Yokogawa´s Rotameter Catalogue

Variable Area Flowmeter
Rotameter – The Original

BU01A08A08-E-E

vigilantplant.®
The clear path to operational excellence

YOKOGAWA

Table of Contents

1 Foreword

Welcome to the 2nd edition of Yokogawa's Glass Rotameter Catalogue.

With this edition we introduce the new RGC4 Rotameter which replaces the RGC3 model. The RGC4 model will now complete the porfolio of our proven selection of Glass and Plastic Rotameters. These simple and affordable flowmeters have a very broad application range, smart design and decades of reliable performance.

In these days when environmental management has finally found its way into our minds and enterprises, the pure mechanical principle of the Rotameter regains even more momentum. For manufacturers it is important to optimize productivity, consume less energy and reduce energy costs. Using Rotameters with their comparably low pressure loss results in low pumping costs and therefore energy savings. Rotameters work without power and are therefore sustainable. The new RGC4 can be completely disassembled and consists from recyclable materials only. The RGC4 design, made from common standard components and parts being used from other Yokogawa flow products, leads to a synergy effect in production and to resource and energy conservation. This is key to sustainable future Yokogawa takes into account at every stage of the product lifecycle. Think of your carbon foot print – use Rotameters!

2 Principle of Operation

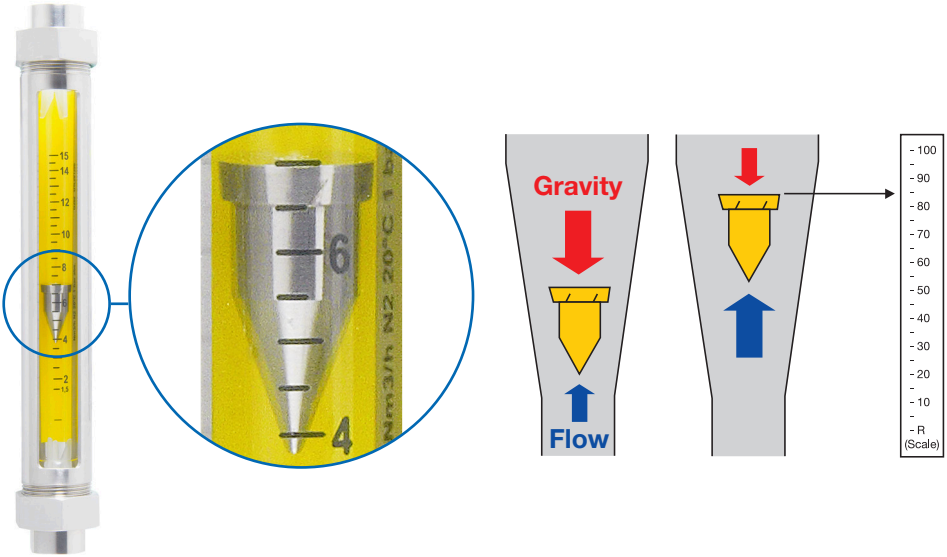
A Rotameter measures the flow of liquids, gases and steam by using a float inside a tapered tube.

The medium passes through the metering tube from bottom to top and consequently rises the float until there is an annular gap between the inside surface of the metering tube and the float and equilibrium of the following forces has been achieved.

Buoyancy / Gravity / Friction force

ROTA developed the form of the rotating float which provides self stabilization. In case of glass and plastic tubes you can simply view the float position to get a reliable reading of the flow rate from the top of the float.

The Rotameter principle is one of the oldest and mature principles in flow measurement. This mechanical principle is as simple as it is reliable.



3 Rotameter Overview

Trust your own eyes: Rotameter RGC & RQC Series

The flow tube is transparent giving you full insight into process and position of the float – a scale located on the tube indicates the true flow rate.

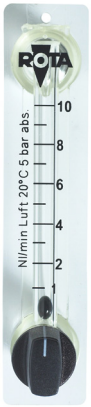
The Rotameter gets its name from the rotating float which was developed by ROTA to provide self stabilization.

A Rotameter is truly modular flowmeter. The variety in cones, floats and scales combine to make the Yokogawa Rotameter suitable for a very wide range of Applications.

RGC1 series
Glass Rotameter

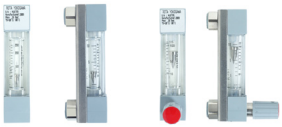
RGC2 series
Glass Rotameter

RGC4 series
Glass Rotameter

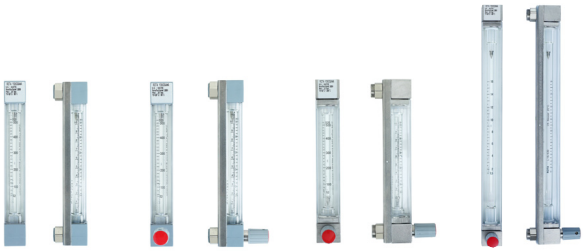


RQC1 series
Plastic Rotameter

Step 1: Use the table below to find the correct model based on accuracy, fluid type and flow rate.
Step 2: Detailed specification, drawing and ordering information can be found in the relevant page in the Model Description section.



RGC1 series



RGC2 series

4 Rotameters Selection Table

Rotameter Model	Type	Process Connection Size	Process Connection Material	Additional Features
RGC1	Glass	1/4" NPT	Polypropylene	None
	Glass	Female		None
RGC1	Glass	1/4" NPT	Polypropylene	Flow adjustment valve
	Glass	Female		Flow adjustment valve
RGC2	Glass	1/4" Rp	Stainless Steel	Easy tube replacement design with flow adjustment valve
	Glass	Female		Easy tube replacement design with flow adjustment valve
RGC4	Glass	1/2" G 1" G 2" G	Stainless Steel	None
RQC1	Plastic	1/4" Rp Female	Polyamide	None
RQC1	Plastic	1/4" Rp Female	Polyamide	Flow adjustment valve

*Acc. to Directive VDI/VDE 3513, sheet 2 (qG=50%)

Step 3: If necessary Contact your local sales representation for additional informations or visit our website at www.rotameter.eu


RGC4 series





RQC1 series


Customer Standards



Metal Rotameters

Permitted Operating Conditions	Maximum Flow		Accuracy*	Page
	Water (20ºC)	Air (20ºC, 1 bar abs.)		
max. 16 bar	1l/h … 110 l/h	16 l/h … 1600 l/h	4%	10
max. 80ºC	25 ml/h … 63 l/h	1,9 l/h … 2400 l/h	2.5%	14
max. 16 bar	1l/h … 110 l/h	16 l/h … 1600 l/h	4%	12
max. 80ºC	25 ml/h … 63 l/h	1,9 l/h … 2400 l/h	2.5%	16
max. 16 bar	25 ml/h … 63 l/h	1,9 l/h … 2400 l/h	2.5%	18
max. 80ºC	25 ml/h … 63 l/h	1,9 l/h … 2400 l/h	1.6%	20
max. 16 bar max. 100ºC	100 l/h … 10.000 l/h	1600l/h … 160 m³/h	1.6%	22
max. 10 bar max. 60ºC	/	180 l/h … 1600 l/h	4%	24
max. 10 bar max. 60ºC	/	180 l/h … 1600 l/h	4%	26

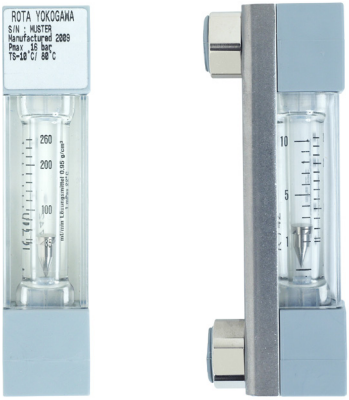
For further information visit our website at www.yokogawa.com/eu

RGC1 MODEL Without adjustment valve

Metering tube: 75mm

Description

This type of Rotameter is designed for measurement of low liquid and gas flows.



Benefits

- Cost-effective solution
- Space-saving design
- Negligible pressure loss

Applications

- Visual fluid monitoring
- Flow / No-flow indication
- Gas analysis
- …

Technical data

Process Connection	Size: ¼" NPT female Material: Polypropylene
Metering tube	Length: 75 mm Material: Borosilicate (Duran 50)
Float material	for liquid: Stainless Steel for gas: Glass ball
Gasket material	Buna (NBR)
Permitted operating conditions	Max. 16 bar (@20°C), Max. 80°C
Measuring span	10:1
Measuring accuracy Acc. Directive VDI/VDE 3513, sheet 2	4% (q_G=50%)

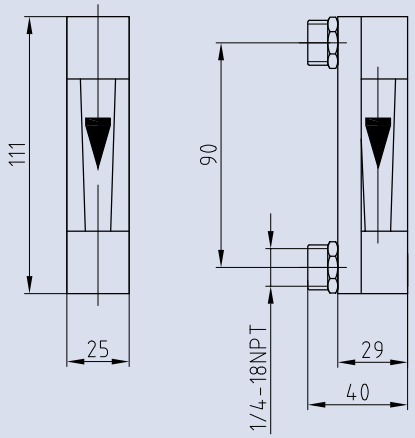
Flow Tables

Water (20°C)	
Max. Flow [l/h]	**Part number**
1	RGC1000
2,5	RGC1001
4	RGC1002
6	RGC1003
10	RGC1004
15	RGC1005
26	RGC1006
40	RGC1007
63	RGC1008
110	RGC1009

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	**Part number**
16	RGC1020
40	RGC1021
65	RGC1022
100	RGC1023
160	RGC1024
250	RGC1025
400	RGC1026
630	RGC1027
1000	RGC1028
1600	RGC1029

Dimensions [mm]
RGC1 without valve

Process connection: ¼'' NPT Female



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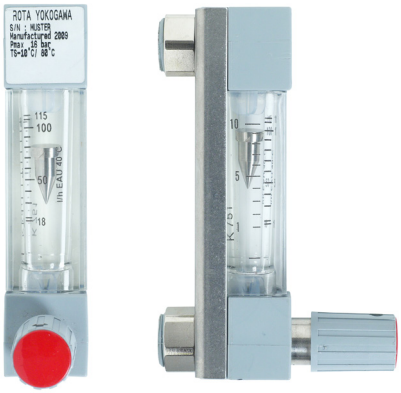
RGC1 MODEL With built-in adjustment valve
Metering tube: 75mm

Description
This type of Rotameter is designed for measurement of low liquid and gas flows.
A needle valve is integrated on the inlet of the Rotameter for flow adjustment.



Benefits
- Cost-effective solution
- Space-saving design
- Negligible pressure loss
- Fine adjustment of flow

Applications
- Visual fluid monitoring
- Flow / No-flow indication
- Gas analysis
- …

Technical data

Process Connection	Size: ¼" NPT female Material: Polypropylene
Metering tube	Length: 75 mm Material: Borosilicate (Duran 50)
Float material	for liquid: Stainless Steel for gas: Glass ball
Gasket material	Buna (NBR)
Valve material	Silver seat; Buna gasket Stainless steel spindle
Permitted operating conditions	Max. 16 bar (@20°C) Max. 80°C
Measuring span	10:1
Measuring accuracy Acc. Directive VDI/VDE 3513, sheet 2	4% (q_G=50%)

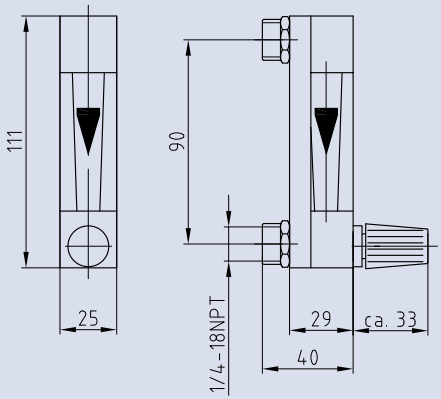
Flow Tables

Water (20°C)	
Max. Flow [l/h]	**Part number**
1	RGC1040
2,5	RGC1041
4	RGC1042
6	RGC1043
10	RGC1044
15	RGC1045
26	RGC1046
40	RGC1047
63	RGC1048
110	RGC1049

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	**Part number**
16	RGC1060
40	RGC1061
63	RGC1062
100	RGC1063
160	RGC1064
250	RGC1065
400	RGC1066
630	RGC1067
1000	RGC1068
1600	RGC1069

Dimensions [mm]
RGC1 with valve

Process connection: ¼'' NPT Female



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RGC1 MODEL Without adjustment valve
Metering tube: 150mm

Description
This type of Rotameter is designed for measurement of low liquid and gas flows.

Benefits
- Cost-effective solution
- Negligible pressure loss
- Better accuracy & readability due to longer metering tube

Applications
- Visual fluid monitoring
- Laboratory process
- Gas analysis
- …

Technical data

Process Connection	Size: ¼" NPT female Material: Polypropylene
Metering tube	Length: 150 mm Material: Borosilicate (Duran 50)
Float material	for liquid & gas : Titanium
Gasket material	Buna (NBR)
Permitted operating conditions	Max. 16 bar (@20°C) Max. 80°C
Measuring span	10:1
Measuring accuracy Acc. Directive VDI/VDE 3513, sheet 2	2.5% (q_G=50%)

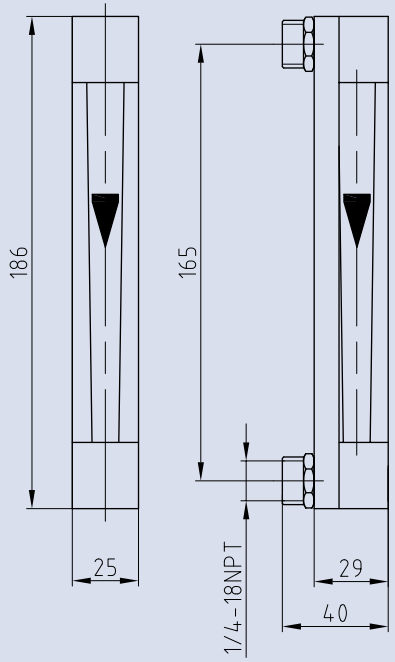
Flow Tables

Water (20°C)	
Max. Flow [l/h]	**Part number**
25 (ml/h)	RGC1200
63 (ml/h)	RGC1201
160 (ml/h)	RGC1202
400 (ml/h)	RGC1203
1	RGC1204
1,6	RGC1205
2,5	RGC1206
4	RGC1207
6,3	RGC1208
10	RGC1209
16	RGC1210
25	RGC1211
40	RGC1212
63	RGC1213

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	**Part number**
1,9	RGC1220
4,4	RGC1221
10	RGC1222
23	RGC1223
50	RGC1224
70	RGC1225
100	RGC1226
180	RGC1227
250	RGC1228
400	RGC1229
630	RGC1230
1000	RGC1231
1600	RGC1232
2400	RGC1233

Dimensions [mm]
RGC1 without valve

Process connection: ¼'' NPT Female



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RGC1 MODEL With built-in adjustment valve
Metering tube: 150mm

Description
This type of Rotameter is designed for measurement of low liquid and gas flows.
A needle valve is integrated on the inlet of the Rotameter for flow adjustment.

Benefits
- Cost-effective solution
- Negligible pressure loss
- Better accuracy & readability due to longer metering tube

Applications
- Visual fluid monitoring
- Laboratory process
- Gas analysis
- …

Technical data

Process Connection	Size: ¼" NPT female Material: Polypropylene
Metering tube	Length: 150 mm Material: Borosilicate (Duran 50)
Float material	for liquid & gas : Titanium
Gasket material	Buna (NBR)
Valve material	Silver seat; Buna gasket Stainless steel spindle
Permitted operating conditions	Max. 16 bar (@20°C) Max. 80°C
Measuring span	10:1
Measuring accuracy Acc. Directive VDI/VDE 3513, sheet 2	2.5% (q_G=50%)

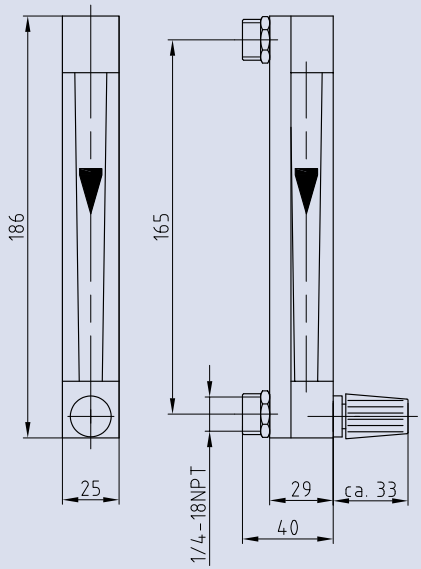
Flow Tables

Water (20°C)	
Max. Flow [l/h]	**Part number**
25 (ml/h)	RGC1240
63 (ml/h)	RGC1241
160 (ml/h)	RGC1242
400 (ml/h)	RGC1243
1	RGC1244
1,6	RGC1245
2,5	RGC1246
4	RGC1247
6,3	RGC1248
10	RGC1249
16	RGC1250
25	RGC1251
40	RGC1252
63	RGC1253

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	**Part number**
1,9	RGC1260
4,4	RGC1261
10	RGC1262
23	RGC1263
50	RGC1264
70	RGC1265
100	RGC1266
180	RGC1267
250	RGC1268
400	RGC1269
630	RGC1270
1000	RGC1271
1600	RGC1272
2400	RGC1273

Dimensions [mm]
RGC1 without valve

Process connection: ¼'' NPT Female



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RGC2 MODEL With built-in adjustment valve
Metering tube: 150mm

Description
This type of Rotameter is designed for measurement of low liquid and gas flows.
A needle valve is integrated on the inlet of the Rotameter for flow adjustment.

Benefits
- Easy assembly & disassembly of the metering tube without disconnecting Rotameter
- Designed for aggressive applications
- Negligible pressure loss

Applications
- Laboratory processes
- Chemical processes
- Gas analysis
- …

Technical data

Process Connection	Size: ¼" Rp female Material: Stainless Steel
Metering tube	Length: 150 mm Material: Borosilicate (Duran 50)
Float material	for liquid & gas : Titanium
Gasket material	PTFE/Viton (FPM)
Valve material	Silver seat; Viton gasket Stainless steel spindle
Permitted operating conditions	Max. 16 bar (@20°C) Max. 80°C
Measuring span	10:1
Measuring accuracy Acc. Directive VDI/VDE 3513, sheet 2	2.5% (qG=50%)

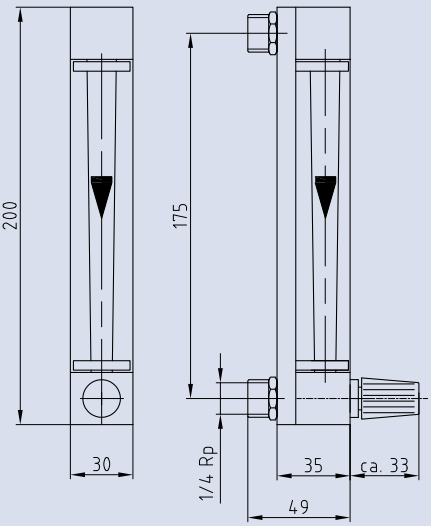
Flow Tables

Water (20°C)	
Max. Flow [l/h]	**Part number**
25 (ml/h)	RGC2200
63 (ml/h)	RGC2201
160 (ml/h)	RGC2202
400 (ml/h)	RGC2203
1	RGC2204
1,6	RGC2205
2,5	RGC2206
4	RGC2207
6,3	RGC2208
10	RGC2209
16	RGC2210
25	RGC2211
40	RGC2212
63	RGC2213

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	**Part number**
1,9	RGC2220
4,4	RGC2221
10	RGC2222
23	RGC2223
50	RGC2224
70	RGC2225
100	RGC2226
180	RGC2227
250	RGC2228
400	RGC2229
630	RGC2230
1000	RGC2231
1600	RGC2232
2400	RGC2233

Dimensions [mm]
RGC2 without valve

Process connection: ¼'' Rp Female



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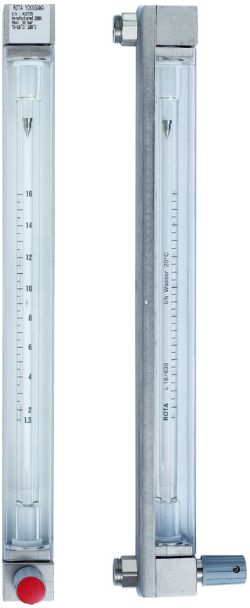
RGC2 MODEL With built-in adjustment valve
Metering tube: 300mm

Description
This type of Rotameter is designed for measurement of low liquid and gas flows.
A needle valve is integrated on the inlet of the Rotameter for flow adjustment.



Benefits
- Easy assembly & disassembly of the metering tube without disconnecting Rotameter
- Designed for aggressive applications
- Negligible pressure loss

Applications
- Laboratory processes
- Chemical processes
- Gas analysis
- …

Technical data

Process Connection	Size: ¼" Rp female Material: Stainless Steel
Metering tube	Length: 300 mm Material: Borosilicate (Duran 50)
Float material	for liquid & gas : Titanium
Gasket material	PTFE/Viton (FPM)
Valve material	Silver seat; Viton(FPM) gasket Stainless steel spindle
Permitted operating conditions	Max. 16 bar (@20°C) Max. 80°C
Measuring span	10:1
Measuring accuracy Acc. Directive VDI/VDE 3513, sheet 2	1.6% (q_G=50%)

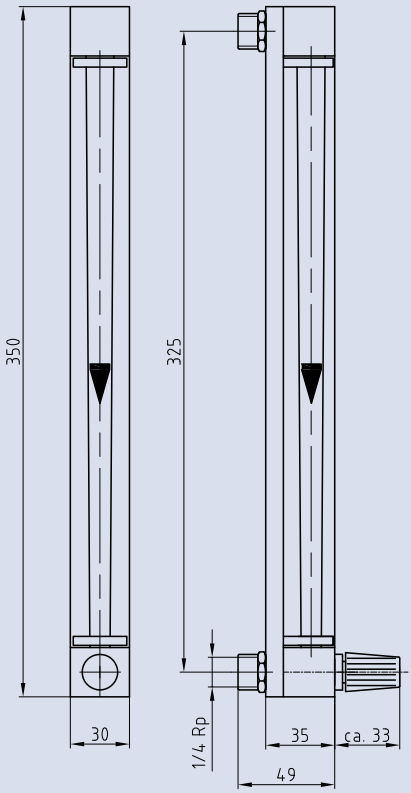
Flow Tables

Water (20°C)	
Max. Flow [l/h]	**Part number**
25 (ml/h)	RGC2400
63 (ml/h)	RGC2401
160 (ml/h)	RGC2402
400 (ml/h)	RGC2403
1	RGC2404
1,6	RGC2405
2,5	RGC2406
4	RGC2407
6,3	RGC2408
10	RGC2409
16	RGC2410
25	RGC2411
40	RGC2412
63	RGC2413

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	**Part number**
1,9	RGC2420
4,4	RGC2421
10	RGC2422
23	RGC2423
50	RGC2424
70	RGC2425
100	RGC2426
180	RGC2427
250	RGC2428
400	RGC2429
630	RGC2430
1000	RGC2431
1600	RGC2432
2400	RGC2433

Dimensions [mm]
RGC2 without valve

Process connection: ¼'' Rp Female



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RGC4 MODEL

Description
This type of Rotameter is designed for a wide measuring range of liquid and gas flows.

Benefits
Robust and sturdy construction
High measuring accuracy
High readability

Applications
- Industrial processes
- Visual fluid monitoring
- Water circuits
- …

RGC4

Technical data

Process Connection	Size: ½" up to 2" G female Material: Stainless Steel
Housing	Material: Stainless Steel
Metering tube	Length: 300 mm Material: Borosilicate (Duran 50)
Float material	for liquid : Stainless Steel for gas : PTFE
Gasket material	Buna (NBR)
Permitted operating conditions	Max. 16 bar (@20°C) Max. 100°C
Measuring span	10:1
Measuring accuracy Acc. Directive VDI/VDE 3513, sheet 2	1.6% (q_G=50%)

Flow Tables

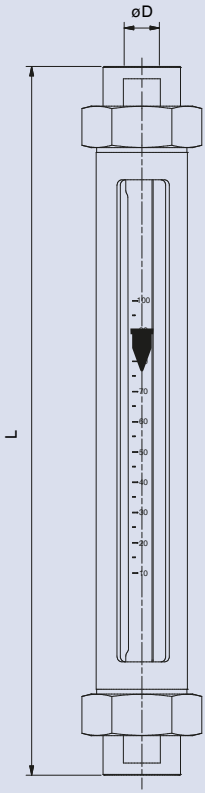
Water (20°C)		
Max. Flow [l/h]	**Connection Size**	**Part number**
100	½“	RGC4700
160	½“	RGC4701
250	1“	RGC4702
400	1“	RGC4703
630	1“	RGC4704
1000	1“	RGC4705
1600	1“	RGC4706
2500	1“	RGC4707
4000	2“	RGC4708
6300	2“	RGC4709
10000	2“	RGC4710

Air (20°C, 1 bar abs.)		
Max. Flow [l/h]	**Connection Size**	**Part number**
1600	½“	RGC4720
2500	½“	RGC4721
4000	1“	RGC4722
6300	1“	RGC4723
10 [m³/h]	1“	RGC4724
16 [m³/h]	1“	RGC4725
25 [m³/h]	1“	RGC4726
40 [m³/h]	1“	RGC4727
63 [m³/h]	2“	RGC4728
100 [m³/h]	2“	RGC4729
160 [m³/h]	2“	RGC4730

Dimensions [mm]
RGC4 all tubes

Process Connection Diameter ØD	Dimension L [mm]
½“	375
1“	375
2“	375

Process connection: ½” up to 2” G female



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RQC1 MODEL Without adjustment valve
Metering tube: 75mm

Description
This type of Rotameter is especially designed for measurement of gas flows.

Benefits
- Low cost solution
- Space-saving design
- Negligible pressure loss

Applications
- Visual fluid monitoring
- Control panels
- Flow / No-flow indication
- …

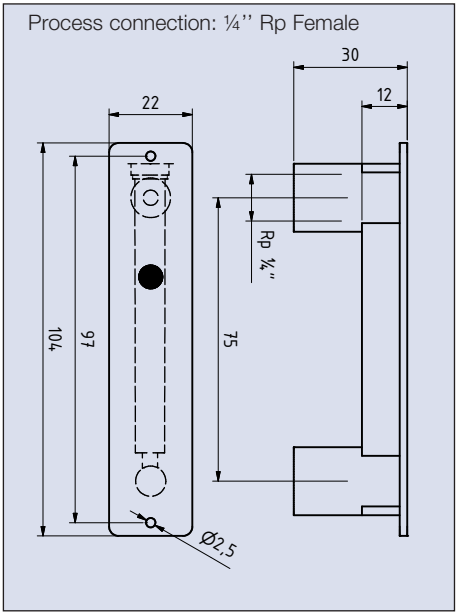
Technical data

Process Connection	Size: ¼" Rp female Material: Polyamide
Metering tube	Length: 75 mm Material: Polyamide
Float material	Niro Ball
Gasket material	Buna (NBR)
Permitted operating conditions	Max. 10 bar (@20°C) Max. 60°C
Measuring span	10:1
Measuring accuracy Acc. Directive VDI/VDE 3513, sheet 2	4% (q_G=50%)

Flow Table

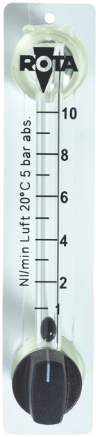
Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	**Part number**
180	RQC1000
250	RQC1001
400	RQC1002
630	RQC1003
1000	RQC1004
1600	RQC1005

Dimensions [mm]
RQC1 without valve



RQC1 MODEL With built-in adjustment valve
Metering tube: 75mm

Description
This type of Rotameter is especially designed for measurement of gas flows.
A needle valve is integrated on the inlet of the Rotameter for flow adjustment.



Benefits
- Low cost solution
- Space-saving design
- Negligible pressure loss

Applications
- Visual fluid monitoring
- Control panels
- Flow / No-flow indication
- …

Technical data

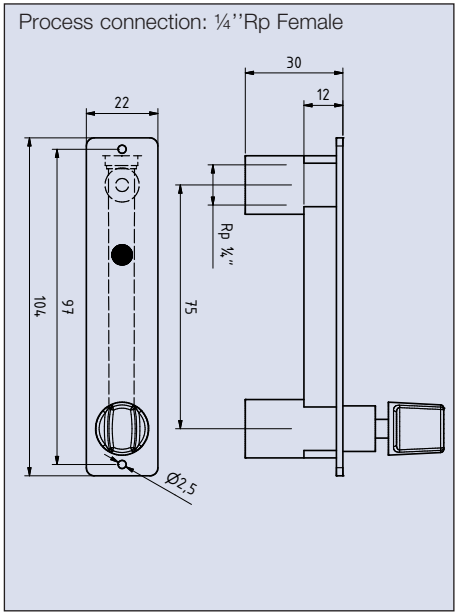
Process Connection	Size: ¼" Rp female Material: Polyamide
Metering tube	Length: 75 mm Material: Polyamide
Float material	Niro Ball
Gasket material	Buna (NBR)
Valve material	Polyamide seat; Buna gasket Stainless steel spindle
Permitted operating conditions	Max. 10 bar (@20°C) Max. 60°C
Measuring span	10:1
Measuring accuracy Acc. Directive VDI/VDE 3513, sheet 2	4% (q_G=50%)

Flow Table

Air (20°C, 1 bar abs.)	
Max. Flow [l/h]	**Part number**
180	RQC1200
250	RQC1201
400	RQC1202
630	RQC1203
1000	RQC1204
1600	RQC1205

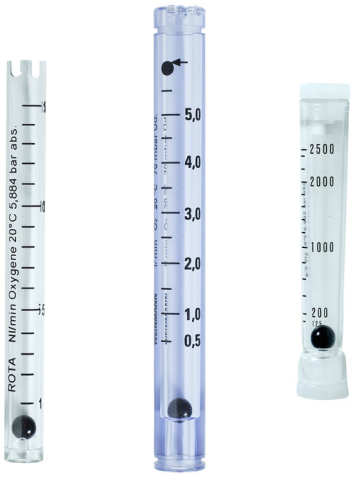
Dimensions [mm]

RQC1 with valve



6 Customer Standards

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 made of glass or plastic.

Most custom-made Rotameters contain different sizes, special materials and scales or individual flow ranges.

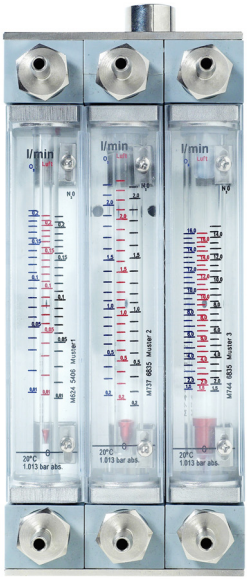
Once the standard is created it leads to short response time and high quality.

Customer standards are suited for a continuous supply of a larger amount of custom-made Rotameters.

All you need to do is tell us what is necessary to fulfil your requirements and we will provide the solution.

Our customers have the opportunity to develop with us a specific solution for their application and take advantage of our 100 years experience.

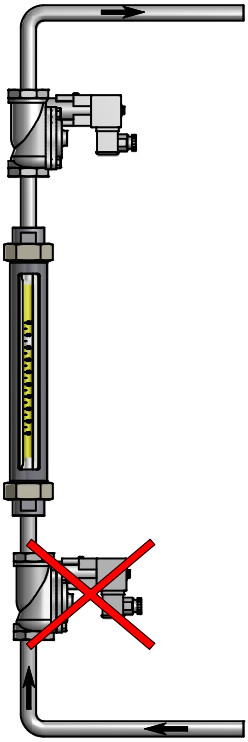
Please contact our Technical Sales Team for your customized Rotameters.



7 Best Practises for Installation of Rotameters

Extract from VDI/VDE 3513 - Part 3

- Rotameters must be vertically oriented (flow direction: bottom to top).
- It is absolutely imperative to avoid stress resulting from the connecting pipeline.
- Rotameters must be shielded from pipeline vibration by taking suitable installation measures. Rotameters must be safeguarded from pulsations in the measured medium.
- Disturbance-free inlet and outlet sections are generally not required. However, in case of gases measurement a straight, undisturbed length of approx. 5 times the internal pipe diameter is recommended.
- For gases, in order to avoid measuring errors, it is advisable to select the arrangement such that the pressure in the Rotameter is as constant as possible and corresponds to the calibration pressure.



8 Introduction of Metal Rotameters

Robust and universal: Metal Rotameter Series RAMC

Patented blocked float indication system
Retrofitable damping system for gas applications
Extension for high/low temperature applications
Explosion proof housing available
HART® protocol
Profibus PA
Suitable for SIL 2 applications
Special material like Monel or Hastelloy on request

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

At first glance the instrument looks impressive with its all stainless steel design. A closer look reveals a unique patented “blocked float indication system”. 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 – the interchangeability of floats – then the RAMC is for you.

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

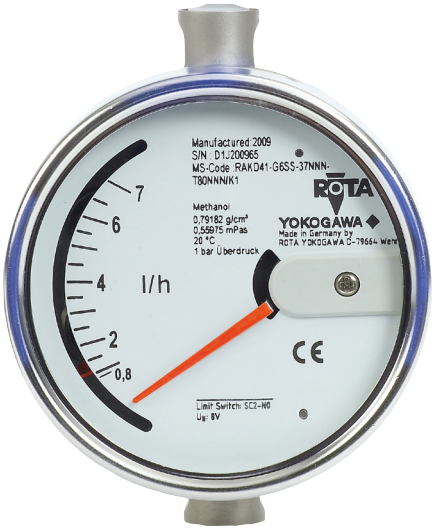
Operational safety is of the utmost importance in any flowmeter, and the RAMC is no exception – wetted parts are available in a variety of materials, and intrinsically safe outputs or an explosion proof housing are available as an option.

Already in 2005 the well-known independent organisation Exida® made a hardware assessment according to the relevant functional safety standards like IEC 61508. The assessment consists of a Failure Modes, Effects and Diagnostic Analysis (FMEDA). From the FMEDA failure rates are determined and consequently the Safe Failure Fraction (SFF) is calculated for the device. The result of the FMEDA must be considered in order to determine suitability for a specific Safety Integrity Level (SIL).

The RAMC with 4…20 mA output or HART® protocol is suitable for the use in safety-instrumented systems according to IEC 61508-2 with SIL 1 level due to its unique and patented blocked float indication system.

The RAMC with local indicator and either standard or fail-safe limit switches can be used up to SIL 2 level applications.

Small in size, big in performance: Metal Rotameter RAKD



- Easy to read display
- All stainless steel design
- Adjustment valve and flow controller available
- Fast connection technique using Quickon connector
- Suitable for SIL 2 applications

The RAKD is the smaller brother of the RAMC – is robust in design – for low flows and high pressure applications.

The RAKD differentiates itself from other comparable variable area meters by means of light and guided float design. This feature avoids oscillations caused by gas compressibility, leading to very stable measurement. Further the RAKD offers a wide range of process connections.

With the FMEDA for the RAKD Yokogawa is the first supplier to become complete to provide safety excellence to all Metal Rotameter applications.

The RAKD with either standard or fail safe limit switches is suitable for safety applications up to SIL Level 2. The RAKD configuration with valve and flow controller reaches SIL Level 1.

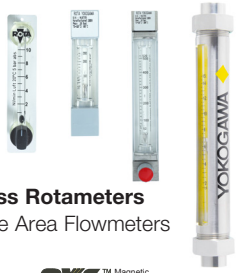
9 Yokogawa Flow-Solutions Overview

(See bulletin 01A05A05-E-E)

Yokogawa's six Flow Technologies provide a solution for many flow applications:

- Variable area flowmeters
- Coriolis mass flowmeters
- Vortex flowmeters
- Magnetic flowmeters
- Ultrasonic flowmeters
- DP flow with multivariable transmitter

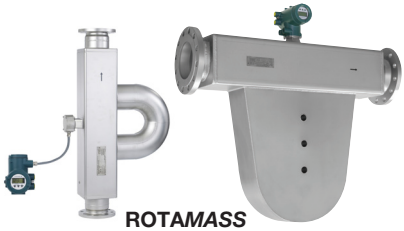
Please do not hesitate to contact your local sales representation for further information or visit our website at www.yokogawa.com/eu.



Glass Rotameters
Variable Area Flowmeters

Admag
Magnetic Flowmeters

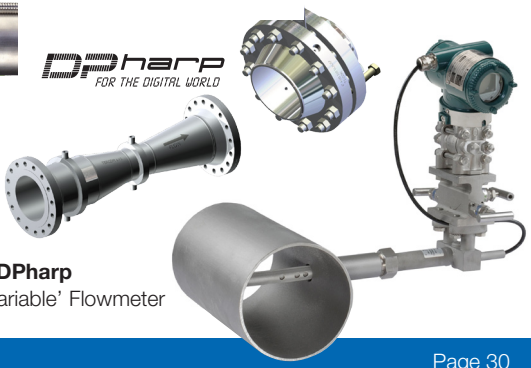
Metal Rotameters
Variable Area Flowmeters



ROTA*MASS*
Coriolis Mass Flowmeters

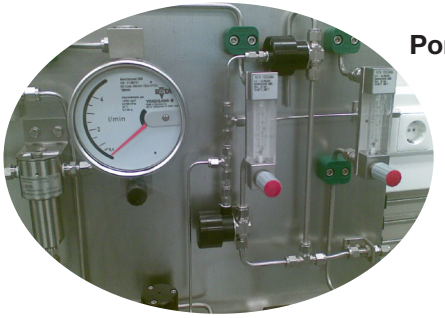
digitalYEWFLO
Vortex Flowmeters

US300
Ultrasonic Flowmeters

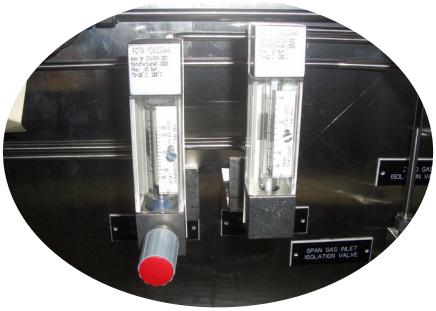


DPharp
DP 'Multivariable' Flowmeter

10 Applications

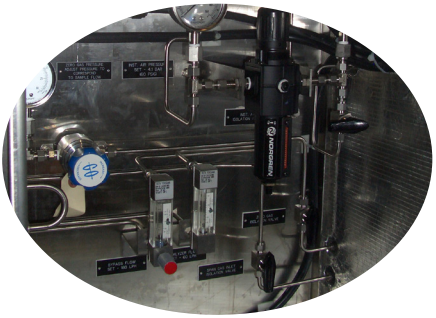


Portable skid for gas measurement

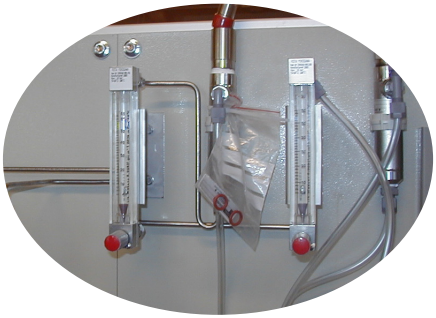


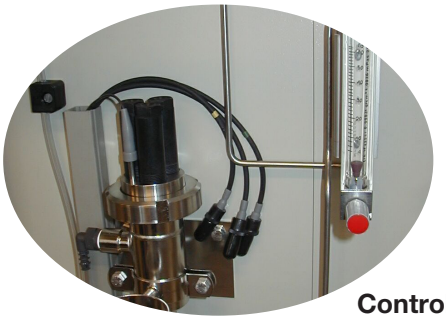
Over the last hundred years we have built up a reputation for Quality Reliability Safety.

Gas analyser station



Sampling Systems





Control Panel

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