

# 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 troubled, opaque or aggressive mediums. The instrument is mounted in a vertical pipeline with flow direction upwards. Inside the special shaped conic metal tube, a float is guided concentrically. The position of this float is magnetically transmitted to the indicator. The indicators are exchangeable without influence on the accuracy.

### FEATURES

- Different process connections like flanges according to EN and ASME
- All wetted parts in stainless steel or PTFE
- Maximum flow 0.025 - 130 m<sup>3</sup>/h water resp. 0.75 - 1400 m<sup>3</sup>/h air (20 °C/ 1.013 bar abs)
- Measuring accuracy acc. Directive VDI/VDE 3513 sheet 2 (q<sub>G</sub>=50 %)
- Float damping to avoid float bouncing with gas applications
- Optional heat tracing (with steam or fluid heat carrier)
- Indicator in stainless steel, aluminium, protection class IP66/67
- Local 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 (US/C), NEPSI, PESO, EAC, INMETRO
- Flame proof version (Ex-d): ATEX, IECEx, NEPSI, PESO, KOSHA, EAC, TS
- Dust explosion proof: ATEX, IECEx, NEPSI, PESO, KOSHA
- 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 local-controlling display with the following features:

- Flow indication (totalize, actual, percent)
- Indication of different volume- and mass flow units
- Second (manual) calibration storing
- Patented float blocking indication function
- Signal output damping
- Error message indication
- Temperature measurement in the electronic transmitter
- HART5/7-Communication
- Profibus PA-Communication

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RAMC with housing type 90



RAMC with housing type 91

## 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
- Aramide fibres /NBR binder (Gasket for process connection R4 or T4)
- Other materials on request

#### Fluids to be measured:

suitable for a variety of liquids, gas and steam

#### Measuring range:

See table 11 and 12

#### Measuring range ratio:

10:1

#### Process connections/ Stainless steel:

##### Flanges:

- acc. to EN1092-1
    - DN100 – DN150 PN16
    - DN15 – DN100 PN40
    - DN50 – DN80 PN63
    - DN15 – DN50 PN100
  - acc. ASME B 16.5 (AISI 316/316L dual certified)
    - ½" – 6" Class 150 raised face
    - ½" – 6" Class 300 raised face
    - ½" – 3" Class 600 raised face
- Roughness of sealing
- |          |              |
|----------|--------------|
| Form B1: | RA 3.2 - 6.3 |
| Form B2: | RA 0.8 - 3.2 |
| ASME:    | RA 3.2 - 6.3 |

##### Threaded connection:

- male acc. DIN 11851
- NPT- female
- G- female
- Clamp acc. DN25/ 1" – DN100/4"

#### Process pressure:

Depends on process connection, see table 10 to 12 higher pressure (up to 700 bar) on request

#### Process temperature:

- medium wetted parts made of stainless steel
  - : -196 °C – +370 °C
- medium wetted parts made of PTFE
  - : -80 °C – +130 °C

See fig. 7a to 7c

#### Measuring accuracy:

Table 1

Material of wetted parts	Size	Measuring accuracy acc. Directive VDI/ VDE 3513 sheet 2 ( $q_s=50\%$ )
SS	DN 15 - 100	1.6 %
SS	DN 125 - 150	2.5 %
PTFE	DN 15 -100	2.5 %

#### 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 – /T6):

- Art. 3 section 3: (Volume < 1L)
- Fluid Group: 2 (non-dangerous fluids)
- Classification: Table 2 of PED directive (vessels)

#### CANADIAN REGISTRATION NUMBERS (CRN ) available upon request

#### Installation:

- Mounting direction: vertical
- Flow direction : upwards
- Mounting length : see tables 10, 12, 13, 14
- Straight pipe inlet length : DN 80/100 at least 5D, not necessary for smaller sizes

#### Weight:

See table 15

### LOCAL INDICATOR

(Indicator/Transmitter Code -T)

#### Principle:

The indication is made by magnetic coupling of a magnet enclosed in the float and a magnet in the indication unit, which follows the movements of the float, with a pointer.

#### Indicator housing:

- Materials:
  - Stainless Steel (1.4404/316L) (housing type 90)
  - painted aluminium casting acc. to EN 13195 AC 44200 material (housing type 91) each with safety-glass window
- Degree of protection:
  - IP66/67
  - NEMA 4, 4X, 6 (not for flame proof housing)

#### Scales:

- Standard: removable aluminium plate with scale (double scale as option)
- Marking: direct readable units or percentage of Qmax.

#### Transportation- and Storage condition:

-40 °C – +110 °C

### ELECTRONIC TRANSMITTER

(Indicator/Transmitter Code -E, -H, -J, -G)

#### Standard type (Code -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 V – 30 V DC

##### Output signal:

- 4- wire units: - 0 – 20 mA, 4 – 20 mA - pulse output (option /CP) max. frequency 4 Hz see fig. 3-5
- 3- wire units: 0 - 20 mA, 4v20 mA
- 2- wire units: 4 - 20 mA

The 20 mA point is selectable between 60 % and 100 % of Qnom.

##### 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 V – 30 V DC

##### Output signal:

- 2- wire units: 4 – 20 mA

##### Load resistance:

- HART-version: 250 – 500 Ω

#### Profibus PA - communication type (Code -G):

- 2- wire bus connection not polarity sensitive: 9 – 32 V DC acc. to IEC 61568-2 and FISCO model
- Basic current: 14 mA
- Failure current (FDE): 10 mA additional to basic current
- Transmission rate: 31.25 kBAud
- AI block for volume flow or mass flow
- Configurable with PDM DD
- Supports I&M- functions

**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. 7a to fig. 7c.

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 – +70 °C
- Accuracy: ± 5 °C

**Transportation- and Storage condition:**

-40 °C – +70 °C

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

± 0.2 % from scale

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

± 0.1 % from scale

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

± 0.1 % from scale

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

± 0.1 % from scale

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

± 0.5 % /10 K from scale

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

± 0.15 % from scale

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

± 0.2 % /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 (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

RAMC with Profibus PA:

Criterion A: Burst, Surge, HF- Immunity

Criterion B: ESD

In case of single sided grounding of the cable shield it is possible that for all tests criterion B is reached.

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

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

**POWER SUPPLY FOR ELECTRONIC TRANSMITTER (Option /UT)****Type:**

Power supply with galvanically separated input and output

- RN221N-B1, HART- compatible

**Supply voltage:**

20 – 250 V DC/ AC 50/60 Hz

**Maximum load:**

700 Ω

**Output signal:**

4 - 20 mA

**CABLE GLAND (for transmitter –E, -H, -J and –G):****Size:**

- M16x1.5 (standard)
- Thread M20x1.5 (option /A13; standard for option /KF1)
- Thread ½" NPT (option /A5)

**Cable diameter:**

6 – 9 mm

**Maximum cross section of core:**

Ø 1.5 mm<sup>2</sup>

**LIMIT SWITCHES IN STANDARD VERSION**

(option /K1 – /K3)

**Type:**

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

**Nominal voltage:**

8 V DC

**Output signal:**

≤ 1 mA or ≥ 3 mA

**LIMIT SWITCHES IN FAIL SAFE VERSION**

(option /K6 – /K10)

**Type:**

Inductive proximity switch SJ3.5-SN; SJ3.5-S1N acc. DIN EN 60947-5-6 (NAMUR)

**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.../K10)****Size:**

- M16x1.5 (standard for type 90)
- Thread M20x1.5 (option /A13; standard for type 91)
- Thread ½" NPT (option /A5)

**Cable diameter:**

6 – 9 mm

**Maximum cross section of core:**

Ø 1.5 mm<sup>2</sup>

**POWER SUPPLY FOR LIMIT SWITCHES (Option /W□□)****Type:**

acc. DIN EN 60947-5-6 (NAMUR)

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

**Power supply:**

- 230 V AC ± 10 %, 45-65 Hz
- 115 V AC ± 10 %, 45-65 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 power supply option /W2E or /W4E must be selected. If Fail-Safe limit switch option /K8, /K9 or /K10 is ordered, for 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 Min, Max and Min-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 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 – K10)  
Suitable for application in safety functions up to and including SIL2.

RAMC with standard limit switches (/K1 – 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 – K10)

RAMC with standard limit switches (/K1 – K3)

Details see FMEDA report.

**METROLOGICAL REGULATION IN CIS AND EAC COUNTRIES**

Russia, Kazakhstan, Uzbekistan, Belorussia and Turkmenistan are members of CIS.

RAMC has "Pattern Approval Certificate of Measuring Instruments" and is registered as a measuring instrument in Russia, Kazakhstan, Uzbekistan, Belorussia and Turkmenistan.

Option /QR2 is for Kazakhstan.

Option /QR3 is for Uzbekistan.

For the Ukraine the test certificate of Rota Yokogawa is sufficient.

Therefore no special option exists."

Russia, Kazakhstan and Belorussia are covered by EAC.

For export to CIS and EAC countries please contact your Yokogawa representative.

## HAZARDOUS AREA SPECIFICATIONS

Overview hazardous area certified instruments:

Location	Europe		Global		USA / Canada	India	Korea	China	Russia, Belorussia, Kazakhstan	Brazil	Taiwan
Certificate	ATEX		IECEX		FM	PESO	KOSHA	NEPSI	EAC	INMETRO	TS
<b>Electronic transmitter (WT-MAG)</b>											
Protection	ia	ic	ia/tb	ia	ic	ia/tb	IS/NI	ia	ia	ia	-
Option	/KS1	/KS3	/KS2	/ES1	/ES3	/ES2	/FS1	/GS1	/GS1	/US1	-
Comments		*2)	*1)	-	*2)	*1)	*3)	-	-	-	-
See page	6	6	9	6	6	9	6	6	6	6	-
<b>Limit switches</b>											
Protection	ia	ic	ia/tb	ia	-	ia/tb	IS/NI	-	ia	ia	-
Option	/KS1	/KS3	/KS2	/ES1	-	/ES2	/FS1	-	/GS1	/US1	-
Comments		*2)	*1)	-	-	*1)	*5)	-	-	-	-
See page	7	7	9	7	-	9	7	-	7	7	-
<b>RAMC indicator</b>											
Protection	d/tb	-	db/tb	-	-	db/tb	-	ia	d/DIP	d	d/tb
Option	/KF1	-	/KC1	/EF1	-	/KF1	/NS1	/NF1	/GF1	/GC1	/EF1
Comments	*7)	-	*8)	*7)	-	*4)	-	*7)	*7)	*8)	*7)
See page	8	-	9	8	-	8	8	8	8	8	8
<b>Power supplies for intrinsic safe components (see page 7)</b>											
Option /UT	yes	yes	yes	yes	yes	no	no	yes	yes	no	-
Option /W1A,B	yes	yes	yes	yes	yes	yes	yes	no	yes	no	-
Option /W2A,B	yes	yes	yes	yes	yes	yes	yes	no	yes	no	-
Option /W4A,B	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	-
Option /W2E,F	yes	yes	yes	yes	no	no	no	no	yes	no	-
Option /W4E,F	yes	yes	yes	yes	no	no	no	yes	yes	no	-
Notation	IS = intrinsic safe; NI = non incendiive; DIP = dust ignition proof										
Comment *1)	Dust proof by RAMC housing										
Comment *2)	For use in category 3G										
Comment *3)	Same certification for USA and Canada										
Comment *4)	PESO certificate available from Yokogawa Sales Office										
Comment *5)	Only for USA; power supply free selectable										
Comment *6)	For USA and Canada; power supply must be option /WxA or /WxB (x=1 or 2 or 4)										
Comment *7)	Only with housing 91										
Comment *8)	Only indicator type T without limit switches										

## ELECTRONIC TRANSMITTER

### Attention:

The maximum ambient temperature of the transmitter or of the limit switches according to the temperature class may not be exceeded because of heat transmission from the medium.

**Table 6 Entity parameters of electronic transmitter**

	Ui [V]	Ii [mA]	Pi [W]	Ci [nF]	Li [mH]	Tamax [°C]
KS1/2/3	30	101	1,4	4,16	0,15	70
ES1/2/3	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
US1	30	101	1,4	4,16	0,15	70

### Intrinsically safe electronic transmitter 4 - 20 mA (with/without HART-communication) with ATEX-certification (option /KS1):

#### Certificate:

PTB 12 ATEX 2003 X

#### Output signal:

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

#### Explosion proof:

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

#### Entity parameter:

see table 6

### Intrinsically safe electronic transmitter Profibus PA - communication with ATEX- certification (option /KS1):

#### Certificate:

PTB 96 ATEX 2160 X

#### Output signal:

Profibus PA

#### Explosion proof:

Ex ia IIB/IIC T4; group II; category 2G

**Table 7 Entity parameters**

	IIC	IIB	FISCO IIB/IIC
Ui	24 V	17.5 V	acc. IEC 60079-27
Ii	250 mA	280 mA	
Li	negligible small	negligible small	
Ci	negligible small	negligible small	

### Intrinsically safe electronic transmitter 4 - 20 mA (with/without HART-communication) with IECEx-certification (option /ES1):

#### Certificate:

IECEx PTB 12.0020 X

#### Output signal:

4 – 20 mA (2- wire unit, 3- wire unit); 0 – 20 mA (3- wire unit)

#### Explosion proof:

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

#### Entity parameter:

see table 6

### Intrinsically safe electronic transmitter 4 – 20 mA (with/without HART-communication) with ATEX- or IECEx- certification for use in category 3G (option /KS3 or /ES3):

#### Output signal:

4 – 20 mA (2- wire unit, 3- wire unit); 0 – 20 mA (3- wire unit)

#### Explosion proof:

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

#### Entity parameter:

see table 6

### Intrinsically safe/ non incendive electronic transmitter with FM - certification (USA + Canada) option /FS1:

#### Certificate:

No.: 3027471/3027471C

#### Output signal:

4 – 20 mA (2-wire unit)

#### Explosion proof:

Intrinsic safe Cl. I, Div. 1, GP. A, B, C, D T6

Intrinsic safe Cl. 1, Zone 0, AEx ia IIC T6

Non incendive Cl. I, Div. 2, GP. A, B, C, D T6

#### Entity parameter of electronic transmitter:

see table 6

### Intrinsically safe electronic transmitter with PESO- certification (India)

Option /KS1 must be selected.

Same data as ATEX-certified type (/KS1).

PESO- certificate is available at your Yokogawa Sales Office.

### Intrinsically safe electronic transmitter with EAC- certification (Russia, Belarus, Kazakhstan) (option /GS1):

#### Certificate:

RU C-DE.ГБ08.B.01183

#### Output signal:

4 – 20 mA (2- wire unit, 3- wire unit); 0 – 20 mA (3- wire unit)

#### Explosion proof:

0ExialICT6 X

#### Entity parameter:

see table 6

### Intrinsically safe electronic transmitter 4 – 20 mA (with/without HART-communication) with INMETRO-certification (Brazil) (option /US1):

#### Certificate:

DEKRA 15.0006 X

#### Output signal:

4 – 20 mA (2- wire unit, 3- wire unit); 0 – 20 mA (3- wire unit)

#### Explosion proof:

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

#### Entity parameter:

see table 6



**LIMIT SWITCHES****Intrinsically safe limit switches with ATEX-certification (option /K1 – /K10 with /KS1):****Certificate:**

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

**Explosion proof:**

Ex ia IIC T6, group II category 2G

**Entity parameter:**

see certificate of conformity

**Intrinsically safe limit switches with ATEX-certification for use in category 3G (option /K1 – /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 – /K3)  
 see specification of SJ3,5-SN (P&F)\* (/K6 – /K10)  
 \* P&F = Pepperl & Fuchs

**Intrinsically safe limit switches with IECEx-certification (option /K1.../K10 with /ES1):****Certificate:**

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

**Explosion proof:**

Ex ia IIC T6 Gb

**Entity parameter:**

see certificate of conformity

**Intrinsically safe/ non incendive limit switches with FM- certification (USA) (option /K1 – /K10 with /FS1):****Explosion proof:**

IS: Cl. I, Div. 1, Gp. ABCD, 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-certification (Russia, Belorussia, Kazakhstan) (option /K1 – /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 INMETRO-certification (option /K1 – /K10 with /US1):****Certificate:**

Option /K1.../K3 acc. to certificate TÜV 13.1131 X  
 Option /K6.../K10 acc. to certificate TÜV 14.0352 X

**Explosion proof:**

Ex ia IIC T6/T1 Ga

**Entity parameter:**

see certificate of conformity

**Intrinsically safe limit switches with NEPSI- certification (China) (option /NS1):**

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

**ELECTRICAL RAMC****Intrinsically safe RAMC with NEPSI- certification (China) (option /NS1):****Certificate:**

GYJ15.1064

**Electronic transmitter:**Output signal: 4-20 mA (2- wire unit, 3- wire unit);  
0-20 mA (3- wire unit)

Explosion proof: Ex ia IIC T6

Max. Tamb.: 70 °C

Entity parameter: see table 6

**Limit switches:**

Option /K1 – /K3 acc. to certificate GYJ16.1391X

Option /K6 – /K10 acc. to certificate GYJ16.1392X

**Flame proof and dust proof RAMC with ATEX- certificate (option /KF1):****Certificate:**

IBExU 05 ATEX 1086

**Flame proof:**

Ex d 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 – 20 mA (2- wire unit, 3- wire unit); 0 – 20 mA (3- wire unit)

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

2- or 3- wire unit

**Limit switches:**

Options /K1 – /K10 possible

**Ambient temperature:**

-20 °C – +60 °C

**Minimum process temperature:**

-20 °C

**Threads for cable glands:**

- M20x1.5 (standard)
- ½" NPT (option /A5)

**Temperature classification:**

see table 8

**Flame proof and dust proof RAMC with IECEx- certificate (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 – 20 mA (2- wire unit, 3- wire unit); 0 – 20 mA (3- wire unit)

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

2- or 3- wire unit

**Limit switches:**

Options /K1 – /K10 possible

**Ambient temperature:**

-20 °C – +60 °C

**Minimum process temperature:**

-20 °C

**Threads for cable glands:**

- M20x1.5 (standard)
- ½" NPT (option /A5)

**Temperature classification:**

see table 8

**Flame proof and dust proof RAMC with PESO- certificate (India):**

Option /KF1 must be selected. PESO- certificate is available at your Yokogawa Sales Office.

**Flame proof and dust proof RAMC with KOSHA- certificate (Korea) (option /EF1):**

Certificate: 12-AV4BO-0721X

Same data as IECEx- certified type (/EF1).

Option /EF1 must be selected.

**Flame proof RAMC with EAC- certificate (Russia, Belorussia, Kazakhstan) (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 – 20 mA (2- wire unit, 3- wire unit); 0 – 20 mA (3- wire unit)

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

2- or 3- wire unit

**Limit switches:**

Options /K1 – /K10 possible

**Ambient temperature:**

-40 °C – +60 °C

**Minimum process temperature:**

-20 °C

**Threads for cable glands:**

- M20x1.5 (standard)
- ½" NPT (option /A5)

**Temperature classification:**

see table 8

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

GYJ13.1018X

**Flame proof:**

Ex d IIC T1~T6 Gb

**Dust proof:**DIP A20 T<sub>A</sub>, T1~T6 IP67Max. surface temperature T<sub>A</sub>: corresponding process temperature**Housing:**

Painted aluminium casting type 91

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

4 – 20 mA (2- wire unit, 3- wire unit); 0 – 20 mA (3- wire unit)

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

2- or 3- wire unit

**Limit switches:**

Options /K1 – /K10 possible

**Ambient temperature:**

-20 °C – +60 °C

**Minimum process temperature:**

-20 °C

**Threads for cable glands:**

- M20x1.5 (standard)
- ½" NPT (option /A5)

**Temperature classification:**

see table 8



## Flame proof and dust proof RAMC with Taiwan Safety Label:

### 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 Label

**Table 8**

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

## NON-ELECTRICAL RAMC

### ATEX registered RAMC (option /KC1):

#### Registration no.:

IBExU 099/15

#### Explosion proof:

II 2GD IIC TX

#### Max. surface temperature:

TX: corresponding process temperature

#### Ambient temperature:

-40 °C – +90 °C

#### Max. process temperature

standard: +220 °C

indicator on distance: +370 °C

### RAMC with EAC- certification (option /GC1):

#### Certificate no.:

RU C-DE.Г508.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 – +90 °C

#### Max. process temperature:

standard: +220 °C

indicator on distance: +370 °C

## INTRINSIC SAFE COMPONENTS WITH DUST-PROOF

### ATEX- certified intrinsically safe electronic transmitter 4 - 20 mA, with/without limit switches with dust proof RAMC (option /KS2):

#### Certificate:

PTB 12 ATEX2003 (Intrinsic safe electronic transmitter)

PTB 99 ATEX2219X (Intrinsic safe limit switch SC3.5-N0)

PTB 00 ATEX2049X (Intrinsic safe limit switch SJ 3.5-S.N)

IBExU 05 ATEX1086 (Dust proof)

#### Output signal electronic transmitter:

4 – 20 mA (2- wire unit, 3- wire unit); 0 – 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 6 for electronic transmitter (/KS1)

see certificates for limit switches

#### Housing:

Painted aluminium casting, type 91

#### Ambient temperature:

-20 °C – +60 °C

#### Minimum process temperature:

-20 °C

#### Threads for cable glands:

• M20x1.5 (standard)

• ½" NPT (option /A5)

### IECEx- certified intrinsically safe electronic transmitter 4 - 20 mA, with/without limit switches with dust proof RAMC (option /ES2):

#### Certificate:

IECEx PTB12.0020 (Intrinsic safe electronic transmitter)

IECEx PTB11.0091 (Intrinsic safe limit switch SC3.5-N0)

IECEx PTB11.0092 (Intrinsic safe limit switch SJ 3.5-S.N)

IECEx IBE12.0007 (Dust proof)

#### Output signal electronic transmitter:

4 – 20 mA (2- wire unit, 3- wire unit); 0 – 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 6 for electronic transmitter (/KS1)

see certificates for limit switches

#### Housing:

Painted aluminium casting, type 91

#### Ambient temperature:

-20 °C – +60 °C

#### Minimum process temperature:

-20 °C

#### Threads for cable glands:

• M20x1.5 (standard)

• ½" NPT (option /A5)

## POWER SUPPLIES FOR INTRINSIC 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

**Certificate:**

ATEX: PTB 00 ATEX 2018  
IECEX: PTB06.0089  
FM: 3007835, Control Drawing 02 02 00 111  
CSA: 1067708, Control Drawing 02 02 00 112  
EAC: RU C-DE.ГБ05.B.00213

**Supply voltage:**

20 – 250 V DC/ AC 50/60 Hz

**Maximum load impedance:**

700 Ω

**Output signal:**

4 – 20 mA

**Control circuit:**

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

**Entity parameters:**

see fig. 4

### Power supply for intrinsically safe limit switches (option W□□):

**Type:**

acc. DIN EN 50227 (NAMUR)

- KFA5-SR2-Ex\*-W (115 V AC)
- KFA6-SR2-Ex\*-W (230 V AC)
- KFD2-SR2-Ex\*-W (24 V DC)
- KHA6-SH-Ex1 (115/230 V AC), Fail Safe, 1 channel
- KFD2-SH-Ex1 (24 V DC), Fail Safe, 1 channel

**Certificates:**

- KFA5-SR2-Ex\*-W: ATEX : PTB 00 ATEX 2081  
CSA : 1029981 (LR 36087-19)  
FM : ID 3011578  
IECEX : PTB11.0031  
PESO : P333188/1  
KOSHA : 2009-BO-0157  
EAC : RU C-П.ГБ05.B.00718
- KFA6-SR2-Ex\*-W: ATEX : PTB 00 ATEX 2081  
CSA : 1029981 (LR 36087-19)  
FM : ID 3011578  
IECEX : PTB11.0031  
PESO : P333188/1  
KOSHA : 2009-BO-0157  
EAC : RU C-П.ГБ05.B.00718
- KHA6-SH-Ex1: ATEX : PTB 00 ATEX 2043  
EAC : RU C-П.ГБ05.B.00718
- KFD2-SR2-Ex\*-W: ATEX : PTB 00 ATEX 2080  
CSA : 1029981 (LR 36087-19)  
FM : ID 3011578  
IECEX : PTB11.0034  
PESO : P333188/2  
KOSHA : 2009-BO-0157  
EAC : RU C-П.ГБ05.B.00718
- KFD2-SH-Ex1: ATEX : PTB 00 ATEX 2042  
EAC : RU C-П.ГБ05.B.00718

**Control circuit (ATEX):**

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

**Entity parameter:**

see fig. 4 (ATEX) and certificate

INSTALLATION

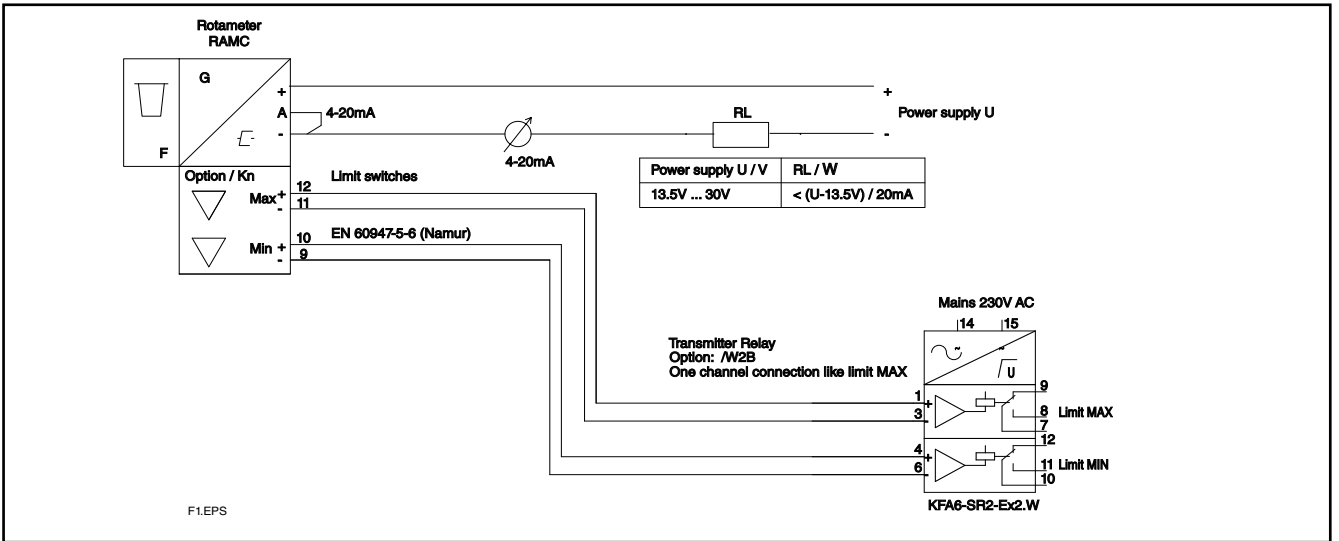


fig. 1 RAMC 2- wire unit with inductive limit switches and transmitter relay

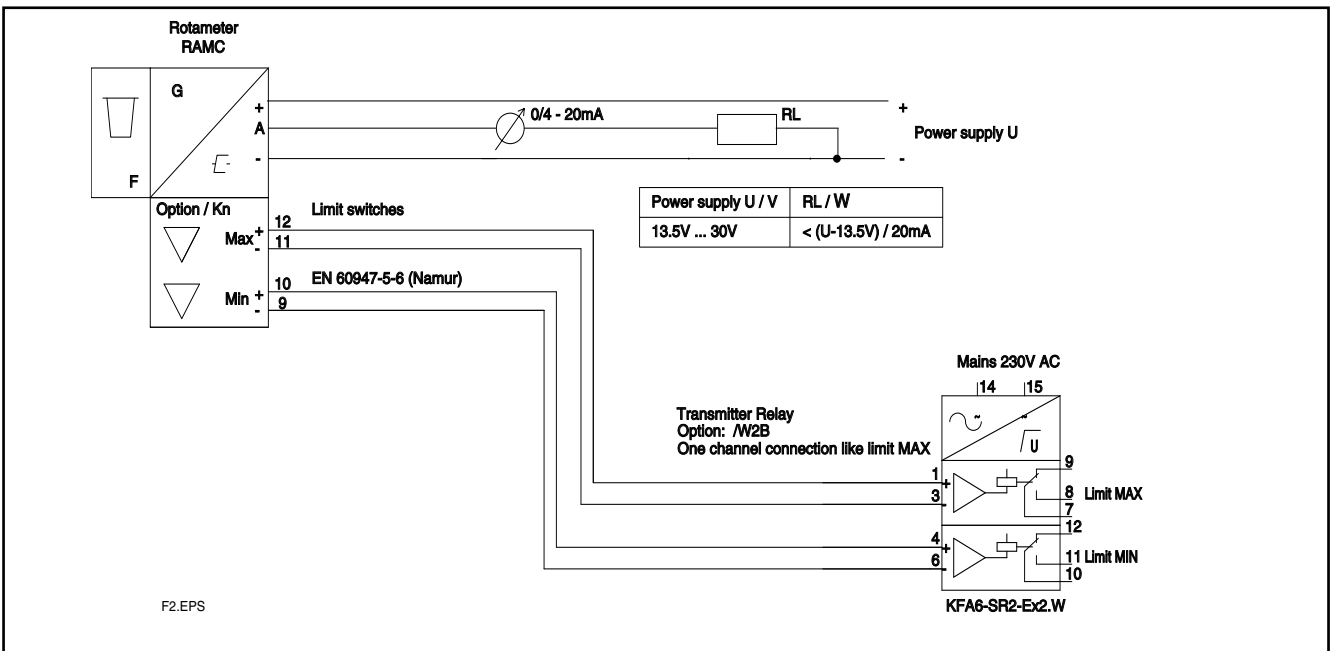


fig. 2 RAMC 3- wire unit with inductive limit switches and transmitter relay

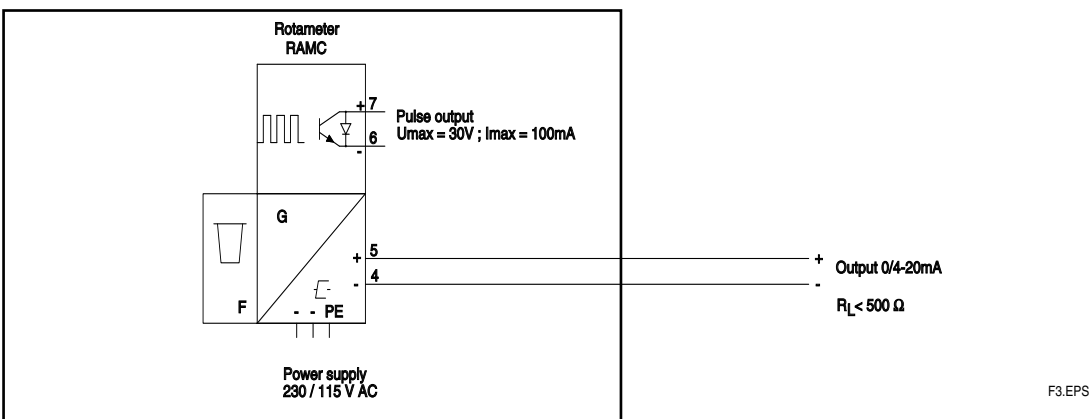


fig. 3 RAMC 4-wire unit with pulse output

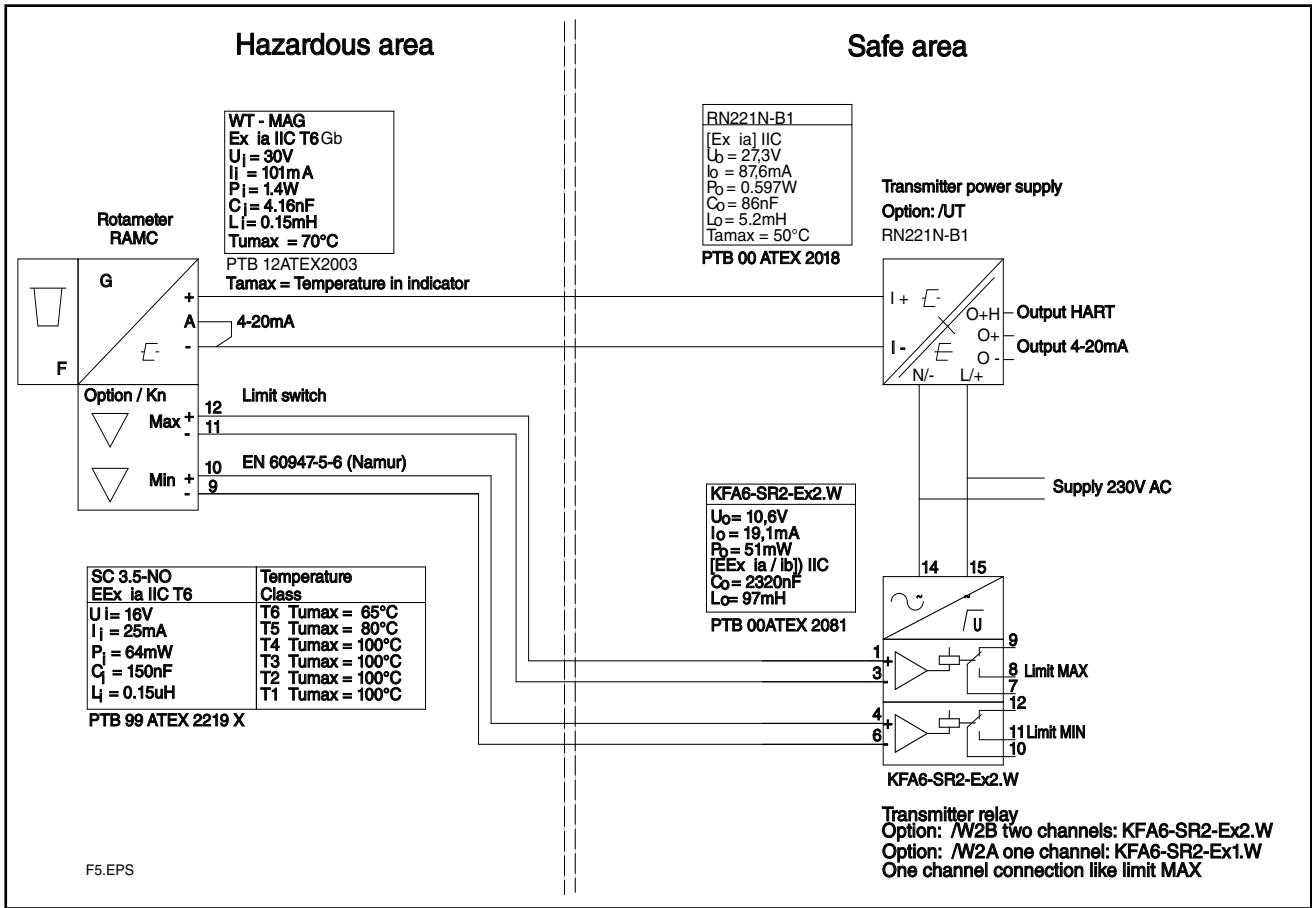


fig. 4 Intrinsic safe version according ATEX (option /KS1 or /KS2): RAMC 2- wire unit with power supply, inductive limit switches and transmitter relay

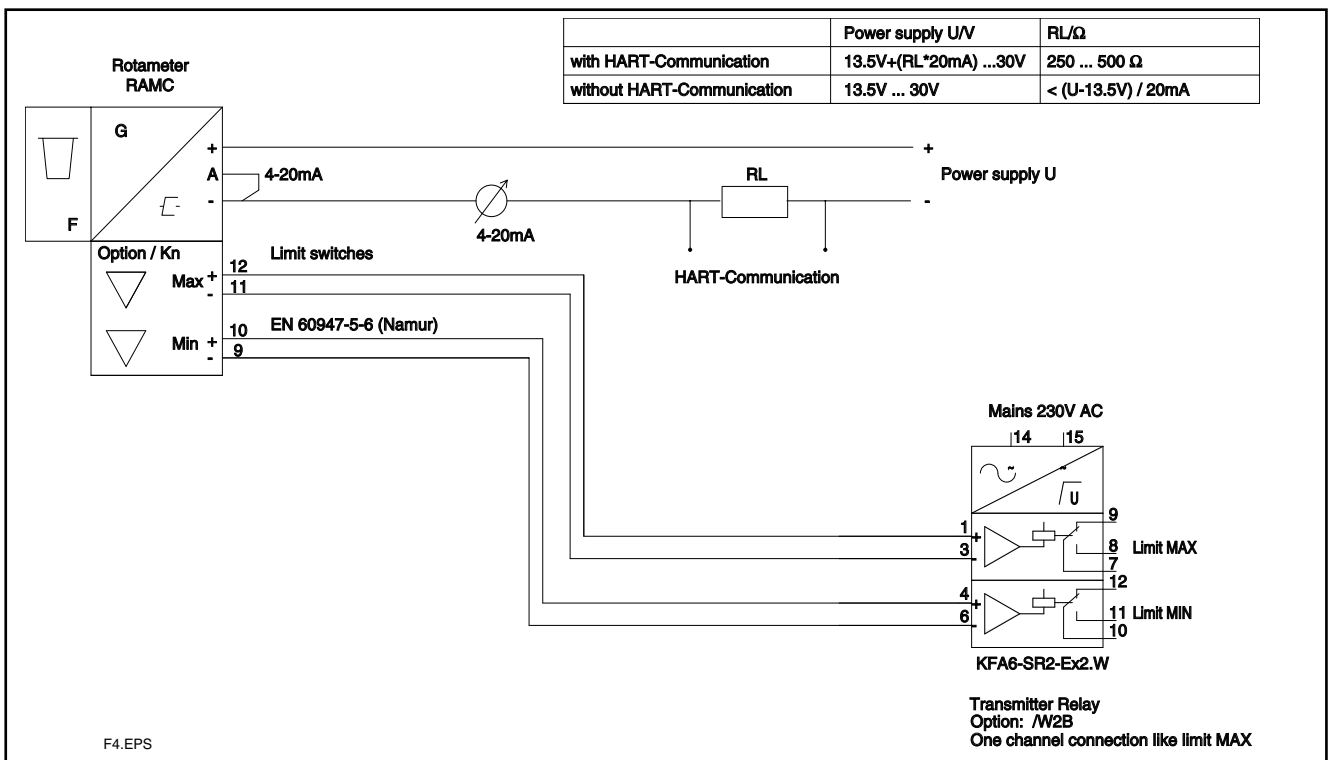


fig. 5 RAMC 2- wire unit with HART-communication, inductive limit switches and transmitter relay

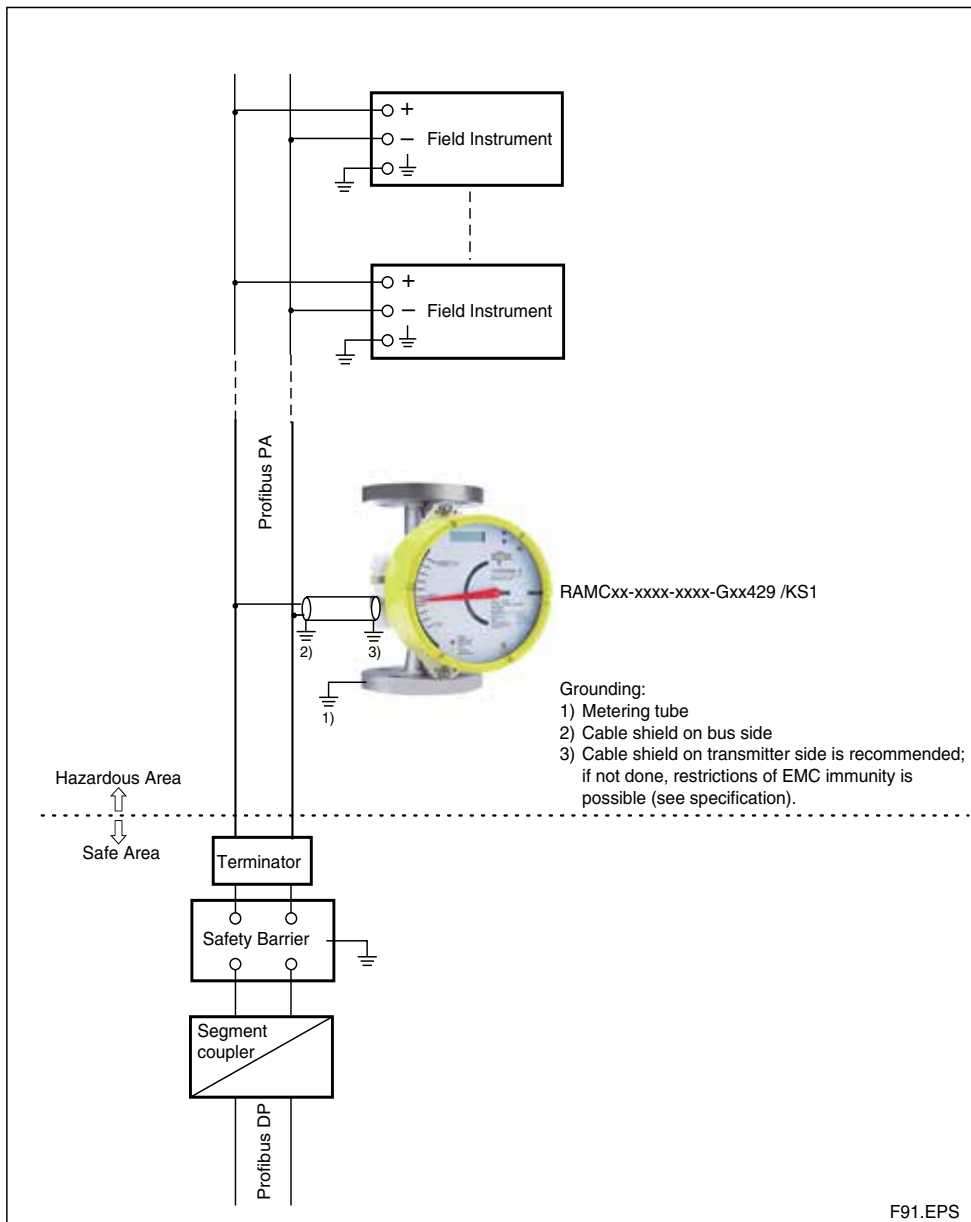


fig. 6 RAMC Profibus PA - communication

### Planning and Installation Hints

- The user is responsible for the use of our flowmeters regarding suitability and use as agreed.
- 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 medium.
- Ambient- and process temperature must be lower than the specified maximum values.
- If dirt accumulation is to be expected, we recommend to install 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 take care that the distance between the tube middle axes is not less than 300 mm. The distance to other ferric materials should not be less than 250 mm.
- Avoid static magnetic fields next to the Rotameter.

## MODEL SPECIFICATIONS

Model	Suffix code	Description	Restrictions
RAMC01 RAMC23 RAMC02		Size DN 15 (½") Size DN 20 (¾") Size DN 25 (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 DN 32 (1¼") Size DN 40 (1½") Size DN 50 (2") Size DN 65 (2½")	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 DN 80 (3") 3½" Size DN 100 (4") Size DN 125 (5") Size DN 150 (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 PN 16, process connection dimension + facing acc. EN 1092-1 Form B1 EN flange PN 40, process connection dimension + facing acc. EN 1092-1 Form B1 EN flange PN 63, process connection dimension + facing acc. EN 1092-1 Form B1 EN flange PN 100, process connection dimension + facing acc. EN 1092-1 Form B1 ASME flange class 150, process connection dimension + facing acc. ASME B 16.5 ASME flange class 300, process connection dimension + facing acc. ASME B 16.5 ASME flange class 600, process connection dimension + facing acc. ASME B 16.5 NPT PN 40 female thread G PN 40 female thread Rp removable female thread Thread acc. DIN 11851 Tri- clamp PN 10, PN16 acc. DIN 32676 NPT removable female thread Flange Rosista PN 10 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...12 Without measuring tube/without float	Only with RAMCNN
Indicator/ Transmitter	-T -E -G -H -J -N	Indicator local Indicator electronic Indicator electronic with Profibus PA Indicator electronic with HART 5 (includes Software Tag HART 5) Indicator electronic with HART 7 (includes Software Tag HART 7) Without indicator	Only with output 429 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 round blanc; SS Housing round yellow; AI Without housing	Only with indicator N
Power supply/ Output	240 244 140 144 430 434 424 429 NNN	230 V AC; 4- wire; 0-20 mA 230 V AC; 4- wire; 4-20 mA 115 V AC; 4- wire; 0-20 mA 115 V AC; 4- wire; 4-20 mA 24 V DC; 3- wire; 0-20 mA 24 V DC; 3- wire; 4-20 mA 24 V DC; 2- wire; 4-20 mA Profibus PA; 9...32 V DC Without power supply	Only with indicator E; not with limit switches Only with indicator E; not with limit switches Only with indicator E; not with limit switches Only with indicator E; not with limit switches Only with indicator E Only with indicator E Only with indicator E Only with indicator E, H, J Only with indicator G; not with limit switches Only with indicator T or N



## OPTIONS

Options	Code	Description	Restriction	
Indicator	/A5	Thread for cable gland ASME ½" NPT 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 M20 x 1,5 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	
Marking	/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 14n + 24n; /FS1, /GS1 not with -E, -H, -J	
	/B0	Tag plate (1.4404/316L) on flange and marking on scale	Plate 9 x 40 mm; max. 45 digits	
	/B1	Tag plate (1.4404/316L) fixed by wire and marking on scale	Plate 9 x 40 mm; max. 45 digits	
	/BT2	Software tag, bus address for Profibus PA	32 digits for tag; 4 digits bus address; only indicator G	
	/B4	Neutral version	Not with hazardous approval type	
	/B8	Customer provided marking on label		
	/B10	Percent scale		
Limit switches	/BG	Customer specific notes on scale	Max. 45 digits	
	/BD	Dual scale	Adjustment only for the first mentioned fluid	
	/K1	MIN- contact	Not for power supply 14n + 24n	
	/K2	MAX- contact	Not for power supply 14n + 24n	
	/K3	MIN-MAX- contact, MIN-MIN- contact, MAX-MAX- contact	Not for power supply 14n + 24n	
	/K6	MIN- contact "Fail safe" version	Not for power supply 14n + 24n	
	/K7	MAX- contact "Fail safe" version	Not for power supply 14n + 24n	
	/K8	MIN-MAX- contact "Fail safe" version	Not for power supply 14n + 24n	
Pulse output	/K9	MIN-MIN- contact "Fail safe" version	Not for power supply 14n + 24n	
	/K10	MAX-MAX- contact "Fail safe" version	Not for power supply 14n + 24n	
	/CP	Pulse output isolated	Only for power supply 14n + 24n	
	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
	Delivery to Korea	/KC	With KC-mark for Korea	Not with /VE or /CN
Eurasian Conformity	/VE	With EAC- mark	Not with /KC or /CN	
Delivery to China	/CN	For delivery to China	Not with /VE or /KC	
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	
Heat tracing	/T1	Heat tracing, process connection G ¼" PN 40 female thread	Only for SS material of wetted parts	
	/T2	Heat tracing, process connection DN 15 PN 40	Only for SS material of wetted parts	
	/T3	Heat tracing, process connection DN 25 PN 40	Only for SS material of wetted parts	
	/T4	Heat tracing, process connection ASME ½" 150#	Only for SS material of wetted parts	
	/T5	Heat tracing, process connection ASME 1" 150#	Only for SS material of wetted parts	
	/T6	Heat tracing, process connection ¼" PN 40 NPT female thread	Only for SS material of wetted parts	
Power supply for electronic transmitter	/UT	RN221N-B1, 20...250V DC/AC, Ex i, HART compatible	Only for indicator E, H, J	

Options	Code	Description	Restriction
Test and certificates	/H1	Oil + fat free for wetted surfaces acc. ASTM G93-03 level C	
	/H3	Certificate pure water application	
	/P2	Certificate of compliance with the order acc. EN 10204: -2.1	
	/P3	As /P2 + Test report acc. EN 10204 -2.2	
	/P6	Material certificate acc. EN 10204 -3.1	only for metallic pressurized parts
	/PM3	PAMI test (3 points: Process connection inlet, measuring tube, process connection outlet)	only for SS material of wetted parts
	/PP	Pressure test report measuring system	according to EN 12266-1
	/PT	Flow table for conversion	
	/P9	Dye Penetration test acc. DIN EN ISO 3452-1 at the welding of the process connection, with certificate	Not for connection RAMC01-T6SS-□□S0-..., RAMC01-G6SS-□□ S0-...; not for /T□; not with /P15 or /P16
	/P10	Combination of /P3 + /P6 + /PP	see individual options
	/P11	Combination of /P3 + /P6 + /PM3	see individual options
	/P12	Combination of /P3 + /P6 + /P9 + /PP	see individual options; not with /P15 or /P16
	/P13	Combination of /P3 + /P6 + /P9 + /PM3 + /PP + /WP	see individual options; not with /P15 or /P16
	/P14	Dye Penetrant test of flange welding acc. ASME V	only for SS- wetted part material; Not for connection RAMC01-T6SS-□□ S0-..., RAMC01-G6SS-□□ S0-...; not for /T□
	/P15	ASME B31.3 compliance NORMAL FLUID SERVICE	only RAMC□-A1SS, RAMC□-A2SS, RAMC□-A3SS, not for /T□
/P16	ASME B31.3 compliance Category M FLUID SERVICE	only RAMC□-A1SS, RAMC□-A2SS, RAMC□-A3SS, not for /Tx; only with /RTA or /P20	
/P20	Combination of ASME package /P14, /WPA, /RTA	see individual options; only with /P15 or /P16	
/WP	WPS acc. DIN EN ISO 15609-1 (Welding Procedure Specification) WPQR acc. DIN EN ISO 15614-1 (Welder Performance Qualification Record) WQC acc. DIN EN 1418 (Welder Qualification Certificate), robot welding WQC acc. DIN EN 287-1 (Welder Qualification Certificate), manual welding (SS) WQC acc. DIN EN ISO 6906-4 (Welder Qualification Certificate), manual welding (nickel alloy)	not for connection RAMC01-T6SS-□□ S0-..., RAMC01-G6SS-□□ S0-...; not for /T□; not with /P15 or /P16	
/WPA	Welding procedures and certificates acc. ASME IX	only with /P15 or /P16	
/RTA	X-ray test acc. ASME V	only with /P15 or /P16	
Gost approval	/QR2	Primary Calibration and Test Confirmation valid in Kazakhstan	See page 4; only with /VE
	/QR3	Primary Calibration and Test Confirmation valid in Uzbekistan	See page 4

Options	Code	Description	Restriction
Hazardous area approvals	/KS1	ATEX intrinsically safe "ia"	Only for power supply 424, 430, 434, 429; for indicator T only with limit switches
	/KS2	ATEX intrinsically safe "ia" + dust proof "tb"	Only for power supply 424, 430, 434; for indicator T only with limit switches; only for housing 91
	/KS3	ATEX intrinsically safe "ic" for use in category 3G	Only for power supply 424, 430, 434; for indicator T only with limit switches
	/ES1	IECEX intrinsically safe "ia"	Only for power supply 424, 430, 434; for indicator T only with limit switches
	/ES2	IECEX intrinsically safe "ia" + dust proof "tb"	Only for power supply 424, 430, 434; for indicator T only with limit switches; only for housing 91
	/ES3	IECEX intrinsically safe "ic"	Only for power supply 424, 430, 434; not with limit switches
	/FS1	FM intrinsically safe/ non incendive electr. transmitter (USA/ Canada), FM intrinsically safe/ non incendive limit switches (USA)	Only for power supply 424 (electronic transmitter); for indicator T only with limit switches
	/NS1	NEPSI intrinsically safe approval (China)	Only for power supply 424, 430, 434; for indicator T only with limit switches; not with indicator J; only with /CN
	/GS1	EAC intrinsically safe "ia"	Only for power supply 424, 430, 434; only with /VE; for indicator T only with limit switches
	/US1	INMETRO intrinsically safe "ia"	only for power supply 424, 430, 434; not with limit switches
	/KF1	ATEX flame proof "d"/ dust proof "tb"	Only for power supply 424, 430, 434; for indicator T only with limit switches; only with housing 91
	/EF1	IECEX flame proof "d"/ dust proof "tb"	Only for power supply 424, 430, 434; for indicator T only with limit switches; only with housing 91
	/NF1	NEPSI flame proof "d"/ dust proof approval (China)	Only for power supply 424, 430, 434; for indicator T only with limit switches; only for housing 91; only with /CN
	/GF1	EAC flame proof "d"	Only for power supply 424, 430, 434; for indicator T only with limit switches; only for housing 91; only with /VE
	/KC1	ATEX non- electrical type	Only for indicator T without limit switches
/GC1	EAC non- electrical type	Only for indicator T without limit switches; only with /VE	
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.../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.../K10	
Instruction manuals	/IE <sub>n</sub>	Quantity of instruction manuals in English	n = 1...9 selectable*)
	/ID <sub>n</sub>	Quantity of instruction manuals in German	n = 1...9 selectable*)
Special order	/Z	Special design must be specified separately. If /Z is selected, several Suffix of Model-Suffix Code can be changed to Z.	

\*) if no instruction manual is selected, only a DVD with instruction manuals is shipped with the flowmeter

#### Specify the following when ordering:

- 1) Model, suffix code and option code
- 2) Fluid name; Process temperature; Process density; Process pressure; Process viscosity
- 3) For gases: Condition of the scale (st. or actual)
- 4) Options: Tag No.; Customer specific notes



## FLOW TABLES FOR METAL TUBES

Table 11

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>a)</sup>	Code	Viscosity <sup>b)</sup>	Cone-Float-combin.	Pressure loss <sup>a)</sup>	Code	Viscosity <sup>b)</sup>	Cone-Float-combin.	Max. flow	Pressure loss <sup>a)</sup>	Code	Cone-Float-combin.	Pressure loss <sup>a)</sup>	Code	Cone-Float-combin.	Pressure loss <sup>a)</sup>	Code	
	m <sup>3</sup> /h <sup>c)</sup>	gpm <sup>d)</sup>	mbar	mPa's	mPa's	mbar	mPa's	mPa's	mbar	mPa's	m <sup>3</sup> /h <sup>e)</sup>	scfm <sup>f)</sup>	mbar	Code	mbar	Code	Code	mbar	Code	
1	0.025	0.11	40	10	-	-	-	-	-	0.75	0	45	43 S0	45	-	-	-	-	-	
	0.04	0.18	40	80	-	-	-	-	-	1.2	1.1	45	44 S0	45	-	-	-	-	-	
	0.063	0.28	40	80	-	-	-	-	-	1.8	1.7	45	47 S0	45	-	-	-	-	-	
	0.1	0.44	40	80	-	-	-	-	-	3	2.8	45	51 S0	45	-	-	-	-	-	
	0.13	0.57	12	50	-	-	-	-	-	4	3.6	13	53 L1	13	-	-	-	-	-	
	0.16	0.7	-	-	53 M1	15	100	-	-	5.5	5	-	-	-	53 M1	21	-	-	-	
2	0.22	1.0	12	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	0.25	1.1	40	100	54 M1	15	50	54 L1	13	6.5	6	13	54 L1	13	-	-	-	-		
	0.32	1.4	-	-	57 L1	12	50	-	-	9	8.5	5	-	-	54 M1	21	-	-		
	0.4	1.8	40	50	57 M1	15	50	-	-	10	9	13	57 L1	13	-	-	-	-		
	0.5	2.2	-	-	61 L1	12	50	-	-	14	13	8	-	-	57 M1	21	-	-		
	0.63	2.8	40	50	61 M1	15	100	-	-	16	15	9	61 L1	13	-	-	-	-		
	0.8	3.5	-	-	62 L1	12	50	-	-	22	20	12	-	-	61 M1	21	-	-		
	1.0	4.4	40	100	62 M1	15	100	-	-	25	23	14	62 L1	13	-	-	-	-		
	1.6	7.0	40	100	-	-	-	-	-	34	32	20	-	-	62 M1	21	-	-		
	2.2	10.1	-	-	62 V1	45	50	-	-	50	45	28	-	-	62 S1	45	-	-		
3	1.3	5.7	17	50	-	-	-	-	-	40	36	23	63 L2	19	-	-	-	-		
	2.1	9.2	-	-	64 L2	17	50	-	-	50	47	29	-	-	63 M2	23	-	-		
	2.5	11.0	42	30	64 M2	17	10	-	-	60	55	35	64 L2	19	-	-	-	-		
	4	17.6	42	10	-	-	-	-	-	85	80	50	-	-	64 M2	23	-	-		
	6	26.4	-	-	64 V2	43	50	-	-	120	110	70	-	-	64 S2	47	-	-		
	3.2	14	13	50	-	-	-	-	-	100	90	57	67 L5	16	-	-	-	-		
	5.0	22	-	-	71 L5	13	50	-	-	130	120	75	-	-	67 M5	25	-	-		
	6.3	28	47	30	-	-	-	-	-	160	150	90	71 L5	16	-	-	-	-		
	8.5	37	-	-	72 L5	13	50	-	-	200	180	115	-	-	71 M5	25	-	-		
	10	44	47	5	72 M5	19	5	-	-	250	230	140	72 L5	16	-	-	-	-		
4	16	70	47	5	-	-	-	-	-	340	320	200	-	-	72 M5	25	-	-		
	25	110	-	-	72 V5	63	5	-	-	500	470	290	-	-	72 S5	54	-	-		
	25	110	60	10	-	-	-	-	-	550	500	320	73 L8	30	-	-	-	-		
	40	176	60	10	-	-	-	-	-	850	800	500	74 L8	30	-	-	-	-		
	63	277	60	10	-	-	-	-	-	1400	1300	800	77 L8	30	-	-	-	-		
	100	440	70	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
6	130	572	70	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

a) Pressure loss at the float with water or air.

b) For higher viscosity the specified precision is no more guaranteed.

c) Flow is referred to 20 °C and 1 bar abs.

d) Flow in US Gallons per minute at 70 °F.

e) Flow referred to 0 °C and 1.013 bar abs at operation conditions of 20 °C and 1,013 bar abs.

f) 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 Rota Yokogawa Sizing-Program.

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

**Table 12**

Pos.	Process connection						Measuring range for water and liquids						Measuring range for air and gases													
	EN-Flange			ASME-Flange			Max. Flow			Pressure loss <sup>a)</sup>			Viscosity <sup>b)</sup>			Max. Flow			Cone-Float-combination			Pressure loss <sup>a)</sup>				
	PN 16 Code	D2	L <sup>(1)</sup>	150 lbs Code	L <sup>(1)</sup>	300 lbs Code	m <sup>3</sup> /h <sup>c)</sup>	gpm <sup>d)</sup>	mbar	mPa·s	m <sup>3</sup> /h <sup>e)</sup>	gpm <sup>d)</sup>	mbar	mPa·s	m <sup>3</sup> /h <sup>e)</sup>	gpm <sup>d)</sup>	m <sup>3</sup> /h <sup>e)</sup>	scfm <sup>f)</sup>	Code	Code	Code	mbar	Code	Code	Code	
	PN 40 Code	D4	mm	A1	mm	A2	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
2																										
3																										
4																										
5																										
6																										

- (1) L = Mounting length
- a) Pressure loss at the float with water or air.
- b) As from this viscosity the specified precision is no more guaranteed.
- c) Flow is referred to 20 °C and 1 bar abs.
- d) Flow in US Gallons per minute at 70 °F.
- e) Flow referred to 0 °C and 1.013 bar abs at operation conditions of 20 °C and 1,013 bar abs.
- f) 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.

For your special application please use the Rota Yokogawa Sizing-Program.



## TEMPERATURE GRAPHS FOR RAMC METAL DESIGN, STANDARD AND INTRINSIC SAFE

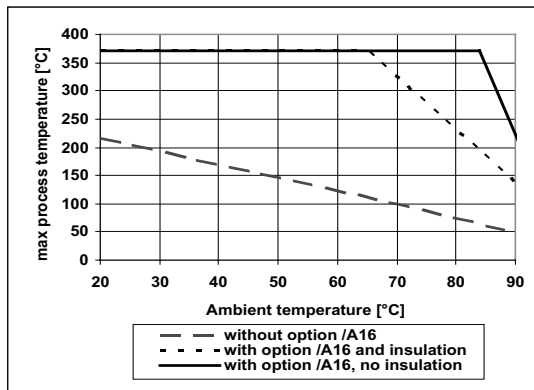


fig. 7a RAMC : • type 90 / 91  
• only with indicator

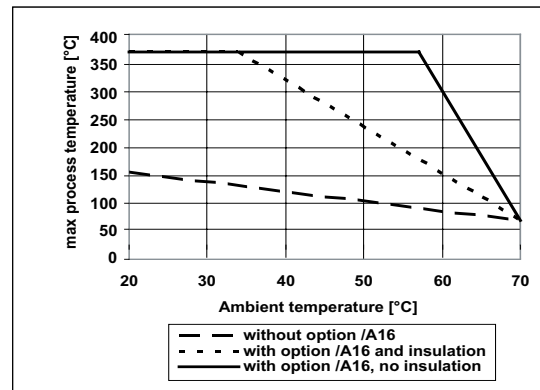


fig. 7b RAMC : • type 90 / 91  
• with limit switches  
• with electronic transmitter

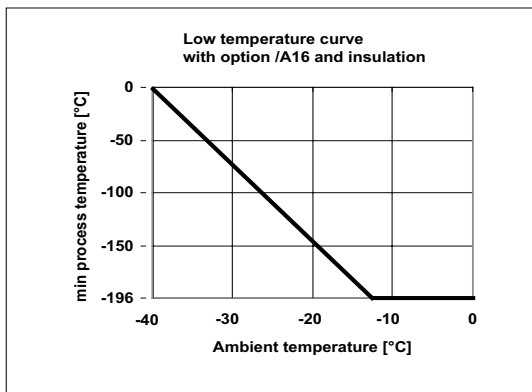


fig. 7c RAMC : • type 90 / 91  
• with or without limit switches  
• with or without electronic transmitter

T10.EPS

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 rock wool between tube and indicator.

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 4 to 6).



## PRESSURE RATING

The pressure relevant temperature limits of the RAMC are:

-196 – 370 °C for units with SS wetted parts

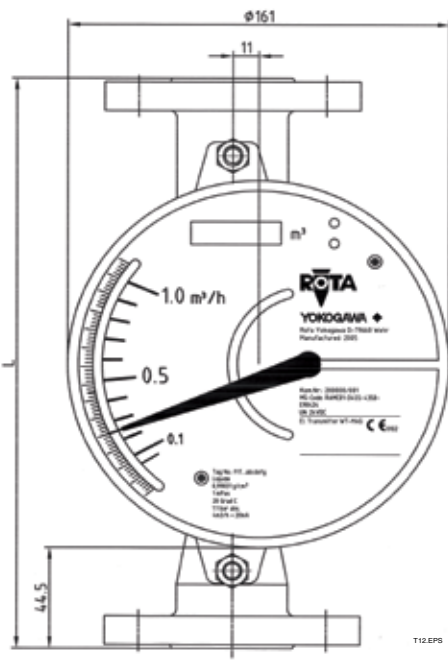
-80 – 130 °C for units with PTFE wetted parts.

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

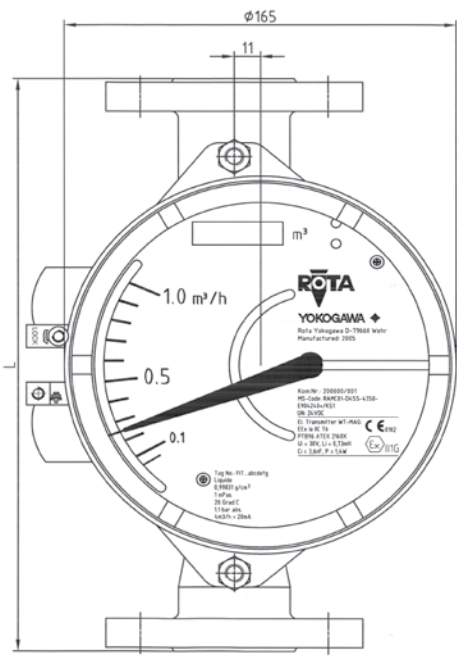
Process connection			Process temperature									
			-196 °C	RT (20 °C)	50 °C	100 °C	150 °C	200 °C	250 °C	300 °C	350 °C	370 °C
A1 )	Flange ASME 150lbs		19 bar	19 bar	18.4 bar	16.2 bar	14.8 bar	13.7 bar	12.1 bar	10.2 bar	8.4 bar	7.4 bar
A2 )	Flange ASME 300lbs		49.6 bar	49.6 bar	48.1 bar	42.2 bar	38.5 bar	35.7 bar	33.4 bar	31.6 bar	30.3 bar	29.9 bar
A3 )	Flange ASME 600lbs		99.3 bar	99.3 bar	96.2 bar	84.4 bar	77 bar	71.3 bar	66.8 bar	63.2 bar	60.7 bar	59.8 bar
D2	Flange EN PN16		16 bar	16 bar	15.6 bar	14.2 bar	12.8 bar	11.7 bar	10.9 bar	10.3 bar	9.9 bar	9.6 bar
D4	Flange EN PN40		40 bar	40 bar	39.1 bar	35.6 bar	32 bar	29.3 bar	27.2 bar	25.8 bar	24.7 bar	24 bar
D5	Flange EN PN63		63 bar	63 bar	61.6 bar	56 bar	50.4 bar	46.2 bar	42.8 bar	40.6 bar	38.9 bar	37.8 bar
D6	Flange EN PN100		100 bar	100 bar	97.8 bar	88.9 bar	80 bar	73.3 bar	68 bar	64.4 bar	61.8 bar	60 bar
R4/T4	Internal Thread	RAMC01...	25 bar	25 bar	25 bar	25 bar	20 bar	20 bar	20 bar	20 bar	-----	-----
R4/T4	Internal Thread	RAMC23...	25 bar	25 bar	25 bar	25 bar	20 bar	20 bar	20 bar	20 bar	-----	-----
R4/T4	Internal Thread	RAMC02...	16 bar	16 bar	16 bar	16 bar	16 bar	16 bar	16 bar	16 bar	-----	-----
R4/T4	Internal Thread	RAMC03...	16 bar	16 bar	16 bar	16 bar	16 bar	16 bar	16 bar	16 bar	-----	-----
R4/T4	Internal Thread	RAMC05...	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	-----	-----
R4/T4	Internal Thread	RAMC06...	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	-----	-----
G6/T6	Internal Thread	RAMC01...	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	-----	-----
G6/T6	Internal Thread	RAMC23...	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	-----	-----
G6/T6	Internal Thread	RAMC02...	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	-----	-----
G6/T6	Internal Thread	RAMC03...	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	-----	-----
G6/T6	Internal Thread	RAMC06...	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	40 bar	-----	-----
			Process temperature									
			-196 °C	RT (20 °C)	50 °C	100 °C	140 °C	see corresponding standard for the connection				
S2	Clamp DIN 11851	RAMC02...		40 bar	40 bar	40 bar	40 bar					
S2	Clamp DIN 11851	RAMC05...		25 bar	25 bar	25 bar	25 bar					
S2	Clamp DIN 11851	RAMC06...		25 bar	25 bar	25 bar	25 bar					
S2	Clamp DIN 11851	RAMC08...		25 bar	25 bar	25 bar	25 bar					
S2	Clamp DIN 11851	RAMC10...		25 bar	25 bar	25 bar	25 bar					
S2	Clamp DIN 11851	RAMC12...		16 bar	16 bar	16 bar	16 bar					
			Process temperature									
			-196 °C	RT (20 °C)	50 °C	100 °C	150 °C	see corresponding standard for the connection				
S4	Tri- Clamp DIN 32676	RAMC02...		16 bar	16 bar	16 bar	16 bar					
S4	Tri- Clamp DIN 32676	RAMC03...		16 bar	16 bar	16 bar	16 bar					
S4	Tri- Clamp DIN 32676	RAMC04...		16 bar	16 bar	16 bar	16 bar					
S4	Tri- Clamp DIN 32676	RAMC05...		16 bar	16 bar	16 bar	16 bar					
S4	Tri- Clamp DIN 32676	RAMC06...		10 bar	10 bar	10 bar	10 bar					
S4	Tri- Clamp DIN 32676	RAMC08...		10 bar	10 bar	10 bar	10 bar					
S4	Tri- Clamp DIN 32676	RAMC10...		10 bar	10 bar	10 bar	10 bar					
S5	Rosista Flange	RAMC02...		10 bar	see corresponding standard for the connection							
S5	Rosista Flange	RAMC04...		10 bar								

) Dual certified AISI 316/316L

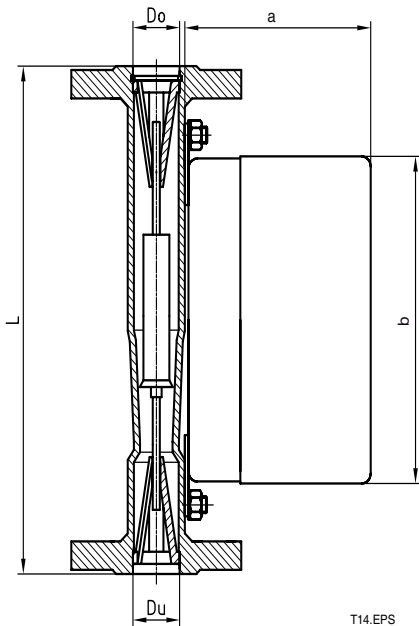
**DIMENSIONS AND WEIGHTS**



**fig. 8a Front view housing type 90**

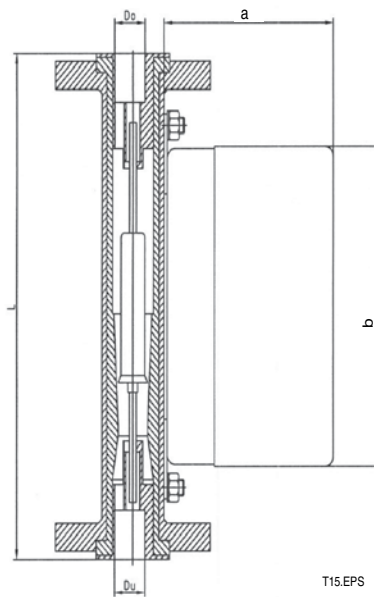


**fig. 8b Front view housing type 91**



**fig.9 Metal version**

T14.EPS



**fig.10 Metal version with lining**

T15.EPS

	a mm	b mm
Housing type 90	104	161
Housing type 91 standard	110	165
Housing type 91 flame proof, option /KF1	118	165

Table 13

Inner diameter of stainless steel flanges								Inner diameter of flanges with PTFE- lining			
Pos. <sup>1)</sup>	EN-flange without groove			ASME-flange			Rosita-flange	Pos. <sup>1)</sup>	EN- flange	ASME- flange	Du = Do mm
	Size	Du mm	Do mm	Size	Du mm	Do mm	Du=Do mm		Size	Size	
1	DN15-DN50	20.7	20.7	½" - 1"	20.7	20.7	20.7	----	----	----	----
2	DN15-DN50	29.5	29.5	½"	20.7	20.7	29.5	2	DN15-DN25	¾" - 1"	23.5
				¾" - 2"	29.5	29.5					
3	DN25-DN50	45.2	45.2	1"	32.2	32.2	45.2	3	DN25-DN50	1¼" - 1½"	36.0
				1¼" - 2"	45.2	45.2					
4	DN50-DN100	62.0	76.0	2"	62.0	65.5	----	4	DN50-DN80	2½" - 3"	66.0
				2½" - 3"	62.0	76.0					
5	DN80-DN150	88.2	88.2	3" - 6"	88.2	88.2	----	5	DN80-DN100	3½" - 4"	82.0
6	DN100-DN150	110.0	110.0	4" - 6"	110.0	110.0	----	6	DN100	4"	110.0

<sup>1)</sup> see table 10, 11, 12

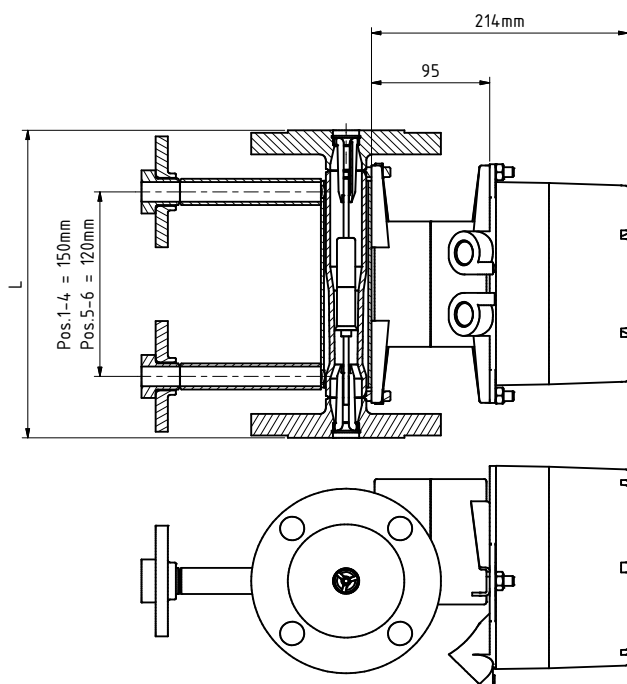


fig. 11 RAMC type 91 and Option /A16 and T2

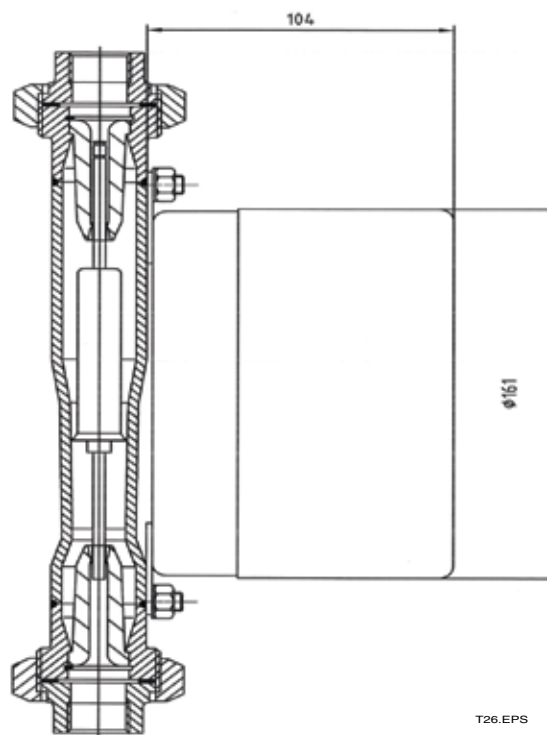


fig. 12 RAMC with connection R4/T4

T26.EPS

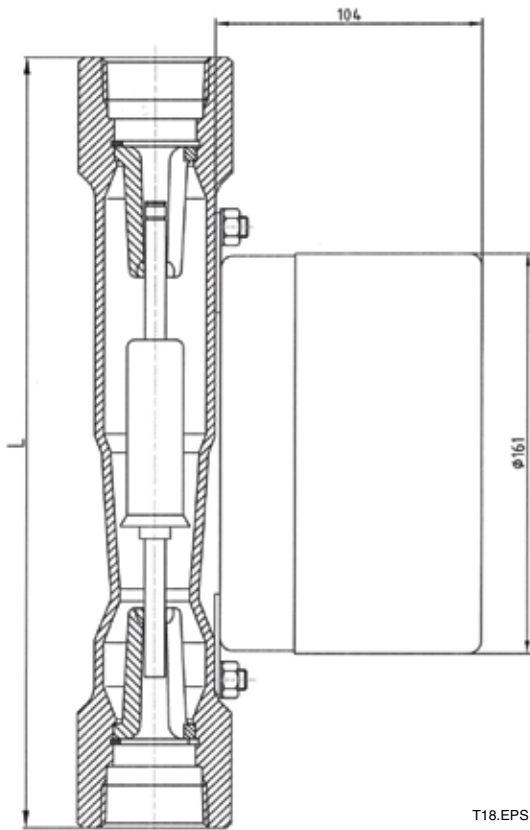


fig. 13 RAMC with connection T6/G6

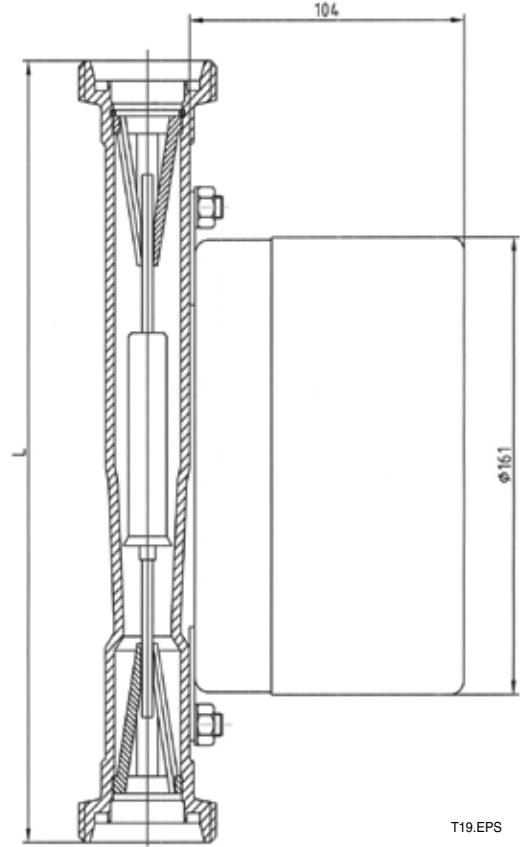


fig. 14 RAMC with connection S2

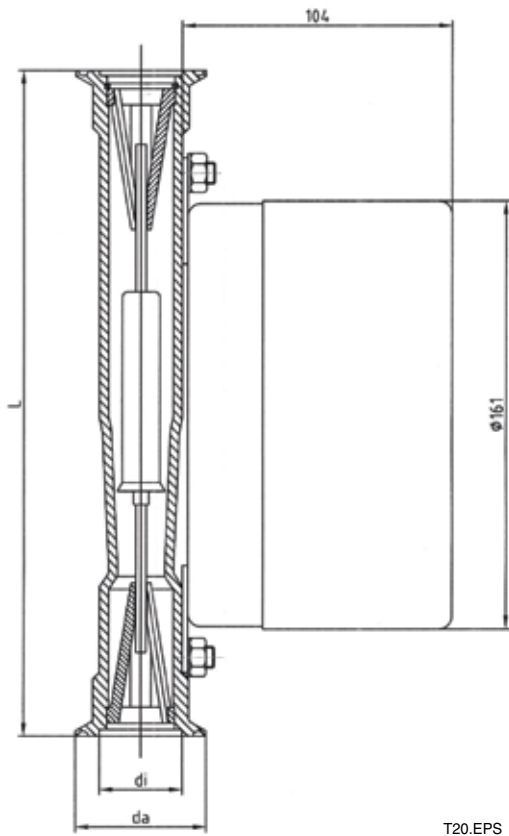


fig. 15 RAMC with connection S4

Table 14 Diameter for connection sizes S4

Position *)	Size [mm]	$d_i$ [mm]	$d_a$ [mm]
1	DN25/1"	36	50.5
	DN32	36	50.5
	DN40/1 1/2"	36	50.5
2	DN25/1"	36	50.5
	DN32	36	50.5
	DN40/1 1/2"	36	50.5
3	DN50/2"	47.8	64
4	DN65/3"	72.1	95
5	DN100/4"	97.6	119

\*) see table 10, 11, 12

Table 15 Weights

Position*)	Weight [kg]
1	3 - 5
2	3 - 5
3	6.5 - 8
4	8.6 - 11
5	13 - 16
6	17 - 20

\*) see table 10, 11, 12

Indicator on distance (option /A16) additional 1 kg








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Apr. '15