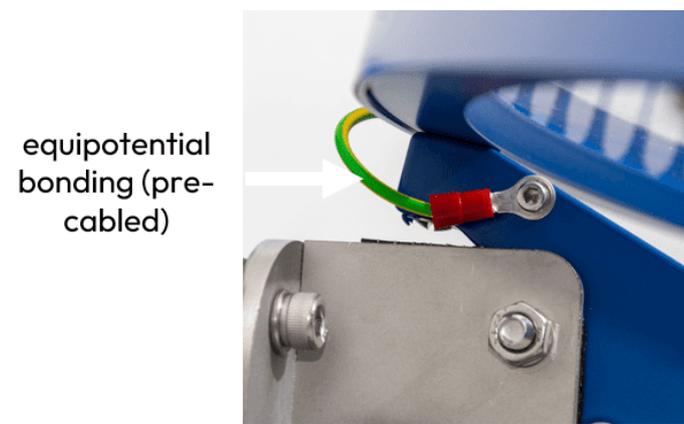


Figure 7 - HailSens equipotential bonding

2.5 External Cable Connection

Connectors are provided to connect external cables.

- M12 4-pin: power supply
- SMA: antenna
- RJ45/Cat 6 plug: Ethernet cable connection

Note: The pressure compensation gland automatically regulates pressure and moisture inside the housing. It is NOT a connection/socket. It is important to note that a damaged pressure compensation gland will corrupt the protective function of the enclosure.

The position of the connectors is illustrated in the following figure:

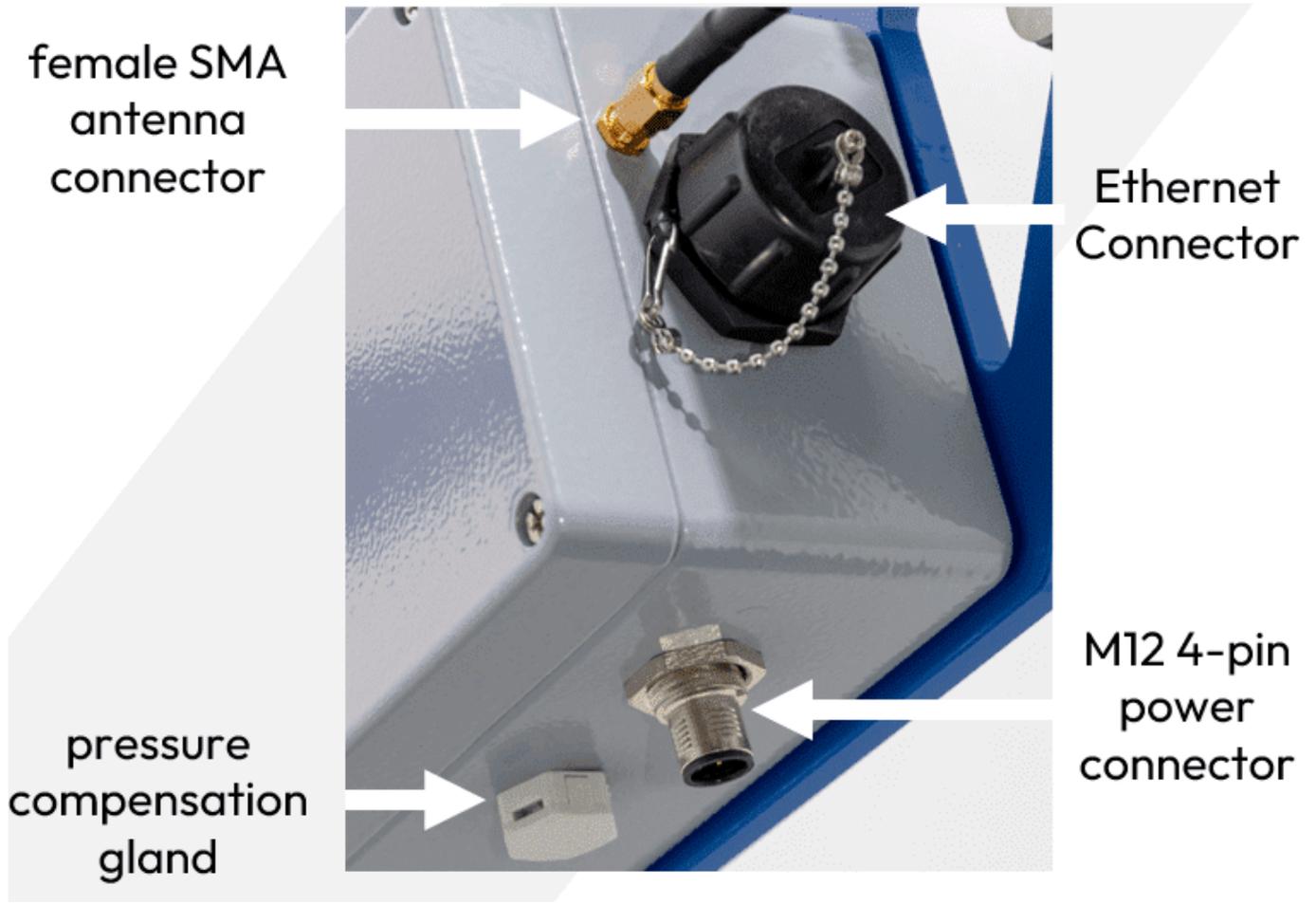


Figure 8 - Connectors at the bottom and right side of the housing

2.5.1 Connecting the Ethernet cable

HailSens IoT is equipped with a special RJ45 connector. To ensure waterproof protection, the outer RJ45 connector must be sealed with the supplied cap or a connected cable with a waterproof cable gland. Two caps are provided:



The round cap is used when no cable is connected. This is a waterproof and weatherproof Cat 6 RJ45 jack with an RJ45 jack on the back (RJ45 pass-through).

The conical cap is used with a cable. This threaded coupling is designed for waterproof and dustproof mounting on Cat 6 RJ45 jacks. For optimal dustproof and waterproof connection, we recommend using Cat 6 cables with an OD of 7-9 mm.

To install, simply slide the conical cap onto the open end(s) of the Cat 6 cable. Crimp an RJ45 connector to the open cable end. Connect the RJ45 plug into the waterproof Cat 6 RJ45 jack and screw the waterproof protector to the waterproof Cat 6 RJ45 jack.

2.6 For Wireless Data Communication: Insert SIM Card

Preliminaries: For all monitoring sites, it is recommended to check the availability, strength and stability of the mobile network before actually installing the HailSens. Note that multiple connection attempts due to unstable networks or frequent roaming will increase the power consumption. Signal strength and network coverage will also affect the choice of the correct antenna and antenna position.

SIM card, antenna and antenna cable are optional items that can be purchased from KISTERS (if desired).

Note: In some regions, individual network providers may deny access to unregistered devices. Make sure you are on a network operated by a provider that does not require pre-qualification/registration of devices.

Region	Network Technology
EMEA	LTE CatM (LTE-M)
USA	LTE Cat1 (LTE)
APAC	LTE CatM (LTE-M)

- A SIM card must be inserted in the SIM card slot of the integrated data logger/data modem unit.
- Unscrew and remove the cover (four screws). Insert the SIM card.
- When refitting the cover, make sure that the seal is seated correctly. Tighten the four screws with controlled torque - the seal may be compromised if the cover is too tight.
- Ensure that data services are enabled for the SIM card.

3 Configuration

Local Connection

Requires a computer that is connected via the Micro-USB port on the electronics board and has a browser.

- Install the Sierra Wireless Windows USB driver `GenericDriverSetup.exe` on the PC/laptop.
- Download link for the USB driver:
<https://cdn.hyquestolutions.eu/fileadmin/Meteorology/HailSens2022/Downloads/GenericDriverSetup.exe>
- The HailSens IoT can be user-configured. Start the browser and enter the following URL: `http://192.168.2.2`

Remote Connection

For HailSens units connected via an RJ45/Ethernet connection using a static IP address, the units can be accessed remotely.

- Open your browser and enter the static IP address of the sensor.

Configuration Dialogue

The configuration dialogue opens in your browser.

IoTα-F30X Custom Solutions
Edge M2M Extender

HailSens Series II Configuration

GENERAL/REST

SensorIdent: Save

Service URL: DataSphere Save

User: Save

Pass: Save

HailSens Calibration

Calparam 1: Save

Calparam 2: Save

Threshold: Save

Calibration Mode: Save

MOBILE COMMS

SIM Pin	<input type="text" value="XXXX"/>	Save
APN	<input type="text" value="iot.1nce.net"/>	Save
APNuser	<input type="text"/>	Save
APNpass	<input type="text"/>	Save
Authentication	<input type="text" value="None"/>	Save
Connection Retries	<input type="text" value="5"/>	Save
Connection Error Timeout	<input type="text" value="1000"/>	Save

STATIC COMMS

IP Address	<input type="text" value="192.168.13.31"/>	Save
NetMask	<input type="text" value="255.255.255.0"/>	Save
Network	<input type="text" value="STATIC"/>	Save
Default Gateway	<input type="text"/>	Save
Timeserver	<input type="text" value="time.nasa.gov"/>	Save
Static Network Interface Mode	<input checked="" type="checkbox"/>	Save

SYSTEMINFO

Modem: kIoTa F30X

Home Network Operator:

Current RAT: Not available

Signal: No signal strength

Distribution: Poky (Yocto Project Reference Distro) 2.2.3

FSN: VU0115851B1110

Host system: Linux fx30 3.18.44

hailsens
real-time hail measurement sensor

SERVICES

You are coming from [::ffff:192.168.2.3]

[running] SensorBoardReaderext

[running] RestWriter

[running] GateKeeper

Restart Service

Load Configuration

Figure 9 – HailSens IoT Configuration Dialogue

The Network settings only apply to the Ethernet port and do not affect the USB-based network connection.

The parameters that can be edited by the user are listed and briefly explained in the following table.

After applying changes in the NETWORK section, a reboot of the device is required to activate the settings. To perform the reboot, disconnect the device from the power-source for at least 5 seconds.

Section	Parameter	Comment
GENERAL/REST	SensorIdent	Sensor UUID
	Service URL	<code>http://tsoupload.kisters.de/HailsensUpload/rest</code>
	User	Username (authentication)
	Pass	Password (authentication)
HailSens Calibration	Calparam 1 - 3	calibration settings; individual setting for each sensor
	Calibration Mode	Check to enter Calibration Mode
MOBILE COMMS	SIM-Pin	Pin of the inserted SIM card
	APN	APN for inserted SIM
	APNuser	APN User (if required)
	APNpass	APN Pass (if required)
	Authentication	Authentication Method
	Connection Retries	Connection Retries
	Connection Error Timeout	Connection Error Timeout
STATIC COMMS	IP-Adress	Fixed IP-Adress or address obtained by DHCP
	NetMask	Netmask for IP-Adress
	Network	IP-Mode (DHCP/STATIC)
	Default Gateway	Default Gateway
	Static Network Interface Mode	Check if cable-bound, uncheck for mobile comms

Table 1 - HailSens IoT Configuration: Settings List

The network-mode (mobile or Ethernet) can be switched by checking the according box "Static network interface active" in the "Static Comms" section.

The currently selected mode can be indicated by the red background of the according section (example in the figure above: Static comms is active).

3.1 LTE-M Wireless Data Transmission (MOBILE COMMS)

To use the integrated LTE-M modem for data transmission, a data SIM must be installed.

Initial settings must be made in order to use the HailSens IoT with the data SIM card installed. Use a SIM card that is either data-only or has data tariffs activated. Phone calls using data communication require an exclusive application.

The APN setup is required to connect to the Internet. The APN is an access point for connecting to the Internet. It should be configured according to the contract plan you have with your network operator. If the APN setup has not yet been performed on the communication device, be sure to perform the APN registration.

For details see [figure 157](#) in the [Configuration 157](#) chapter, section: MOBILE COMMS.

Note: In some regions and depending on availability of data modems, the sensor can be equipped with a standard 4G LT Cat1 modem. Contact your provider to make sure to obtain a compatible SIM card.

3.2 Ethernet Data Transmission (STATIC COMMS)

The factory setting is set to DHCP which allows to access the unit after connecting to the network providing an according DHCP-Server. In case that this is not available, install the supplied USB-Driver-Package to your computer and connect it to the Mini-USB port of the integrated data logger/modem.

4 Operation

HailSens devices are delivered pre-wired. For [external cable connection](#) ¹³ see the chapter with the same name.

HailSens IoT is designed for unattended use. Once properly installed, powered-up and configured, the sensor unit operates on its own and does not require any specific user-interaction.

4.1 HailSens IoT: Electronics

The HailSens Series II electronics are housed in a grey box mounted on the support arm under the transducer plate. The box contains all the electronic components required to operate the sensor. Under normal circumstances, the box does not need to be opened: all signals are accessible via connectors on the outside of the box.

There is one exception to this rule: the box must be opened to install a SIM card. This is not necessary if your system has been pre-configured.

4.2 HailSens IoT: Power Supply

Nominal supply voltage is 12 Vdc. For the entire voltage range see the Data Sheet.

The sensor is delivered without a power supply. Potential power supplies are:

- 12 Vdc / 1 A power supplies,
- solar power unit with battery and battery charger.

The sensor is powered via the 4-pin connector on the electronic box.

PIN	Colour	Assignment
1	Brown	+12 Vdc
2	White	N/A
3	Black	GND
4	Blue	N/A

Table 2 - PIN-Out M12 4-Pin Power Connector

4.3 RESTful API/JSON

The HailSens IoT is programmed to transmit datagrams in JSON (JavaScript Object Notation) containers to a RESTful API server. JSON is a minimal, readable format for structuring data.

- KISTERS datasphere users: API and data formats are of no particular interest for users whose HailSens device(s) is (are) reporting directly to KISTERS datasphere (optional Cloud-based data management).
- For users who wish to develop their own IP endpoint, a separate document of technical information for programmers is available on request.

5 Maintenance

The entire design of the HailSens IoT 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.

5.1 Overall Visual Check

During site visits check the sensor for mechanical damage.

Check whether all cables are properly connected and that no mechanical strain is exerted on cables, leads or wires.

The sensor electronics box is equipped with an earth stud. Check whether the stud is properly connected to an earth pike or to an electrically conductive part of the mounting pole.

Visually inspect the transducer plate for visible cracks or rifts. Visible cracks or rifts – even if they are clearly inside the plate – will impact the measurement. 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

Initial Checks

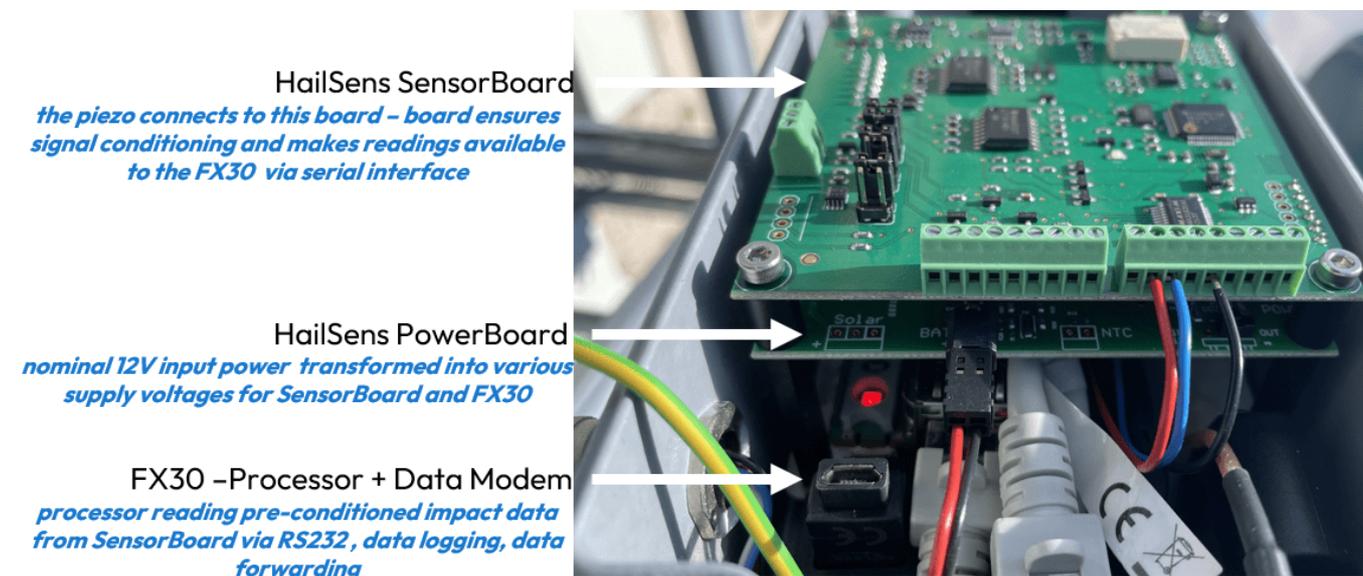


Figure 10 - Interior of the electronics box - position of the three electronics boards

Power Supply

- Ensure that the device is properly plugged in and receiving power.
- Check the power supply or battery.
- Disconnect the power cable and measure the voltage between pin 1 and pin 3. The voltage must be within the supply voltage range specified in the [Technical Data](#)^[23].
- If all is well externally, open the electronics box cover and check the LED status.
 - Sensor board: if OK, the LED flashes every 10 seconds.
 - Processor unit:
 - Solid red = process is powered
 - Solid amber = processor is booted up

Connections

- Verify that all cables (power, data, etc.) are securely connected.
- Inspect cables and connectors for any visible damage.

Environment

- Check the operating environment of the HailSens: Ensure that it is within the recommended temperature and humidity ranges (see chapter [Technical Data](#)^[23]).

Mechanical Integrity

- Transducer plate: Visually inspect the transducer plate for visible cracks or rifts. Visible cracks or rifts - even if they are clearly inside the plate - will impact the measurement. 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 bottom of the transducer plate. If the ring protrudes above the transducer plate, it may interfere with the wash-off of both debris and hailstones, resulting in inaccurate measurements during a hail event.

Device-Specific Steps

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 (Micro-USB connection) 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.

HailSens Configuration

- Open the configuration web app and check all settings.
- For wireless communication: Check that all APN settings are correct and comply with the provider's specifications.
- Check the time-server URL. Default: `time.nasa.gov` for systems with open access to the Internet. This setting must point to a private *rdate* time-server in all closed private network environments.

Firmware and Software

- Ensure that the device firmware is up-to-date. Follow the manufacturer's instructions for updating the firmware.
- 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.

Network Configuration

- Wireless - Private APN: It is important to check the entire data transmission path, starting with the APN settings, IP endpoints and server-side software components.
- Wired: It is necessary to check the Ethernet connection. It is also important to ensure that ports are open and that firewalls are aware of the sensor.
Note: The HailSens processor can be protected by its own firewall. If you are unable to contact the device, check the firewall settings.
- Overall: Verify that the network settings match the device specifications.
- Check that there are no IP address conflicts on your network that could prevent the unit from communicating properly.

Contact KISTERS Support

If the above steps do not resolve the problem, contact HailSens customer support for further assistance. Provide them with detailed information about the problem and the steps you have already taken.

- Provide current site installation images.
- Specify whether the unit uses cellular or Ethernet connectivity.
- For mobile, have APN data to hand.
- For Ethernet connection, describe the setup:
 - Is the HailSens connected directly to a modem-router?
 - Is the HailSens connected to a switch?
 - What are the IT security settings?
- Describe the problem.
- It is recommended that you give a step-by-step description of the problem, if possible. It is also advisable to include sample data and screenshots of the sensor settings.

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]
Range	0,005 J ... 28 J Lower detection level: ≥ 5 mm (hail pellets according to WMO)
Accuracy	kinetic energy and pellet equivalent diameter: ± 10 % (according specific mass density on ice and spherical model)
Data Transmission	Physical output: <ul style="list-style-type: none"> ▪ wireless IP data modem, SMA connector, antenna ▪ wired: Ethernet RJ45 connector JSON datagrams via LTE-M (4G) or Ethernet to defined RESTful web service JSON: timestamp, pellet kinetic energy, pellet equivalent diameter, calibration factor Heartbeat: every 6 hours Measurement data: 1 data package per impact
Local Communication	Micro-USB
Housing	Aluminium die-cast, IP66
Supply Power	nominal: 12 Vdc - Range: 10...18 Vdc
Power Consumption	60 mA at 12 Vdc (≈ 0.7 W), wireless comms engaged max 120 mA at 12 V (1.4 W)
Operating Temperature	Deployment operating and storage temperature: -40 °C to $+70$ °C Calibrated measurement range: 0 to $+70$ °C Humidity: 0 - 100 % RH
Ingress Protection	IP66
Dimensions	<ul style="list-style-type: none"> ▪ Transducer plate (round): $\varnothing 500$ mm (19.685") ▪ Mounting: 2" to 4" pole on a heavy concrete ground plate: (500 x 500 x 50) mm (L x B x H) Height: 300 mm
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.

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