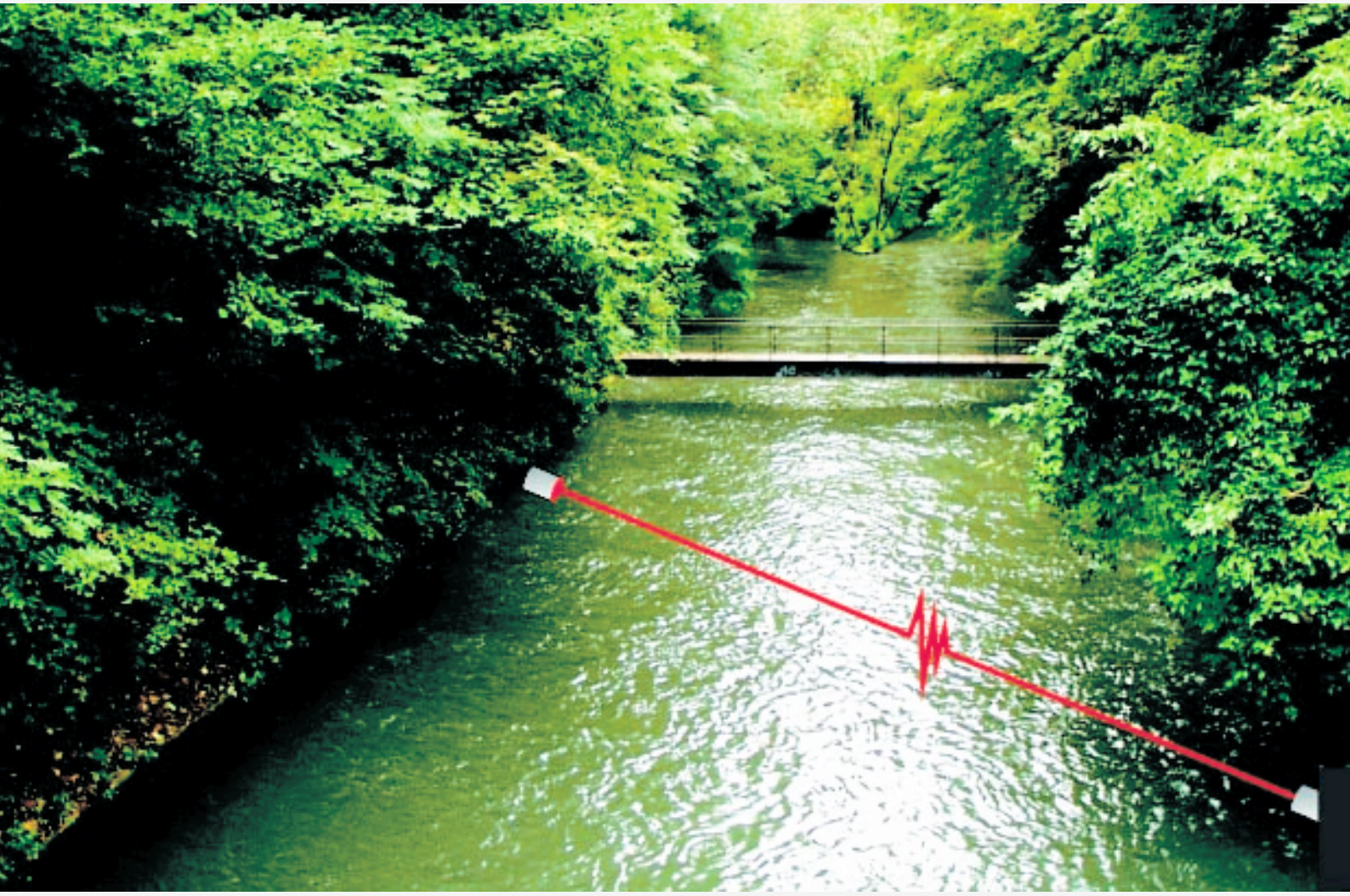
OTT HYDROMETRIE



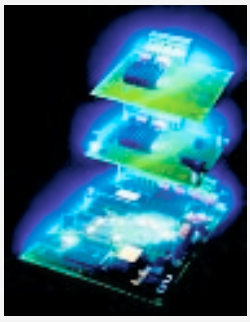
An ultrasonic system for discharge measurement of open channel flow locations using differential ultrasound transit time and side looking doppler (back-up) methods

Sonicflow

'Sonicflow' intelligent evaluation card with integrated lightning protection and DSP processor
– Compact, modular design

Ultrasonic transducer
The transducer casing is designed for easy adjustment both horizontally and vertically: this allows to align the transducers accurately in relation to each other.

Sonicflow

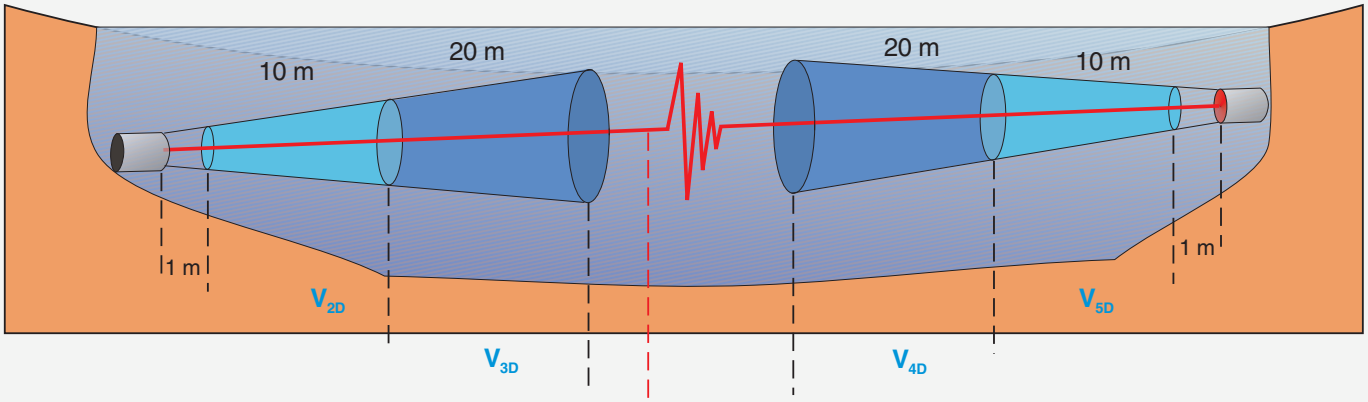


Sonicflow is a new ultrasonic measurement system from OTT designed to continuously log the flow velocity v in open channels. While developing the new Sonicflow system, OTT was able to draw on years of experience involving over 100 installations of the tried and tested AFFRA system.

Unlike conventional systems, the Sonicflow incorporates two measurement procedures. During normal operation, flow velocity is calculated using the differential ultrasound transit time method. However, if the channels contains a high concentration of suspended matter or dissolved oxygen, the Sonicflow switches automatically to Doppler operation. This enables discharge measurements to be carried out reliably and accurately even under difficult conditions (e.g. floods).

The Sonicflow system exploits innovative technology for signal processing and calculation of flow velocity. This technology is based on an intelligent digital signal processor (DSP) featuring very high measuring accuracy. In addition, it allows differential ultrasound propagation time measurements to be carried out even if the water level above the ultrasonic transducer is low.

Besides conventional applications, the Sonicflow system can also be used for:
- **Tidal areas, river mouths (backflow, changing flow directions)**
- **Reliable flow monitoring (industrial channels) e.g. in hydro power stations, pulp and paper, etc.**
- **Exact quantity measurement and monitoring of irrigation canals**



Doppler method
Measurement volume 1 = V_{d1}
Measurement volume 2 = V_{d2}

Doppler method
Measurement volume 3 = V_{d3}
Measurement volume 4 = V_{d4}

Differential ultrasound transit time method VL

Measurement

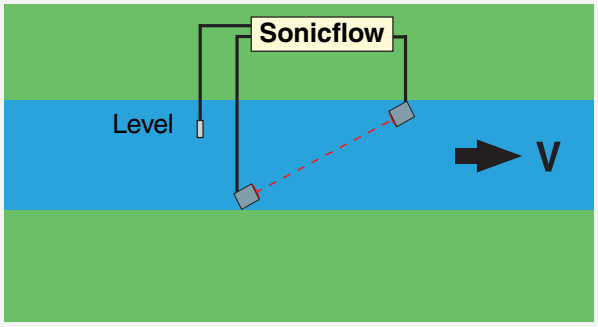
The Sonicflow measures flow velocities first by means of the differential ultrasound transit time method and then using the Doppler method. In both measurement procedures, the passive ultrasonic transducers act as transmitters and receivers.

Example: Single-path arrangement

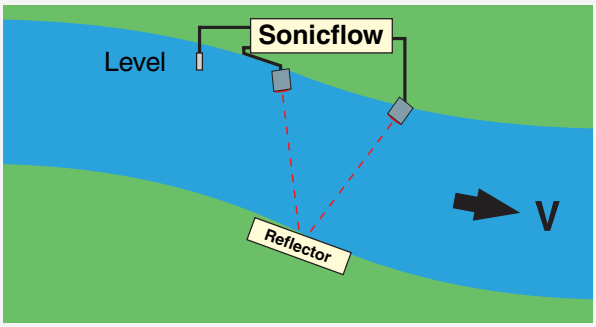
Differential ultrasound transit time method
An acoustic signal is transmitted at a particular angle so that it is simultaneously directed both towards and against the main direction of flow. The transit time for the signal transmitted against the main direction of flow is longer than the transit time for the signal transmitted in the main direction of the flow. The resulting time differential is directly proportional to flow velocity v in the measuring path.

Doppler method
In the case of the Doppler method, a bundle of ultrasound beams measures the flow velocities using two fixed measurement volumes (1 ... 10 m and 10 ... 20 m). The transducer generates a short ultrasound pulse at a specific frequency which is propagated along an acoustic signal path. Part of the ultrasound beam is reflected of moving particles in the water (suspended matter, air bubbles) and returned to the transducer at a changed frequency. The change in frequency (Doppler shift) is directly proportional to the flow velocity of the particles.

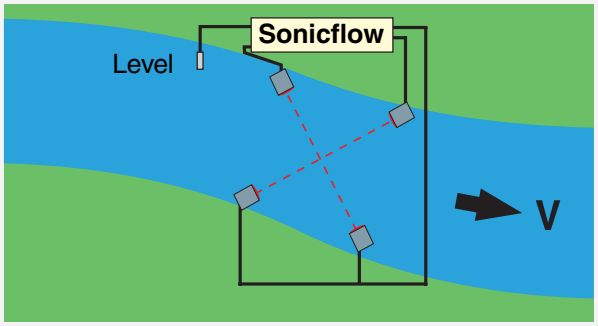
Under normal conditions, the Sonicflow single-path arrangement calculates the mean flow velocity along the entire measuring path. However, if the flow contains a high proportion of suspended matter or dissolved oxygen, the Sonicflow switches automatically to Doppler operation. Accurate measurement of discharge velocity is enabled even in unfavourable conditions (e.g. durings floods) by taking four mean velocities in the measurement volumes.



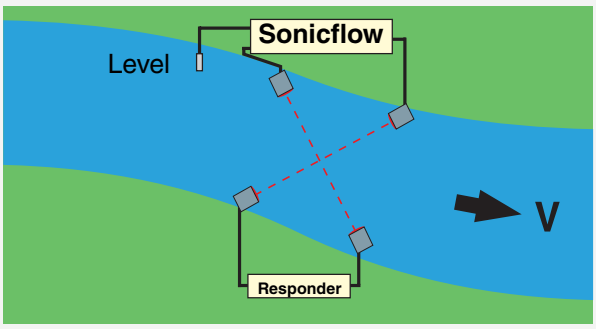
The **"single-path arrangement"** is the simplest type of set-up. It is particularly suitable for use in waters where the flow angle is constant or bi-directional, e.g. in tidal areas.
The water width is the largest measurable value (5 ... 250 m) in this configuration.



The **"single-path-reflector arrangement"** is the preferred choice for waters with difficult inflow conditions and medium water widths (5 ... 20 m). It is also suitable for locations where connecting cables cannot be laid.



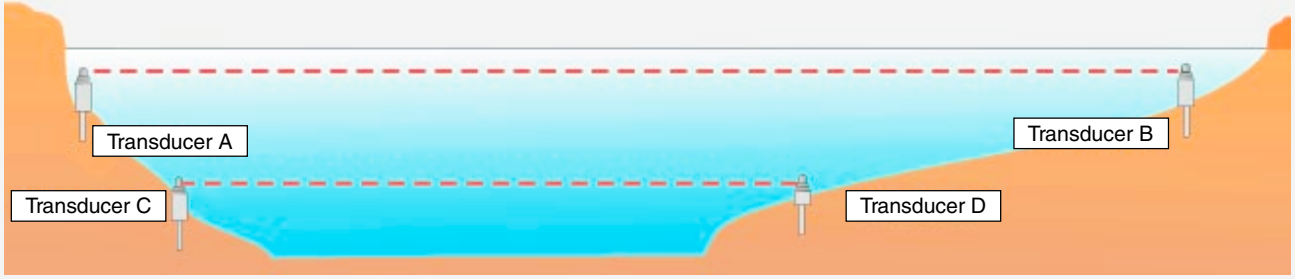
The **"two-path cross arrangement"** is least sensitive to changes in the flow direction.
It is particularly suitable for use in the following cases: Large channel widths (5 ... 250 m) with difficult inflow conditions; river bends; where high accuracy is required.



Where the **"two-path-cross arrangement with responder"** * is used, laying of a connecting cable in or above the body of water is not necessary. This configuration is the preferred choice for waters with difficult inflow conditions, large water widths (5 ... 250 m) or for locations where it is not possible to lay a connecting cable.

Advantages

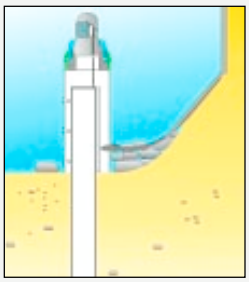
- **Accurate and reliable measurement thanks to the combination of two measurement procedures (differential ultrasound transit time and Doppler methods)**
- **Suitable also for use in low water levels as only minimum coverage of the sensors is necessary**
- **Functional design ensures that the system is user-friendly:**
  - **– Easy to install, operate and maintain**
  - **– No complicated equipment necessary for aligning the transducers exactly in relation to each other**
- **Convenient evaluation software for professional processing and remote transfer of data using a variety of communication methods (serial modem, GSM modem, satellite, etc.)**
- **12 V DC current supply**
  - **– Low current consumption enables operation using rechargeable batteries or solar supply**
- **Integrated lightning protection**
- **Compact, modular system design suitable for numerous applications and different hydrological requirements (e.g. single-path arrangement, multi-plane installation)**



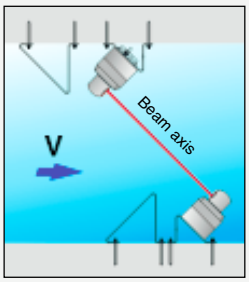
*) "Two-path cross arrangement with responder" currently being developed

Accessories

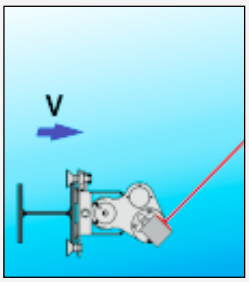
A variety of sensor mountings is available for different station designs



Sensor mounting in waters with **low flow velocities**



Wall mounting
e.g. fixed to a canal wall with a plate for deflecting debris



Mounting attached to a **double T-support** for waters with **high flow velocities**

Reflector for returning the ultrasonic signal ⇒ No laying of cables necessary

NIMBUS

Kalesto

Level sensors for calculating discharge Q are also necessary in addition to the Sonicflow measurement data in respect of the water level **h**. A variety of different sensor types or measurement principles can be used to suit particular requirements. These may include devices such as radar sensors, bubbler systems, pressure probes, shaft encoders, etc.
More detailed information is provided in the relevant product brochures. Water level sensors from other manufacturers may also be installed in the Sonicflow system.
NIMBUS ⇒ for measurement of water level using the bubbler principle. Compact sensor card for installation in the HYDROSENS-MIDI housing. Simple operation, etc.
Kalesto radar sensor ⇒ Non-contact measurement principle; not affected by floating debris; very simple assembly located at a remote position.
Maintenance-free; includes integrated lightning protection.

Evaluation

OTT-LOG
Multichannel-
data logger

Evaluation module for calculating discharge Q from the Sonicflow measurement data and the level.

Buffered roll over memory for up to 400,000 measured values (1 MB)
– Presetting of sample- / storage interval, event-driven recording.

RS 232 interface for directly connecting the Sonicflow HYDROSENS combination to various remote data transfer systems (serial modem / GSM, satellite, radio, etc.).

Additional slots for connecting other sensors (e.g. for measuring conductivity, temperature, precipitation, etc.).

CAN-Bus for attachment to other HYDROSENS modules such as an OTT-COM communication module ⇒ **alarm management** if specified limit values are either exceeded or not met; three additional RS 232 interfaces and a connection to an OTT-S measured value announcer.

HYDROSENS MIDI

Wall housing, IP54 (190 x 250 x 140 mm) for accommodating the Sonicflow / OTT-LOG combination

Optical interface (infrared technology)
On-site readings of OTT-LOG storage values using a notebook/PC or VOTA multifunctional unit.

LC-display for the clearly indication of system- and sensor parameters (observer function).

Operating terminal
A clearly laid-out operating matrix enables rapid and direct configuration on-site of **the data logger and connected sensors** via the integrated touch-sensitve keyboard.

Service

Effective
project management

In addition to our range of measurement equipment (hardware and software), OTT also offers extensive support in the area of project management. OTT can coordinate and execute planning, installation, calibration, servicing and evaluation of the Sonicflow assembly, including data processing. Our **comprehensive range of services is available "under one roof"**, thus making project organisation much easier for users.
With over **125 years experience** in designing and operating hydrometric stations (measurement of discharge, water level etc.) nationally and internationally, OTT has acquired a reputation as an effective and reliable business partner.
Stations installed and set-up by OTT service personnel are ready for **turn-key** operation by the user.
Maintenance contracts can be tailored to suit your individual requirements. **If you would like advice or information, do not hesitate to contact us.**

Technical data

Sonicflow ultrasonic system

Intelligent Sonicflow evaluation card
(Basic card for connecting up to two measuring paths); may be extended with expansion cards to handle a maximum of 8 paths.
European card format 160 x 100 x 60 mm³, for installation in a protective housing (such as the HYDROSENS 'MIDI')

incl.:

RS 485 output
for connection to an external data logger (e.g. OTT-LOG, Logosens, etc.)

Digital signal processor (DSP)
for state-of-the-art signal analysis and exact calculation of transit times. Coded signal transmission possible.
Combined measurement principle which applies equally to operation using either differential ultrasound transit time or the Doppler method (back-up measurement e.g. if a large amount of suspended partical is present).

Integrated overvoltage protection
of sensor inputs (transducer, level sensor)

Temperature range: – 10 °C ... + 60 °C

Channel width: 5 m ... 250 m

Meas. range v: – 10 m/s ... + 10 m/s

Measuring accuracy:
1% of the measured value ± 2 mm/s for a single-path standard installation with path length of 100 m and path angle of 45°

12 V DC / 6.5 Ah current supply
(Rechargeable batteries, solar energy or mains supply)

Ultrasonic transducer (transceiver)
incl. 30 m connecting cable (standard)

Frequency: 250 kHz
Band width: 50%

Transducer mounting for various hydrological requirements consisting of 2" pipe system, concrete wall or double T-support IPB 200 in accordance with DIN 1025
– Easy assembly and alignment
– Accessories

Details on request.

Evaluation

OTT-LOG buffered roll over memory
512 kB for 200,000 measured values (in series) or 1 MB for 400,000 measured values (optional)
– Adjustable sample-/storage interval 1 min ... 24 h
– Event-driven recording (storage delta)
– Simple configuration using clearly-designed operating matrix

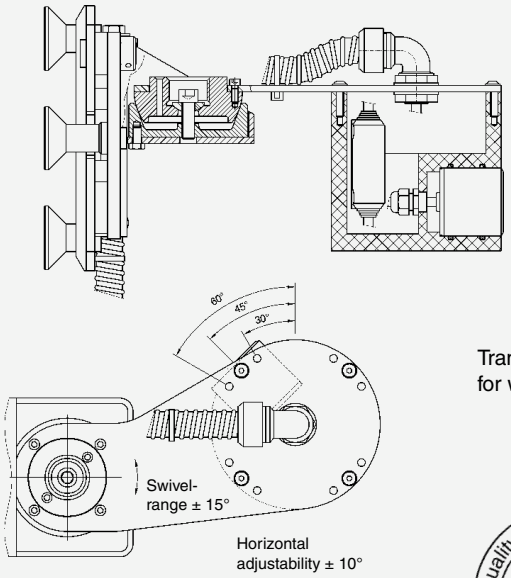
Connection terminals
for additional sensors e.g. to measure level, conductivity, temperature, etc.

Real-time clock

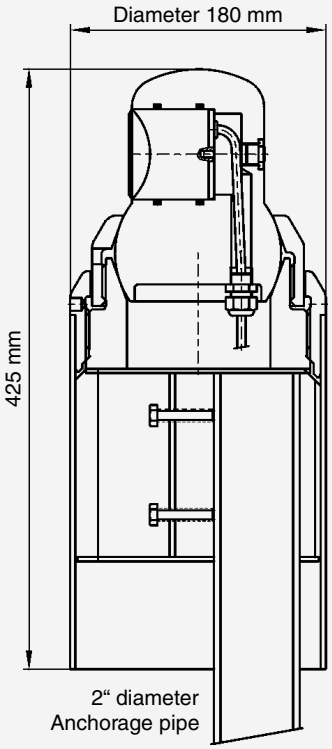
RS 232 interface

CAN-BUS

HYDROSENS 'MIDI' plastic housing
Size: 190 x 250 x 140 mm (L x W x H)
(Other types of housing can be installed as required).
To be fitted on the wall of the enclosure or similar construction; accommodates the following devices, for example:
– Sonicflow evaluation card with expansion cards
– OTT-LOG data logger
– NIMBUS sensor card for calculating water level by means of the bubbler principle



Dimensions



Transducer mounting for waters with low flow velocities v_{max} = 0 ... 3 m/s

Transducer mounting on double T-support for waters with high flow velocities v > 3 m/s

Small design details may be changed without notice.

Delivery program, e.g.:

Pressure Probes
Shaft Encoders
Data Loggers
Remote Data Transmission
Waterlevel Recorders
Current Meters

Please ask for free information

Quality-Management OTT HYDROMETRIE ISO 9001 certificated per ISO 9001

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OTT HYDROMETRIE

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