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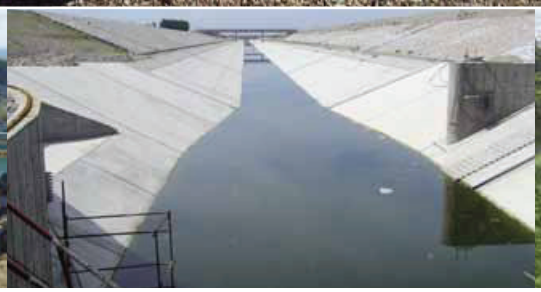
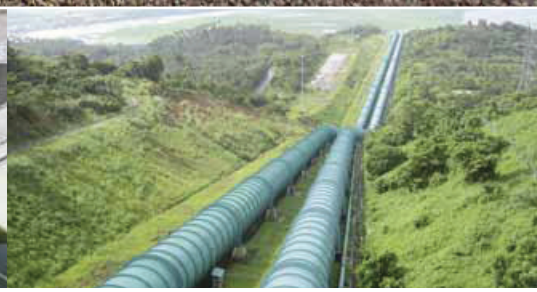
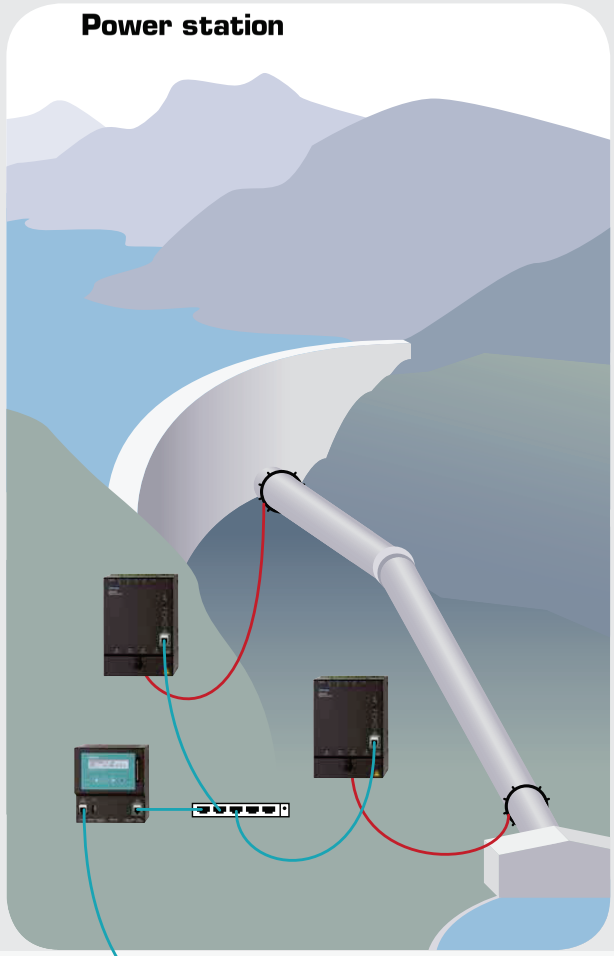


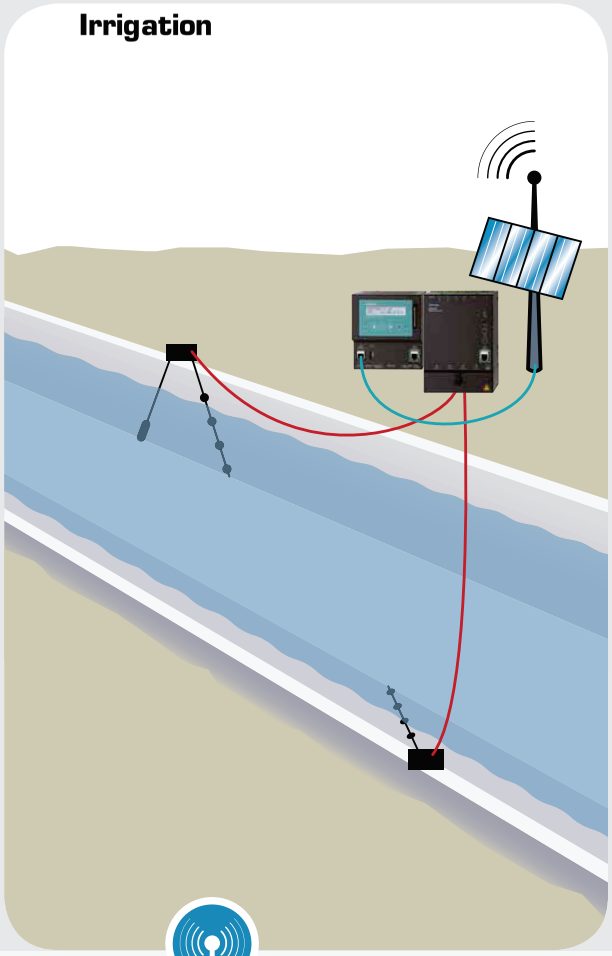


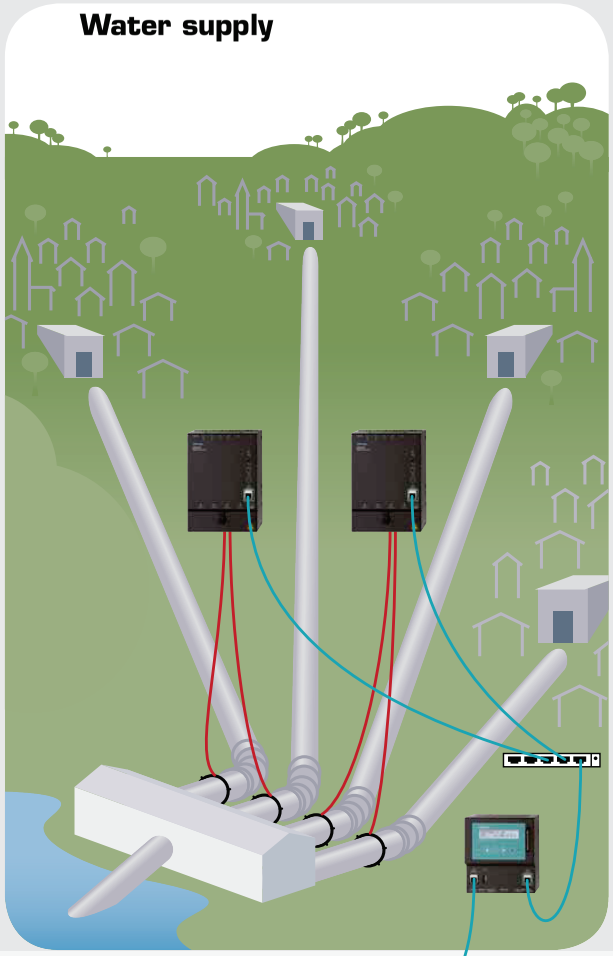
RISONIC modular

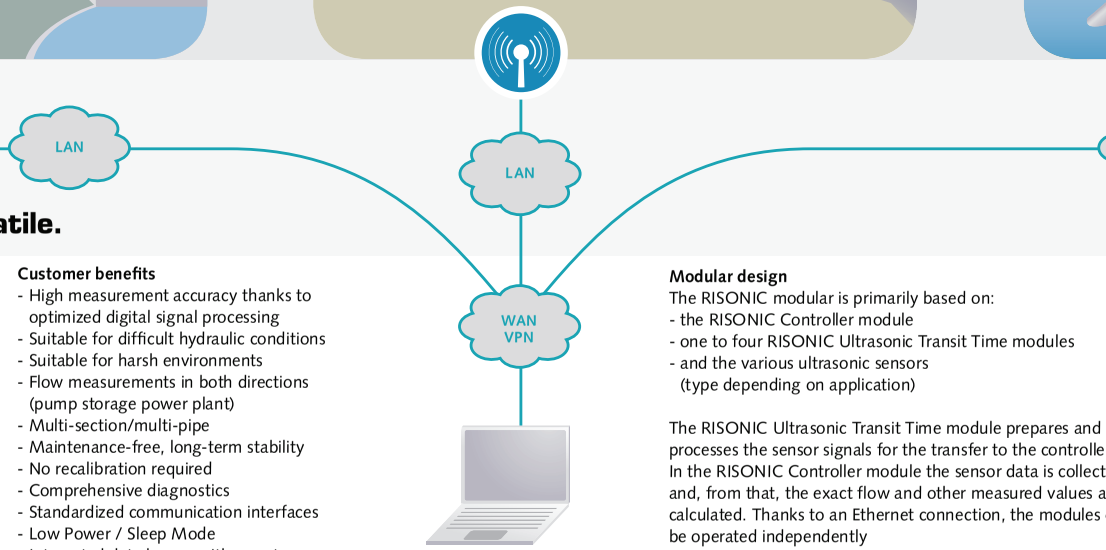
Ultrasonic transit time flow measurement in penstocks and open channels

FLOW CONTROL • PENSTOCK MONITORING • WATER BALANCE • TURBINE/PUMP EFFICIENCY MEASUREMENT









Applications

User-friendly, flexible, and versatile.

The RISONIC modular was developed for flow measurements in filled/partially filled penstocks and open channels. Typical areas of application include water power stations, water utilities, irrigation systems, and cooling water circuits.

Applications
- Flow control
- Water balance
- Penstock monitoring
- Turbine/pump efficiency measurements (IEC 60041, ASME PTC 18)

Customer benefits
- High measurement accuracy thanks to optimized digital signal processing
- Suitable for difficult hydraulic conditions
- Suitable for harsh environments
- Flow measurements in both directions (pump storage power plant)
- Multi-section/multi-pipe
- Maintenance-free, long-term stability
- No recalibration required
- Comprehensive diagnostics
- Standardized communication interfaces
- Low Power / Sleep Mode
- Integrated data logger with remote access via web interface

Modular design
The RISONIC modular is primarily based on:
- the RISONIC Controller module
- one to four RISONIC Ultrasonic Transit Time modules
- and the various ultrasonic sensors (type depending on application)

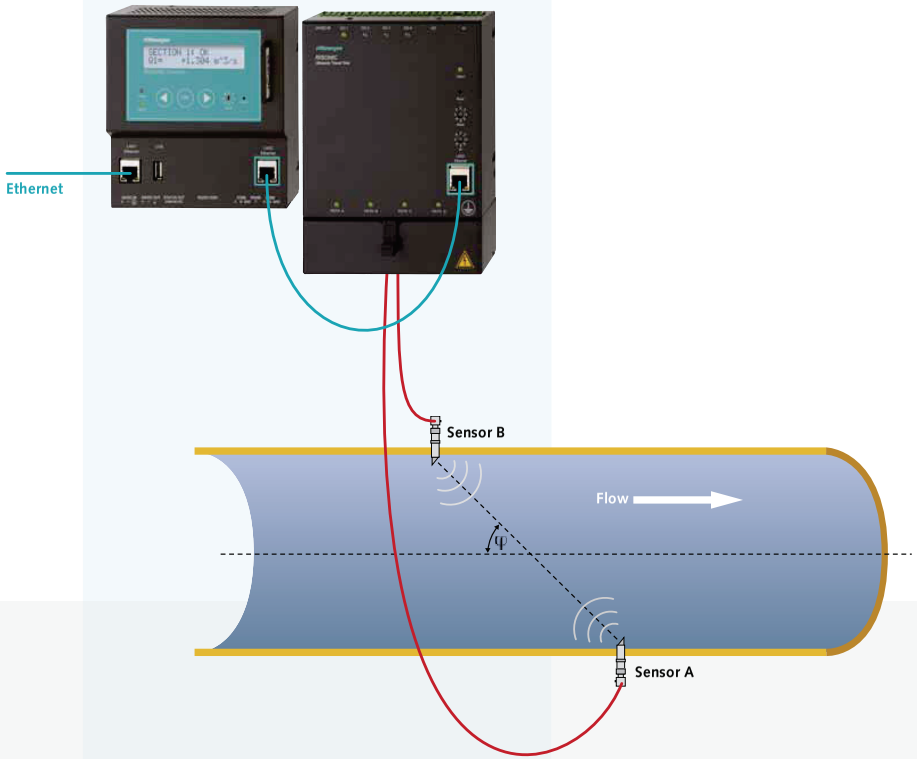
The RISONIC Ultrasonic Transit Time module prepares and pre-processes the sensor signals for the transfer to the controller. In the RISONIC Controller module the sensor data is collected and, from that, the exact flow and other measured values are calculated. Thanks to an Ethernet connection, the modules can be operated independently

User-friendly operation
User-friendly parameter configuration and operation.
- Integrated intuitive user interface
- Illuminated LCD
- Automatic measured value display
- Menu tree for manual queries and maintenance
- Web interface for the parameter configuration and remote access

Functional description

Ultrasonic transit time method

The sensors A and B alternate as sender and receiver. With a voltage impulse a piezo-ceramic oscillator is excited. The ultrasonic impulse spreads out through the medium to be measured.
The opposite site receives the impulse, converts it into an electric signal and analyzes it. A sound wave spreads out faster in the direction of the flow than against it. The RISONIC modular measures the transit time tAB and tBA. The transit time difference (tAB – tBA) of the two ultrasonic waveforms is directly proportional to the mean path velocity of the medium. From the mean path velocity in conjunction with the pipe geometry the flow can be determined.



One-path measuring arrangement

Multi-path measuring arrangement

Multi-path measuring arrangement with crossed paths

Under difficult hydraulic conditions a multi-path measuring arrangement can improve the measuring accuracy.

Specifications

Measuring accuracy	Up to 0.5% of the measured value display (depending on the number of measuring paths, hydraulic conditions and the geometric parameters, such as path angle, path length, and their accuracy at the measuring point).
Max. number of measuring paths	16
Max. number of ultrasonic modules	4
Number of measuring paths per ultrasonic module	1 to 4 measuring paths in a multitude of different path arrangements
Max. number of measuring points	4
Pipe diameter	0.3 to 20m (with a path angle of 45°)
Channel width	0.75 to 100 m (with a path angle of 45°)
Flow speed	±20 m/s
Ultrasonic module to sensor distance	max. 300 m with 1 MHz sensors max. 500 m with 500 kHz sensors max. 1,000 m with 200 kHz sensors
Controller module interfaces	- LAN1: Ethernet 10/100 BaseT, USB 1.1 host, Compact Flash card - COM1: RS232, COM2: RS485, COM3: RS485 - Status relay
Ultrasonic module interfaces	- 1 analog output, 1 analog input (4 … 20 mA) - 4 relay outputs
Power supply	24 VDC (19.2 … 30 V)
Power consumption	Controller module: < 10 W Ultrasonic module: < 5 W Sleep Mode: < 0.5 W
Overvoltage protection	Integrated
Safety class	IP 20 on DIN rail IP 65 in field unit
Operating temperature range	-20 to +70 °C
Storage temperature	-40 to +85 °C
Device dimensions (H, W, D)	Controller module: 147 x 146 x 64 mm Ultrasonic module: 184 x 147 x 52 mm
Weight	Controller module: approx. 1.1 kg Ultrasonic module: approx. 1.3 kg
Installation options	- Attached to DIN rail TS 35 in the control cabinet - Built into field unit IP65

Factors impacting the measuring accuracy:
- Method to determine the transit times and differential transit times
- Accuracy of the geometric data of the measuring arrangement
- Integration method to calculate the flow based on path velocity and geometric data

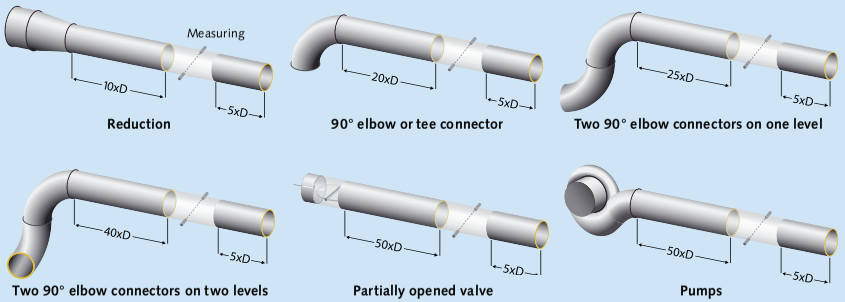
Contamination factors
Contamination (typically quartz sand) in the water dampens the ultrasonic impulse, and, in extreme cases, makes a valid measurement impossible. The damping factor depends on the ultrasonic frequency, temperature, and particle properties. The RISONIC modular is equipped with an automatic amplification control to be able to react to contamination in the water.
Changes in the water composition can be recognized by monitoring the ultrasonic waveforms. Projection tools developed by Rittmeyer enable range estimates, provided that the water composition is known.

Engineering

Efficient tools and methods

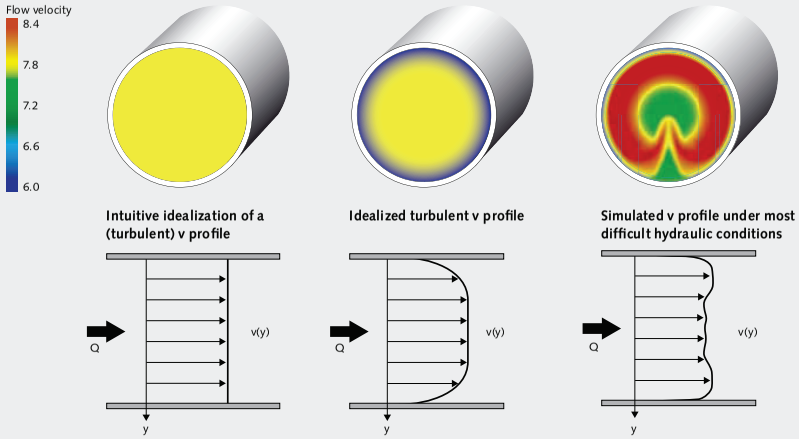
For the applicable measuring arrangement the following customer-specific and plant-specific factors are decisive:
- Pipe geometry incl. obstructions
- Measuring purpose
- Measuring accuracy requirements

Rules of thumb for calming sections (left-to-right flow) for a 1-path measurement and 1% accuracy.



In a first step the most ideal installation site under the given conditions is determined. Then, in consideration of the above-mentioned factors, the measuring arrangement and orientation is configured. Multi-path measuring arrangements can have shorter calming sections.

Subsequently, a suitable integration method for calculating the flow is selected based on the hydraulic conditions. These methods provide the sensor positions and the weighting of the individual measuring paths. Depending on the severity of the hydraulic conditions and the accuracy requirements, a variety of integration methods is available.



Integration method

For pipes (round):	Gauss-Jacobi	OWICS (Optimal Weighted Integration for Circular Sections)	OWISS (Optimal Weighted Integration for Simulated Sections)
For pipes (rectangular):	Gauss-Legendre	OWIRS (Optimal Weighted Integration for Rectangular Sections)	

For extremely severe hydraulic conditions Rittmeyer provides CFD (Computational Fluid Dynamics) simulation services. The CFD simulation supports the selection of an optimal installation site, the orientation of the measuring paths and the integration. Furthermore, from the simulation the measuring accuracy can be estimated.

Installation/commissioning

Field-proven

Other important prerequisites for first rate flow measurements are the professional installation of the sensors at the theoretically defined positions, the professional determination of the cross-sectional area of the pipe at the measuring point, and measuring the exact positions of the installed sensors.

Determining the sensor positions

Measuring method with theodolite

Drilling the sensor holes

Do-it-yourself sensor installation
For the sensor installation performed by the customer Rittmeyer provides a wide range of helpful marking and installation tools.

Precision installation
In order to meet the highest accuracy demands Rittmeyer recommends a precision installation performed by our experienced staff. To determine the geometric dimensions at the measuring point Rittmeyer uses a theodolite with integrated interferometer and laser pointer attachment for distance measurements.

Scope of services
- Determining the pipe cross-sectional areas
- Determining the installation sites for the sensors
- Sensor installation
- Re-measuring the installed sensors
- Sensor wiring
- Defining safety measures against excess pressure and mechanical damage
- Parameter configuration of the measuring device
- Commissioning
- Testing
- Customer training
- Maintenance

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Networked, international, performance-oriented

Rittmeyer develops, manufactures and installs instrumentation and process control system solutions for the water and energy sector. Founded in 1904, Rittmeyer has commissioned more than 20,000 installations to date. With 8 subsidiaries, a sales and representative office and agencies in over 25 countries we are active worldwide.

Thanks to state-of-the-art technology, world class expertise and highest quality we provide our customers with reliable, precise and tailored solutions.

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