

Datenblätter

Pegel

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

/HydroMet

User Manual

HyQuant

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 +Abbreviations	5
III	Scope of Delivery	7
IV	Optional Accessories	8
V	Safety Instructions	9
VI	Specific SafetyInstructions	10
Part I	Introduction	11
1.1	KISTERS HyQuantSensors.....	11
1.1.1	Types of HyQuant Sensors.....	12
1	Why RADAR technology?.....	12
1.1.1	HyQuant Components.....	14
Part II	Installation	15
2.1.1.1	Site Selection CriteriaforLandV.....	15
2.2 ³	Orientation of the HyQuant.....	16
2.3	Standard Installation Bracket.....	17
2.4	Optional Bracket for Round Tubes.....	18
2.5	Power Supply.....	18
2.6	Cable and Connector Pinout.....	19
Part III	Configuration	20
3.1	ConfigurationSoftware.....	20
3.1.1	System Requirements.....	20
3.1.2	HyComm Updates.....	20
3.1.3	Firmware Updates.....	21
3.2	Enabling of the Local Wi-Fi Hotspot for Configuration.....	21
3.2.1	Enable with Reed Switch/Magnet.....	21
3.2.2	Enable via Modbus.....	22
3.2.3	Enable via SDI-12.....	22
3.2.4	Enable via Power Cycle.....	22
3.2.5	Automatic Disabling.....	22
3.3	Filters.....	23
3.4	Rain Filter for Velocity Measurements.....	24
3.4.1	Rain Filtering Principle in HyQuant.....	25
3.	Reference Level.....	27
5	Operational Range.....	27
3.	Configuration for Q Calculation.....	27
6	Settings.....	28
3. 3.8.1	Parameters.....	28
7 3.8.2	Units.....	32
Part IV	Operation	33

4.1	Radar Beams.....	33
4.2	Quality Flags.....	35
4.3	SDI-12.....	36
4.3.1	Standard Commands.....	36
4.3.2	Extended Commands.....	44
4.4	Modbus.....	44
4.4.1	Default Settings.....	44
4.4.2	Modbus Register Mapping.....	45
Part V	Maintenance	47
Part VI	Troubleshooting	49
Part VII	Repair	51
Part VIII	TechnicalData	52
Part IX	Regulatoryand ComplianceInformation	54

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.

Any errors found in any KISTERS product should be reported to KISTERS where every effort will be made to quickly resolve the problem.

Copyright Notice: No parts of this work may be reproduced in any form or by any means without the written permission of the publisher. KISTERS waives copyright for users to print out parts of the documentation in hard copy for their own use only.

Trademark Notice: KISTERS products and services referred to in this document are trademarks or registered trademarks of KISTERS. Other product names used may or may not be the trademarks of their respective owners.

© 2025 | KISTERS. Any rights not expressly granted herein are reserved.

This document is public.

II Glossary + Abbreviations

Term	Description
CE	Short for French “Conformité Européenne”; CE Marking on a product indicates that the manufacturer verifies that their products meet the European Union's (EU) health, safety, and environmental protection standards. It is a legal obligation that confirms compliance with the Product Directives.
dB	Short for decibel; The decibel is a relative unit of measurement that equals one-tenth of a bel (B). It measures the intensity of an electrical signal by comparing it with a specific level on a logarithmic scale.
ESD	Short for Electrostatic Discharge; the release of stored static electricity. Most commonly, the potentially damaging discharge of high voltages that occurs when an electronic device is touched by a charged body.
Doppler	Short for Doppler Radar; a radar that is specifically designed to use the Doppler effect to generate information on the velocity of objects that are located at a distance. This is achieved by reflecting a microwave signal off an intended target and analysing how the motion of the object has affected the frequency of the returned signal.
FCC	Short for Federal Communication Commission; The FCC logo or mark is a symbol used on electronic products produced or marketed in the United States. It shows that the device's electromagnetic radiation is under the limits defined by the Federal Communications Commission, and the manufacturer has complied with the Supplier's Declaration of Conformity authorization procedures.
FMCW	Short for Frequency-Modulated Continuous Wave; an FMCW radar has the ability to alter its operating frequency while measuring. This means that the transmission signal is modulated in either frequency or phase. Changes in frequency or phase are technically necessary to perform radar measurements through runtime measurements.
GHz	Short for gigahertz, a frequency unit equal to a billion hertz or cycles per second.
GND	Short for ground; in electronics, the ground serves as the reference point for all signals or a common path in an electrical circuit from which all the voltages can be measured.
Gyroscope	A tool employed to measure or uphold orientation.
HDPE	Short for high-density polyethylene, a thermoplastic polymer.
IP	Short for Ingress Protection; IP ratings indicate the degree of protection provided by an enclosure against solids and liquids.
L	Short for Level or Water Level.
Modbus RTU	Modbus is a communication protocol for transmitting data, which follows a request-response model. The protocol uses a Client-Server architecture where the Client sends a request to the Server device, which responds accordingly. The language of the protocol is clear, concise and designed to enable interoperability among different devices. Modbus RTU is the prevailing option for serial connections. With Modbus RTU, data is transmitted in binary format.

Term	Description
Output rate	The output rate pertains to how frequently the output data is refreshed. It remains constant and is independent of filter settings, since the data is updated discretely during each output cycle. The unit for the sample rate is Hertz (Hz). It is equivalent to the reciprocal second, as $1 \text{ Hz} = 1 [\text{s}^{-1}]$.
Q	International short notation of the hydrological discharge determined for a stream cross-section.
Radar	Short for Radio Detection and Ranging; a system or device that employs short radio waves to determine the position or velocity of objects by measuring the direction, frequency and timing of reflected signals.
Radome	A blend word made from radar and dome – the radome is the shelter that protects the radar antennas.
RS-485	RS-485 is an industrial standard that establishes the electrical interface and physical layer for point-to-point communication between electrical devices. It effectively enables long cabling distances in environments with strong electrical interference and permits multiple devices to communicate on the same bus. Electrical signalling is balanced.
Sample rate	HyQuant utilizes radar technology to convert analogue water level changes into a digital data stream. By sampling water height amplitude at specific time intervals, HyQuant produces discrete data. The sampling rate is the frequency of sample collection per second, measured in samples per second (sps). The unit for the sample rate is Hertz (Hz). It is equivalent to the reciprocal second, as $1 \text{ Hz} = 1 [\text{s}^{-1}]$.
SDI-12	Serial Digital Interface at 1200 baud, an asynchronous serial communications protocol for smart sensors, SDI-12 sensors reply to commands send by the data logger, the standard also specifies supply voltage and current and including modes for low-power operation.
SLA	Short for Sealed Lead-Acid; A sealed lead-acid battery, also known as a gel cell, is a type of lead-acid battery where the electrolyte, which is sulphuric acid, is thickened so that it does not spill out.
SNR	Short for Signal-to-Noise Ratio; Signal-to-Noise Ratio (SNR) is a measure of the relative strength of the desired signal to the noise signal at a specific point in time. A higher number indicates better performance. It is typically expressed in decibels (dB).
USB	Universal Serial Bus, an asynchronous serial communication protocol for peripheral devices.
V	Short for Velocity or Surface Water Velocity.
V dc	Short for Volt Direct Current.
Wi-Fi	Certification mark of the interoperability of wireless computer networking devices using wireless network protocols based on the IEEE 802.11 family.

III Scope of Delivery

- § 1 × HyQuant Sensor device
- § 1 × Two-part mounting bracket (tilt and swivel)
- § 1 × 10 m cable with 8-pin female angled connector and open-ended wires
- § 1 × Torx key (T10)
- § 1 × Magnet
- § 1 × Test certificate
- § 1 × Quick installation guide

IV Optional Accessories

§ HyQuant user manual (in English language) Configuration software HyComm HyComm
§ user manual Tube/Pole mount bracket 20 m connection cable with 8-pin angled plug
§ connector (socket) and open wire ends 30 m connection cable with 8-pin angled plug
§ connector (socket) and open wire ends 40 m connection cable with 8-pin angled plug
§ connector (socket) and open wire ends SDI-12/USB interface adapter RS-485/USB
§ interface adapter KISTERS iRIS 270/350 FX data logger or KISTERS IoTa Sensor Node
§
§
§
§

V Safety Instructions

§ Read the user manual including all operating instructions prior to installing, connecting and powering up the KISTERS HyQuant. 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 HyQuant 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 HyQuant, 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 HyQuant 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 HyQuant 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 HyQuant out of service, it must be disposed of in compliance with local waste and environmental regulations. The KISTERS HyQuant 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.

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 HyQuant.
- § Information to ensure the safety of the appliance.

VI Specific Safety Instructions

Intended use

HyQuant is a hydrographic sensor that uses radar technology for contactless measurement of either water stage or water surface velocity or both. Do not use the sensor for other applications. At all times respect the specifications for use, deployment, maintenance, repair and disposal described in the present manual. HyQuant must not be used in areas where there is a risk of explosion!



WARNING

- § Risk of explosion due to sparking and electrostatic charging - not intrinsically safe.
- § Operation of the HyQuant in such an atmosphere may result in ignition of the atmosphere, which could cause serious damage to property and injury to personnel.
HyQuant must not be operated in a potentially explosive atmosphere. Furthermore, the HyQuant does not have
- § ATEX approval (explosion protection).

- § Whether you are installing or deploying the sensor, please note and follow the detailed safety information provided for each work step.
- § Working on electrical systems requires special knowledge and training. For this reason, the electrical installation of the HyQuant may only be carried out by a suitably trained specialist.
Electrical, technical and climatic specifications must be respected at all times.
- § Modifications or retrofitting to the HyQuant will void the warranty and the RF approval required for safe operation of the device.
Comply with electrical safety standards.
- § Comply with Health, Safety & Environment regulations and directives.
- §



WARNING

- § Risk of drowning.
- § Be particularly careful when working over or near to water.
- § Wear a Life Jacket/Buoyancy Aid:
 - § Ensure that workers at risk of falling into the water are provided with and wear a life jacket or buoyancy aid.
 - § The life jacket should be thoroughly checked by the user prior to use.
- § Never Work Alone: Always be accompanied when working near or over water.

1 Introduction

Thank you for choosing our product. We hope you will enjoy using the device. KISTERS manufactures, sells, installs and operates quality instrumentation, data loggers and communication technology.

Products are designed with passion for environmental monitoring and with a deep understanding of the quality, accuracy and robustness needed to fulfil the requirements of measurement practitioners in the field. The present User Manual will help you

understand, install and deploy the device. If, however, you feel that a particular information is missing, incomplete or confusing, please do not hesitate to contact us for further support!

HyQuant is a hydrographic sensor that uses radar technology for contactless measurement of water stage (model HyQuant L) and water surface velocity (model HyQuant V) or both (model HyQuant L+V, which can be expanded to HyQuant Q for discharge measurement). Radar sensors are characterised by long-term stability and low maintenance. HyQuant has been designed to ensure stable system behaviour and stable signals in all weather conditions and for all types of natural or polluted water.

For more information, see the following subsections:

§ [KISTERS HyQuant Sensors](#)^[1]

1.1 KISTERS HyQuant Sensors

All HyQuant models have been awarded the CE mark, and have received FCC and UL approval. Consequently, they are suitable for deployment in the respective target markets.



Figure 1 – HyQuant Sensor with standard mounting bracket and sensor cable

HyQuant models are equipped with:

- § A 61 GHz radar module
- § HyQuant L: One antenna pair for level measurement
- § HyQuant V: One antenna pair for surface velocity measurement
- § HyQuant L+V and Q: Two antenna pairs, one for level and one for velocity measurement
- § Wi-Fi interface for local configuration

- § Digital data output via either SDI-12 or Modbus (RS-485)
- § Aluminium die-cast housing with HDPE lid/radome
- § M12 8-pin male sensor/actuator connector
- § A gyroscope to determine the angular position during installation

For more information, see the following subsections:

- § [Types of HyQuant Sensors](#)¹²
- § [Why RADAR technology?](#)¹²
- § [HyQuant Components](#)¹⁴

1.1.1 Types of HyQuant Sensors

HyQuant L – Level or Stage Sensor

The distance between the antenna edge of the sensor and the surface of the medium is the measured variable for this system, with the antenna edge acting as the measurement reference plane. When properly configured, the sensor will output the absolute water level calculated with respect to a user defined reference datum.

HyQuant L is available in two measuring ranges:

- § HyQuant L20: up to 20 m
- § HyQuant L50: up to 50 m

Radar levels are used for non-contact level measurement in surface water. A distance measurement is made based on the time it takes for electromagnetic waves (microwaves) to travel from the sensor to the water surface and back. As the radar sensor measures the distance between the sensor and the water level, different modes are available for referencing the water level, e.g. to a staff gauge.

HyQuant V – Surface Velocity Sensor

The measured variable is the flow velocity of the water at the surface of the stream/river/brook. HyQuant V is available for installation heights of up to 20 m above the lowest expected water level. The sensor is based on the Doppler frequency shift principle for surface velocity measurement. The sensor emits a microwave radar signal at a specific frequency. This signal is reflected when it hits the water surface. The reflected electromagnetic wave oscillates at a shifted frequency. The observed frequency shift is proportional to the surface flow velocity. The sensor samples at high speed and evaluates all the reflected signals collected to determine the surface flow velocity.

HyQuant L+V – Combined Water Level/Stage and Surface velocity Sensor

HyQuant L+V is available for installation heights up to 20 m at the lowest expected water level. This model combines the features of the L and V models in a single unit of the same size.

HyQuant Q – Radar sensor for discharge monitoring

HyQuant Q is available for installation heights up to 20 m at the lowest expected water level. HyQuant Q is an L+V with additional, fully integrated discharge calculation capabilities.

1.1.2 Why RADAR technology?

HyQuant uses RADAR technology because it provides stable, reliable and highly accurate non-contact quantification of water levels in a variety of ecological and natural contexts. The scanning frequency allows adequate detection of dynamic features, including ripples on the water surface.

Radar water level measurement offers a major advantage over other measurement systems because radar technology is largely independent of the properties of the medium being measured, such as:

- § Temperature
- § Viscosity
- § Density
- § Conductivity

Radar sensors are also unaffected by daylight, fog and light rain.

Heavy rainfall is known to affect radar measurements because it is difficult to distinguish reflections from thick droplets from those from the water surface. In addition, kinetic energy causes concentric waves to form on the water surface, further complicating the measurement process. To mitigate these effects, HyQuant V, L+ V and Q are equipped with tailor-made filters.

HyQuant is a microwave based sensor. Radar beams follow the wave theory. The beam angle indicates the width of the beam opening from the antenna. The beam angle increases with distance. Ensure that HyQuant radar sensors have an unobstructed vertical view of the water surface: There should be no obstructions in the beam path from the antenna to the water surface. See section [Radar Beams](#) for more information on measuring the beam spread.

The sensor is supplied with a mounting bracket and has a low profile. HyQuant sensors are easy to install and require minimal maintenance.

1.1.3 HyQuant Components

The basic components of the actual HyQuant unit are illustrated in this chapter. [Figure 2](#)  shows the exact position of each component.

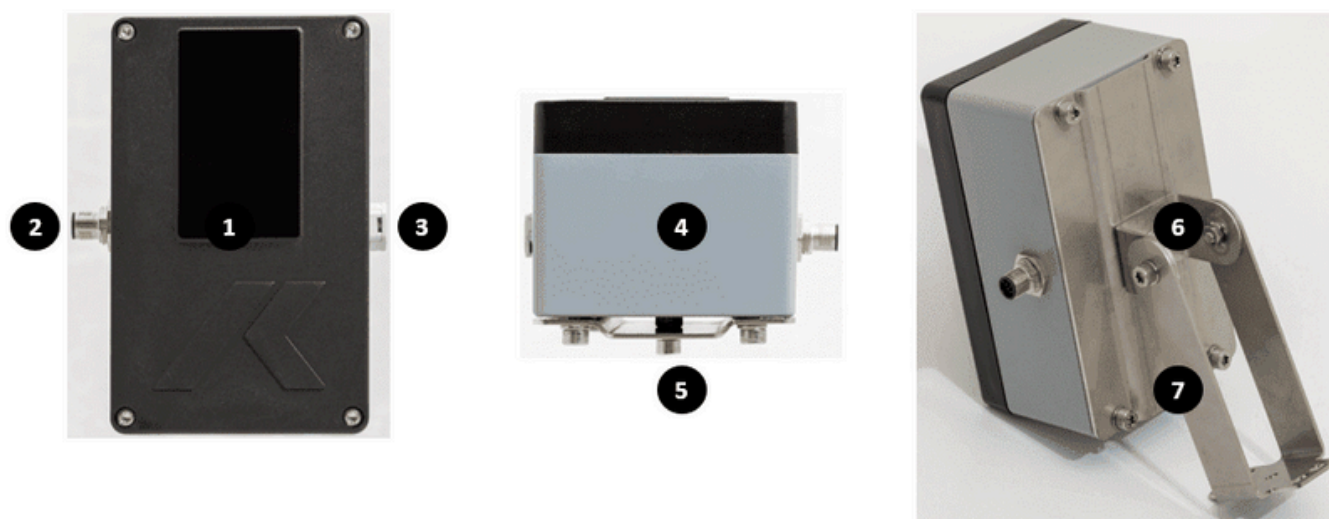


Figure 2 – HyQuant front and side view

HyQuant is a small, self-contained device that exchanges measurement data with external devices (data loggers, RTUs, etc.) via a cable connection and either SDI-12 or Modbus protocol.

No.	Description
①	Lid with integrated radome
②	M12 8-pin connector for signal cable (supplied)
③	Pressure compensating gland
④	Die-cast aluminium housing
⑤	Rear mounting plate
⑥	U-bracket
⑦	Mounting bracket

Table 1 – List of HyQuant Components

2 Installation

HyQuant is always supplied with a mounting bracket and a sensor/actuator cable with one end terminated with an M12 8-pin female connector (HyQuant side) and one end with open wires. Note that optional items such as longer cables and a pole mount bracket are available and can be ordered separately.

Note: Before installation, please check that all components are included according to Scope of Delivery and that they have not been damaged during transport.

For more information, see the following subsections:

- § [Site Selection Criteria for L and V](#) ¹⁵
- § [Orientation of the HyQuant](#) ¹⁶
- § [Standard Installation Bracket](#) ¹⁷
- § [Optional Bracket for Round Tubes](#) ¹⁸
- § [Power Supply](#) ¹⁸
- § [Cable and Connector Pinout](#) ¹⁹

2.1 Site Selection Criteria for L and V

To ensure accurate measurements, careful consideration must be given to selecting suitable installation locations for water level (L) and/or flow velocity (V) sensors. HyQuant sensors are designed for use in hydrological applications. HyQuant sensors can be deployed in waterways, rivers, streams, brooks, lakes, reservoirs and similar bodies of water.

WARNING

- § Risk of explosion due to sparking and electrostatic charging - not intrinsically safe.
- § Operation of the HyQuant in such an atmosphere may result in ignition of the atmosphere, which could cause serious damage to property and injury to personnel.
- § HyQuant must not be operated in a potentially explosive atmosphere. Furthermore, the HyQuant does not have ATEX approval (explosion protection).

- § Alignment: Ensure accurate alignment of the sensor in the Y and Z directions ($< \pm 2^\circ$ deviation) using the built-in tilt sensor.
- § Suitable locations: Consider potential installation locations such as bridge structures, pontoons, or auxiliary constructions directly above the section of the waterway to be measured.
- § Exception for steel bridges: It is advisable to avoid mounting sensors on steel bridges in the middle between two supporting poles/structures. Solar radiation can cause steel bridges to heat up, expand and sag, affecting the measured distance and therefore the hydrological water level. Steel can also be more reflective than other construction materials, so care must be taken.
- § Stability and vibration: Choose a stable, vibration-free location to avoid interference from traffic or wind.
- § Avoid bridge piers: Avoid flow velocity effects, backwater zones and turbulence by avoiding installation directly on or near bridge piers.
- § Height placement: Mount sensors above typical high water marks to prevent antenna immersion and ensure accurate readings. Maintain a minimum distance of 0.15 metres (5.9 inches) between the sensor and the water surface.
- § Water surface conditions:
 - § For L measurements: Optimum water surface characteristics include a smooth surface within the circular measurement area.
 - § For V measurements: Ensure a minimum water surface roughness of 2 mm around the sensor radar footprint.
 - § For all parameters: Avoid areas with turbulent water surfaces, foam accumulation, obstructions causing changes in water level or flow velocity, ice or snow-covered surfaces, and protruding obstructions.
- § Wind Influence on V measurements: Minimise wind effects on the water surface (such as inverse flows or side-flows resulting from cross-winds) to maintain measurement accuracy.
- § Clearance: Ensure that the radar footprint of the sensor is clear of obstructions, with no inflows, outlets, weirs or other obstacles in front of the measurement point. Optimum minimum clearance: 10 times the width of the waterway.
- § Bottom stability: Choose stable channel bottoms and cross sections free of large rocks and vegetation to avoid measurement inaccuracies.
- § Avoid areas with variable bed load: Contactless measurement technologies require a stable riverbed, especially for determining flow velocities. In areas with variable bed load, heavy rainfall can alter the riverbed, potentially changing the direction of the flow and causing unpredictable variations in velocity. In extreme cases, the flow may shift entirely outside the sensor's measurement field, resulting in inaccurate or invalid readings.

By carefully following these criteria, suitable installation locations can be identified to ensure accurate and reliable water level and flow velocity measurements.

2.2 Orientation of the HyQuant

The enclosure is made of a grey aluminium die-cast housing with a black HDPE lid. The radome is located on the smooth raised surface of the lid. HDPE has a dielectric constant that makes it virtually transparent for electromagnetic microwaves. The lid with the integrated radome protects the radar antennas from weather and mechanical shock. The KISTERS 'K'16 is located just below the radome.

For HyQuant V, L+V and Q:

Sensor Alignment and Flow Direction Interpretation

The flow sensor provides a positive flow velocity reading when the 'K' marking on the sensor lid is facing upstream (water flows from 'K' marking to the radome area of the lid). This is the manufacturer's recommended installation.

If the sensor is installed with the 'K' marking on the sensor lid facing downstream, the system will interpret this as a negative flow velocity.

This means:

- § Positive value when 'K' marking on sensor lid faces upstream.
- § Negative value when 'K' marking on sensor lid faces downstream.

Return Flows or Flow Reversals

If the sensor is installed correctly (with the 'K' marking on sensor lid faces upstream) and the flow direction reverses (due to return flows or unstable conditions, such as moving bed load), the system will display a negative flow velocity, indicating the change in direction.

Note: If the rain filter is activated, this interpretation of the flow direction no longer applies, as the rain filter modifies how the flow data is evaluated.

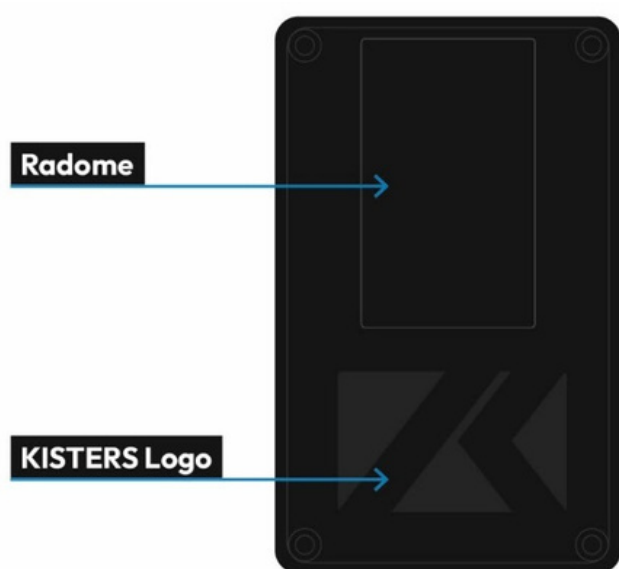


Figure 3 – Position of both the radome and the KISTERS 'K' on the lid

HyQuant assumes that it is positioned parallel to the water surface. During installation, the gyro data helps the installer find the best position relative to the water surface. HyComm, the KISTERS sensor configuration software, displays the mounting angle on a mobile device connected to the sensor via Wi-Fi.

HyQuant sensors must be installed parallel to the water surface (acceptable tolerance: $\pm 2^\circ$) to ensure:

- § proper orientation of the level beam, which points straight downwards at 0° ,
- § proper orientation of the velocity beam, which points sideways at a 45° inclination.

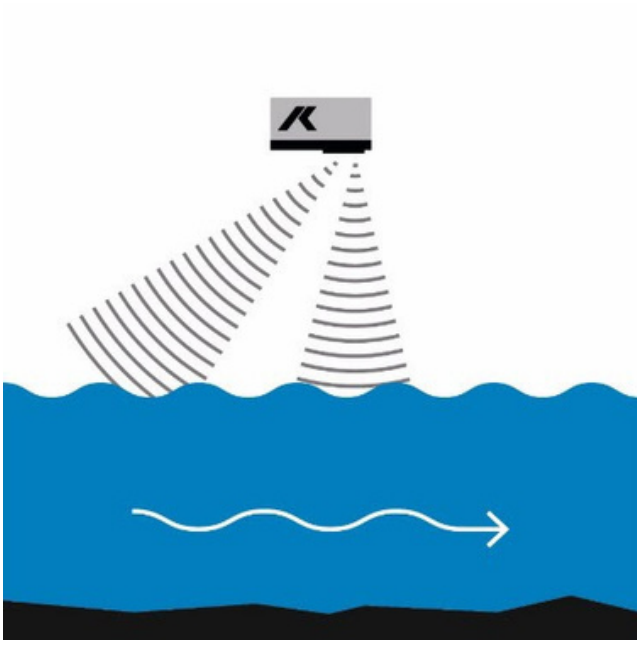


Figure 4 – Orientation of the HyQuant sensor relative to the flow direction (arrow)

2.3 Standard Installation Bracket



WARNING

- § Risk of pinching.
- § Fingers are exposed to pinch points when installing a HyQuant device with bolts.
- § Take precautions and wear protective gloves.

The mounting bracket is included in the foam insert base of the standard shipping box. It consists of two parts:

- § a small U-shaped bracket for mounting against the base plate of the HyQuant sensor, and
- § a long U-shaped arm with mounting lugs.



Figure 5 – Rear side view of HyQuant with mounting bracket installed

The mounting lugs and corresponding holes are designed to accept M6 screws. The standard mounting bracket is compatible with any support that provides a flat surface, including:

- § Rectangular metal tubes with a minimum width of 30 mm.
- § Concrete surfaces: walls, bridge support structure, ...

2.4 Optional Bracket for Round Tubes

The sensor's optional cylindrical pole mount is available as a peripheral and must be purchased separately. It facilitates installation and alignment of the sensor on a pole or tube running parallel to the water surface, with an outer diameter of up to 60.3 mm (2"). The accessory provides a flat mounting sheet for the standard mounting bracket. A clamp bracket is used to mount the sensor on round poles with diameters ranging from 1.5" to 2" (60 cm outer diameter).

2.5 Power Supply

! CAUTION

- § Device Operating on Low DC Power.
- § No life or health risk except for vulnerable or highly sensitive individuals who should refrain from working with electrical devices.
- § Precaution: Electrical devices should always be installed by qualified personnel.

The HyQuant operates within a voltage range of 9 to 30 V dc, with a nominal operating voltage of 12 V dc, which is typical for SLA batteries (Sealed lead acid battery) - a rechargeable battery suitable for solar-powered applications. It can also be connected to a DC mains power supply.

As soon as a suitable power supply is connected, the HyQuant is ready for use.

2.6 Cable and Connector Pinout

HyQuant sensors are supplied with a suitable 10 m sensor/actuator cable with an 8-pin M12 female connector at one end and open wires at the other end. The HyQuant enclosure is equipped with an 8-pin M12 male connector. The cable connector should be plugged into the housing receptacle.

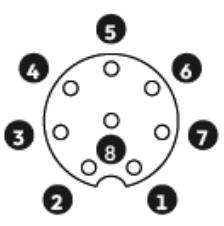
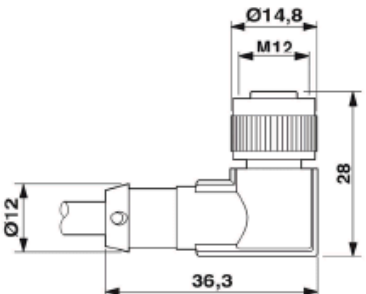
Note: The connector only fits in one direction due to the coding.

WARNING

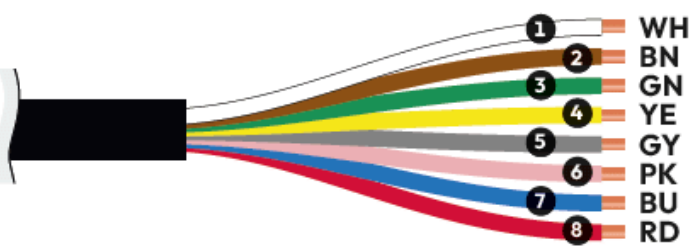
- § Incorrect connection of the supply power may result in damage to the HyQuant. The HyQuant has a reverse polarity
- § protected interface and power circuit to protect against this. However, it is important to note that an improper or incorrect connection between the power and interface lines could still result in damage to the instrument. Check the pin-out configuration and ensure that no power is applied to the connector
- § cables other than those specifically marked 'Power VCC +' and 'Power GND -'.

Cable and connector pinout							
1	2	3	4	5	6	7	8
Power VCC +	Power GND -	SDI-12 GND	SDI-12 Data	RS485A	RS485B	NC	NC

Pin assignment (female view)

Connection diagram



Pin	Color	Label
1	White	WH
2	Brown	BN
3	Green	GN
4	Yellow	YE
5	Grey	GY
6	Pink	PK
7	Blue	BU
8	Red	RD

Caution: Incorrect or faulty connection can damage the device. All interface and power cables are protected against reverse polarity, but incorrect connection of power cables to interface cables can damage the device.

Table 2 – Connector Pinout

3 Configuration

HyQuant is equipped with an integrated Wi-Fi hotspot and can be locally configured/operated wirelessly from a PC/Notebook with activated Wi-Fi via KISTERS' HyComm software. The Wi-Fi hotspot is protected against unauthorised access from outside. This makes it impossible to read measurements or status values or change device settings via this interface without authentication. The Wi-Fi hotspot must be activated as described below.

For more information, see the following subsections:

- § [Configuration Software](#) ²⁰
- § [Enabling of the Local Wi-Fi Hotspot for Configuration](#) ²¹
- § [Filters](#) ²³
- § [Rain Filter for Velocity Measurements](#) ²⁴
- § [Reference Level](#) ²⁷
- § [Operational Range](#) ²⁷
- § [Configuration for Q Calculation](#) ²⁷
- § [Settings](#) ²⁸

3.1 Configuration Software

HyComm is KISTERS software used for local communication between a Windows computer and the HyQuant radar sensor. Communication is via a Wi-Fi connection, with the HyQuant acting as a Wi-Fi hotspot. HyComm allows [parameter configuration](#) ²⁸ of the sensor. You can find more information about HyComm in a [separate manual](#) that can be downloaded from the [HyComm product page](#).

To protect the parameterisation, you can protect the device with a keyword of your choice.

3.1.1 System Requirements

Make sure your PC/laptop/tablet computer meets the following system requirements:

- § Operating system: Windows 10 or later
- § Wireless connection: Wi-Fi / adapter: enabled
- § Wired connection: SDI-12 to USB interface or RS-485 to USB interface (for Modbus interface)
- § Note: The interfaces can be ordered from KISTERS as an optional extra.

3.1.2 HyComm Updates

When HyComm starts with Internet access, it automatically checks for a new release. If an update is available, it will be downloaded and the message shown in [Figure 6](#) ²⁰ will be displayed:

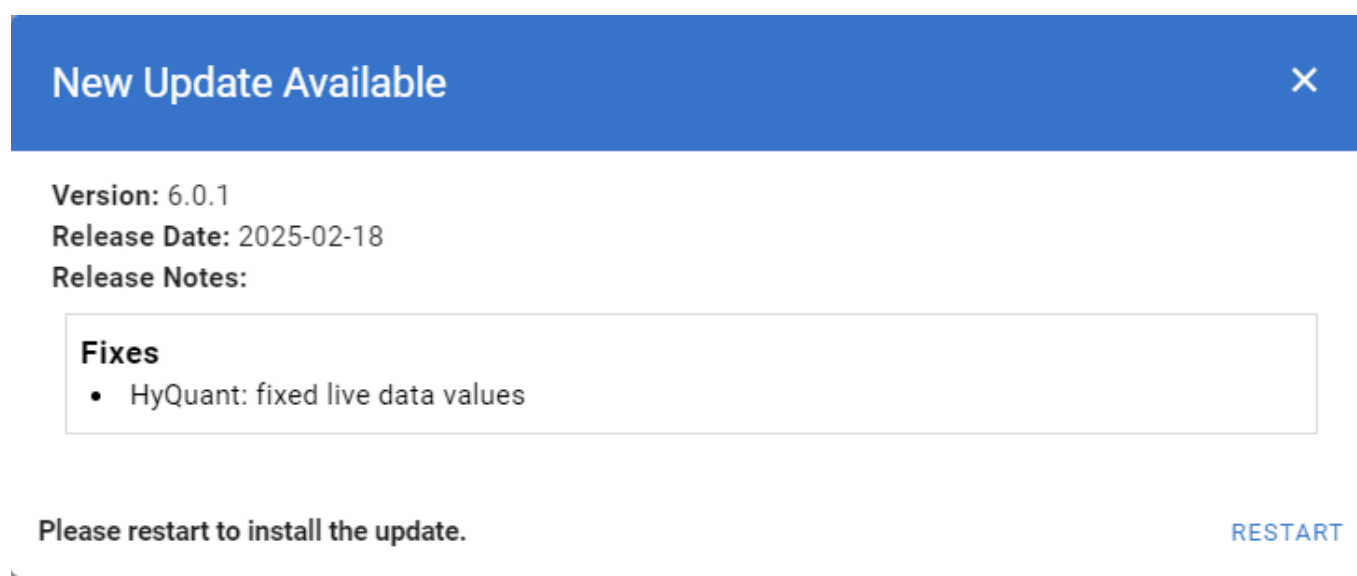


Figure 6 – HyComm Update Alert Message

Note: Windows notification settings may suppress this notification.

The update is installed in the background after HyComm is closed. This process typically takes between 20 seconds and one minute, depending on the system. For manual updates, the download link on our website will always point to the latest version.

3.1.3 Firmware Updates

HyQuant firmware updates are automatically detected and downloaded to the local drive each time HyComm is started. This feature effectively allows users to be equipped with the latest firmware version when visiting sites with limited or no network coverage. When a new firmware update is available, it is instantly downloaded for offline use. All that is required is an Internet connection, not a connection to a device.

When connecting to a device with outdated firmware, you are notified of the firmware update and can choose to install the update.

Note: It is strongly recommended that the latest version of HyComm is installed before proceeding with a firmware update.

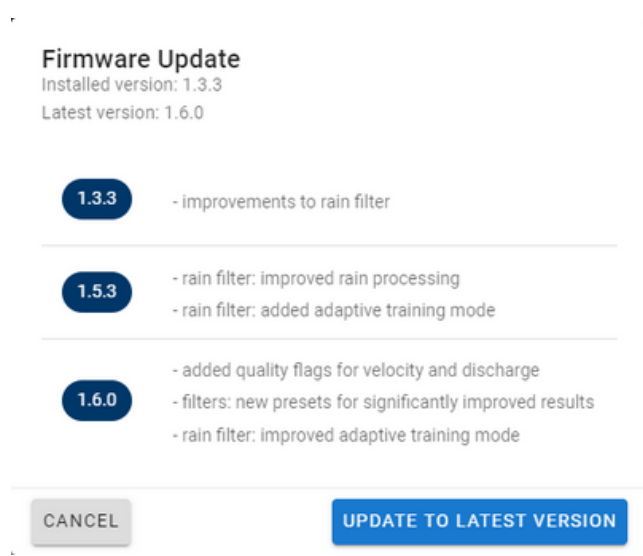


Figure 7 – HyComm for HyQuant Firmware Update

3.2 Enabling of the Local Wi-Fi Hotspot for Configuration

There are different ways to enable the local Wi-Fi hotspot:

- § [Enable with Reed Switch / Magnet](#)²¹
- § [Enable via Modbus](#)²²
- § [Enable via SDI-12](#)²²
- § [Enable via Power Cycle](#)²²

Once the hotspot has been enabled, regardless of the method used, there will be a beep to indicate that the hotspot is starting up. It can take up to 60 seconds after the beep for the Wi-Fi hotspot to become available. The SSID of the hotspot is the same as the serial number of the sensor and the default password is `Kisters123!`.

Note: It is strongly recommended to change the password using HyComm to prevent others from changing the sensor configuration.

After that you connect your HyQuant to the local Wi-Fi hotspot.

3.2.1 Enable with Reed Switch/Magnet

The HyQuant contains a reed switch which is actuated by moving a magnet in the immediate vicinity of the reed switch. The position of the reed switch integrated in the HyQuant housing is shown in [Figure 822](#). It is necessary to place the magnet directly on the housing.

⚠ WARNING

Risk of falling when activating the Wi-Fi hotspot.

If the HyQuant is installed at a great height above the water and/or the sensor is difficult to access, there is a risk of falling when activating the Wi-Fi hotspot.

- § Use personal protective equipment (PPE) to prevent falls.
- § If possible, use a swivelling bracket for installation. This allows you to swivel the sensor into a safe working area for configuration.



Figure 8 – HyQuant lid with indication of the reed-switch position

3.2.2 Enable via Modbus

To enable the local Wi-Fi of the HyQuant device, write ' 1 ' to holding register (FC06) 401.

See [Modbus Register Mapping](#)⁴⁵.

3.2.3 Enable via SDI-12

To enable the local Wi-Fi of the HyQuant device, use the following SDI-12 extended command:

```
aXWI-FI!
```

See [Extended Commands](#)⁴⁴.

3.2.4 Enable via Power Cycle

HyQuant automatically turns on its Wi-Fi hotspot when it is powered on. This allows to simply disconnect and reconnect the power supply to activate the Wi-Fi hotspot.

Note: If the sensor is connected to SDI-12 and the logger is configured to switch off the HyQuant between measurements, this feature should be disabled using HyComm. Otherwise the Wi-Fi hotspot will be activated every time the logger reads a value, which can increase power consumption. HyComm Navigation path: CONNECTION > WI-FI deactivate START WI-FI WHEN SENSOR IS POWERED ON.

3.2.5 Automatic Disabling

When HyQuant is running the Wi-Fi hotspot, the power consumption is significantly higher than normal. To keep power consumption down, the hotspot is automatically deactivated after 5 minutes of inactivity. The hotspot is considered inactive as long as HyComm is not connected. As long as HyComm is connected, the Wi-Fi hotspot is not turned off.

3.3 Filters

Removing Unwanted Reflections/Outliers

Objects in close proximity to the sensor, particularly sharp metal or concrete edges, can cause unwanted reflections. Normally, the radar will detect the water surface as the most prominent reflection. However, occasionally a false reflection can be stronger.

By comparing new readings with the average of recent values, the radar sensor can identify false signals and reject them using a configurable threshold. This setting is automatically adjusted when one of the adjustable filters is selected.

User Adjustable Filters

In the KISTERS HyComm software you can choose from a total of three different filter presets. Each of them reflects digital filter settings for a typical water flow situation as found in real open channel flows.

- § The filter settings are designed to remove false signals. The more turbulent the water surface, the longer the filter. Therefore, (recent) historical data will have a greater influence on the evaluation of current readings. The effect is that the correct values are correctly identified, the overall trend is not altered by the filter and no significant and real changes are missed.
- § The purpose of the filter presets, with a user adjustable "strength", is to remove the "noise" caused by a turbulent surface to give a smooth measurement curve. HyComm allows to change the filter "strength" and observe the effect on the distance value in real time.

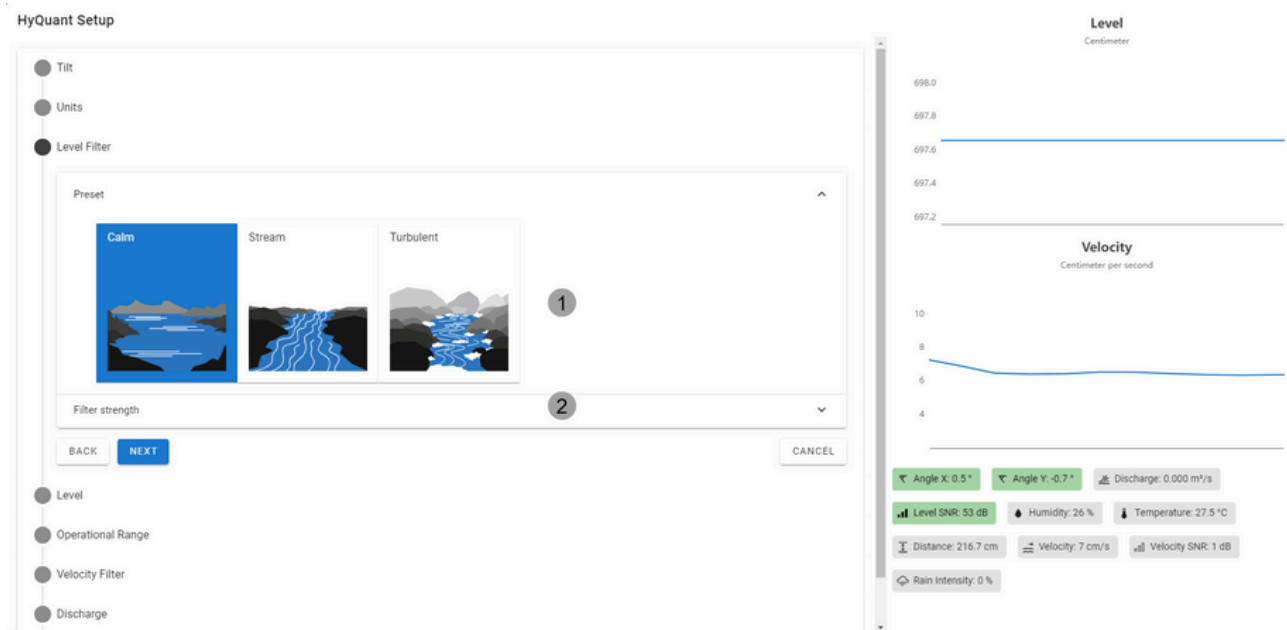


Figure 9 – Level Filter: Dialogue to select filter preset and filter strength

- § One of the main advantages of the HyQuant filter settings in HyComm is that they prevent you from having to enter complex digital filter parameters.

Site Conditions (Filter Type)	Description	Example
Calm	A calm body of water is a contained body of freshwater with no or very low flow velocity, but subject to some surface turbulence depending on wind conditions.	Lake, reservoir, pond, rainwater retention basin, ...
Stream	Refers to an uninterrupted expanse of water flowing along a channel (or open canal) confined by its bed and banks.	River, waterway, brook, creek, tributary, open canal, open channel, etc.
Turbulent	A turbulent, continuously or intermittently flowing stream whose discharge varies greatly over short periods due to thunderstorms or snowmelt.	Torrent, natural mountain streams/brooks/creeks, whitewater, ...

Table 3 – HyQuant L: Filters

3.4 Rain Filter for Velocity Measurements

Concept

When using HyQuant in the field, it's crucial to consider the effects of the weather, especially rain, when measuring in slow-moving water.

For accurate surface velocity readings in rainy conditions, especially in low-flow scenarios, corrections or adjustments may be needed. Non-contact sensors such as the HyQuant measure the surface velocity, not the velocity within the water column. To do so, HyQuant detects surface ripples or waves larger than or equal to 3 mm in height. In calm conditions (no wind, no rain), the surface velocity is closely related to the mean flow velocity by a calibration factor known as the *k*-factor.

Rain alters the surface of the water by creating different interference patterns due to:

- § High velocity raindrops hitting the water surface.
- § Circular waves propagating from each raindrop impact, each with its own specific velocity.

These disturbances create additional surface velocities that a surface radar can detect, leading to potential inaccuracies.

Velocity dependence of the influence of rain:

- § The impact of rain is more pronounced in water bodies with low flow speeds.
- § For velocities below 1.5 m/s, rain-induced ripples can significantly distort surface velocity readings.
- § For velocities above 1.5 m/s, the influence of rain becomes negligible, as the surface waves generated by the flow dominate over the rain-induced disturbances.

Prerequisites

- § Firmware version: 1.6.0 or later.
- § Update to the latest version of HyComm before installing new firmware.
- § The Rain Filter options - REAL TIME FILTER and ADAPTIVE TRAINING MODE- must be enabled in the HyComm software.

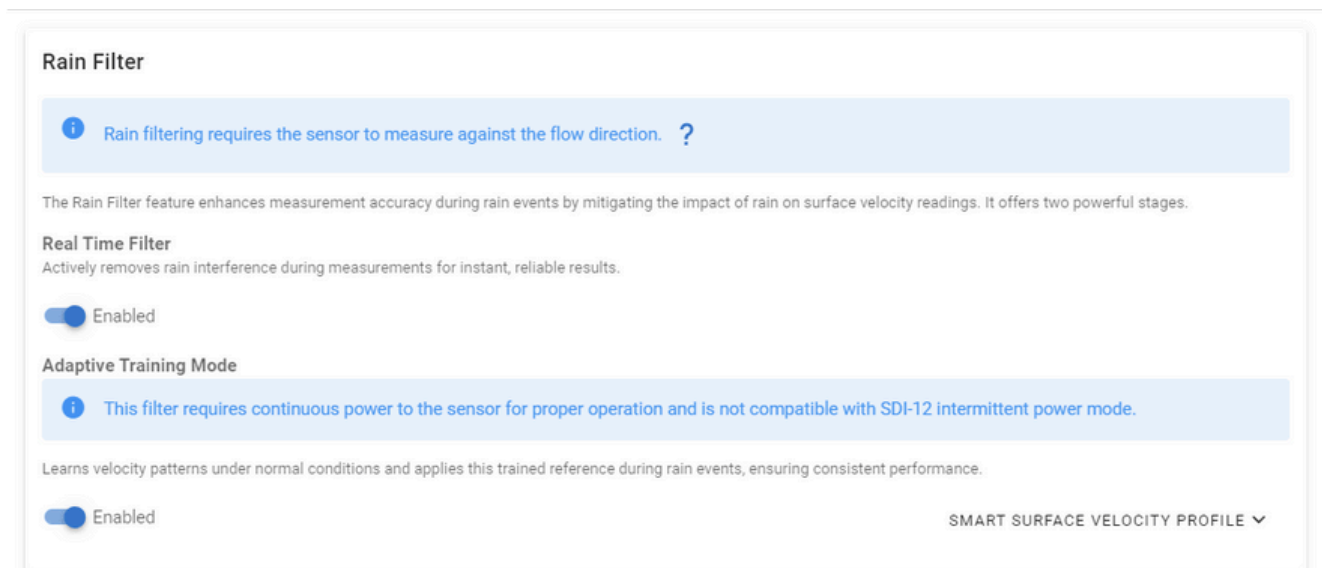


Figure 10 – HyComm Settings for Rain Filter

3.4.1 Rain Filtering Principle in HyQuant

The HyQuant device incorporates a two-stage rain filtering system designed to ensure reliable surface velocity measurements, even during rain. Below, you can find an overview of how it works and its key components.

Note: Rain filtering is only effective when the sensor is facing upstream (against the water flow).

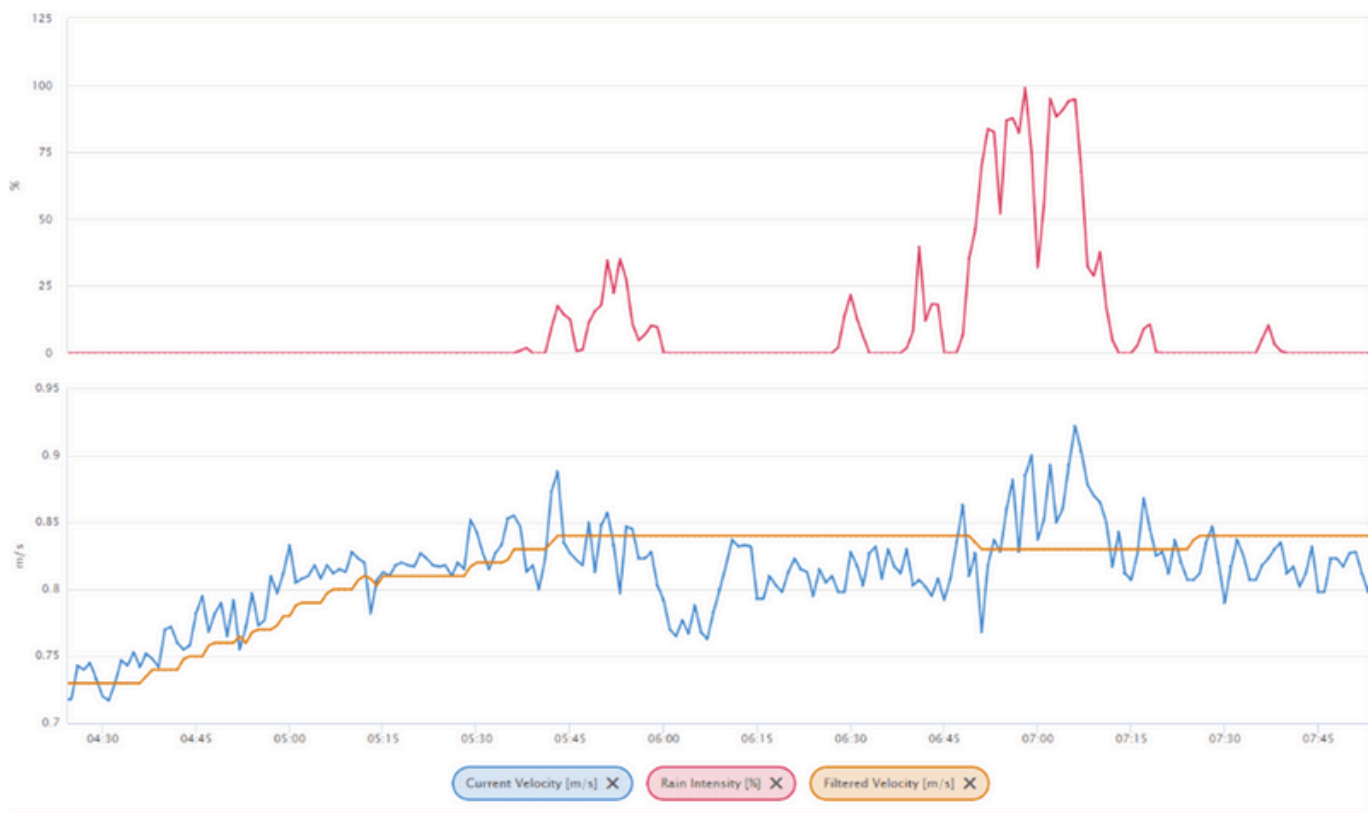


Figure 11 – Velocity measurement during a rain event

- § Red graph: Rain intensity in percent.
- § Blue graph: Unfiltered velocity. During rainfall, the surface velocity is disturbed by the rain.
- § Orange graph: The filtered velocity uses the Smart Surface Velocity Profile to ensure a reliable velocity reading even during rain events.

Rain Intensity

The HyQuant can reliably detect rain and measure its intensity, and this data can be accessed via SDI-12 and Modbus interfaces.

Note: Rain intensity percentages may not be mistaken for rainfall quantity!

Two-Stage Rain Filtering System

The filter can be configured in HyComm. The settings are part of the velocity filter settings. See [Figure 12](#)

26

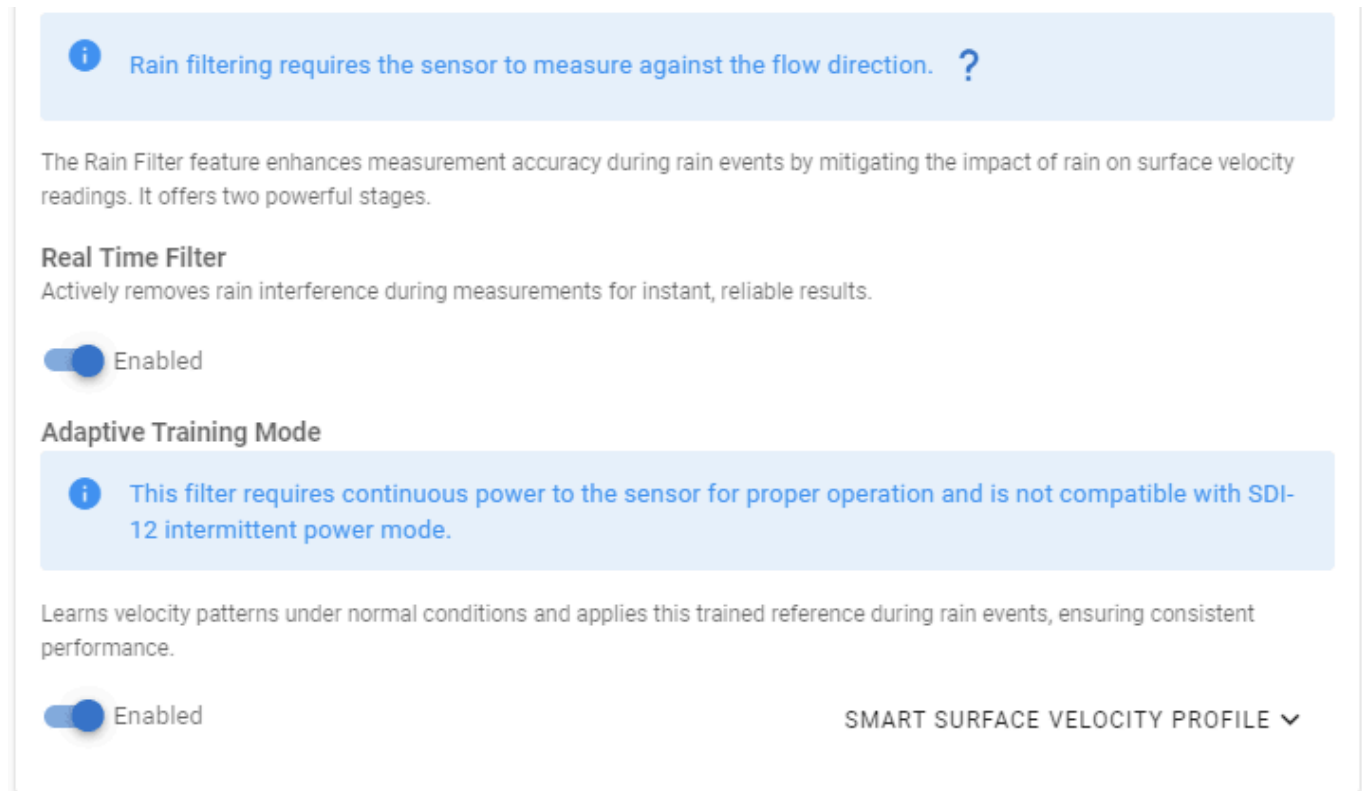


Figure 12 – HyComm – Enabling the Rain Filter and the Adaptive Training mode

Stage 1: Real-time filtering (immediate compensation)

Filters out rain-induced disturbances on the fly by removing interference caused by rain components detected by the radar.

Performance factors:

- § Works best with higher water velocities and low rain intensity.
- § Less effective in low flow conditions with heavy rain, where variations may still occur.

Stage 2: Adaptive training mode (long-term compensation)

Note: Adaptive training requires continuous monitoring, so it won't work if the sensor is powered intermittently (e.g. for SDI-12-only readings).

The Smart Surface Velocity Profile in Stage 2 represents a sophisticated method of improving the accuracy of water monitoring by developing a site-specific correlation between water level and surface velocity.

Key aspects:

- § Learning over time: This feature builds a dynamic relationship between water level and surface velocity specific to the installation site, assuming a constant cross-sectional profile. The system improves its accuracy as it collects more data and adapts to the unique characteristics of the water body.
- § Rainfall adaptation: During rainfall, pre-learned profiles are used to adjust surface velocity readings, ensuring reliable measurements despite environmental variations.

- § Installation dependency: The profile is specific to the location of the sensor. Changing the installation, such as moving the sensor, will invalidate the existing profile. In such cases you must discard the current profile using the velocity filter settings in HyComm.
- § Device replacement: If a HyQuant instrument is replaced, the Smart Surface Velocity Profile can be saved and restored on the new instrument, maintaining continuity and reducing setup time.

Note: The real-time filter is mandatory and is automatically activated when adaptive training mode is enabled.

3.5 Reference Level

The primary measurand of a radar level sensor is the distance between the antenna and the water surface. This distance must be converted into a level reading for hydrological purposes. To obtain a level reading, the sensor must be referenced to a site specific reference level.

Referencing can be:

- § Relative to a staff gauge
- § Relative to a geodetic datum

The KISTERS HyComm software is used to enter the site specific level reference. HyComm guides you through the process with convenient input screens.

3.6 Operational Range

The operating range definition allows to restrict or limit the measurement range.

- § Limit the maximum depth: This function is particularly useful to avoid false readings, for example during a drought when a stream runs dry. In such a situation, the radar beams will be reflected by any object (e.g. rocks, man-made structures, ...) that happens to be in the detection area.
- § Limit the minimum depth: this helps you to ignore obstacles in the radar beam in the vicinity of the installation position.

In both cases, the OPERATIONAL RANGE setting helps to avoid false readings. All measurements outside the operating range are ignored. HyQuant L returns the user-defined upper or lower limit.

3.7 Configuration for Q Calculation

Only HyQuant Q models can be configured to calculate the discharge Q from the measured surface velocity V , the measured water level L and a correction constant k that relates the surface velocity to the average velocity for a given wet cross section of the stream. The KISTERS HyComm software allows to make the settings. Choose from three available mean velocity calculation methods:

- § Constant k -factor: k -factors are chosen to reflect the characteristics of the chosen monitoring site. In hydrology, k -factors are essential for understanding the impact of stream conditions on flow. Various studies suggest k -factors based on empirical data. For example, one approach is to use a factor of 0.87 for natural streams, while for engineered channels it may be around 0.95. It is important to refer to specific hydrological studies or guidelines relevant to the geographical area and stream type for precise values.
- § Dynamic k -factor: This is based on the use of imported k -factors to improve accuracy. The k -factors have been calculated using a power law. This method is more accurate but requires more effort to provide good input data for the power law model.
- § V Index: It is based on k -factors calculated using statistical methods that model the relationship between measured surface velocities and the mean velocity of a cross section. The method is moderately complex and achieves good accuracy.

Also define a cross section profile: To accurately calculate the discharge (Q) of a stream, a cross-sectional profile of the stream is essential. This profile helps to convert the measured surface velocity into an average velocity across the entire width of the stream.

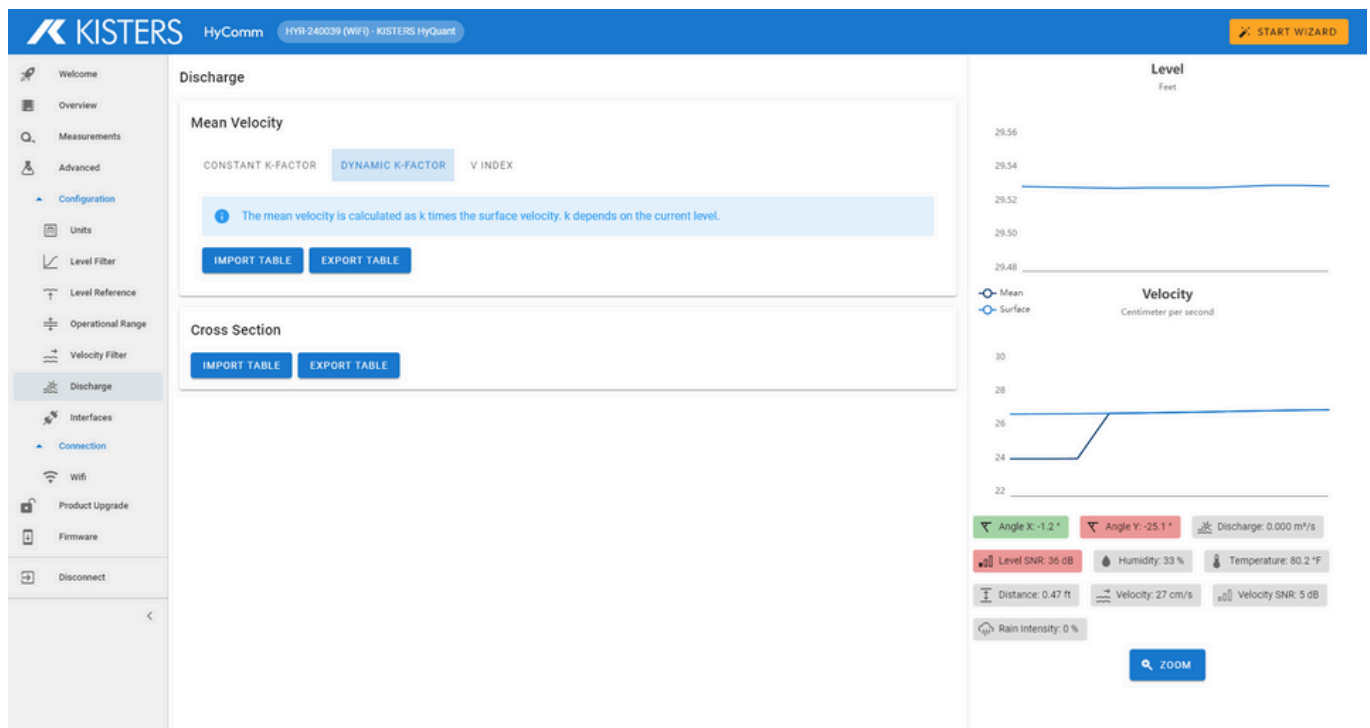


Figure 13 – HyComm Dynamic k-Factor

Format of a suitable k -table:

- § The best way to create a table is in Microsoft EXCEL®.
 - § Note: For all tables, only the first two columns are used.
 - § The table and data values are typically exported from a cross section or rating curve editor or the corresponding module of your hydrological data management software. The KISTERS software solutions WISKI, HYDSTRA and SKED all provide the required functionality.
 - § Save the data in a CSV UTF-8 (Comma Separated Values) file.
- Details can be found in the following PDF document, which can be downloaded from the KISTERS website: [White Paper - Discharge Calculation with HyQuant Q](#)

3.8 Settings

The following settings can be made in the KISTERS HyComm software. For more information on KISTERS HyComm, please refer to the separate user documentation: [HyComm User Manual](#).

The settings are divided into the following subsections:

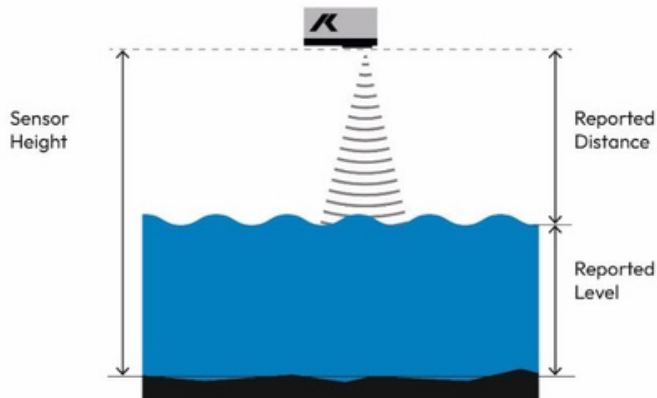
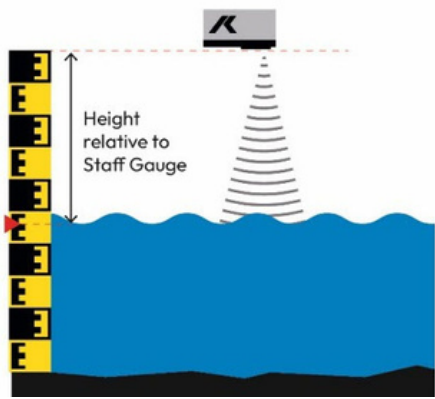
- § [Parameters](#) ²⁸
- § [Units](#) ³²

3.8.1 Parameters

The following operating parameters of the HyQuant L can be set using the KISTERS HyComm configuration software. The navigation path for each parameter is given at the end of the corresponding description.

Item	Description	Default
Units and decimals	Units can be adapted to local / user preferences: see Units ³² . Navigation path: CONFIGURATION > UNITS	Metric units

Item	Description	Default
Filter type (for level and velocity)	Select installation environment (see Table 324) Define filter length (1 - 200 seconds) Navigation path: CONFIGURATION > LEVEL FILTER	Calm: 10 seconds
Interface selection	Available interfaces: § SDI-12 § Modbus Both can be enabled or disabled, but at least one must be enabled. Navigation path: CONFIGURATION > INTERFACES	SDI-12: enabled Modbus: enabled
SDI-12 configuration	Set device address using KISTERS HyComm configuration software or SDI-12 commands. Navigation path: CONFIGURATION > INTERFACES > SDI-12 Note: When SDI-12 is enabled, it is strongly recommended to disable automatic Wifi startup.	Address: 0
Modbus configuration	The following settings can be modified by you: § Address range: 1 - 255 § Parity: Even, Odd, None § Stop bits: 1 or 2 § Baud rate: 9600, 19200, 38400, 57600, 115200 § Note: Data bits are always set to 8 and are not configurable. Navigation path: CONFIGURATION > INTERFACES > MODBUS	Address: 1 Baud rate: 9600 Parity: None Stop bits: 1

Item	Description	Default
Gauge zero reference height	HyQuant L provides a water level reading. The water level is the height of a surface water body above a fixed reference height, known as the gauge zero reference height. The reference height is levelled and may not correspond to the level of the river bed. It must remain stable during the operating time of the water level gauge. By definition, a radar sensor measures the distance between the sensor antenna and the water surface. The absolute water level is then calculated using the following formula: Absolute water level = [Gauge zero reference height] - [Distance] Select one of the following two options to enter the required gauge zero reference height: § Navigation path: CONFIGURATION > LEVEL REFERENCE > KNOWN PARAMETER: SENSOR HEIGHT (above reference level) You can enter the distance between the sensor and the reference level.  § Navigation path: CONFIGURATION > LEVEL REFERENCE > KNOWN PARAMETER: STAFF GAUGE You can enter the staff gauge measurement.  See Reference Level ²⁷.	Sensor height above reference level defaults to 0, level will be 0 unless set. Reading the staff gauge always returns 0

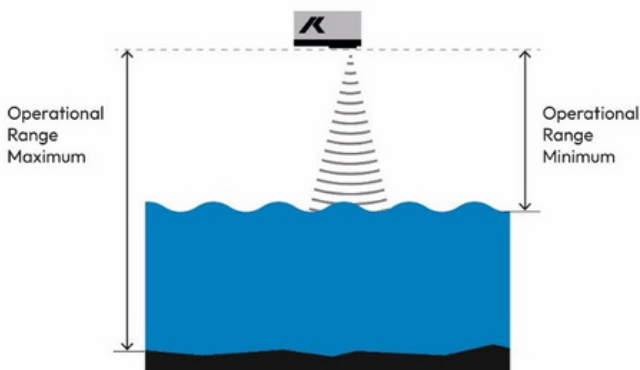
Item	Description	Default
Operating range (level)	The operational range is the range within which the readings recorded by the sensor are valid. A maximum and minimum level can be configured to define the operating range. The operating range is then by definition less than or equal to the measurement range. Values above the fixed maximum are automatically set to the maximum level and those below the minimum are set to the specified minimum level. The quality flag indicates whether or not the values are within the operating range. See Operational Range²⁷. Navigation path: CONFIGURATION > OPERATIONAL RANGE 	Min: 100 for L20, 150 for L50 [mm] Max: Upper range [mm]
Flow direction	HyQuant detects the direction of flow. When the sensor is installed and aligned as described in chapter Orientation of the HyQuant¹⁶, with the 'K' marking on the sensor lid facing upstream, the flow velocity is measured as a positive value. If for some reason HyQuant is installed with the 'K' marking on the sensor lid facing downstream, a correction is required and you must change the flow direction setting to negative. Options: positive, negative Navigation path:	positive
Wi-Fi automatically enabled on power up	See chapter Enable via Power Cycle²² Navigation path: CONNECTION > WIFI	Enable on power up
Wi-Fi password	The password is configurable. For IT security reasons, it is advisable to change the initial password the first time you log in. Note: It should be noted that if you forget the password, you won't be able to change it without returning the device to KISTERS. Navigation path: CONNECTION > WIFI	Kisters123!

Table 4 – Parameters

3.8.2 Units

The units for “filtered/current level value”, “filtered/current distance” and temperature can be set in the “KISTERS HyComm” configuration software under the CONFIGURATION > UNITS navigation path. All other units are preset at the factory.

Parameter	Description	Units
Filtered water level	Sensor height above reference point - Filtered distance § Lower cut-off is the user-defined minimum level of the operating range, if enabled.	[mm, cm, m, ft, in]
Current level	Sensor height above reference point - Current distance § Lower cut-off is the user-defined minimum level of the operating range, if enabled.	
Current distance	Distance measurements taken from HyQuant after removal of outliers and similar spikes. The reference is the HyQuant lid.	
Filtered distance	Current distance filtered with moving average filter. The moving average filter of duration N calculates the average of each consecutive set of N sensor readings. Each reading is weighted equally.	
Level quality Flag	bitfield	./.
Filtered velocity	Surface flow velocity	[mm/s, m/s, mph, km/h, fps, fpm, cm/s]
Current velocity	Surface flow velocity	
Velocity quality flag	bitfield	./.
Discharge	Discharge calculated based on cross-section	[m3/s, ft3/s, in3/s]
Discharge quality flag	bitfield	./.
Supply voltage		[V]
Internal temperature		[°C, °F]
Internal relative humidity		[%]
Angle	Separate for X and Y axis	[°]
Radar SNR	Signal to noise of the current distance measurement.	[dB]

Table 5 – Units

4 Operation

Note: HyQuant starts measuring as soon as the supply voltage is applied. It should be noted, however, that a radar sensor always requires a correct setting of its operating parameters, in particular the reference to a defined zero point in order to convert distance measurements into hydrological water levels. It is recommended to download HyComm from the KISTERS website and to configure HyQuant without delay. Depending on the model of HyQuant used, the sensor continuously determines the current water level, the current surface velocity and the current discharge. New data is provided once per second.

A HyQuant sensor determines additional values in parallel with the actual water measurements:

- § Internal device temperature
- § Internal humidity
- § Tilt angle of sensor X axis
- § Tilt angle of sensor Y axis
- § SNR value of water level measurement
- § Water level measurement status indicator

This 'metadata' can be used to assess the quality of a measurement and identify potential sources of error at an early stage. All measurements can be accessed via the SDI-12 or Modbus RTU (RS-485) interface. A detailed description of how to make measurements available via the two interfaces can be found in chapter [SDI-12](#)36 and [Modbus](#)44.

It is also possible to perform temporary in-situ measurements as a special application. In this case, the HyQuant is connected directly to a PC/laptop via Wi-Fi and no data logger is required. The measured values are then displayed directly in the HyComm configuration software. It is also necessary to observe the criteria for a suitable installation site (see chapter [Site Selection Criteria for L and V15](#)). It is also very important that the sensor is aligned parallel to the water surface.

4.1 Radar Beams

! CAUTION

- § Radar electromagnetic wave emissions.
- § The device operates with very low emitting power radar beams.

Precaution:

- § While the risk is minimal, it is advisable to avoid prolonged direct exposure.
- § Vulnerable or highly sensitive individuals should exercise caution.
- § Always follow standard safety guidelines when handling or installing radar devices.

Radar emits electromagnetic waves. The beam is the focused electromagnetic emission from the radar antenna. The beam is defined by the main lobe. It is accompanied by one or more side lobes.

The main lobe is the area delimited by the beam angle, i.e. the lateral positions where the attenuation reaches approximately -3 dBm.

§ HyQuant L: The beam angle is defined as 8° (4° on either side of the 0° perpendicular).

§ HyQuant V: The beam angle is defined as 8° azimuth by 12° elevation (again divided by the perpendicular).

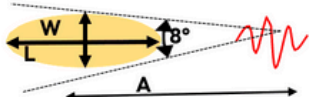
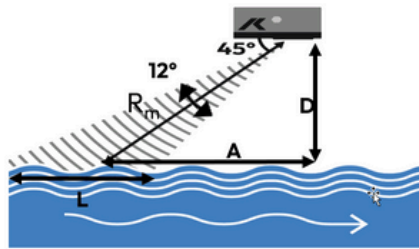
Sidelobes are clearly identifiable accumulations of electromagnetic waves next to the main lobe. Ideally, sidelobes are completely attenuated, but this is never the case. Depending on the material and the orientation of an obstacle, sidelobes can interfere with the measurement in the main lobe. HyQuant is equipped with special algorithms to filter out these interferences. The

beam angle is defined in degrees. The angle is the total geometric aperture of the beam. The concept is illustrated in [Figure 14](#)34. The beam angle can be used to calculate the beam width at a given distance from the water surface to the sensor antenna.

HyQuant radar antenna – caution: 2 different cases:
 •Velocity: beam angle azimuth = 8°, and elevation 12°
 •Level: beam angle azimuth = elevation = 8°.

$$W = 2 \times D \times \tan(8^\circ/2) \quad R_m = \frac{D}{\sin(45^\circ)}$$

$$L \approx 2R_m \tan(12^\circ/2)$$



Distance „A“ centre of sensor radar footprint

R_m	distance antenna to midpoint
L	extension in elevation direction
A	$A = D$ with 45° emitting and incident angle

Metric				Imperial			
D [m]	W [m]	Rm [m]	L [m]	D [ft]	W [ft]	Rm [ft]	L [ft]
20,0	2,80	28,28	5,95	65,62	19,51	92,80	19,51
15,0	2,10	21,21	4,46	49,21	14,63	69,60	14,63
10,0	1,40	14,14	2,97	32,81	9,75	46,40	9,75
7,0	0,98	9,90	2,08	22,97	6,83	32,48	6,83
5,0	0,70	7,07	1,49	16,40	4,88	23,20	4,88
3,0	0,42	4,24	0,89	9,84	2,93	13,92	2,93
2,0	0,28	2,83	0,59	6,56	1,95	9,28	1,95
1,0	0,14	1,41	0,30	3,28	0,98	4,64	0,98
0,5	0,07	0,71	0,15	1,64	0,49	2,32	0,49

Figure 14 – Beam angle and calculation of equivalent diameter on water surface for distance D

4.2 Quality Flags

Quality flags are accessible via both SDI-12 and Modbus interfaces. These flags serve as a crucial indicator of the reliability of the velocity readings provided by the HyQuant. While the sensor is engineered to ensure accurate measurements under standard operating conditions, external factors may sometimes affect the quality of the data.

Quality Flag	Bit definition	Description
Level	Bit 0: Level below operating range	
	Bit 1: Level above operating range	
	Bit 2: Level below hardware range	Vertical distance between sensor and water body too high (20 m for L20, V, L+V, Q; 50 m for L50).
	Bit 3: Level above hardware range	Water too close to the sensor
Velocity	Bit 0: Reserved for future use	
	Bit 1: Rain indicator (0: no rain, 1: rain)	Equal to 1 = rain is detected, and subsequently the rain intensity is greater than 0.
	Bit 2: Reading from smart surface velocity profile	Rain is detected and the filtered velocity is calculated using the Smart Surface Velocity Profile.
	Bit 3: Reserved for future use	
	Bit 4: No validated velocity in smart surface velocity profile	Rain is detected but the sensor has not yet been trained for the current condition.
Discharge	Refer to explanations for velocity quality flag	

Table 6 – Quality Flag Definition

How to decode Quality Flags

A bitwise quality flag is a specialised encoding that represents multiple quality indicators within a single binary value. To decode it:

- § Convert the flag into its binary form.
- § Examine the position of each bit. Each bit corresponds to a specific quality condition (as shown in [Table 635 above](#)).
- § A bit value of 1 indicates that the condition is active, while 0 indicates that it is not.

This method efficiently represents and interprets multiple quality aspects in a compact format.

Example

```
Velocity Quality Flag = 6
Binary representation = 0000 0110
  bit 1 = 1 => Rain indicator indicates rain
  bit 2 = 1 => reading from Smart Surface Velocity Profile
```

4.3 SDI-12

Note:

- § In order to use the SDI-12 interface, it must be activated via the HyComm software. Navigation path: CONFIGURATION > INTERFACES> SDI-12
- § The SDI-12 sensor address can also be changed via the HyComm software if required (Navigation path: CONFIGURATION > INTERFACES> SDI-12). Factory default setting: "0"
- § If the sensor is not permanently powered when using the SDI-12 interface (the sensor is only switched on at the time of the actual measurement), it is strongly recommended for IT security reasons to disable the automatic activation of the Wi-Fi hotspot. Otherwise the sensor will start the Wi-Fi hotspot every time the power is turned on.

4.3.1 Standard Commands

Name	Command	Response	Details
Address Query	?!	a<CR><LF>	a - the sensor address Sensor responds with its address. This will only work when only one sensor is connected.
Acknowledge Active	a!	a<CR><LF>	a - the sensor address The sensor responds with its address in order to show that it is available
Send Identification	aI!	a13KISTERS_HY QUANfffmmmmxx xxxxxxxx<CR><LF>	a - the sensor address 13 - SDI-12 Version 1.3 KISTERS_ - company name (8 character) HYQUAN - sensor Name HyQuant (6 character) fff - firmware version (3 characters i.e. 1.01 = '101') Add-on information1: § mmm - model (3 characters, L20, L50, VEL, L+V) § xxxxxxxx - device serial number (10 characters, i.e. HYR-230001)
Change Address	aAb!	b<CR><LF>	a - the original sensor address b - the new sensor address

Table 7 – SDI-12 - Standard Commands

4.3.1.1 HyQuant L20, L50

Name	Command	Response	Details
Start Measurement (and request CRC)	aM! aMC!	atttn<CR><LF> When measurement is ready (Service Request): a<CR><LF>	a - the sensor address ttt - The time taken by the sensor to generate the measurement output is shown in seconds. The datalogger must wait until this time has elapsed before requesting data. After power up, the sensor will take as long as the configured filter length to calculate the first valid value. As soon as a reading is available, this time will be zero. n = 5 - number of measurement values that will be returned

Name	Command	Response	Details
			When the sensor has measured the required data, it will generate a service request. This cannot take longer than ttt. Note that a service request will not be generated if ttt is equal to zero. When a CRC is requested, subsequent Send Data commands will respond with the appropriate CRC code (refer to details below). It is important to note that the SDI-12 standard limits the number of values that can be returned from a measurement started with the aM! command to 9. To obtain further values, aM1! and so on must be used..
Start additional Measurement 1 (and request CRC)	aM1! aMC1!	atttn<CR><LF> When measurement is ready (Service Request): a<CR><LF>	See above n = 4
Start additional Measurement x (and request CRC)	aMx! aMCx! x >= 2	atttn<CR><LF> When measurement is ready (Service Request): a<CR><LF>	see above n = 0
Start Concurrent Measurement (and request CRC)	aC! aCC!	atttnn<CR><LF>	a - the sensor address ttt - time in seconds until the sensor will have the measurement ready. The data recorder must wait for this time until it can request the data. See above for detailed description. nn = 09 - number of measurements that will be returned When a CRC is requested the subsequent Send Data commands will respond with CRC (see below)
Send Data	aD0!	a+d+d+d+d+d<CR><LF> a+d+d+d+d+d+d<CRC><CR><LF>	a - sensor address +d - filtered level [user-defined unit] +d - current level [user-defined unit] +d - current distance [user-defined unit] +d - SNR [dB] +d - quality flag <CRC> - 3-character CRC code is only appended if aMC! or aCC! commands were issued before
Send Data additional aM1!	aD0!	a+d+d+d+d+d<CR><LF> a+d+d+d+d+d+d<CRC><CR><LF>	a - sensor address +d - sensor temperature [user-defined unit] +d - sensor tilt angle x direction [°] +d - sensor tilt angle y direction [°] +d - sensor height above reference level [user-defined unit] <CRC> - 3-character CRC code is only appended if aMC! or aCC! commands were issued before

Name	Command	Response	Details
Send Data after aC! / aCC!	aD1!		
Send additional data after aMn! command	aDx!	a<CR><LF> a<CRC><CR><LF>	Only cases return data, other additional data is not available. x = 1 ... 9 (after M / MC) x = 2 ... 9 (after C / CC)

Table 8 – SDI-12 - Standard Commands > HyQuant L20, L50

4.3.1.2 HyQuant L+V

Name	Command	Response	Details
Start Measurement (and request CRC)	aM! aMC!	atttn<CR><LF> When measurement is ready (Service Request): a<CR><LF>	a - the sensor address ttt - The time taken by the sensor to generate the measurement output is shown in seconds. The datalogger must wait until this time has elapsed before requesting data. After power up, the sensor will take as long as the configured filter length to calculate the first valid value. As soon as a reading is available, this time will be zero. n = 6 - number of measurement values that will be returned When the sensor has measured the required data, it will generate a service request. This cannot take longer than ttt. Note that a service request will not be generated if ttt is equal to zero. When a CRC is requested, subsequent Send Data commands will respond with the appropriate CRC code (refer to details below). It is important to note that the SDI-12 standard limits the number of values that can be returned from a measurement started with the aM! command to 9. To obtain further values, aM1! and so on must be used.
Start additional Measurement 1 (and request CRC)	aM1! aMC1!	atttn<CR><LF> When measurement is ready (Service Request): a<CR><LF>	See above n = 3
Start additional Measurement 1 (and request CRC)	aM2! aMC2!	atttn<CR><LF> When measurement is ready (Service Request): a<CR><LF>	See above n = 4
Start additional Measurement x	aMx! aMCx!	atttn<CR><LF>	see above n = 0

Name	Command	Response	Details
(and request CRC)	x >= 3	When measurement is ready (Service Request): a<CR><LF>	
Start Concurrent Measurement (and request CRC)	aC! aCC!	atttnn<CR><LF>	a - the sensor address ttt - time in seconds until the sensor will have the measurement ready. The data recorder must wait for this time until it can request the data. See above for detailed description. nn = 14 - number of measurements that will be returned When a CRC is requested the subsequent Send Data commands will respond with CRC (see below)
Send Data	aD0!	a+d+d+d+d+d+d +d<CR><LF> a+d+d+d+d+d+d +d <CRC><CR><LF>	a - sensor address +d - filtered level [user unit] +d - filtered velocity [user unit] +d - SNR level [dB] +d - SNR velocity [dB] +d - quality flag level +d - quality flag velocity +d - rain intensity [%] <CRC> - 3-character CRC code is only appended if aMC! or aCC! commands were issued before
Send Data additional aM1!	aD0!	a+d+d+d<CR><LF> > a+d+d+d<CRC><CR><LF>	a - sensor address +d - current level [user unit] +d - current distance [user unit] +d - current velocity [user unit] <CRC> - 3-character CRC code is only appended if aMC! or aCC! commands were issued before
Send Data after aC! / aCC!	aD1!		
Send Data additional aM2!	aD0!	a+d+d+d+d<CR><LF> a+d+d+d+d<CRC><CR><LF>	a - sensor address +d - sensor temperature [user-defined unit] +d - sensor tilt angle x direction [°] +d - sensor tilt angle y direction [°] +d - sensor height above reference level [user-defined unit] <CRC> - 3-character CRC code is only appended if aMC! or aCC! commands were issued before
Send Data after	aD2!		

Name	Command	Response	Details
aC! / aCC!			
Send additional data after aMn! command	aDx!	a<CR><LF> a<CRC><CR><LF>	Only cases return data, other additional data is not available. x = 1 ... 9 (after M / MC) x = 3 ... 9 (after C / CC)

Table 9 – SDI-12 - Standard Commands > HyQuant L+V

4.3.1.3 HyQuant Q

Name	Command	Response	Details
Start Measurement (and request CRC)	aM! aMC!	atttn<CR><LF> When measurement is ready (Service Request): a<CR><LF>	a - the sensor address ttt - The time taken by the sensor to generate the measurement output is shown in seconds. The datalogger must wait until this time has elapsed before requesting data. After power up, the sensor will take as long as the configured filter length to calculate the first valid value. As soon as a reading is available, this time will be zero. n = 6 - number of measurement values that will be returned When the sensor has measured the required data, it will generate a service request. This cannot take longer than ttt. Note that a service request will not be generated if ttt is equal to zero. When a CRC is requested, subsequent Send Data commands will respond with the appropriate CRC code (refer to details below). It is important to note that the SDI-12 standard limits the number of values that can be returned from a measurement started with the aM! command to 9. To obtain further values, aM1! and so on must be used.
Start additional Measurement 1 (and request CRC)	aM1! aMC1!	atttn<CR><LF> When measurement is ready (Service Request): a<CR><LF>	See above n = 6
Start additional Measurement 1 (and request CRC)	aM2! aMC2!	atttn<CR><LF> When measurement is ready (Service Request): a<CR><LF>	See above n = 4
Start additional Measurement x (and request CRC)	aMx! aMCx! x >= 3	atttn<CR><LF> When measurement is	see above n = 0

Name	Command	Response	Details
		ready (Service Request): a<CR><LF>	
Start Concurrent Measurement (and request CRC)	aC! aCC!	attnn<CR><LF>	a - the sensor address ttt - time in seconds until the sensor will have the measurement ready. The data recorder must wait for this time until it can request the data. See above for detailed description. nn = 16 - number of measurements that will be returned When a CRC is requested the subsequent Send Data commands will respond with CRC (see below)
Send Data	aD0!	a+d+d+d+d+d+d d <CR><LF> a+d+d+d+d+d+d d <CRC><CR> <LF>	a - sensor address +d - filtered level [user unit] +d - filtered velocity [user unit] +d - SNR level [dB] +d - SNR velocity [dB] +d - discharge [user unit] +d - rain intensity [%] <CRC> - 3-character CRC code is only appended if aMC! or aCC! commands were issued before
Send Data additional aM1!	aD0!	a+d+d+d+d+d+d d <CR><LF> a+d+d+d+d+d+d d <CRC><CR> <LF>	a - sensor address +d - current level [user unit] +d - current distance [user unit] +d - current velocity [user unit] +d - quality flag level +d - quality flag velocity +d - quality flag discharge <CRC> - 3-character CRC code is only appended if aMC! or aCC! commands were issued before
Send Data after aC! / aCC!	aD1!		
Send Data additional aM2!	aD0!	a+d+d+d+d<CR> <LF> a+d+d+d+d<CRC> ><CR><LF>	a - sensor address +d - sensor temperature [user-defined unit] +d - sensor tilt angle x direction [°] +d - sensor tilt angle y direction [°] +d - sensor height above reference level [user-defined unit] <CRC> - 3-character CRC code is only appended if aMC! or aCC! commands were issued before
Send Data after	aD2!		

Name	Command	Response	Details
aC! / aCC!			
Send additional data after aMn! command	aDx!	a<CR><LF> a<CRC><CR><LF>	Only cases return data, other additional data is not available. x = 1 ... 9 (after M / MC) x = 3 ... 9 (after C / CC)

Table 10 – SDI-12 - Standard Commands > HyQuant Q

4.3.1.4 HyQuant Velocity

Name	Command	Response	Details
Start Measurement (and request CRC)	aM! aMC!	atttn<CR><LF> When measurement is ready (Service Request): a<CR><LF>	a - the sensor address ttt - The time taken by the sensor to generate the measurement output is shown in seconds. The datalogger must wait until this time has elapsed before requesting data. After power up, the sensor will take as long as the configured filter length to calculate the first valid value. As soon as a reading is available, this time will be zero. n = 5 - number of measurement values that will be returned When the sensor has measured the required data, it will generate a service request. This cannot take longer than ttt. Note that a service request will not be generated if ttt is equal to zero. When a CRC is requested, subsequent Send Data commands will respond with the appropriate CRC code (refer to details below). It is important to note that the SDI-12 standard limits the number of values that can be returned from a measurement started with the aM! command to 9. To obtain further values, aM1! and so on must be used.
Start additional Measurement 1 (and request CRC)	aM1! aMC1!	atttn<CR><LF> When measurement is ready (Service Request): a<CR><LF>	See above n = 3
Start additional Measurement x (and request CRC)	aMx! aMCx! x >= 2	atttn<CR><LF> When measurement is ready (Service Request): a<CR><LF>	see above n = 0
Start Concurrent Measurement (and request CRC)	aC! aCC!	atttnn<CR><LF>	a - the sensor address ttt - time in seconds until the sensor will have the measurement ready. The data recorder must wait for this time until it can

Name	Command	Response	Details
			request the data. See above for detailed description. nn = 08 - number of measurements that will be returned When a CRC is requested the subsequent Send Data commands will respond with CRC (see below)
Send Data	aD0!	a+d+d+d+d+d<C R><LF> a+d+d+d+d+d<C RC><CR><LF>	a - sensor address +d - filtered velocity [user unit] +d - current velocity [user unit] +d - SNR [dB] +d - quality flag +d - rain intensity [%] <CRC> - 3-character CRC code is only appended if aMC! or aCC! commands were issued before
Send Data additional aM1!	aD0!	a+d+d+d<CR><LF> > a+d+d+d<CRC>< CR><LF>	a - sensor address +d - sensor temperature [user-defined unit] +d - sensor tilt angle x direction [°] +d - sensor tilt angle y direction [°] <CRC> - 3-character CRC code is only appended if aMC! or aCC! commands were issued before
Send Data after aC! / aCC!	aD1!		
Send additional data after aMn! command	aDx!	a<CR><LF> a<CRC><CR><LF>	Only cases return data, other additional data is not available. x = 1 ... 9 (after M / MC) x = 2 ... 9 (after C / CC)

Table 11 – SDI-12 - Standard Commands > HyQuant Velocity

4.3.2 Extended Commands

Name	Command	Response	Details
Enable Wi-Fi	aXWI-FI!	a0<CR><LF>	a - sensor address Enable the HyQuant Wi-Fi for sensor configuration with HyComm
Set Staff Gauge	aXSG+s!	a+d<CR><LF>	a - sensor address +s - the current staff gauge value +d - the new value of sensor height above reference level stored in the sensor
Set Sensor Height above reference level	aXSHAR+s!	a+d<CR><LF>	a - sensor address +s - the measured sensor height above reference level +d - the new value of sensor height above reference level stored in the sensor

Table 12 – SDI-12 - Extended Commands

4.4 Modbus

Note: To use the Modbus (RTU) protocol on the RS-485 interface, "Modbus" must be activated via the HyComm software. Navigation path: CONFIGURATION > INTERFACES > MODBUS.

4.4.1 Default Settings

The communication parameters of the RS-485 interface can also be set using the configuration software (Navigation path: CONFIGURATION > INTERFACES > MODBUS). Before commissioning, check that the Modbus server and client parameters match.

Parameter	Default
Baudrate	9600
Parity	None
Data bits	8
Stop bits	1
Modbus byte order	Big endian
Modbus float / uint32 word order	Big endian
Modbus default Server address	1

Table 13 – Modbus default settings

4.4.2 Modbus Register Mapping

R	W	Modbus Register	Internal Address	Length/ bytes	Type	Description	Data range
x		1	0	4	float32	Filtered level measurement	Depending on configured unit
x		3	2	4	float32	Current level measurement	Depending on configured unit
x		5	4	2	uint16	SNR Level	0 ... 100 dB
x		6	5	2	uint16	Quality flag level	See table Quality Flag Definition 35
						Spare	
x		11	10	4	float32	Filtered velocity measurement	Depending on configured unit
x		13	12	4	float32	Current velocity measurement	Depending on configured unit
x		15	14	2	uint16	SNR Velocity	0 ... 100 dB
x		16	15	2	uint16	Quality flag velocity	See table Quality Flag Definition 35
x		17	16	2	uint16	Rain intensity	0 ... 100 %
						Spare	
		21	20	4	float32	Discharge	Depending on configured unit
		23	22	2	uint16	Quality flag discharge	See table Quality Flag Definition 35
						Spare	
x		31	30	4	float32	Filtered distance	Depending on configured unit,
x		33	32	4	float32	Current distance	Depending on configured unit
						Spare	
x		41	40	4	float32	X axis tilt angle	Range $\pm 90^\circ$, Resolution: 0.1° [°]
x		43	42	4	float32	Y axis tilt angle	Range $\pm 90^\circ$, Resolution: 0.1° [°]
x		45	44	4	float32	Internal temperature	
x		47	46	2	uint16	Internal humidity	
						Spare	

R	W	Modbus Register	Internal Address	Length/ bytes	Type	Description	Data range
x		61	60	2	uint16	Model	0: L20 1: L50 2: VEL 3: L+V 4:Q
x		62	61	2	uint16	FW version major	
x		63	62	2	uint16	FW version minor	
x		64	63	2	uint16	FW version subminor	
x		65	64	2	uint16	Serial number [0 - 1]	
x		66	65	2	uint16	Serial number [2 - 3]	
x		67	66	2	uint16	Serial number [4 - 5]	
x		68	67	2	uint16	Serial number [6 - 7]	
x		69	68	2	uint16	Serial number [8 - 9]	
x	x	81	80	4	float32	Staff gauge value	[unit as configured]
x	x	83	82	4	float32	Sensor height above reference point	[unit as configured]
x	x	401	400	2	uint16	Enable Wi-Fi	In Write mode: 1. Wi-Fi enabled In Read mode: 0: Wi-Fi not enabled 1: Wi-Fi enabled

Table 14 – Modbus default settings

5 Maintenance

! CAUTION

- § Radar electromagnetic wave emissions.
- § The device operates with very low emitting power radar beams.

Precaution:

- § While the risk is minimal, it is advisable to avoid prolonged direct exposure.
- § Vulnerable or highly sensitive individuals should exercise caution.
- § Always follow standard safety guidelines when handling or installing radar devices.

! WARNING

Risk of falling when activating the Wi-Fi hotspot.

If the HyQuant is installed at a great height above the water and/or the sensor is difficult to access, there is a risk of falling when activating the Wi-Fi hotspot.

- § Use personal protective equipment (PPE) to prevent falls.
- § If possible, use a swivelling bracket for installation. This allows you to swivel the sensor into a safe working area for configuration.

! WARNING

- § Risk of drowning.
- § Be particularly careful when working over or near to water.
- § Wear a Life Jacket/Buoyancy Aid:
 - § Ensure that workers at risk of falling into the water are provided with and wear a life jacket or buoyancy aid.
 - § The life jacket should be thoroughly checked by the user prior to use.
- § Never Work Alone: Always be accompanied when working near or over water.

The HyQuant radar sensor is designed for low maintenance. No special maintenance is required, nor is it necessary to replace components at regular intervals. However, the entire measurement point should be inspected and checked regularly. We recommend that the following maintenance operations are carried out at least once a year, e.g. as part of a measurement point inspection. Unscheduled maintenance is recommended after exceptional events (flooding) or if the readings are implausible.

Maintenance work to be carried out annually (recommended):

- § Check that there are no obstructions between the radar sensor and the water surface. If necessary, remove flotsam, vegetation or other objects from the measurement section.
- § Check the underside of the device with the radar antenna for soiling (insect nests, bird droppings, spider webs, other dirt deposits). If necessary, clean the underside of the device with a damp cloth and a little household detergent. Do not use aggressive cleaning agents.
- § Check the sensor position and correct if necessary: the underside of the device must be aligned as parallel as possible to the water surface.
- § Check the mounting point of the radar sensor for position and stability. Correct if necessary or if not possible, select a new fixing point.
- § Check the angled plug connector and connecting cable for mechanical damage. If necessary, replace complete connecting cable with angled plug connector.
- § Check all screw connections for sufficient tightening strength. Re-tighten screws if necessary.
- § Check all metal fastening components for corrosion. If there is a risk of the radar sensor falling down due to material failure, replace corroded parts.
- § Check [sensor alignment](#) 16: Verify that the sensor is properly aligned relative to the water surface ($\pm 2^\circ$). For velocity sensors, ensure that the HyQuant is correctly positioned and aligned with the flow direction: the KISTERS 'K' marking on the sensor lid must be facing upstream (water flows from 'K' marking to the radome area of the lid).
- § Finally, carry out a control measurement and compare with the reference value (e.g. level staff value). If this results in an unexpectedly large deviation, the radar sensor must be re-referenced. The cause of the deviation is often a change in the position of the mounting point.

Note: In accordance with the prevailing local conditions, it may be necessary to implement maintenance procedures at more frequent intervals. This is particularly the case in instances where there is a substantial accumulation of debris at the measuring point, or where the likelihood of increased soiling is high due to unfavourable environmental conditions.

6 Troubleshooting

CAUTION

- § Radar electromagnetic wave emissions.
- § The device operates with very low emitting power radar beams.

Precaution:

- § While the risk is minimal, it is advisable to avoid prolonged direct exposure.
- § Vulnerable or highly sensitive individuals should exercise caution.
- § Always follow standard safety guidelines when handling or installing radar devices.

WARNING

Risk of falling when activating the Wi-Fi hotspot.

If the HyQuant is installed at a great height above the water and/or the sensor is difficult to access, there is a risk of falling when activating the Wi-Fi hotspot.

- § Use personal protective equipment (PPE) to prevent falls.
- § If possible, use a swivelling bracket for installation. This allows you to swivel the sensor into a safe working area for configuration.

WARNING

- § Risk of drowning.
- § Be particularly careful when working over or near to water.
- § Wear a Life Jacket/Buoyancy Aid:
 - § Ensure that workers at risk of falling into the water are provided with and wear a life jacket or buoyancy aid.
 - § The life jacket should be thoroughly checked by the user prior to use.
- § Never Work Alone: Always be accompanied when working near or over water.

WARNING

- § Incorrect connection of the supply power may result in damage to the HyQuant. The HyQuant has a reverse polarity protected interface and power circuit to protect against this. However, it is important to note that an improper or incorrect connection between the power and interface lines could still result in damage to the instrument. Check the pin-out configuration and ensure that no power is applied to the connector
- § cables other than those specifically marked 'Power VCC +' and 'Power GND -'.

The device ensures high functional reliability, but malfunctions can occur during operation. Such malfunctions may result from the following causes:

Sensor is not ready for operation; no communication with the sensor possible

- § Check the power supply to the device. Within range? Polarity reversed? Direct current?
- § Check the cable connector: Mechanical damage? Not connected?
- § Check the cable: Mechanical damage?
- § Assess error messages if any.
- § Assess changes in the installation site: for instance, new obstacles obstructing direct view to the water surface?

No SDI-12 or Modbus data

- § SDI-12 or Modbus connection to the connected data logger: Is the wiring suitable for the interface used? Is the RS-485 interface mismatched? Is the sensor address configured correctly? Are there addressing conflicts with other SDI-12 sensors on the same bus? Is the required communication interface activated in the HyQuant L? Do the communication parameters of the Modbus (RTU) interface of the sensor and controller match?
- §
- §

Unstable or no readings

- § [Sensor position](#) 16: parallel to the water surface? Is the 'K' marking raised on the lid of the device, facing upstream?
- § Unstable water level?
- § Check the lid: deposition of dirt or scratches on the radome?
- § Obstruction in the measurement beam?
- § False reflections on large object in close vicinity to the sensor?

Erroneous sensor configuration

- § The sensor settings require verification to ensure they are both plausible and complete.
- § Refer to section [Configuration](#) 20 for a detailed description of configuration/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 90001 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

Technical specifications	HyQuant – L20 / L50	HyQuant V	HyQuant L + V
Radar Type / Frequency Band	FMCW 60 GHz V-Band Radar level sensor	FMCW Doppler 60 GHz V-Band Radar Velocity sensor.	Integrated FMCW 60 GHz V-band Radar Level (L) and Doppler Velocity (V) sensor
Measurement Range	§ L20: 0.10 ... 20 m § L50: 0.15 ... 50 m	§ L: 0.10 ... 20 m § V: 0.05 ... 15 m/s	
Sampling Rate	1 Hz (1 measurement / second)		
Accuracy	≤ 2 mm	L: ≤ 2 mm V: § 0.02 ... 4.5 m/s: 1 % of measured value § 4.5 ... 15 m/s: 2 % of measured value	
Resolution	±1 mm	L: ±1 mm V: 1 mm/s	
Blind Zone / Blanking Distance	§ L20: 0.1 m § L50: 0.15 m	0.1 m	
Minimum Ripple - Velocity	N/A	2–3 mm	
Supply Voltage (Range)	9 ... 30 V dc		
Power Consumption @ 12 V dc	Typical < 20 mA, peak operation < 80 mA		
Beam Angle (azimuth by elevation)	8° by 8°	§ L: 8° by 8° § V: 8° by 12°	
Ingress Protection	IP68	IP68 means that the device is both dustproof and protected against continuous immersion in water to a maximum depth of 1.5 metres for a maximum of 3 hours. It does not provide protection against other liquids such as salt water, soapy water, alcohol or heated liquids. Note: To achieve IP68, ensure that the 8-pin M12 connector is correctly inserted and securely fastened.	
Communication & Interfaces	SDI-12, Modbus, Wi-Fi		
Operating Temperature Range	-40 ... +80 °C		
Humidity Range	Relative Humidity 0 ... 100 % non-condensing		
Dimensions & Weight	§ HyQuant sensor with backplate (L×W×H): 160 × 97 × 91 mm, 1.15 kg § Packaged Dimensions (L×W×H): 300 × 300 × 187 mm, 2.5 kg		
Signal Connector	M12 8-pin		

Technical specifications	HyQuant – L20 / L50	HyQuant V	HyQuant L + V
Materials	Housing: Powder-coated aluminium and Radome / Front panel (lid) HDPE		
Compliance	CE, FCC Class B, UL, RoHS, further information available on our website		

Table 15 – Technical Data

9 Regulatory and Compliance Information

EU

Technology	Maximum Rated Output Power	Notes	
WLAN 2.4 GHz	15.0 dBm EIRP (average)	Includes up to 2 dB FCC/ISED-based tune-up tolerance. specific EIRP may vary.	Country-
Radar 60 GHz	19.0 dBm EIRP (average)	Includes up to 2 dB FCC/ISED-based tune-up tolerance. specific EIRP may vary.	Country-

During configuration, the radar and Wi-Fi transmit simultaneously. During normal operation, only the radar is active.

US / Canada

Technology	Maximum Rated Output Power	Notes
WLAN 2.4 GHz	21.5 dBm EIRP (average) 21.0	Includes up to 2 dB FCC/ISED tune-up tolerance.
Radar 60 GHz	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.














































White Paper - Discharge Calculation with HyQuant Q

The following is a brief description of the three typical methods used in hydrology to calculate discharge Q of a stream using a KISTERS HyQuant Q radar sensor. This white paper focuses on features available only on the HyQuant Q model. HyQuant Q builds on the HyQuant L+V, a sensor for simultaneous measurement of level and surface velocity, by incorporating discharge calculations, making it a comprehensive tool for hydrological monitoring without the need for additional sensors or housing modifications.

A brief tour of Q Calculation Methods

To calculate the discharge (Q) of a stream accurately, a cross-section profile of the stream is essential. This profile helps transform the measured surface velocity into the average velocity across the entire stream width. Here's a step-by-step overview:

Step 1: Establishing a Cross-Section Profile:

- A detailed measurement of the stream's cross-section is needed to understand the variations in depth and width of the riverbed.
- This involves dividing the stream into several sub-sections (or boxes) and measuring the depth at various points across the stream.

Step 2: Determining Sub-Section Areas:

- The area of each sub-section needs to be calculated. This is done by measuring the width and depth of each segment.
- These measurements help in understanding how much water each part of the stream can hold and contribute to the total discharge.

Step 3: Measuring Riverbed Variations:

- The height variations of the riverbed need to be determined accurately. Different methods such as manual surveying, ADCP, LiDAR, or echo sounding can be used to obtain this data.
- This information ensures that the cross-section profile reflects the actual shape and depth variations of the streambed.

Step 4: Applying the k -Factor:

- The k -factor is used to convert the measured surface velocity into the mean velocity across the cross-section.
- k is determined based on the cross-section data and is crucial for accurate discharge calculation.
- The k -factor may vary along the cross-section and needs to be interpolated between the measured levels to apply it accurately across all sub-sections.

By using a detailed cross-section profile and an appropriate k -factor, HyQuant Q will transform the measured surface velocity into mean velocities. This allows for a precise calculation of the stream's discharge, ensuring accurate hydrological assessments.

KISTERS' HyComm software enables the user to enter k -factors. The three distinct methods implemented in HyQuant Q are described in the following.

Constant k -Factor Method

- **Overview:** This method uses a constant value of the k -factor (or α) derived from textbooks or historical data for specific types of rivers or streams.
- **Procedure:**
 - o Measure the surface flow velocity V_s
 - o Apply the constant k -factor to convert V_s to the average flow velocity V_m : $V_m = k \times V_s$
 - o Measure the cross-sectional area A of the stream.
 - o Calculate discharge Q using the formula: $Q = V_m \times A$.
- **Advantages:** Simple and quick, useful for streams with stable characteristics.
- **Disadvantages:** May not be accurate for streams with variable flow conditions or irregular cross-sections.

Dynamic k using a Power Law profile

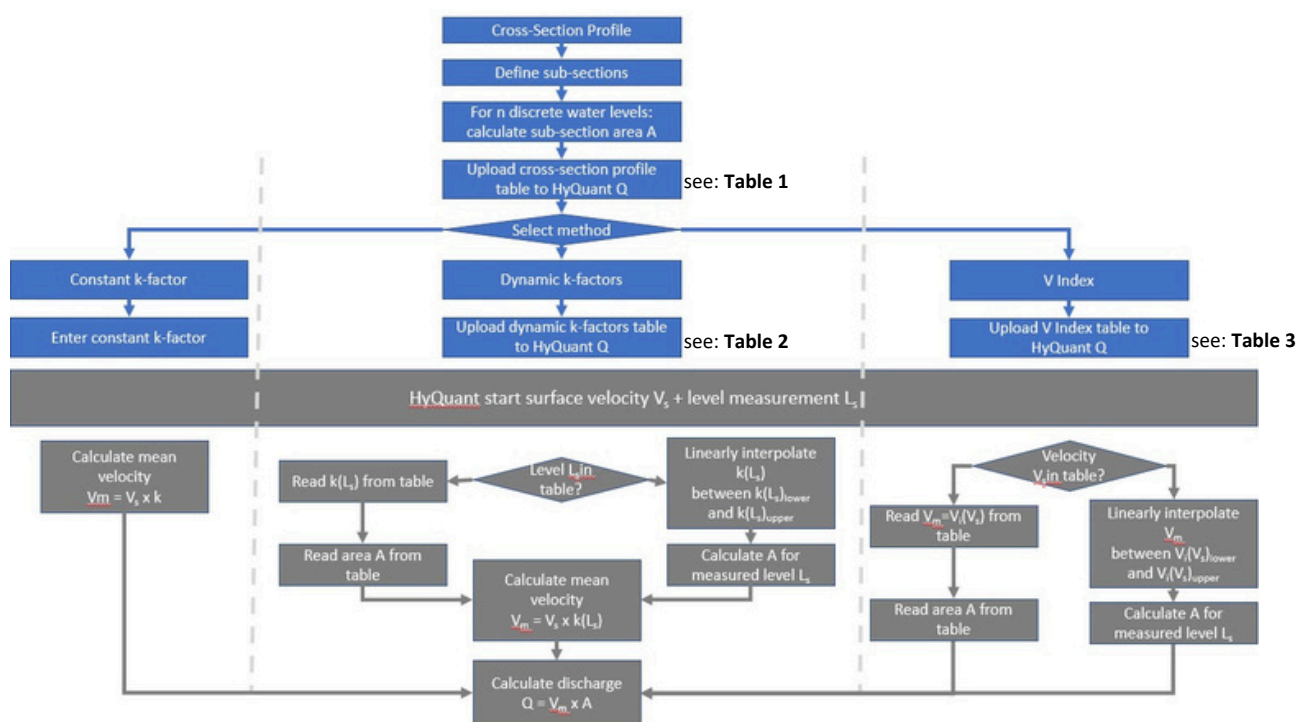
- **Overview:** This method utilizes the relationship between depth and velocity based on a power law profile to determine the k -factor.
- **Procedure:**
 - o Measure the depth y and velocity $V(y)$ at multiple points in the cross-section.
 - o Fit the measured velocity data to a power law profile: $V(y) = V_{max} \left(\frac{y}{d} \right)^n$, where V_{max} is the maximum velocity at the surface, d is the total depth, and n is the exponent.
 - o Calculate the k -factor from the power law parameters: $k = \frac{1}{1+n}$.
 - o Measure the surface velocity V_s
 - o Apply the k -factor to convert V_s to the average flow velocity V_m : $V_m = k \times V_s$
 - o Measure the cross-sectional area A of the stream.
 - o Calculate discharge Q using the formula: $Q = V_m \times A$.
- **Advantages:** Provides a tailored k -factor based on empirical data, can be more accurate than using a constant k -factor.
- **Disadvantages:** Requires detailed measurements and fitting to a power law, which can be complex and time-consuming.

Index Velocity Method

- **Overview:** This method utilizes the relationship between measured surface or near-surface velocities and the average flow velocity in the cross-section.
- **Procedure:**
 - o Measure the surface flow velocity V_{index}
 - o Establish a calibration relationship between V_{index} and the average velocity V through detailed measurements and statistical analysis.
 - o Measure the cross-sectional area A of the stream.
 - o Calculate discharge Q using the calibrated relationship and the cross-sectional area: $Q = V_m \times A$.
- **Advantages:** More accurate for streams with variable conditions, uses real-time data.
- **Disadvantages:** Requires extensive initial calibration and continuous monitoring.

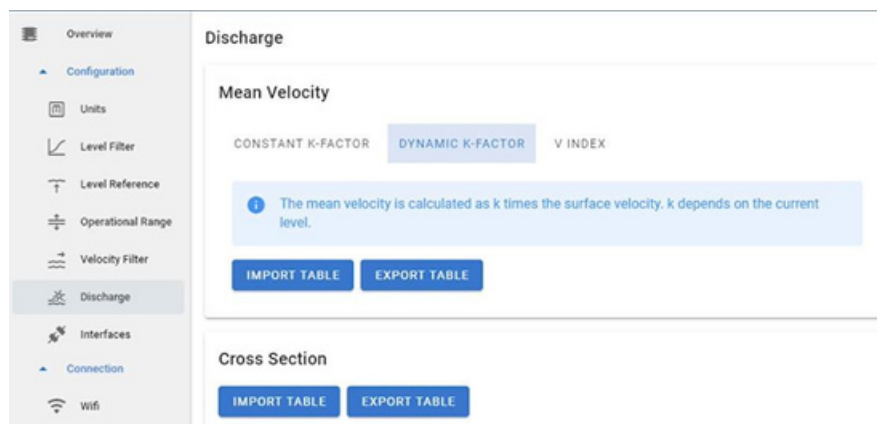
Practical application of the three methods with HyQuant Q and HyComm

Each radar sensor needs to be configured. Level measurements must be adjusted to a reference water level or zero point. Q models require additional settings, in particular a correction factor to convert surface velocity to mean velocity, taking into account variations in river cross section at the monitoring point. The HyComm configuration software is designed for use with KISTERS' HyQuant radar sensors and allows local communication and configuration. To connect the HyQuant sensor to HyComm, users need to activate the mobile hotspot on the sensor and connect their computer or portable device to the sensor's Wi-Fi access point. This simple process ensures that users can quickly connect and begin configuring the sensor. The following describes how to use HyComm to configure a HyQuant Q sensor for Q measurements. Please note that these functions are only available for the HyQuant Q and not for the other models of the product family. The following flow chart illustrates the path through HyComm for entering input values (constants or tables of numerical values) and selecting a Q calculation method. Blue boxes contain user actions, while HyQuant actions are described in grey boxes.



QSettings in HyComm

For a HyQuant Q sensor, the user can select one of the three supported Q calculation methods. Select "Discharge" from the left menu bar. The following dialogue opens:



Preliminaries

The cross-section must be determined for all Q calculation methods. A table of section data must be provided. The table can be imported and exported. The cross-section table defines a relationship between water level and area. Level data is entered as discrete values. For measured levels between two specified levels, HyQuant Q uses linear interpolation to derive the correct value of k .

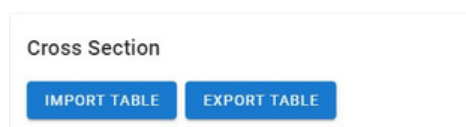


Table structure

Table 1 – Cross-Section Table

		Column 1		Column 2		
Table	Header	Description	Range	Header	Description	Range
cross-section	W [cm]	Level	0..2000	A [m²]	Cross-section	0..∞

Sample Table

- The headers of each column must be exactly as shown in the samples.
- Table entries must be sorted in ascending order. The relevant attribute for sorting is the first column water level W [cm].
- Respect the exact sequence of table columns as shown in the samples.
- All water level values W [cm] must be relative to the same zero-point reference.

	A	B	C
1	W [cm]	A [m²]	
2	1	0,7	
3	2	1,5	
4			
5			

Constant k-Factor

k -factors are chosen to reflect characteristics of the chosen monitoring site. In hydrology, k -factors are essential for understanding the impact of stream conditions on flow.

Various studies suggest k -factors based on empirical data. For example, one approach for natural streams is to use a factor of 0.87, while for engineered channels, it might be around 0.95. It's essential to refer to

specific hydrological studies or guidelines relevant to the geographical area and stream type for precise values.

Mean Velocity

CONSTANT K-FACTOR

DYNAMIC K-FACTOR

V INDEX



The mean velocity is calculated as k times the surface velocity.

k-factor

0.8

SAVE

Dynamic k -factor and V Index

Both methods rely on externally calculated values organized in tables. These tables can be imported and exported.

- **Dynamic k -factor:** relies on applying imported k -factors for improved accuracy. The k -factors have been calculated using a power law. The method is more accurate but requires more effort in providing solid input data for the power law model. Refer to “Dynamic k using a Power Law profile” for details.
- **V Index:** relies on k -factors calculated using statistical methods modelling the relationship between measured surface velocities and the mean velocity of a cross-section. The method is moderate complex and achieves good accuracy. Refer to “Index Velocity Method” for details.

HyComm interpolates the values and stores a value for each level step (cm or in) or velocity step (mm/s or in/s).

Mean Velocity

CONSTANT K-FACTOR

DYNAMIC K-FACTOR

V INDEX



The mean velocity is calculated as k times the surface velocity. k depends on the current level.

IMPORT TABLE

EXPORT TABLE

Table structure

Table 2 – Dynamic k -factor Table

Table	Column 1			Column 2		
	Header	Description	Range	Header	Description	Range
k -factor	W [cm]	Level	0..2000	k -factor	k -factor	0..1.0

Table 3 – V-Index Table

Table	Header	Column 1		Header	Column 2	
		Description	Range		Description	Range
v -index	v [m/s]	Surfacevelocity	0..15	v [m/s]	Meanvelocity	0.. ∞

CAUTION: v -index table needs to start with $v_{\text{surface}} = 0$

Sample Tables

- The headers of each column must be exactly as shown in the samples.
- Table entries must be sorted in ascending order. The relevant attribute for sorting is the first column and thus either a water level W [cm] or a velocity v [m/s].
- Respect the exact sequence of table columns as shown in the samples.

k-factor:

	A	B	C
1	W [cm]	k-factor	
2	0	0,9	
3	100	0,95	
4			
5			

- All water level values W [cm] must be relative to the same zero-point reference.

V-Index:

	A	B	C
1	v [m/s]	v [m/s]	
2	0	0	
3	0,5	0,45	
4			
5			

- The first entry defines a zero point with both water level and the area equal to zero.

Interpolation – Maximum Number of Table Entries

HyComm will identify the lowest level value in the table and exclude all values that are smaller than this value plus the range.

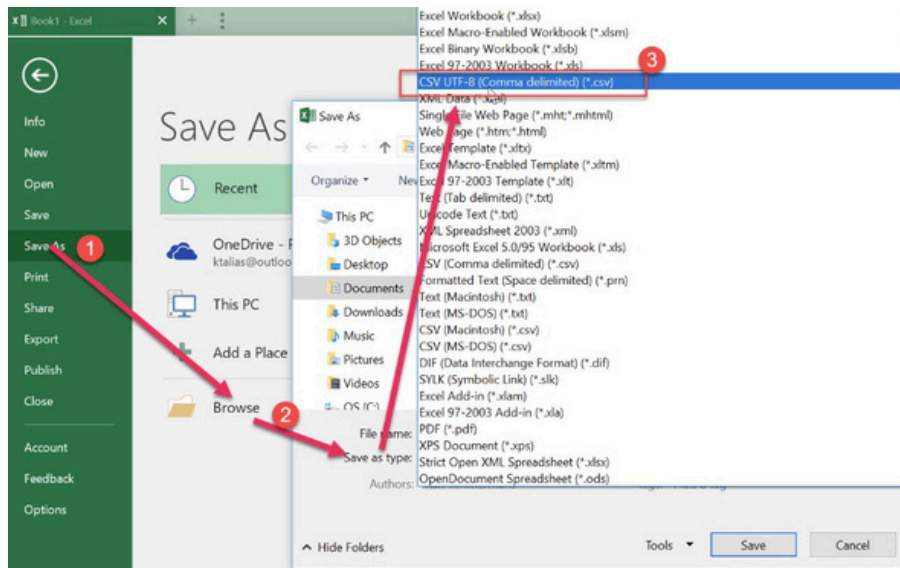
To illustrate, consider the following example:

- HyQuant model: L+V20 → range=20m
- The lowest acceptable value in the table is 120m, which is likely referenced to a zero-point setting.
- All values above 120+20=140m will be discarded.

HyComm then performs an interpolation and populates the requisiteraster with the resulting values. The advantage of the interpolation is that the algorithm determines the number of values in the table, thereby preventing the user from uploading an excessive number of values into HyQuant.

File structure The best way to create a table is in Microsoft EXCEL®. Note that for all tables, only the first two columns are used. Additional columns will be ignored when the tables are imported.

- Create a table that follows the table structure information defined above
- The table and data values are typically exported from a cross-section or rating curve editor or the corresponding module of your hydrological data management software. KISTERS software solutions WISKI, HYDSTRA and SKED all provide the required functionality.
- Ensure that the table structure, including headers, follows the specifications in the table structure definitions above. Additional formatting requirements:
 - The decimal separator can be either ‘,’ or ‘.’.
 - A thousand separator is not allowed.
 - Ensure that the table values are put in an ascending order from the first column.
- Save the data in a CSV UTF-8 file (Comma Separated Values) file:
 1. Select the “Save As” option in EXCEL.
 2. Check the file type settings in “Save file as”.
 3. Select the file type: CSV UTF-8 (with delimiter) and specify ‘;’ as a column delimiter.



Conclusion

In summary, the KISTERS HyQuant Q radar sensor offers a comprehensive solution for accurately calculating the discharge (Q) of a stream by integrating both level and surface velocity measurements with advanced discharge calculation methods. Utilizing the cross-section profile of a stream is crucial for transforming surface velocities into mean velocities and ensuring precise discharge calculations. The cross-section must be determined for all Q calculation methods, requiring detailed measurement of the stream's depth and width variations. The HyQuant Q model provides flexibility with three distinct methods for discharge calculation: the constant k -factor method, the dynamic k -factor using a power law profile, and the index velocity method. Each method offers unique advantages and suits different stream conditions. It is important to note that k -factors must be calculated or modelled separately, as the HyComm software is only used to import this data and upload it to the HyQuant Q sensor. Similarly, HyComm does not provide functionality to actively manage cross-section data; it can only import and export tables defining the relationship between water level and cross-sectional area. The HyComm software enhances the functionality of the HyQuant Q sensor, enabling users to configure the sensor, enter k -factors, and upload cross-section data efficiently. By leveraging the HyQuant Q sensor and HyComm software, hydrologists can perform accurate hydrological assessments with ease, making the HyQuant Q a vital tool in modern water monitoring and management.



Ultraschall-Funksensor

WILSEN.sonic.level

WS-UCC2500-F406-B41-01-02

- < Batteriebetrieben
- < Datenübertragung über LoRaWAN
- < LoRaWAN-Downlink-Kanal für Abfrage und Anpassung von Parameterwerten
- < Bluetooth-Schnittstelle für Inbetriebnahme, Parametrierung und Diagnose

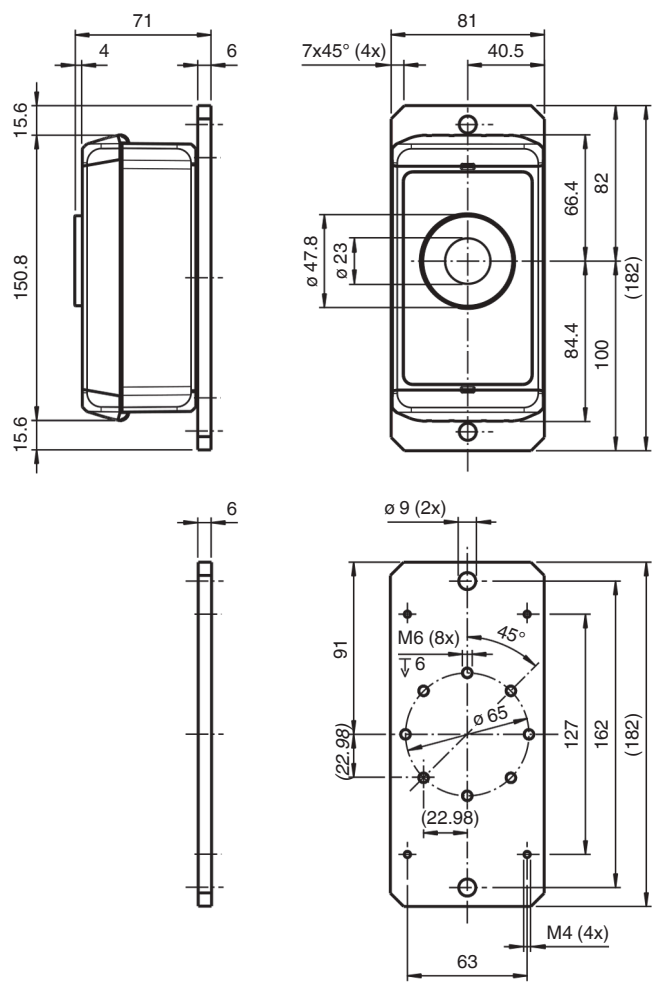
Ultraschall-Funksensor mit LoRaWAN-Schnittstelle, speziell für Füllstandsüberwachung in Tanks und Silos, Erfassungsbereich 150 ... 2500 mm, Auflösung 1 mm



Funktion

Der Ultraschall-Funksensor kann zur Fernüberwachung von Füllständen, Pegelständen und Abständen eingesetzt werden. Die genannten Messgrößen, sowie weitere Mess- und Zustandsdaten des Sensors werden in einstellbaren Zeitintervallen erfasst und an die Gegenstelle im LoRa-Netzwerk übertragen. Dort stehen die Daten zur Anzeige oder Weiterverarbeitung zur Verfügung. Über den Downlink-Kanal des Sensors kann vom LoRa-Netzwerk aus der Ferne auf den Sensor zwecks Abfrage oder Anpassung der Sensorparameterwerte zugegriffen werden. Eine Parametrierung kann auch über die zusätzlich im Sensor vorhandene Bluetooth-Schnittstelle unter Verwendung eines Mobilgeräts (Smartphone oder Tablet) und der zum Sensor gehörigen App WILSEN erfolgen.

Abmessungen



Technische Daten

Hauptsensor	
Erfassungsart	Ultraschall
Erfassungsbereich	150 ... 2500 mm
Blindzone	0 ... 150 mm
Auflösung	1 mm
Genauigkeit	± 3 % des Endwertes über den gesamten Temperaturbereich
Messintervall	10 min ... 24 h
Integrierte Sensorik	
GPS-Sensor	zur Geo-Positionsbestimmung
Erfassungshäufigkeit	30 min ... 24 h
Temperatursensor	
Auflösung	0,5 °C
Genauigkeit	± 2 °C
Elektrische Daten	
Stromversorgung	Hochleistungs-Lithium-Batterie 3,6 V , 13000 mAh Batterielebensdauer ca. 10 Jahre bei mitteleuropäischen Umgebungsbedingungen, 3 Messungen und Funkübertragungen pro Tag bei ausreichender Netzabdeckung.
Schnittstelle 1	
Schnittstellentyp	Bluetooth 5.0 LE
Sendeleistung	+ 8 dBm
Frequenzbereich	2402 ... 2480 MHz
Schnittstelle 2	
Schnittstellentyp	LoRaWAN

Veröffentlichungsdatum: 2023-07-27 Ausgabedatum: 2023-07-27 Dateiname: 70150488_ges.pdf

Technische Daten

Spezifikation	LoRaWAN-Schnittstellen-Spezifikation V1.0.3	
Gerätetyp		LoRaWAN-Klasse-A-Gerät ja 868 MHz + 8
Downlink-Kanal		dBm 863 ... 870 MHz (Europa)
Sendefrequenz		10 min ... 24 h
Sendeleistung		
Frequenzbereich		
Übertragungsintervall		
Richtlinienkonformität		
Elektromagnetische Verträglichkeit		
Richtlinie 2014/30/EU		EN 301 489-1 V2.2.3:2019 EN 301 489-3 V2.1.1:2019 EN 301 489-17 V3.2.4:2020 EN 301 489-19 V2.1.1:2019
Funkanlagen und Telekommunikationsendeinrichtungen		
Richtlinie 2014/53/EU		EN 300 220-2 V3.1.1:2017 EN 300 328 V2.2.2:2019 EN 303 413 V1.1.1:2017
RoHS		
Richtlinie 2011/65/EU (RoHS)		EN 63000:2018
Konformität		
Mech. Belastbarkeit		EN 60947-5-2:2020 IEC 60947-5-2:2019
Schockfestigkeit		EN 60947-5-2:2020
Schwingungsfestigkeit		IEC 60947-5-2:2019
Klimatische Bedingungen		EN 60947-5-2:2020
		IEC 60947-5-2:2019
Umgebungsbedingungen		
Umgebungstemperatur		-25 ... 70 °C (-13 ... 158 °F)
Lagertemperatur		-40 ... 85 °C (-40 ... 185 °F)
Mechanische Daten		
Schutzart		IP66 / IP67
Material		
Gehäuse		PC (UL94-V0)
Wandler		PTFE-beschichtet Gehäuse: PBT
Masse		620 g
Werkseinstellungen		
Schallkeule		breit
Übertragungsintervall		24 h
Messintervall		24 h

Veröffentlichungsdatum: 2023-07-27 Ausgabedatum: 2023-07-27 Dateiname: 70150488_ges.pdf

Beachten Sie „Allgemeine Hinweise zu Pepperl+Fuchs-Produktinformationen“.

 Pepperl+Fuchs-Gruppe
www.pepperl-fuchs.com

 USA: +1 330 486 0001
fa-info@us.pepperl-fuchs.com

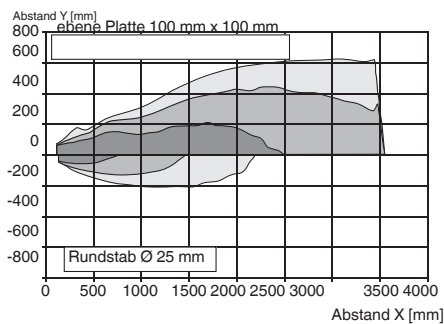
 Deutschland: +49 621 776 1111
fa-info@de.pepperl-fuchs.com

 Singapur: +65 6779 9091
fa-info@sg.pepperl-fuchs.com

 **PEPPERL+FUCHS**

Kennlinie

Charakteristische Ansprechkurve



Zusätzliche Informationen

Weitere Dokumentation

Für die Inbetriebnahme, Parametrierung und Anwendung des Sensors existieren zusätzlich eine Kurz-Inbetriebnahmeanleitung, ein Handbuch sowie weitere technische Informationen, die Sie über www.pepperl-fuchs.com von der Produktdetailseite herunterladen können.

All-in-One Radarsensor für Wasserstands- und Geschwindigkeitsmessungen

Wasserstand | Fließgeschwindigkeit | Hydrologie

Allgemeine Beschreibung

HyQuantL+V ist der moderne Radarsensor für Wasserstands- und Geschwindigkeitsmessungen von KISTERS. Er arbeitet mit der Doppler-Technologie im 60 GHz-Frequenzband (FMCW*). Mit erstklassiger Radarelektronik und Radar-on-Chip-Technologie bietet Ihnen der HyQuant L+V Vorteile wie:

Simultane Datenerfassung: Gleichzeitige Erfassung von Wasserstand und Fließgeschwindigkeit als notwendige Daten für die Abflussbestimmung.

Kompakte Bauweise: Mit einem Gewicht von nur 1,15 kg ist der HyQuant L+V **der kleinste seiner Art**. Das optisch unauffällige Design minimiert die Gefahr von Vandalismus und ermöglicht eine **flexible und einfache Installation** an verschiedenen Konstruktionen wie Brücken und Masten an schmalen und breiten Gewässern, in städtischen und abgelegenen Gebieten.

Einsatz von Doppelantenne: Wir setzen sorgfältig entwickelte, getrennte Antennenpaare für die Wasserstands- und Geschwindigkeitsmessungen ein. Die erforderliche Strahlneigung für V wird durch die Konstruktion ermöglicht. Dies vereinfacht die Montage des Sensors, der für eine optimale Positionierung lediglich parallel zur Wasseroberfläche ausgerichtet werden muss.

All-in-One-Lösung: Sie benötigen keine zusätzlichen Gehäuse für unterschiedliche Sensoren.

Optionales Upgrade auf Q: Erweitern Sie das Gerät um die Durchflussberechnung, ohne technische Änderungen vornehmen zu müssen.

Kleine Antennen, kurze Wellenlängen und ein optimierter Öffnungswinkel sorgen für eine **hohe Auflösung und Genauigkeit über den gesamten Messbereich**. Die von Ihnen einstellbaren Filtereinstellungen ermöglichen die Anpassung an verschiedene Szenarien.

Mit HyQuant L+V erhalten Sie Zugang zu einer berührungslosen Technologie, die auf der Radar-on-Chip basiert. Sie benötigen kein Radar-Know-how. Keine Kompromisse mehr bei Größe, Funktion oder Leistung.

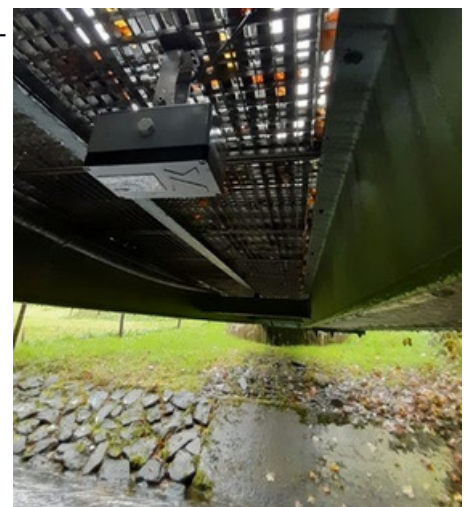
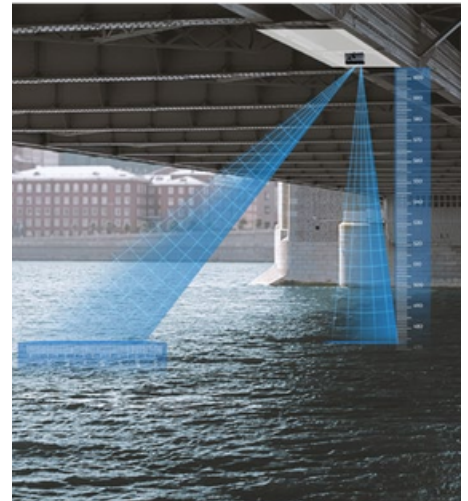
Anwendungsbereiche

HyQuantL+V eignet sich hervorragend für offene Fließgewässer, da es gleichzeitig Wasserstand und Fließgeschwindigkeit misst.

- Hydrologie: Flüsse, Bäche, offene Kanäle, Binnengewässer, zeitenabhängig
- Risikomanagement: Hochwasservorhersage und -warnung, Überschwemmungen von bewohnten Gebieten
- Bewässerung: offene Kanäle, Bewässerungsmanagement
- Industrielle Anwendungen: Wasserkraft, Bergbau, Industriebrachen
- Studien zum Klimawandel

Funktionen

- L: Pegelermittlung zur Ermittlung hydrologischer Wasserstandsdaten
- Wasserstands- und Geschwindigkeitsdaten bei allen Pegelzuständen und niedrigen, normalen und hohen Fließgeschwindigkeiten
- Maximale Messentfernung: 20 m
- Datenschnittstellen: SDI-12 oder Modbus
- Vor-Ort-Konfiguration über Wi-Fi: kostenlose HyComm-Software mit automatischen Firmware-Updates und Schritt-für-Schritt geführte Konfiguration
- Nahezu kein Blindbereich: misst bis zum Gehäusedeckel
- Geringer Stromverbrauch
- Geringer Wartungsaufwand
- Robustes Gehäuse
- Metrische oder imperiale Einheiten
- 10 m Kabel, Torx-Schlüssel und ein um 360° drehbarer Montagebügel im Lieferumfang enthalten
- Einfache Einrichtung mit der Kurzanleitung zur Installation



*FMCW: Frequency Modulated Continuous Wave

Technische Daten

Radartyp/Frequenzband	All-in-One Radarsensor für Wasserstands- und Geschwindigkeitsmessungen, der mit der Doppler-Technologie im 60 GHz-Frequenzband arbeitet (FMCW*)	
Messbereiche	L: 0,10 ... 20 m	V: 0,05 m/s ... 15 m/s
Ausgaberate	1 Hz	
Messgenauigkeit	L: ≤ 2 mm	V: 1 % des gemessenen Werts (in einem Bereich von 0,02 m/s bis 4,5 m/s) V: 2 % des gemessenen Werts (in einem Bereich von 4,50 m/s bis 15 m/s)
Auflösung	L: 1 mm	V: 1 mm/s
Wellen mind.	2 ... 3 mm	
Blindbereich	0,1 m	
Versorgungsspannung (Bereich)	10 ... 30 VDC	
Stromverbrauch bei 12V	Typisch ~50 mA; bei aktiviertem Wi-Fi: ~90 mA (einschließlich optionalem Upgrade auf Q)	
Strahlwinkel	L: 8° mal 8° (Azimut und Elevation)	V: 8° Azimut; 12° Elevation
Schutzklasse	IP68	
Kommunikation und Schnittstellen	SDI-12, Modbus, WLAN	
Betriebstemperatur	-40 ... +80 °C	
Luftfeuchtigkeit	0 ... 100 % RH (nicht kondensierend)	
Abmessungen und Gewicht	HyQuant Sensor mit Rückwand: L x B x H: 160 x 97 x 91 mm, 1,15 kg Verpackungsmaße: L x B x H: 300 x 300 x 187 mm, 2,5 kg	
Signalanschluss	M12 8-polig	
Materialien	Gehäuse: pulverbeschichtetes Aluminium; Abdeckung/Radom: HDPE	
Compliance	CE, FCC Klasse B, UL, RoHS (Weitere Informationen finden Sie auf unserer Homepage.)	

Zubehör

HyComm-Konfigurations-Software:

Konfiguration des Sensors über Wi-Fi/SDI-12/Modbus, Verwendung eines Schritt-für-Schritt-Assistenten oder über den Direktmodus, Sensormesswerte in Echtzeit und farb-kodierte Positionierungshilfe, automatische Sensor-Firmware-Updates, usw.

iRIS 270 und UnderCover Pro: Datenlogger der Marke KISTERS mit SDI-12 Schnittstelle

Optionale Mastmontageschelle: für Mastdurchmesser von 20 mm bis 60 mm

Adapter: SDI-12 auf USB und Modbus auf USB

Maßgeschneiderte Arm-/Auslegerkonstruktion(en)

Bei Fragen sprechen Sie uns gern an.



Vertriebspartner

KISTERS Europa I hydromet.sales@kisters.eu I kisters.eu
KISTERS Australien I sales@kisters.com.au I kisters.com.au
KISTERS Neuseeland I sales@kisters.co.nz I kisters.co.nz

KISTERS

LoRaWAN/NB-IoT Air/Water Pressure Sensor

OVERVIEW:

The Dragino Air/Water Pressure Sensor is used for Internet of Things solution. It can measure Air, Water pressure and liquid level and upload the sensor data send to IoT platform via LoRaWAN and NB-IoT network.

The Dragino Air/Water Pressure Sensor includes Thread Installation Type and Immersion Type, it supports different pressure range which can be used for different measurement requirement.

It supports BLE configure and wireless OTA update which make user easy to use.

The Dragino Air/Water Pressure Sensor series is powered by 8500mAh Li-SOCI2 battery or solar panel with li-on battery, it is designed for long-term use up to several years.



Thread Installation Type Immersion Type

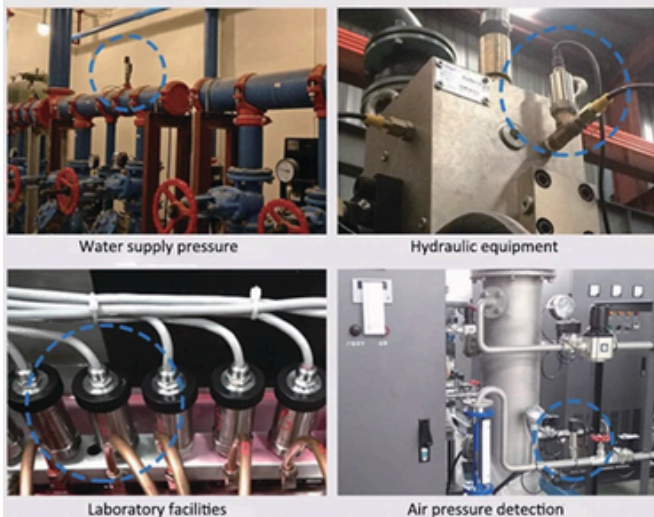
Thread Installation Type

Probe Specification:

- Hersman Pressure Transmitter
- Measuring Range: -0.1 ~ 0 ~ 60MPa, see order info.
- Accuracy: 0.2% F.S
- Long-Term Stability: 0.2% F.S $\pm 0.05\%$
- Overload 200% F.S
- Zero Temperature Drift: 0.03% FS/ $^{\circ}\text{C}$ ($\leq 100\text{Kpa}$), 0.02%FS/ $^{\circ}\text{C}$ ($> 100\text{Kpa}$)
- FS Temperature Drift: 0.003% FS/ $^{\circ}\text{C}$ ($\leq 100\text{Kpa}$), 0.002%FS/ $^{\circ}\text{C}$ ($> 100\text{Kpa}$)
- Storage temperature: -30 $^{\circ}\text{C}$ ~80 $^{\circ}\text{C}$
- Operating temperature: -40 $^{\circ}\text{C}$ ~60 $^{\circ}\text{C}$
- Material : 304 stainless steel
- Connector Type: Various Types, see order info

Application:

Apply to various industrial applications



Immersion Type

Probe Specification:

- Immersion Type, Probe IP Level: IP68
- Measuring Range: Measure range can be customized, up to 100m.
- Accuracy: 0.2% F.S
- Long-Term Stability: $\pm 0.2\%$ F.S / Year
- Overload 200% F.S
- Zero Temperature Drift: $\pm 2\%$ F.S
- FS Temperature Drift: $\pm 2\%$ F.S
- Storage temperature: -30 $^{\circ}\text{C}$ ~80 $^{\circ}\text{C}$
- Operating temperature: -40 $^{\circ}\text{C}$ ~85 $^{\circ}\text{C}$
- Material: 316 stainless steels

Application:



Dragino Technology Co., Limited

Room202, Block B, BCTIncubationBases (BaoChengTai), No.8CaiYunRoad
LongCheng Street, LongGang District ; Shenzhen 518116, China
Direct: +86 755 86610829 | Fax: +86 755 86647123

WWW.DRAGINO.COM
sales@dragino.com

Model Variants

Variants	PS-LB	PS-LS	PS-NB	PS-NS
Apperance				
				
Connectivity	LoRaWAN®	LoRaWAN®	NB-IoT	NB-IoT
Configure Method	TTL, BLE, LoRaWAN	TTL, BLE, LoRaWAN	TTL, BLE, NB-IoT	TTL, BLE, NB-IoT
Upgrade Method	TTL, BLE, LoRa	TTL, BLE, LoRa	TTL, BLE	TTL, BLE
Features	* Ultra-low power consumption * Measure air / gas or water pressure * Different pressure range available * Thread Installation Type or Immersion Type * Controllable 3.3v,5v and 12v output to power external sensor * Monitor Battery Level * Support Bluetooth v5.1 remote configure and OTA update firmware			
Battery & Power	* Li/SOCI2 Battery	* Solar + Li-on Battery	* Li/SOCI2 Battery	* Solar + Li-on Battery
Power Consumption	* Sleep Mode: 5uA @ 3.3v * LoRa Transmit Mode: 125mA @ 20dBm, 82mA @ 14dBm	* Sleep mode: 74uA@3.8V * LoRa Transmit Mode: 206mA@14dBm, 236mA@20dBm	* Sleep mode: 14uA@3.3V * Max Transmit power: 350mA@3.3V	* Sleep mode: 74uA@3.4V * Max Transmit power: 350mA@3.4V
Supply Voltage	2.5v ~ 3.6v	3.7v ~ 4.2v	2.5v ~ 3.6v	3.7v ~ 4.2v
Operating Temperature	-40 ~ 85°C	-40 ~ 85°C	-40 ~ 85°C	-40 ~ 85°C

Battery & Enclosure Option:



Li-SOCI2 Battery:

- Li/SOCI2 un-chargeable battery
- Capacity: 8500mAh Self-
- Discharge: <1% / Year @ 25°C
- Max continuously current: 130mA
- Max boost current: 2A, 1 second



Solar Version:

- 3000mAh Re-chargeable battery
- 0.9W on board solar pannel Suitable to used in the place where sun is su cient

Wireless Option:



- LoRaWAN 1.0.3 Class A
- Bands: CN470/EU433/KR920/US915/EU868/AS923/AU915/IN865
- OTAA or ABP Mode.
- World Wide Unique LoRaWAN Key
- RX sensitivity: down to -139 dBm.
- Max +22 dBm - 100 mW RF output



- NB-IoT Bands, B1/B2/B3/B4/B5/B8/B12/B13/B17/B18/B19/B20/B25/B28/B66/B70/B85 @H-FDD
- Uplink via MQTT, MQTTs, TCP, or UDP
- Multiply Sampling and one uplink

Dragino Technology Co., Limited

Room202, Block B, BCTIncubationBases (BaoChengTai),No.8CaiYunRoad
LongCheng Street, LongGang District ; Shenzhen 518116,China
Direct: +86 755 86610829 |Fax: +86 755 86647123

WWW.DRAGINO.COM
sales@dragino.com

What is 1D version for NB-IoT version?

The 1D version of NB-IoT Air/Water Pressure Sensor is with 1NCE SIM Card and DataCake IoT Service.

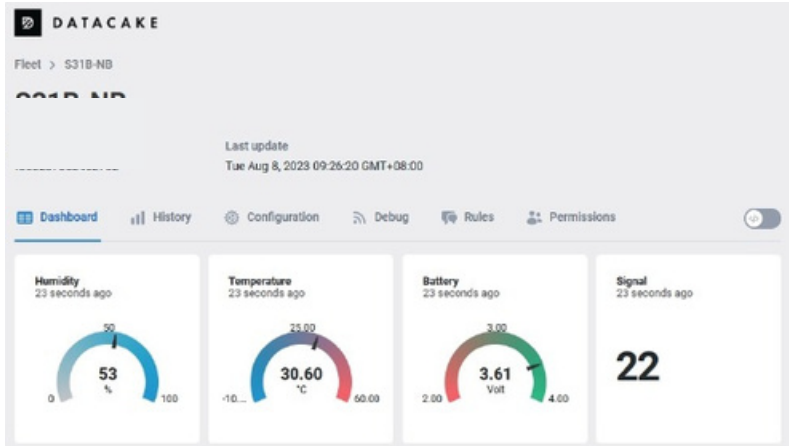
1NCE card provides 10 years lifetime for NB-IoT connection and Includes 500MB data traffic which is enough for 10 years normal uplink for the NB-IoT Sensor.

Coverage of 1NCE card is NB-IoT network coverage: Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Finland, Germany, Great Britain, Greece, Hungary, Ireland, Italy, Latvia, Malta, Netherlands, Norway, Puerto Rico, Russia, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Taiwan, USA, US Virgin Islands.



1D version with DataCake IoT service pre-installed. This save a lot of work from user side to configure IoT server.

Below is Dash Board is the demo in DataCake.



Order Info:

PS : Pressure Sensor Series Prefix					
Wireless Tech: L: LoRaWAN , N : NB-IoT					
Battery Type: B: 8500mAh LI-SOIC2 Battery : S: Solar Panel + Li-on Battery					
Probe Type:					
T20		Thread Type - M20 x 1.5			
T14		Thread Type - M14 x 1.5			
T27		Thread Type - M27 x 2			
TG2		Thread Type - G1/2			
TG4		Thread Type - G1/4			
TN4		Thread Type - NPT1/4			
TP4		Thread Type - PT1/4			
I1		Immersion Version - 1 meter cable			
I2		Immersion Version - 2 meter cable			
I3		Immersion Version - 3 meter cable			
I4		Immersion Version - 4 meter cable			
Ixx		Immersion Version - xx meter cable			
I100		Immersion Version - 100 meter cable			
PRESSURE -- Only for Thread Type					
A		0-0.6MPa			
B		0-1MPa			
C		0-1.6MPa			
D		0-2.5MPa			
E		0-10MPa			
F		0-40MPa			
G		0-60MPa			
H		-0.1-0MPa			
I		-0.1-0.1MPa			
J		0-5KPa			
K		0-50KPa			
L		0-100KPa			
		Frequency or SIM Version			
		CN470/EU433/KR920/US915/ EU868/AS923/AU915/IN865 GE -- General version (Exclude SIM card) 1D -- With 1NCE & DataCake Connection			
PS	- L	B - T20	- B	EU868	Example: PS-LB-T20-B-EU868
PS	- L	S - I5	-	US915	Example: PS-LS-I5-US915
PS	- N	B - T20	- B - GE		Example: PS-NB-T20-B-GE
PS	- N	S - I5	- 1D		Example: PS-NS-I5-1D

Dragino Technology Co., Limited

Room202, Block B, BCTIncubationBases (BaoChengTai),No.8CaiYunRoad
LongCheng Street, LongGang District ; Shenzhen 518116,China
Direct: +86 755 86610829 |Fax: +86 755 86647123

WWW.DRAGINO.COM

sales@dragino.com

Brückenhalter

für Pegel- und Fließgeschwindigkeitssensoren

Vorteile

- Unauffällige, einfache Montage
- Leichte Wartung der Sensorik
- Langlebig und wetterfest
- Passend für alle Brücken
- Ausleger und Länge flexibel bestellbar

Sicherheit

- Schraubverbindungen gegen Vandalismus bzw. ungewolltes Öffnen gesichert
- Verriegelungsmöglichkeit mit Sicherheitschloss



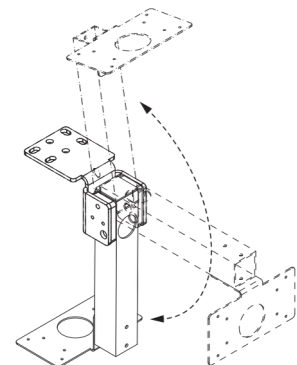
Montage

1. Der Brückenhalter wird standardmäßig auf dem Bauwerk mit 2 Verbundankern M8x110mm (Verbundankerpatrone + Ankerstange V4A) befestigt.
2. Die Bohrungen erfolgen auf dem Brückenbauwerk, es wird für die Montage kein Gerüst oder Leiter benötigt.

(Nähere Informationen zur Montage entnehmen Sie der Installationsanleitung!)

Wartung der Sensorik

Die montierte Sensorik lässt sich einfach von der Brücke aus warten. Durch den Schwenkarm können Reinigung, Batteriewechsel und gegebenenfalls Firmware-Updates schnell und einfach durchgeführt werden. Hierdurch reduzieren sich die Wartungskosten um ein vielfaches.



dimeto GmbH

Innovative Entwicklung von Sensorsystemen
St.-Barbara-Straße 12 / Gebäude 2
D-66299 Friedrichsthal

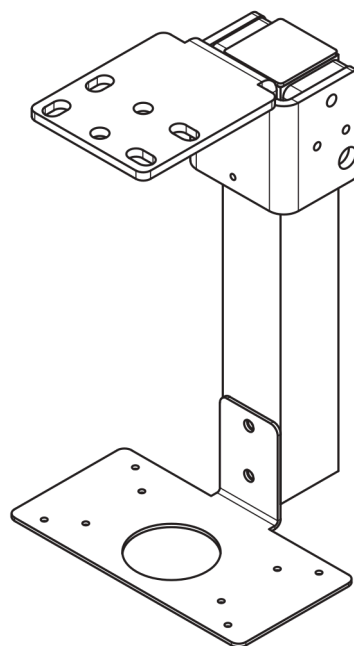
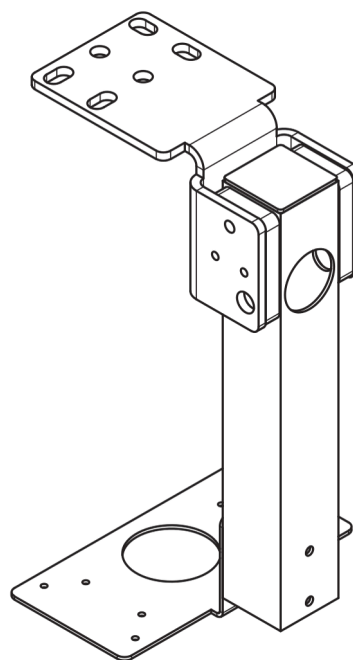
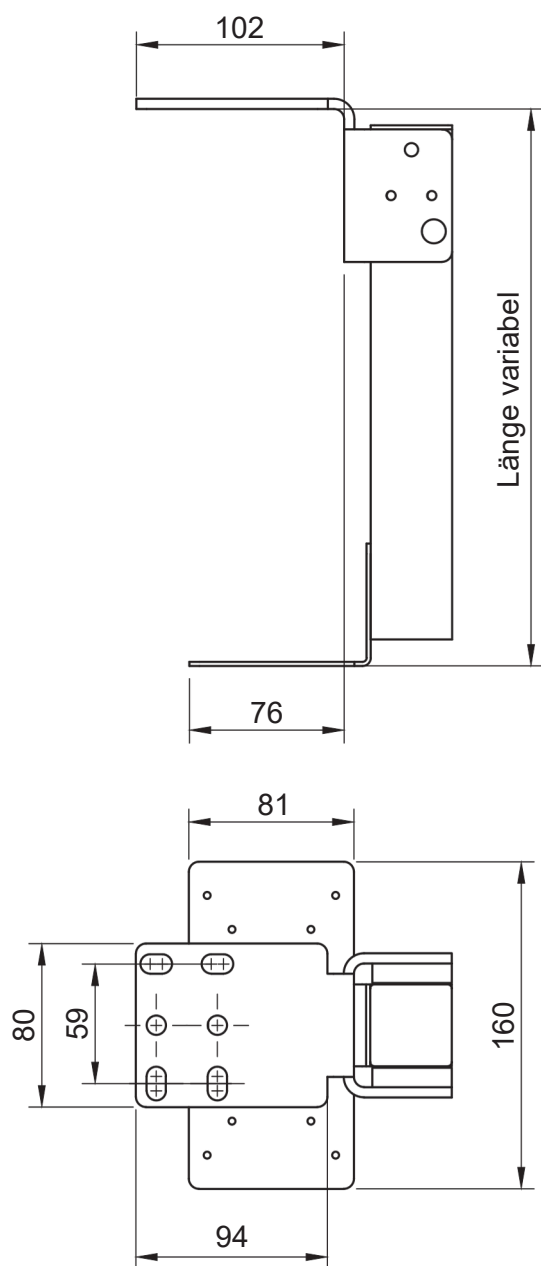
Kontakt

Telefon: +49(0)681 387223 97
E-Mail: info@dimeto.de
Website: www.dimeto.de

dimeto®
Measure. Values. Change.

Brückenhalter

Technische Zeichnung



Material	Edelstahl (V4A)
Gewicht	ca. 1,5 kg- 2,5 kg
Länge	ca. 150 mm - 500 mm (weitere Längen nach Anfrage)

dimeto GmbH

Innovative Entwicklung von Sensorsystemen
St.-Barbara-Straße 12 / Gebäude 2
D-66299 Friedrichsthal

Kontakt

Telefon: +49(0)681 387223 97
E-Mail: info@dimeto.de
Website: www.dimeto.de

dimeto[®]
Measure. Values. Change.

APOLLON-Q

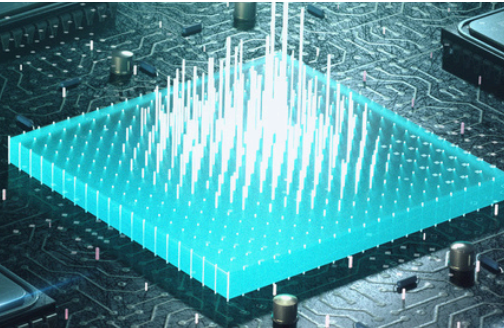
TECHNICAL DATASHEET

STANDARD SPEZIFIKATIONEN

Merkmal	Wert
Dimensionen	109mm x 53mm x 33mm
Gewicht	160g (mit 2 Batterien)
Betriebstemperatur	-20°C - +85°C
Lagertemperatur	-20°C - +85°C
Empfohlene Lagertemperatur	+10°C - +25°C
Luftfeuchtigkeit im Betrieb	20% - 95%
IP Rating	IP66
Sensorik für Distanzmessung	Radar und Optisch
Batterie	Primärzelle Nennspannung 3V (Je nach Ausführung eine oder zwei Batterien)
Material	Glasfaserverstärktes Polybutylenterephthalat Beständig gegen folgende chemischen Stoffe: • mineralische Schmierstoffe • Öle und Fette • Kohlenwasserstoffe • Benzin • Alkohole • Schwache Laugen • Schwache organische Säuren • Heißes Wasser • Starke Mineralsäuren Weiteres: • Beständig gegen UV-Strahlung und Witterung (für den Außeneinsatz geeignet)
Provisioning	NFC
NFC Antenne	Integriert
RF Antenne	Integriert
Standard Messbereich	80mm bis 2000mm
Maximaler Messbereich	30mm bis 3500mm

APOLLON-Q

TECHNICAL DATASHEET



KONNEKTIVITÄT UND RF SPEZIFIKATIONEN

Merkmal	Wert
RF Standards	NB-IoT, LTE-CAT-M1, LoRaTM, MITÖY
Frequenz LoRaTM	868MHz Band Band 8, 20
Frequenz NB-IoT	(900MHz, 800MHz) 14 dBm
Sendeleistung LoRaTM	23 dBm LoRaWANTM 1.0.2
Sendeleistung NB-IoT	
LoRaTM Speziikation	

SENSOR SPEZIFIKATIONEN OPTISCHER SENSOR

Merkmal	Wert
Messfeld	16 x 16 Punkte
Öffnungswinkel	Standard 30°
Wellenlänge	940 nm
Messfrequenz	Bis zu 50 Hz
Reichweite	2 Meter standard (bis 3,50m möglich)
Laser Klasse	Klasse 1
Minimale Reichweite	Standard 5 cm (bis 2 cm mit geringerer Genauigkeit möglich)
Auflösung	1 mm
Linsen Eigenschaften	Hydrophob und staubabweisend

APOLLON-Q

TECHNICAL DATASHEET

MONTAGEARTEN

Montageart	Zubehör
Verschraubung	2x DIN912 M4x25/30/35/40 Edelstahl V2A/A2 - Spanplattenschrauben TX Teilgewinde 4,0x25/30/35/40
Magneten	2x Neodymmagneten (indoor) zusammen 32 kg Tragkraft* 2x Ferrit-Topfmagneten (outdoor) zusammen 16 kg Tragkraft* - Schutzkappe
Kleben	Montagekleber
Halterung	Externe Halterung - extra Schutz vor Vandalismus und Zerstörung

ZUBEHÖR

Artikel Code	Beschreibung	Enthalten
APOQ-SCREW-DIN912-25	2 Mal DIN912 M4x25 Schraube aus Edelstahl V2A/A2	Enthalten
APOQ-GLUE	Montagekleber	Auf Anfrage/nicht enthalten
APOQ-HOLD	Externe Halterung, die über vier Schrauben extra befestigt werden kann. Der Sensor wird mit 2 Schrauben in die Halterung eingeschraubt.	Nicht enthalten
APOQ-MAG-NEO	2 Mal Neodytopfmagnet, Haftkraft 32 kg inkl. 2 Schrauben	Nicht enthalten
APOQ-MAG-FE	2 Mal Ferritopfmagnet, Haftkraft 32 kg inkl. 2 Schrauben	Nicht enthalten
APOQ-MAG-COVER	Anti-Rutsch Abdeckung für Ferritmagneten, sichert gegen verrutschen des Sensor	Nicht enthalten
APOQ-SCREW-ISO7380-25	Sicherheitsschraube ähnl. ISO7380 mit Linsenkopf und Torx+Pin Antrieb M4x25 aus Edelstahl V2A/A2	Nicht enthalten

VERSIONEN

Artikel Code	Kommunikation	Sensorik
APOQ-LOEU-T	LoRa™	Optisch
APOQ-LOEU-R	LoRa™	Radar
APOQ-LOEU-TR	LoRa™	Optisch und Radar
APOQ-NB-T	NB-IoT, LTE-CATM1	Optisch
APOQ-NB-R	NB-IoT, LTE-CATM1	Radar
APOQ-NB-TR	NB-IoT, LTE-CATM1	Optisch und Radar

* Annahme unter perfekten Bedingungen

APOLLON-Q

TECHNICAL DATASHEET

MONTAGEARTEN

Montageart	Zubehör
Verschraubung	2x DIN912 M4x25/30/35/40 Edelstahl V2A/A2 - Spanplattenschrauben TX Teilgewinde 4,0x25/30/35/40
Magneten	2x Neodymmagneten (indoor) zusammen 32 kg Tragkraft* 2x Ferrit-Topfmagneten (outdoor) zusammen 16 kg Tragkraft* - Schutzkappe
Kleben	Montagekleber
Halterung	Externe Halterung - extra Schutz vor Vandalismus und Zerstörung

ZUBEHÖR

Artikel Code	Beschreibung	Enthalten
APOQ-SCREW-DIN912-25	2 Mal DIN912 M4x25 Schraube aus Edelstahl V2A/A2	Enthalten
APOQ-GLUE	Montagekleber	Auf Anfrage/nicht enthalten
APOQ-HOLD	Externe Halterung, die über vier Schrauben extra befestigt werden kann. Der Sensor wird mit 2 Schrauben in die Halterung eingeschraubt.	Nicht enthalten
APOQ-MAG-NEO	2 Mal Neodytopfmagnet, Haftkraft 32 kg inkl. 2 Schrauben	Nicht enthalten
APOQ-MAG-FE	2 Mal Ferritopfmagnet, Haftkraft 32 kg inkl. 2 Schrauben	Nicht enthalten
APOQ-MAG-COVER	Anti-Rutsch Abdeckung für Ferritmagneten, sichert gegen verrutschen des Sensor	Nicht enthalten
APOQ-SCREW-ISO7380-25	Sicherheitsschraube ähnl. ISO7380 mit Linsenkopf und Torx+Pin Antrieb M4x25 aus Edelstahl V2A/A2	Nicht enthalten

VERSIONEN

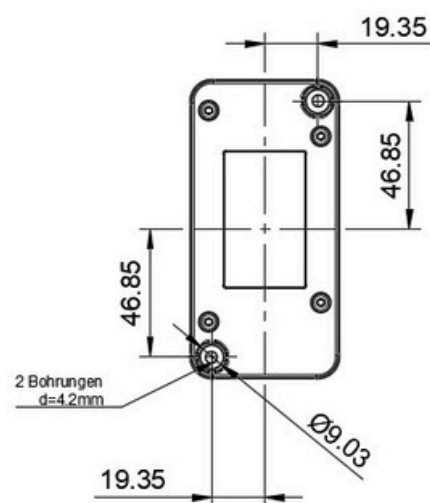
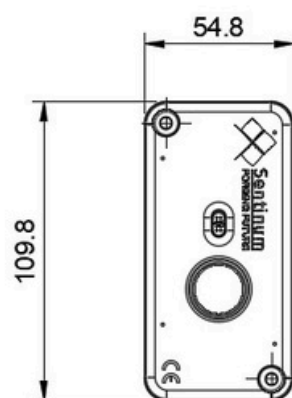
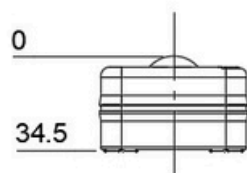
Artikel Code	Kommunikation	Sensorik
APOQ-LOEU-T	LoRa™	Optisch
APOQ-LOEU-R	LoRa™	Radar
APOQ-LOEU-TR	LoRa™	Optisch und Radar
APOQ-NB-T	NB-IoT, LTE-CATM1	Optisch
APOQ-NB-R	NB-IoT, LTE-CATM1	Radar
APOQ-NB-TR	NB-IoT, LTE-CATM1	Optisch und Radar

* Annahme unter perfekten Bedingungen

APOLLON-Q

TECHNICAL DATASHEET

ZEICHNUNG SENSOR



Beschreibung der Payload



Ultraschall-Funksensor
WILSEN.sonic.distance
WS-UC*-F406-B41-*-02-Y

PEPPERL+FUCHS



Support: fa-info@pepperl-fuchs.com
Internet: www.pepperl-fuchs.com

Allgemeine Hinweise zum Betrieb von WILSEN-Geräten in einer LoRaWAN-Umgebung

Rejoin

Ein WILSEN-Gerät führt einen Rejoin (= Neuansmeldung beim LoRa-Netzwerk-Server (LNS)) im laufenden Betrieb "nur bei Bedarf" aus. Hierzu sind im Gerät entsprechende Erkennungsmechanismen aktiv, die feststellen, wenn keine Verbindung mehr zum LNS besteht. In diesen Fällen wird vom WILSEN ein Rejoin selbstständig durchgeführt.

Unconfirmed/Confirmed Messages

Standardmäßig sind die WILSEN-Geräte auf "unbestätigte Nachrichtenübertragung" (unconfirmed messaging) eingestellt. Durch diese Art der Übertragung wird das LoRa-Netzwerk geringstmöglich belastet. Wenn in Ihrer Anwendung eine gesicherte Nachrichtenübertragung erforderlich ist, können Sie die Art der Nachrichtenübertragung im WILSEN-Gerät auf "bestätigt" (confirmed) ändern. Details hierzu finden Sie im betreffenden Handbuch Ihres WILSEN-Geräts. Dies können Sie über www.pepperl-fuchs.com von der Produktdetailseite herunterladen.

Downlink/Steuerbarkeit über LoRa

Bei den WILSEN-Geräten handelt es sich um LoRa-Klasse-A Geräte. Neben der typischen Übertragung der Uplink-Nachrichten ist das Gerät in der Lage, vom LNS kommende Downlink-Nachrichten anzunehmen und zu verarbeiten. Die dabei vom Gerät unterstützten Befehle können Sie der separaten Dokumentation "WILSEN Downlink Beschreibung" entnehmen. Diese können Sie über www.pepperl-fuchs.com von der Produktdetailseite herunterladen.

Generelle Struktur einer LoRaWAN-Payload

Die generelle Struktur einer LoRaWAN-Payload sieht wie folgt aus:

Commands of physical Layer	Commands of MAC layer	Application Payload	MIC of MAC Layer	CRC of physical layer
----------------------------	-----------------------	---------------------	------------------	-----------------------

Struktur der Applikationsnutzdaten				
Application Data Package 1	ADP2	ADP3	...	ADPn

Länge	Einzigartige Kennung (UUID)	Daten
0x06	0x0201	0x41C567C9

Inhalt eines Application Data Packages

Das WILSEN-Gerät stellt seine Messwerte und Informationen über drei verschiedene Payloads zur Verfügung.

Payload 1

Die Payload 1 beinhaltet die Sensormesswerte (exkl. GPS-Positionsdaten) und wird typischerweise in allen Anwendungen verwendet, in denen keine GPS-Positionsdaten benötigt werden.
Die Übertragung der Payload 1 und ihre Häufigkeit werden über die Einstellungen im „Untermenü LoRaWAN Konfiguration“ der WILSEN-App festgelegt (siehe betreffendes Handbuch für WILSEN-Gerät).

Länge der Payload: 20 Bytes

Aufbau der Application Data Payload:

ADP1	ADP2	ADP3	ADP4
Abstandswert in mm / Gewässerpegel in mm *	Amplitude (0 ... 255)	Temperatur in °C	Batteriezustand

* ADP1 enthält je nach Sensoreinstellung entweder den Abstandswert in mm oder den Gewässerpegel in mm. Die beiden Werte können anhand ihrer UUID (siehe folgende Tabelle) unterschieden werden.

Der folgenden Tabelle können Sie Details zu den einzelnen Data Packages entnehmen:

Einzigartige Kennung UUID (16bit)	Data Package Bezeichnung	Datentyp	Datenlänge (Byte)	Zusätzliche Informationen
0x0B02	proxx_mm	uint16	2	Abstandswert in mm
0x0B08	water_body_level_mm	uint16	2	Gewässerpegel in mm
0x0B07	amplitude	uint8	1	Amplitude (0 ... 255)
0x0201	temp_celcius	float	4	Temperatur in °C
0x5101	battery_vol	uint8	1	Batteriezustand: Wert wird in Volt/10 bereitgestellt

Ein Beispiel für diese Payload sieht wie folgt aus:

04 0B 02 01 AB 03 0B 07 FF 06 02 01 41 00 00 00 03 51 01 23

Abstandswert in mm	Amplitude	Temperatur in °C	Batteriezustand
--------------------	-----------	------------------	-----------------

Hinweis

Wenn sich ein Objekt innerhalb der Blindzone des Ultraschallsensors befindet, werden in der Payload die folgenden Werte übertragen:

- Abstandswert: 0 mm bzw. Gewässerpegel: maximaler Wert des Gewässerpegels in mm
- Amplitudenwert: 0

Wenn sich kein Objekt im Erfassungsbereich des Ultraschallsensors befindet, werden in der Payload die folgenden Werte übertragen:

- Abstandswert: 65535 mm bzw. Gewässerpegel: 0 mm
- Amplitudenwert: 0

Payload 2

Die Payload 2 beinhaltet die Sensormesswerte inkl. GPS-Positionsdaten und wird typischerweise in allen Anwendungen verwendet, in denen zusätzlich zu den Sensormesswerten auch die GPS-Positionsdaten erforderlich sind. Die Payload 2 kann zusätzlich oder auch anstelle von Payload 1 verwendet werden.

Die Übertragung der Payload 2 und ihre Häufigkeit werden über die Einstellungen im „Untermenü GPS Konfiguration“ der WILSEN-App festgelegt (siehe betreffendes Handbuch für WILSEN-Gerät).

ADP1	ADP2	ADP3	ADP4	ADP5	ADP6
Abstandswert in mm / Gewässerpegel in mm *	Amplitude (0 ... 255)	Temperatur in °C	Batteriezustand	Geografischer Breitengrad	Geografischer Längengrad

* ADP1 enthält je nach Sensoreinstellung entweder den Abstandswert in mm oder den Gewässerpegel in mm. Die beiden Werte können anhand ihrer UUID (siehe folgende Tabelle) unterschieden werden.

Länge der Payload: 34 Bytes

Aufbau der Application Data Packages:

Einzigartige Kennung UUID (16bit)	Data Package Bezeichnung	Datentyp	Datenlänge (Byte)	Zusätzliche Informationen
0x0B02	proxx_mm	uint16	2	Abstandswert in mm
0x0B08	water_body_level_mm	uint16	2	Gewässerpegel in mm
0x0B07	amplitude	uint8	1	Amplitude (0 ... 255)
0x0201	temp_celcius	float	4	Temperatur in °C
0x5101 0x5001	battery_vol latitude	uint8 int32	1 4	Batteriezustand: Wert wird in Volt/10 bereitgestellt
				Geografischer Breitengrad: Dezimalwert in Breitengradwert/1000000
0x5002	longitude	int32	4	Geografischer Längengrad: Dezimalwert in Längengradwert/1000000

Ein Beispiel für diese Payload sieht wie folgt aus:

04 0B 02 01 AB 03 0B 07 FF 06 02 01 41 01 99 9A 03 51 01 22 06 50 02 00 7D 21 78 06 50 01 02 F1 C3 DF

Hinweis

Wenn sich ein Objekt innerhalb der Blindzone des Ultraschallsensors befindet, werden in der Payload die folgenden Werte übertragen:

- Abstandswert: 0 mm bzw. Gewässerpegel: maximaler Wert des Gewässerpegels in mm
- Amplitudenwert: 0

Wenn sich kein Objekt im Erfassungsbereich des Ultraschallsensors befindet, werden in der Payload die folgenden Werte übertragen:

- Abstandswert: 65535 mm bzw. Gewässerpegel: 0 mm
- Amplitudenwert: 0

Wenn das Gerät keine gültige GPS-Position erfassen konnte, werden in der Payload die folgenden Werte übertragen:

- Längengrad: 0.000000
- Breitengrad: 0.000000

Payload 3

Unabhängig von Payload 1 oder 2 wird vom Sensor zusätzlich die Payload 3 („Heartbeat“) alle 24 Stunden übertragen. Die Payload 3 enthält Informationen zum Sensor in Form der Zählerstände für die Häufigkeiten der Ultraschallmessungen, der LoRa-Übertragungen, der GPS-Positionsbestimmungen, sowie des Batteriezustands.

Diese Payload ist wie folgt aufgebaut:

ADP1	ADP2	ADP3	ADP4	ADP5
P+F Seriennummer	Zählerstand LoRa- Übertragungen	Zählerstand GPS- Positionsbestimmungen	Zählerstand Ultraschallmessungen	Batteriezustand

Länge der Payload: 38 Bytes

Aufbau der Application Data Packages:

Einzigartige Kennung UUID (16bit)	Data Package Bezeichnung	Datentyp	Datenlänge (Byte)	Zusätzliche Informationen
0x2A25	SerialNr	uint8(14)	14	P+F Seriennummer, ASCII-kodiert
0x3102	lora_count gps_count	uint16	2	Zählerstand LoRa-Übertragungen: Anzahl der LoRa-Übertragungen
				Zählerstand GPS-Positions- bestimmungen: Anzahl der durchge- führten GPS-Positionsbestimmungen
0x3103	us_sensor_count	uint32	4	Zählerstand Ultraschallmessungen: Anzahl der durchgeführten Ultraschall- messungen
0x5101	battery_vol	uint8	1	Batteriezustand: Wert wird in Volt/10 bereitgestellt.

Ein Beispiel für diese Payload sieht wie folgt aus:

10 2A 25 34 38 30 30 30 30 30 36 32 38 37 38 33 04 31 01 07 01 04 31 02 03 22 06 31 03 00 00 0F 1C 03 51 01 23

Hinweis

Diese Payloadübertragung ist nicht veränderbar. Selbst bei abgeschalteten LoRa- und GPS-Übertragungsintervallen wird diese Payload als Lebenszeichen (=Heartbeat) des Sensors übertragen. Für die Übertragung der Payload 3 wird der gleiche Nachrichtentyp und ggf. die gleiche Anzahl an Übertragungen verwendet, wie diese beiden Parameter im WILSEN für die Übertragung der Payload 1 gesetzt sind.



Downlink-Beschreibung

Für Ultraschall-Funksensoren der Serie
WILSEN.sonic

WS-UC*-F406-B41-*-02-*

PEPPERL+FUCHS



Support: fa-info@pepperl-fuchs.com
Internet: www.pepperl-fuchs.com

Allgemeine Hinweise

Was ist ein Downlink-Kanal?

Der Downlink-Kanal ist in einem LoRaWAN-Netzwerk üblicherweise die Fernzugriffsmöglichkeit eines LoRa-Netzwerkserver auf im Netzwerk angemeldete Geräte. Über den Downlink-Kanal können Parameterwerte und Einstellungen im Gerät abgefragt oder geändert werden.

Welche Voraussetzungen gelten für einen Gerätezugriff über den Downlink-Kanal?

- Der LoRaWAN Netzwerk Service Provider muss die LoRaWAN-Funktion „Downlink“ unterstützen.
 - Bei dem Gerät, auf das zugegriffen werden soll, handelt es sich um ein WILSEN-Gerät mit Firmware Version 2.3.10 oder höher.
- Der Downlink-Kanal ist im WILSEN-Gerät aktiviert (Werkseinstellung).

Wann sind WILSEN-Geräte für Downlink-Nachrichten empfangsbereit?

Bei den WILSEN-Geräten handelt es sich um LoRa-Klasse-A Geräte. Das bedeutet, sie sind nicht dauerhaft empfangsbereit für Downlink-Nachrichten. Downlink-Nachrichten können lediglich innerhalb eines kurzen Zeitintervalls nach jeder Uplink-Nachricht dieser Geräte empfangen werden. Deshalb werden Downlink-Nachrichten für ein spezifisches Gerät auf dem LoRa-Netzwerkserver in eine Warteschlange gestellt. Wenn es sich dann mit einer Uplink-Nachricht beim LoRa-Netzwerkserver meldet, werden die Downlink-Nachrichten an dieses Gerät geschickt. Die Übertragung von Downlink-Nachrichten ist somit im gleichen Intervall möglich, in dem das Gerät seine Messwerte per Uplink-Nachricht an den LoRa-Netzwerkserver überträgt.

Welche Befehle werden vom WILSEN-Gerät bei Downlink-Nachrichten unterstützt?

Prinzipiell unterstützt das WILSEN-Gerät alle Befehle und Parameter, die auch über die App im Zugriff für den Nutzer sind. Lediglich die LoRaWAN-Kommunikationsparameter (DevEUI, AppEUI und AppKey) können nicht via Downlink verändert werden.

Eine Übersicht der entsprechenden Befehlskodes und Parameterwerte für Downlink-Nachrichten finden Sie im Folgenden dieses Dokuments.

Details zu den einzelnen Parametern finden Sie im betreffenden Handbuch Ihres WILSEN-Geräts. Dieses können Sie über www.pepperl-fuchs.com von der Produktdetailseite herunterladen.

Wie verifiziere ich, ob die Downlink-Nachricht vom WILSEN-Gerät empfangen und korrekt verarbeitet wurde?

IndenWerkseinstellungen sind die WILSEN-Geräte so parametrisiert, dass sie eine Bestätigungsnachricht („Acknowledge“) auf empfangene Downlink-Nachrichten an den LoRa-Netzwerkserver schicken. Der Inhalt dieser Bestätigungsnachricht besteht entweder aus den angefragten Parameterwerten und/oder spiegelt die empfangenen, neu gesetzten Parameterwerte zurück. Ungültige Befehle und Befehle mit ungültigen Parameterwerten fehlen in der Bestätigungsnachricht. Auf diese Weise kann vom Anwender sehr einfach verifiziert werden, ob die Nachricht angekommen ist und ob alle darin enthaltenen Befehle vom WILSEN-Gerät ausgeführt / verarbeitet werden konnten. Im Fall einer bereits sehr starken Auslastung des LoRaWAN-Netzwerks, kann das Senden der Bestätigungsnachricht in den WILSEN-Geräten abgewählt werden. In diesem Fall erhält der Anwender keinerlei direkte Bestätigung des Empfangs der Downlink-Nachricht. Wurden Parameterwerte wie beispielsweise Mess- oder Sendeintervalle geändert, ist dies dennoch indirekt über nunmehr in diesem neuen Intervall kommende Uplink-Nachrichten ersichtlich.

Hinweis

Informieren Sie sich über die geltenden Regeln und Grenzen für Downlink-Nachrichten für Ihr LoRaWAN-Netz und halten Sie diese ein. Details hierzu erhalten Sie bei Ihrem Gateway-Hersteller bzw. LoRa-Netzwerkserver-Anbieter.

Länderspezifische Beschränkungen der zulässigen Sendezeit („Air time“) für Downlink-Nachrichten sind einzuhalten!

Wie bei der maximal zulässigen Sendezeit („Air time“) von 1% pro Stunde pro LoRaWAN-Gerät für Uplink-Nachrichten, gibt es länderspezifische zeitliche Beschränkungen auch für das Senden von Downlink-Nachrichten je LoRaWAN-Gateway. Die Einhaltung der gesetzlich geregelten, maximal zulässigen Sendezeit („Air time“) für Downlink-Nachrichten je Gateway wird üblicherweise direkt auf Gateway-Ebene sichergestellt. Die dabei je nach Gateway-Hersteller gesetzten Grenzen und Regeln variieren jedoch und sind teilweise strenger als die gesetzlichen Vorgaben. Ferner setzt ggf. auch der LoRa-Netzwerkserver-Anbieter weitere, teils engere Regeln und Vorgaben hierfür an.

Generelle Struktur einer LoRaWAN-Downlink-Payload

Die generelle Struktur einer LoRaWAN-Downlink-Payload besteht immer aus den 3 Teilen:

- **Length:** Gibt die Information an, wie viele nachfolgende Bytes zu diesem Befehl gehören.
- **ID:** Kennzeichnet den auszuführenden Befehl oder den zu ändernden Parameter.
- **Value:** Enthält den zu diesem Parameter/Befehl zugehörigen Wert, sofern ein solcher für das entsprechende Kommando erforderlich ist.

Diese Struktur wiederholt sich für jedes Kommando bzw. jeden Parameter. Mehrere Befehle können in eine Downlink-Payload gepackt und somit in einer Downlink-Nachricht an das WILSEN-Gerät geschickt werden. Dabei darf die Gesamtlänge der Downlink-Payload 51 Byte nicht überschreiten.

Beispiel

Die Hex-Werte-Folge 03F30101 steht für den Befehl „Setze den Nachrichtentyp auf ‚bestätigt‘“.

Die Hex-Werte-Folge 04F3030C00 steht für den Befehl „Setze den Spreading Factor auf ‚SF12‘“.

Zusammengestellt zu einer Downlink-Payload ergibt sich die Hex-Werte-Folge 03F3010104F3030C00. Diese wird mit nur einer Downlink-Nachricht an das WILSEN-Gerät übertragen.

Vorgehensweise für das Senden einer Downlink-Nachricht an ein WILSEN-Gerät

Hinweis

Stellen Sie sicher, dass der Downlink-Kanal im WILSEN-Gerät aktiviert ist (Werkseinstellung). Die Prüfung ist mit Hilfe der WILSEN-App auf einem Mobilgerät möglich.

Befolgen Sie nachfolgende Schritte für eine Übertragung einer Downlink-Nachricht an ein WILSEN-Gerät in Ihrem LoRaWAN-Netz:

1. Überprüfen Sie mit Hilfe der WILSEN-App, ob der „Downlink-Kanal“ aktiviert ist.
2. Bauen Sie über Bluetooth eine Verbindung zum entsprechenden WILSEN-Gerät auf
3. Wechseln Sie nach dem Verbindungsaufbau in das Menü „LoRaWAN Konfiguration“ und prüfen Sie den Parameter „Downlink Kanal“. Dieser muss eingeschaltet sein.

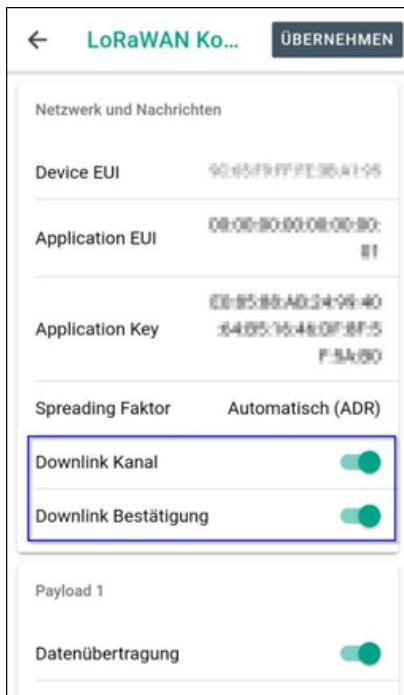


Abb. 1 WILSEN App

Hinweis

Wir empfehlen auch die „Downlink Bestätigung“ eingeschaltet zu haben. Durch die vom WILSEN-Gerät bereitgestellte Bestätigungsnachricht sind der korrekte Empfang und die korrekte Verarbeitung des Downlink-Kommandos leicht nachvollziehbar.

4. Stellen Sie den Inhalt Ihrer Downlink-Nachricht zusammen, in Abhängigkeit davon was im WILSEN-Gerät abgefragt oder geändert werden soll.

Hinweis

Zu diesem Zweck stellt Ihnen Pepperl+Fuchs den kostenfreien Web Service „LoRaWAN Downlink Support“ unter <https://wilsen-services.pepperl-fuchs.com/> zur Verfügung. Die Nutzung und die Möglichkeiten dieses Web Services werden im Kapitel „Verwendung des Pepperl+Fuchs „LoRaWAN Downlink Support“ Web Services“ ausführlich beschrieben.

Alternativ können Sie die Downlink-Nachricht auch selbst manuell zusammenstellen. Die dazu erforderlichen Informationen finden Sie in den beiden Kapiteln „Generelle Struktur einer LoRaWAN-Downlink-Payload“ und „Zur Verfügung stehende Befehle und Parameter“.

5. Wählen Sie in Ihrem LoRa-Netzwerk das oder die Geräte aus, die diese Nachricht erhalten sollen.
6. Stellen Sie die generierte Downlink-Nachricht in die Warteschlange.

Hinweis

Details zur Vorgehensweise finden Sie in den Support-Unterlagen Ihres LoRaWAN-Netzanbieters. Für einige LoRaWAN-Netzanbieter bietet auch der Pepperl+Fuchs Web Service „LoRaWAN Downlink Support“ eine

entsprechende Unterstützung an. Details hierzu finden Sie in Kapitel „Verwendung des Pepperl+Fuchs „LoRaWAN Downlink Support“ Web Services“.

- Die Downlink-Nachricht wird nun über den LoRa-Netzwerkserver automatisch an das jeweilige Gerät übertragen, wenn sich dieses das nächste Mal mit einer Uplink-Nachricht meldet.

Verwendung des Pepperl+Fuchs „LoRaWAN Downlink Support“ Web Services

Die Verwendung des von Pepperl+Fuchs kostenfrei zur Verfügung gestellten LoRaWAN Downlink Support“ Web Services unter <https://wilson-services.pepperl-fuchs.com/>, bietet sich für die gelegentliche oder spontane Nutzung des Downlink-Features an.

Soll die automatische Generierung und der Versand von Downlink-Nachrichten in eine Applikationsumgebung dauerhaft eingebunden werden, finden Sie die dafür nötigen Informationen in den Kapiteln:

- „Generelle Struktur einer LoRaWAN-Downlink-Payload“
- „Zur Verfügung stehende Befehle und Parameter“

Der „LoRaWAN Downlink Support“ Web Service beinhaltet die folgenden Funktionen:

- Einfache Zusammenstellung der Downlink-Nachricht durch direktes Anwählen der gewünschten Befehle.
 - Kopieren der erstellten Nachricht zwecks anschließendem Einfügen und Versand über die Downlink-Sendefunktion Ihres LoRa-Netzwerkserver.
 - Alternativ direkter Versand der Downlink Nachricht aus dem Tool heraus. Unterstützt werden derzeit die Plattformen „TheThingsNetwork (TTN)“ und „ChirpStack (in Version 3 und 4)“.
- Payload-Decoder zur Decodierung der vom WILSEN übermittelten Bestätigungsnachricht als Antwort auf die Downlink-Nachricht

Abb. 2 "LoRaWAN Downlink Support" Web Service

Nr.	Kurzbeschreibung	Erläuterung
1	Zusammenstellen der Downlink-Nachricht	Hier stellen Sie durch Auswahl der gewünschten Parameter Ihre Downlink-Nachricht zusammen. Der Aufbau des Menüs entspricht dem Menü in der WILSEN App und beinhaltet alle via Downlink steuerbaren oder abfragbaren Sensorparameter. Beschreibungen zu den Parametern finden Sie im Handbuch zu Ihrem WILSEN Gerät. ✓ Durch Klicken öffnet sich der betreffende Menüweig. ✓ Ein Anhaken des gewünschten Parameters und – falls erforderlich – Eingabe des gewünschten Wertes, führt zum Hinzufügen dieses Befehls in die Downlink-Nachricht.

		 Durch Klicken auf das Mülltonnen-Symbol werden alle in diesem Menüzeig ausgewählten Parameter wieder abgewählt und aus der Downlink-Nachricht entfernt.
2	Erstellte Downlink-Payload steht hier zum Kopieren bereit	 Nach Abschluss Ihrer Zusammenstellung klicken Sie auf das Symbol, um die zusammengestellte Downlink-Nachricht in den Zwischenspeicher Ihres Computers zu kopieren. Anschließend können Sie sie in der Downlink-Sendefunktion Ihres LoRa-Netzwerksservers einfügen und darüber an die gewünschten Geräte versenden.
3	Direkter Versand der Downlink-Nachricht aus dem Web Service heraus	Alternativ zum Versand über die Downlink-Sendefunktion Ihres LoRa-Netzwerksservers können Sie den Versand auch direkt aus dem „LoRaWAN Downlink Support“ Web Service heraus vornehmen. Derzeit werden die Plattformen „TheThingsNetwork“ oder „Chirpstack (V3 oder V4)“ unterstützt, zukünftig können weitere Plattformen hinzukommen. 1. Wählen Sie zunächst Ihre verwendete LoRa-Netzwerkplattform aus der Liste „Network“ aus. 2. Tragen Sie anschließend die für die jeweilige Plattform nötigen Angaben ein, z. B. Domain und API Key. Hinweis Die Erstellung des API Key für den Fernzugriff auf Ihre LoRa-Netzwerkplattform ist von Plattform zu Plattform unterschiedlich. Deshalb befindet sich hinter  how to guide ein spezifischer Link, der Ihnen für die gewählte Plattform erläutert, wie Sie den API Key erstellen. 3. Nach Eingabe aller für das Netzwerk relevanten Daten, werden Ihnen unter „Devices“ alle in Ihrem Netzwerk im Zugriff befindlichen Geräte angezeigt. Wählen Sie aus dieser Liste das oder die Geräte aus, die die zusammengestellte Downlink-Nachricht erhalten sollen 4. Drücken Sie abschließend auf die Schaltfläche „Push“   Dadurch wird die Nachricht an Ihren LoRa-Netzwerkserver übermittelt und in dessen Warteschlange zum Versand an das oder die gewählten Geräte gestellt. Sollten Sie ggf. noch in der Warteschlange befindliche Downlink-Nachrichten für ein spezifisches Gerät ersetzen wollen, so übermitteln Sie die zu sendende Nachricht an den LoRa-Netzwerkserver statt mit „Push“ über die Schaltfläche „Replace“ .
4	Downlink Reply Decoder	Diese Funktion hilft Ihnen, die von Ihrem WILSEN-Gerät gesendete Bestätigungsnachricht einfach zu decodieren, die als Antwort auf Ihre Downlink-Nachricht gesendet wurde. Öffnen Sie einfach diese Funktion und geben Sie die empfangene Antwortnachricht per Copy & Paste ein. Klicken Sie anschließend auf "DECODE". Danach wird der Inhalt der Antwortnachricht in Klartext angezeigt.
5	Hell- / Dunkel-Modus	Schalten Sie hier die Anzeige des „LoRaWAN Downlink Support“ Web Service zwischen Hell- oder Dunkel-Modus um.

Zur Verfügung stehenden Befehle und Parameter

Um die automatische Generierung und/oder den Versand spezifischer Downlink-Nachrichten in Ihre Applikationsumgebung dauerhaft einbinden zu können, finden Sie hier detaillierte Payload-Informationen.

Beachten Sie darüber hinaus die im Kapitel „Generelle Struktur einer LoRaWAN-Downlink-Payload“ zur Verfügung gestellten weiteren Informationen.

In den folgenden Tabellen finden Sie die dazu nötigen Hexadezimalwerte für „Length“, „ID“ und „Value“ aller zur Verfügung stehenden Befehle, gegliedert nach Befehlsgruppen.

Ultraschallsensor-Konfiguration

Befehl / Parameter	Length [hex]	ID [hex]	Value [hex]
Abfrage aller Ultraschall-Parameter	02 03	F400	
Schallkeulenbreite		F401	- FE (schmal) - FD (mittel) - FC (breit) - 37 (benutzerdefiniert)
Abfrage: „Schallkeulenbreite“	02	F401	- 05 (normal)
Benutzerdefinierte Ultraschallpulslänge	03	F402	- 03 (kurz) - 10 (sehr kurz)
Abfrage: „Benutzerdefinierte Ultraschallpulslänge“	02	F402	
Benutzerdefinierte Sendeleistung	03	F403	- 3F (hoch) - 28 (mittel) - 0C (niedrig)
Abfrage: „Benutzerdefinierte Sendeleistung“	02	F403	
Benutzerdefinierte Empfindlichkeit	03	F404	- 3F (maximal) - 33 (sehr hoch) - 30 (hoch) - 26 (mittel) - 1B (niedrig) - 0F (minimal)
Abfrage: „Benutzerdefinierte Empfindlichkeit“	02	F404	
Distanzwert für „Voll (100%)“ [mm]	04	F405	Hinweis: Parameter nur bei WILSEN.sonic.level Geräten vorhanden! UCC2500: 0096 (150 = min.) .. 09C4 (2500 = max.) UCC4000: 00FA (250 = min.) .. 0FA0 (4000 = max.) UC7000: 01F4 (500 = min.) .. 1B58 (7000 = max.)
Abfrage: Distanzwert für „Voll (100%)“	02	F405	Hinweis: Parameter nur bei WILSEN.sonic.level Geräten vorhanden!
Distanzwert für „Leer (0%)“ [mm]	04	F406	Hinweis: Parameter nur bei WILSEN.sonic.level Geräten vorhanden! UCC2500: 0096 (150 = min.) .. 09C4 (2500 = max.) UCC4000: 00FA (250 = min.) .. 0FA0 (4000 = max.) UC7000: 01F4 (500 = min.) .. 1B58 (7000 = max.)
Abfrage: Distanzwert für „Leer (0%)“	02	F406	Hinweis: Parameter nur bei WILSEN.sonic.level Geräten vorhanden!

Pegelmessung von Gewässern	03	F40E	Hinweis: Parameter nur bei WILSEN.sonic.distance Geräten ab Firmware Version 2.5 vorhanden! - 01 (aktiviert) - 00 (deaktiviert)
Abfrage: „Pegelmessung von Gewässern“	02	F40E	Hinweis: Parameter nur bei WILSEN.sonic.distance Geräten ab Firmware Version 2.5 vorhanden!
Distanz zum Gewässergrund [mm]	04	F40F	Hinweis: Parameter nur bei WILSEN.sonic.distance Geräten ab Firmware Version 2.5 vorhanden! UCC2500: 0096 (150 = min.) .. C350 (50000 = max.) UCC4000: 00FA (250 = min.) .. C350 (50000 = max.) UC7000: 01F4 (500 = min.) .. C350 (50000 = max.) Hinweis: Parameter nur bei WILSEN.sonic.distance Geräten ab Firmware Version 2.5 vorhanden! - 01 (aktiviert) - 00 (deaktiviert)
Abfrage: „Distanz zum Gewässergrund [mm]“	02	F40F	Hinweis: Parameter nur bei WILSEN.sonic.distance Geräten ab Firmware Version 2.5 vorhanden! - 01 (aktiviert) - 00 (deaktiviert)
Messsequenz	03	F407	- 01 (Mittelwertbildung) - 02 (2)
Abfrage: „Messsequenz“	02	F407	- 03 (3)
Auswertemethode	03	F408	- 04 (4)
Abfrage: „Auswertemethode“	02	F408	- 05 (5)
Messwerte pro Sequenz	03	F409	- 06 (6) - 07 (7) - 08 (8) - 09 (9) - 0A (10) - 0064 (100 ms) - 03E8 (1 s) - 2710 (10 s) - EA60 (1 min)
Abfrage: „Messwerte pro Sequenz“	02	F409	
Im Abstand von [ms]	04	F40A	Hinweis: Parameter nur bei WILSEN.sonic.level Geräten vorhanden! - 01 (aktiviert) - 00 (deaktiviert)
Abfrage: „Im Abstand von“	02	F40A	
Anwendungsfilter	03	F40B	Hinweis: Parameter nur bei WILSEN.sonic.level Geräten vorhanden! Hinweis: Parameter nur bei WILSEN.sonic.level Geräten vorhanden! - 01 (Containerbefüllung) Hinweis: Parameter nur bei WILSEN.sonic.level Geräten vorhanden!
Abfrage: „Anwendungsfilter“	02	F40B	
Nachbearbeitungsfilter	03	F40C	Hinweis: Parameter nur bei WILSEN.sonic.level Geräten vorhanden! Hinweis: Parameter nur bei WILSEN.sonic.level Geräten vorhanden!
Abfrage: „Nachbearbeitungsfilter“	02	F40C	- 01 (1) - 02 (2)
Zusätzliche Messungen	03	F40D	- 03 (3) - 04 (4) - 05 (5) - 06 (6) - 07 (7) - 08 (8) - 09 (9)

			- 0A (10)
Abfrage: „Zusätzliche Messungen“	02	F40D	Hinweis: Parameter nur bei WILSEN.sonic.level Geräten vorhanden!

GPS-Konfiguration

Befehl / Parameter	Length [hex]	ID [hex]	Value [hex]
Abfrage aller GPS-Parameter	02 03	F200	
GPS Positionserfassung	02	F201	- 01 (aktiviert)
Abfrage: „GPS Positionserfassung“	03	F201	- 00 (deaktiviert)
GPS Genauigkeit		F204	Hinweis: Parameter erst ab Firmware Version 2.5 verfügbar! - 01 (Eco-Modus) - 02 (Präzisions-Modus) Hinweis: Parameter erst ab Firmware
Abfrage: „GPS Genauigkeit“	02	F204	Version 2.5 verfügbar! - 00000708 (30 min)
Erfassungsintervall [s]	06	F202	- 00000E10 (1 h) - 00001C20 (2 h) - 00002A30 (3 h) - 00003840 (4 h) - 00005460 (6 h) - 00007080 (8 h) - 0000A8C0 (12 h) - 0000FD20 (18 h) - 00015180 (24 h) Hinweis: Parameter erst ab Firmware
Abfrage: „Erfassungsintervall“	02	F202	Version 2.5 verfügbar!
Nachrichtentyp	03	F205	- 00 (unbestätigt) - 01 (bestätigt) Hinweis: Parameter erst ab Firmware Version 2.5 verfügbar!
Abfrage: „Nachrichtentyp“	02	F205	Hinweis: Parameter erst ab Firmware Version 2.5 verfügbar!
Anzahl Übertragungen	03	F206	-01 (1) -03 (3) Hinweis: Parameter erst ab Firmware Version 2.5 verfügbar!
Abfrage: „Anzahl Übertragung“	02	F206	-0000003C (1 min) -0000012C (5 min) -00000258 (10 min)
Nächste Erfassung [s]	06	F203	
Abfrage: „Nächste Erfassung“	02	F203	

LoRaWAN-Konfiguration

Befehl / Parameter	Length [hex]	ID [hex]	Value [hex]
Abfrage aller LoRa-Parameter	02 04	F300	
Spreading Faktor		F303	- FFFF (Automatisch - ADR) - 07FF (7 – fix) - 08FF (8 – fix) - 09FF (9 – fix) - 0AFF (10 – fix) - 0BFF (11 – fix) - 0CFF (12 – fix)
Abfrage: „Spreading Faktor“	02	F303	
Downlink Kanal	03	F307	- 00 (deaktiviert) - 01 (aktiviert) Hinweis: Wird der Downlink-Kanal deaktiviert, werden vom Sensor ab diesem Zeitpunkt keine Downlink-Nachrichten mehr angenommen und verarbeitet. Der Sensor ist somit via Downlink nicht mehr erreichbar. Der Downlink-Kanal kann ausschließlich vor Ort über die WILSEN App und die Bluetooth-Schnittstelle wieder aktiviert werden.
Abfrage: „Downlink Kanal“	02	F307	- 00 (deaktiviert)
Downlink Bestätigung	03	F308	- 01 (aktiviert)
Abfrage: „Downlink Bestätigung“	02	F308	- 01 (aktiviert)
Datenübertragung	03	F304	- 00 (deaktiviert)
Abfrage: „Datenübertragung“	02	F304	- 00000258 (10 min)
Übertragungsintervall [s]	06	F305	- 00000384 (15 min) * - 00000708 (30 min) - 00000E10 (1 h) - 00001C20 (2 h) - 00002A30 (3 h) - 00003840 (4 h) - 00005460 (6 h) - 00007080 (8 h) - 0000A8C0 (12 h) - 0000FD20 (18 h) - 00015180 (24 h) * Hinweis: Dieser Übertragungsintervallwert ist erst ab Firmware Version 2.5 in den Geräten vorhanden! - 00 (unbestätigt) - 01 (bestätigt)
Abfrage: „Übertragungsintervall“	02	F305	
Nachrichtentyp	03	F301	Hinweis: Der hier gewählte Nachrichtentyp gilt für die Übertragung von „Payload 1“ und „Payload 3“. - 01 (1) - 03 (3)
Abfrage: „Nachrichtentyp“	02	F301	
Anzahl Übertragungen	03	F302	Hinweis: Die hier gewählte Anzahl Übertragungen gilt für die Übertragung von „Payload 1“ und „Payload 3“. - 0000003C (1 min) - 0000012C (5 min) - 00000258 (10 min)
Abfrage: „Anzahl Übertragungen“	02	F302	
Nächste Übertragung [s]	06	F306	

Abfrage: „Nächste Übertragung“	02	F306
--------------------------------	----	------

Gerätekonfiguration

Befehl / Parameter	Length [hex]	ID [hex]	Value [hex]
Abfrage aller Geräte-Parameter	02 03	F100	
Bluetooth	02	F101	-01 (aktiviert)
Abfrage: „Bluetooth“	12	F101	-00 (deaktiviert)
Gerätename	02	F102	-16 Bytes Text
Abfrage: „Gerätename“	02	F102	
Zähler zurücksetzen	02	F103	
Rücksetzen auf Werkseinstellungen (inkl. Passwort)	22	F104	
Passwort ändern		F105	SHA-256 Hash-Wert abgeleitet von der Passwort-Zeichenfolge

Hinweis

Für die Berechnung des SHA-256 Hash-Werts stehen im Internet zahlreiche Hash-Generatoren zur Verfügung. Nachfolgend finden Sie exemplarisch die Standardpasswort-Zeichenfolge `00000000` und den dazugehörigen SHA-256 Hash-Wert [hex]:

SHA-256(`00000000`) = 7E071FD9B023ED8F18458A73613A0834F6220BD5CC50357BA3493C6040A9EA8C

Geräteinformationen

Befehl / Parameter	Length [hex]	ID [hex]	Value [hex]
Abfrage aller Geräteinformationen	02 02 02 02	F500	
Abfrage: „Teilenummer“	02	F501	
Abfrage: „Hardware Version“		F502	
Abfrage: „Firmware Version“		F503	
Abfrage: „Seriennummer“		2A25	

WILSEN Sensors

New firmware version 2.5.11 with feature extensions available

Document ID	TDOCT-9796_ENG
Firmware version	2.5.11
Publication date	2025-04-10

Modifications

- This firmware update is mainly relevant for WILSEN.sonic devices that currently run with firmware V2.3.xx.
- All other device types (i.e. WILSEN.valve and WILSEN.node) were already delivered ex-stock having firmware V2.5.10 on board. For those devices only the additional 15 min. transmission interval will be added by this firmware update.
The new firmware V2.5.11 cannot be applied to WILSEN.sonic devices that run on firmware V2.2.xx or older.

The WILSEN firmware V2.5.11 brings some functional add-ons

More precise geo-localization

 add-on for all WILSEN.sonic devices (all other device types have it already)

The **more precise geo-localization** option as known from the WILSEN.valve and WILSEN.node devices is now also available for the WILSEN.sonic.

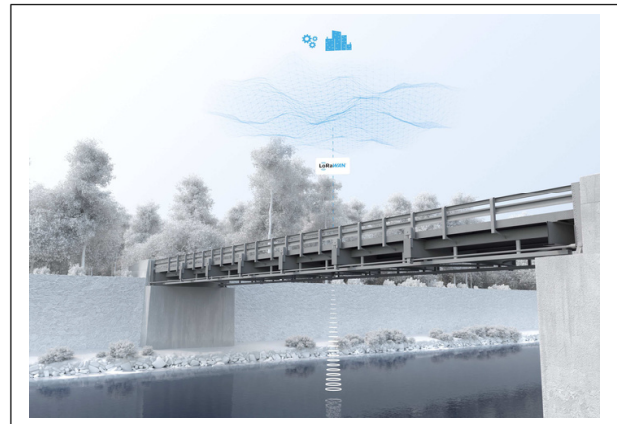
In the GPS settings you can now decide to do the localization in “eco mode” (i.e. with an accuracy of about 75 to 100 m around the actual position – as before) to have the best compromise between geo-localization and battery saving.

Or you can select the new “**precision mode**” with a **very high localization accuracy of 5 to 10 m** around the actual position. This mode consumes more energy from the battery for a localization, but the GPS in general can also be switched on and off via the LoRaWAN downlink channel in case no continuous tracking of the device is needed.

Furthermore, you can now select the transmission settings of Payload-2 (contains measurement data and geo position) independently of the settings for the regular, cyclic Payload-1 transmissions (Payload-1 contains measurement data only).

Additional “15 min.” LoRaWAN Payload-1 transmission interval ⓘ add-on for all WILSEN devices

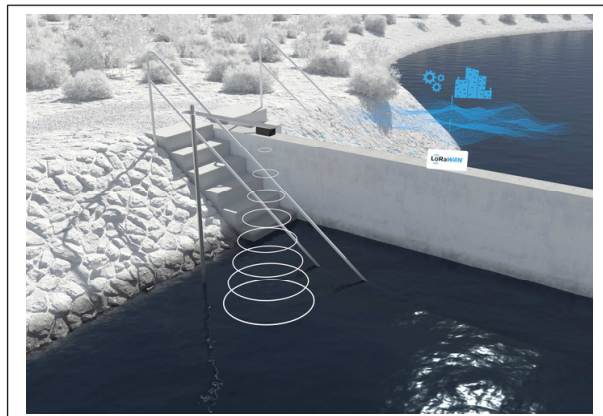
Based on the feedback we got from several customers in the water management industry, we added a **LoRaWAN transmission interval** for Payload-1 of **“15 minutes”** – as it is **requested by the standards in the water management**.



Water body level measurement mode ⓘ add-on for all WILSEN.sonic.distance devices

You are now able to select whether a WILSEN.sonic.distance device provides the distance to a target (as before) or, whether it **directly provides the level of a water body** (like a river, lake, retention basin, etc.).

To do so, just tell the WILSEN.sonic.distance its mounting height above water body ground and it's able to calculate the water body level for you.



To avoid confusion when payload messages from a WILSEN.sonic.distance device are received without knowing which measuring mode is selected, the two possible values can be distinguished based on their UUID in the payload message. Only the value corresponding to the selected measurement mode is included.

In addition, the available payload decoders provide the values in different variables.

Relevance for users / Recommended to update?

If the new functions and modifications are of interest and helpful for you, we recommend to update your devices.

If not, there is no need to update working devices in the field as no hidden improvements or even security updates come along with the new firmware.

Associated products

The update can be applied to the following WILSEN.sonic devices:

Part number	Type code	Device type
70150488	WS-UCC2500-F406-B41-01-02	WILSEN.sonic.level
70150489	WS-UCC2500-F406-B41-01-02-Y	WILSEN.sonic.distance
70150490	WS-UCC4000-F406-B41-01-02	WILSEN.sonic.level
70150491	WS-UCC4000-F406-B41-01-02-Y	WILSEN.sonic.distance
70149230	WS-UC7000-F406-B41-01-02	WILSEN.sonic.level
70149231	WS-UC7000-F406-B41-01-02-Y	WILSEN.sonic.distance

It can also be applied to the following WILSEN.valve and WILSEN.node devices while only the 15 min. LoRa transmission interval is added:

Part number	Type code	Device type
70162453	WS-VAL-2N-F406-B41-01-02	WILSEN.valve
70162454	WS-VAL-2N4-F406-B41-01-02	WILSEN.valve
70162455	WS-VAL-2ZL-F406-B41-01-02	WILSEN.valve
70162456	WS-VAL-4ZL-F406-B41-01-02	WILSEN.valve
70162457	WSN-2N-F406-B41-01-02	WILSEN.node
70162458	WSN-2ZL-F406-B41-01-02	WILSEN.node

How to update

The update of your WILSEN sensor is possible by using the WILSEN mobile app on a mobile device (e.g. smart phone, tablet). The update has to be performed separately for each device.

1. If the mobile app is not yet installed on your mobile device, please enter your app store and search for "WILSEN" from Pepperl+Fuchs. Alternatively you can scan one of the following QR code to find the app in your app store directly:



Google Play Store



Apple App Store

2. Follow the instructions for downloading and installing the app.



Note: Ensure that Bluetooth and the GPS function are enabled and the permissions of the app are not restricted by user. Additionally ensure that your mobile device has access to the internet as this is mandatorily required for the firmware update.

3. Start the app by tapping the app icon.



☐ The 'Device Discovery' of the WILSEN app appears. One by one the available devices in Bluetooth range are listed.



Note: By entering the desired device name or parts thereof, you can reduce the devices displayed on the list to match the search.

4. Tap on the desired device name in the list to connect it to the app.
(In case the default device name was not changed, it is "WILSENxxxxxxxx" where the "x"s are the last 10 digits of the device's serial number. This allows usually an easy identification of the desired device.)

5. Within 30 s enter the default password 00000000 when commissioning a new device or the valid password for an already known device and confirm with 'OK'.

☐ The app switches to the 'Sensor Status & Configuration' menu which displays current sensor values and provides access to the sensor settings.

6. Select 'Device Information' by tapping on the text.

7. Choose 'Firmware Update' by tapping on it.

8. Read and confirm the hints provided before the update starts.

☐ The firmware update is downloaded to and afterwards processed on your WILSEN device. This can take up to several minutes.



Caution: Ensure that your mobile device does not enter 'sleep mode' or is turned off until the firmware update is completed!

☐ After the firmware update the WILSEN device is automatically rebooted. A few seconds later it will be visible in the 'Device Discovery' of the WILSEN mobile app again.



Note: As long as not stated differently in the information about the new firmware version, all sensor parameters remain unchanged and the device will continue to work as parameterized before the update.

Support

For support, please contact your local Pepperl+Fuchs sales representative.