100 Years of Accurate Flow Measurement

The rock foundation on which you can always rely

1909 - 2009

Unified operator interface to control safety
Avoid surprises
Pre-empt bottlenecks
Optimize operation and maintenance
Reduce blind spots
Monitor plant-wide asset conditions

Field Instrument Solutions
- Concentration
- Density
- Flow
- Pressure
- Temperature

• Concentration
• Density
• Flow
• Pressure
• Temperature

Pre-empt bottlenecks
Optimize operation and maintenance

Avoid surprises
Predict asset conditions and avoid downtime

Reduce blind spots
Monitor plant-wide asset conditions
Making critical plant information fully visible is just the beginning of the vigilant cycle.

Envision a plant where people are watchful and attentive while your business responds to change quickly and efficiently. Now picture an operation that delivers non-stop production while confidently expanding your capabilities into the future. Imagine no further. This is the vision and promise behind VigilantPlant, the clear path to operational excellence.

Seeing clearly gives you the knowledge necessary to anticipate the changes required in your process.

Knowing in advance brings you the speed and flexibility to optimize your plant in real time.

Acting with agility, you are able to adapt to the ups and downs of your business environment.

VigilantPlant excels at bringing out the best in your plant and your people - keeping them fully aware, well informed, and ready to face the next challenge.

vigilantplant®
The clear path to operational excellence
Value Chain - Our shared goal is customer satisfaction through operational excellence

We see customer satisfaction as an ongoing achievement - a journey more than a destination. VigilantPlant helps your journey by empowering your value chain, leveraging automation solutions that integrate plant-wide information and optimizing plant lifecycle. When your people are attentive and watchful and your business responds to change quickly and efficiently, you secure:

- Competitive pricing
- Regulatory compliance
- On-spec product
- On-time delivery
One Tool for all
Easy and fast device configuration

**Before**
Previously, a dedicated configuration tool was used for each a distinct field communication protocol.

Many clicks × multiple configuration tools = complex field maintenance work

**After**
Now with FieldMate, it is possible to single-handedly manage field devices from multiple suppliers for many different protocols.

Fewer clicks × one configuration tool = field maintenance work efficiency

Field
Benefit

Faster Engineering & Maintenance Work
- Rapid device configuration
- Easy loop testing and better device tuning
- Quicker problem solving
- No need to purchase multiple handheld tools
- Faster and more effective training on a single integrated tool

Leading Edge Technologies

Multi Protocol Access:
- Foundation™ fieldbus complete support: latest FF DDS
- HART advanced interoperability: SDC625
- PROFIBUS plug and play: genuine FDT Application
- BRAIN protocol full support: multi-purpose BRAIN DTM

Plug & Play:
Instant device recognition upon connection

Graphical device management:
Intuitive user display optimized for each field device

Future Proof

FieldMate fully embraces both the FDT and EDDL technologies which insures smooth integration of future devices.

FieldMate provides a common architecture
- An independent platform and operating system, independent of host systems
- Compatible with existing EDDL and DTM-based device descriptions
- Applicable to any field device communication technologies
# Yokogawa’s flow selection table

## Fluid Type

<table>
<thead>
<tr>
<th>Fluid Type</th>
<th>Measurement</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam</td>
<td>Volumetric flow</td>
<td>High measurement accuracy, High process temperatures, High process pressures, Easy retroactive installation</td>
</tr>
<tr>
<td>Pure gases</td>
<td>Mass flow</td>
<td>Low pressure loss, Wide dynamic range</td>
</tr>
<tr>
<td>Contaminated gases</td>
<td>Temperature</td>
<td>High measurement accuracy, High process pressures, Easy retroactive installation</td>
</tr>
<tr>
<td>High viscosity liquids</td>
<td>Density</td>
<td>High measurement accuracy, High process pressures, Easy retroactive installation</td>
</tr>
<tr>
<td>Low viscosity liquids</td>
<td>Concentration</td>
<td>High measurement accuracy, High process pressures, Easy retroactive installation</td>
</tr>
<tr>
<td>Conductive liquids</td>
<td></td>
<td>High measurement accuracy, High process pressures, Easy retroactive installation</td>
</tr>
<tr>
<td>Non-conductive liquids</td>
<td></td>
<td>High measurement accuracy, High process pressures, Easy retroactive installation</td>
</tr>
</tbody>
</table>

## Product Lines

### Variable Area/Float/Rotameters

- **RAMC**
  - Page 10
  - Best choice

- **RAKD**
  - Page 11
  - Possible

### Rotameters (glass)

- **Rotameter (glass)**
  - Page 12
  - Best choice

### Rotameters (plastic)

- **Rotameter (plastic)**
  - Page 12
  - Possible

### Coriolis

- **Rotamass 3 Series**
  - Page 13
  - Possible

### Vortex

- **digitalYEWFL0**
  - Page 17
  - Possible

### Electromagnetic

- **ADMAG AXF & RXF**
  - Page 19
  - Possible

### Ultrasonic

- **US 300-Series**
  - Page 21
  - Possible

### Differential Pressure

- **DPharp**
  - Page 23
  - Possible

- **MV391 OA**
  - Possible
<table>
<thead>
<tr>
<th>Petrochemical</th>
<th>Chemical/Pharmaceutical</th>
<th>Food &amp; Beverage</th>
<th>Water/Energy/Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mineral oil</td>
<td>Gasoline/diesel</td>
<td>Air</td>
<td>Water/energy/others</td>
</tr>
<tr>
<td>Tar</td>
<td>Solvents</td>
<td>Lacquer (water based)</td>
<td>Paper pulp</td>
</tr>
<tr>
<td>Solvents</td>
<td>Air</td>
<td>Lacquer (diluted)</td>
<td>Butane</td>
</tr>
<tr>
<td>Air</td>
<td>Cleaning agents</td>
<td>Cleaning agents</td>
<td>Slurry</td>
</tr>
<tr>
<td>Cleaning agents</td>
<td>Steam</td>
<td>Cleaning agents</td>
<td>Waste gas</td>
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<tr>
<td>Steam</td>
<td>Acids</td>
<td>Acids</td>
<td>Silt</td>
</tr>
<tr>
<td>Acids</td>
<td>Vegetable oil</td>
<td>Vegetable oil</td>
<td>Propane</td>
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<tr>
<td>Vegetable oil</td>
<td>Milk</td>
<td>Milk</td>
<td>Natural gas</td>
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<tr>
<td>Milk</td>
<td>Beer</td>
<td>Beer</td>
<td>Liquid oxygen</td>
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<tr>
<td>Beer</td>
<td>Wine</td>
<td>Wine</td>
<td>Water</td>
</tr>
<tr>
<td>Wine</td>
<td>Waste water</td>
<td>Waste water</td>
<td>Waste water</td>
</tr>
<tr>
<td>Waste water</td>
<td>Vodka</td>
<td>Vodka</td>
<td>Vodka</td>
</tr>
<tr>
<td>Vodka</td>
<td>Whisky</td>
<td>Whisky</td>
<td>Whisky</td>
</tr>
<tr>
<td>Whisky</td>
<td>Sake</td>
<td>Sake</td>
<td>Sake</td>
</tr>
<tr>
<td>Sake</td>
<td>Water</td>
<td>Water</td>
<td>Water</td>
</tr>
<tr>
<td>Water</td>
<td>Paper pulp</td>
<td>Paper pulp</td>
<td>Paper pulp</td>
</tr>
</tbody>
</table>

**Measurement Accuracy:**
- High measurement accuracy
- Wide dynamic range
- Bi-directional measurement
- Low pressure loss
- Without auxiliary energy
- High process temperatures
- High process pressures
- Easy retroactive installation

**Flow Measurement:**
- Variable Area/float/Rotameters
- RAMC
- RAKD
- Rotameter (glass)
- Rotameter (plastic)
- Rotamass 3 Series
- Vortex digital YEWFLO
- Electro-magnetic ADMAG AXF & RXF
- Ultrasonic US 300-Series
- Differential Pressure DPharp
Proven technology: The Rotameter (variable area) principle

The Rotameter (variable area flowmeter) is one of the oldest and mature principles in flow measurement.

A float is guided inside a conically shaped tube. The float rises within the tube as the flow increases.

This mechanical principle is as simple as it is reliable.

Due to its operating principle the Rotameters are installed in vertical pipes. Once the process medium flows through the tube, the gravimetric force balances with the flow resistive force in such a way that the position of the float indicates the flow rate value.
Economical:
Modular and flexible

Rotameters are completely modular and flexible. The measuring tube can be made of glass, plastic or metal – depending on the application.

If the tube is made of metal, the float position is transferred to an external indicator via a magnetic coupling. In the case of glass and plastic tubes you can simply view the float position to get a reliable reading of the flow rate.

The mechanical nature of the measuring principle provides a flow device that does not require any electrical power supply. However, there are many applications in process plants that do require electronic indication and transmission of the measured flow rate to other associated devices. This capability has considerably expanded the range of applications for the variable area flowmeter.
Robust and universal: Rotameter **RAMC** – the original

At first glance the instrument looks impressive with its all stainless steel design. A closer look reveals a unique patented “float blockage” detection system. Operational safety is of the utmost importance in any flowmeter, and the RAMC is no exception – wetted parts are available in a variety of materials, and intrinsically safe outputs are available as an option.

The Rotameter RAMC has been assessed in accordance with SIL 1 and SIL 2 level by EXIDA on the basis of EN 61508 and EN 61511 standards for operational safety. When having a local indicator with fail safe limit switches the RAMC meets SIL 2. The RAMC with 4-20mA output or HART communication reaches SIL 1 and is the only Rotameter in the world having SIL for electronic transmitter.

If you value flexibility in a flowmeter – from the measurement of air to highly aggressive liquids – in situ replacement of the indicator without degradation of performance – and the interchangeability of floats – then the RAMC is the right choice for you.

The RAMC combines all the advantages of the variable area principle with robust design, reliable measurement, with or without power, culminating in a truly universal flowmeter for gases, liquids and steam applications.

**What makes this Rotameter different from other brands is known by many users, who value the ease of installation and trouble-free operation.**

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### Specifications

- For Pipe Sizes: DN 15 to DN 150 (1/2" to 6")
- End Connections: Flanges, threaded or Triclamp
- Measuring Range:
  - Water 20°C (68°F): 2.5 l/h to 130 m³/h
  - Air 20°C (68°F); 1 bar (15 psi) abs: 75 l/h to 1400 m³/h
- Material: 1.4404 (AISI 316L); PTFE lining
- Process Temp. Range: -180°C to +370°C (-292° F to 698° F)
- Pressure Range: up to 100 bar (1450 psi)
- Ambient Temperature: -20°C to 100°C (-4° F to 212° F)
- Accuracy: Class 1.6/2.5 VDI/VDE
- Indicator: Analog scale plate/LCD
- Ex-approvals: ATEX, FM (US, C), GOST, SAA, NEPSI
- Inputs/Outputs: Analog 0-20 mA/4-20 mA
- Communication: HART, PROFIBUS PA
- Power Supply:
  - 24 V DC 2-wire, 24 V DC 3-wire
  - 230 V AC 4-wire, 115 V AC 4-wire
- Protection Classes: IP 66/67, IP65 (plastic housing)
- Comments: Fail Safe Limit switches available
- Special options on request
Small in size, big in performance: Rotameter **RAKD**

The RAKD differentiates itself from other comparable variable area meters by means of its light and guided float design. This feature avoids oscillations caused by gas compressibility, resulting in a very stable measurement.

This design has a direct bearing on stability – pressure loss is lower by two-thirds compared to other comparable meters.

The RAKD variable area flowmeter is highly accurate, particularly for low flows and high pressure applications. Once again no auxiliary energy is required.

For Pipe Sizes
- 1/4", 3/8", 1/2", DN 15, DN 25

End Connections
- Flanges, threaded, cutting ring, nozzle

Measuring Range
- Water 20°C (68°F)
  - 1 l/h to 250 l/h
- Air 20°C (68°F), 1bar (15 psi) abs
  - 40 l/h to 8000 l/h

Material
- 1.4571 (AISI 316TI)
- Hastelloy or Monel on request

Process Temp. Range
- 0°C to +250°C (-13°C to +482°F)

Process Pressure up to
- 150 bar (2120 psi)
- Higher pressure on request

Ambient Temperature
- 20°C up to 100°C (4°F up to 212°F)

Accuracy
- Class 0.5/0.6E

Indicator
- Analog scale plate

Exproof
- ATEX, CSA, SAA, NEPSI, GOST

Signal Outputs/Inputs
- Analog 4-20 mA

Power Supply
- 24 V DC 2-wires

Protection Class
- IP 66/67

Comments
- Fail Safe Limit switches available
- Fine control valves available
- Pressure controller available
- Special options on request

Electrical Connections
- Easy installation with Quickon connector

The RAKD is the smaller brother of the RAMC – is robust in design – for low flows and high pressure applications.
The flow metering tube is transparent giving you full insight into the process and position of the float – a scale on the outside of the tube indicates the true flow rate. All the measurement tubes in this series of variable area flowmeters are made of either glass or plastic.

A Rotameter is a truly modular flowmeter. The variety in cones, floats, scales, process connections and options combine to make the Yokogawa Rotameter suitable for a very wide range of applications. An example is our glass meter which resists highly corrosive mediums, is antistatic and especially suitable for low flow gas measurement.

Rotameter gets its name from the rotating float. Special diagonal notches cause the float to rotate. This eliminates friction and guarantees very stable behaviour and highest accuracy; oscillations are eliminated by using low density floats.

This simple and affordable flowmeter has a very broad application range, smart design and decades of proven performance.

Trust your own eyes: Rotameter RA-Series

<table>
<thead>
<tr>
<th>RA-Series</th>
<th>RAGK/RAGL</th>
<th>RAGH/RAGG</th>
<th>RAQN</th>
</tr>
</thead>
<tbody>
<tr>
<td>For Pipe Sizes</td>
<td>1/4&quot; to 3/8&quot;, 6 to 12 mm</td>
<td>1/4&quot; to 2 1/2&quot;, DN 15 to DN 40</td>
<td>3/8&quot; to 2&quot;</td>
</tr>
<tr>
<td>End Connections</td>
<td>NPT, cutting ring</td>
<td>Female threads, Nipple</td>
<td>Female threads</td>
</tr>
<tr>
<td>Swagelok</td>
<td>Glue socket</td>
<td>Glue socket</td>
<td></td>
</tr>
<tr>
<td>Measuring Range</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water 20°C (68°F)</td>
<td>0.0025 l/h to 600 l/h</td>
<td>0.0025 ml/h to 10 m³/h</td>
<td>10 l/h to 10 m³/h</td>
</tr>
<tr>
<td>Air 20°C (68°F), 1 bar [15 psi] abs</td>
<td>0.2 l/h to 6300 l/h</td>
<td>0.1 l/h to 250 m³/h</td>
<td>160 l/h to 250 m³/h</td>
</tr>
<tr>
<td>Material</td>
<td>1.4571 (AISI 316Ti)</td>
<td>1.4571 (AISI 316Ti)</td>
<td>Steel, PVC</td>
</tr>
<tr>
<td>Polypropylene, PTFE</td>
<td>Steel, PVC, PTFE</td>
<td>Various float materials available</td>
<td></td>
</tr>
<tr>
<td>Various float materials available</td>
<td>Various float materials available</td>
<td>Various float materials available</td>
<td></td>
</tr>
<tr>
<td>Measuring Tube</td>
<td>Borosilicate Glass</td>
<td>Borosilicate Glass</td>
<td>Polyamide or Polyurethane</td>
</tr>
<tr>
<td>Process Temp. Range</td>
<td>Max. 130°C</td>
<td>Max. 130°C</td>
<td>Max. 60°C</td>
</tr>
<tr>
<td>(Max. 266°F)</td>
<td>(Max. 266°F)</td>
<td>(Max. 140°F)</td>
<td></td>
</tr>
<tr>
<td>Pressure Range up to</td>
<td>16 bar (232 psi)</td>
<td>Depending on measuring tube size: 10 bar (145 psi)</td>
<td></td>
</tr>
<tr>
<td>Ambient Temperature</td>
<td>0°C up to 80°C</td>
<td>0°C up to 80°C</td>
<td>0°C to 60°C</td>
</tr>
<tr>
<td>(32°F up to 176°F)</td>
<td>(32°F up to 176°F)</td>
<td>(32°F to 140°F)</td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>Class 1.6/2.5/4 (sphere 6)</td>
<td>Class 1.6/2.5/4</td>
<td>Class 2.5/4 ISO/IDE</td>
</tr>
<tr>
<td>Indicator</td>
<td>Direct reading scale</td>
<td>Direct reading scale</td>
<td>Direct reading scale</td>
</tr>
<tr>
<td>Comments</td>
<td>Limit switches available</td>
<td>Limit switches available</td>
<td>Limit switches available</td>
</tr>
<tr>
<td>Pressure controller available</td>
<td>Valves available</td>
<td>Special options on request</td>
<td></td>
</tr>
<tr>
<td>Valves available</td>
<td>Special options on request</td>
<td>Special options on request</td>
<td></td>
</tr>
</tbody>
</table>
No limitation: Rotameter customized solutions

The Rotameter is known all over the world as a reliable measurement instrument and nowadays is synonymous with the variable area flowmeter principle. We built this reputation on customer oriented solutions.

We have the ability to design and manufacture customer specific solutions. Especially Rotameters where we have almost a century of experience in manufacturing specific sizes, utilizing special materials and creating special scales. All you need to do is tell us what is necessary to fulfill your requirements and we will provide the solution (e.g. Rotameter adapted to customer’s housing or armature).

Our customers have the opportunity to develop with us a specific solution for their application and take advantage of almost 100 years of experience. The result is a Rotameter designed and built for your specific application.
Total reliability: The Coriolis mass flowmeter principle

This high precision measurement principle is unaffected by fluctuating line pressures and changes in viscosity or temperature. Even the physical properties of the fluid such as, high viscosity fluids (slurries and pastes) or the environmental conditions will not affect the accuracy.

The Coriolis principle enables the precise measurement of mass flow, density, temperature and volume flow. The detector tubes are excited by an electromagnetic driver at their resonant frequency. When the fluid passes through the tubes the effect of the Coriolis forces deflects the tubes minutely.

The interaction in the tubes between the natural resonant frequency and the minute deflection due to the Coriolis effect is detected as a small phase shift by two electromagnetic sensors.

This small phase shift is a direct measure of the mass flow passing through the detector. The change in resonance frequency of the tubes is a measure of the density of the fluid in the meter.

Combined with modern digital technology and signal processing this measurement principle is unsurpassed in accuracy, stability and rangeability.
Versatile and durable Flow & Density measurements ROTAMASS 3 Series

Whenever the task is to measure mass flow, density, temperature and volume flow, the ROTAMASS is the right choice.

The ROTAMASS 3 Series is the best-in-class mass flowmeter featuring discrete, parallel, thick-walled, seamless tubes that are uniquely decoupled from process vibration and pipeline stress.

The ROTAMASS measures gases and liquids – even with paste-like consistency – from zero-flow and at temperatures of up to 350°C (662°F). With its state of the art measuring features, e.g. online concentration measurements and diagnostic capabilities for entrained gas and solid particles, the ROTAMASS sets the standard.

The ROTAMASS is easy to clean. When mounted in a vertical pipe the flowmeter is self draining and it meets the highest surface area treatment quality standards for sanitary applications with EHEDG and 3A approvals. The ROTAMASS meets the highest requirements for use in hazardous areas. With its unique, robust "box-in-box-design" the ROTAMASS is decoupled from external oscillations and mechanical stresses.

The ROTAMASS 3 Series is the solution for any fluid that is pumped through a pipe – from oil to milk, from liquefied gas to molten tar. It can be installed in process plants or on a truck without any compromise in accuracy and stability.

No other flowmeter offers so many features and such a high return on investment as the ROTAMASS 3 Series Coriolis Flowmeter.

For pipe sizes DN 8 to 200 (¼” to 8”)
End Connections Flange or threaded
Electronics Integral, remote field or rack mount
Measuring Range 0 to 6000 [l/h] to 25046 [lb/min]
Measuring Tube Stainless steel 1.4404 (316L), Material Hastelloy 2.4602 (C 22)
Measuring Temp. Range -200°C to +350°C (-328°F to +662°F)
Process Pressure up to 285 bar (4133 psi)
Ambient Temperature -40°C to 50°C (40°F to 122°F)
Accuracy Mass Flow* ±0.1 % liquid ±0.5% gas
Accuracy Density ±0.5 g/l (16) or ±1 g/l (14)
Accuracy Temperature ±0.5°C
Display 4 Line ICD backlit, Multi language
Ex-approvals ATEX, FM (US), C, CEex or GOST
Signal Outputs/Inputs 2 x 4 to 20 mA, 2 x pulse/frequency/status output
Communication HART, Foundation Fieldbus
Power Supply 90 to 264 V AC
Protection Class IP 67
* of measured value

YOKOGAWA

15
Long Term Stability: The vortex flowmeter principle

Flow measurement is – if you will – nothing but a message providing information, the information is most accurate if the measurement takes place right at the heart of the flow stream. This was the philosophy at Yokogawa when in 1968 the world's first instrument to measure the flow of flue gas was developed.

The basic principle of vortex shedding is visible in daily life. The fluttering of a flag in the wind is a prime example. The frequency of the vortices is an indication of wind speed. Applied to flow measurement, vortex shedding is produced by the use of a blunt, normally flat faced body placed in the pipe perpendicular to the flowing fluid. As fluid passes the blunt body or shedder bar, alternating vortices are created with a frequency that is directly proportional to the fluid velocity.

The vortex technology is ideally suited and applicable for measuring clean gases, steam and low viscous liquids.

The advantages are: relatively low pressure loss, very stable signal and with no moving parts resulting in a very reliable flow measurement over time.

Cut away of Shedder bar with temperature sensor for multi-variable version.
Empowered Technology: digitalYEWFLO

The next generation in vortex measurement is the digitalYEWFLO. Combining the field proven sensor and body assemblies used in over 300,000 units installed worldwide, with unique digital electronics and possessing Yokogawa’s SSP technology the digitalYEWFLO provides the ultimate in accuracy and stability.

The new DigitalYEWFLO Reducer versions (/R1 or /R2 options) drastically minimize upstream & downstream pipe lengths.

Yokogawa’s “Spectral Signal Processor” SSP analyzes the fluid conditions and uses the data to select the optimal settings for the application, providing features never seen before in a vortex flowmeter. The signals from the patented dual sensors, inside the shedder bar are monitored constantly. Intelligent noise functions eliminate noise, thus providing vibration immunity and high stability, even at low flows.

The user interface is a two line LCD display giving flow rate and totalized value simultaneously as well as functional data and diagnostic information.

For Pipe Sizes DN15 to 400 (0.5” to 16”)

<table>
<thead>
<tr>
<th>End Connections</th>
<th>Flange or wafer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Flange Reducer: 1 step down R1</td>
</tr>
<tr>
<td></td>
<td>Flange Reducer: 2 steps down R2</td>
</tr>
</tbody>
</table>

Electronics

<table>
<thead>
<tr>
<th>Measuring Range</th>
<th>0.3 to 4000 m³/h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(0 to 18000 GPM - US), e.g. for water</td>
</tr>
</tbody>
</table>

Body Material

- Stainless steel SCS 1.4410
- Stainless steel 1.4408 (CF8)
- Stainless steel 1.4552 (CF8L)
- Carbon steel (MCB)
- Stainless steel 1.4517 / 1.4542
- Duplex stainless steel DC5/2511H
- Duplex stainless steel C2207s

Process Temp. Range

-196°C to +450°C (-321° F to +842° F)

Pressure Range up to PN 420 / ANSI Class 2500

Ambient Temperature

-29°C to 85°C (20°F to 185°F)

Accuracy

±0.75% liquid, ±0.5% temp.

±1.5% gas and steam

Display

2 Line LCD

Ex-approvals

ATEX, FM, CSA, IECEx, TIIS, GOST

Signal Outputs/ Inputs

4 to 20 mA, pulse/alarm output

Communication

HART, BRAIN, Foundation Fieldbus

Power Supply

10.5 to 42 V DC

Protection Class

IP 67 (NEMA 4X)

Max. Distance Sensor – Signal converter: 30 m (100 ft)

Special Functions

- Self diagnostic functionality
- Built-in temperature sensor for Mass flow calculation

Special options on request

* of measured value
The simplicity of Faraday’s Law is utilized by Yokogawa’s ADMAG AXF to provide a non obstructive magnetic flowmeter that will address all your instrumentation requirements. ADMAG AXF provides with its optimized dual-frequency coil excitation the highest signal-to-noise ratio of all comparable magnetic flowmeters on the market. Therefore stable measurement values are achieved even when measuring multiphase liquids or mediums with low conductivity. This enables you to solve your easy and your most difficult flow applications with one single device. The self-diagnosis-function detects product build-up or coating on the electrode surfaces, and makes maintenance predictable as information on how to correct the problem will be displayed. ADMAG AXF is also available with various sanitary process connections making it ideal for the food and pharma industry.

According to Faraday’s law of induction, a voltage is induced in a conductive liquid flowing through a magnetic field. It is this voltage, that constitutes the relevant parameter for this measurement. The higher the flow velocity through the magnetic field the larger the induced voltage. Applying this principle to practical flow measurement results in a tube with magnetic coils attached to the outside and electrode assembled on the inside of the tube. The coils set up a magnetic field through the entire tube. A conductive liquid flowing through this tube generates a voltage, which is detected by the electrodes.

The advantages of this principle are obvious: No parts of the instrument obstruct the flow; no moving parts to diminish accuracy by wear and tear. Sanitary requirements are met to the highest degree. The magnetic flowmeter principle is an ingenious – but simple – method, which guarantees accurate measurement for all flow ranges. With an optional accuracy specification of 0.2% process optimization is no problem.
No more guesswork – maintenance is predictable:

RXF is a latest member within the Yokogawa magmeter portfolio. This meter is dedicated to the water industry.

RXF provides all necessary features for this industry including newest diagnostic features and communication protocols for water projects. The flanged flow tubes with hard rubber liner are available in various flange ratings, and designed also for high pressure applications up to ANSI 2,500 (DN420).

### ADMAG AXF vs RXF

<table>
<thead>
<tr>
<th>Feature</th>
<th>ADMAG AXF</th>
<th>RXF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sizes</td>
<td>2 mm to 2600 mm (0.1&quot; to 104&quot;)</td>
<td>15 mm to 2000 mm (0.5&quot; to 80&quot;)</td>
</tr>
<tr>
<td>End Connections</td>
<td>Flange or sanitary</td>
<td>Flange</td>
</tr>
<tr>
<td>Electronics</td>
<td>Integral or remote</td>
<td>Integral or remote</td>
</tr>
<tr>
<td>Measuring Range</td>
<td>0 to 101,000 m³/h</td>
<td>0 to 11,000 m³/h</td>
</tr>
<tr>
<td>Liner Material</td>
<td>PFA, PU, EPDM, Ceramic, Natural soft rubber</td>
<td>Hard rubber (Soft rubber, PTFE on request) for potable water</td>
</tr>
<tr>
<td>Electrode Material</td>
<td>Stainless steel 1.4404 (SUS316)</td>
<td>Stainless steel 1.4404 (SUS316)</td>
</tr>
<tr>
<td>Process Temperature Range</td>
<td>-40° C to +180° C (40° F to +350° F)</td>
<td>-10° C to +90° C (14° F to +194° F) (+130°C for PTFE)</td>
</tr>
<tr>
<td>Pressure Range up to</td>
<td>2/4 MPa (290/580 psi)</td>
<td>10 MPa (1450 psi)</td>
</tr>
<tr>
<td>Ambient Temperature</td>
<td>20° C to +60° C (68° F to +140° F)</td>
<td>20° C to +60° C (68° F to +140° F)</td>
</tr>
<tr>
<td>Accuracy*</td>
<td>±0.35 % (standard), ±0.2 % (optional)</td>
<td>±0.5 %</td>
</tr>
<tr>
<td>Display</td>
<td>3 Line graphical Display, Multi language</td>
<td>3 Line graphical Display, Multi language</td>
</tr>
<tr>
<td>Ex Approvals</td>
<td>ATEX, FM, CSA, ECEx, TIS, GOST</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>Signal Outputs/Inputs</td>
<td>4 to 20 mA, Pulse/alarm output status input</td>
<td>Pulse/alarm output status input</td>
</tr>
<tr>
<td>Communication</td>
<td>HART, BRAIN, Foundation Fieldbus, PROFIBUS</td>
<td>HART, BRAIN (Foundation Fieldbus, PROFIBUS on request)</td>
</tr>
<tr>
<td>Power Supply</td>
<td>80 to 264 V AC, 47 to 63 Hz</td>
<td>80 to 264 V AC, 47 to 63 Hz</td>
</tr>
<tr>
<td>90 to 130 V DC, 20.4 to 28.8 V DC/AC</td>
<td>90 to 130 V DC, 20.4 to 28.8 V DC/AC</td>
<td></td>
</tr>
<tr>
<td>Protection Class</td>
<td>IP67/68 (NEMA 4X)</td>
<td>IP67/68 (NEMA 4X)</td>
</tr>
<tr>
<td>Max. Dist. Sensor - Signal Converter</td>
<td>200 m (656 ft)</td>
<td>200 m (656 ft)</td>
</tr>
</tbody>
</table>

* of measured value
NONE-wetted flow measurement: The clamp-on ultrasonic flowmeter principle

How does it work? In transit time ultrasonic flowmeters, a sound wave is introduced to the flowing fluid in such a way that the sound wave alternately travels against the flow in one direction (upstream) and with the flow in the other direction (downstream). The difference in transit time of the wave is proportional to the flowing velocity of the fluid. By multiplying this velocity with the area of the pipe, volumetric flow is calculated.

Users interested in the practical advantages of non-intrusive, easy to install, highly accurate measurement should consider the clamp-on ultrasonic flowmeter.

It can happen that some users are not aware of the developments in the latest techniques in ultrasonic flow measurement. The innovative, clamp-on ultrasonic flowmeter utilizes the transit time principle and meters liquid and high-pressure gas flows without penetrating the process pipe.
The US300 Series provides many solutions to typical problem areas encountered in today’s flow operations. Significant features are the advanced dual µP correlation transit time signal processing; the matched pair stainless steel transducers eliminate zero offsets, whilst warranting excellent linearity. You can measure volumetric flow, sound velocity, and mass flow on all pipe sizes up to 6.5 m in diameter.

Process downtime – pipe wall coating – pressure loss – wear and tear! For many users these are typical concerns when installing and maintaining a flowmeter. However, with the US300PM (portable) and US300FM (fixed) the advantages are – “dry” transducers, lack of moving parts and an installed cost independent of pipe size are all contributing to a minimum cost of ownership.
The EJX910A/930A Multi-Variable transmitter is a sophisticated flowmeter designed to maximize the full potential of differential flowmetering. The DPharp’s Multi-Sensing capability combined with an onboard flow computer, enables our EJX910A/930A to fully characterize the process conditions and therefore, optimize the total flow measurement.

Traditional differential pressure transmitters are only sized at one particular point, the nominal process conditions, around which their accuracy holds true, this ultimately limits their turndown to approximately 5:1 and in some applications 3:1. The flow accuracy degrades significantly the further the flow is from the nominal process conditions. In contrast, our EJX910A/930A Multi-Variable flowmeter is able to characterize the full flow profile and is not limited to the nominal process conditions.

Dynamic flow compensation allows the EJX910A/930A Multi-Variable flowmeter to eliminate errors in the differential flow calculations and to model the flow profile more precisely. Variations in the flowing medium caused by expandability, compressibility, viscosity and density are compensated, along with the dimensional changes of the primary element and pipeline caused by temperature. Every 100 milliseconds the onboard flow computer calculates and updates the flow model, improving the accuracy to better than or equal to 1% of the flow rate while also extending the turndown to 10:1 on flow.
The EJX910A currently supports a number of primary elements: Orifice plates, Venturi’s and Nozzles in accordance with ISO 5167 (1991 & 2003). While averaging pitot tubes are not covered by an industry standard they are still supported by our EJX910A. This ensures application versatility by allowing end users to optimize their plant operations with the selection of an appropriate primary element.

The FSA120 flow configuration wizard simplifies the handling and commissioning of the EJX910A by breaking down the entry of the required process parameters into logical and convenient blocks within the EJX910A DTM. As a configuration tool, the FSA120 also allows online simulation and offline flow modeling, enabling end users to check the validity of the flowmeter parameters prior to installation.

A further advantage of the FSA120 configuration tool is the use of existing FDT/DTM technology. FDT is an open industry interface or frame application while DTM is the specific device manager. This allows the EJX910A DTM to be used in any compliant FDT frame application, exposing its full Multi-Variable measurement & diagnostic capabilities without restriction.

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>±1 % of mass flow rate over 10:1 flow range (100:1 differential pressure range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static Pressure Range/Span</td>
<td>Range: 0 to 320 bar abs / Span: 10 to 320 bar abs</td>
</tr>
<tr>
<td>Temperature Range/Span</td>
<td>Range: -200 to 850 °C / Span: 10 to 1050 °C</td>
</tr>
<tr>
<td>Output Signal</td>
<td>Flow rate, differential pressure, static pressure, ext. temperature, total flow</td>
</tr>
<tr>
<td></td>
<td>4-20mA and pulse output</td>
</tr>
</tbody>
</table>
Whether installed in the harsh environmental conditions of an offshore oil production platform, down stream in a refinery, or the burning desert heat, EJA & EJX deliver accurate, repeatable, high integrity process measurements.

Reduced process variability, increased yield, and improved product reproducibility are achieved with best reference accuracy as low as 0.025% of span. All backed by an unconditional stability guarantee of 0.1% of URL for 10 years. This ensures an installed total performance of better than 0.125% of span.

Best installed performance means delivering best in class transmitters. Robustness, reliability and quality that you can rely on are characteristics that Yokogawa is renowned for.

Safety as Standard
In today’s highly regulated environment, compliance with the latest safety standards and regulations is mandatory. For these reasons Yokogawa believes safety should not be an option. It should be standard in all process automation & control equipment.

Our strategy is to continue to build the finest high quality, reliable, industrial automation & control solutions while incorporating the latest safety standards such as IEC61508 in their design. EJX, with its unique digital, inherently fail-safe DP\textsuperscript{harp} sensor, has been designed and built in accordance with this new philosophy. Whether or not EJX is installed in a Safety Instrument Function (SIF) it will deliver a lifetime of benefits. One benefit being high integrity process measurements validated by onboard safety diagnostic functions.

With EJX, you no longer have to sacrifice plant availability for plant safety. EJX allows you to maximize your plant’s safe availability while optimizing operational uptime.

Multi-Sensing
DP\textsuperscript{harp} multi-sensing digital sensor has the unique ability to accurately measure static pressure and differential pressure simultaneously. This single digital sensor provides additional insight and a wider window into your process. This window includes advanced diagnostics which are realized through continuous statistical analysis of the resonators.

This information is available through the supported digital communication protocols; HART, BRAIN, Foundation Fieldbus, PROFIBUS PA, EDDL and FDT/DTM. The purely digital signal provided by the DP\textsuperscript{harp} is never degraded by any analog to digital converters.

Multi-sensing allows the process to operate with fewer devices by utilizing the additional functionality of the EJA & EJX pressure transmitters.
Robustness

Robustness is the ability to function under extreme conditions. DPharp for the digital world provides the most rugged and reliable pressure transmitters available today. Constructed from the highest grade of materials, our transmitters continue to perform even in the most severe applications.

The DPharp digital sensor is the heart of EJA and EJX. This micro-machined single crystal silicon sensor, in conjunction with the unique overpressure protection system, will withstand abnormal pressure events without loss of accuracy or performance.

Many processes contain corrosive and other aggressive mediums. Therefore, EJA & EJX are available with a selection of compatible materials, such as 316L stainless steel, Monel, Tantalum and Titanium.

To protect against harsh environments the IP67/NEMA-4X dual compartment explosion-proof housing is also available in either low-copper aluminium or stainless steel. Plant availability is largely dependent on the robustness of the installed instrumentation. EJA & EJX deliver uncompromising quality and durability with longevity in mind.

Stability and Reliability

Science has identified single crystal materials as those materials which have negligible hysteresis. Unfortunately, these same single crystal materials do not make very good pressure sensors in their natural state and significant development was needed to produce an excellent pressure sensor based upon these materials. Such sensors exist today in the form of our Yokogawa DPharp resonant pressure sensor.

By micro-machining the resonators directly within the single crystal silicon material we are able to derive the maximum benefits from the elasticity of the single crystal silicon material while enhancing sensitivity and repeatability. In fact, the properties of the resonators remain constant over time. This makes DPharp the ideal pressure sensor for harsh industrial automation environments. DPharp delivers stability, repeatability and reliability that you can rely on.

<table>
<thead>
<tr>
<th>Features Table</th>
<th>EJX</th>
<th>EJA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>0.025%</td>
<td>0.065%</td>
</tr>
<tr>
<td>Stability</td>
<td>0.1% of URL for 10 Years</td>
<td>0.1% of URL for 5 Years</td>
</tr>
<tr>
<td>Turndown</td>
<td>200:1</td>
<td>100:1</td>
</tr>
<tr>
<td>Multisensing</td>
<td>D/P &amp; S/P</td>
<td>·</td>
</tr>
<tr>
<td>Multi Variable</td>
<td>D/P, S/P, PT, CV &amp; QCA</td>
<td>·</td>
</tr>
<tr>
<td>Communications</td>
<td>BRAIN, HART, FF &amp; FDT/DTM</td>
<td>·</td>
</tr>
<tr>
<td>Agency Approvals</td>
<td>ATEX, FM, CSA, IEC &amp; TIS</td>
<td>·</td>
</tr>
<tr>
<td>Safety</td>
<td>FMEDA</td>
<td>·</td>
</tr>
<tr>
<td>Response time</td>
<td>≤ 90 msec</td>
<td>·</td>
</tr>
<tr>
<td>User Linearisation</td>
<td>10 point matrix</td>
<td>·</td>
</tr>
<tr>
<td>Alarms</td>
<td>Contact output</td>
<td>·</td>
</tr>
</tbody>
</table>
Temperature Sensors

An assortment of temperature sensors are readily available, these include Resistance Temperature Detectors (RTD’s) and Thermocouples (TC’s) to suit all process automation applications. Wire wound RTD’s represent the most common temperature sensors, because of their inherent accuracy and stability, they are used extensively in process measurement and control. Thermocouples deliver high temperature capability and are more vibration tolerant than RTD’s. Furthermore, they can be manufactured in small diameters for asset monitoring purposes. The quality of the sensor remains essential to the overall health of your process and plant.

Thermowells

Thermowells are an important part of the temperature measurement and the plant’s containment solution, providing protection against potentially dangerous process mediums.

A correctly designed thermowell can withstand:
- Erosion
- Corrosion
- High pressures and velocities
- Various mechanical stressors

Quality of design and manufacturing is essential to meet the requirements of a variety of process environments. Thermowells can be manufactured from barstock, forgings or tubular construction and in a variety of materials ranging from stainless steel to exotic alloys. These ensure mechanical integrity, safety and longevity. A welded flanged thermowell can be an acceptable solution for many applications, however, a full penetration welded flanged thermowell (double “J”) delivers the maximum mechanical strength for high pressure service. Once welded and heat treated the thermowell becomes effectively a one piece construction of similar alloys. Quality assurance testing, such as; dye-penetration, X-Ray, ultrasonic and pressure testing confirm the welding process. The ultimate thermowell is formed from a single piece of material, forging and therefore, has no welds. This is an excellent choice for high pressure, arduous process.
Multi Input Temperature Transmitter
- 8 channel
- Sensor diagnostics lead break and short circuit detection
- Field mounted via DIN Rail
- Aluminum / Stainless Steel enclosure options
- Over 20 Resistance/Thermocouple and Voltage inputs
- Intrinsically safe for zone 1
- FISCO and Entity

YTA50
P.C Programmable
Head mount Transmitter
Accuracy +/- 0.2%
16 inputs RTD, TC, mV & OHM

YTA70
Head mount Transmitter
Accuracy +/- 0.2%
17 inputs RTD, TC, mV & OHM

YTA70
Head mount Transmitter
Accuracy +/- 0.2%
17 inputs RTD, TC, mV & OHM

YTA110
Field/Direct Sensor Mount Transmitter
Accuracy +/- 0.1%
5 Year Stability
Programmable Display with Bar graph
20 inputs RTD, TC, mV & OHM
TUV Certified
SIL 2 Safety Requirement as standard

YTA310
Field/Direct Sensor Mount Transmitter
Accuracy +/- 0.05%
5 Year Stability
Optional SST housing
Programmable Display with Bar graph
20 inputs RTD, TC, mV & OHM
TUV Certified
SIL 2 Safety Requirement as standard

YTA320
Field/Direct Sensor Mount Transmitter
Accuracy +/- 0.05%
5 Year Stability
Optional SST housing
Dual Sensor Input
Sensor matching
Sensor Redundancy backup
Averaging and Differential Temperature
Programmable Display with Bar graph
20 inputs RTD, TC, mV & OHM
TUV Certified
SIL 2 Safety Requirement as standard

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Dual Sensor Input
Sensor matching
Sensor Redundancy backup
Averaging and Differential Temperature
Programmable Display with Bar graph
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