



Hydropower

Water supply

Wastewater

Irrigation



# FLOW MEASUREMENT

Pioneers in sustainable energy and water management



# Ready for the future

The world's population is growing beyond 8 billion and with it the global demand for electricity and water.

## Integrated solutions from a single source

Efficient and sustainable use of water resources is more important than ever before – now and for the generations to come.

With more than 100 years of expertise in high-end instrumentation solutions for demanding applications, Rittmeyer has contributed to a sustainable environment for generations and is an acknowledged partner in the worldwide industry for efficient, sustainable and economic management of water and energy resources.

Rittmeyer is a leading provider of advanced and high-end solutions and is offering a state-of-the-art instrumentation portfolio alongside proven engineering, installation, commissioning and after-sales services.



Andreas Borer, CEO



« Passion, expertise & experience – customers can rely on us at any time! »

## Quick facts

- Founded in 1904
- Headquarters in Baar (Switzerland)
- Global presence with subsidiaries and partners
- More than 20 000 installations worldwide
- Member of the BRUGG Group

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Rittmeyer flow measurement systems are extremely precise and durable also under tough conditions. Their versatility allows for a broad range of smart applications.

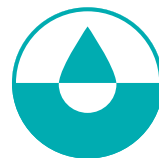
## Your benefits

- **Efficiency** – higher return on investment
- **Predictive maintenance** – lower operation costs
- **Safety** – responsible care & peace of mind
- **Sustainability** – responsible consumption and production



## Hydropower

Flow measurement in pipes, tunnels, and channels (from head to tail race) for large-down to micro-scale hydropower plants including pumped storage and run-of-river.



## Wastewater

Flow measurement in discharge pipes for cleaned water to be released for human consumption or industrial and environmental use.



## Water supply

Flow measurement in various waterways for the versatile water industry. From rivers, to large channels, down to small pipes, total flow calculation is made easy to ensure the efficient transportation and distribution management.



## Irrigation

Flow measurement in water conveyance networks of surface channels or canals, tunnels or pipes to monitor agricultural water supply, consumption, pump performance, drainage, etc.

# Importance of flow measurement

Flow measurement enables efficient, ecological and sustainable management of water resources and increases safety for people and environment – topics ever more important on the agenda of humanity.

## Typical applications

The fields of application for flow measurements in hydro-power, water supply, irrigation, and wastewater are versatile:

- Efficiency monitoring and optimization
- Water consumption monitoring & billing
- Protection of tunnel and pipe systems
- Water transportation and distribution management
- Early detection of leakages to avoid ruptures & losses
- Residual water management
- Regulatory and statistical purposes
- ... and many more



## Filled pipes

A wide range of filled pipes in different shapes and dimensions are in use.

Rittmeyer provides highest accuracies in all situations:

- Exposed, buried, conduit, horseshoe and gallery pipes
- Diameters from 0.08m to a theoretical maximum of 52 m



## Partially filled pipes

Typical applications with partially filled pipes are measurements in tunnels or sewage drains.



## Open channels and rivers

For water supply and irrigation purposes, open channels with a wide range of dimensions and profiles are in use. Rittmeyer provides solutions for widths of up to 130m.



# Measurement methods

Different measurement methods can be used to determine flow:

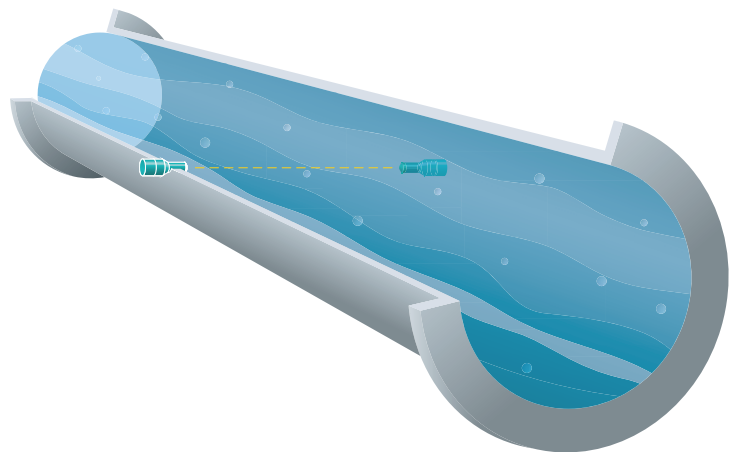
- Direct method with ultrasonic signal processing, absolute measurement
- Indirect method with linearization curves and level transmitters, relative measurement

## Ultrasonic transit time method

This method requires at least one pair of ultrasonic transducers to form an ultrasonic path which measures the flow velocity of water and calculates the flow and volume information. The average water flow velocity along the path is measured by emitting and receiving ultrasonic pulses, in both forward and reverse direction of the flow. Using more than one ultrasonic path substantially enhances the system accuracy.

Two types of transducers are available:

- Intrusive transducers that are in direct contact with water
- Non-intrusive clamp-on transducers that are not in contact with water



### Benefits

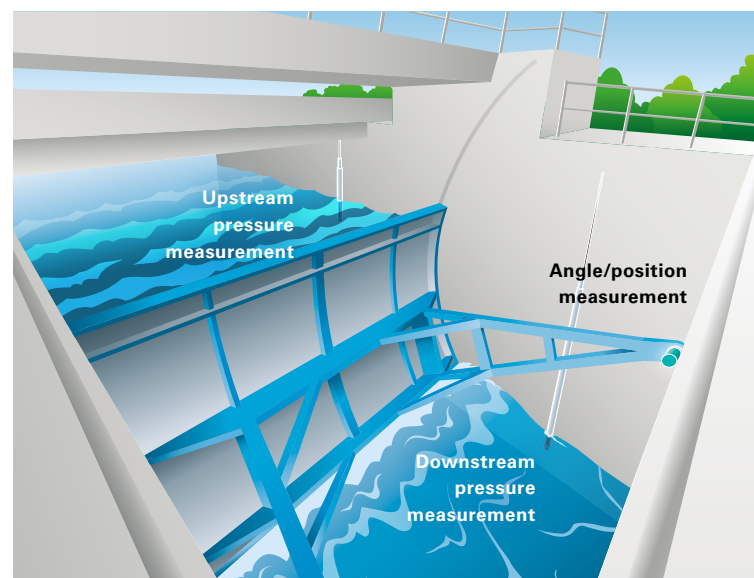
- Wide range of pipe diameters of up to 52 meters
- Wide range of open channel widths of up to 130 meters
- High accuracy of up to 0.5 % in the field and 0.2 % under ideal conditions
- High flexibility for configurations such as crossed/non-crossed setups, up to 20 paths per measurement section, different plane angles, etc.
- Drift-free and long-term stability
- Easy to retrofit into existing, even third-party installations
- No moving parts

## Gate discharge method

By measuring the exact angle or position of a gate, the open flow-through area below the gate can be determined. Combined with the measurement of one or two water level values before and after the gate, the flow rate can be calculated.

### Benefits

- Cost-efficient discharge measurement solution
- Expandable to an automatic gate control, e.g. for flood protection or minimal ecological flow
- Usable for remote installations with no SCADA integration
- Robust and easy to install



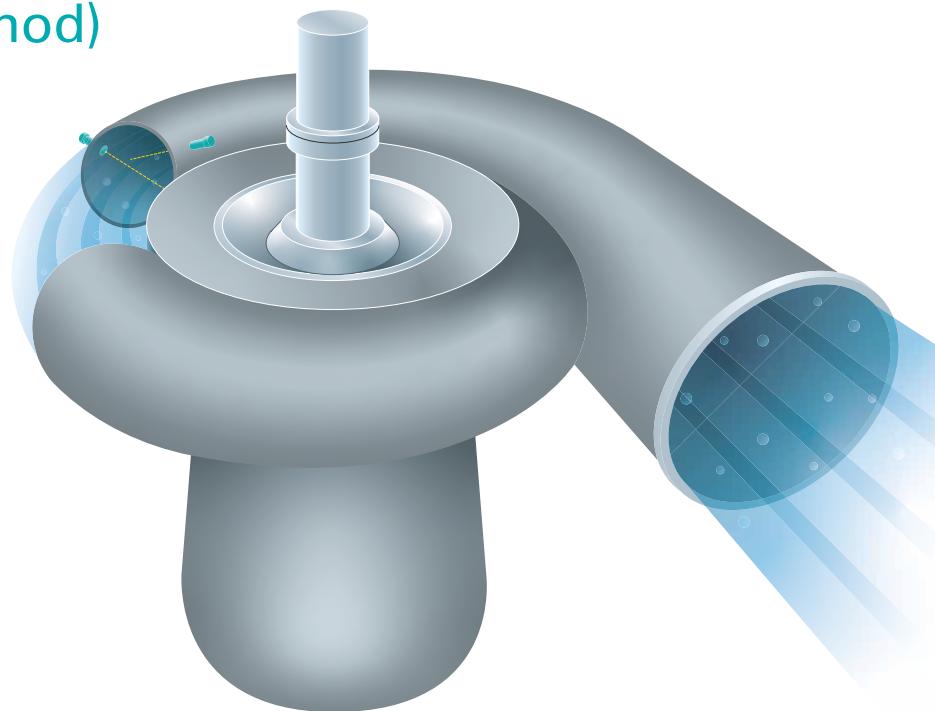


## Differential pressure measurement (Winter-Kennedy method)

A constriction of the pipe profile, i.e. near a turbine, increases the velocity of the water and causes a pressure drop. The differential pressure between two points with different cross sections is measured. Based on this, the flow is calculated using either a mathematical function or a reference table. This method is commonly used in hydraulic engineering.

### Benefits

- Installation costs are largely independent of the pipe diameter
- Pressure taps are often already available, simplifying the installation process



## Flow determination in open flumes

The flow through open channels, flumes, tailraces, weirs, etc. can be determined by using a level measurement transducer together with geometrically defined spillway shapes such as rectangle, triangle, V-notch or venturi. Based on the level measurement with submerged pressure transducers or others like ultrasonic/radar transducers, the flow rate is calculated by using either a pre-defined function or a reference table. In the field, accuracies of 3% can be achieved while under ideal conditions accuracies of 1.5% or better are possible.

### Benefits

- Easy to install
- Very cost-efficient
- Reliable and robust
- Also for waste-water applications



# Advanced applications

Various advanced applications are combined into one Rittmeyer solution. Thanks to that, hardware and instrumentation components can be reduced to a minimum – for maximum efficiency and cost savings.

## Rittmeyer combines 4 smart applications in 1 device:

- Flow measurement
- Turbine efficiency monitoring
- Penstock leak detection
- Sediment monitoring



## Turbine efficiency monitoring

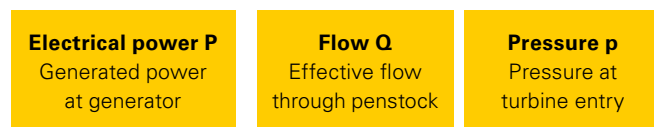
With the Rittmeyer turbine efficiency monitoring application, power plant operators can reliably determine temporal changes in turbine efficiencies by using high-precision ultrasonic transit time flow and pressure measurements. Pre-defined processing rules assure simplified evaluations.

Thus, damages on turbine parts can be detected at an early stage. This reduces down-time as well as expensive and time-consuming replacement of turbine parts to a minimum.

Research studies have shown, that ultrasonic Rittmeyer flowmeters can be used for efficiency testing as a comparable alternative to thermodynamic methods.

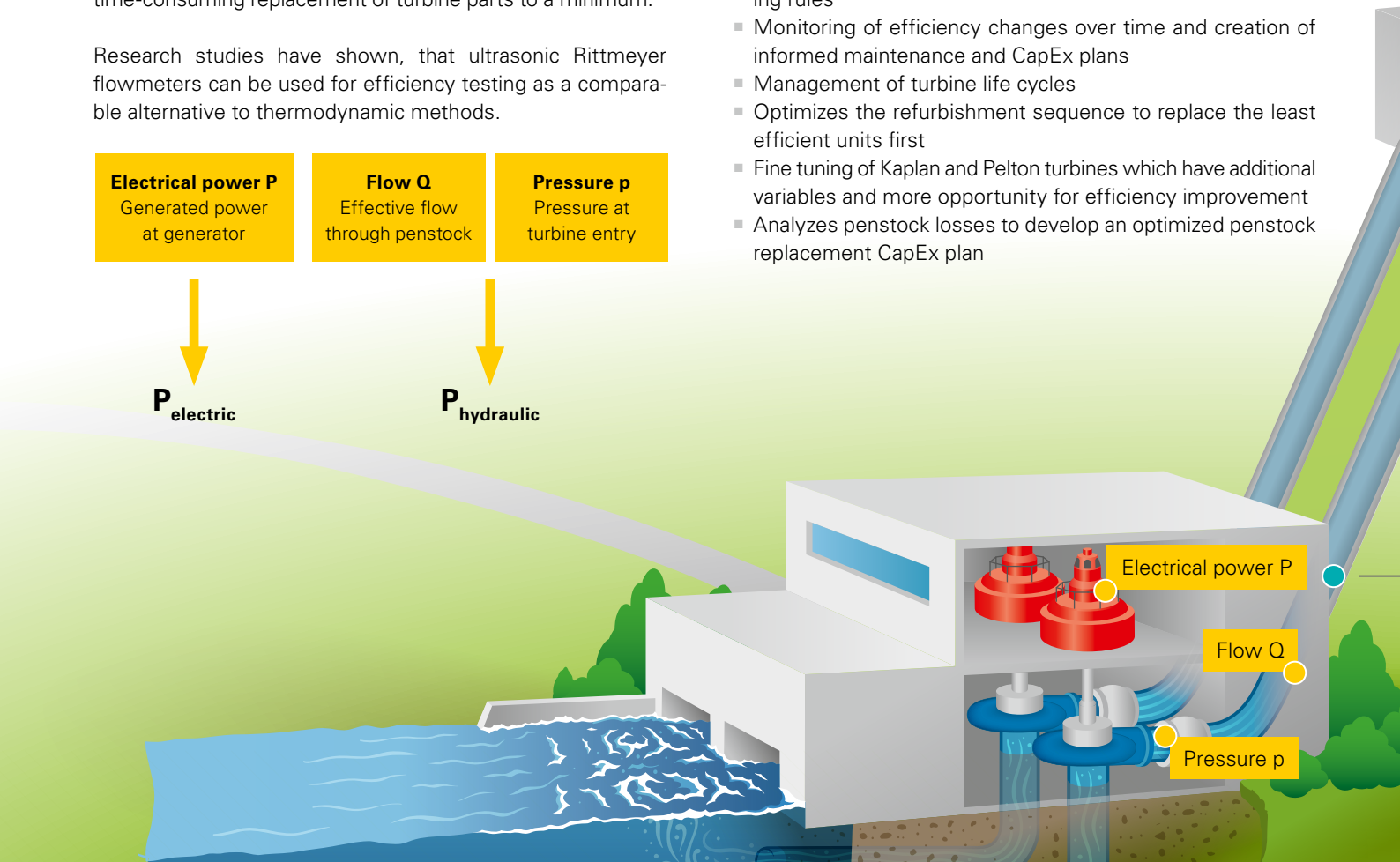
### Your benefits

- Maximizes productivity due to real-time efficiency information
- Excellent return on investment on the installed flow measurement system
- Preventive maintenance due to early-stage information about potential turbine damages
- Easy implementation due to predefined intelligent processing rules
- Monitoring of efficiency changes over time and creation of informed maintenance and CapEx plans
- Management of turbine life cycles
- Optimizes the refurbishment sequence to replace the least efficient units first
- Fine tuning of Kaplan and Pelton turbines which have additional variables and more opportunity for efficiency improvement
- Analyzes penstock losses to develop an optimized penstock replacement CapEx plan



$P_{\text{electric}}$

$P_{\text{hydraulic}}$



« With Rittmeyer instrumentation systems, our power generation has been increased by 3%. »

James A. Besho Jr. P.E., Stuyvesant Falls Hydroelectric Plant

## Penstock leak detection

The unique concept of the Rittmeyer penstock leak detection system (PLDS) allows for early detection of leaks, thus maximizing public and environmental safety. With high-precision flow measurements at both ends of the penstock, leaks and ruptures of the penstock can be quickly identified. As an alternative to the ultrasonic measurement at the lower end of

the penstock, the flow can also be measured using the Winter-Kennedy method at the turbine inlet.

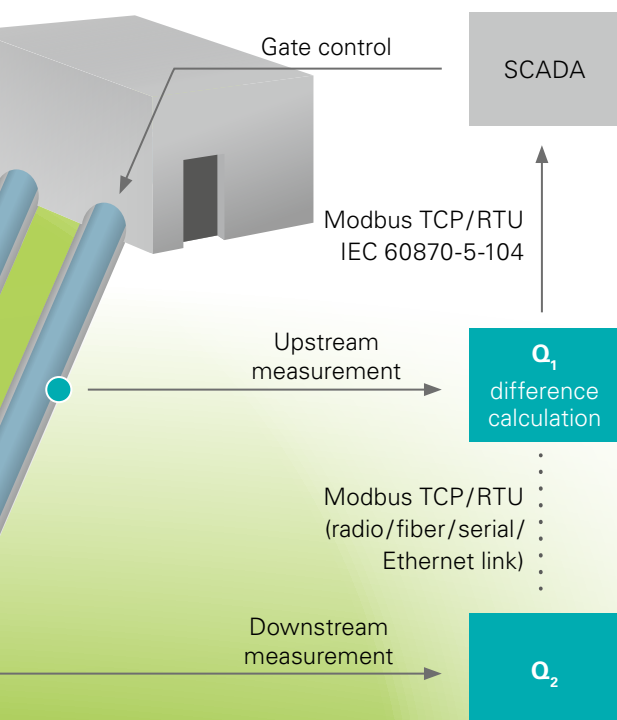
Besides ruptures and larger leaks, the PLDS ensures that smallest leaks are reliably detected by accumulating the difference between the upstream and downstream flow over a longer period of time.

Thresholds, time delays and corresponding actions are easily configured to match the specific requirements on site. With the integration of additional transducers, even more precise monitoring of critical locations is possible.

The entire control and processing unit can be fit into a compact wall-mounted cabinet and can operate fully independent of other plant process control systems.

The PLDS application can also be combined with the sediment monitoring application in parallel on the same control unit.

The system can also be used for leak detection in open channels, i.e. for flood protection.



### Your benefits

- Minimizes potential damage through safe and early leak detection
- Taking account of public safety responsibility
- Meets regulatory safety requirements
- Easy to integrate into existing plant equipment
- Bidirectional monitoring possible (pump and turbine operation)
- Easy retrofit with existing third-party transducers and installations

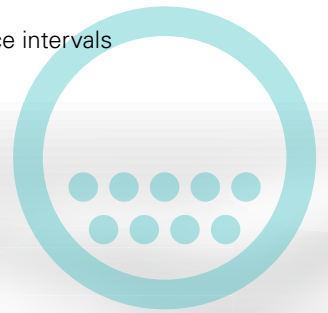
## Sediment monitoring

When it comes to plant operation, maximum productivity comes first. Suspended solids and sediments in the water can lead to damages on installed equipment. Even the smallest impairment can severely decrease turbine efficiency. It is imperative to detect damages at an early stage to prevent high costs from expensive power generation outages and time-consuming replacements of damaged turbine parts.

The amount of suspended particles in the water can be monitored with Rittmeyer ultrasonic measurements. Based on the signal attenuation, the sediment concentration is derived. In addition to filled pipe systems, sediments can also be monitored in open channels.

### Your benefits

- Protects plant and equipment against erosion
- Reduces wear and tear on turbines and pumps
- Reduces maintenance costs
- Maximizes turbine efficiency
- Assists to optimize maintenance intervals



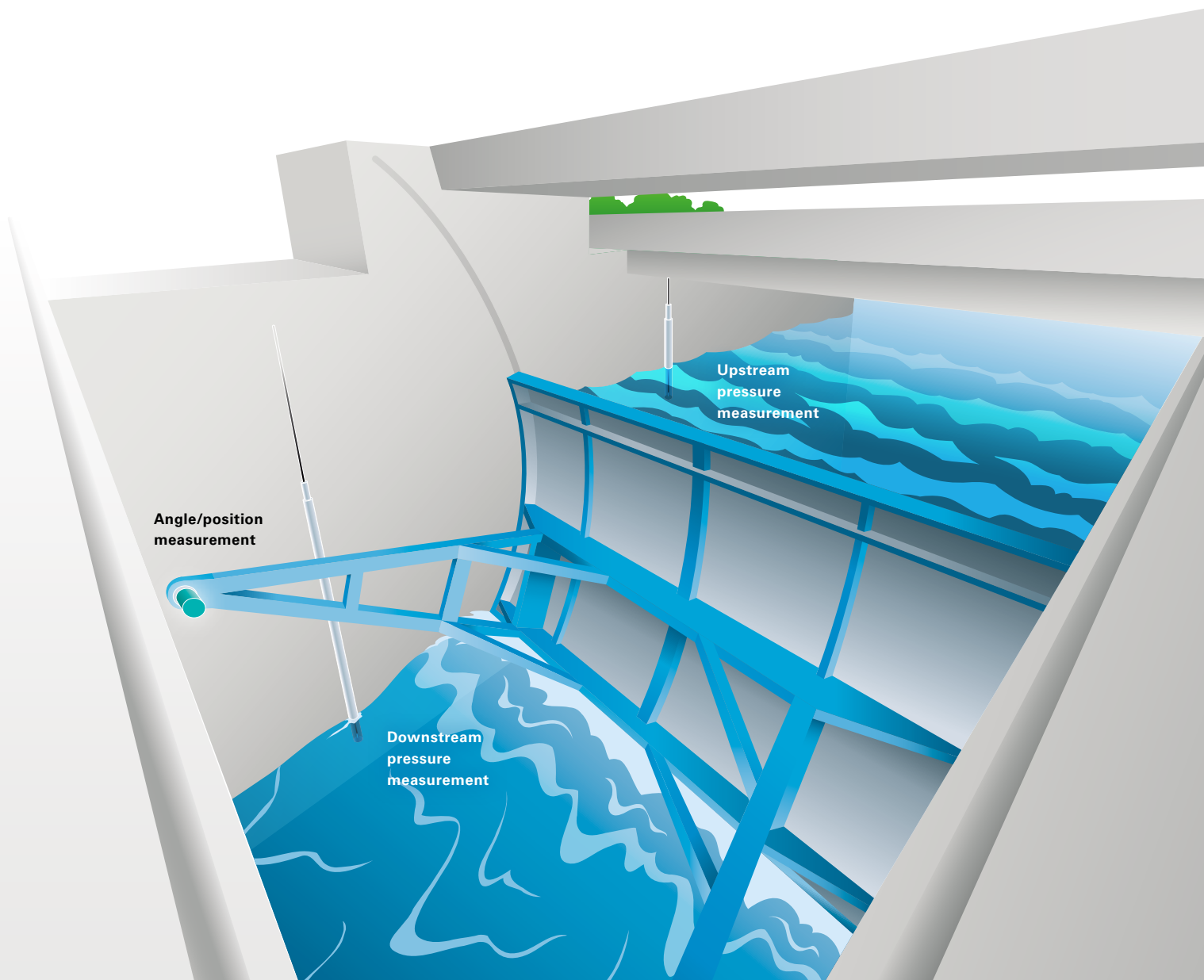
# Gate discharge measurement

Through the combination of angle or position transmitters with one or two pressure transmitters, a long-term stable measurement of the gate discharge can be realized for various gate types, such as radial, tainter, crest, slide, roller, sluice, and lock gates.

With built-in processing rules of Rittmeyer angle and position transmitters and the measuring results from the level transmitters, the flow can be reliably calculated. This measurement is an autonomous solution and can be connected to a SCADA, if required.

## Your benefits

- Autonomous and cost-efficient flow measurement solution, also for remote installations
- Expandable to an automatic gate control, i.e. for flood protection
- Easy integration into SCADA



# Measurement solutions

With over 100 years of experience in measuring flow, Rittmeyer helps you to find tailor-made high-precision solutions for your individual requirements.

## RISONIC *modular*

Ultrasonic transit time flow measurement

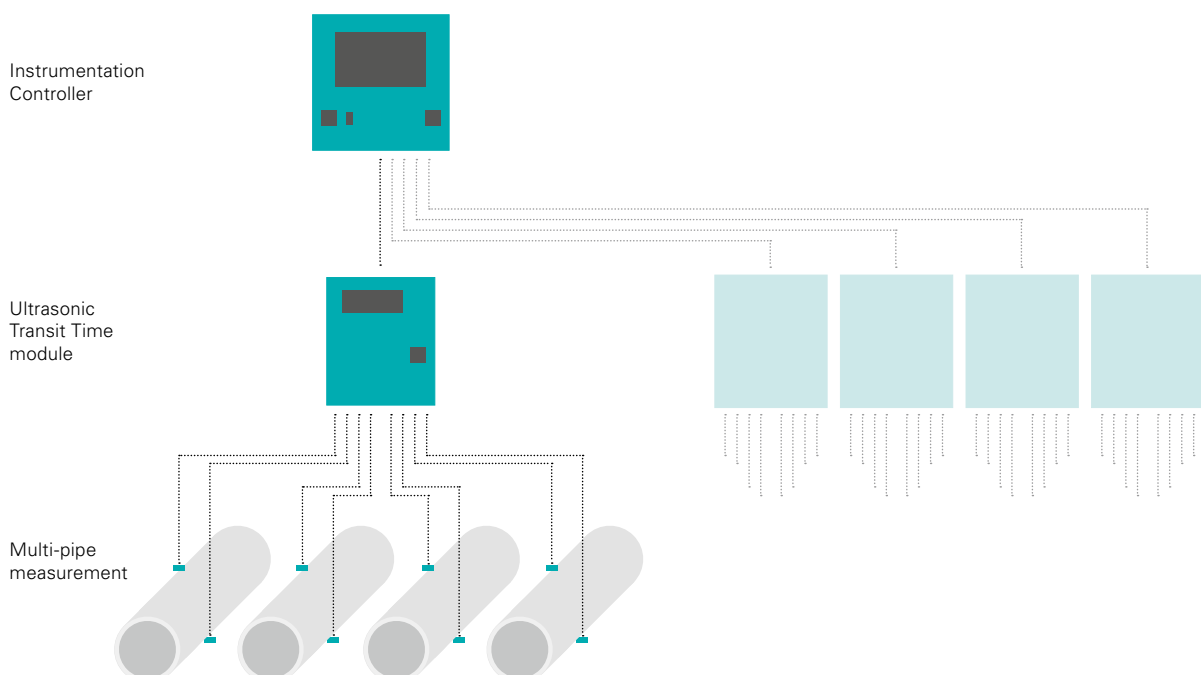


### A single device to address most common challenges in the water industry

With its scalable design, RISONIC *modular* offers advanced, smart and flexible applications in addition to the standard flow measurement. Cost efficiency as well as maintenance-free long-term stability and reproducible results even in harsh environments are the characteristics of RISONIC *modular*.

The Instrumentation Controller includes several applications:

- Turbine efficiency monitoring
- Pipe leak detection system (PLDS)
- Sediment monitoring
- Predictive maintenance
- ... and many more





With CFD analysis, Rittmeyer experts evaluate the optimal transducer positions for your individual measurement.

## Your benefits

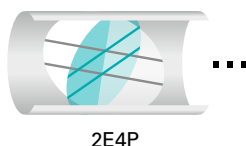
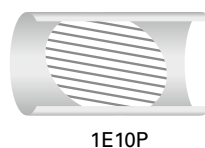
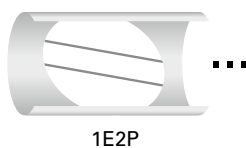
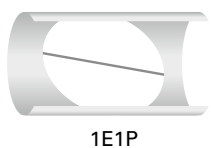
- One controller for various applications
- High accuracy of up to 0.5 % on site and 0.2 % under ideal conditions
- Flow measurement layout according to IEC 60041 / ASME PTC 18
- IEC 60870-5-104 and Modbus RTU/TCP communication
- Real redundant measurement – if the SCADA system doesn't work, the flow will still be monitored
- Easy-to-configure web interface
- Comprehensive communication interfaces
- Backward compatibility for other flow measurement systems as well as older Rittmeyer systems
- Long-term stability – no need for recalibration
- Remote control – no need to be on site
- Bi-directional flow measurements for use in pumped storage hydropower plants
- **Additional benefit:** RISONIC *modular* can measure flow and level concurrently with one single control unit!



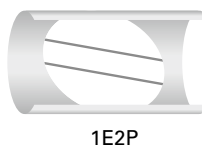
## Path arrangements

Rittmeyer supports all path arrangements as per IEC 60041 / ASME PTC 18. Several scenarios are possible, from the measurement of one pipe with up to 20 paths, to the measurement of four different pipes or pipe sections with five paths per measuring point. The more paths a measurement comprises, the higher the accuracy will be.

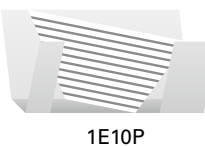
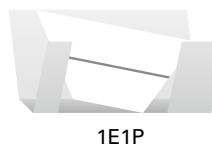
### Filled pipes



### Partially filled pipes



### Open channels





## Flow transducers

Transducer	Type A	Type B	Type C	Type G	Type K	Type R*
Oscillating frequency	1 MHz / 500 kHz	1 MHz / 500 kHz	1 MHz / 500 kHz	1 MHz / 500 kHz / 200 kHz	1 MHz / 200 kHz	1 MHz / 500 kHz
Pipe diameters	0.75 m – 52 m	0.75 m – 52 m	0.2 m – 35 m	0.08 m – 6 m		0.2 m – 15 m
Channel width					0.2 m – 130 m	
Intrusive (pipe/channel inside mounting)		■			■	■
Intrusive (pipe drilled mounting)	■		■			■
Non-intrusive (pipe outside mounting)				■		
Replaceable during operation	■		■	■		■

\* Retrofit versions for former generation and other brands

## Cable protection system

The Rittmeyer cable protection system is a unique solution to protect the intrusive, pipe inside mounted transducer cables inside a penstock. Precise, rugged and with a design which minimizes flow disturbance, Rittmeyer's cable protection system is the choice for your inside mounted flow measurement system.



# RISONIC *clamp-on*

State-of-the-art and non-intrusive flow measurement



RISONIC *clamp-on* is a cost-efficient and state-of-the-art flow measurement solution with clamp-on transducers for filled pipes.

Clamp-on transducers allow for non-intrusive flow measurements with high repeatability and accuracy, in situations where a pipe cannot be emptied or where drilling of a pipe for permanent installation is not feasible. Magnetic frames, adhesive mounting or mounting straps are available for transducer installation in any situation.

Supporting all common communication protocols and latest interface technologies, the RISONIC *clamp-on* is easy to integrate with existing SCADA or other systems, even in remote locations.

For mobile and temporary measurement needs, a mobile and battery-powered hard case version is also available.

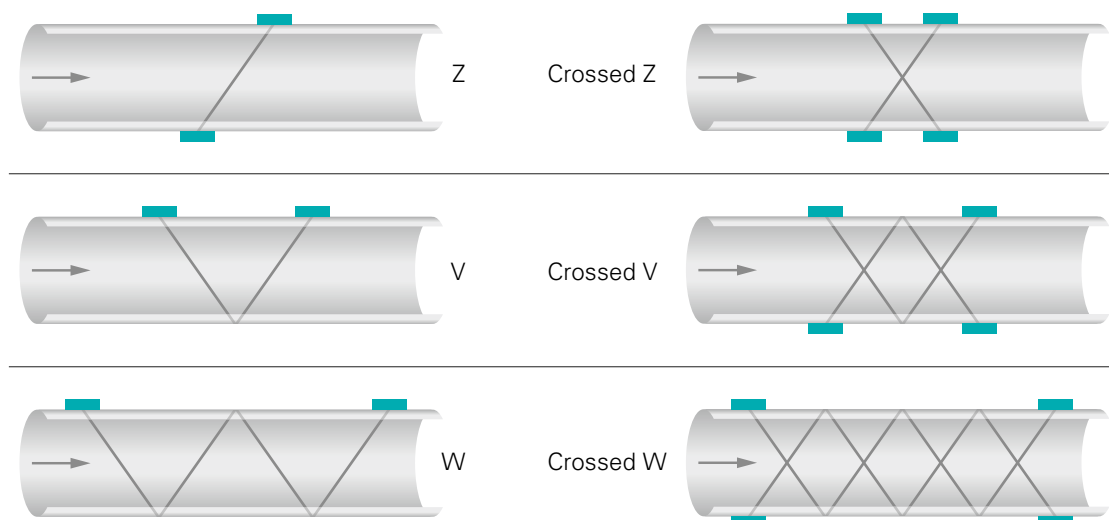
With the advanced applications, i.e. leak detection, sediment monitoring, turbine efficiency monitoring or the calculation of total flow, RISONIC *clamp-on* underlines the promise of an "all-in-one" flow measurement solution.



## Your benefits

- Highly accurate and reliable non-intrusive flow measurement
- No interruption of operation
- No drilling of holes into the pipe
- Multi pipe measurement: 1 RISONIC *clamp-on* for up to 4 different pipes/measurements
- IEC 60870-5-104 and Modbus RTU/TCP communication
- Easy installation
- Easy remote configuration and diagnosis via web interface
- Bi-directional flow measurements for use in pumped storage hydropower plants
- Various standard and advanced application features

## Path arrangements

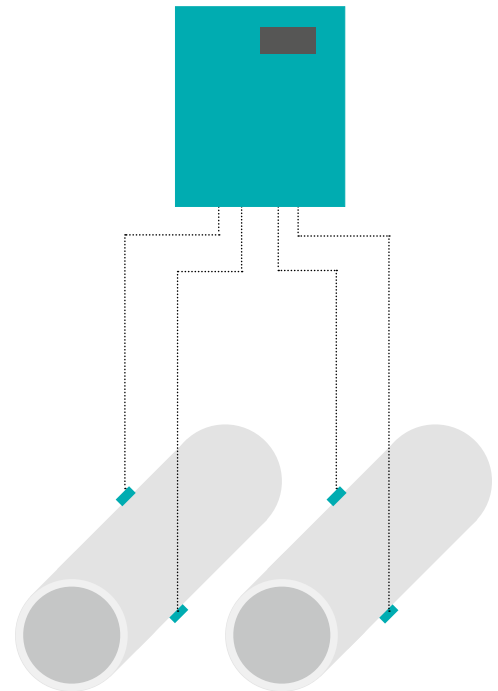


## RISONIC *compact*

Cost-efficient solution for clamp-on flow measurement



For many flow applications, i.e. for flow measurements in water supply and distribution networks, RISONIC *compact* is the ideal solution. With latest communication interfaces and optional 3G/4G/5G cellular features, this precise and reliable clamp on flow measurement system combines Swiss quality with maximum cost efficiency. RISONIC *compact* supports 2 measurement paths (4 transducers) and comes in a fully watertight housing.



## RIPRESS *smart*

Level- and pressure-based flow measurement



Besides the ultrasonic transit time method, flow can also be determined with pressure-based measurement methods. RIPRESS *smart* is a versatile, low-maintenance and cost-efficient pressure measurement solution, which is easy to install. With up to four measuring points, it facilitates accurate flow measurements and also records other parameters such as temperature. With numerous predefined applications and processing rules, the configuration is very simple.

Thanks to the variety of available communication interfaces, other transmitter types – including third-party ones – can be connected to the Instrumentation Controller as well: i.e. ultrasonic or radar level transducers, pH probes, temperature probes, etc.

### Your benefits

- Highly accurate level measurement: up to  $\pm 0.05\%$  full scale
- Temperature compensation
- Easy configuration and diagnostics with predefined formulas for flow (spillway, Venturi, Parshall flume, ...) and volume (cylinder, sphere, tank, ...) calculations
- Remote diagnostics with integrated web server



## RIPOS *smart* / RIVERT *smart*

### Gate discharge measurement



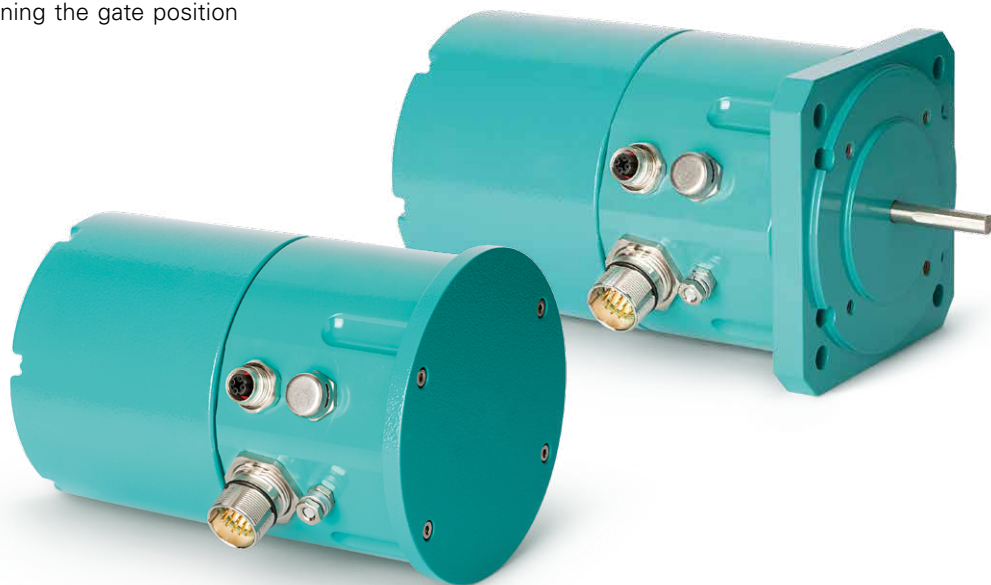
Rittmeyer's rugged rotation and angle transmitters RIPOS *smart* and RIVERT *smart* provide absolute and reliable measurements of exact gate position even in harsh environments. They are fully backward compatible with the complete Rittmeyer product line, thus ensuring comprehensive investment protection.

RIPOS *smart* or RIVERT *smart*, in combination with one or two level transmitters, measure the water flow during gate discharges with an accuracy of approx. 5–10% of  $Q_{\max}$ . Thanks to the installed level transmitters, a cost-efficient flood protection can be realized at the same time.

Due to absolute measurements, no referencing is required, and measured values are available right after power-on. A redundant measurement can be achieved with two independent devices, for example with a RIVERT *smart* measuring the angle and a RIPOS *smart* determining the gate position via a rope length transmitter drum.

### Your benefits

- Rugged and durable design: IP67, operating temperature range -40 °C ... +60 °C
- High accuracy: 0.044° (RIPOS *smart*) / 0.022° (RIVERT *smart*)
- Comprehensive communication interfaces (i.e. 4...20 mA, Modbus RTU/TCP, IEC 60870-5-104)
- Built-in web server for easy configuration and diagnostics
- Integrated data logger with remote access
- Advanced process value calculations (mathematical functions, conversion tables, integration, limit values)



# Which product for which application?



	RISONIC modular	RISONIC clamp-on	RISONIC compact	RIPRESS smart	RIPOS smart / RIVERT smart
Filled pipes	■	■	■	■	
Partially filled pipes, tunnels, galleries	■				
Open channels, irrigation, weirs, flumes	■			■	
Gates					■
Turbine housing (Winter-Kennedy)				■	
Residual water	■			■	
Penstock leak detection	■	■			
Sediment monitoring	■	■			
Turbine efficiency	■	■			
Total flow	■	■		■	■
Predictive maintenance	■	■			



Find the ideal product for your application within seconds with the **Product Finder** on our website:

[rittmeier.com/product-finder](http://rittmeier.com/product-finder)

# Rittmeyer world-wide Service & Competence Centers

Proven **expertise in hydraulics, flow dynamics and measurement technologies** is not only reflected in our high-quality solutions – but **also available as a service**.

All-inclusive **turn-key installations, care-free maintenance packages**, as well as **IoT and cloud solutions** can make your life easier.

Rittmeyer's Service & Competence Center supports you from design and specifications all the way to efficiency and **asset protection throughout the life time of your equipment**.



## Consulting

Rittmeyer offers **pre-studies** for your specifically planned flow, level, or gate positioning solution and **reviews your existing installation**. Jointly, we engineer the optimal and most sustainable solution for you, including for example:

- Design & specification of your particular solution
- Penstock **leak detection, sediment monitoring, turbine efficiency monitoring**
- **CFD analytics** for high accuracy in challenging conditions (Computational Fluid Dynamics; Gauss-Jacobi, OWICS, etc.)

## Installation

Rittmeyer **installs and commissions** your chosen flow, level, or gate positioning solution and **trains** your operation personnel, including for example:

- **Turn-key installation** by experienced service technicians
- Laser-based **telemetric survey** tools for highest accuracy in transducer positioning
- Commissioning, incl. reports according to **IEC 60041, ASME PTC 18**

## Regional Centers



### Europe

Rittmeyer AG, Switzerland  
 sales@rittmeier.com  
 Phone +41 844 11 22 11



### Asia

Rittmeyer Singapore  
 sales@rittmeier.com  
 Phone +41 844 11 22 11



### North America

Rittmeyer LLC, USA  
 sales@rittmeier.com  
 Phone +1 360 481 41 66



## After sales service packages

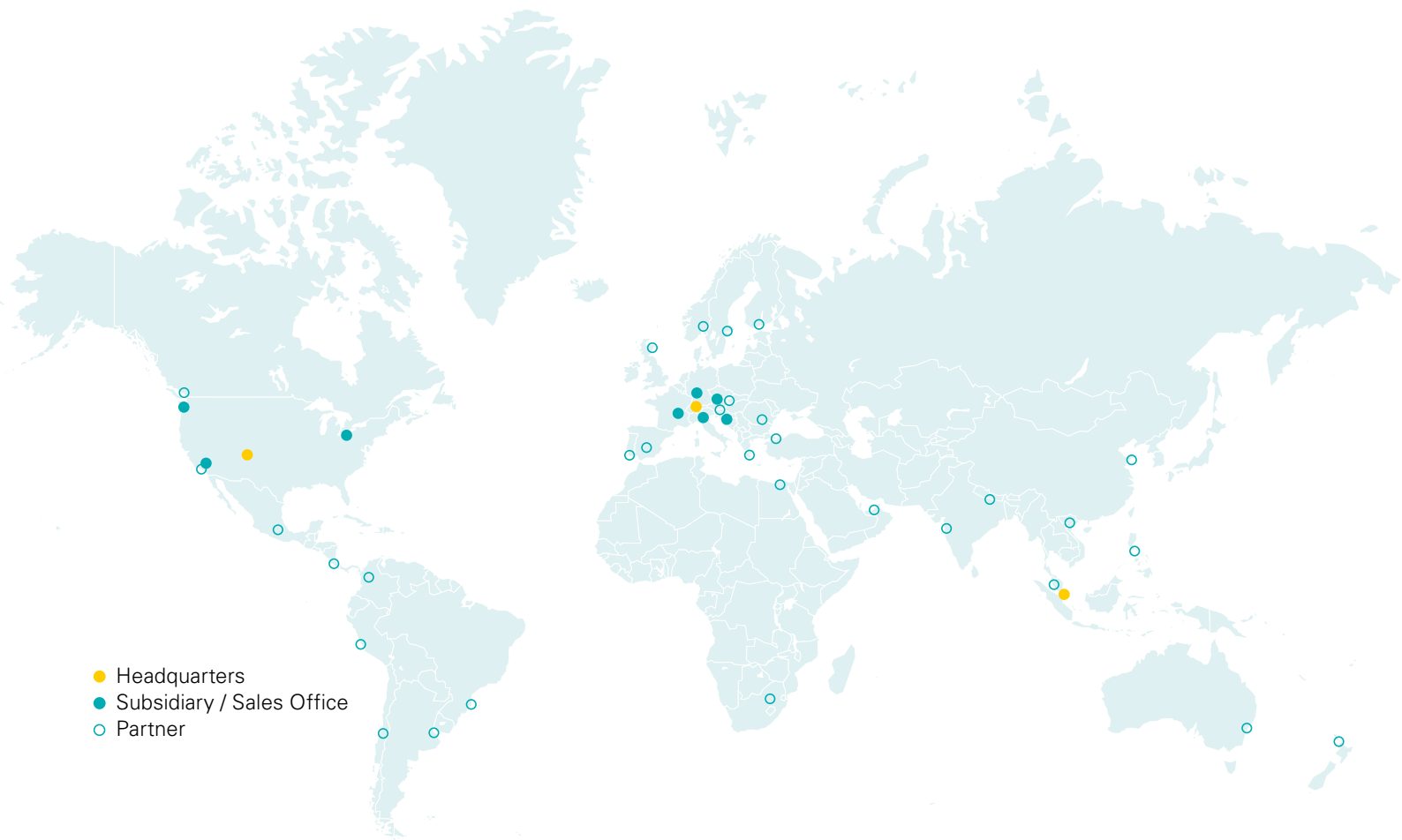
Rittmeyer devices work highly **reliable and precise for decades** – with very little or no maintenance at all. Nevertheless, many customers wish for regular checkups of their installed solutions, being it for:

- Steadily increasing **safety and regulatory requirements**
- Growing **commercial and environmental focus** on efficiency & water consumption
- Increased **technical complexity**, personnel changes
- Or just simply to “put their mind at ease”

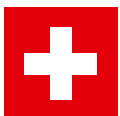
## Embedded services

Rittmeyer devices are **IoT capable** and easily compatible with existing process control systems thanks to their **versatile communication features** (Ethernet, Modbus RTU+TCP, PROFINET/PROFIBUS, HART®, M-Bus, CAN, BACnet, etc.).

Rittmeyer offers **cloud solutions** for your data, can assist you in **analysis and interpretation** and, with the RITUNE® suite, even provide a **full-fledged data monitoring or process control system**.



- Headquarters
- Subsidiary / Sales Office
- Partner



Swiss made

Rittmeyer, a member of the BRUGG GROUP, develops, manufactures and installs metrology system solutions for water utilities and hydro-power plants. The company's high-precision measuring instruments for pressure, level, flow, angle and position are in operation around the globe. Since its establishment in 1904, Rittmeyer has put more than 20000 installations into operation and is represented worldwide with subsidiaries, sales offices, and a distribution network in over 25 countries.

[www.rittmeyer.com](http://www.rittmeyer.com)

**rittmeyer**  
**BRUGG**

Rittmeyer AG  
Inwilerriedstrasse 57  
POB 1660  
CH-6341 Baar  
+41 41 767 10 00  
sales@rittmeyer.com

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