

# General Specifications

## Model RAMC Metal Short-stroke ROTAMETER

GS 01R01B02-00E-E

The short-tube Rotameter is used for measurement of flow rates of liquids and gases. Its special application is in turbulent, opaque or aggressive fluids. The instrument is mounted in a vertical pipeline with flow direction upwards. Inside the special shaped conical metal tube, a float is guided concentrically. The position of this float is magnetically transmitted to the indicator. The indicators are exchangeable without influencing the accuracy.

### FEATURES

- Different process connections like flanges according to EN and ASME
- All wetted parts in stainless steel or PTFE
- Flow range water: 0.0025 to 130 m<sup>3</sup>/h
- Flow range air: 0.075 to 1400 m<sup>3</sup>/h (+20 °C, 1.013 bar abs)
- Measuring accuracy acc. standard VDI/VDE 3513 sheet 2 ( $q_G = 50 \%$ ) at calibration conditions
- Float damping to avoid float bouncing with gas applications
- Optional heat tracing (with steam or fluid heat carrier)
- Indicator in steel or aluminum, protection class IP66/67
- Mechanical indicator without additional power supply
- Microprocessor controlled transmitter with 24 V, 115 V or 230 V power supply
- Intrinsically safe version (Ex i): ATEX, IECEx, FM (C/US), NEPSI, PESO, EAC
- Flame proof version (Ex d): ATEX, IECEx, NEPSI, PESO, KOSHA, EAC, TS
- Dust explosion proof: ATEX, IECEx, NEPSI, TS
- Ex for non-electrical RAMC: ATEX, EAC
- FMEDA report available for SIL application
- Limit switches, also available as "fail-safe" version
- Electronic transmitter as standard with digital display with the following features:
  - ◆ Flow indication (totalizer, actual, percent)
  - ◆ Indication of different volume- and mass flow units
  - ◆ Possibility of user calibration in the field
  - ◆ Float blocking indication function
  - ◆ Adjustable signal output damping
  - ◆ Error message indication
  - ◆ Temperature measurement in the electronic transmitter
  - ◆ HART® 5/7-Communication



RAMC with housing type 90



RAMC with housing type 91

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## STANDARD SPECIFICATIONS

### RoHS Directive 2011/65/EU:

RoHS conform according to EN 50581

### MEASURING TUBE

#### Materials of wetted parts:

- Stainless steel AISI 316L (1.4404)
- PTFE (if selected)
- Gasket for process connection R4 or T4:  
Aramide fibres with NBR binder
- Other materials on request

#### Fluids to be measured:

Clean liquids, gas and steam

#### Measuring range:

See table 10 and 11

#### Measuring turndown ratio:

10:1

#### Process connections/ Stainless steel:

##### Flanges:

- Acc. to EN 1092-1
  - DN100 to DN150 PN16
  - DN15 to DN100 PN40
  - DN50 to DN80 PN63
  - DN15 to DN50 PN100
- Acc. to ASME B 16.5 (AISI 316/316L dual certified)
  - ½" to 6" Class 150 raised face
  - ½" to 6" Class 300 raised face
  - ½" to 3" Class 600 raised face
- Flange facing roughness
  - Form B1: RA 3.2 to 6.3
  - Form B2: RA 0.8 to 3.2
  - ASME: RA 3.2 to 6.3
- Threaded connection:
  - Male acc. to DIN 11851
  - NPT-female
  - G-female
  - Clamp acc. to DN25, 1" to DN100, 4"

#### Process pressure:

Depends on process connection, see table 9 and 11 higher pressure (up to 700 bar) on request

#### Process temperature:

- Wetted parts made of stainless steel:  
-196 °C to +370 °C
- Wetted parts made of PTFE:  
-80 °C to +130 °C

See fig. 1a to fig. 1c

#### Measuring accuracy at calibration conditions:

Table 1

Material of wetted parts	Size	Measuring accuracy acc. standard VDI/VDE 3513 sheet 2 (q <sub>6</sub> =50 %)
SS	DN15 to DN100	1.6 %
SS	DN125 to DN150	2.5 %
PTFE	DN15 to DN100	2.5 %

#### Calibration conditions:

Water, 1 to 2 bar, +15 °C to +25 °C

#### Pressure Equipment Directive (PED):

- Tubes:
  - Modul: H
  - Fluid Group: 1 (dangerous fluids)
  - Produced acc. to category: III
  - Classification: Table 6 of PED directive (piping)
- Heating (options /T1 to /T6):
  - Art. 4 section 3: (Volume < 1 L)
  - Fluid Group: 2 (non-dangerous fluids)
  - Classification: Table 2 of PED directive (vessels)

#### Installation:

- Mounting direction:  
vertical
- Flow direction:  
upwards
- Mounting length:  
see table 9 and 11
- Straight pipe inlet length:  
DN80/100 at least 5D, not necessary for smaller sizes

#### Weight:

See table 17

#### Canadian Registration Numbers (CRN)

Available upon request

### MECHANICAL INDICATOR, type -T

#### Principle:

The flow values is indicated by a pointer with the aid of a magnet enclosed in the float and a magnet in the indicator unit which follows the movements of the float.

#### Indicator housing:

- Materials:
  - Housing type 90: stainless steel 1.4404/316L
  - Housing type 91: aluminum, Polyurethane, yellow, RAL 1021 acc. to EN 13195 material: AC 44200
  - Both housing types with safety-glass window
- Degree of protection:
  - IP66/67
  - NEMA 4, 4X, 6 (not for Ex d housing)

#### Scales:

- Standard:  
removable aluminium plate with scale  
(double scale as option)
- Marking:  
direct readable units or percentage of Q<sub>max</sub>.

#### Transportation- and Storage condition:

-40 °C to +110 °C

### ELECTRONIC TRANSMITTER, type -E, -H, -J

#### Standard type -E:

##### Power supply:

- 4-wire units with galvanic isolation:
  - 230 V AC +10 %/ -15 %, 50/60 Hz,  
fuse 0.063 A, time lag, (5x20) mm
  - 115 V AC +10 %/ -15 %, 50/60 Hz,  
fuse 0.125 A, time lag, (5x20) mm
- 2/3-wire units: U = 14 to 30 V DC

##### Output signal:

- 4-wire units:
  - 0 to 20 mA
  - 4 to 20 mA
  - Pulse output (option /CP): max. frequency 4 Hz
- 3-wire units:
  - 0 to 20 mA
  - 4 to 20 mA
- 2-wire units: 4 to 20 mA

The 20 mA point is selectable between 60 % and 100 % of scale end value.

##### Load resistance:

- 4-wire units: ≤ 500 Ω
- 2/3-wire unit: ≤ (U - 14 V)/ 20 mA, max. 500 Ω

#### HART®-communication type (Code -H, -J):

##### Power supply:

2-wire units: U = 14 to 30 V DC

##### Output signal:

2-wire units: 4 to 20 mA

##### Load resistance:

HART®-version: 250 to 500 Ω

**Digital display:**

8 digits, 7 segment LC-display character height 6 mm

**Process-/ Ambient temperature:**

The dependency of the process temperature from the ambient temperature is shown in fig. 1a to fig. 1c. The internal temperature of the electronic transmitter can be indicated on the display or checked via HART® communication.

**Measurement of the internal transmitter temperature:**

- Range: -25 °C to +70 °C
- Accuracy: ± 5 °C

**Transportation- and Storage condition:**

-40 °C to +70 °C

**Linearity<sup>1)</sup>:**

± 0.2 % of 20 mA

**Hysteresis<sup>1)</sup>:**

± 0.1 % of 20 mA

**Repeatability<sup>1)</sup>:**

± 0.1 % of 20 mA

**Influence of power supply<sup>1)</sup>:**

± 0.1 % of 20 mA

**Temperature coefficient of the output signal<sup>1)</sup>:**

± 0.5 % /10 °C of 20 mA

**AC-part of output signal<sup>1)</sup>:**

± 0.15 % of 20 mA

**Long-term stability<sup>1)</sup>:**

± 0.2 % per year

**Max. output signal:**

21.5 mA

**Output signal in case of failure:**

≤ 3.6 mA (acc. NE 43)

**Response time (99 %):**

About 1.5 s with damping 1 s

**Electromagnetic compatibility (EMC):**

Acc. EN 61326-1, Class A, Table 2 and EN 61326-2-3: Criterion A, restriction: HF-immunity between 500 MHz and 750 MHz: criterion B

**Device safety acc. EN 61010-1:**

- Over voltage category: II (acc. to EN 60664-1)
- Pollution degree: I
- Safety class: 115 V, 230 V AC power supply, safety class I  
24V DC power supply, safety class III

**POWER SUPPLY FOR ELECTRONIC TRANSMITTER,**

option /UT

**Type:**

Power supply with galvanically separated input and output; RN221N-B1, HART®-compatible

**Supply voltage:**

20 to 250 V DC/ AC 50/60 Hz

**Maximum load:**

700 Ω

**Output signal:**

4 to 20 mA

**CABLE GLAND for transmitter -E, -H, -J****Size:**

- Standard: M16x1.5 for housing type 90
- Standard: M20x1.5 for housing type 91
- Option /A13: thread M20x1.5
- Option /A5: thread NPT ½"

**Cable diameter:**

6 to 9 mm

**Maximum cross section of core:**

Ø 1.5 mm<sup>2</sup>

**LIMIT SWITCHES IN STANDARD VERSION,**

option /K1 to /K3

**Type:**

Inductive proximity switch SC3.5-N0  
acc. to EN 60947-5-6

**Nominal voltage:**

8 V DC

**Output signal:**

≤ 1 mA or ≥ 3 mA

**LIMIT SWITCHES IN FAIL-SAFE VERSION,**

option /K6 to /K10

**Type:**

Inductive proximity switch SJ3.5-SN; SJ3.5-S1N  
acc. to EN 60947-5-6

**Nominal voltage:**

8 V DC

**Output signal:**

≤ 1 mA or ≥ 3 mA

**HYSTERESIS OF LIMIT SWITCHES****Min-contact/ Max-contact:**

- Pointer movement: ≈ 0.8 mm
- Float movement: ≈ 0.8 mm

**Minimum distance between 2 contacts:**

≈ 2 mm

**CABLE GLAND, option /K1 to /K10****Size:**

- Standard: M16x1.5 for housing type 90
- Standard: M20x1.5 for housing type 91
- Option /A13: thread M20x1.5
- Option /A5: thread NPT ½"

**Cable diameter:**

6 to 9 mm

**Maximum cross section of core:**

Ø 1.5 mm<sup>2</sup>

**POWER SUPPLY FOR LIMIT SWITCHES, option /W□□****Type:**

Acc. to EN 60947-5-6

- KFA5-SR2-Ex\*-W (115 V AC); \* = 1 or 2
- KFA6-SR2-Ex\*-W (230 V AC); \* = 1 or 2
- KFD2-SR2-Ex\*-W (24 V DC); \* = 1 or 2

**Fail-safe**

- KHA6-SH-Ex1 (115/230 V AC), 1 channel
- KFD2-SH-Ex1 (24 V DC), 1 channel

**Power supply:**

- 230 V AC ± 10 %, 45 to 65 Hz
- 115 V AC ± 10 %, 45 to 65 Hz
- 24 V DC ± 25 %

**Relay output:**

1 or 2 potential-free changeover contact(s)

**Switching capacity:**

Max. 250 V AC, max. 2 A

**Note:**

If fail-safe limit switch option /K6 or /K7 is ordered, for the power supply option /W2E or /W4E must be selected. If fail-safe limit switch option /K8, /K9 or /K10 is ordered, for the power supply option /W2F or /W4F must be selected.

<sup>1)</sup> referenced to 20 °C ambient temperature

**SWITCHING LEVELS FOR LIMIT SWITCHES**  
**Table 2 Limit switch as Min, Max, Min-Max, Min-Min and Max-Max contact in standard version**

		Option /K1	Option /K2	Option /K3
Function	Pointer	Signal	Signal	Signal
		SC3,5-N0	SC3,5-N0	SC3,5-N0
MAX	above LV	----	1 mA	1 mA
	below LV	----	3 mA	3 mA
Function	Pointer	Signal	Signal	Signal
		SC3,5-N0	SC3,5-N0	SC3,5-N0
MIN	above LV	3 mA	----	3 mA
	below LV	1 mA	----	1 mA

Note: LV = Limit Value

**Table 3 Limit switch as Min, Max and Min-Max contact in fail-safe version**

		Option /K6	Option /K7	Option /K8
Function	Pointer	Signal	Signal	Signal
		SJ3,5-SN	SJ3,5-SN	SJ3,5-SN
MAX	above LV	----	1 mA	1 mA
	below LV	----	3 mA	3 mA
	fail-safe	----	1 mA	1 mA
Function	Pointer	Signal	Signal	Signal
		SJ3,5-SN	SJ3,5-SN	SJ3,5-SN
MIN	above LV	3 mA	----	3 mA
	below LV	1 mA	----	1 mA
	fail-safe	1 mA	----	1 mA

Note: LV = Limit Value

**Table 4 Limit switch as Min-Min contact in fail-safe version**

		Option /K9
Function	Pointer	Signal
		SJ3,5-S1N
MIN	above LV	3 mA
	below LV	1 mA
	fail-safe	1 mA
Function	Pointer	Signal
		SJ3,5-SN
MIN	above LV	3 mA
	below LV	1 mA
	fail-safe	1 mA

Note: LV = Limit Value

**Table 5 Limit switch as Max-Max contact in fail-safe version**

		Option /K10
Function	Pointer	Signal
		SJ3,5-SN
MAX	above LV	1 mA
	below LV	3 mA
	fail-safe	1 mA
Function	Pointer	Signal
		SJ3,5-S1N
MAX	above LV	1 mA
	below LV	3 mA
	fail-safe	1 mA

Note: LV = Limit Value

#### **FOLLOWING IEC 61508**

RAMC with fail-safe limit switches (/K6 to /K10):

Suitable for application in safety functions up to and including SIL2.

RAMC with standard limit switches (/K1 to /K3):

Suitable for application in safety functions up to and including SIL1.

Details see FMEDA report.

#### **FOLLOWING ISO 13849-1**

Safety Metrics available for:

- RAMC with fail-safe limit switches (/K6 to /K10)
- RAMC with standard limit switches (/K1 to /K3)

Details see FMEDA report.

#### **APPROVALS IN EAEU AND CIS COUNTRIES Eurasian Conformity (EAC)**

RAMC complies to applicable Technical Regulations valid in EAEU countries Russia, Belarus, Kazakhstan, Armenia and Kyrgyzstan, option /VE.

- TR CU 004
- TR CU 020
- TR CU 032
- TR CU 012 can be added for hazardous area applications (options /GF1, /GS1, /GC1).

#### **Pattern Approval certificate of Measuring Instruments**

RAMC has Pattern Approval certificates and is registered as a measuring instrument in Kazakhstan, Uzbekistan and Russia.

- Option /QR2 for Kazakhstan
- Option /QR3 for Uzbekistan
- Option /VR for Russia

An additional Primary verification certificate is available for Russia with option /QR, only in combination with option /VR.

## HAZARDOUS AREA SPECIFICATIONS

Table 6 Overview hazardous area certified instruments:

Location	Europe				Global			USA / Canada	India	Korea	China	Russia, Belarus, Kazakhstan, Armenia, Kyrgyzstan	Taiwan	
Certificate	ATEX				IECEX			FM	PESO	KOSHA	NEPSI	EAC	TS	
<b>Electronic transmitter, Code -E, -H, -J</b>														
Protection	ia	ic	ia/tb	-	ia	-	ia/tb	IS/NI	ia	-	-	ia	-	-
Option	/KS1	/KS3	/KS2	-	/ES1	-	/ES2	/FS1	/KS1+/Q11	-	-	/GS1	-	-
Comments	-	<sup>2)</sup>	<sup>1)</sup>	-	-	-	<sup>1)</sup>	<sup>3)</sup>	-	-	-	-	-	-
See page	6	6	9	-	6	-	9	6	-	-	-	6	-	-
<b>Limit switches</b>														
Protection	ia	ic	ia/tb	-	ia	-	ia/tb	IS/NI	-	-	-	ia	-	-
Option	/KS1	/KS3	/KS2	-	/ES1	-	/ES2	/FS1	-	-	-	/GS1	-	-
Comments	-	<sup>2)</sup>	<sup>1)</sup>	-	-	-	<sup>1)</sup>	-	-	-	-	-	-	-
See page	7	7	9	-	7	-	9	7	-	-	-	7	-	-
<b>Complete RAMC</b>														
Protection	d/tb	-	-	db/tb	-	-	-	d	d	ia	d/DIP	d	-	d/tb
Option	/KF1	-	/KC1	/EF1	-	-	-	/KF1+/Q11	/EF1+/KC	/NS1	/NF1	/GF1	/GC1	/EF1
Comments	<sup>5)</sup>	-	<sup>6)</sup>	<sup>5)</sup>	-	-	-	<sup>5)</sup>	<sup>5)</sup>	-	<sup>5)</sup>	<sup>5)</sup>	<sup>6)</sup>	<sup>5)</sup>
See page	7	-	10	8	-	-	-	8	8	7	8	8	10	7
<b>Power supplies for intrinsically safe components (see page 9)</b>														
Option /UT	yes	-	-	-	-	-	-	-	-	-	-	-	-	-
Option /W1A,B	yes	-	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	-	-
Option /W2A,B	yes	-	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	-	-
Option /W4A,B	yes	-	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	-	-
Option /W2E,F	yes	-	yes	no	no	no	no	no	no	no	yes	yes	-	-
Option /W4E,F	yes	-	yes	no	no	no	no	no	no	yes	yes	yes	-	-
Notation	IS = Intrinsically Safe; NI = Nonincendive; DIP = Dust Ignition Proof													
Comment <sup>1)</sup>	Dust proof by RAMC housing													
Comment <sup>2)</sup>	For use in category 3G													
Comment <sup>3)</sup>	Same certification for USA and Canada													
Comment <sup>4)</sup>	Only for USA; power supply free selectable													
Comment <sup>5)</sup>	Only with housing 91													
Comment <sup>6)</sup>	Only indicator type -T without limit switches													

## HAZARDOUS AREA APPROVALS FOR ELECTRONIC TRANSMITTER, type -E, -H, -J

### Attention:

The approvals for hazardous areas only apply to the defined conditions according to the temperature class. The maximum ambient temperature of the transmitter or limit switches must not be exceeded by the heat transfer of the liquid.

**Table 7 Entity parameters of electronic transmitter**

Option	Ui in V	Ii in mA	Pi in W	Ci in nF	Li in mH	max. Ta in °C
/KS1/2/3	30	101	1.4	4.16	0.15	70
/ES1/2	30	101	1.4	4.16	0.15	70
/FS1	30	100	1.4	40	0.15	70
/NS1	30	101	1.4	4.16	0.15	70
/GS1	30	101	1.4	4.16	0.15	70

### Intrinsically safe electronic transmitter with ATEX-approval, option /KS1

#### Certificate:

PTB 12 ATEX 2003 X

#### Output signal:

- 4 to 20 mA (2-/3-wire unit)
- 0 to 20 mA (3-wire unit)

#### Explosion proof:

Ex ia IIC T6 Gb; group II; category 2G

#### Entity parameter:

See table 7

### Intrinsically safe electronic transmitter with IECEx-approval, option /ES1

#### Certificate:

IECEX PTB 12.0020 X

#### Output signal:

- 4 to 20 mA (2-/3-wire unit)
- 0 to 20 mA (3-wire unit)

#### Explosion proof:

Ex ia IIC T6 Gb; group II; category 2G

#### Entity parameter:

See table 7

### Intrinsically safe electronic transmitter with ATEX-approval for use in category 3G, option /KS3

#### Output signal:

- 4 to 20 mA (2-/3-wire unit)
- 0 to 20 mA (3-wire unit)

#### Explosion proof:

Ex ic IIC T6 Gc; group II; category 3G

#### Entity parameter:

See table 7

### Intrinsically safe/ nonincendive electronic transmitter with FM-approval (USA + Canada), option /FS1

#### Certificate:

No.: 3027471-/3027471C

#### Output signal:

4 to 20 mA (2-wire unit)

#### Explosion proof:

- Intrinsically safe Cl. I, Div. 1, GP. A, B, C, D T6
- Intrinsically safe Cl. 1, Zone 0, AEx ia IIC T6
- Nonincendive Cl. I, Div. 2, GP. A, B, C, D T6

#### Entity parameter of electronic transmitter:

See table 7

### Intrinsically safe electronic transmitter with PESO-approval (India), option /KS1 with /Q11

Same data as ATEX-certified type, option /KS1.

#### Certificate:

PESO Ref. No.: P3339351/1

### Intrinsically safe electronic transmitter with EAC-approval Russia, Belarus, Kazakhstan, Armenia and Kyrgyzstan, option /GS1

#### Certificate:

RU C-DE.ГБ08.B.01183

#### Output signal:

- 4 to 20 mA (2-/3-wire unit);
- 0 to 20 mA (3-wire unit)

#### Explosion proof:

0ExiaIICT6 X

#### Entity parameter:

See table 7

## HAZARDOUS AREA APPROVALS FOR INTRINSICALLY SAFE LIMIT SWITCHES, option /K1 to /K10

**Intrinsically safe limit switches with ATEX-approval,** option /K1 to /K10 with /KS1

**Certificate:**

- PTB 99 ATEX 2219X ( SC3.5-NO), /K1 to /K3
- PTB 00 ATEX 2049X (SJ 3.5-S.N), /K6 to /K10

**Explosion proof:**

Ex ia IIC T6, group II category 2G

**Entity parameter:**

See certificate

**Intrinsically safe limit switches with ATEX-approval for use in category 3G,** option /K1 to /K10 with /KS3

**Explosion proof:**

Ex ic IIC T6 X, group II category 3G

**Entity parameter:**

- See specification of SC3,5-N0 Blue (P&F)\* (/K1 to /K3)
  - See specification of SJ3,5-SN (P&F)\* (/K6 to /K10)
- \* P&F = Pepperl & Fuchs

**Intrinsically safe limit switches with IECEx-approval,** option /K1 to /K10 with /ES1

**Certificate:**

- IECEx PTB11.0091 (SC3.5-NO) (/K1 to /K3)
- IECEx PTB11.0092 (SJ 3.5-S.N) (/K6 to /K10)

**Explosion proof:**

Ex ia IIC T6 Gb

**Entity parameter:**

See certificate

**Intrinsically safe/nonincendive limit switches with FM-approval (USA),** option /K1 to /K10 with /FS1

**Explosion proof:**

- IS: Cl. I, II, III, Div. 1, Gp. ABCDEFG, T6, Ta = +60 °C,
- NI: Cl. I, Div. 2, Gp. ABCD, T5, Ta = +50 °C,  
Cl. II, Div. 1, Gp. EFG  
Cl. III, Div. 1

**Entity parameter:**

- See FM-control drawing 116-0165 for IS
- See FM-control drawing 116-0155 for NI

**Intrinsically safe limit switches with EAC-approval Russia, Belarus, Kazakhstan, Armenia and Kyrgyzstan,** option /K1 to /K10 with /GS1

**Certificate:**

RU C-DE.ГБ08.B.01183

**Explosion proof:**

0Ex ia IIC T6...T1 X

**Entity parameter:**

See certificate

**Intrinsically safe limit switches with NEPSI-approval (China),** option /K1 to /K10 with /NS1

**Certificate:**

- GYJ16.1391X (/K1 to /K3)
- GYJ16.1392X (/K6 to /K10)

## HAZARDOUS AREA APPROVALS FOR COMPLETE ELECTRICAL RAMC

**Intrinsically safe RAMC with NEPSI-approval (China),** option /NS1

**Certificate:**

GYJ15.1064

**Electronic transmitter:**

- Output signal:
  - 4 to 20 mA (2-/3-wire unit);
  - 0 to 20 mA (3-wire unit)
- Explosion proof: Ex ia IIC T6

**Ambient temperature:**

-40 °C to +70 °C

**Entity parameter:**

See table 7

**Limit switches:**

- Option /K1 to /K3 acc. to certificate GYJ16.1391X
- Option /K6 to /K10 acc. to certificate GYJ16.1392X

**Flame proof and dust proof RAMC with ATEX-approval,** option /KF1

**Certificate:**

IBExU 05 ATEX 1086

**Flame proof:**

Ex db IIC T1...T6 Gb; group II; category 2G

**Dust proof:**

Ex tb IIIC TX Db IP6X; group III; category 2D

Max. surface temperature TX: corresp. process temperature

**Housing:**

Painted aluminium casting, type 91

**Output signal with electronic transmitter -E, -H, -J:**

- 4 to 20 mA (2-/3-wire unit);
- 0 to 20 mA (3-wire unit)

**Power supply with electronic transmitter -E, -H, -J:**

2- or 3-wire unit

**Limit switches:**

Options /K1 to /K10 possible

**Ambient temperature:**

-20 °C to +60 °C

**Minimum process temperature:**

-20 °C

**Threads for cable glands:**

- Standard: M20x1.5
- Option /A5: NPT ½"

**Temperature classification:**

See table 8

**Flame proof and dust proof RAMC with IECEx-approval,** option /EF1

**Certificate:**

IECEx IBE12.0007

**Flame proof:**

Ex db IIC T1...T6 Gb

**Dust proof:**

Ex tb IIIC TX Db IP6X

Max. surface temperature TX: corresp. process temperature

**Housing:**

Painted aluminium casting, type 91

**Output signal (with electronic transmitter -E, -H, -J):**

- 4 to 20 mA (2- or 3-wire unit);
- 0 to 20 mA (3-wire unit)

**Power supply (with electronic transmitter -E, -H, -J):**

2- or 3-wire unit

**Limit switches:**

Options /K1 to /K10 possible

**Ambient temperature:**

-20 °C to +60 °C

**Minimum process temperature:**

-20 °C

**Threads for cable glands:**

- Standard: M20x1.5
- Option /A5: NPT ½"

**Temperature classification:**

See table 8

**Flame proof and dust proof RAMC with PESO-approval (India), option /KF1 with /Q11**

Same data as ATEX-certified certified type, option /KF1.

**Certificate:**

PESO Ref. No.: P432024/1

**Flame proof RAMC with KOSHA-approval (Korea), option /EF1 with /KC****Certificate:**

12-AV4BO-0721X

**Flame proof:**

Ex d IIC T1...T6

Option /EF1 in combination with /KC must be selected.

**Temperature classification:**

See table 8

**Flame proof RAMC with EAC-approval (Russia, Belarus, Kazakhstan, Armenia and Kyrgyzstan), option /GF1****Certificate:**

RU C-DE.ГБ08.B.01183

**Flame proof:**

1Ex d IIC T1...T6

**Housing:**

Painted aluminium casting, type 91

**Output signal with electronic transmitter -E, -H, -J:**

- 4 to 20 mA (2-/3-wire unit)
- 0 to 20 mA (3-wire unit)

**Power supply with electronic transmitter -E, -H, -J:**

2- or 3-wire unit

**Limit switches:**

Options /K1 to /K10 possible

**Ambient temperature:**

-40 °C to +60 °C

**Minimum process temperature:**

-20 °C

**Threads for cable glands:**

- Standard: M20x1.5
- Option /A5: NPT ½"

**Temperature classification:**

See table 8

**Flame proof and dust proof RAMC with NEPSI-approval (China), option /NF1****Certificate:**

GYJ18.1039X

**Flame proof:**

Ex d IIC T1~T6 Gb

**Dust proof:**

Ex tD A21 IP67 T80°C

**Housing:**

Painted aluminium casting type 91

**Output signal with electronic transmitter -E, -H, -J:**

- 4 to 20 mA (2-/3-wire unit)
- 0 to 20 mA (3-wire unit)

**Power supply with electronic transmitter -E, -H, -J:**

2- or 3-wire unit

**Limit switches:**

Options /K1 to /K10 possible

**Ambient temperature:**

-20 °C to +60 °C

**Minimum process temperature:**

-20 °C

**Threads for cable glands:**

- Standard: M20x1.5
- Option /A5: NPT ½"

**Temperature classification:**

See table 8

**Flame proof and dust proof RAMC with Taiwan Safety Mark****Registration Document:**

ML041200702782

Option /EF1 must be selected.

Same data as IECEx-certified type (/EF1)

For export to Taiwan please contact your Yokogawa representative regarding Taiwan Safety Mark.

**Table 8 Temperature rating for Ex d devices**

Temp. class	Max. Process temperature		
	No extension	On extension	On extension with insulation
T6	85 °C	85 °C	85 °C
T5	100 °C	100 °C	100 °C
T4	120 °C	135 °C	135 °C
T3	120 °C	200 °C	200 °C
T2	120 °C	300 °C	300 °C
T1	120 °C	370 °C	350 °C

## INTRINSICALLY SAFE COMPONENTS WITH DUST-PROOF

### Intrinsically safe electronic transmitter with/without limit switches in dust proof indicator ATEX-certified, option /KS2

#### Approval:

- PTB 12 ATEX2003X (Intrinsically safe electronic transmitter)
- PTB 99 ATEX2219X (Intrinsically safe limit switch SC3.5-N0)
- PTB 00 ATEX2049X (Intrinsically safe limit switch SJ 3.5-S.N)
- IBEExU 05 ATEX1086 (Dust proof)

#### Output signal electronic transmitter:

- 4 to 20 mA (2-/3-wire unit)
- 0 to 20 mA (3-wire unit)

#### Explosion proof:

Ex ia IIC T6 Gb; group II; category 2G

#### Dust proof:

Ex tb IIIC TX Db IP6X; group III; category 2D  
Max. surface temperature TX: corresponding process temperature

#### Entity parameter:

- See table 7 for electronic transmitter (/KS1)
- See certificates for limit switches

#### Housing:

Painted aluminium casting, type 91

#### Ambient temperature:

-20 °C to +60 °C

#### Minimum process temperature:

-20 °C

#### Threads for cable glands:

- Standard: M20x1.5
- Option /A5: NPT ½"

### Intrinsically safe electronic transmitter with/without limit switches in dust proof indicator IECEx-certified, option /ES2

#### Approval:

- IECEx PTB12.0020X (Intrinsically safe electronic transmitter)
- IECEx PTB11.0091X (Intrinsically safe limit switch SC3.5-N0)
- IECEx PTB11.0092X (Intrinsically safe limit switch SJ 3.5-S.N)
- IECEx IBE12.0007 (Dust proof)

#### Output signal electronic transmitter:

- 4 to 20 mA (2-/3-wire unit)
- 0 to 20 mA (3-wire unit)

#### Explosion proof:

Ex ia IIC T6 Gb; group II; category 2G

#### Dust proof:

Ex tb IIIC TX Db IP6X; group II; category 2D  
Max. surface temperature TX: corresponding process temperature

#### Entity parameter:

- See table 7 for electronic transmitter (/ES1)
- See certificates for limit switches

#### Housing:

Painted aluminium casting, type 91

#### Ambient temperature:

-20 °C to +60 °C

#### Minimum process temperature:

-20 °C

#### Threads for cable glands:

- Standard: M20x1.5
- Option /A5: NPT ½"

## POWER SUPPLIES FOR INTRINSICALLY SAFE COMPONENTS

### Power Supply for the intrinsically safe electronic transmitter, option /UT

#### Type:

Power supply with galvanically separated input and output RN221N-B1, HART®-compatible

#### Approval:

- ATEX: PTB 00 ATEX 2018
- Other certificates available on request.

#### Supply voltage:

20 to 250 V DC/AC 50/60 Hz

#### Maximum load impedance:

700 Ω

#### Output signal:

4 to 20 mA

#### Control circuit:

Intrinsically safe [Ex ia] IIC; group II; category (1)GD

#### Entity parameters:

See certificate

### Power supply for intrinsically safe limit switches, option W□□

#### Type:

Acc. to EN 60947-5-6:

- KFA5-SR2-Ex\*-W (115 V AC), \* = 1 or 2
- KFA6-SR2-Ex\*-W (230 V AC), \* = 1 or 2
- KFD2-SR2-Ex\*-W (24 V DC), \* = 1 or 2

Fail-safe:

- KHA6-SH-Ex1 (115/230 V AC), fail-safe, 1 channel
- KFD2-SH-Ex1 (24 V DC), fail-safe, 1 channel

#### Approvals:

- KFA5-SR2-Ex\*-W: ATEX: PTB 00 ATEX 2081  
FM: ID 3011578  
IECEX: PTB11.0031  
EAC: RU C-П.ГБ05.В.00718  
NEPSI:GYJ17.1283
- KFA6-SR2-Ex\*-W: ATEX: PTB 00 ATEX 2081  
FM: ID 3011578  
IECEX: PTB11.0031  
EAC: RU C-П.ГБ05.В.00718  
NEPSI:GYJ17.1283
- KHA6-SH-Ex1: ATEX: PTB 00 ATEX 2043  
EAC: RU C-П.ГБ05.В.00718
- KFD2-SR2-Ex\*-W: ATEX: PTB 00 ATEX 2080  
FM: ID 3011578  
IECEX: PTB11.0034  
EAC: RU C-П.ГБ05.В.00718  
NEPSI:GYJ17.1284
- KFD2-SH-Ex1: ATEX: PTB 00 ATEX 2042  
EAC: RU C-П.ГБ05.В.00718

#### Control circuit (ATEX):

[Ex ia] IIC; group II; category (1)GD

#### Entity parameter:

See certificate

## HAZARDOUS AREA APPROVALS FOR COMPLETE MECHANICAL RAMC

### ATEX registered RAMC, option /KC1

**Archive No.:**

IBExU 099/15

**Explosion proof:**

II 2GD IIC TX

**Max. surface temperature:**

TX: corresponding process temperature

**Ambient temperature:**

-40 °C to +90 °C

**Max. process temperature**

- Standard: +220 °C
- Indicator on distance: +370 °C

### RAMC with EAC-approval, option /GC1

**Approval:**

RU C-DE.ГБ08.B.01183

**Explosion proof:**

- II Gb IIC T\* X
- III Db IIIC T\* °C X

**Max. surface temperature:**

TX: corresponding process temperature

**Ambient temperature:**

-40 °C to +90 °C

**Max. process temperature:**

- Standard: +220 °C
- Indicator on distance: +370 °C

## PLANNING AND INSTALLATION HINTS

- The user is responsible for the use of the flowmeters regarding suitability and use as designed.
- The actual operation pressure must be lower as the specified pressure limits of the Rotameter.
- Make sure that the wetted parts are resistant against the process fluid.
- Ambient- and process temperature must be lower than the specified maximum values.
- If dirt accumulation is to be expected, we recommend installing a bypass pipe.
- To avoid float bouncing in case of gas application notice the recommendations of VDI/VDE 3513 Sheet 3.
- To avoid mutual magnetic influence in case of parallel design of several Rotameters please make sure that the distance between the tube middle axes is at least 300 mm. The distance to other ferric materials should be at least 250 mm.
- Avoid static magnetic fields next to the Rotameter.

**Specify the following when ordering:**

- Model, suffix code and option code
- Fluid name, process temperature, fluid density, process pressure, fluid viscosity
- For gases: condition of the scale (st. or actual)
- Options: Tag No.: customer specific notes

For your special application please use the Yokogawa Sizing Software FlowConfigurator.

## MODEL SPECIFICATIONS

Model	Suffix code	Description	Restrictions
RAMC01 RAMC23 RAMC02		Size DN15 (1/2") Size DN20 (3/4") Size DN25 (1")	for D4, D6, A1, A2, A3, T4, R4, T6, G6 for D4, D6, A1, A2, A3, T4, R4, T6, G6 for D4, D6, A1, A2, A3, S2, S4, S5, T4, R4, T6, G6
RAMC03 RAMC04 RAMC05 RAMC06		Size DN32 (1 1/4") Size DN40 (1 1/2") Size DN50 (2") Size DN65 (2 1/2")	for D4, D6, A1, A2, A3, S4, T6, G6 for D4, D6, A1, A2, A3, S4, S5, T6, G6 for D4, D5, D6, A1, A2, A3, S2, S4, T4, R4 for D4, D5, A1, A2, A3, S2, S4, T4, R4, T6, G6
RAMC08 RAMC09 RAMC10 RAMC12 RAMC15 RAMCNN		Size DN80 (3") Size 3 1/2" Size DN100 (4") Size DN125 (5") Size DN150 (6") Without measuring tube	for D4, D5, A1, A2, A3, S2, S4 for A1, A2 for D2, D4, A1, A2, S2, S4 for D2, A1, A2, S2 for D2, A1, A2
Process connection	-D2 -D4 -D5 -D6 -A1 -A2 -A3 -T6 -G6 -R4 -S2 -S4 -T4 -S5 -NN	EN flange PN16, process connection dimension + facing acc. to EN 1092-1 Form B1 EN flange PN40, process connection dimension + facing acc. to EN 1092-1 Form B1 EN flange PN63, process connection dimension + facing acc. to EN 1092-1 Form B1 EN flange PN100, process connection dimension + facing acc. to EN 1092-1 Form B1 ASME flange class 150, process connection dimension + facing acc. to ASME B 16.5 ASME flange class 300, process connection dimension + facing acc. to ASME B 16.5 ASME flange class 600, process connection dimension + facing acc. to ASME B 16.5 NPT PN40 female thread G PN40 female thread Rp removable female thread Thread acc. to DIN 11851 TRI-CLAMP® PN10, PN16 acc. to DIN 32676 NPT removable female thread Rosista flange PN10 Without process connection	
Material of wetted parts	SS PF NN	Stainless steel Teflon lining Without wetted parts	Only with RAMCNN
Cone/Float	-nnnn -NNNN	See tables 10 and 11 Without measuring tube/without float	Only with RAMCNN
Indicator/Transmitter	-T -E -H -J -N	Mechanical indicator Indicator with transmitter Indicator with transmitter, HART® 5 (includes Software Tag HART® 5) Indicator with transmitter, HART® 7 (includes Software Tag HART® 7) Without indicator	Only with output 424 8 digits for tag; 24 digits for long tag; Only with output 424 8 digits for tag; 32 digits for long tag; Only with housing NN
Housing type	90 91 NN	Housing SS Housing AI, yellow painted Without housing	Only with indicator -N
Power supply/Output	240 244 140 144 430 434 424 NNN	230 V AC; 4-wire; 0 to 20 mA 230 V AC; 4-wire; 4 to 20 mA 115 V AC; 4-wire; 0 to 20 mA 115 V AC; 4-wire; 4 to 20 mA 24 V DC; 3-wire; 0 to 20 mA 24 V DC; 3-wire; 4 to 20 mA 24 V DC; 2-wire; 4 to 20 mA Without power supply	Only with indicator -E; not with limit switches Only with indicator -E Only with indicator -E Only with indicator -E, -H, -J Only with indicator -T or -N

## OPTIONS

Options	Code	Description	Restriction	
Indicator	/A5	Thread for cable gland ASME NPT ½" female	Not with /A13	
	/A12	US-engineering units	Only for indicator -E and -H; not with -J because already available as standard	
	/A13	Thread for cable gland ISO M20x1.5 female	Only for housing 90	
	/A16	Indicator on 95 mm extension	Only for housing 90, 91	
	/A20	Scale for type T66	Not with hazardous approval type; not with indicator	
	/A21	Scale and EEPROM for type E66, H66, G66	Not with hazardous approval type not with indicator; not with /A16	
	/A22	Scale for type T90, T91	Not with hazardous approval type; not with indicator	
	/A23	Scale and EEPROM for type E90, H90, G90, J90, E91, H91, G91, J91	Not with hazardous approval type; not with indicator; not with /A16	
	/A25	Pressure balance element	Not with /KS2, /ES2, /KF1, /EF1, /NF1, /GF1 and housing 91 with /A5 or /A13	
	/A26	Indicator for -40 °C ambient temperature	Not with /K1, /K2, /K3, /K9, /K10, /KF1, /EF1, /NF1, /KS2, /ES2, power supply 14□ + 24□; /FS1	
	Marking	/B0	Tag plate (1.4404/316L) on flange and marking on scale	Plate 9x40 mm; max. 45 digits
		/B1	Tag plate (1.4404/316L) fixed by wire and marking on scale	Plate 9x40 mm; max. 45 digits
/B4		Neutral version	Not with hazardous approval type	
/B8		Customer provided marking on label		
/B10		Percent scale		
/BG		Customer specific notes on scale	Max. 45 digits	
/BD		Dual scale	Adjustment only for the first mentioned fluid	
Limit switches	/K1	MIN-contact	Not for power supply 14□ + 24□	
	/K2	MAX-contact	Not for power supply 14□ + 24□	
	/K3	MIN-MAX-contact, MIN-MIN-contact, MAX-MAX-contact	Not for power supply 14□ + 24□	
	/K6	MIN-contact "fail-safe" version	Not for power supply 14□ + 24□	
	/K7	MAX-contact "fail-safe" version	Not for power supply 14□ + 24□	
	/K8	MIN-MAX-contact "fail-safe" version	Not for power supply 14□ + 24□	
	/K9	MIN-MIN-contact "fail-safe" version	Not for power supply 14□ + 24□	
	/K10	MAX-MAX-contact "fail-safe" version	Not for power supply 14□ + 24□	
	Pulse output	/CP	Pulse output isolated	Only for power supply 140, 144, 240, 244; not with limit switches
	Flange Facing	/D10	Form B2 acc. to EN 1092-1	Only for EN-flanges (D2, D4)
/D11		Form D acc. to EN 1092-1	Only for EN-flanges (D2, D4)	
Damping	/SD	Float damping system	Only for SS; not for cone 81, 82; only for gas application	
Flange protection	/QK	Flange covers	Only for flanges A1, A2, A3, D2, D4, D5, D6	
Heat tracing	/T1	Heat trace connection female thread G ¼" PN40	Heating is only for metallic instruments "SS" available	
	/T2	Heat trace connection EN flange DN15 PN40 Form B1	Heating is only for metallic instruments "SS" available	
	/T3	Heat trace connection EN flange DN25 PN40 Form B1	Heating is only for metallic instruments "SS" available	
	/T4	Heat trace connection ASME flange ½" Class 150RF	Heating is only for metallic instruments "SS" available	
	/T5	Heat trace connection ASME flange 1" Class 150 RF	Heating is only for metallic instruments "SS" available	
	/T6	Heat trace connection female thread NPT ¼" PN40	Heating is only for metallic instruments "SS" available	
Housing Coating	/X1	Single layer epoxy coating system for housing type 91; Cover green RAL 6001, Bottom green RAL 6001	Not for housing 90; not with /KC1 or /GC1	
	/X2	High Anti Corrosion coating (3 layers) for housing type 91; /A16 will also be coated; Cover yellow RAL 1021, Bottom white RAL 9001	Not for housing 90; not with /KC1 or /GC1	
Power supply for electronic transmitter	/UT	RN221N-B1, 20 to 250 V DC/AC, Ex i, HART® compatible	Only for indicator -E, -H, -J, only ATEX or standard, only for output 424	
Power supply for limit switches (transmitter relay)	/W1A	KFA5-SR2-Ex1.W/ 115 V AC, 1 channel	Only for limit switches /K1, /K2, /K3	
	/W1B	KFA5-SR2-Ex2.W/ 115 V AC, 2 channel	Only for limit switches /K1, /K2, /K3	
	/W2A	KFA6-SR2-Ex1.W/ 230 V AC, 1 channel	Only for limit switches /K1, /K2, /K3	
	/W2B	KFA6-SR2-Ex2.W/ 230 V AC, 2 channel	Only for limit switches /K1, /K2, /K3	
	/W2E	KHA6-SH-Ex1/ 115/230 V AC, 1 channel, fail-safe	Only for limit switches /K6, /K7	
	/W2F	2x KHA6-SH-Ex1/ 115/230 V AC, 1 channel, fail-safe	Only for limit switches /K8, /K9, /K10	
	/W4A	KFD2-SR2-Ex1.W/ 24 V DC, 1 channel	Only for limit switches /K1, /K2, /K3	
	/W4B	KFD2-SR2-Ex2.W/ 24 V DC, 2 channel	Only for limit switches /K1, /K2, /K3	
	/W4E	KFD2-SH-Ex1/ 24 V DC, 1 channel, fail-safe	Only for limit switches /K6, /K7	
	/W4F	2x KFD2-SH-Ex1/ 24 V DC, 1 channel, fail-safe	Only for limit switches /K8, /K9, /K10	

Options	Code	Description	Restriction
Test and certificates	/H1	Oil + fatfree for wetted surfaces acc. to ASTM G93-03 level B	Only for metallic pressurized parts  Not for connection RAMC01-T6SS-□ □ S0-..., RAMC01-G6SS-□ □ S0-...; not for /T□; not with /P15 or /P16 See individual options See individual options See individual options; not with /P15 or /P16 See individual options; not with /P15 or /P16 Only for SS wetted part material; not for connection RAMC01-T6SS-□ □ S0-..., RAMC01-G6SS-□ □ S0-...; not for /T□ Only RAMC□-A1SS, RAMC□-A2SS, RAMC□-A3SS; not for /T□ Only RAMC□-A1SS, RAMC□-A2SS, RAMC□-A3SS; not for /T□; only with /RTA or /P20 See individual options; only with /P15 or /P16 Not for /T□; not with /P15 or /P16
	/P2	Certificate of compliance with the order acc. to EN 10204-2.1	
	/P3	Similar to /P2 + Test report acc. to EN 10204-2.2	
	/P6	Material certificate acc. to EN 10204-3.1	
	/PM3	PAMI test (3 points: Process connection inlet, measuring tube, process connection outlet)	
	/PP	Pressure test report flow tube acc. to EN 12266-1	
	/PT	Flow table for conversion to other fluids	
	/P9	Dye penetration test acc. to EN ISO 3452-1 at the welding of the process connection, with certificate	
	/P10	Combination of /P3 + /P6 + /PP	
	/P11	Combination of /P3 + /P6 + /PM3	
	/P12	Combination of /P3 + /P6 + /P9 + /PP	
	/P13	Combination of /P3 + /P6 + /P9 + /PM3 + /PP + /WP	
	/P14	Dye penetrant test of flange welding acc. to ASME V	
	/P15	ASME B31.3 compliance NORMAL FLUID SERVICE	
/P16	ASME B31.3 compliance Category M FLUID SERVICE		
/P20	Combination of ASME package /P14, /WPA, /RTA		
/WP	Welding documentation acc. to ISO 3834-2		
/WPA	Welding and certificates acc. to ASME BPVC, IX,		
/RTA	X-ray test acc. to ASME BPVC V		
Hazardous area approvals	/KS1	ATEX intrinsically safe "ia"	Only for power supply 424, 430, 434, 429; for indicator -T Only with limit switches Only for power supply 424, 430, 434; for indicator -T only with limit switches; only for housing 91 Only for power supply 424, 430, 434; for indicator -T only with limit switches Only for power supply 424, 430, 434; for indicator -T only with limit switches Only for power supply 424, 430, 434; for indicator -T only with limit switches; only for housing 91 Only for power supply 424 (electronic transmitter); for indicator -T only with limit switches Only for power supply 424, 430, 434; for indicator -T only with limit switches; not with indicator -J; only with /CN Only for power supply 424, 430, 434; only with /VE or /VR; for indicator -T only with limit switches Only for power supply 424, 430, 434; for indicator -T only with limit switches; only with housing 91 Only for power supply 424, 430, 434; for indicator -T only with limit switches; only with housing 91; only in combination with /KC Only for power supply 424, 430, 434; for indicator -T only with limit switches; only for housing 91; only with /CN Only for power supply 424, 430, 434; for indicator -T only with limit switches; only for housing 91; only with /VE or /VR Only for indicator -T without limit switches Only for indicator -T without limit switches; only with /VE or /VR Only with option /KS1 or /KF1
	/KS2	ATEX intrinsically safe "ia" + dust proof "tb"	
	/KS3	ATEX intrinsically safe "ic" for use in category 3G	
	/ES1	IECEx intrinsically safe "ia"	
	/ES2	IECEx intrinsically safe "ia" + dust proof "tb"	
	/FS1	FM intrinsically safe/ nonincendive electr. transmitter (USA/ Canada), FM intrinsically safe/ nonincendive limit switches (USA)	
	/NS1	NEPSI intrinsically safe approval (China)	
	/GS1	EAC intrinsically safe "ia"	
	/KF1	ATEX flame proof "d"/ dust proof "tb"	
	/EF1	IECEx flame proof "d" / dust proof "tb" in combination with /KC: KOSHA flame proof "d" (Korea)	
	/NF1	NEPSI flame proof "d"/ dust proof approval (China)	
	/GF1	EAC flame proof "d"	
	/KC1	ATEX non-electrical type	
/GC1	EAC non-electrical type		
/Q11	PESO intrinsically safe "ia" or PESO flame proof "d"		
Country-specific delivery	/VE	EAC-mark for EAEU countries	Not with /Q11 Not with /Q11 Not with /Q11; for explosion proof see /EF1 Not with /Q11
	/VR	EAC-mark and Pattern Approval marking for Russia	
	/KC	KC-mark for Korea	
	/CN	China RoHS mark	
Country-specific application	/QR	Primary verification certificate valid in Russia	Only with /VR see page 4, only with /VE
	/QR2	Primary verification certificate and Pattern Approval valid in Kazakhstan	
	/QR3	Primary verification certificate and Pattern Approval valid in Uzbekistan	

Options	Code	Description	Restriction
User's Manuals	/IE n /ID n	Quantity of instruction manuals in English Quantity of instruction manuals in German	n = 1 to 9 selectable <sup>1)</sup> n = 1 to 9 selectable <sup>1)</sup>
Special order	/Z	Special design must be specified separately. If /Z is selected, several Suffix of Model-Suffix Code can be changed to Z.	

<sup>1)</sup> If no User's Manual is selected, only a DVD with User's Manuals is shipped with the flowmeter.



**FLOW TABLES FOR METAL TUBES**

**Table 10**

Pos.	Measuring range for water and liquids						Measuring range for air and gases								
	Recommended combination			Alternative combination			Recommended combination			Alternative combination					
	Max. flow	Pressure loss <sup>1)</sup>	Viscosity <sup>2)</sup>	Cone-Float-combin.	Code	Pressure loss <sup>1)</sup>	Viscosity <sup>2)</sup>	Cone-Float-combin.	Code	Max. flow	Pressure loss <sup>1)</sup>	Cone-Float-combin.	Code		
m <sup>3</sup> /h <sup>3)</sup>	mbar	mPa's			mbar	mPa's				m <sup>3</sup> /h <sup>3)</sup>	mbar				
gpm <sup>4)</sup>										scfm <sup>6)</sup>					
1	0.025	0.11	43 S0	40	10	-	-	-	-	0.75	0.7	43 S0	45		
	0.04	0.18	44 S0	40	80	-	-	-	-	1.2	1.1	44 S0	45		
	0.063	0.28	47 S0	40	80	-	-	-	-	1.8	1.7	47 S0	45		
	0.1	0.44	51 S0	40	80	-	-	-	-	3	2.8	51 S0	45		
	0.13	0.57	53 L1	12	50	-	-	-	-	4	3.6	53 L1	13		
	0.16	0.7	-	-	-	-	-	53 M1	15	100	5	3.2	-	53 M1	21
2	0.22	1.0	54 L1	12	50	-	-	-	-	-	-	-	-		
	0.25	1.1	53 S1	40	100	54 M1	15	50	6.5	6	54 L1	13			
	0.32	1.4	-	-	-	-	-	57 L1	12	9	5	-	54 M1	21	
	0.4	1.8	54 S1	40	50	57 M1	15	50	10	9	57 L1	13			
	0.5	2.2	-	-	-	-	-	61 L1	12	14	8	-	57 M1	21	
	0.63	2.8	57 S1	40	50	61 M1	15	100	16	15	9	61 L1	13		
3	0.8	3.5	-	-	-	-	-	62 L1	12	22	20	-	61 M1	21	
	1.0	4.4	61 S1	40	100	62 M1	15	100	25	23	14	62 L1	13		
	1.6	7.0	62 S1	40	100	-	-	-	34	32	20	-	62 M1	21	
	2.2	10.1	-	-	-	-	-	62 V1	45	50	28	-	62 S1	45	
	1.3	5.7	63 L2	17	50	-	-	-	-	40	36	23	63 L2	19	
	2.1	9.2	-	-	-	-	-	64 L2	17	50	47	29	-	63 M2	23
4	2.5	11.0	63 S2	42	30	64 M2	17	10	60	55	35	64 L2	19		
	4	17.6	64 S2	42	10	-	-	-	85	80	50	-	64 M2	23	
	6	26.4	-	-	-	-	-	64 V2	43	50	70	-	64 S2	47	
	3.2	14	67 L5	13	50	-	-	-	-	100	90	57	67 L5	16	
	5.0	22	-	-	-	-	-	71 L5	13	50	120	75	-	67 M5	25
	6.3	28	67 S5	47	30	-	-	-	-	160	150	90	71 L5	16	
5	8.5	37	-	-	-	-	-	72 L5	13	50	200	115	-	71 M5	25
	10	44	71 S5	47	5	72 M5	19	5	250	230	140	72 L5	16		
	16	70	72 S5	47	5	-	-	-	340	320	200	-	72 M5	25	
	25	110	-	-	-	-	-	72 V5	63	500	470	290	-	72 S5	54
	25	110	73 V8	60	10	-	-	-	550	500	320	73 L8	30		
	40	176	74 V8	60	10	-	-	-	850	800	500	74 L8	30		
6	63	277	77 V8	60	10	-	-	-	1400	1300	800	77 L8	30		
	100	440	81 L1	70	10	-	-	-	-	-	-	-	-		
	130	572	82 L1	70	10	-	-	-	-	-	-	-	-		

- 1) Pressure loss at the float with water or air.
- 2) For higher viscosity the specified precision is no more guaranteed.
- 3) Flow is referred to +20 °C and 1.013 bar abs.
- 4) Flow in US Gallons per minute at +70 °F.
- 5) Flow referred to 0 °C and 1.013 bar abs at operation conditions of +20 °C and 1.013 bar abs.
- 6) Flow in Standard cubic feet per minute referred to +60 °F and 14.7 PSI at operation conditions of +70 °F und 14.7 PSI abs.

For your special application please use the Yokogawa Sizing Software "FlowConfigurator".

## PROCESS CONNECTION- AND FLOW-TABLE FOR TUBES WITH PTFE-LINING

Table 11

Pos.	Process connection						Measuring range for water and liquids				Measuring range for air and gases									
	EN-Flange			ASME-Flange RF			Max. Flow m <sup>3</sup> /h <sup>3)</sup>	Cone- Float- combination	Pressure loss <sup>1)</sup> mbar	Viscosity <sup>2)</sup> mPa*s	Max. flow		Cone- Float- combination	Pressure loss <sup>1)</sup> mbar						
	PN16 Code	PN40 Code	L <sup>7)</sup> mm	Class 150 Code	Class 300 Code	L <sup>7)</sup> mm					m <sup>3</sup> /h <sup>3)</sup>	gpm <sup>4)</sup>			m <sup>3</sup> /h <sup>3)</sup>	i.N. <sup>5)</sup> scfm <sup>6)</sup>				
2	D2	D4	mm	A1	A2	mm	250	3/4" 1"	16	50	5	51 A1 52 A1 53 A1 54 A1 57 A1 61 V1 62 A2	20	3.5	2					
	-	-	-	-	0.16	0.7								3.3	2	5	2.9	51 A1	20	
	-	DN15	250	3/4"	1"	250								0.25	1.12	16	50	8.5	53 A1	20
	-	DN25	-	1"	-	-								0.4	1.8	16	50	13	54 A1	20
	-	-	-	-	-	-								0.63	2.8	16	50	20	57 A1	20
	-	-	-	-	-	-								1	4.5	18	50	34	61 V1	22
3	-	DN25	250	1 1/4" 1 1/2"	1 1/4" 1 1/2"	250	250	1 1/4" 1 1/2"	20	10	85	63 A2 63 V2 64 A5	25	2.5	11.2					
	-	DN40	-	-	-	-								4	18	22	50	-	-	-
	-	DN50	-	-	-	-								4	18	20	30	130	120	75
4	-	DN50 DN65 DN80	250	2 1/2" 3"	2 1/2" 3"	260	270	2 1/2" 3"	20	5	350	71 A5 71 V5 72 V8 73 V8 74 V8	25	200	180					
	-	-	-	-	10	45								20	5	330	200	71 A5	25	
	-	-	-	-	16	70								22	10	-	-	-	-	-
5	DN100	DN80	250	3 1/2" 4"	3 1/2" 4"	270	270	3 1/2" 4"	25	10	850	73 V8 74 V8	27	500	470					
	-	-	-	-	25	110								25	10	800	500	73 V8	27	
	-	-	-	-	40	180								25	10	-	-	-	-	-
6	DN100	DN100	250	4"	4"	270	270	4"	30	10	-	77 10	-	-	-					

<sup>1)</sup> Pressure loss at the float with water or air.

<sup>2)</sup> As from this viscosity the specified precision is no more guaranteed.

<sup>3)</sup> Flow is referred to +20 °C and 1 bar abs.

<sup>4)</sup> Flow in US Gallons per minute at +70 °F.

<sup>5)</sup> Flow referred to 0 °C and 1.013 bar abs at operation conditions of +20 °C and 1.013 bar abs.

<sup>6)</sup> Flow in Standard cubic feet per minute referred to +60 °F and 14.7 PSI at operation conditions of +70 °F and 14.7 PSI abs.

<sup>7)</sup> L = mounting length

For your special application please use the Yokogawa Sizing Software "FlowConfigurator".

**TEMPERATURE LIMITATIONS, STANDARD AND INTRINSICALLY SAFE**

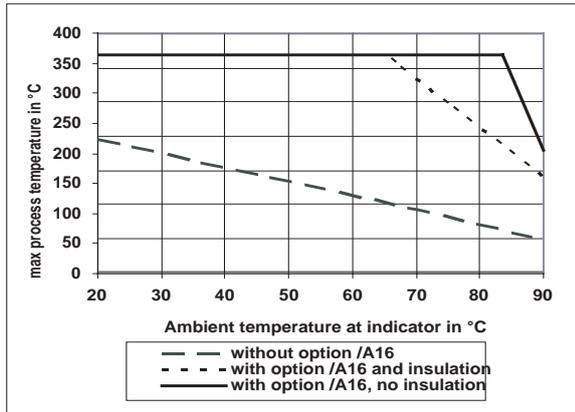


fig. 1a RAMC: • Type 90 / 91 without limit switch

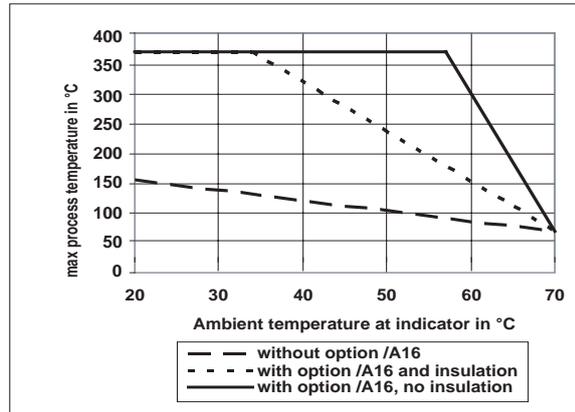


fig. 1b RAMC: • Type E90, H90, J90, E91, H91, J91 and limit switches (in case of intrinsic safe limit switches the maximum ambient temperature is limited by the temperature class according to the certificate or for option /FS1 by the control drawing).

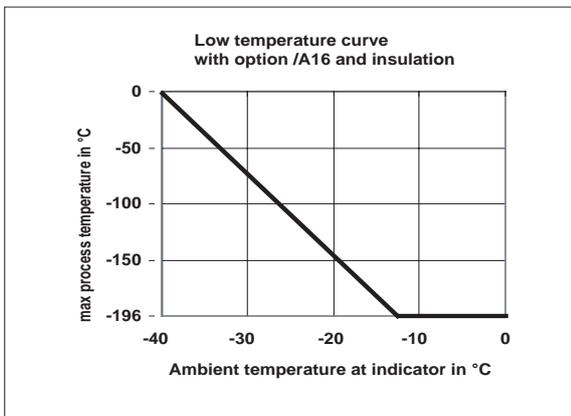


fig. 1c RAMC: • All indicator types

The temperature graphs are reference values for size DN100. They may be influenced negative by trapped heat, external heat sources or radiated heat and influenced positive for smaller sizes.

Insulation means stone wool between tube and indicator, not touching the indicator. The indicator shall not be insulated.

Units with electronic transmitter can show the temperature of the internal transmitter on the display or HART®-type can show and supervise the internal temperature by HART®-communication.

Units with PTFE-lining are usable up to +130 °C.

For units with explosion proof certification the temperature limits according the certificate of conformity must be regarded (see also page 5 to 10).



## PRESSURE TEMPERATURE (PT)-RATING

The pressure relevant temperature limits of the RAMC are:

-196 to +370 °C for units with SS wetted parts

-80 to +130 °C for units with PTFE wetted parts.

These limits are reduced by metrological boundary conditions (see temperature curves and table).

**Table 13**

Process connection		Process pressure p(T) in bar									
Code	Description	-196 °C	RT(20 °C)	50 °C	100 °C	150 °C	200 °C	250 °C	300 °C	350 °C	370 °C
A1 <sup>1)</sup>	Flange ASME Class 150 RF	19	19	18.4	16.2	14.8	13.7	12.1	10.2	8.4	7.4
A2 <sup>1)</sup>	Flange ASME Class 300 RF	49.6	49.6	48.1	42.2	38.5	35.7	33.4	31.6	30.3	24.8
A3 <sup>1)</sup>	Flange ASME Class 600 RF	99.3	99.3	96.2	84.4	77	71.3	66.8	63.2	60.7	49.5
D2	Flange EN PN16	16	16	15.6	15.1	13.7	12.7	11.9	11.0	10.5	10.2
D4	Flange EN PN40	40	40	38.9	37.9	34.4	31.8	29.9	27.6	26.4	25.7
D5	Flange EN PN63	63	63	61.5	59.7	54.3	50.1	47.1	43.5	41.7	40.5
D6	Flange EN PN100	100	100	97.8	94.7	86.1	79.5	74.7	69.0	66.1	64.2
T4/R4	Internal thread ½" (RAMC01-...)	25	25	25	25	20	20	20	20		
T4/R4	Internal thread ¾" (RAMC23-...)	25	25	25	25	20	20	20	20		
T4/R4	Internal thread 1" (RAMC02-...)	16	16	16	16	16	16	16	16		
T4/R4	Internal thread 2" (RAMC05-...)	10	10	10	10	10	10	10	10		
T4/R4	Internal thread 2½" (RAMC06-...)	10	10	10	10	10	10	10	10		
T6/R6	Internal thread ½" (RAMC01-...)	40	40	40	40	40	40	40	40		
T6/R6	Internal thread ¾" (RAMC23-...)	40	40	40	40	40	40	40	40		
T6/R6	Internal thread 1" (RAMC02-...)	40	40	40	40	40	40	40	40		
T6/R6	Internal thread 1¼" (RAMC03-...)	40	40	40	40	40	40	40	40		
T6/R6	Internal thread 1½" (RAMC04-...)	40	40	40	40	40	40	40	40		
T6/R6	Internal thread 2½" (RAMC06-...)	40	40	40	40	40	40	40	40		
Code	Description	-	RT(20 °C)	50 °C	100 °C	140 °C	-	-	-	-	-
S2	Fitting DIN 11851 (RAMC02-...)		40	40	40	40					
S2	Fitting DIN 11851 (RAMC05-...)		25	25	25	25					
S2	Fitting DIN 11851 (RAMC06-...)		25	25	25	25					
S2	Fitting DIN 11851 (RAMC08-...)		25	25	25	25					
S2	Fitting DIN 11851 (RAMC10-...)		25	25	25	25					
S2	Fitting DIN 11851 (RAMC12-...)		16	16	16	16					
S4	TRI-CLAMP® DIN 32676 (RAMC02-...)		25	25	25	25					
S4	TRI-CLAMP® DIN 32676 (RAMC03-...)		25	25	25	25					
S4	TRI-CLAMP® DIN 32676 (RAMC04-...)		25	25	25	25					
S4	TRI-CLAMP® DIN 32676 (RAMC05-...)		16	16	16	16					
S4	TRI-CLAMP® DIN 32676 (RAMC08-...)		10	10	10	10					
S4	TRI-CLAMP® DIN 32676 (RAMC10-...)		10	10	10	10					
S5	Flange Rosista (RAMC02-...)		10								
S5	Flange Rosista (RAMC04-...)		10								

<sup>1)</sup> Dual certified AISI 316/316L

## DIMENSIONS AND WEIGHTS

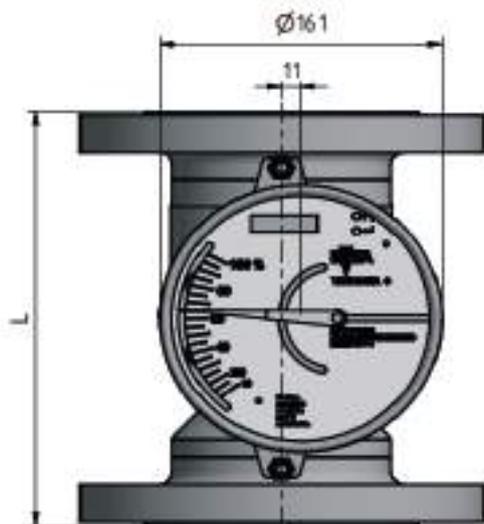


fig. 2a Front view housing type 90 (SS)

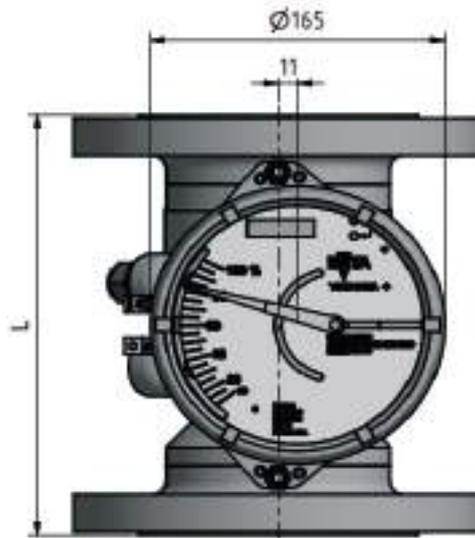
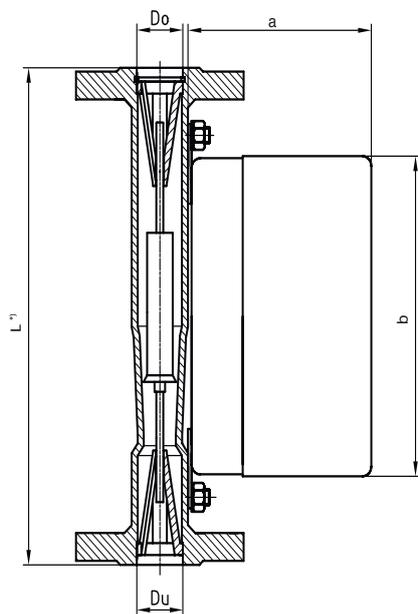
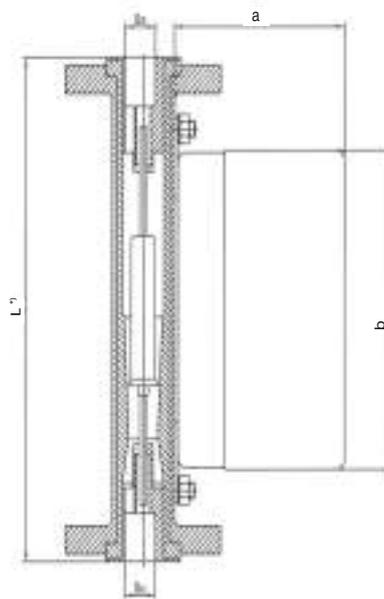


fig. 2b Front view housing type 91 (Al)



<sup>1</sup> see Table 9

fig.3 SS metering tube



<sup>1</sup> see Table 11

fig.4 SS metering tube with PTFE-lining

Table 14 Housing types

	a in mm	b in mm
Housing type 90	104	161
Housing type 91 standard	110	165
Housing type 91 flame proof, option /□F1	118	165

Table 15

Inner diameter of stainless steel flanges			Inner diameter of flanges with PTFE-lining				
Pos. <sup>1)</sup>	Size		Du = Do in mm	Pos. <sup>1)</sup>	Size		Du = Do in mm
1	DN15 to DN50	½" to 1"	20.7	----	----	----	----
2	DN15 to DN50	½" to 2"	20.7	2	DN15 to DN25	¾" to 1"	23.5
3	DN25 to DN50	1" to 2"	29.5	3	DN25 to DN50	1¼" to 1½"	36.0
4	DN50 to DN100	2" to 3"	65.5	4	DN50 to DN80	2½" to 3"	66.0
5	DN80 to DN150	3" to 6"	88.2	5	DN80 to DN100	3½" to 4"	92.0
6	DN100 to DN150	4" to 6"	110.0	6	DN100	4"	110.0

<sup>1)</sup> See table 9, 10, 11

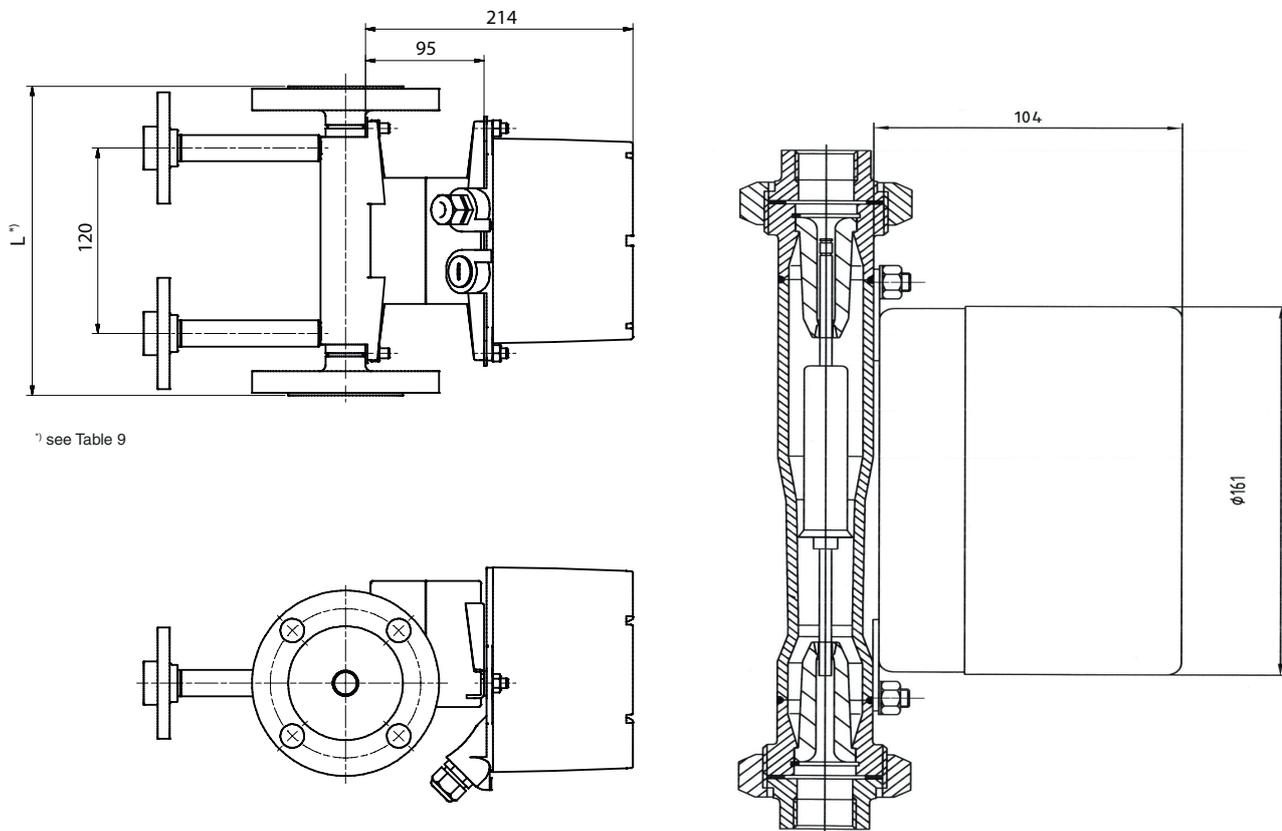
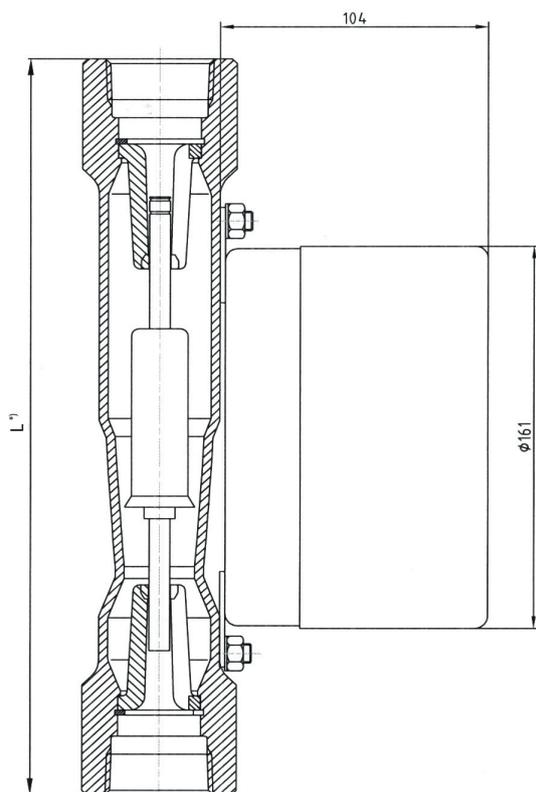
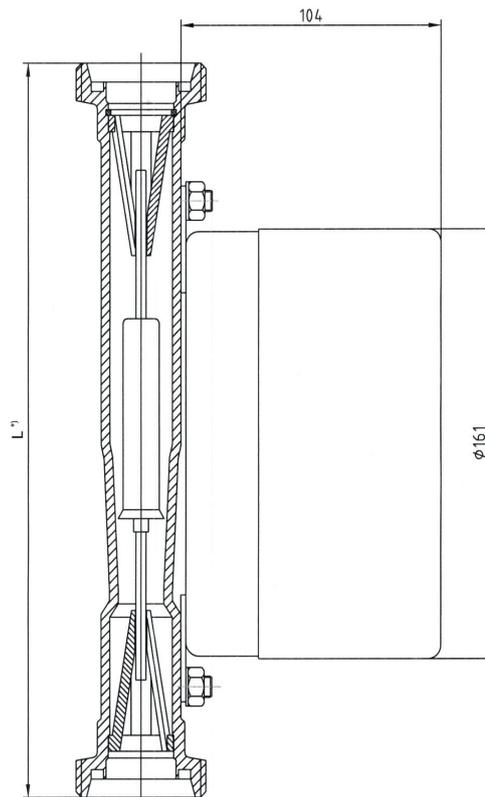


fig. 6 RAMC type control valve BA/T416 and /T2



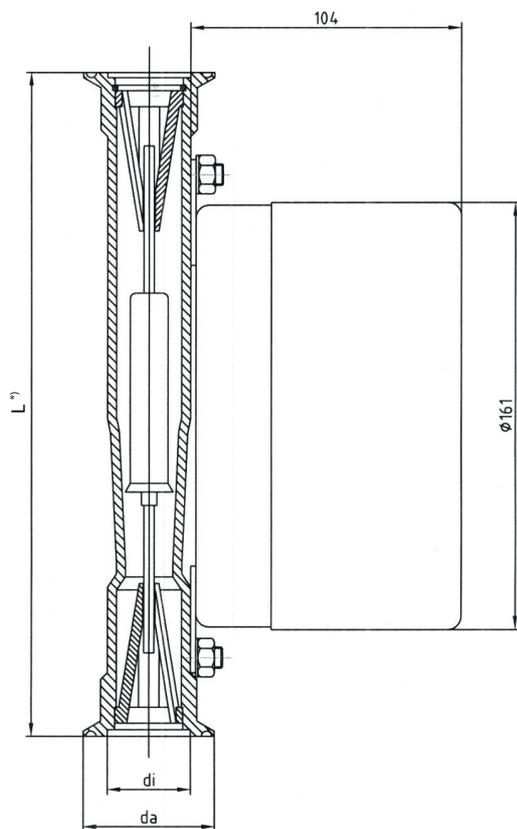
<sup>1)</sup> see Table 9

**fig. 7 RAMC with connection T6/G6**



<sup>1)</sup> see Table 9

**fig. 8 RAMC with connection S2**



<sup>1)</sup> see Table 9

**fig. 9 RAMC with connection S4**

**Table 16 Diameter for connection sizes S4**

Pos. <sup>1)</sup>	Size	di in mm	da in mm
1	DN25, 1"	36	50.5
	DN32	36	50.5
	DN40, 1½"	36	50.5
2	DN25, 1"	36	50.5
	DN32	36	50.5
	DN40, 1½"	36	50.5
3	DN50, 2"	47.8	64
4	DN65, 3"	72.1	91
5	DN100, 4"	97.6	119

<sup>1)</sup> See table 9 and 11

**Table 17 Weights**

Pos. <sup>1)</sup>	Weight in kg
1	3 to 5
2	3 to 5
3	6.5 to 8
4	8.6 to 11
5	13 to 16
6	17 to 20

<sup>1)</sup> See table 9, 10, 11

Indicator on distance (option /A16) additional 1 kg

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