# User'sModel RAMCManualMetal Short Stroke ROTAMETER

IM 01R01B02-00E-E

vigilantplant.



Rota Yokogawa GmbH & Co. KG Rheinstr. 8 D-79664 Wehr Germany IM 01R01B02-00E-E ©Copyright 2003 (Rü) 10th edition, January 2013 (Rü) Blank Page

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# 1. Introduction

Before use, read this manual thoroughly and familiarize yourself fully with the features, operations and handling of Rotameter RAMC to have the instrument deliver its full capabilities and to ensure its efficient and correct use.

### **Notices Regarding This Manual**

- This manual should be passed to the end user.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. No part of this document may be reproduced or transmitted in any form or by any means without the written permission of Rota Yokogawa (hereinafter simply referred to as Yokogawa).
- This manual neither does warrant the marketability of this instrument nor it does warrant that the instrument will suit a particular purpose of the user.
- Every effort has been made to ensure accuracy in the contents of this manual. However, should any questions arise or errors come to your attention, please contact your nearest Yokogawa sales office that appears on the back of this manual or the sales representative from which you purchased the product.
- This manual is not intended for models with custom specifications.
- Revisions may not always be made in this manual in conjunction with changes in specifications, constructions and/or components if such changes are not deemed to interfere with the instrument's functionality or perfor-mance.

#### Notices Regarding Safety and Modification

- For the protection and safety of personnel, the instrument and the system comprising the instrument, be sure to follow the instructions on safety described in this manual when handling the product. If you handle the instrument in a manner contrary to these instructions, Yokogawa does not guarantee safety.
- If this instrument is used in a manner not specified in this manual, the protection provided by this instrument may be impaired.
- As for explosion proof model, if you yourself repair or modify the instrument and then fail to return it to its original form, the explosion protected construction of the instrument will be impaired, creating a hazardous condition. Be sure to consult Yokogawa for repairs and modifications.

# The following safety symbols and cautionary notes are used on the product and in this manual:

#### 

This symbol is used to indicate that a hazardous condition will result which, if not avoided, may lead to loss of life or serious injury. This manual describes how the operator should exercise care to avoid such a risk..

# 

This symbol is used to indicate that a hazardous condition will result which, if not avoided, may lead to minor injury or material damage. This manual describes how the operator should exercise care to avoid a risk of bodily injury or damage to the instrument.

### 

This symbol is used to call your attention to a condition that must be observed in order to avoid the risk of damage to the instrument or system problems.

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This symbol is used to call your attention to information that should be referred to in order to know the operations and functions of the instrument.

### For Safe Use of Rotameter RAMC

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- If the process fluid is harmful to personnel, handle Rotameter RAMC carefully even after it has been removed from the process line for maintenance or other purposes. Exercise extreme care to prevent the fluid from coming into contact with human flesh and to avoid inhaling any residual gas.
- In case of Explosion proof type instrument, further requirements and differences are described in Chapter 10 "EXPLOSION PROTECTED TYPE INSTRUMENTS". The description in Chapter 10 is prior to other descriptions in this instruction manual.

### 

• When carrying Rotameter RAMC around, exercise extreme care to avoid dropping it accidentally and causing bodily injury.

### Warranty

- The warranty of this instrument shall cover the period noted on the quotation presented to the Purchaser at the time of purchase. The Seller shall repair the instrument free of charge when the failure occurred during the warranty period.
- All inquiries on instrument failure should be directed to the Seller's sales representative from whom you purchased the instrument or your nearest sales office of the Seller.
- Should the instrument fail, contact the Seller specifying the model and instrument number of the product in question. Be specific in describing details on the failure and the process in which the failure occurred. It will be helpful if schematic diagrams and/or records of data are attached to the failed instrument.
- Whether or not the failed instrument should be repaired free of charge shall be left solely to the discretion of the Seller as a result of an inspection by the Seller.

### The Purchaser shall not be entitled to receive repair services from the Seller free of charge, even during the warranty period, if the malfunction or damage is due to:

- improper and/or inadequate maintenance of the instrument in question by the Purchaser.
- handling, use or storage of the instrument in question beyond the design and/or specifications requirements.
- use of the instrument in question in a location not conforming to the conditions specified in the Seller's General Specification or Instruction Manual.
- retrofitting and/or repair by an other party than the Seller or a party to whom the Seller has entrusted repair services.
- improper relocation of the instrument in question after delivery.
- reason of force measure such as fires, earthquakes, storms/ floods, thunder/lightning, or other reasons not attributable to the instrument in question.

## 

- Rotameter RAMC is a heavy instrument.
- Please give attention to prevent that persons are injured by carrying or installing. It is preferable for carrying the instrument to use a cart and be done by two or more persons.
- When removing the instrument from hazardous processes, avoid contact with the fluid and the interior of the meter.
- In case of Explosion proof type instrument, further requirements and differences are described in Chapter 10 " EXPLOSION PROTECTED TYPE INSTRUMENTS". The description in Chapter 10 is prior to other descriptions in this instruction manual.

### Notices regarding EMC

The Rotameter RAMC is conform to the European EMC Guideline and fulfills the following standards:

- EN 61326-1
- EN 55011

The RAMC is a class A product and should be used and installed properly according to the EMC Class A requirements

# 

Although the transmitter has been designed to resist high frequency electrical noise, if a radio transceiver is used near the transmitter or it external wiring, the transmitter may be affected by high frequency noise pickup. To test for such effects, bring the transceiver in use slowly from a distance of several meters from the transmitter, and observe the measurement loop for noise effects. Thereafter, always use the transceiver outside the area affected by noise.

## **1.1 ATEX Documentation**

This is only applicable to the countries in European Union.



Všetky návody na obsluhu pre prístroje s ATEX Ex sú k dispozícii v jazyku anglickom, nemeckom a francúzskom. V prípade potreby návodu pre Exprístroje vo Vašom národnom jazyku, skontaktujte prosím miestnu kanceláriu firmy Yokogawa.

Všechny uživatelské příručky pro výrobky, na něž se vztahuje nevýbušné schválení ATEX Ex, jsou dostupné v angličtině, němčině a francouzštině. Požadujete-li pokyny týkající se výrobků s nevýbušným schválením ve vašem lokálním jazyku, kontaktujte prosím vaši nejbližší reprezentační kancelář Yokogawa.

Visos gaminiø ATEX Ex kategorijos Eksploatavimo instrukcijos teikiami anglø, vokieèiø ir prancûzø kalbomis. Norëdami gauti prietaisø Ex dokumentacijà kitomis kalbomis susisiekite su artimiausiu bendrovës "Yokogawa" biuru arba atstovu

Visas ATEX Ex kategorijas izstrådâjumu Lietoðanas instrukcijas tiek piegâdâtas angïu, vâcu un franèu valodâs. Ja vçlaties saòemt Ex ierîèu dokumentâciju citâ valodâ, Jums ir jâsazinâs ar firmas Jokogava (Yokogawa) tuvâko ofisu vai pårstâvi.

Kõik ATEX Ex toodete kasutamisjuhendid on esitatud inglise, saksa ja prantsuse keeles. Ex seadmete muukeelse dokumentatsiooni saamiseks pöörduge lähima lokagava (Yokogawa) kontori või esindaja poole.

Wszystkie instrukcje obsługi dla urządzeń w wykonaniu przeciwwybuchowym Ex, zgodnych z wymaganiami ATEX, dostępne są w języku angielskim, niemieckim i francuskim. Jeżeli wymagana jest instrukcja. obsługi w Państwa lokalnym ję zyku, prosimy o kontakt z najbliższym biurem Yokogawy.

Vsi predpisi in navodila za ATEX Ex sorodni pridelki so pri roki v anglišèini, nemšèini ter francošèini. Èe so Ex sorodna navodila potrebna v vašem tukejnjem jeziku, kontaktirajte vaš najbliši Yokogawa office ili predstaunika.

Az ATEX Ex můszerek gépkönyveit angol, német és francia nyelven adjuk ki. Amennyiben helyi nyelven kérik az Ex eszközök leírásait, kérjük keressék fel a legközelebbi Yokogawa irodát, vagy képviseletet.

Всички упътвания за продукти от серията ATEX Ex се предлагат на английски, немски и френски език. Ако се нуждаете от упътвания за продукти от серията Ex на родния ви език, се свържете с най-близкия офис или представителство на фирма Yokogawa.

Toate manualele de instructiuni pentru produsele ATEX Ex sunt in limba engleza, germana si franceza. In cazul in care doriti instructiunile in limba locala, trebuie sa contactati cel mai apropiat birou sau reprezentant Yokogawa.

II-manwali kollha ta' I-istruzzjonijiet għal prodotti marbuta ma' ATEX Ex huma disponibbli bl-Ingliż, bil-Germaniż u bil-Frančiż. Jekk tkun teħtieġ struzzjonijiet marbuta ma' Ex fil-lingwa lokali tiegħek, għandek tikkuntattja lill-eqreb rappreżentan jew uffićċju ta' Yokogawa.

# 1.2 General description

This manual describes installation, operation and maintenance of the RAMC. Please read it carefully before using this device.

Further, please note that customer features are not described in this manual. When modifying specifications, construction or parts, this manual is not necessarily revised unless it can be assumed that these changes will impair RAMC functions or performance.

All units are thoroughly tested before shipping. Please check the received units visually to ensure that they have not been damaged during transport. In case of defects or questions please contact your nearest YOKOGAWA service centre or sales office. Please describe any defect precisely and indicate model code as well as serial number.

YOKOGAWA refuses any liability for units which have been repaired by the user without prior consent and do not meet the specifications as a consequence.

# 1.3 Principle of measurement

The RAMC is a Variable Area Flow Meter for volume and mass measurements of gases and liquids. A float, whose movement is nearly independent of viscosity is guided concentrically in a specially shaped cone. The position of the float is transferred magnetically to the indicator, which shows the measurement values by a pointer on a scale. The indicator can be equipped with limit switches and an electronic transmitter.



### Fig. 1-1

All units are calibrated with water by the manufacturer. By adjusting the calibration values to the measured substance's state of aggregation (density, viscosity), the flow rate scale for each measuring tube can be determined.

Indication units can be exchanged without impairment of precision. However, the scale for the tube must be mounted on the new indicator (and in case of an electronic transmitter the calibration EEPROM, too).

# 1.4 Overview



Fig. 1-2

### Explanations of specifications on flanges

- type of flange e.g. DIN
- size of flange e.g. DN15
- Pressure range of flange and measuring tube e.g. PN40
- Material of wetted parts e.g. 1.4404
- Manufacturing code of flange manufacturer
- Lot. No.





Fig. 1-3 Scale example for -E / -H-type (electronic transmitter)



# 2. Precautions

## 2.1 Transportation and storage

Before transporting the unit, it is recommended to fix the float with a card-board strip in the same way as when shipped from factory. Prevent foreign objects from entering the tube (e.g. by covering openings). To protect the unit and especially the tube's interior from soiling, store it only at clean and dry locations

## 2.2 Installation

Ambient temperature and humidity of the installation location must not exceed the specified ranges. Avoid locations in corrosive environments. If such environments are unavoidable, ensure sufficient ventilation. Although the RAMC features a very solid construction, the instrument should not be exposed to strong vibration or impact stress.

Please note that the RAMC's magnetic sensing system can be influenced by external inhomogeneous magnetic fields (such as solenoid valves). Alternating magnetic fields ( $\geq$  10Hz) as well as homogeneous, static magnetic fields (in the area of the RAMC), like the geomagnetic field have no influence. Asymmetric ferromagnetic bodies of considerable mass (e.g. steel girders) should be kept at a distance of at least 250 mm from the RAMC.

To avoid interference, the distance between two adjacent RAMC must be at least 300 mm.

## 2.3 Pipe connections

Ensure that the bolts of the flanges are tightened properly and that the gaskets are tight. Do not expose the unit to pressures higher than the indicated maximum operating pressure (refer to specifications).

While the system is pressurized the flange bolts must not be tightened or loosened.

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# 3. Installation

# 3.1 Installation in the pipeline

Be sure to remove the transport lock card-board strip from the measuring tube. Check that no cardboard remains in the tube.

The RAMC flow rate meter must be installed in a vertical pipeline, in which the medium flows upwards. The vertical position has to be checked at the outer edge of the flanges. Bigger nominal diameters (DN80/DN100) require straight pipe sections of at least 5D in front and behind the RAMC.

The nominal diameter of the RAMC should correspond to the nominal diameter of the pipeline.

To avoid stress in the connecting pipes, the connecting flanges must be aligned in parallel and axial direction. Bolts and gaskets have to be selected according to the maximum operating pressure, the temperature range and corrosion conditions. Centre gaskets and tighten nuts with a torque appropriate for the pressure range. If contamination or soiling of the RAMC is to be expected, a bypass should be installed to allow the removal of the instrument without interruption of the flow.

Please read also chapter 2.2. For further instructions on installation please refer to VDI/VDE3513.

Nominal Size				Bolts		Maximum Torque				
EN 1092-1 AS		ASME	B 16.5	EN 1092-1 ASME		EN 1092-1		ASME 150 lbs		
DN	PN	Inches	lbs		150 lbs	300 lbs	Nm	ft*lbf	Nm	ft*lbf
15	40	1⁄2	150/300	4 x M12	4 x ½″	4 x ½″	9.8	7.1	5.2	3.8
25	40	1	150/300	4 x M12	4 x ½″	4 x ½″	21	15	10	7.2
50	40	2	150/300	4 x M16	4 x 5/8´´	8 x 5/8´´	57	41	41	30
80	16	3	150/300	4 x M16	4 x 5/8´´	8 x ¾″	47	34	70	51
100	16	4	150/300	4 x M16	8 x 5/8´´	8 x ¾″	67	48	50	36

Tightening the flange threads for RAMC with PTFE- liner with the following torques:

# 3.2 Wiring of electronic transmitter (-E, -H) and limit switches (/K\_)

Please regard the drawings on the following pages.

On the rear of the RAMC are two cable glands for round cables with a diameter of 6 to 9 mm (not for Ex-d-type option /\_F1). Unused glands must be closed with a blind plug M16x1.5.

For wiring of RAMC with option /\_F1 see chapter 10.9.2, 10.10.2, 10.13.2.

Wires should not be bent directly at terminal screws. Do not expose wires to mechanical pressure. Wires must be arranged according to common installation rules, especially signal and power lines must not be bundled together.

The RAMC terminals accept wires with a maximum sectional area of 1.5 mm<sup>2</sup>.

Measuring and indicating instruments, connected in series to the output of the electronic transmitter, must not exceed a load impedance of

 $R_{I} = (U - 13.5 V) / 20 \text{ mA} - \text{for } 2\text{-/}3\text{-wire RAMC or } 500 \Omega \text{ for } 4\text{-wire RAMC}.$ 

2- or 3-wire units are connected to the terminals marked "+", "-" and "A" of the power connector.

For 2-wire instruments the terminals "-" and "A" have to be shorted with a jumper. Take care not to loose that jumper when mounting wires.

Wiring inside the case should be kept as short as possible to avoid that moving parts are blocked.

### Attention: Hints for Unit Safety (according DIN EN 61010)

- Heed the nominal voltage indicated on the scale.
- The electrical connections have to be executed according to VDE0100 "Errichten von Starkstromanlagen mit Nennspannungen bis 1000 V" (Installation of high current assemblies with nominal voltages of up to 1000 V) or equivalent national regulations.
- For units with a nominal voltage of 115 V or 230 V the correspondingly marked terminal has to be connected to protective earth (PE).
- Units with a nominal voltage of 24 V may only be connected to a protected low voltage circuit (SELV-E according to VDE0100/VDE 0106 or IEC 364/IEC 536).
- The RAMC indicator housing must be grounded to ensure electromagnetic interference protection.
- This can be done by grounding the pipeline.
- This unit does not include a power switch. Therefore, a switch has to be prepared at the installation location in the vicinity of the unit. The switch should be marked as the power separation switch for the RAMC.



Fig. 3-2 4-wire unit



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





Fig. 3-5 RAMC 4-wire unit with pulse output



### Fig. 3-6

Ex-version acc. to ATEX (Option /KS1 and /KS2) : RAMC 2-wire unit with power supply, limit switches and transmitter relay



Fig. 3-7 RAMC 2-wire unit with HART-communication, with limit switches and transmitter relay

# 4. Start of operation

## 4.1 Hints on flow rate measurement

The measured fluid should neither consist of a multi-phase mixture nor contain ferrite ingredients or large solid mass particles.

The **RAMC** scale is adjusted to the state of operation/aggregation of the measured fluid by the manufacturer. If the state of operation changes, it might become necessary to establish a new scale. This depends on several factors:

- If the RAMC is operated in the given viscosity independent range, only the density of the float as well as the operational density of the previous and new substance have to be considered. In case the operational density only changes marginally (≤ 0.5%), the present scale can be used.
- If the **RAMC** is operated outside the given viscosity independent range, the viscosities at the previous and new state of operation as well as the mass and diameter of the float have to be taken into account.

# 4.2 Pulsation and pressure shock

Pressure shock waves and pulsating flow influence measurement considerable or can destroy the meter. Surge conditions should be avoided. (open valves slowly, raise operating pressure slowly) If float bouncing occurs in gases increase the line pressure until the phenomena stop. If this is not possible provide the float with a damper. A damping kit is available as spare part.

# 4.3 Start of operation of electronic transmitter

Ensure that the device has been connected correctly according to section 3-2 and that the used power supply meets the requirements indicated on the scale.

Switch on the power supply.

The digital display gives the totalizer value in the measuring unit, indicated on the right side of the display. The RAMC is now ready for operation.

Unit graduation, measuring unit, damping, etc. can be adjusted by an operating menu (refer to section 6.2). In case of an error, the bars beneath the 8 digits of the display will flash. The corresponding error message can be checked using the operating menu and then taking the appropriate counter measures (refer to section 6-2-8 "Error Messages").

The transmitter has been prepared and calibrated according to the model code as a 2-, 3- or 4-wire unit. In 2-wire units, a jumper connects "A" and "-." When switching from a 2- to a 3-wire configuration, this jumper should be removed. The current output should then be adjusted as explained in section 6-2-6.

When changing from a 3- to 2-wire configuration, the jumper should be set in place, and the current output has to be adjusted according to section 6-2-6.

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# 5. Limit switches (Option /K[])

The optional limit switches are available as maximum or minimum type switches. They are proximity switches according to EN 60947-5-6 (NAMUR). Maximal two switches can be installed. The option (/Wnn) includes the respective transmitter relay.

These switches have been specified for hazardous area. However, the transmitter relay must be installed in safe area.

The limit switches are connected to the transmitter relays as indicated in chapter 3.2.

The terminals for the limit switches are on a small board on top of the transmitter case.

### Use of 2 standard limit switches (option /K3):

The MIN-MIN and MAX-MAX functions have been integrated at the factory as MIN-MAX switches in the RAMC. The MIN-MIN or MAX-MAX function is set by adjusting the switching direction of the transmitter relay. The concerning 2- channel transmitter relays are:

Option /W1B: KFA5-SR2-Ex2.W

Option /W2B: KFA6-SR2-Ex2.W

Option /W4B: KFD2-SR2-Ex2.W

The following table shows the assignment:

Fund	ction	Switching direction of transmitter relay *		
Channel 1	Channel 2	Channel 1	Channel 2	
MIN	MAX	S1 position I S2 position		
MIN	MIN	S1 position I	S2 position II (ON)	
MAX	MAX	S1 position II (ON)	S2 position I	

\* see following figure for S1 and S2 on transmitter relay.



Use of Fail Safe limit switches (option /K6 ... /K10):

For Fail Safe application only 1- channel transmitter relays are available.

Option /W2E: KHA6-SH-Ex1.W

Option /W2F: 2 x KHA6-SH-Ex1.W

Option /W4E: KFD2-SH-Ex1.W

Option /W4F: 2 x KFD2-SH-Ex1.W

If other transmitter relays are used as the above mentioned types, the transmitter relay has to be applied as protection technology to ensure functional safety.

Please notice chapter 9.3 "Standard specifications".

For questions regarding protection technology, please consult your YOKOGAWA service center.

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# 6. Electronic Transmitter (-E)

# 6.1 Operation principle

The position of the float is magnetically transferred to a magnetic follow up system. The position angle of this magnetic rocker is detected by magnet sensors. A micro controller determines the angle by means of a combining reference value table in the memory and calculates the flow rate by the angle with calibration and operation parameters the calibration EEPROM. The flow rate is given as a current, either 0-20 mA or 4-20 mA, and, in addition, indicated on the digital display (refer also to section 6-2). The electronic transmitters have been electronically adjusted before shipping and, therefore, are mutually exchangeable.

Calibration data of the metering tube as well as customer specific data are entered into a calibration EEPROM, inserted on the board. This calibration EEPROM and the indication scale are assigned to the respective metering tube.

When replacing an indicator (e.g. because of a defect) the scale and calibration EEPROM of the old unit have to be inserted in the new unit. Then, no calibrations or adjustments are necessary.

If an indicator with electronic transmitters is installed to a new metering tube, the calibration EEPROM of that tube has to be inserted into the transmitter and the indicator scale for that particular tube has to be mounted. A change in the fluid data (e.g. specific gravity, pressure, etc.) requires the preparation and mounting of a new calibration EEPROM and scale.

Normally the range of the current output is equal to the rounded measuring range of the tube (end value on scale). The customer can position the 20 mA point between 60% and 100% of the end value on scale. The set of the 20 mA point is shown on the scale (refer to Fig. 1-4). The flow cut off is positioned at 5% of the end value. Below 5% flow the current output shows 0 mA (4 mA).

# 6.2 Parameter setting

The displays allows indication of various parameters:

- Flow rate (8 mass or volume units in combination with 4 time units)
- Counter (8 mass or volume units)
- Flow rate indication in percent
- Special functions:
- Setting of different damping times
- Switching of current output 0-20 mA / 4-20 mA or vice versa
- Indication of error messages
- Manual adjustment
- Service functions
- Detection of float blockage

The setting of these parameters is done by two buttons.



Fig. 6-1 Operation keys

The buttons access three functions:

- upper button (  $\uparrow$  ) : Exit setting mode

- lower button ( $\rightarrow$ ) : Scroll through menu/selection of parameters - both buttons ( $\uparrow + \rightarrow$ ) = Enter : Entering parameters/selecting setting mode

If no button is pressed for one minute while the operating menu is active, the indication reverts to the measuring indication. This does not apply to subfunctions F32, F33, F52, F63.

For indication of volume or mass values at maximum 6 digits in front of the decimal point and 7 decimals are used. This format allows an indication range for flow rates from 0.0000001 unit/time to 106000 unit/time. Flow rate values exceeding 106000 are shown as '------' on the display. In this case the next bigger flow rate unit (next smaller time unit) has to be selected.

For the indication of totalizers values 8 digits are used at maximum of which 7 digits can be assigned for decimal values. The decimal point setting is determined by selecting the unit. Therefore, possible totalizer offsets are:

Unit \*1

Unit \*1/10

Unit \*1/100

The totalizer counts up to 99999999 or 9999999.9 or 999999.99 and is reset to zero.

The next page shows the operating menu.

The following describes selection and execution of functions.

menue.	
Indication meas .v	al

as .val	F1- : Indication	F11 : Selection	F11-1 : Flow rate
			F11-2 : Totalizer
			F11-3 : %
			F11-4 : Temperature
			Euro / US
		F12 : Flow rate unit	F12-1 : m <sup>3</sup> / m <sup>3</sup>
			F12-2 : I / acf
			F12-3 : Nm <sup>3</sup> / Nm <sup>3</sup>
			F12-4 : NL / scf
			F12-5 : t / ton
			F12-6 : kg / kg
			F12-7 : scf / lb
			F12-8 : gal / usg
			Euro / US
		F13 : Time unit	F13-1 : h / h
			F13-2 : min / min
			F13-3:s /s
			F13-4 : day / day
		F14 : Reset Totalizer	F14-1 : Execute
		F15 : Temperature unit	F15-1 : degC
			F15-2 : DegF
	F2- : Damping	F21 : Selection	F210:0s
			F211:1s
			F21 5 : 5 s
			F21 10 : 10 s

F3- : Output	F31 : Selection	F31 0-20 : 0-20 mA	
		F31 4-20 : 4-20 mA	
		L	
	F32 : Offset adjustment	F32 00	
	E33 : Span adjustment	E33_00	
	F34 · Pulse output *)	F34-1 : not active	
	· · · · · · · · · · · · · · · · · · ·	F34-2 : last digit	
		F34-3 : last but one digit	
F4- : Frror messages	F41 · Indication	F41 Enn	
E5- : Manual calibr	E51 · Op/Off	E51-1 : off	
		E51-2 : on	
		1 3 1-2 . 011	
	EF2 : Calibratian table	EEQ E: E% point	
	1 52 . Calibration table	FE0 15 : 15% point	
		F52 25 : 25% point	
		F52 35 : 35 point	
		F52 45 : 45% point	
		F52 55 : 55% point	
		F52 65 : 65% point	
		F52 75 : 75% point	
		F52 85 : 85% point	
		F52 95 : 95% point	
		F52 105 : 105% point	
F6- : Service	F61 : Revision indicatior	H F	
	F62 : EEPROM revision	A C	
		•	
	F63 : Current output test	F63 04 : 0 or 4 mA	
		F63 20 : 20 mA	
		L	
	F64 : Calibration table	F64-1 : Standard	
		F64-2 : Remote version	
	F65 : Master Reset	F65-1 : Execute	
F7- · Float Block Ind	F71 · Off/On	F71-1 : Off/On	
		F71-2 : On/Off	
	E72 · Lower limit	F72-1 : 5% of Omax	
	F72 : Lower limit	F72-1 : 5% of Qmax	
	F72 : Lower limit	<b>F72-1 : 5% of Qmax</b> F72-2 : 15% of Qmax	
	F72 : Lower limit	F72-1:5% of Qmax     F72-2:15% of Qmax     F72-3:30% of Qmax	
	F72 : Lower limit	F72-1:5% of Qmax     F72-2:15% of Qmax     F72-3:30% of Qmax	
	F72 : Lower limit F73 : Supervision time	F72-1 : 5% of Qmax     F72-2 : 15% of Qmax     F72-3 : 30% of Qmax     F73-1 : 5 Minutes	
	F72 : Lower limit F73 : Supervision time	F72-1 : 5% of Qmax     F72-2 : 15% of Qmax     F72-3 : 30% of Qmax     F73-1 : 5 Minutes     F73-2 : 15 Minutes	
	F72 : Lower limit F73 : Supervision time	F72-1 : 5% of Qmax   F72-2 : 15% of Qmax   F72-3 : 30% of Qmax   F73-1 : 5 Minutes   F73-2 : 15 Minutes	

Bold type = Factory Pre-setting

\*) Option /CP

### 6.2.1 Selection of indication function (F11)

The function F11 selects the display's indication function. The following indications can be set: flow rate, totalizer, % value or temperature.

At the factory the display is preset to totalizer indication.

Description	Selection	Кеу	Indication
Change to setting mode		Enter	Display mode F1-
Setting function		Enter	F11 F11 -1
Selection	Flow rate	Enter	F11
or	Totalizer	→ Enter	F11 -2 F11
or	%	$2 \times \rightarrow$	F11 -3
or	Temperature	Enter 3 x → Enter	F11 F11 -4 F11
Back to display mode		↑ ↑	F1- Display mode

Note: If you press "^" instead of "Enter", you can return from the selected point to the previous menu without activating the displayed parameter.

When selecting "Flow rate" the measuring unit is set with function F12 and F13. When selecting "Totalizer" the measuring unit is set with F12. If % indication is selected, F12 and F13 have no effect. The internal totalizer is updated, if "Flow rate" or "Counter" is selected. In case of setting to "%" the internal counter is not updated and keeps its previous value.

If "Temperature" is selected the unit can be set by function F15. The indicated value is the temperature in the indication unit.

After changing the indicating function and measuring units the corresponding measuring unit label should be fixed on the right side next to the display.

### 6.2.2 Setting the unit (F12 / F13)

When ordering the transmitter two sets of metering units are available. It is not possible to switch between them. These two sets comprise the following metering units:

	Standard	Description	Unit	Menu / Index
Flow rate unit	SI	Cubic meter	m³	-1
	SI	Liter	I	-2
	SI	Norm cubic meter	Nm <sup>3</sup>	-3
		(0°C; 1 Atm.abs = 1.013 bar		
	SI	Norm Liter	NI	-4
	SI	Ton	t	-5
	SI	Kilogram	kg	-6
		Standard cubic feet	scf	-7
		(21°C; 1Atm.abs = 1.013 bar		
		Gallon (imperial, UK)	gal	-8
Time unit	SI	Hour	h	-1
	SI	Minute	min	-2
	SI	Second	s	-3
		Day	d	-4

#### European unit set, Standard

### US unit set, Option /A12

	Standard	Description	Unit	Menu / Index
Flow rate unit	SI	Cubic meter	m³	-1
		Actual cubic feet	acf	-2
	SI	Norm cubic meter	Nm <sup>3</sup>	-3
		(32°F; 1 Atm.abs = 14.69 psi		
		Standard cubic feet	scft	-4
		(70°F; 1Atm.abs = 14.69 psi		
		Long ton	ton	-5
	SI	Kilogram	kg	-6
		Pound	lb	-7
		Gallon (US)	usg	-8
Time unit	SI	Hour	h	-1
	SI	Minute	min	-2
	SI	Second	s	-3
		Day	d	-4

With functions F12 and F13, the measuring unit for displayed value is selected.

F12 selects volume and mass units, while F13 sets the corresponding time unit. When selecting the indication function "totalizer" the set time unit is not taken into account and only the selected mass or volume unit is effective. When choosing the "%" indication F12 and F13 have no effect. The selection of the measuring unit is performed as follows:

Description		Selection	Кеу	Indication
Change to setting mode			Enter	Display mode F1-
Setting	1		Enter	F11
Masse/Volume unit	unit se	t		F12
	Euro	US	Enter	F12 -1
Selection unit	m3	m3	Enter	F12
or	1	acf	$\rightarrow$	F12 -2
			Enter	F12
or	Nm3	Nm3	$2 x \rightarrow$	F12 -3
			Enter	F12
or	NI	scf	$3 x \rightarrow$	F12 -4
			Enter	F12
or	t	ton	$4 \text{ x} \rightarrow$	F12 -5
			Enter	F12
or	kg	kg	$5 x \rightarrow$	F12 -6
	-	-	Enter	F12
or	scf	lb	$6 x \rightarrow$	F12 -7
			Enter	F12
	gal	usg	$7 x \rightarrow$	F12 -8
	-	-	Enter	F12
Setting			$\rightarrow$	F13
Time unit			Enter	F13 -1
Selection time unit	h	h	Enter	F13
or	min.	min	$\rightarrow$	F13 -2
			Enter	F13
or	s	S	$2 x \rightarrow$	F13 -3
			Enter	F13
or	day	day	$3 x \rightarrow$	F13 -4
		-	Enter	F13
Back to display mode			↑	F1-
			↑	Display mode

**Note:** If you press "<sup>↑</sup>" instead of "Enter", you can return from the selected point to the previous menu without activating the displayed parameter.

After changing the measuring unit the corresponding measuring unit label should be fixed on the right side next to the display. A sheet with stickers is included.

Attention:When switching the mass/volume unit the totalizer is reset to zero.When changing the time unit the totalizer value remains unchanged.

### 6.2.3 Totalizer reset (F14)

Function F14 resets the totalizer to zero. The counter reset is performed as follows:

Description	Selection	Кеу	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		Enter 3 x → Enter	F11 F14 F14 -1
Selection	Reset	Enter	F14
Back to display mode		↑ ↑	F1- Display mode

**Note:** If you press "<sup>↑</sup>" instead of "Enter", you can return from the selected point to the previous menu without activating the displayed parameter.

### 6.2.4 Selection of temperature unit (F15)

The function F15 sets the unit of temperature indication. The following indications can be set : degC (Celsius) or degF (Fahrenheit). At the factory the display is set to degC indication. The selection of the indication is as follows :

Description	Selection	Кеу	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		Enter 4 x → Enter	F11 F15 F15 -1
Selection	degC degF	Enter → Enter	F15 F15 -2 F15
Back to display mode		$\uparrow$	F1- Display mode

**Note:** If you press "<sup>↑</sup>" instead of "Enter", you can return from the selected point to the previous menu without activating the displayed parameter.

### 6.2.5 Setting of damping (F2-)

Function F21 allows damping the output with a certain time constant (63% value). Normally the time constant is set to 1 sec.

The selection of the time constant is as follows:

Description	Selection	Кеу	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		→ Enter	F2- F21
Selection damping constant or	0 s 1 s	Enter Enter → Enter	F21 0 F21 F21 1 F21 1 F21 5
or	10 s	2 x → Enter 3 x → Enter	F21 5 F21 F21 10 F21
Back to display mode		$\uparrow$	F2- Display mode

**Note:** If you press "<sup>↑</sup>" instead of "Enter", you can return from the selected point to the previous menu without activating the displayed parameter.

### 6.2.6 Selection / Adjustment 4-20 mA / 0-20 mA (F3-)

Function F3- sets the current output to 4-20 mA or 0-20 mA. In addition, offset and span have to be readjusted. Offset compensation is for fine tuning the 0 or 4 mA point. Span or range compensation is for precise adjustment of the 20 mA point.

For compensating the output, an ampere metre (mA) should be connected to the circuit loop. For wiring refer to the diagrams in chapter 3.

The current output is set according to customer specifications at the factory. Switching the output is executed as follows:

Description	Selection	Кеу	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode Output selection		2 x → Enter Enter	F3- F31 F31 0-20
Selection or	0-20 4-20	Enter → Enter	F31 F31 4-20 F31
Setting function Offset-Adjustment		→ Enter	F32 F32 00
Offset-Adjustment (Setting current to 0/4 mA)	Increase Decrease if 0/4 mA	↑ → Enter	F32 in steps of +1 (+20 μA) F32 in steps of -1 (-20 μA) F32
Setting function Span setting		Enter	F33 F33 0
Span setting (Setting current to 20 mA)	Increase Decrease if 20 mA	↑ → Enter	F33 in steps of +1 (+20 μA) F33 in steps of -1 (-20 μA) F33
Back to display mode		$\uparrow$	F3- Display mode

An adjusting step corresponds to 20  $\mu$ A. The complete adjusting range is ± 0.62 mA (31 steps). If the adjusting range does not suffice, change to display F32 or F33 by pressing ENTER when display shows F32 31 or F33 31, press ENTER again and continue adjusting at F32 00 or F33 00. 3 wire connection:

At this the ranges 0-20 mA and 4-20 mA are possible. At a switch over between the two ranges with F31 the current output is automatically adjusted at equipment as of firmware version 1.4 . (s.F 61). A perhaps necessary fine adjustment can be carried out with F32 or F33.

2 wire connection: At this only the range of 4-20 mA is meaningful. The range of 0-20 mA is not closed however. At the change to 0-20 mA with F31 the equipment assumes a remodelling on 3 wire connection and the current output is adjusted according to this. A perhaps necessary fine adjustment can be carried out with F32 or F33.

### WARNING

Since YOKOGAWA doesn't have any influence on the custom-designed connection the current output is not automatically adapted, if the connection is changed from 2 wire to 3 wire or vice versa .This must be manually carried out with the functions F32 and F33.

Preset values :

Connection	2- wire	3-wire
Current range		
0 - 20 mA		$I_0 = 0 \text{ mA}$
		$I_{20} = 20 \text{ mA}$
4 - 20 mA	$I_4 = 0.4 \text{ mA} + 3.6 \text{ mA}$	$I_0 = 4 \text{ mA}$
	$I_{20} = 16.4 \text{ mA} + 3.6 \text{ mA}$	$\tilde{I}_{20} = 20 \text{ mA}$
Note	Do not use F31	Use F31 for changing

### 6.2.7 Pulse output (F34) (Option /CP)

With the function F34 the optional pulse output can be activated and adjusted.

Description	Selection	Кеу	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		$\begin{array}{c} 2 \text{ x} \rightarrow \\ \text{Enter} \\ 3 \text{ x} \rightarrow \end{array}$	F3- F31 F34
Selection	Activation	Enter Enter	F34 -1 F34
or	Resolution last digit	→ Enter	F34 -2 F34
or	Resolution last but one digit	2 x → Enter	F34 -3 F34
Back to display mode		<b>↑</b>	F3- Display mode

### 6.2.7.1 General

The volume totalizer function in the electronic transmitter is available with a potential free pulse contact.

The connection is supported only at 4-wire-units on the power supply at pins 6, 7.

The pulse output is activated and selected by function F34 in the menu structure.

Two different pulse rates can be selected. The lower pulse rate (higher solution) corresponds to the last (least significant) digit of the totalizer. The higher pulse rate (lower solution) corresponds to the last but one digit of the totalizer.

### 6.2.7.2 Connection



### 6.2.7.3 Adjustments

The function F34 is added to the menu structure.

With the selection of F34 -1 the pulse output is switched off. With the selection of the functions F34 -2 or F34 -3 the pulse output is activated with the concerning solution.

- · F34 -1 not active
- · F34 -2 last totalizer digit
- · F34 -3 last but one totalizer digit

Special case : If Qmax is higher than 10000, the pulse rate is increased by factor 10 in both cases. That means: • F34 -2 last but one totalizer digit

· F34 -3 third totalizer digit from the right
#### 6.2.7.4 Calculation of pulse rate

Concerning the final flow-value (Qmax ), which was declared in the customers order, the pulse rate is calculated in factory and is written onto the sheet 'Data of Pulse Output (Option /CP)', which is included. This value can be transferred to a blank label of the also included sheet with unit-stickers and then fixed on the scale. After changing the flow rate unit with F12 the pulse rate must be recalculated. Calculation of pulse rate :

- · Read the value of Qmax from the scale or recalculate it.
- $\cdot$  Search for the concerning range in the first row of the table below.
- $\cdot$  Read the concerning pulse rates in the second and third row.
- $\cdot$  The measuring unit is equal to the flow

Maximum flow Qmax without unit	Pulse rate for F34-2 without unit	Pulse rate for F34-3 without unit
Qmax ≤ 1	0.0001	0.001
1 < Qmax ≤ 10	0.001	0.01
10 < Qmax ≤ 100	0.01	0.1
100 < Qmax ≤ 1000	0.1	1
1000 < Qmax ≤ 10000	1	10
$10000 < Qmax \le 100000$	10	100

e.g..: Final value (Qmax) = 400 m3/h

 $\rightarrow$  Pulse rate 0.1 m<sup>3</sup> for F34-2 and 1 m<sup>3</sup> for F34-3

## 🕅 ΝΟΤΕ

• The factory default is F34 -2 (solution : 1 last digit).

• After Master Reset F34 -1 (Pulse output not active) is selected.

• After changing the flow rate unit with F12 the pulse-register is deleted and the pulse rate is automatically redefined according to the new unit.

• After totalizer Reset with F14 the pulse output does not change.

When changing the indication with F11 -3 to '%', the totalizer stops and the pulse output is switched off.
 After switching power on one pulse is generated at the output.

For 2- respectively 3-wire-units the function F34 is not supported.

## 6.2.8 Error messages (F4-)

If the 8 bars beneath the digits start flashing, an error has occurred in the measuring transmitter/current output. Since the pointer indication is independent from the electric measuring transmitter, it may show the correct measuring value even if the transmitter is defective. Function F41 allows checking of assigned error codes.

Error codes are called onto the display as follows:

Description	Selection	Кеу	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		3 x → Enter Enter Enter	F4- F41 F41 Enn F41
Back to display mode		$\uparrow$	F4- Display mode

#### List of error messages :

Code	Meaning	Remedy
01	RAM-error	Indication unit needs service
02	ADC-error	Indication unit needs service
03	Internal EEPROM faulty	Indication unit needs service
04	Calibration-EEPROM faulty	If EEPROM is missing insert, -otherwise order new
	-	EEPROM
05	Wrong totalizer value in EEPROM	Reset totalizer
06	Overflow (flow rate too high)	Reduce flow rate
07	Internal EEPROM faulty	Indicator unit needs service
08	Float blocking indication realized,	Deactivate float-blocking-indication or run Autozero
	supervision time gone off	function

In case of error the appropriate remedy has to be taken.

## 6.2.9 Manual adjustment (F5-)

During manufacturers adjustment and calibration process the relation between flow rate with water (or with air) and float position (indicated as angle on the mm-scale) is determined. Based on the properties of the customers fluid at expected operating conditions the flow scale and the corresponding EEPROM is then calculated.

If the fluid properties are changing (by change of the fluid or by change of the process conditions) the scale as well as the EEPROM has to be adapted. Easiest and recommended way to do this is to order new scale and EEPROM for the new properties from manufacturer and to replace both.

A second possibility is to readjust the meter by the user. This readjustment procedure will only adjust the current output and the display indication (but only in % of the new flow range), At least the readjustment by the user is possible by two different procedures:

1 Manual "dry" readjustment based on recalculated original scale:

The following steps have to be performed:

- 1.a ) Calculate the new of flow rate to mm (on scale) relation based on original manufacturers calibration certificate.
- 1.b ) Place the RAMC (with the measuring tube) horizontally on a table (Note: the distance to any ferromagnetic parts must be at least higher then 25 cm!).
- 1.c ) Go to menu function F51 and press ENTER to switch to manual adjustment mode. (Switching back to the original adjustment is possible by pressing ENTER again).
- 1.d ) Go to menu function F52 in order to start the manual adjustment.
- 1.e ) Move the float to a position where the pointer is indicating on mm-scale the mm-value belonging to 5% of the new flow rate (Note: these values have to be calculated in step a first!)
- 1.f) Press ENTER to adjust the first 5% point.
- 1.g) Repeat steps 1.e) to 1.f) for the 15%; 25%; 35%; 45%; 55%; 65%; 75%; 85%; 95% and 105% points. (Note: The whole loop from 5% to 105% has to be adjusted in the requested order without interruption. It is not possible to skip or stop and restart the adjustment.)
- 1.h ) The adjustment has to be finished and stored by pressing "  $\uparrow$  "

After storage the new adjustment is permanently available and can be switched "on" or "off" by function F51.

## NOTE

When manually adjustment is active, the user is responsible for the measurement accuracy.

Activating/deactivating manua	al adjustment table (F51)

Description	Selection	Кеу	Indication
			Display mode
Change to setting mode		Enter	F1-
Setting mode		$4 \text{ x} \rightarrow$	F5-
		Enter	F51
Selection		Enter	F51 -1 or -2 (*)
	Change state	$\rightarrow$	F51 -2 or -1
	Take state	Enter	F51
Back to display mode		$\uparrow$	F5-
		1	Display mode

(\*) -1 : manual adjustment OFF;

-2 : manual adjustment ON

Input of manual adjustment table (F52) The manual adjustment table is input as follows:

Description	Selection	Кеу	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		$\begin{array}{c} 4 \text{ x} \rightarrow \\ \text{Enter} \\ \rightarrow \end{array}$	F5- F51 F52
Selection	5%- point 15%- point 25%- point 35%- point 45%- point 55%- point 65%- point 75%- point 85%- point 95%- point 105%- point	Enter Enter Enter Enter Enter Enter Enter Enter Enter Enter Enter Enter Enter	F52 F52 -5 F52 -15 F52 -25 F52 -35 F52 -35 F52 -45 F52 -55 F52 -65 F52 -75 F52 -85 F52 -95 F52 -105
Back to display mode		$\uparrow$	F5- Display mode

2 Manual "wet" adjustment by comparison to a reference master meter with the real process fluid at operating conditions:

This adjustment is useful under the following conditions:

- The original manufacturer's calibration is not available or needs to be renewed.
   Or
- The user is not able to recalculate the new mm to flow rate table. And
- The user has the possibility to compare the meter indication with a master meter with the process fluid at process conditions.

In these cases the following steps have to be performed:

- 2.a ) Place the RAMC in line with the master meter in an installation allowing controlled flow with the process fluid at process conditions in a flow range from 5% to 105% of the expected flow range.
- 2.b ) Go to menu function F51 and press ENTER to switch to manual adjustment mode. (Switching back to the original adjustment is possible by pressing ENTER again).
- 2.c ) Go to menu function F52 in order to start the manual adjustment.
- 2.d) Set the flow to 5% of the new flow rate indicated by the master.
- 2.e ) Press ENTER to adjust the first 5% point.
- 2.f) Repeat steps 2.d) to 2.e) for the 15%; 25%; 35%; 45%; 55%; 65%; 75%; 85%; 95% and 105% points. (Note: The whole loop from 5% to 105% has to be adjusted in the requested order without interruption. It is not possible to skip or stop and restart the adjustment.)
- 2.g ) The adjustment has to be finished and stored by pressing "  $\uparrow$  :

After storage the new adjustment is permanently available and can be switched "on" or "off" by function F51.

For the manual adjustment procedure according to the two cases described the following remarks have to be taken into account:

- After manual adjustment the flow-scale of the indicator is no longer valid.
- The display will only indicate in % of the new flow range.
- Switching of units is impossible.
- The indicator can be always resetted to the original adjustment according to manufacturers calibration at any time.
- The given procedures will only adjust the current output and the display to the new measuring range for a different fluid and/or new process conditions.
- The result of this adjustment is NOT a calibration! If proof of the new adjustment is requested a real calibration by comparison to a standard has to be made after adjustment!
- The following interactions with other functions apply:

#### Interaction with other functions:

	Action	Function	Effect
1.	Setting of manual adjustment values	F52 -5	Manual adjustment table is overwritten
2.	Activating of manual adjustment table	F51 -2	<ul> <li>Manual adjustment table active</li> <li>%-indication only</li> <li>Totalizer does not count</li> <li>No other flow rate unit selectable</li> <li>Function F64 for option /A2 has no effect, with manual adjustment</li> </ul>
3.	Deactivating of manual adjustment table	F51 -1	<ul> <li>Standard adjustment table active</li> <li>F11 is set to flow rate</li> <li>Flow unit is the same as before activating manual adjustment</li> <li>Totalizer value is the same as before activating manual adjustment</li> </ul>

Due to the limitations described it is strongly recommended to order a new scale and EEPROM from manufacturer (this gives a real new flow scale without new calibration) or to order a new calibration by the manufacturer together with a new scale and EEPROM for the new fluid and/or new process conditions (this gives new adjustment plus new calibration).

## 6.2.10 Revision indication (F61/F62)

Functions F61 and F62 enable the indication of revision states for hardware, software of calibration EEPROM and internal EEPROM.

The indication is called up as follows:

Description	Selection	Кеу	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode Revision		$5 x \rightarrow$ Enter 2 x $\rightarrow$	F6- F61 Hhh <sup>1</sup> Fff <sup>2</sup>
Setting mode EEPROM Revision		↑ → Enter	F61 F62 Aaa <sup>3</sup> Ccc <sup>4</sup>
Back to display mode		$\uparrow$	F6- Display mode

<sup>1</sup> H = Hardware <sup>2</sup> F = Firmware <sup>3</sup> A = Internal EEPROM <sup>4</sup> C = Calibration-EEPROM

## 6.2.11 Current output test (F63)

Function F63 sets the output current to 0/4mA or 20mA respectively. With this you can determine whether output current correction by function F32 is required. The adjustment of the current output is as follows:

Description	Selection	Кеу	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		5 x → Enter Enter	F6- F61 F63
Selection or	Output 0/4 mA Output 20 mA	Enter → Enter	F63         0/4           F63         20           F63         20
Back to display mode		$\uparrow$	F6- Display mode

Note: During selection you can switch between 0/4mA and 20mA with the"→"-key. If you press "↑" instead of "Enter", you can return from the selected point to the previous menu item without activating the displayed parameter.

## 6.2.12 Switching between standard / Indicator on extension (F64)

F64 allows switching between the standard calibration table and a calibration table of the remote version (option /A2 for high temperatures). The adjustment has to be performed according to the RAMC type (MS code).

This is done as follows:

Description	Selection	Кеу	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		$5 x \rightarrow$ Enter 3 x $\rightarrow$	F6- F61 F64
Selection or	Standard Remote Version	Enter → Enter	F64 -1 F64 -2 F64
Back to display mode		↑ ↑	F6- Display mode

Note: If you press "<sup>↑</sup>" instead of "Enter", you can return from the selected point to the previous menu without activating the displayed parameter.

### 6.2.13 Master Reset (F65)

If the unit shows aberrant behavior or does not execute functions any longer, function F65 allows a master reset of the micro controller.

Attention: All parameter settings are reset to factory settings (see operation menu).

The master reset is executed as follows:

Description	Selection	Кеу	Indication
Change to setting mode		Enter	Display mode F1-
Setting mode		$5 x \rightarrow$ Enter $4 x \rightarrow$	F6- F61 F65
Selection	Reset	Enter Enter	F65 -1 F65
Back to display mode		$\uparrow$	F6- Display mode

**Note:** If you press "<sup>↑</sup>" instead of "Enter", you can return from the selected point to the previous menu without activating the displayed parameter.

## 6.2.14 Float blocking indication (F7-)

## 6.2.14.1 Function

#### Float

Pulsating movements of the flow medium (gasses, liquids) lead to fluctuations of the float and with that to fluctuations of the tap system/pointer. Therefore the electrical measuring signal permanently changes and with that the display value and the output current value.

The fluctuations can be reduced with the help of the damping function "F21". That shows however that the medium still flows and the float/the tap system is not blocked. This means that in most applications there is a permanently changing measuring signal which can be used for the recognition of the movement or the blockade of the float.

#### Basic noise

Since it is an electronic evaluation circuit, permanently minimal fluctuations of the measuring signal appear. The basic noise is caused by vibrations in the plant as well as by temperature influences or external magnetic fields. The basic noise also appears, if

- no medium flows through the measuring pipe
- the float and with that the tap system are in the rest position
- the float/the tap system is blocked.

#### **Float-Blocking-Indication**

The function of the Float-Blocking-Indication allows the electronic transmitter to distinguish the fluctuations, which are caused by a moving float, with the fluctuations of the basic noise to state a fault status. If the measuring signal does not exceed the autozero value during a defined supervision time, this is recognized as blockade and an error condition is shown.

### 6.2.14.2 Operation

#### Switching on

At delivery of the equipment the Float-Blocking-Indication is turned off. By the function "F71 2" the Float-Blocking-Indication can be activated.

#### Autozero function

The autozero function is called to find out the level of basic noise in the application. This is started with the function "F74 1" and lasts for 90 seconds. While the autozero function is running the value "0.000" is displayed and the 4 bars will flash below the numbers. After approx. 80 seconds the current autozero value appears on the display. This value gets stored and will not be lost after power off / on the RAMC or after switching off / on the Float-Move-Detection-function. The stored value is typed over first after a renewed autozero.

#### Autozero without flow

To execute the autozero function the following expiry is recommended:

- Plant in operation (measuring tube filled with medium)
- Drive flow to zero (place float into rest position)
- Raise the pointer to 10% to 20% of the flow and fix it on the scale with adhesive tapes or underlayed paper stripe .
- Start Autozero function by menu.
- Check Autozero value after approx. 80 seconds.

### During the Autozero function it absolutely has to be respected that:

- the RAMC is not moved by touching or using the 2 buttons.

- the pointer is protected against slipping.
- the tube is not exposed to strong tremors

If these prerequisites are not adhered, it comes to the inquiry of too high autozero results. This leads that a relatively quiet flow can trigger the Float-Blocking-Indication.

#### Autozero with flow

The Autozero function can be carried out also under flow, if the flow cannot be switched off. To this the following expiry is recommended:

- Plant in operation (measuring tube filled with medium)
- Move flow to constant value (preferably between 10% and 40%)
- Fix pointer on the oriented scale factor with adhesive tapes or underlayed paper stripe
- Start Autozero function by menu.
- Check Autozero value after approx. 80 seconds.

It has to be respected on this absolutely, for this the flow is constant during the Autozero duration! Normally at this variant higher Autozero results must be expected !

#### Autozero range

The factory default autozero value is zero (0.000).

At the inquiry of the autozero value it has to be respected that the pointer / tap system are not in the rest position. In this case the autozero value is zero and the Float-Move-Detection does not work. Normally the autozero value is smaller than 0.200. If higher results should appear in the application, a multiple inquiry of the autozero value is recommended to confirm the value.

#### Supervision range (measuring range)

The measuring range in which Float-Move-Detection is active lies between 5% and 105% of the maximum flow Qmax (Factory Setting). With the help of the function "F72" this range can be reduced if a supervision is not possible or not desired in the lower flow range. The range can be restricted to 15% or 30% to 105% (see point 3.1 to 3.3).

#### Supervision time (Time Out)

The supervision time of the measuring signal is 5 minutes (Factory Setting). If the measuring signal should not exceed the autozero value during this period, this is recognized as blockade and an error condition is shown. The supervision time can be increased with the function "F73" up to 15 minutes.

#### Indication of a blocking condition

After the recognition of the blockade the error code "08" is produced and the bars under the displayed measurement value are flashing (see fault behavior). Simultaneously the current output is set to a value, which enables a clear fault detection of a connected evaluation unit :

- 2 wire 4-20 mA: Error condition: IA (IG) < 3.6 mA
- 3 wire 4-20 mA: Error condition: IA < 0.0 mA
- 3 wire 0-20 mA: Error condition: IA = 0.0 mA

### 6.2.14.3 Unsuitable applications

It is possible, that the Float-Blocking-Indication- Function does not work satisfactorily. This can be caused with different factors which are explained briefly here. In these cases the function of the Float-Blocking-Indication is not suitable for the respective application and it should be turned off.

#### Applications with gases

At applications with gases and float-damping it can happen, that the pulsating movements of the medium (and with that of the float) are damped so strongly in the measuring tube, that the measuring signal lies under the autozero value and a Float-Blocking-Indication is not possible.

#### Applications with high viscous media

If a high viscous medium should be used in the plant, the damping can get so high by the high viscosity of the flow that the measuring signal lies below the autozero value, and a Float-Blocking-Indication is not possible.

#### Applications with quiet flow

If the plant has an extremely quiet flow (gases or liquids) ,the supervision range can be limited in the lower flow range. Normally greater flow (>30%) causes greater medium flow deviations. The duration of the supervision can be put to 15 minutes to reach a longer supervision time.

#### 6.2.13.4 Parameter setting

#### Error message (F41)

Code	Meaning	Remedy
08	Float blockage	Check float in tube, clean tube if necessary.
	Supervision time gone off	Deactivate float blocking indication or run Autozero function.

#### Factory defaults / Master Reset (F65)

The RAMC is adjusted at delivery (Factory Setting):

- F71 1 Float-Move-Detection OFF
- F72 1 Lower limit value of the supervision area 5 %
- F73 1 Supervision time (Time Out) 5 min
- F74 Autozero inactive Autozero value = 0

After Master Reset the following attitudes are given :

- F71 1 Float-Blocking-Indication OFF
- F72 1 Lower limit value of the supervision area 5 %
- F73 1 Supervision time (Time Out) 5 min
- F74 Autozero inactive Autozero value not changed

#### Damping (F21)

The selection of the damping value has no influence on the autozero value or the measurement value of the Float-Blocking-Indication !

### Float-Blocking-Indication (F7x)

Function F71: On-/Off- switching of the float-blocking-indication

Description	Selection	Кеу	Indication		
Change to setting mode		Enter	Display mode F1-		
Setting mode		6 x → Enter	F7- F71		
Selection or	FBI OFF/ON FBI ON/OFF	Enter → Enter	F71 F72 F71		
Back to display mode		$\uparrow$	F7- Display mode		

Function F72: Selection of the lower limit value of the supervision range

Description	Selection	Кеу	Indication		
Change to setting mode		Enter	Display mode F1-		
Setting mode		$ \begin{array}{c} 6 \text{ x} \rightarrow \\ \text{Enter} \\ \rightarrow \end{array} $	F7- F71 F72		
Selection	5% of Qmax	Enter Enter	F72 -5 F72		
or	15% of Qmax	→ Enter	F72 -15 F72		
or	30% of Qmax	→ Enter	F72 -30 F72		
Back to display mode		$\uparrow \\ \uparrow$	F7- Display mode		

### Function F73: Selection of the supervision time

Description	Selection	Кеу	Indication			
			Display mode			
Change to setting mode		Enter	F1-			
Setting mode		6 x →	F7-			
		Enter	F71			
		2 x →	F73			
Selection	5 Minutes	Enter	F73 -5			
		Enter	F73			
or	15 Minutes	$\rightarrow$	F73 -15			
		Enter	F73			
Back to display mode		↑	F7-			
		↑	Display mode			

#### Function F74:Start Autozero function and storage

Description	Selection	Кеу	Indication		
Change to setting mode		Enter	Display mode		
Setting mode		$\begin{array}{c} 6 \text{ x} \rightarrow \\ \text{Enter} \\ 3 \text{ x} \rightarrow \end{array}$	F7- F71 F74		
Selection Inquire autozero value (80s) Display autozero value (10s)	Autozero	Enter Enter	F74 -1 0.000 0.xxx		
Back to display mode		$\uparrow$	F7- Display mode		

Blank Page

# 7. HART<sup>®</sup> - Communication

## 7.1 General

RAMC with indication unit type -H have, additional to the current output, the possibility for HART<sup>®</sup>-

Communication. Also without HART<sup>®</sup>- Communication the units are fully able to work. The HART<sup>®</sup>- Communication does not influence the current output, except in Multidrop-Mode (see below).

There exists no difference between the not-Ex and the Ex versions. For use in the hazardous area a HART<sup>®</sup>-able transmitter power supply is required.

#### Single-Mode :

The poll address must be zero in Single-Mode.

#### **Multidrop-Betrieb :**

In Multidrop-Mode maximum 15 HART<sup>®</sup>- units can be connected parallel. Therefore the poll-address must be differnt from zero. The current output is switched to 4mA and there are all functions of the unit available.



The HART®-Communication is only available with plugged calibration-EEPROM

## 🖄 ΝΟΤΕ

The HART®-Communication is only available for 2-wire units, 4 ... 20mA. Therefore the short-circuit bridge must be connected between ´A´ and ´-´.

#### **Deviations in the RAMC- Menu**

In HART<sup>®</sup> devices the operating menu according chapter 6 is not available.

Pressing the  $\uparrow$  -button the indication can be changed between flow, totalizer and temperature. Factory default is totalizer. Pressing  $\rightarrow$  button an error indication appears on display. 00000000 or 00000000

A detailed explanation see chapter 7.4.2

## 7.2 Connection

The connection is carried out in accordance with below figure. Please note, that the load resistor must have a value between 250 and  $500\Omega$ .

The minimum power supply is 13.5V + (RL\*20mA) ; RL = load resistor

The maximum power supply is 30V.

As connection cable a protected twisted cable pair is recommended.



## 7.3 HART Menu (Rev 01 DD rev 02)

		НОТ КЕҮ	Write protect Enable wrt 10 min New password			R W W
			Available in generic mode	R=Read, W=Write,S=Set	T=Test, p=perform	
Device Setup	Process Variables	Flow value [cum/h] Flow % rnge [%] Flow AO value [mA] Totalizer value [kg] % Span value Temperature value [°C]				R R R R R
Flow AO Flow AO Flow LRV Flow URV	Diag/ Service	Test device	Device status	Status group 1	RAM error ADC error ADJ-EE error CAL-EE error Totalizer false Flow overrun ADJ error 2 Float blocked	R R R R R R R R
				Status group 2	Temp over limit Max flow 1 active Max flow 2 active FB autoz active Power fail warn Oper timer error Mancal active	R R R R R R R R
			Reset all errors	reset		р
			Self test	perform		р
			Master reset	perform		р
		Loop test	4mA/20mA/other/end			Т
		Calibration	Apply URV/LRV	4 mA	Set as 4mA value Read new value Leave as found	S S S
				20 mA	Set as 20mA value Read new value Leave as found	S S S
			Reset URV/LRV	Exit Reset 4 mA Reset 20 mA Exit	Perform Perform	p p
			D/A trim	4 mA/ 20mA		s
			calib table	Std version Dist version		R/S R/S
			Manual calib	Status mancal	ON / OFF	R
				Activate/deactiv	ON / OFF	S
				Set mancal points	5%/15%/ /95%/105%	S



		Flow unit table	EU /US	EU	US	R
		Flow units select	Cum / h	*	*	R/S
			L/h	*		R/S
			NmlCum / h	*	*	R/S
			NmIL / h	*		R/S
			MetTon / h	*	*	R/S
			Kg / h StdCuEt / h	*	*	R/5
				*		R/S
			Cum / min	*	*	R/S
			L/min	*		R/S
			NmlCum / min	*	*	R/S
			NmIL / min	*		R/S
			MetTon /min	*		R/S
			Kg / min	*	*	R/S
			StdCuft / min	*	*	R/S
			Imp gal / min			R/5
			Cum / h	*	*	R/S
			NmlCum / h	*	*	R/S
			Ka / h	*	*	R/S
			StdCuFt / h	*	*	R/S
			CuFt / h		*	R/S
			LTon / h		*	R/S
			Lb / h		*	R/S
			gal / h	*	*	R/S
			Cum / min	*	*	R/5
			Ka / min	*	*	R/S
			StdCuFt / min	*	*	R/S
			CuFt / min		*	R/S
			LTon / min		*	R/S
			Lb / min		*	R/S
			gal / min		*	R/S
		Total reset	perform			n
		Total Teset	penonn			þ
		Temperure unit	degC			R/S
			degF			R/S
	Configure output	Analog output	Flow AO			R
			AO alrm typ			R
			Loop test			T
			D/A trim			I
			Dellede			DAA
		HART output	Poll addr			R
			Num resp preams			Ŵ
	Display selection	Standard	ManCal			
		Flow	Percent			R/S
		Totalizer	Temperature			R/S
		Temperature				R/S
			I			Б
	Device information	Model				R D
		Manufacturer				R
		Distributor				R
		Snsr s/n				R
		Final assy no				R
		Write protect				R
		Tag				R/W
		Descriptor				R/W
		Message				R/W
		Date Poll addr				
		Num reg preams				R
		Num resp preams				W
		Long tag				R/W
		MS Code				R



The generic menu structure differs to the implemented menu structure. The generic mode does not support all implemented commands. The parameters with grey background are also contained in generic mode.

## 7.4. Description of the HART®- Parameter

НОТ КЕҮ	Write protect Enable wrt 10m	<ul> <li>Read Status of write protection</li> <li>Enable writing for 10 minutes by entering password. After writing</li> <li>a parameter the time of 10 minutes starts again</li> </ul>
	New password	Selection of a new password by entering up to 8 character If 8 blanks are entered as new password, write protection is disabled. If the user password is lost, a joker password is available from the YOKOGAWA service department.
Online		
This shows cu	urrent process data.	
	Flow	Flow in selected measurement unit
	Flow AO	Current output in mA

FIOW	Flow in selected measurement unit
Flow AO	Current output in mA
Flow URV	Upper range value related to the current output
Flow LRV	Lower range value related to the current output

### 7.4.1 Process variables

### Device setup

#### Process variables

Flow value [cum/h] Flow % rnge [%] Flow AO value [mA] Totalizer value [kg] % span value Temperature value [°C] Flow in oriented measurement unit %-value related to 20mA Current output in mA Totalizer %-Value related to flow final value Temperature in transmitter

### 7.4.2 Diagnostic- and Service-Menu

#### **Device setup**

Diag/Service

#### Test device Device stat

status	
Status group 1	
Error indication:	
RAM Error	OFF/ONMemory error
ADC Error	OFF/ONerror A/D converter
ADJ-EE-Error	OFF/ONerror adjustment-EEPROM
CAL-EE Error	OFF/ONerror calibration-EEPROM
Totalizer false	OFF/ONtotalizer value false
Flow Overrun	OFF/ONFlow too high
ADJ Error 2	OFF/ONadjustment-EEPROM fault
Float blocked	OFF/ONFloat-Move-Detection recognized, supervision time
	passed

Device setup

Diag/Service

Test device Device Status

Status group 2 Error indication: Temp over limit OFF/ONTemperature exceed 70°C Max flow1 active OFF/ONURV overrun Max flow2 active OFF/ONURV underrun FB autoz active OFF/ONFloat blocking autozero on Power fail warn OFF/ONPower off has happened Oper timer error OFF/ONOperation timer fault Mancal active OFF/ONManual calibration activated Error description :

				22 Q2 Q2		no no no yes	no no no yes yes	no no yes yes yes	no no no yes yes yes	no no yes yes yes yes	no no no no yes yes yes yes yes yes	no no no no no yes yes yes yes yes yes ves no yes yes yes no no yes yes	no no no no no yes yes yes yes yes Clear Values yes unction yes	no no no no yes yes yes yes yes yes (Clear Values yes unction yes	no no no no no yes yes yes yes yes unction yes unction yes unction yes unction yes	no no no no no yes yes yes yes unction yes unction yes nonitor yes yes
	NO (RAMC to service !)		NO (RAMC to service !)	NO (RAMC to service !) NO (RAMC to service !)	NO (RAMC to service !) NO (RAMC to service !) Insert new EEPROM	NO (RAMC to service !) NO (RAMC to service !) Insert new EEPROM Reset Counter	NO (RAMC to service !) NO (RAMC to service !) Insert new EEPROM Reset Counter NO (active during overflow)	NO (RAMC to service !) NO (RAMC to service !) Insert new EEPROM Reset Counter NO (active during overflow) NO (RAMC to service !)	NO (RAMC to service !) NO (RAMC to service !) Insert new EEPROM Reset Counter NO (active during overflow) NO (RAMC to service !) NO (RAMC to service !)	NO (RAMC to service !) NO (RAMC to service !) Insert new EEPROM Reset Counter NO (active during overflow) NO (RAMC to service !) NO (RAMC to service !)	NO (RAMC to service !) NO (RAMC to service !) Insert new EEPROM Reset Counter NO (active during overflow) NO (RAMC to service !) NO (RAMC to service !) Switch off Temp Log Funct./C	NO (RAMC to service !) NO (RAMC to service !) Insert new EEPROM Reset Counter NO (active during overflow) NO (RAMC to service !) NO (RAMC to service !) NO (RAMC to service !) Switch off Temp Log Funct./C	NO (RAMC to service !) NO (RAMC to service !) Insert new EEPROM Reset Counter NO (active during overflow) NO (RAMC to service !) NO (RAMC to service !) NO (RAMC to service !) Switch off Temp Log Funct./C Clear Values at Flow Log Fur Clear Values at Flow Log Fur	NO (RAMC to service !) NO (RAMC to service !) Insert new EEPROM Reset Counter NO (active during overflow) NO (RAMC to service !) NO (RAMC to service !) NO (RAMC to service !) NO (RAMC to service !) Clear Values at Flow Log Fur Clear Values at Flow Log Fur	NO (RAMC to service !) NO (RAMC to service !) Insert new EEPROM Reset Counter NO (active during overflow) NO (RAMC to service !) NO (RAMC to service !) NO (RAMC to service !) NO (RAMC to service !) Clear Values at Flow Log Fur Clear Values at Flow Log Fur Clear warning autozero) Clear warning at operation m	NO (RAMC to service !) NO (RAMC to service !) Insert new EEPROM Reset Counter NO (active during overflow) NO (RAMC to service !) NO (RAMC to service !) NO (RAMC to service !) Switch off Temp Log Funct./C Switch off Temp Log Funct./C Clear Values at Flow Log Fur NO (active during autozero) Clear warning at operation m NO (RAMC to service !)
	ON/OFF N					ON/OFF N ON/OFF II	ON/OFF N ON/OFF IT ON/OFF F	ON/OFF N ON/OFF IT ON/OFF F ON/OFF N	ON/OFF IN ON/OFF IT ON/OFF F ON/OFF N ON/OFF N	ON/OFF IT ON/OFF IT ON/OFF A ON/OFF A ON/OFF A	ON/OFF N ON/OFF IT ON/OFF A ON/OFF N ON/OFF N ON/OFF N	ON/OFF N ON/OFF IT ON/OFF R ON/OFF N ON/OFF N ON/OFF N ON/OFF S	ON/OFF IT ON/OFF IT ON/OFF A ON/OFF A ON/OFF A ON/OFF A ON/OFF S ON/OFF S	ON/OFF N ON/OFF Ir ON/OFF A ON/OFF A ON/OFF A ON/OFF C ON/OFF C	ON/OFF IT ON/OFF IT ON/OFF A ON/OFF A ON/OFF A ON/OFF C ON/OFF C ON/OFF C	ON/OFF IT ON/OFF IT ON/OFF A ON/OFF A ON/OFF A ON/OFF A ON/OFF A ON/OFF A ON/OFF A
	<u>1</u> check	<u>0</u> check		<u>0</u> check	<u>0</u> check 0 check	2 check 2 check 2 check	DcheckDcheckDcheckDno check	0     check       0     check       0     check       1     no check       1     no check	DcheckDcheckDcheckDno checkDno checkDno check	0     check       0     check       0     check       0     no check       0     no check       0     no check	0     check       0     check       0     check       0     no check       0     no check       1     no check	0     check       0     check       0     check       0     check       0     no check       1     no check       1     no check       1     no check	0     check       0     check       0     check       0     no check       0     no check       1     no check       0     no check       1     no check	0     check       1     check       1     no check	0     check       1     check       1     no check	0     check       1     check       1     no check
a Display	0000001	00000010		00000100	00000100 00001000	00000100 00001000 0001000	00000100 00001000 00010000 00100000	00000100 00001000 00010000 0010000 0100000 01000000	00000100 0001000 00010000 00100000 01000000	00000100 00001000 00010000 00100000 01000000	00000100 00001000 00010000 00100000 01000000	00000100 00001000 00010000 00100000 01000000	00000100           00001000           0001000           0010000           00100000           01000000           10000000           0000000           0000000           0000000	00000100           00001000           0001000           00010000           0100000           01000000           10000000           00000001           00000010           00000010           00000010           00000010           00000010           00000010	00000100           00001000           00010000           00100000           01000000           01000000           00000000           00000001           00000010           00000010           00000010           00000010           00000010           00000010           00000010	00000100           00001000           00010000           00100000           01000000           10000000           10000000           00000000           00000000           00000000           00000000           00000000           00000000           00000000           00000000           00000000           00000000           00000000           00000000
blinking															1	
	3.6 mA / > 21 mA	3.6 mA / > 21 mA	1 2 E m / 1 0 1 m V	0.0 IIIA / > 2 I IIIA	3.6 mA / > 21 mA	3.6 mA / > 21 mA	3.6 mA / > 21 mA 3.6 mA / > 21 mA no change no change	3.6 mA / > 21 mA 3.6 mA / > 21 mA no change no change no change	3.6 mA / > 21 mA 3.6 mA / > 21 mA no change no change no change 3.6 mA / > 21 mA	3.6 mA / > 21 mA 3.6 mA / > 21 mA no change no change 3.6 mA / > 21 mA	3.6 mA / > 21 mA 3.6 mA / > 21 mA no change no change 3.6 mA / > 21 mA 3.6 mA / > 21 mA	3.6 mA / > 21 mA 3.6 mA / > 21 mA no change no change 3.6 mA / > 21 mA 3.6 mA / > 21 mA no change no change	3.6 mA / > 21 mA 3.6 mA / > 21 mA no change no change 3.6 mA / > 21 mA no change no change no change no change	3.6 mA / > 21 mA 3.6 mA / > 21 mA no change no change 3.6 mA / > 21 mA 3.6 mA / > 21 mA no change no change no change no change	3.6 mA / > 21 mA no change no change no change 3.6 mA / > 21 mA 3.6 mA / > 21 mA no change no change no change no change no change	3.6 mA / > 21 mA a.6 mA / > 21 mA no change no change 3.6 mA / > 21 mA a.6 mA / > 21 mA no change no change no change no change no change no change
	error	error	arror	5	error	error warn	error warn warn	error warn warn	error warn warn warn warn error	error warn warn warn error	error warn warn warn error error	error earn warn warn error error warn warn	error warn warn warn error error warn warn warn	error warn warn warn error warn warn warn	error error warn warn error warn warn warn warn	error error warn warn error error warn warn warn warn warn
	RAM error	ADC error			CAL-EE error	CAL-EE error Totalizer false	CAL-EE error Totalizer false Flow overrun	CAL-EE error CAL-EE error Totalizer false Flow overrun ADJ error 2	CAL-EE error CAL-EE error Totalizer false Flow overrun ADJ error 2 FB time elapsed	CAL-EE error CAL-EE error Totalizer false Flow overrun ADJ error 2 FB time elapsed	CAL-EE error CAL-EE error Flow overrun ADJ error 2 FB time elapsed Temp over limit	CAL-EE error CAL-EE error Flow overrun ADJ error 2 FB time elapsed Temp over limit Max flow 1 active	CAL-EE error CAL-EE error Flow overrun ADJ error 2 FB time elapsed Temp over limit Max flow 1 active Max flow 2 active	CAL-EE error CAL-EE error Flow overrun ADJ error 2 FB time elapsed Temp over limit Max flow 1 active Max flow 2 active FB autoz active	CAL-EE error CAL-EE error Flow overrun ADJ error 2 FB time elapsed Temp over limit Max flow 1 active FB autoz active FB autoz active	CAL-EE error CAL-EE error Flow overrun ADJ error 2 FB time elapsed Temp over limit Max flow 1 active Max flow 2 active FB autoz active Power fail warning Operate timer error
	L L										group 2	droup 2	dnor	dnonb 5	dinoup 2	diración di la contracta di la

Type:	The information will be divided into errors and warnings.
Current:	An error will change the output current to the selected error current level.
	The level is selectable by "Alarm select" in HART (default: LOW)!
Bars:	All 8 bars are blinking in case of an error or warning.
Self test:	Only the checked errors will be treated by the self test function.
HHT275:	The marked errors/warnings are displayed on the HHT275.
Reset:	The indicated error/warning can be reset or disabled by the listed operation.
1):	On every Power Up, this warning occurs; it is NOT SHOWN ON DISPLAY.
2):	If this function is active, the bars are NOT BLINKING ON DISPLAY.

#### Device setup

Diag/S	ervi	се			
	_	-	-	-	

Test device

Reset all errors

Reset all errors and warnings

### Device setup

Diag/Service

Test device

Self test

Execute a self test to find existing errors.

#### **Device setup**

	100	10-	~
U U	iay.	/Sei	vice

Test device

Execute master reset. All parameters are set to default.

#### **Device setup**

Diag/Service

#### Loop Test

Set the analogue output fix to 4mA, 20mA or arbitrary current. Finish with 'End'.

## Device setup

ce selup		
Diag/Service		
Calibra	ition	
	Apply URV/LRV	
	4mA	Assignment of 4mA
		Set as 4mA value: Current flow is set to 4mA.
		Read new value: Read current flow for 4mA.
		Leave as found: No change
	20mA	Assignment of 20mA
		Set as 20mA value: Current flow is set to 20mA.
		Read new value: Read current flow for 20mA.
		Leave as found: No change
	Exit	Leave parameter

Device setup Diag/Service				
Calibration				
Reset	JRV/LRV			
	Reset 4mA Reset 20mA Exit	Set 4m/ Set 20m Leave p	A to factory so A to factory arameter	et LRV set URV
Device setup				
Diag/Service				
Calibration				
D/A Tri	m			
	Adjustment of cu	urrent out	put to 4mA a	and 20mA.
Device setup				
Diag/Service				
Calibration				
Calib	table			
	Selection of calil	bration ta	ble: Standar	d / Distance version
Device setup				
Diag/Service				
Calibration				
Manua	l calib			
	Status mancal		ON/OFFSho	ow status of manual calibration table
	Activate/deactiva	ate	ON/OFF Acti	ivate or deactivate manual calibration table
	Set mancal poin	nts of monu	5%105%	Set manual calibration points
	See description	or manua	al calibration	in chapter 6.2.9
Device setup				
Diag/Service				
Diagnostics				
Temp r	nax log			
	Temp max log		ON/OFFActi Logging fund	ivate or deactivate Temp max ction
	Duration/value		Days	Time since appearance of
			Hours	maximum temperature
			Minutes	
			Temp max	Max. temperature value
	Old durat/value		Davs	Time since appearance of
			Hours	maximum temperature before
			Minutes	clear or reset
			Temp max	Max.temperature value before clear or reset
	Clear values		The values i parameter C	in parameter Duration/value are written to DId durat/value .
			Parameter E set to actual	Duration/value is cleared and temp max is I temperature.
Description of temperature maxin	num logaina funct	tion:		
The temperature value is supervi	sed constantly. As	s soon as	the value ex	ceeds the actual maximum value, the
time measurement starts. The mi	nutes are added u tten by a higher va	up, the po alue auto	eriod can be matically if it	requested by the user any time. The time that a seconds: the time

measurement starts once more. The determined values (max temperature/period) can be cleared by the user. They are written into the parameter Old durat/value after Clear values or after power off/on, the actual time value is deleted, the max temperature value is set on the actual temperature value. By switching Temp max log off the values are not cleared.

When exceeding the maximum temperature of 70°C the error message "Temp over limit" appears.

tics		
Flow URV log		
Flow URV log	ON/OFFActivate o Logging function	r deactivate Flow URV
URV overrun time	Days/Hours T Minutes exceed	ïme since… ling URV
URV underrun time	Days/Hours Minutes …	Time since fall below URV
Min overrun time Se	election of hysteresis time	9
Clear values	Clears the values i underrun time	in URV overrun time and URV

Description of Flow URV logging function :

The flow value is supervised constantly. As soon as the value reaches the upper limit value (103%; 20.5mA) (event 1), the time is measured, during the flow value is over the limit value. If this error condition remains actively longer than the hysteresis value, the limiting value recognition is activated and the condition stored. As soon as the flow value falls below the limit value, the supervision (event 2) ends, for a new cycle the hysteresis time must pass.

After the recognition you can request the passed time:

Time from event1 till query time: delta-T1

Time from event2 till query time: delta-T2

The time difference is the time the upper limit was exceeded.

hysteresis <= t <= (delta-t1 - delta-t2)

The stored values remain unchanged after power off and must be cleared by the user. The actual cycle is overwritten automatically by a new one. Therefore only the last cycle is always stored.

The default value for hysteresis is 30 seconds.



## **Temperature MAX function**



Flow URV Funktion

Reset power fail

Power fail warning is cleared.

... to power off.

Minutes

Description of power monitoring function:

After power on the minutes are counted in parameter Operation time.

At power off the time from parameter Operation time is stored in parameter Oper time shadow.

After power off/on the power fail warning is set. It can be cleared by Reset power fail.

## 7.4.3 Basic-Setup Menu

#### Device setup

#### Basic setup

Tag	Tag Number (8 characters)
Flow unit	Flow measurement unit
Temp unit	Temperature measurement unit
Set damping	Obtained damping
Long tag	Long Tag Number (24 characters)

## 7.4.4 Detailed-Setup Menu

#### **Device setup**

Detailed setup	
Characterize meter	
Details on the measu	iring tube.
Snsr unit	Flow measurement unit in accordance with scale
Scale USL	Upper sensor limit related to flow
Snsr s/n	Serial number of the measuring tube
Final assy no.	Number of final assembly
MS Code	Ordering code of the device
Device setup	
Detailed setup	
Configure signal	

Configure sign Flow d	aı amping	
	Flow damping Set damping	Read damping value 0.25s/1.00s/5.00s/10.00s

#### **Device setup**

Detailed setup Configure signal Flow unit table EU/US

Read preset unit set (see chapter 6-2-2)

#### **Device setup**

Detailed setup

Configure signal

Flow unit select

Selectable flow units:

EU	US
Cum/h	Cum/h
L/h	NmlCum/h
NmlCum/h	Kg/h
NmlL/h	StdCuFt/h
MetTon/h	CuFt/h
Kg/h	Lton/h
StdCuFt/h	Lb/h
ImpGal/h	gal/h
Cum/min	Cum/min
L/min	NmlCum/min
NmlCum/min	Kg/min
NmlL/min	StdCuFt/min
MetTon/min	CuFt/min
Kg/min	Lton/min
StdCuFt/min	Lb/min
ImpGal/min	gal/min

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Device setup **Detailed setup Configure signal Total reset** Reset totalizer **Device setup Detailed setup Configure signal** Temperature unit degC / degF Select temperature unit **Device setup Detailed setup Configure output** Analog output Indication, test and adjustment of current output : Flow AO Read Current output in mA AO Alm typ Lo current < 3,6mA at error Hi current > 21.0mA at error Loop Test Set the analogue output fix to 4mA, 20mA or arbitrary current. Finish with 'End'. D/A Trim Adjustment of current output at 4mA and 20mA. **Device setup Detailed setup Configure output HART** output

HART<sup>®</sup> specific parameter : Poll Addr Poll Address (Function see above) (Def.: 0) Num req preamsNumber of leading FF to HART<sup>®</sup> unit (Def.: 5) Num resp preamNumber of leading FF from HART<sup>®</sup>-unit (Def.:5)

#### **Device setup**

### Detailed setup

Display selection Selection of measuring value on display, Different if manual calibration is activated. For standard calibration table: Flow / Totalizer / Temperature For manual calibration table: Percent / Temperature

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#### Device setup Detailed setup

#### Device Information

Unit	specific	data:

onit specifie ac	
Model	Model name
Dev ID	Device ID
Manufacturer	Manufacturer
Distributor	Distributor
Snsr s/n	Serial number of the measuring tube
Final assy no	Number of final assembly
Write protect	Write protection
Tag	Type in Tag-Number
Descriptor	Type in description
Message	Type in message
Date	Type Date
Poll addr	Type Poll Address
Num req pream	Number of leading FF to $HART^{\mathbb{R}}$ - unit
Num rsp pream Long tag	Number of leading FF from HART <sup>®</sup> - unit Type in Long Tag-number

Long tag MS Code Revision #'s Type in Long Tag-number Ordering code of the device Revision numbers: Universal rev.: 5 Fld. Dev. rev.: Field device Revision HW rev.:Hardware Revision FW rev.: Firmware Revision ADJ-EE rev.: Adjustment-EEPROM Revision CAL-EE rev.: Calibration-EEPROM Revision

#### 7.4.5 Review

#### **Device Setup**

#### Review Model name Model Device ID Dev id Manufacturer Manufacturer Distributor Distributor Serial number of the measuring tube Flow Snsr s/n Final assy no Number of final assembly Write Protect Write protection Tag Tag Number Descriptor Description Message Message Date Date Poll address Poll address Number of leading FF to HART<sup>®</sup>- unit Num req pream Number of leading FF from HART<sup>®</sup>- unit Num rsp pream Type in Long Tag-number Long tag MS Code Ordering code of the device Universal rev.: 5 Fld. Dev. rev.: Field device Revision HW rev.: Hardware Revision FW rev.: Firmware Revision Adjustment-EEPROM Revision ADJ-EE rev.: Calibration-EEPROM Revision CAL-EE rev.:

## 7.5 Maintenance

## 7.5.1 Function test

- $\cdot$  Wire the unit according to the connection diagram.
- Check  $\text{HART}^{\mathbb{R}}$  -communication with  $\text{HART}^{\mathbb{R}}$  -communicator or with PC with  $\text{HART}^{\mathbb{R}}$ -ability communication program.
- Setting: Device setup / Process variables.
- PV AO shows the current value; compare this value with the measured current.

## 7.5.2 Troubleshooting

Do the following test if problems with  $HART^{\mathbb{R}}$ -units appear :



# 8. Service

## 8.1 Maintenance

## 8.1.1 Function test

Checking free movement of pointer:

- Remove housing cover (4 screws on housing type 66).
- After deflecting the pointer by hand, it must return to measurement value. If the pointer pivots to different values upon repeated deflections, there is too much friction in the bearings. In this case, send indication unit to service.

Checking free movement of float:

- First, free movement of pointer has to be ascertained.
- Check visually if pointer follows each flow rate change. If not, clean float and measuring tube.

Unit with electronic transmitter:

- The display must show values corresponding to indication function and measuring unit settings.
- The bars under the 8 digits must not flash. If an error occurs, the corresponding countermeasure (refer to chapter 6.2.8 error messages) has to be taken or the unit has to be sent to service.
- Without flow, the output current must be 0 or 4 mA. At a flow rate of 100% the current must be 20 mA.

Additional function test for HART<sup>®</sup> units (-H)

- check HART<sup>®</sup> communication using a HART<sup>®</sup> Handheld terminal or a PC with HART<sup>®</sup> communication software.
- Setting: Device setup / Process variables
- PV AO shows the current value that should be delivered at output Check this value using a multimeter.

## 8.1.2 Measuring tube, float

The RAMC is maintenance-free. If contamination of the measuring tube impairs the mobility of the float, the tube and the float have to be cleaned. To do this, the RAMC has to be removed from the pipe.

- Replacement or cleaning of the float:
- Remove RAMC from the pipe.
- Remove upper retainer from metering tube.
- Take float stopper and float out through the top of metering tube.
- Clean float and metering cone
- Insert float and float stopper into the metering tube.
- Set retainer into tube.
- Check float for free movement.
- Install RAMC to the pipe.
- Attention: Do not expose float to strong alternating magnetic fields. The float and especially its measuring edge must not be damaged.

## 8.1.3 Explosion drawing



Number	Part
1	Circlip
2	Float stop
3	Float
4	Float stop welded in
5	Cone
6	Indicator

## 8.1.4 Electronic transmitter

The electronic transmitter is maintenance-free. The electronic section is sealed and cannot be repaired. Since the transmitter has been adjusted fully to the mechanical components at the factory, single components can only be replaced with a reduction of the accuracy.

Solely the display and operation unit (LCD PCB) can be replaced. For this the unit has to be sent to service. The current output can be adjusted by means of software. The current output test in chapter 6.2.11 determines whether an adjustment is necessary. The adjustment is carried out according to chapter 6.2.6. The power supply PCB of 4-wire units includes a fuse. For fuse replacement be sure to switch off the power supply. Only use fuses with the capacity and characteristic as indicated in the specifications in section 9.5 or as imprinted on the fuse holder.

## 8.1.5 Exchange of EEPROM and scale

#### **Preparations:**

- · Check the commissioning-no., the key-code and the data of the new parts.
- · Switch off power supply.
- For units with option /KF1 wait more than 2 minutes before opening the indicator.
- For RAMC with housing type 91 unlock the safety screw at the cover.
- · Remove the cover of the indicator unit.
- · Make sure that all accessible parts are not under voltage.

#### 

The pointer may not be twisted or bent on the axis!

#### Exchange of EEPROM:

### **WARNING**

The calibration-EEPROM can be damaged by electro-static discharge (ESD) . Therefore, only touch insulated parts and never terminals.

The EEPROM is plugged in on the right side of the electrical angle transmitters and safeguarded with a latch (s. fig 3-1 / 3-2).

- · Unscrew the screw of the securing latch, but only a few turns!
- Turning the securing latch up, so that the EEPROM can be pulled out.
- · Put in the new EEPROM (no wrong positioning possible).
- · Turn the securing latch to below above the EEPROM and fix it with the screw.

#### Exchange of scale at units without limit switches:

- · Unscrew the 2 screws of the scale.
- Pulling out the scale of the indicator unit to the left by raising the scale above the 4 corners for units with housing 66. For units with electronic transmitter the scale must additional raised above the 2 buttons.
- Sliding the new scale from the left under the pointer correspondingly until the 4 corner holes click in the footbridges for units with housing type 66 and the 2 buttons click in in the accompanying holes for unit with electronic transmitter.
- · Fasten the scale with the 2 screws.

#### Exchange scale at units with limit switches:

Please, consult to this the service department of ROTA YOKOGAWA.

#### Final jobs :

- · Connect the cover of the indicator.
- For RAMC with housing type 91 lock the safety screw.
- · Switch on power supply.
- · Check function of the unit.

## 8.1.6 Exchange of indicator

The indication units may be replaced by units of the same type, on the condition that the scale of the measuring tube as well as the calibration EEPROM (in case of electronic transmitter) are mounted on the new unit.

Operation for units with electronic transmitter (-E / -H) :

- Switch off power.
- For units with option /KF1 wait more than 2 minutes before opening the indicator.
- For RAMC with housing type 91 unlock the safety screw at the cover.
- Unscrew cover of indication unit.
- Disconnect cables and pull them through the cable glands out of the RAMC.
- Remove scale and calibration EEPROM from old indication unit and mount them to new indication unit.

## 

The calibration-EEPROM can be damaged by electro-static discharge (ESD) . Therefore, only touch insulated parts and never terminals.

- Do not bend pointer when mounting.

- Mount cover of indication unit.
- Dismount old indication unit from the measuring tube and replace it with a new one. Be sure to mount shims and distance rollers in the same sequence as before disassembled.

## 8.1.7 Troubleshooting

In case the RAMC does not work properly, use the following flow charts for troubleshooting, then check, isolate and remedy the fault.

Precision problems with "T" unit: execute test 1

Precision problems with "E" or "H" unit: execute test 1 and test 2

HART<sup>®</sup> communication problems with "H" unit: execute test 3 and see chapter 7.5.

If the indicated countermeasure do not remedy the fault or in case of troubles which cannot be remedied by the user, please contact your YOKOGAWA service centre.



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T82.EPS



## 8.2 Template for sending back to service

#### Sending an instrument back to service

Installation and operation of the Rotameter RAMC in compliance with this manual is generally trouble-free. In case a RAMC has to be sent for repairs or checking to our service, please observe the following: Due to legislation for the protection of the environment and for the safety of our staff, YOKOGAWA may only ship, repair and check sent devices on the condition that this does not constitute any risk to environment and staff.

YOKOGAWA can only process your returned RAMC if you attach a certificate of harmlessness according to the following sample.

If the unit has been in contact with corrosive, poisonous, flammable or water polluting substances, you must,

- ensure that all parts and hollow spaces of the unit are free of these dangerous substances.

- attach a certificate of harmlessness to the returned unit.

Please understand that YOKOGAWA cannot process your returned unit without such a certificate.

ROTA YOKOGAWA GmbH & Co. KG Service & Repair Department Rheinstraße 8; D - 79664 Wehr Phone no.: +49 (0)7761-567-190 Fax no.: +49 (0)7761-567-285 e-Mail: services.flow@de.yokogawa.com



## **Declaration of Decontamination**

Legal regulations for the safety of our employees and operating equipment determine that we need the declaration of decontamination before your order can be handled. Please make sure to include it with the shipping documents, attached to the outside of the packaging you use for shipment.

Customer data		
Company:		
Address:		
Contact person:		E-Mail:
Phone no.:		Fax no.:
Reference/Order no.:		L
Instrument data*		
Туре:		Serial no.:
Туре:		Serial no.:
*If not enough, note on separate sheet		
Process data		
Process medium:		
Medium is:	[] toxic [] corrosive [] explosive [] biological hazardous [] unknown if dangerous [] non hazardous	Remarks:
Cleaning agent:		
Kind of cleaning :		
Other remarks / Reason of return:		

We hereby confirm that this statement is filled in completely and truthfully. The returned instruments were carefully cleaned and are thus free from product residue and dirt. I agree that if this arrangement does not match with the instruments, they will be sent back to the above mentioned customer address at our expenses.

Name

Date

Signature

Blank Page
## 9. Technical Data

## 9.1 Model- and suffix-codes

Model	Suffix	code					Description	Restrictions
RAMC01							Size DN 15 (½ inch)	for D4, D6, A1, A2, A3, T4, R4, T6, G6
RAMC23						Size DN 20 (¾ inch)	for D4, D6, A1, A2, A3, T4, R4, T6, G6	
RAMC02						Size DN 25 (1 inch)	for D4, D6, A1, A2, A3, S2, S4, S5, T4,	
								R4, T6, G6
RAMC03							Size DN 32 (1¼ inch)	for D4, D6, A1, A2, A3, S4, T6, G6
RAMC04							Size DN 40 (1½ inch)	for D4, D6, A1, A2, A3, S4, S5, T6, G6
RAMC05							Size DN 50 (2 inch)	for D4, D5, D6, A1, A2, A3, S2, S4,T4, R4
RAMC06							Size DN 65 (2½ inch)	for D4, D5, A1, A2, A3, S2, S4, T4, R4,
								T6, G6
RAMC08							Size DN 80 (3 inch)	for D4, D5, A1, A2, A3, S2, S4
RAMC09							3½ inch	for A1, A2
RAMC10							Size DN 100 (4 inch)	for D2, D4, A1, A2, S4, S4
RAMC12							Size DN 125 (5 inch)	for D2, A1, A2, S2
RAMC15							Size DN 150 (6 inch)	for D2, A1, A2
RAMCNN							Without measuring tube	
Process	-D2						EN flange PN 16, process connection dimen-	
connection							sion + facing acc. EN 1092-2 Form B1	
	-D4						EN flange PN 40, process connection dimen-	
							sion + facing acc. EN 1092-2 Form B1	
	-D5						EN flange PN 63, process connection dimen-	
							sion + facing acc. EN 1092-2 Form B1	
	-D6						EN flange PN 100, process connection dimen-	
							sion + facing acc. EN 1092-2 Form B1	
	-A1						ASME flange class 150, process connection	
							dimension + facing acc. ASME B 16.5	
	-A2	A2 ASME flange class 300, process connection						
		dimension + facing acc. ASME B 16.5						
	-A3	ASME flange class 600, process connection						
	ТС						dimension + facing acc. ASME B 16.5	
	-10						G RN 40 female thread	
	-60	Bn removable female thread						
	-62	Thread acc. DIN 11851						
	-52						Tri- clamp PN 10 PN16 acc DIN 32676	
	-14						NPT removable female thread	
	-85						Flange Bosita PN 10	
	-NN						Without process connection	
Material of		00						
Naterial of	welled	55					Stainless steel	
parts							Without wetted parts	
		ININ	r		_			
Cone / Floa	t		-nnnn				See tables 10 12	
			-NNNN				Without measuring tube / without float	Only with RAMCNN
Indicator / T	ransmit	ter		-T			Indicator local	
				-E			Indicator electronic	
				-G			Indicator electronic with Profibus PA	Only with output 429
				-H			Indicator electronic with HART	Only with output 424
				-N			Without indicator	Only with housing NN
Housing / T	ype				90		Housing round blanc; SS	
					91		Housing round yellow; Al	
					NN		Without housing	Only with indicator N
Power supp	ly / Out	put				240	230 V AC ; 4- wire; 0-20 mA	Only with indicator E; not with limit switches
		-				244	230 V AC ; 4- wire; 4-20 mA	Only with indicator E; not with limit switches
		140   115 V AC ; 4- wire; 0-20 mA		115 V AC ; 4- wire; 0-20 mA	Only with indicator E; not with limit switches			
		144   115 V AC ; 4- wire; 4-20 mA		115 V AC ; 4- wire; 4-20 mA	Only with indicator E; not with limit switches			
						430	24 V DC; 3- wire; 0-20 mA	Only with indicator E
						434	24 V DC; 3- wire; 4-20 mA	Only with indicator E
						424	24 V DC; 2- wire; 4-20 mA	Only with indicator E, H
						429	Profibus PA; 9 32 V DC	Only with indicator G; not with limit switches
						NNN	Without power supply	Only with indicator T or N

## 9.2 Options

Options	Code	Description	Restriction
Indicator	/A5	Thread for cable gland ASME 1/2 "NPT female	Not with /A13
	/A12	US- engineering units	Only for indicator E, H
	/A13	Thread for cable gland ISO M20 x 1,5 female	Not with /A5, /KF1,/NF1, /KS2
	/A14	Housing color green	Only for housing 91
	/A16	Indicator on 95 mm extension	Only for housing 90 + 91
	/A17	Housing color green	Only for housing 90
	/A18	Housing color yellow	Only for housing 90
	/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
	/A22	Scale for type T90, T91	Not with hazardous approval type; not with indicator
	/A23	Scale and EEPROM for type E90, H90, G90, E91, H91, G91	Not with hazardous approval type; not with indicator
	/A25	Pressure balance element	Not with /KS2, /ES2, /KF1, /EF1, /NF1 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, /FS1, /CS1, /NS1, / <del>SS1</del> , power supply 14n
			+ 24n.
Marking	/B0	Tag plate (SS) on flange and customer specified tag	Plate 9 x 40 mm; max. 45 digits
	/D-1	number on scale	Dista O. v. 40 mm mov. 45 disite
	/D1	number on scale	Fiale 9 x 40 mm, max. 45 uigits
	/BT1	Software tag HART 5	8 digits for tag; 22 digits for long tag; only indicator H
	/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	
	/BG	With customer specified tag number on scale	Max. 45 digits
	/BD	Dual scale	Adjustment only for the first mentioned fluid
Limit switches	/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
	/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
Pulse output	/CP	Pulse output isolated	Only for power supply 14n + 24n
Flange Facing	/D10	EN raised face B2 : Ra 0.8 - 3.2	Only for EN- flanges (D2, D4)
	/D11	EN groove Form D	Only for EN- flanges (D2, D4)
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:	
		2004 -2.1	
	/P3	As /P2 + Test report acc. EN 10204: 2004 -2.2	
	/P6	Material certificate acc. EN 10204: 2004 -3.1	Only for metallic pressurized parts
	/PM3	PAMI test (3 points: Process connection inlet, measuring	Only for SS material of wetted parts
		tube, process connection outlet)	
		Pressure test report measuring system	
		Flow table for conversion	
	/P9	Dye penetration test of flange welding acc. to EN 5/1	G6SS-IIIIS0; not for /Tx
	/WP	WPS acc. DIN EN ISO 15609-1 (Welding Procedure	Not for connection RAMC01-T6SS-[][]S0 RAMC01-
		Specification)	G6SS-[][]S0: not for /Tx
		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)	
Damping	/SD	Float damping system	Only for SS: not for cone 81 + 82: only for gas applica-
		······································	tion

Options	Code	Description	Restriction
Flange protection	/QK	Flange covers (EN flange)	Only for EN- flanges (D2, D4)
Delivery to Korea	/КС	With KC-mark in Korea	
Hazardous area	/KS1	ATEX intrinsically safe "ia"	Only for power supply 424, 430, 434, 429; for indicator T
approvalo	/KS2	ATEX intrinsically safe "ia" + dust proof "tb"	Only for power supply 424, 430, 434; for indicator T only with limit switches: only for bousing 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
	/KN1	ATEX non incendive "nL" for use in category 3G / 3D	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" for use in category 3G	Only for power supply 424, 430, 434; not with limit switches
	/FS1	FM intrinsically safe / non incendive electr. transmitter (USA) FM intrinsically safe / non incendive limit switches (USA)	Only for power supply 424 (electronic transmitter); for indicator T only with limit switches
	/CS1	FM intrinsically safe / non incendive electronic transmitter (Canada), CSA intrinsically safe limit switches (Canada)	Only for power supply 424 (electronic transmitter); for indicator T only with limit switches; limit switches only / K1, /K2, /K3, only in combination with power supply / WxA or /WxB
	/NS1	NEPSI intrinsically safe approval (China)	Only for power supply 424, 430, 434; not for indicator S; for indicator T only with limit switches; only housing 90
	/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
Gost approval	/QR1 /QR2	Primary Calibration and Test Confirmation valid in Russia Primary Calibration and Test Confirmation valid in Kazakhstan	See page 4 See page 4
	/QR3	Primary Calibration and Test Confirmation valid in Uzbekistan	See page 4
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
	/14 /T5	Heat tracing, process connection ASME 12 150#	Only for SS material of wetted parts
	/T6	Heat tracing, process connection 14" 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
Power supply	/W1A	KFA5-SR2-Ex1.W / 115 V AC, 1 channel	Only for limit switches /K1, /K2, /K3
for limit switches	/W1B	KFA5-SR2-Ex2.W / 115 V AC, 2 channel	Only for limit switches /K1, /K2, /K3
(transmitter relay)	/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 to /K7
	/W2F	2x KHA6-SH-Ex1 / 115/230 V AC, 1 channel, Fail Safe	Only tor limit switches /K8 to /K10
	/W4A	KFD2-SR2-Ex1.W / 24 V DC, 1 channel	Only for limit switches /K1, /K2, /K3
		KFU2-SH2-EX2.W / 24 V DC, 2 Channel KED2-SH-Ev1 / 24 V DC, 1 channel Fail Safa	Only for limit switches /K1, /K2, /K3
	/W4E /W4F	2x KFD2-SH-Ex1 / 24 V DC. 1 channel. Fail Safe	Only for limit switches /K8 to /K10
Special order	/7	Special design must be specified separately	
*) if no instruction m	ianual is :	selected, only a DVD with instruction manuals is shipped wi	th the flowmeter

## 9.3 Standard Specifications

**MEASURING TUBE** Materials of wetted parts : Stainless steel AISI 316L (1.4404) - PTFE 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 : - acc. EN1092-1 - Flanges : DN100 - DN150 PN16 DN15 - DN100 PN40 DN50 – DN80 PN63 DN15 – DN50 PN100 - acc. ASME B 16.5 1/2" - 6" Class 150 raised face 1/2" - 6" Class 300 raised face 1/2" - 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 : -200 ...+370 °C - medium wetted parts made of PTFE : -80 ... +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 $(q_g=50\%)$
SS	DN 15 - 100	1.6%
SS	DN 125 - 150	2.5%
PTFE	DN 15 -100	2.5%

#### Heat tracing

## Pressure Equipment Directive (PED) Directive 97/23/EG :

Tubes :

- Modul : H
- Fluid Group : 1 (dangerous fluids)Produced acc. to category
  - roduced acc. to categ
- Classification : Table 6 (piping)
- Heating (options /T1 to /T6) :
- Art. 3 section 3 : (Volume < 1L)
- Fluid Group : 2 (non-dangerous fluids)
- Classification : Table 2 (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 (1.4301 / 304) (housing type 90)
  - (housing type 90) - painted aluminium casting (housing type 91) each with safety-glass window
  - Degree of protection : - IP66/67

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 to +110°C

#### **ELECTRONIC TRANSMITTER**

(Indicator/Transmitter Code -E, -H, -G, -J) 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, 4 - 20 mA - 2- wire units : 4 - 20 mA The 20 mA point is selectable between 60% and 100% of Qnom. Load resistance : ≤ **500** Ω - 4- wire units : - 2/3- wire unit :  $\leq$  (U - 14 V) / 20 mA, max. 500  $\Omega$ HART- communication type (Code -H, -J) : Power supply : - 2-wire units : U = 14 V ... 30 V DC **Output signal :** 4 – 20 mA - 2- wire units : 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 to +70 °C ±5°C - Accuracy : Transportation- and Storage condition : -40 °C to +70 °C Linearity 1) : ± 0.2 % f.s. Hysteresis <sup>1)</sup>: ± 0.1 % f.s. Repeatability <sup>1)</sup>: ± 0.1 % f.s. Influence of power supply <sup>1)</sup> : ± 0.1 % f.s. Temperature coefficient of the output signal 1) : ± 0.5 % /10 K f.s. AC-part of output signal <sup>1)</sup>: ± 0.15 % f.s. Long-time stability 1): ± 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 1s) Electromagnetic compatibility (EMC) : - Acc. EN 61326-1: 2006, Class A, Table 2 and EN 61326-2-3 : 2006 : 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. DIN EN 61010-1: 2001 : Over voltage category : II (acc. VDE 0110 or IEC 664) - Pollution degree : I (with 115 / 230V AC power supply) - Safety class : 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 1/2" NPT (option /A5)
- Cable diameter :

6 – 9 mm

Maximum cross section of core : Ø 1.5 mm<sup>2</sup>

1) referenced to 20°C ambient temperature

## LIMIT SWITCHES IN STANDARD VERSION (option /K1 to /K3)

Type : Inductive proximity switch SC3.5-N0 acc. DIN EN 60947-5-6 Nominal voltage : 8 V DC **Output signal :** 

 $\leq$  1 mA or  $\geq$  3 mA

#### LIMIT SWITCHES IN FAIL SAFE VERSION

(option /K6 to /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 :

 $\leq$  1 mA or  $\geq$  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 :
  - M16x1.5 (standard)
  - Thread M20x1.5 (option /A13; standard for option /KF1)
  - Thread 1/2" 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%, 45-65Hz
- 115 V AC ± 10%, 45-65Hz
- 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.

#### SWITCHING LEVELS FOR LIMIT SWITCHES Table 2 Min, Max and Min-Max-contact in standard version

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

#### Table 3 Min, Max and Min-Max-contact in fail-safe version

		Option /K6	Option /K7	Option /K8			
Function	Dointor	Signal	Signal	Signal			
Function	Pointer	SJ3,5-SN	SJ3,5-SN	SJ3,5-SN			
МАХ	above LV below LV Fail Safe		1 mA 3 mA 1 mA	1 mA 3 mA 1 mA			
Function	Dointor	Signal	Signal	Signal			
Function	Pointer	SJ3,5-SN	SJ3,5-SN	SJ3,5-SN			
MIN	above LV below LV Fail Safe	3 mA 1 mA 1 mA		3 mA 1 mA 1 mA			
Note: LV = Limit value							

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

		Option /K9
Function	Deinter	Signal
Function	Pointer	SJ3,5-S1N
MIN	above LV below LV Fail Safe	3 mA 1 mA 1 mA
Function	Deinter	Signal
i=uncuon	e Pointer :	
	1 onner	SJ3,5-SN
MIN	above LV below LV Fail Safe	<b>SJ3,5-SN</b> 3 mA 1 mA 1 mA

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

		Option /K10			
Function	Dointor	Signal			
Function	Fointer	SJ3,5-SN			
MAX	above LV below LV Fail Safe	1 mA 3 mA 1 mA			
Function	Deinter	Signal			
Function	Fointer	SJ3,5-S1N			
MAX	above LV below LV Fail Safe	1 mA 3 mA 1 mA			
Note: LV = Limit value					

## **COMPLIANCE WITH IEC 61508**

RAMC with local indicator and fail safe limit switches (-T[] []NNN /K6 ... /K10):

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

## RAMC with local indicator and standard limit switches (-T[][]NNN /K1 ... /K3):

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

### RAMC with 4-20mA output (-E[][]424 and -H[][]424):

Suitable for application in safety functions up to and including SIL1, but only with activated Float Blocking Indication.

Reliability data available on request in FMEDA report.

## **COMPLIANCE WITH ISO 13849**

For Safety Metrics acc. to ISO 13849-2 please refer to the FMEDA report.

### **METROLOGICAL REGULATION IN CIS (GOST)**

RAMC has "Pattern Approval Certificate of Measuring Instruments" and is registered as a measuring instrument in Russia, Kazakhstan, Uzbekistan, Belarus and Ukraine. The calibration laboratory of Rota Yokogawa is approved by Federal Agency on Technical Regulating and Metrology in Russia and other Metrological Organizations in CIS countries to issue primary calibration confirmations for RAMC, option /QR[].

Furthermore RAMC is RTN (GGTN) approved for installation in hazardous areas.

For export to CIS countries please contact your Yokogawa representative.

## HAZARDOUS AREA SPECIFICATIONS

## Overview hazardous area certified instruments:

Location	Europe Global				USA	Canada	India	Korea	Ch	ina			
Certificate	ATEX				IECEx		FM	FM	PESO	KOSHA	NE	PSI	
	Electronic transmitter (WT-MAG)												
Protection	ia	ic	nL	ia/tb	ia	ic	ia/tb	IS/NI	IS/NI	ia	ia	-	-
Option	/KS1	/KS3	/KN1	/KS2	/ES1	/ES3	/ES2	/FS1	/CS1	/KS1	/EF1	-	-
Comments		*2)		*1)		*2)	*1)	*3)	*3)	*4)		-	-
See page	6	6	6	9	6	6	9	6	6	6	6	-	-
	Limit switches												
Protection	ia/iaD	ic	nL	ia/tb	ia	-	ia/tb	IS/NI	IS/NI	-	-	ia	-
Option	/KS1	/KS3	/KN1	/KS2	/ES1	-	/ES2	/FS1	/CS1	-	-	/NS1	-
Comments		*2)		*1)		-	*1)	*5)	*6)	-	-		-
See page	7	7	7	9	7	-	9	7	7	-	-	7	-
					R/	AMC indi	cator						
Protection	d/tb		-		d/tb		-	-	-	d	d/tb	ia	d/DIP
Option	/KF1		-		/EF1		-	-	-	/KF1	/EF1	/NS1	/NF1
Comments	*7)		-		*7)		-	-	-	*4)			*7)
See page	8		-		8		-	-	-	8	8	6	8
			Power	supplies	for intrin	nsic safe	compone	nts (see	oage 9-9)				
Option /UT		уe	es			yes		yes	yes	no	no	ye	€S
Option /W1A,B		ye	es		yes		yes	yes	yes	yes	n	0	
Option /W2A,B		ye	es			yes		yes	yes	yes	yes	n	0
Option /W4A,B		ye	es			yes		yes	yes	yes	yes	ye	es
Option /W2E,F		ye	es			yes		no	no	no	no	n	0
Option /W4E,F		ye	es			yes		no	no	no	no	ye	es
Notation	IS = intrir	nsic safe;	NI = non i	ncendive;	DIP = dus	st ignition	proof						
Comment *1)	Dust proc	of by RAM	C housing	9									
Comment *2)	For use ir	n category	' 3G										
Comment *3)	Same ce	rtification	or USA a	nd Canada	a								
Comment *4)	PESO ce	rtificate av	ailable fro	om Yokoga	awa Sales	Office							
Comment *5)	Only for L	JSA; powe	er supply f	ree select	able								
Comment *6)	For USA	and Cana	da; power	supply m	ust be opt	tion /WxA	or /WxB (	x=1 or 2 c	or 4)				

## 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.

	Ui [V]	li [mA]	Pi [W]	C i[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
KN1	30	152	1.4	4.16	0.15	70
FS1/CS1	30	100	1.4	40	0.15	70
NS1	30	101	1.4	4.16	0.15	70

#### Table 6 Entity parameters of electronic transmitter

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

PTB 12ATEX 2003

Output signal :

4–20 mA (2- wire unit, 3- wire unit) ; 0-20mA (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 96ATEX 2160X

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	24V	17.5V	acc. IEC 60079-27
li	250mA	280mA	
Li	negligible small	negligible small	
Ci	negligible small	negligible small	

#### Electronic transmitter 4 - 20mA (with/without HART-communication) type "n" (non incendive) acc. EN 60079-15 for category 3 (option /KN1) : Output signal :

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

Ex nL IIC T6 protection "nL"; group II ; category 3G Dust proof :

Ex II 3D; group II ; category 3D

Max. surface temperature : 80°C

```
Entity parameter :
```

see table 6

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

IECEX PTB 12.0020

Output signal :

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

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

Entity parameter : see table 6

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

Output signal :

4–20 mA (2- wire unit, 3- wire unit) ; 0-20mA (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) (USA: option /FS1; Canada: option /CS1) : Certificate :

No. : 3027471

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 KOSHA- certification (Korea)

Option /ES1 must be selected. Same data as for IECEx certification.

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

Option /KS1 must be selected. PESO- certificate is available at your Yokogawa Sales Office.

## Intrinsically safe RAMC with NEPSI- certification (China) (option /NS1) :

Certificate : GYJ0101551 Output signal : 4–20 mA (2- wire unit, 3- wire unit) ; 0-20mA (3- wire unit) Explosion proof : Ex ia IIC T6 Max. Tamb. : 70°C Entity parameter of electronic transmitter : see table 6 Limit switches : option /K1 to /K10 Entity parameter of limit switches : see certificate NEPSI GYJ06542X

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### LIMIT SWITCHES

Intrinsically safe and dust proof 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)
- ZELM 03 ATEX 0128X (for dust proof)

Explosion proof :

Ex ia IIC T6, group II category 2G

Dust proof (only indicator "T") :

Ex iaD 20 T 108 °C, group I I category 1D Max. surface temperature : T108°C

Entity parameter :

see certificate of conformity

### Limit switches for category 3 (option /K1 ... /K10 with /KN1):

Explosion proof :

EEx nL IIC T6 X protection "nL"; 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) see specification of SJ3,5-S1N (P&F)\* (/K6 ... /K10) \* P&F = Pepperl & Fuchs

#### 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)

#### Intrinsically safe limit switches with IECExcertification (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 CSA- certification (Canada) (option /K1 ... /K3 with /CS1) : Explosion proof Ċl. I, II, IIİ, Div. 1, Gp. ABCDEFG Entity parameter :

see drawing 116-0047 Only in combination with option /WxA or /WxB.

#### Intrinsically safe limit switches with NEPSIcertification (China) (option /K1 .. /K10 with /NS1): Certificate : GYJ11.1505X (option /K1.../K3) GYJ11.1507X (option /K6.../K10) Explosion proof

Ex ia IIC T1 ... T6 Entity parameter :

see certificate

#### 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 :** 

PTB 00 ATEX 2018 ATEX: IECEx: PTB06.0089 3007835, Control Drawing 02 02 00 111 1067708, Control Drawing 02 02 00 112 FM: CSA: NEPSI: GYJ06495 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 fia. 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 CSA FM IECEx PESO	: PTB 00 ATEX 2081 : 1029981 (LR 36087-19) : ID 3011578 : PTB11.0031
	KOSHA	: 2009-BO-0157
- KFA6-SR2-Ex*-W:	ATEX	: PTB 00 ATEX 2081
	CSA	: 1029981 (LR 36087-19)
	FM	: ID 3011578
	IECEx	: PTB11.0031
	PESO	
	KOSHA	: 2009-BO-0157
- KHA6-SH-Ex1:	ATEX	: PTB 00 ATEX 2043
- KFD2-SR2-Ex*-W:	ATEX	: PTB 00 ATEX 2080
	CSA	: 1029981 (LR 36087-19)
	FM	: ID 3011578
	IECEx	: PTB11.0034
	PESO	· · · · · <b>· ·</b> · · · · ·
	KOSHA	: 2009-BO-0157
	NEPSI	: GYJ12.1081
- KFD2-SH-Ex1:	AIEX	: PIB 00 AIEX 2042
	NEPSI	· GY.1091350

Control circuit (ATEX) :

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

Entity parameter

see fig. 4 (ATEX) and certificate

## FLAME PROOF AND DUST PROOF RAMC

#### Flame proof and dust proof RAMC with ATEXcertificate (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) : 4-20 mA (2- wire unit, 3- wire unit) ; 0-20 mA (3- wire unit) Power supply (with electronic transmitter -E, -H) : 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 : - M20x1.5 (standard) - 1/2" NPT (option /A5) **Temperature classification :** Table 8 see table 8 Flame proof and dust proof RAMC with IECEx-

## Flame proof and dust proof RAMC with IECEx certificate (option /EF1): Certificate :

IECEx IBE12.0007 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) : 4-20 mA (2- wire unit, 3- wire unit) ; 0-20 mA (3- wire unit) Power supply (with electronic transmitter -E, -H) : 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 : - M20x1.5 (standard) - 1/2" NPT (option /A5) Temperature classification : Table 8 see table 8

Flame proof and dust proof RAMC with NEPSIcertificate (China) (option /NF1) : Certificate : GYJ071430 Flame proof : Ex d IIC T6 Dust proof : DIP A20 TA T1 - T6 IP67 Max. surface temperature TA: corresponding process temperature Housing : Painted aluminium casting type 91 Output signal (with electronic transmitter -E or -H) : 4-20 mA (2- wire unit, 3- wire unit) ; 0-20 mA (3- wire unit) Power supply (with electronic transmitter -E or -H) : 2- or 3- wire unit Limit switches : Options /K1 to /K10 possible Ambient temperature : -20 °C to 60 °C -20 °C to 55 °C (for use in zone 20) Minimum process temperature : -20°C Threads for cable glands : - M16x1.5 (standard) - 1/2" NPT (option /A5) Temperature classification :

#### Table 8

Tomp	Max.	Process tempera	ture
class	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
Т3	120°C	200°C	200°C
T2	120°C	300°C	300°C
T1	120°C	370°C	350°C

#### Flame proof and dust proof RAMC with PESOcertificate (India) :

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

#### Flame proof and dust proof RAMC with KOSHAcertificate (Korea):

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

#### INTRINSIC SAFE COMPONENTS WITH DUST-PROOF

## ATEX- certified intrinsically safe electronic transmitter 4 - 20mA, 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) ; 0-20mA (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 to 60 °C

## Minimum process temperature : -20°C

#### \_. -20

Threads for cable glands :

- M20x1.5 (standard)

- 1/2" NPT (option /A5)

#### IECEx- certified intrinsically safe electronic transmitter 4 - 20mA, 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) ; 0-20mA (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 to 60 °C

## Minimum process temperature : -20°C

#### -20 C

#### Threads for cable glands : - M20x1.5 (standard)

- IVIZUA I.U (Stariuard)

- 1/2" NPT (option /A5)

## RAMC PROCESS CONNECTION TABLE FOR METAL TUBES Table 9-10

													Pro	ess con	nection	ä														
						ΕN	-Flange	0							ASN	1E-Flan	ge		Male	thread	Cla	du	Female	thread	Ъ	male th	read	Flanç	ge	Cone
		Form B <sup>-</sup>	-		For	m B2		with	Jroove ( D11)	Opt.:	Form B2	(Opt.:	D10)				ŭ	oquo	DIN	1851	Cla	du	PN10	-PN25		PN40		Rosis PN1	sta 0	Float
Pos	PN16	PN40	0	PN63		PN100		PN16	PN40		PN16	N40		sainei		SUUIDS	ō 	sainr	PN16	/PN25/ 140	PN10/	PN 16	TAN	ď	M	σ			0	ombination
	Code	Code	Ē	Code	Ê	Code	Ê	Code	Code	Ê	Code	Code	Ê	Code L	Ö E,	de L <sup>(1</sup>	Cod	E L	Code	Ē	Code	Ē	Code C	ode L <sup>(</sup>	Cod	e Code	Û	Code	Ξ	Code
	D2	D4	E E	D5	Ē	D6	E	5	D4	E	5	D4	E E	<b>A1</b>	¥ E	۲ ۲	n A3	E E	S2	E	S4	ш ш	T4	34 m	л Т6	g	ш ш	S5	E E	
		DN15	LC.			DN15	010		DN15			ON15		1/2"	1/2		1/2,									-				
	-	DN2C	0		-	DN20			DN20		1	DN20		3/4"	3/2	**	3/4'		-		DN25 / 1"		"G/ F							
Ŧ		DN25	5			DN25	260		DN25	050	1	DN25		ت 	-	й с	-"	260	DN25	076	DN32	010	3/4"	СС		1/2"	205	DN25	020	43 S0 44 S0
-		DN35	2002					•	DN32	007		DN32			2				PN40	c/7	1/2"	067	PN25	22	0	N40	067	PN10	002	47 S0 51 S0
		DN40	0					1	DN40			DN40	I								PN16									2010
		DN50	0					1	DN50			DN50																		
		DN16	ß			DN15	250		DN15			DN15		1/2"	1/2	*	1/2,	000											ì	11 - FO M4
		DN20	0			DN20	000	1	DN20			02NC		3/4"	3/6	*+	3/4'				DN25 / 1"								λi δ	3 C1 ; 53 M1 3 S1 ; 54 L1
c		DN25	2			DN25	007		DN25	C L	1	DN25		-	-				DN25		DN32	C L	1/2" 3/4"			3/4" 1"	L	DN25	212	t M1 ; 54 S1 7 L1 ; 57 M1
N		DN35	520					'	DN32	097		DN32	L F	1/4"	50 1 1	72 72	0 1 1/2	5 5 10	PN40	G/2	UN40/ 1/2"	750	PN25	52	۵ م	N40	562	PN10	250 51 61	7 S1 ; 61 L1 M1 : 61 S1
		DN4(							DN40			DN40	-	1/2"	- -	/5,"	1 1/2	280			PN16								80	2 L1 ; 62 M1 62 V1
		DN5C	0						DN50			0SNC		",	Ñ	3														-
		DN2£	5			DN25			DN25			DN25		1"	-	3	1"	020											ő	3 L2 : 64 L2
б		DN3	250	DN50	270	DN32	270		DN32	250		<b>DN32</b>	250 -	1/4"	50 1 1	4" 25	0 1 1/2	<u>a</u>	DN50	275	06NU / 2"	250	-	31		1/2"	310	DN25 DN40	50	63 M2 ; 64 M2
		DN4(	0			DN40			DN40			DN40	-	1/2"	-	۳.	1 1/2	280 580	CZNI		PN16		PN16		<u> </u>	N40		PN10	8	3 S2 ; 64 S2 64 V2
		DN5(	0			DN50	280		DN50			09NC		2"	Ñ	3	ν,	3												04 VZ
		DN5(	0	DN50	260				DN50	1	DN100	09NC		۵" د	N	. 25	0						č						.9	7 L5 : 67 M5
		DNG	2	DN65	200	I	I		DN65	010		29NG5	010	1/2"	2 1	/2"	2 1/2	280		176	-/ 3"	000	2 1/2	6	10	1/2"	300		91	7 S5 ; 71 L5
4		DNBC		DN80	270	I	I		DN80	002		08NC		v "c	3	0 7 1	3"	290	PN25	6/7	PN10	2000	PN10	8 	۵. ۵	N40	670			2 L5;72 M5
		DN10	Q						DN100			0N100																	~	2 55 ; 72V5
	DN100	DN8(	0					DN100	DN80	1	DN100	08NC		a"	ñ	. 26	0													
	DN125 <sup>6</sup>	<sup>(2)</sup> DN10	2					DN125®	DN100	_	DN125 <sup>(2)</sup> I	0N100	<b></b>	3 1/2"	3 1 3	/2"					DN100								ŕ	0// 02 - 0 1 0
ß	DN150 <sup>6</sup>	(2)	250	DN80	270	I	I	DN150		250	ON 150 <sup>(2)</sup>		250	4 1	00 4	с х ,	 	1	DN100 PN25	300	/ 4"	250								4 L8 ; 74 V8
														5"(2)	5	200					PN10								<u> </u>	/ L8 ; // V8
			[											6"(2) 21	60 6"	(Z)														
	DN100							DN100	DN100		DN100			4" 2	4	" 27	0													
9	DN1256	<sup>(2)</sup> DN10.	0 250	•	•	•	•	DN125®		250	ON125 <sup>(2)</sup> [	0N100	250	2"(2)	2.	(2) (2)	1	I	DN125 PN16	300	•	•	•				•		,	81 11 82 11
	DN150 <sup>6</sup>	2						DN150			ON150 <sup>(2)</sup>			6"	60 6"	0 7 8														

 $^{(1)}$  L = face to face length  $^{(2)}$  Accuracy 2.5% instead of 1.6% (q\_g= 50%)

Table 9-11

	tive ation	Pressure	loss <sup>a)</sup>	mbar	•		•	•		21			21	>	21	•	21		21	45		23	•	23	47		25		25	•	25	54			•		•
	Alterna combina	Cone-	Float- combin.	Code						53 M1			54 M1		57 M1		61 M1	•	62 M1	62 S1	•	63 M2		64 M2	64 S2		67 M5	•	71 M5		72 m5	72 S5		•			•
ind gases		Pressure	loss <sup>a)</sup>	mbar	45	45	45	45	13			13	•	13		13		13	•		19		19			16		16		16			30	30	30		•
nge for air a	ination	Cone-	Float- combin.	Code	43 S0	44 S0	47 S0	51 S0	53 L1			54L1		57 L1		61 L1		62 L1			63 L2		64 L2			67 L5		71 L5		72 L5			73 L8	74 L8	77 L8	ı	•
easuring ra	nded comb			scfm <sup>1)</sup>	0.44	0.7	1.05	1.75	2.3	3.2		3.8	5	5.7	æ	6	12	14	20	28	23	29	35	50	20	57	75	06	115	140	200	290	320	500	800		•
Ŵ	Recomme		Max. flow	m³/h i.N.®	0	11	1.7	2.8	3.6	5		9	8.5	6	13	15	20	23	32	45	36	47	55	80	110	06	120	150	180	230	320	470	500	800	1300	ı	•
				m³/h °)	0.75	12	1.8	e	4	5.5		6.5	6	10	14	16	22	25	34	50	40	50	60	85	120	100	130	160	200	250	340	500	550	850	1400		•
			6																																		
	ination		Viscosity	mPa*s	•	•	•	•	•	100	•	50	50	50	50	100	50	100		50	•	50	9		50		50	•	50	ß	•	5		•	•		•
	tive comb	Pressure	loss <sup>a)</sup>	mbar						15		15	12	15	5	15	12	15		45		17	17		43		13		13	19		63					•
liquids	Alterna	Cone-	Float- combin.	Code						53 M1		54 M1	57 L1	57 M1	61 L1	61 M1	62 L1	62 M1		62 V1		64 L2	64 M2		64 V2		71 L5	•	72 L5	72 M5		72 V5					•
r water and			Viscosity <sup>b)</sup>	mPa*s	9	80	80	80	50		50	100		50		50		100	100		50		30	9		50	•	30		ß	5		10	10	9	10	9
ng range fo	bination	Pressure	loss <sup>a)</sup>	mbar	40	40	40	40	12		12	40	•	40		40		40	40		17		42	42		13		47		47	47		60	60	60	70	70
Measurir	anded com	Cone-	Float- combin.	Code	43 S0	44 S0	47 S0	51 SO	53 L1		54 L1	53 S1		54 S1		57 S1		61 S1	62 S1		63 L2		63 S2	64 S2		67 L5		67 S5		71 S5	72 S5	-	73 V8	74 V8	77 V8	81 11	82 11
	Recomme		flow	gpm <sup>d)</sup>	0.11	0.18	0.28	0.44	0.57	0.7	1.0	11	1.4	1.8	2.2	2.8	3.5	4.4	0'2	10.1	5.7	9.2	11.0	17.6	26.4	14	22	28	37	44	70	110	110	176	277	440	572
			Max.	m³/h °)	0.025	0.04	0.063	0.1	0.13	0.16	0.22	0.25	0.32	0.4	0.5	0.63	0.8	1.0	1.6	2.2	1.3	2.1	2.5	4	9	3.2	5.0	6.3	8.5	9	16	25	25	40	63	100	130
		Pos.												c	N								3						4					5		u	2

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

<sup>b)</sup> For higher viscosity the specified precision is no more guaranteed.

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

 $^{\rm d)}\,$  Flow in US Gallons per minute at 70°F .

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

<sup>†</sup> 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.

## RAMC PROCESS CONNECTION- AND FLOW-TABLE FOR TUBES WITH PTFE LINING Table 9-12

| Pressure | loss <sup>a)</sup>                            |  | mbar   
   
  | 20  | 20   | 20   | 20  | 20   
   | 22  
   
  | 25   | 25   |   | 25   
  | 25  | 25    |  | 27  | 27  |   
   |       |  |  |
|----------|---|--
--
---
---|--|--|---
--
--
--
--	--	--	---
---	---	---	-------
Cone-	Float-	combination	Code
   
  | 51 A1   | 52 A1  | 53 A1  | 54 A1   | 57 A1  
   | 61 V1   
   
  | 62 A2  | 63 A2  |   | 64 A5  
  | 67 A5   | 71 A5 | -  | 72 V8   | 73 V8   |   
   |       |  |  |
|          |   |  | scfm <sup>1)</sup>   
   
  | 2   | 2.9  | 5  | 7.5   | 11   
   | 20  
   
  | 29   | 50   |   | 75   
  | 115   | 200   |  | 290   | 500   |   
   |       |  |  |
|          | Max. Flow                                     |  | m³/h i.N. <sup>e)</sup>  
   
  | 3.3   | 4.7  | 8  | 12  | 18   
   | 32  
   
  | 47   | 80   |   | 120  
  | 180   | 330   |  | 470   | 800   |   
   |       |  |  |
|          |   |  | m³/h ⁰   
   
  | 3.5   | 5  | 8.5  | 13  | 20   
   | 34  
   
  | 50   | 85   |   | 130  
  | 200   | 350   |  | 500   | 850   |   
   | -     |  |  |
|          |   |  |  
   
  |   |  |  |   |  
   |   
   
  |  |  |   | | |
  |   |       |  |   |   |   
   |       |  |  |
|          | Visco   | sity <sup>b)</sup>   | mPa*s  
   
  | 50  | 50   | 50   | 50  | 50   
   | 50  
   
  | 30   | 10   | 50  | 30   
  | 30  | 5     | 10   | 10  | 10  | 10  
   | 10    |  |  |
| Pressure | loss <sup>a)</sup>                            |  | mbar   
   
  | 16  | 16   | 16   | 16  | 16   
   | 18  
   
  | 20   | 20   | 22  | 20   
  | 20  | 20    | 22   | 25  | 25  | 25  
   | 30    |  |  |
| Cone-    | Float-  | combination  | Code   
   
  | 51 A1   | 52 A1  | 53 A1  | 54 A1   | 57 A1  
   | 61 V1   
   
  | 62 A2  | 63 A2  | 63 V2   | 64 A5  
  | 67 A5   | 71 A5 | 71 V5  | 72 V8   | 73 V8   | 74 V8   
   | 77 10 |  |  |
|          | Flow  |  | gpm <sup>d)</sup>  
   
  | 0.45  | 0.7  | 1.12   | 1.8   | 2.8  
   | 4.5   
   
  | 7  | 11.2   | 18  | 18   
  | 28  | 45    | 70   | 70  | 110   | 180   
   | 280   |  |  |
|          | Max.  |  | m³/h ⁰   
   
  | 0.1   | 0.16   | 0.25   | 0.4   | 0.63   
   | ٦   
   
  | 1.6  | 2.5  | 4   | 4  
  | 6.3   | 10    | 16   | 16  | 25  | 40  
   | 63    |  |  |
|          |   |  |  
   
  |   |  |  |   |  
   |   
   
  |  |  |   | | |
  |   |       |  |   |   |   
   |       |  |  |
|          | sdl (   | ר <sub>(i)</sub>   | m  
   
  |   |  | 250  | 007   |  
   |   
   
  |  | 250  |   | | |
  | 026   | 2     |  |   | 270   |   
   | 270   |  |  |
| Flange   | 300   | Code   | A2   
   
  |   |  | 3,4"   | ÷-  |  
   |   
   
  |  | 11⁄4"<br>11⁄2"   |   | | |
  | 21⁄2"   | o"    |  |   | 3½"<br>4"   |   
   | ,14   |  |  |
| ASME-    | sdl   | L <sup>(1)</sup>   | m  
   
  |   |  | 250  | 002   |  
   |   
   
  |  | 250  |   | | |
  | 060   | 007   |  |   | 270   |   
   | 270   |  |  |
|          | 150   | Code   | A1   
   
  |   |  | 3/4"   | 1"  |  
   |   
   
  |  | 1 ¼"<br>1 ½"   |   | | |
  | 21/2"   | "œ    |  |   | 3½"<br>4"   |   
   | 4"    |  |  |
|          | 9   | Ĺ  | mm   
   
  |   |  | 250  | 002   |  
   |   
   
  |  | 250  |   | | |
  | 250   | 000   |  |   | 250   |   
   | 250   |  |  |
| N-Flange | PN40  | Code   | D4   
   
  |   |  | DN15   | DN25  |  
   |   
   
  | DN25   | DN40   | DN50  | | |
  | DN50  | DN80  |  |   | DN80  |   
   | DN100 |  |  |
| ш        | PN 16   | Code   | D2   
   
  |   |  |  |   |  
   |   
   
  |  |  |   | | |
  |   |       |  |   | DN100   |   
   | DN100 |  |  |
|          | Pos.  |  |  
   
  |   |  | •  | 4   |  
   |   
   
  |  | e  |   | | | | | | | | | | | | | | | | | | | | |
  | _   | •     |  |   | 5   |   
   | 9     |  |  |
|          | EN-Flange Cone- Pressure Cone- Pressure Cone- | For the lange         ASME-Flange         Cone-         Pressure         Cone-         Pressure         Cone-         Pressure         Pressure         Pressure         Cone-         Pressure         < | Fange         ASME-Flange         Cone-         Pressure         Cone-         Pressure         Cone-         Pressure         Pressure <th>Pos.         EN-Flange         ASME-Flange         Cone-         Pressure         Cone-         Pressure         Pressure</th> <th>Provide the section of the sectin of the sect</th> <th>Prime         Finance         ASME-Flange         Cone         Pressure         Pr</th> <th>Pose         Finance         ASME-Flange         Cone         Pressure         Pr</th> <th>Point Finge         Finance         ASME-Finance         ASME-Finance         Cone         Pressure         Presure         Pressure         <th row<="" th=""><th>Image: select of the set of th</th><th>All Fielder         All Fielder         Cone         Price         Price</th><th>Ps.         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(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 und 14,7 PSI abs.

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

## 9.4 Dimensions and weights



Fig. 9-1. Front view RAMC type 90



Fig. 9-3 RAMC metal measuring tube

	a mm	b mm
Housing type 90	104	161
Housing type 91 standard	110	165
Housing type 91 flame proof , option /KF1	118	165
Housing type 66	110	161



Fig. 9-2. Front view RAMC type 91



Fig. 9-4 RAMC metal measuring tube with lining

## RAMC Flange dimensions Table 9-14

		Inner o	liameter of s	tainless steel	flanges			Inner	diameter of flang	es with PTFI	E- lining
Boo *)	EN-flange	without gr	oove		ASME-flange		Rosita- flange	Pop <sup>*</sup> )	EN- flange	ASME- flage	
F05. /	Size	Du mm	Do mm	Size	Du mm	Do mm	Du=Do mm	F05. /	Size	Size	Du = Do mm
1	DN15-DN50	20.7	20.7	½´´ - 1´´	20.7	20.7	20.7				
2		20 F	20 F	1⁄2″	20.7	20.7	20 F	2		3/11 111	00 F
	DIN 15-DIN50	29.5	29.5	3⁄4´´ - 2´´	29.5	29.5	29.5	2	DIN15-DIN25	%4 - 1	23.5
3		45.0	45.0	1″	32.2	32.2	45.0			1¼″	26.0
	DIN25-DIN50	45.2	45.2	1¼´-2´´	45.2	45.2	45.2	3	DN25-DN50	- 1½	30.0
4		60.0	76.0	2″	62.0	65.5		4		01/ 11 011	0.00
	DIN50-DIN100	62.0	76.0	2½′′ - 3′′	62.0	76.0		4	DIN50-DIN80	21/2 - 3	66.0
5	DN80-DN150	94.0	94.0	3′′ - 6′′	94.0	94.0		5	DN80-DN100	3½ - 4	82.0
6	DN100-DN150	116.0	116.0	4′′ - 6′′	116.0	116.0		6	DN100	4″	110.0
*) see tab	le 9.10, 9.11, 9.12	2									



Fig. 9-5 RAMC type 91 and option /A16 and /T2









Fig. 9-7 RAMC with connection T6/ G6





Fig. 9-8 RAMC with connection S2

Table 9.15 Diameter for RAMC connection sizes S4

Position *)	Size [mm]	di [mm]	da [mm]
	DN25 / 1 ′′	36	50.5
1	DN32	36	50.5
	DN40 / 1 ½ ′′	36	50.5
	DN25 / 1″	36	50.5
2	DN32	36	50.5
	DN40 / 1 ½ ′′	36	50.5
3	DN50 / 2′′	47.8	64
4	DN65 / 3´´	72.1	91
5	DN100 / 4''	97.6	119
*) see tab	le 9-10, 9-11, 9-12		

## Table 9.16 RAMC 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 9-10, 9-11, 9-12	
Indicator on distance (option	/A16) additional 1kg

# 9.5 Temperature graphs for RAMC metal design, standard and intrinsic safe



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 9-8 to 9-11).

## Minimum ambient temperatures:

Flow meter	Model code	Minimum ambient temperature
RAMC with local indicator	RAMCxx-xxxx-xxxx-TxxNNN	-25°C; -40°C with option /A26 *)
RAMC with standard limit switches	RAMCxx-xxxx-xxxx-xxxxx /K1/K3	-25°C
RAMC with fail safe limit switches /K6/K8	RAMCxx-xxxx-xxxx-xxxxx /K6/K8	-25°C; -40°C with option /A26 *)
RAMC with fail safe limit switches /K9/K10	RAMCxx-xxxx-xxxx-xxxxx /K9/K10	-25°C
RAMC with electronic transmitter	RAMCxx-xxxx-xxxx-Exx1xx RAMCxx-xxxx-xxxx-Exx2xx RAMCxx-xxxx-xxxx-Exx4xx RAMCxx-xxxx-xxxx-Hxx4xx	-25°C -25°C -25°C; -40°C with option /A26 *) -25°C; -40°C with option /A26 *)
RAMC with electronic transmitter PA	RAMCxx-xxxx-xxxx-Gxx429	-25°C
RAMC intrinsic safe type	RAMCxx-xxxx-xxxx-xxxxx /KS1           RAMCxx-xxxx-xxxx-xxxxx /KS3           RAMCxx-xxxx-xxxx-xxxxx /KS1           RAMCxx-xxxx-xxxx-xxxx /KS1           RAMCxx-xxxx-xxxx-xxxx /KS1           RAMCxx-xxxx-xxxx-xxxx /KS1           RAMCxx-xxxx-xxxx-xxxx /KS1           RAMCxx-xxxx-xxx-xxxx /KS1           RAMCxx-xxxx-xxx-xxxx /KS1           RAMCxx-xxxx-xxx-xxxx           RAMCxx-xxxx-xxxx-xxxx           RAMCxx-xxxx-xxxx-xxxx           RAMCxx-xxxx-xxx-xxxx           RAMCxx-xxxx-xxxx-xxxx           RAMCxx-xxxx-xxx-xxxx-xxxx           RAMCxx-xxxx-xxx-xxxx-xxxx           RAMCxx-xxxx-xxx-xxxxx           RAMCxx-xxxx-xxxx-xxx-xxxx	-25°C; -40°C with option /A26 *) -25°C -25°C; -40°C with option /A26 *) -25°C; -40°C with option /A26 *) -25°C; -25°C; -40°C with option /A26 *) -25°C -25°C; -40°C with option /A26 *) -25°C -25°C; -40°C with option /A26 *) -25°C -25°C -25°C -25°C -25°C -25°C
RAMC flame proof or dust proof type	RAMCxx-xxxx-xxxx-xxxx /KF1 / RAMCxx-xxxx-xxxx-xxxxx /EF1 / RAMCxx-xxxx-xxxx-xxxxx /NF1 / RAMCxx-xxxx-xxxx-xxxxx /KS2 / RAMCxx-xxxx-xxxx-xxxxx /ES2 /	-20°C

\*) Below -25°C the LC-display. Also the push bottoms should not be used below -25°C !

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## 10. Explosion-protected Type Instruments

## 10.1 General

## 10.1.1 Intrinsic safety

## 

To ensure intrinsic safety it is not permitted to repair or to modify the electronic transmitter, the display, the limit switches or the calibration EEPROM.

The electronic transmitters type -E /KS1, -H /KS1, -J /KS1, -E /KS2, -H /KS2, -J /KS2, -E /KS3, -H /KS3, -J /KS3, -E /ES1, -H /ES1, -J /ES1, -E /ES3, -H /ES3, -J /ES3, -E /ES2, -H /ES2, -J /ES2, -E /FS1, -H /FS1, -J /FS1, -E /NS1, -H /NS1, -E /CS1, -H /CS1, -J /CS1,  $\frac{-E}{SS1}$ , -H /SS1, -H /SS1, as well as the limit switches option /Kx with option /KS1, /KS2, /KS3, /FS1, /CS1, /NS1, /<del>SS1</del> are intrinsically safe devices.

Power supply for the electronic transmitter and transmitter relay for the limit switches are associated apparatus and should be installed outside any hazardous area.

The electronic transmitter must be connected to an intrinsically safe, certified power supply with a maximum voltage and output power below the maximum values of the electronic transmitter (refer to Technical data, in the concerning chapters). The combined internal inductance and capacity of the electronic transmitter and connecting cables must be less than the permitted external inductance and capacity of the power supply. Accordingly, the limit switches have to be connected to intrinsically safe, certified isolating switching amplifiers. The relevant maximum safety values must be heeded at all times.

Especially in the case of high fluid temperatures, heated metering tubes or heat radiation by heat tracing, make sure that the temperature in the indicator housing does not exceed the permissible maximum ambient temperature of the transmitter (refer to Technical data, chapter 9).

## 10.1.2 Flame proof

In the RAMC with option /KF1, /EF1, /NF1 the transmitter and the limit switches are mounted in a flame proof housing.

Wait 2 minutes after switching power off before opening the cover.

The cover can only be opened after loosing the safety screw.

After closing the cover the safety screw must be fixed before switching power on.

The RAMC with option /KF1, /EF1, /NF1 shall be connected up via suitable cable glands and / or conduit systems that satisfy the requirements of EN 50018 or 60079-1 sections 13.1 and 13.2 and for which a separate test certificate is available. Cable glands and entry fittings (screwed conduit entries) as well as blanking plugs of simple design may not be used. On connection of the RAMC /KF1, /EF1, /NF1 using a conduit entry approved for the purpose, the associated sealing facility must be arranged directly on the housing. Unused openings must be closed off as defined in EN 60079-1 section 11.9 (e.g. certified blanking elements).

Unused openings must be closed off as defined in EN 60079-1 section 11.9 (e.g. certified blanking elements) The RAMC with option /KF1, /EF1, /NF1 shall be connected to the local equipollently grounding system.

Especially in the case of high fluid temperatures, heated metering tubes or heat radiation by heat tracing, make sure that the temperature in the indicator housing does not exceed the permissible maximum ambient temperature of the transmitter (refer to Technical data, chapter 9).

## 10.2 Intrinsically safe ATEX certified components (/KS1)

## 10.2.1 Technical data

## Data of electronic transmitter type -E, -H and -J :

The electronic transmitter is an intrinsically safe device. This device is certified for hazardous areas of zone 1 (category 2) und zone 2 (category 3). It is not homologated for zone 0 (category 1). The classifications in brackets are given according to EU-Regulation 94/9/EG (ATEX).

EC-Type Examination Certificate Nr.: PTB 12ATEX2003 Applicable standards: EN 60079-0: 2009 EN 60079-11: 2007

Identification in accordance with regulation 94/9/EG (ATEX) :



Type of protection	: Intrinsically safe Ex ia IIC T6 Gb
Ambient temperature	: -40°C +70°C
Safety relevant maximum values:	
Maximum voltage	: $U_i = 30 V$
Maximum current (IIC)	: I = 101 mA
Maximum power	: P <sub>i</sub> = 1.4 W
Inner inductance	: L = 0.15 mH
Inner capacity	: C = 4.16nF
	•

Data of electronic transmitter type -G : See IM 01R01B02-01E-E.

### Data of limit switches :

The following table shows the maximum safety parameters for intrinsic safe limit switches according the certificates PTB 99 ATEX 2219X (Standard) and PTB 99 ATEX 2049X (Fail Safe). Table 10.1

	Standard Ex ia	/K1 /K3 IIC T6	Fail Safe / Ex ia	′K6/K10 IIC T6
	Туре 2	Туре 3	Type 2	Туре 3
Ui [V]	16	16	16	16
li [mA]	25	52	25	52
Pi [mW]	64	169	64	169
Ci [nF]	150	150	30	30
Li [µH]	150	150	100	100
max. ambient temp. [°C] for T6	49	28	49	28
max. ambient temp. [°C] for T5	61	40	61	40
max. ambient temp. [°C] for T4 - T1	89	68	89	68

The limit switches are also dust approved.

EC-Type Examination Certificate No.: ZELM 02 ATEX 0128X Identification in accordance with regulation 94/9/EG (ATEX) :



Type of protection : Ex iaD 20 Maximum surface temperature : 108°C. The dust explosion proof for the limit switches is only available if ordered without electronic transmitter (only with housing type "T").

## Intrinsic safe power supply for the electronic transmitter :

The power supply for the electronic transmitter is an associated apparatus that may not be installed in the hazardous area, and it may not exceed the safety relevant maximum values for voltage, current and power of the electronic transmitter as specified above.

For example option /UT can be used.

### Intrinsic safe power supply for the limit switches :

The power supply (transmitter relay) for the limit switches is an associated apparatus that may not be installed in the hazardous area, and it may not exceed the safety relevant maximum values for voltage, current and power of the connected limit switch as specified above.

For example the type KFA6-SR2-Ex... (option (W2\_) according certificate PTB 00 ATEX 2081 (230V AC supply) or the type KFD2-SR2-Ex... (option (W4\_) according certificate PTB 00 ATEX 2080 (24V DC supply) can be used.

## 10.2.2 Installation





## 10.2.3 Marking

Name plates of electronic transmitter :



## 10.3 Nonincendive components for Category 3 (ATEX) (/KN1)

## 10.3.1 Technical data

RAMC with option /KN1 have an electronic transmitter and / or limit switches with protection type "n" (non incendive) for category 3G or dust proof for category 3D.

Identification:



## Data of electronic transmitter :

The electronic transmitter is an apparatus with the type of protection "nL" It can be mounted or installed in the hazardous areas of zone 2 (category 3). The classification in brackets is given according to the new EU regulation 94/9/EG (ATEX). This version is identically constructed as intrinsically safe (ia) version.

Type of protection	: Ex nL IIC T6 X
	n = Nonincendive
	L = energy limited apparatus

Ambient temperature : -25 °C <  $T_a$  < 70 °C

Safety relevant maximum values :

Maximum voltage	: U <sub>i</sub> = 30 V
Maximum current (IIC)	: l = 152 mA
Maximum current (IIB)	: l = 379 mA
Maximum power	: P <sub>i</sub> = 1.4 W
Internal inductance	: L = 0.15 mH
Internal capacity	: C <sub>i</sub> = 4.16 nF

Maximum surface temperature for dust application : 80°C

## Data of limit switches :

The limit switches are apparatus with the type of protection "nL" They can be mounted or installed in the hazardous areas of zone 2 (category 3). The classification in brackets is given according to the new EU regulation 94/9/EG (ATEX ). This versions are identically constructed as the corresponding intrinsically safe (ia) versions.

Type of protection	: EEx nL IIC T6 X n = Nonincendive L = energy limited apparatus
Ambient temperature	: -25 °C < T <sub>a</sub> < 100 °C for SC3,5-N0 (Standard) -40 °C < T <sub>a</sub> < 100 °C for SJ3,5-SN / S1N (Fail safe)

Maximum surface temperature for dust application : 112°C

Maximum safety parameters see table 10.1. See also specification sheet from Pepperl & Fuchs for SC3,5-N0 (Standard) and SJ3,5-SN / S1N (Fail safe).

## 10.3.2 Installation

Protection circuit for a power supply to meet the maximum values of the electronic transmitter :



# 10.4 Intrinsically safe ATEX certified components for category 3G (/KS3)

## 10.4.1 Technical data

## Data of electronic transmitter type -E, -H and -J :

The electronic transmitter is an intrinsically safe device. This device is certified for hazardous areas of zone 2 (category 3D) ). The classifications in brackets are given according to EU-Regulation 94/9/EG (ATEX).

Applicable standards: EN 60079-0: 2009 EN 60079-11: 2007

Identification in accordance with regulation 94/9/EG (ATEX) :



Type of protection	: Intrinsically safe Ex ic IIC T6 Gc
Ambient temperature	: -40°C +70°C
Safety relevant maximum values:	
Maximum voltage	: U <sub>i</sub> = 30 V
Maximum current (IIC)	: I = 101 mA
Maximum power	: P <sub>i</sub> = 1.4 W
Inner inductance	: L = 0.15 mH
Inner capacity	: $\dot{C}_{i} = 4.16 n F$

## Data of limit switches :

The limit switches are apparatus with the type of protection "ic". They can be mounted or installed in the hazardous areas of zone 2 (category 3G). The classification in brackets is given according to the new EU regulation 94/9/EG (ATEX ). This versions are identically constructed as the corresponding intrinsically safe (ia) versions.

Type of protection : Ex ic IIC T6 X

The following table shows the maximum safety parameters:

	Standard /K1 /K3		Fail Safe /K6/K10	
	Туре 2	Туре 3	Туре 2	Туре З
Ui [V]	16	16	16	16
li [mA]	25	52	25	52
Pi [mW]	64	169	64	169
Ci [nF]	150	150	30	30
Li [µH]	150	150	100	100
max. ambient temp. [°C] for T6	49	28	49	28
max. ambient temp. [°C] for T5	61	40	61	40
max. ambient temp. [°C] for T4 - T1	89	68	89	68

## Intrinsic safe power supply for the electronic transmitter :

The power supply for the electronic transmitter may not be installed in the hazardous area, and it may not exceed the safety relevant maximum values for voltage, current and power of the electronic transmitter as specified above.

## Intrinsic safe power supply for the limit switches :

The power supply (transmitter relay) for the limit switches may not be installed in the hazardous area, and it may not exceed the safety relevant maximum values for voltage, current and power of the connected limit switch as specified above.

## 10.4.2 Marking

Name plates of electronic transmitter :

Rota Yokogawa

D-79664 Wehr WT-MAG Mat. No. 16-8040

Serial No, xxxxxxxx

Ex ic IIC T6 Gc
Ui=30V li=101mA Pi=1.4W Li=0.15mH Ci=4.16nF
<b>C E</b> <sub>0344</sub> (Ex) <b>II 3G</b>

## 10.5 Intrinsically safe IECEx- certified components (/ES1)

## 10.5.1 Technical data

## Data of electronic transmitter type -E, -H and -J :

The electronic transmitter is an intrinsically safe device. This device is certified for hazardous areas of zone 1 (category 2) und zone 2 (category 3). It is not homologated for zone 0 (category 1).

Certificate Nr.: IECEx PTB 12.0020

Applicable standards: IEC 60079-0: 2007 edition 5 IEC 60079-11: 2006 edition 5

Type of protection	: Intrinsically safe Ex ia IIC T6 Gb
Ambient temperature	: -40°C +70°C
Safety relevant maximum values:	
Maximum voltage	: $U_i = 30 V$
Maximum current (IIC)	: I = 101 mA
Maximum power	: P <sub>i</sub> = 1.4 W
Inner inductance	: L = 0.15 mH
Inner capacity	: $\dot{C}_{i} = 4.16 n F$

## Data of limit switches :

The following table shows the maximum safety parameters for intrinsic safe limit switches according the certificates IECEx PTB 11.0091X (Standard) and IECEx PTB 11.0092X (Fail Safe). Table 10.3

	Standard /K1 /K3 Ex ia IIC T6		Fail Safe /K6/K10 Ex ia IIC T6	
	Туре 2	Туре 3	Type 2	Туре 3
Ui [V]	16	16	16	16
li [mA]	25	52	25	52
Pi [mW]	64	169	64	169
Ci [nF]	150	150	30	30
Li (µH)	150	150	100	100
max. ambient temp. [°C] for T6	49	28	49	28
max. ambient temp. [°C] for T5	61	40	61	40
max. ambient temp. [°C] for T4 - T1	89	68	89	68

### Intrinsic safe power supply for the electronic transmitter :

The power supply for the electronic transmitter is an associated apparatus that may not be installed in the hazardous area, and it may not exceed the safety relevant maximum values for voltage, current and power of the electronic transmitter as specified above.

For example option /UT can be used.

## Intrinsic safe power supply for the limit switches :

The power supply (transmitter relay) for the limit switches is an associated apparatus that may not be installed in the hazardous area, and it may not exceed the safety relevant maximum values for voltage, current and power of the connected limit switch as specified above.

For example the type KFA6-SR2-Ex... (option (W2\_) according certificate IECEx PTB 11.0031 (230V AC supply) or the type KFD2-SR2-Ex... (option (W4\_) according certificate IECEx PTB 11.0032 (24V DC supply) can be used.



## 10.5.2 Installation

Ex-Version according IECEx (Option /ES1) with electronic transmitter, power supply and Fig. 10.2 limit switches with transmitter relay

## 10.5.3 Marking

F6.EPS

Name plates of electronic transmitter :

#### Rota Yokogawa

D-79664 Wehr

WT-MAG Mat. No. 16-8040

Serial No, xxxxxxx

Ex ia IIC T6 Gb **IECEx PTB 12.0020** Ui=30V li=101mA Pi=1.4W Li=0.15mH Ci=4.16nF

## 10.6 Intrinsically safe IECEx- components for category 3G (/ES3)

## 10.6.1 Technical data

## Data of electronic transmitter type -E, -H and -J :

The electronic transmitter is an intrinsically safe device. This device is use for hazardous areas of category 3.

Applicable standards:	IEC 60079-0: 2007 edition 5 IEC 60079-11: 2006 edition 5	
Type of protection	: Intrinsically safe Ex ic IIC T6 Gc	
Ambient temperature	: -40°C +70°C	
Safety relevant maximum	n values:	
Maximum voltage	: $U_i = 30 V$	
Maximum current (IIC	) : I = 101 mA	
Maximum power	: P <sub>i</sub> = 1.4 W	
Inner inductance	: L = 0.15 mH	
Inner capacity	: C <sub>i</sub> = 4.16nF	

## Data of limit switches :

The following table shows the maximum safety parameters for intrinsic safe limit switches according the certificates IECEx PTB 11.0091X (Standard) and IECEx PTB 11.0092X (Fail Safe). Table 10.4

	Standard /K1 /K3 Ex ic IIC T6 TX		Fail Safe /K6/K10 Ex ic IIC T6 TX	
	Type 2	Туре 3	Type 2	Туре 3
Ui [V]	16	16	16	16
li [mA]	25	52	25	52
Pi [mW]	64	169	64	169
Ci [nF]	150	150	30	30
Li (µH)	150	150	100	100
max. ambient temp. [°C] for T6	49	28	49	28
max. ambient temp. [°C] for T5	61	40	61	40
max. ambient temp. [°C] for T4 - T1	89	68	89	68

### Intrinsic safe power supply for the electronic transmitter :

The power supply for the electronic transmitter is an associated apparatus that may not be installed in the hazardous area, and it may not exceed the safety relevant maximum values for voltage, current and power of the electronic transmitter as specified above.

For example option /UT can be used.

### Intrinsic safe power supply for the limit switches :

The power supply (transmitter relay) for the limit switches is an associated apparatus that may not be installed in the hazardous area, and it may not exceed the safety relevant maximum values for voltage, current and power of the connected limit switch as specified above.

For example the type KFA6-SR2-Ex... (option (W2\_) according certificate IECEx PTB 11.0031 (230V AC supply) or the type KFD2-SR2-Ex... (option (W4\_) according certificate IECEx PTB 11.0032 (24V DC supply) can be used.

## 10.6.2 Marking

Name plates of electronic transmitter :

## Rota Yokogawa

D-79664 Wehr

WT-MAG Mat. No. 16-8040

Serial No, xxxxxxxx

## Ex ic IIC T6 Gc

Ui=30V li=101mA Pi=1.4W Li=0.15mH Ci=4.16nF

# 10.7 Intrinsically safe FM / CSA (USA + Canada) components (/FS1, /CS1)

## 10.7.1 Electronic transmitter (/FS1 for USA, /CS1 for Canada)

## **Technical data:**

Certificate : No. 3027471 Applicable Standards :

FM3600, FM3610, FM3611, FM3810 C22.2 No. 157, C22.2 No. 213

Type of protection :

intrinsic safe Cl. I, Div. 1, GP. A, B, C, D T6 intrinsic safe Cl. I, Zone 0, AEx ia IIC T6 non incendive Cl. I, Div. 2, GP. A, B, C, D T6

Ambient temperature : -25°C ... +70°C

Maximum Entity and Non incendive Field Wiring Parameters :

Vi = 30 V li = 100 mA

Pi = 1.4 W

Ci = 40 nF

 $Li = 150 \,\mu H$ 

## Installation:

For installation see Control Drawings on page 10-13 and 10-14

WARNING

- Installation should be in accordance with National Electrical Code, ANSI / NPFA70.
- For intrinsic safe application a safety barrier or FM approved power supply must be used which meet the above mentioned entity parameters.
- For non incendive application the general purpose equipment must be FM approved which non field wiring which meet the above mentioned non incendive field wiring parameters.
- The FM Approved Hand Held Communicator may be connected at any point in the loop between the electronic transmitter and the Control Equipment

## Maintenance and repair:

WARNING

The instrument modification or part replacements by other than authorized representative of Rota Yokogawa is prohibited and will void the approval of FM Approvals.

## Marking:

Name plates of electronic transmitter :

Rota Yokogawa

D-79664 Wehr APPRIVE WT-MAG Mat. No. 16-8040

Serial No, 0711001

IS-CI. I, Div. 1, GP. A, B, C, D T6 per dwg. 8160190 NI-CI. I, Div. 2, GP. A, B, C, D T6 per dwg. 8160191 CI. I, Zone 0, AEx ia IIC T6 Vmax=30V Imax=100mA Pmax=1.4W <u>Ci=40nF Li=150µH Ta=-25°C to 70°C</u>

## Control Drawings:

Electronic transmitter intrinsically safe



### Electronic transmitter non incendive



## 10.7.2 Limit switches option /K1 ... /K10 (/FS1 for USA)

#### Data of limit switches (FM-approval):

The limit switches are intrinsicall	y safe devices	. They are certified	ed by Pepperl	& Fuchs for:
-------------------------------------	----------------	----------------------	---------------	--------------

Intrinsically safe :	CI. I, Div. 1, GP. A, B, C, D T6 Ta=60°C CI. II, Div. 1, GP. E, F, G CI. III, Div. 1
Non incendive:	Cl. I, Div. 2, GP. A, B, C, D T5 Ta=50°C Cl. II, Div. 1, GP. E, F, G Cl. III, Div. 1

Maximum Entity Field Wiring Parameters :

see FM-control drawing 116-0165 on page 10-16 and 10-17 for intrinsic safety see FM-control drawing 116-0155 on page 10-18 for non incendive

## 10.6.3 Limit switches option /K1 ... /K3 (/CS1 for Canada)

Data of limit switches (CSA-approval): The limit switches are intrinsically safe devices. They are certified by Pepperl & Fuchs for: Intrinsically safe : CI. I, Div. 1, GP. A, B, C, D CI. II, Div. 1, GP. E, F, G CI. III, Div. 1 Maximum Entity Field Wiring Parameters :

see CSA drawing 116-0047 on page 10-19 and 10-20

## WARNING

Only in combination with power supply option /WxA or /WxB.

### Limit switches FM intrisically safe (1)

HAZARDOUS (CLASSIFIED) LOCATION Class I, Division 1, Groups A, B, C, D Class II, Division 1, Groups E, F, G		NONHAZARDOUS LOCATION			
or Class I, Zone 0, Groups IIC T6 (Ta = Pepperl+Fuchs, Inc. "NAMUR" output proximity sensor. See Tables for entity parameters	60°C)		Any FM certified associated apparatu with applicable division and group or zone and group approval and with en parameters:		
			$\frac{\text{DIVISIONS}}{\text{Voc} \le \text{Vmax}}$ $\text{Isc} \le \text{Imax}$ $\text{Ca} \ge \text{Ci+Ccable}$ $\text{La} \ge \text{Li+Lcable}$	$\begin{array}{l} \underline{\text{ZONES}}\\ \text{Uo} \leq \text{Ui}\\ \text{Io} \leq \text{Ii}\\ \text{Co} \geq \text{Ci+Ccable}\\ \text{Lo} \geq \text{Li+Lcable} \end{array}$	

#### Notes:

- 1. For installation in a Division 1 hazardous (classified) location, the wiring must be in accordance with the National Electrical Code, NFPA 70, Article 504. For installation in a Zone 0 hazardous (classified) location, the wiring must be in accordance with the National Electrical Code, NFPA 70, Article 505. For additional information refer to ISA RP-12.6.
- 2. The Entity Concept allows interconnection of intrinsically safe and associated apparatus not specifically examined in combination as a system when the approved values of Voc ( or Uo) and Isc (or Io) for the associated apparatus are less than or equal to Vmax (or Ui) and Imax (or Ii) for the intrinsically safe apparatus and the approved values of Ca (or Co) and La (or Lo) for the associated apparatus are greater than Ci + Ccable, Li + Lcable, respectively for the intrinsically safe apparatus.
- 3. Barriers shall not be connected to any device that uses or generates in excess of 250V rms or DC unless it has been determined that the voltage is adequately isolated from the barrier.
- 4. Note associated apparatus with only Zone 1 approved connections limits the mounting of the sensors to Zone 1.
- 5. 'a' in model number indicates option not affecting safety.
- NAMUR sensors are also nonincendive for Class I, Division 2, Groups A,B,C, and D; Class II, Division 1, Groups E,F, and G; Class III, Division 1; Class I, Zone 2, Groups IIC, IIB, IIA T5 hazardous (classified) locations and need not be connected to an associated apparatus when installed in accordance with Control Drawing 116-0155.
- 7. The correlation between type of connected circuit, maximum permissible ambient temperature and temperature class are indicated at the top of each Table.
- 8. Model number NMB8-SAE16GM27-N1-FE-V1 approved for Class I, Division 1, Groups C and D T4 (Ta = 85°C). See Table 12.
- Warning Equipment with non-metallic enclosures shall not be installed in a location where the external conditions are conducive to the build-up of electrostatic charge on such surfaces. The equipment shall only be cleaned with a damp cloth.

Dieses Dokument enthält sicherheitsrelevante Angaben. Es darf nicht ohne Absprache mit dem Normenfachmann geändert werden!								
This document contains safety-relevant information. It must not be altered without the authorization of the norm expert!								
Confidential according to ISO 16016	Only valid as long as released in EDM or with a v	scale: 1:	1 date: 2010-jun-03					
	Control Drawing	change notice	respons.	US.DRL	116 01655			
PEPPERL+FUCHS	AMUR SENSORS - EM	150 1015	approved	US.DWR	110-01031			
Twinsburg		150- 1915	norm	US.GAP	sheet 1 of 8			
#### Limit switches FM intrisically safe (2)

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NJ 15-30GM-N	140	100	76	91	100	73	88	100	62	77	81	54	63	63
NJ 25-50-N	150	140	73	88	100	69	84	100	51	66	80	39	54	61
NJ 20-40-N	140	140	73	88	100	69	84	100	51	66	80	39	54	61

Table 10 – INDUCTIVE RING SENSORS														
				Тур	1		Тур	2		Тур	3		Тур	4
			1	Ui = 1	6 V	1	Ui = 1	6 V	Ui = 16 V			Ui = 16 V		6 V
			I	i = 25	mA	I	i = 25	mA	Ii = 52 mA			Ii = 76 mA		mA
			P	Pi = 34 mW			i = 64	mW	Pi = 169 mW			Pi = 242 mW		
Model	Ci/ nF	Li/ µH	<b>T6</b>	Т5	T4-T1	<b>T6</b>	Т5	T4-T1	<b>T6</b>	Т5	T4-T1	<b>T6</b>	Т5	T4-T1
RC10-a-N3a	90	120	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RC10-a-N0a	150	100	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RC15-a-N0-a	150	100	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RC15-a-N3a	90	70	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RJ10-Na	30	20	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RJ10-a-Na	30	20	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RJ10-Bia	90	20	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RJ10-a-Bia	90	20	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RJ15-Na	130	20	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RJ15-a-Na	130	20	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RJ15-Bia	90	50	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RJ15-a-Bia	90	50	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RJ21-Na	30	25	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RJ21-Bia	70	50	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A
RJ43-Na	40	50	75	90	100	70	85	100	55	70	90	N/A	N/A	N/A

#### **TABLE 11 – INDUCTIVE SLOT SENSORS**

			1	T	1		T	2		T	2		T	4	_
				Typ	I		lyp	2		Тур	3		Typ	4	
				$U_1 = I$	6 V		$U_1 = I$	6 V		$U_1 = I$	6 V		$U_1 = I$	6 V	
				1 = 25	mA		1 = 25	mA		1 = 52	mA		l1 = 76	mA	
	011	<b>T</b> • /	P	i = 34	mW	P	i = 64	mW	Pi	= 169	0 mW	Pi	1 = 242	mW	·
Model	Ci/ nF	⊥ı/ µН	<b>T6</b>	Т5	T4-T1	<b>T6</b>	Т5	T4-T1	<b>T6</b>	Т5	T4-T1	<b>T6</b>	Т5	T4-1	71
SC2-N0a	150	150	55	67	95	48	60	88	23	35	63	6	18	46	
SC3.5a-N0a	150	150	56	68	96	49	61	89	28	40	68	13	25	53	
SC3.5-N0-Ya	150	150	55	67	95	48	60	88	23	35	63	6	18	46	
SJ1.8-N-Ya	30	100	73	88	100	67	82	100	45	60	78	30	45	57	
SJ2-Na	30	100	56	68	96	49	61	89	28	40	68	13	25	53	
SJ2-SNa	30	100	73	88	100	66	81	100	45	60	78	30	45	57	
SJ2-S1Na	30	100	73	88	100	66	81	100	45	60	78	30	45	57	
SJ2.2-Na	30	100	73	88	100	67	82	100	45	60	78	30	45	57	
SJ3.5-a-Na	50	250	56	68	96	49	61	89	28	40	68	13	25	53	
SJ3.5-H-a	50	250	73	88	100	66	81	100	45	60	89	30	45	74	
SJ3.5-SNa	30	100	73	88	100	66	81	100	45	60	89	30	45	74	
SJ3.5-S1Na	30	100	73	88	100	66	81	100	45	60	89	30	45	74	
SJ5-a-Na	50	250	56	68	96	49	61	89	28	40	68	13	25	53	
SJ5-Ka	50	550	55	67	95	48	60	88	25	37	65	9	21	49	
SJ10-Na	50	100	55	67	95	48	60	88	25	37	65	9	21	49	
SJ15-Na	150	1200	55	67	95	48	60	88	25	37	65	9	21	49	
SJ30-Na	150	1250	55	67	95	48	60	88	25	37	65	9	21	49	
Dieses Dokument er	nthält sich	nerheitsre	elevante	e Anga	ben. Es d	arf nic	nt ohne	Abspra	che mit	dem N	ormenfac	hmanr	n geänd	ert we	rden!
This docume	nt contair	ns safety-	relevar	nt inforn	nation. It	must n	ot be a	ltered wi	thout th	e autho	orization o	of the r	norm ex	pert!	
ential according to ISO 16	016	Only val	id as lo	ng as r	eleased i	n EDM	or with	n a valid	product	ion doo	cumentati	on!	scale	e: 1:1	date: 2010-jun-03
	Control		Drawin	g					change notice respons.			ons.	US.DRL 1		
PPERL+FUCHS		ΝΛΜ							approved		oved	US.DW	٧R	110-0105F	
Twinsburg					1000	0 -	1 111		130-	1910	norm US.GAP sheet 7 of 8		sheet 7 of 8		

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IM 01R01B02-00E-E 10th edition January 01, 2013 -00

#### Limit switches FM non incendive

HAZARDOUS ( CLASS I, ZONE 2, G CLASS I, DIVISION CLASS II, DIVISION CLASS III DIVISION	HAZARDOUS (CLASSIFIED) LOCATION CLASS I, ZONE 2, GROUPS IIC, IIB, IIA (Ta = 50°C) T5 CLASS I, DIVISION 2, GROUPS A, B, C and D CLASS II, DIVISION 1, GROUPS E, F and G CLASS III DIVISION 1 HAZARDOUS LOCATIONS PROXIMITY SENSORS											
PROXIMITY SEM	ISORS			(10	)							
Models C (Capaciti (Discrete Inductiv of numbers and le included. 2 10 See Table 1. for sen	ive), I (Analog Indu e), S (Slot), R (Ring tters. "-" dashes soors with nonincendi	ctive), M (Magnetic g) followed by com s and/or "+" pluse ( ive field wiring parai	c), N Ibination es may b 5 6 meters.		)		Control De	vice				
See Table 2. for ser	nsors with exception	S.										
NOTES:												
(1) Wiring methods mu 502-4(a) for Class Zone 2 wiring requ devices and electri	st be in accordance II, Division 1; 502–4(l irements are equival ical data.	with the National Ele b) for Class II, Divisio ent to Division 2 wir	ectrical C on 2; 503- ring requi	ode, ANSI/N -3(a) for Cla rements. S	IFPA ' ass III, ee ma	70, Article 501-4 Division 1; 503- nufacturer's ins	4(b) for Class I, Div 3(b) for Class III, Di structions for conn	sion 2; vision 2. ection of				
<ul> <li>These proximity se adapter) or a sens Alternatively, sens or enclosure is not</li> </ul>	These proximity sensors are rated "Nonincendive". Proximity sensors without a provision for conduit connection (i.e. via a conduit adapter) or a sensor with a plastic base must be mounted in a tool secured enclosure meeting the requirements of ANSI/ISA S82. Alternatively, sensors in accordance with Table 1 may be wired according to nonincendive field wire methods (a conduit connection or enclosure is not needed).											
Proximity sensors, with the National E	Proximity sensors, conduit, enclosures, and exposed noncurrent-carrying metal parts must be grounded and bonded in accordance with the National Electrical Code, ANSI/NFPA 70, Article 250.											
(4) WARNING - DO NOT	WARNING - DO NOT CONNECT OR DISCONNECT WHILE CIRCUIT IS LIVE UNLESS LOCATION IS KNOWN TO BE NONHAZARDOUS.											
5 The relay outputs	of a proximity senso	or must be supplied I	by a nonii	ncendive so	игсе.							
6 Sensitivity adjustr	nent should only be	done when the area	is known	to be nonh	azard	ous.						
<ul> <li>A temperature rat</li> </ul>	ing of T5 applies for	all nonincendive pro	oximity se	ensors. SEE	TABL	E 2 for exception	ons					
The nonincendive f values of Voc and approved values o nonincendive circui	ield wiring concept a Isc of the nonincendi f Ca and La for the r t.	llows interconnectio ive source are less t nonincendive source	on of noni than or e are great	ncendive cir qual to Vma ter than Ci	rcuits ax and + Ccab	with a nonincen I Imax of the nor Ile and Li + Lcab	dive source when t nincendive circuit a le, respectively, fo	he approved nd the r the				
9 All Nonincendive set	ources must be appro	oved.										
(10) Sensors using V93 locking clamp (P & accordance to the	, V94,V95 connector F model V1-Clip) are National Electrical C	s ("mini" 7/8") with suitable to be moun ode, ANSI/NFPA 70.	the lockir ited outsi	ng clamp (P+ ide the prot	⊦F moo ective	del V9-CL-D2) a e enclosure. Wi	nd V1, V12 connecto ring methods must	ors with be in				
(1) NJa-b-c-d-e. Indu NI/I/2/ABCD/T5 Ta a=1.5, 2, 3 b=C, D, F, PD, FD1	ctive Cylinder Positio a=50°C	on Sensor is suitabl	e for Clas	ss I, Div 2 o	nly.	ТА	BLE 2 – EXCEPTIONS					
c=US, EUZ, EZ, EU d=any diameter					MODE	EL NUMBER	RESTRICTION					
e=V1, V12, V93, V9 NEMA 4X	4, V95 connectors				NBN	3-F25-E8	Do not use in a Clas Hazardous Location	s II, Division 1, Group E				
	TABLE 1 - N	IONINCENDIVE PARAME		)	٧9-	CL-D2 & V1-Clip	Not Approved for u	se in Class II or III locations				
Certification Status Agency Pending Final N	DDEL NUMBER Vm	ax (V) Imax (mA) 60.0 200	C <sub>i</sub> (UF)	L <sub>i</sub> (mH) 0	NJ †   See	ype SENSOR Note (11)	Class I, Div 2 ONLY					
FM         X         X           CSA	J5-18GM50-E2	60.0 200	0	0	NJ2- See	-FD1 type SENSOR Note 11	Class I, Div 2 ONLY	/ Ta = 85C /T4A				
Dieses Dokument enthält	sicherheitstechnisch	he Angaben. Es darf	nicht ohr	ne Abspract	ne mit	dem Normenfac	hmann geändert we	rden!				
This document contai	ins safety-relevant	information. It must	not be a	ltered with	out th	e authorization	of the norm expert	!				
Lontidential according to ISO 1	IDUID   Unly valid a	is long as released in ROL DRAWING	ìEUM or v	virh a valid p	produc	rion documentat change notice	ion: scale: respons. US.DRI	none  date:2009-Feb-25				
Twinsburg	CHS Non	incendive senso	rs FM			150-1681	approved US.DWR	116-0155E				

#### Limit switches CSA

HA CLA CLA CLA	HAZARDOUS (CLASSIFIED) LOCATION CLASS I, ZONE 0 OR 1, GROUPS IIC, IIB, IIA or CLASS I, DIVISION 1, GROUPS A,B,C,D CLASS II, DIVISION 1, GROUPS E,F,G CLASS III, DIVISION 1							NON-HAZARDOUS LOCATION CLASS I, ZONE 2, GROUPS IIC, IIB, IIA or CLASS I, DIVISION 2, GROUPS A,B,C,D							
	Switc any ( Peppy identi	n, Non−ind SA Certifie rl∔Fuchs H fied by out	uctive resid d Entity d AMUR Pro put type M	stive device, evice or simity Senso \* or *N	or models,			4 Intri Conn	Pepperl+Fuchs Ind Switch Isolators See Table 1 Insically Safe Non-Intrins Connections	5) c. sically Sofe s					
	Notes: The intr F.	insically	safe wir	ing must	be install	ed in accordance	e with the	e Canadian E	Electrical Code CSA C22	2.1, Part	1, Appendix				
2	Barriers it has t connect means.	listed in been dete ed to an	Table 1 ermined y device	l shall no that the that use	t be conr voltage is es or gene	ected to any de adequately isole erates in excess	evice that ated from of 60Vrn	uses or ger the barrier. ns or DC unl	nerates in excess of 25 . Barriers listed in Table less the voltage is limit	0Vrms or e 2 shall ed by an	DC unless not be adequate				
3	Any cor connect	nbination ed to a	of up <sup>.</sup> switch i	to 10 cho n a hazai	nnels of t dous loca	the barriers liste tion.	d in Tabl	e 1 or Table	2 may be connected i	n parallel	and				
4	The Ent in comb to Vma are gree	ity conce ination of and Im ater thar	ept allow is a sys ax for t Ci + C	s interco tem wher he intrins cable and	nnection o the appr ically safe Li + Lco	of intrinsically sa oved values of apparatus and able, respectively	fe appard Voc and l the appr v, for the	tus with ass sc for the c oved values intrinsically	sociated apparatus not associated apparatus arr of Ca and La for the o safe apparatus.	specifical e less th associated	ly examined an or equal d apparatus				
5	The foll IIC,IIB,IIA KF**-Sf	owing ma or Clas R2—EX2.V	odels wit s I, Divis I, KFD2-	h part nu sion 2, Gi -SR2-EX2	umber gre roups A,B, 2.2S, KFD2	ater than 10000 C,D hazardous ( —ST2—EX1.*, KFI	0 are ap; classified) D2—ST2—I	proved for m location: K EX2.*, KFD2-	nounting in a Class I, Z F**-SR2-EX1.W, KF**-S -SOT2-EX1.*, KFD2-SOT	one 2, G SR2–EX1.' T2–EX2.*.	roups W.LB,				
W A A	WARNING: Substitution of components may impair intrinsic safety and/or suitability for use in Class I, Division 2, Groups A,B,C,D or Class I, Zone 2, Groups IIC,IIB,IIA. ADVERTISSEMENT: La substitution de composants peut compromettre la sécurité intrinsèque.														
						No changes wi CSA	thout prior	permission	TitleInstallation CSA Certified Isolators	n Dro I Swit	wing for .ch				
1.		Revis	ions		ECO No.	DISCLOSURE, REPROD MAY BE MADE EXCE	UCTION, OR US	E OF ANY PART							
<u>2-</u> : In.	20-2008 Date	Cons.	Resp.	Appr.	Twi	pperl+Fuch: nsburg, OH 440	s⊎lnc. 87–2202	Kepl.No. –	<sup>Draw.</sup> 116–00   No.	)47j	Sh. 1 of 2				

TABLE 1: Barriers Certified to CSA Standard C22.2 No. 157 (Um = 250 V)

		SYS	STEM	ENTITY							
Model Numbers	Terminals	V(V)	Res (0)	V (V)	las(mA)	C a	uF) GF	RPS	L <sub>a</sub> (	(mH) GF	RPS
		*max(*)	Nes. (1)	* 00 ( *)	'SC(IIIA)	A,B	C,E	D,F,G	A,B	C,E	D,F,G
KFD2-S0T-Ex1*,KFD2-S0T-Ex2* KFD2-SR-Ex1*,KFD2-SR-Ex2* KFD2-SRT-Ex1* KFD2-ST-Ex1*,KFD2-ST-Ex2* KFA5-SR2-Ex1*,KFA5_SR2-Ex2* KFA6-SR2-Ex1*,KFA6-SR2-Ex2* KFD2-SR2-Ex1*,KFD2-SR2-Ex2*	1–3, 2–3; 4–6, 5–6	12.6	650	12.9	19.8	1.273	3.820	10.18	84.88	298.7	744.4
KFA5-SOT2-Ex1*,KFA5-SOT2-Ex2* KFA6-SOT2-Ex1*,KFA6-SOT2-Ex2*	1–3, 2–3; 4–6, 5–6	10.5	811	10.5	13.0	2.66	7.9	21.3	192	671	1000

TABLE 2: Barriers Certified to CSA Standard E79-11 (Um = 60 V)

	Load Parameters										
Model Numbers	rerminals	Uo	۱ <sub>۵</sub>	c.	(uF) GF	RPS	L <sub>o</sub> (	(mH) GF	₹PS		
		(V <sub>oc</sub> )	(I <sub>sc</sub> )	IIC	IIB	IIA	IIC	IIB	IIA		
				(A,B)	(C,E)	(D,F,G)	(A,B)	(C,E)	(D,F,G)		
KFD2-SOT2-Ex1*,KFD2-SOT2-Ex2* KFD2-ST2-Ex1*,KFD2-ST2-Ex2*	1–3, 2–3; 4–6, 5–6	10.5	13.0	2.66	7.9	21.3	192	671	1000		

					No changes without prid CSA	or permission	TitleInstallation Drawing for CSA Certified Switch
	Revis	ions		ECO No	THIS DRAWING CONTAINS PROPP DISCLOSURE, REPRODUCTION, OR MAY BE MADE EXCEPT BY WRI	IETARY DATA. NO USE OF ANY PART ITEN PERMISSION.	
2-20-2008 In. Date	Cons.	Resp.	Appr.		Pepperl+Fuchs®Inc winsburg, OH 44087-220	. Repl.No. 2 –	Draw. 116-0047j Sh. 2 of 2 No.

# 10.8 Intrinsically safe NEPSI (China) certified RAMC (/NS1)

The RAMC with electronic transmitter (-E, -H) with or without limit switches is certified as intrinsic safe unit with NEPSI approval.

Certificate Nr.	: GYJ101551					
Type of protection	: Intrinsi	cally safe Ex ia				
Group	: IIC					
Temperature Class	: T6					
Ambient temperature	: -25°C	+70°C				
Safety relevant maximum values of	of electro	nic transmitter :				
Maximum voltage	: U, =	30 V				
Maximum current	: I, =	101 mA				
Maximum power	:P =	1.4 W				
Inner inductance	: L, =	150 µH				
Inner capacity	: C <sub>i</sub> =	4.16 nF				

#### Data of limit switches option /K1 to /K10 :

The following table shows the maximum safety parameters for intrinsic safe limit switches according the certificate NEPSI GYJ03201X :

	Standard Ex ia	/K1 /K3 IIC T6	Fail Safe /K6/K10 Ex ia IIC T6			
	Туре 2	Туре 3	Туре 2	Туре 3		
Ui [V]	16	16	16	16		
li [mA]	25	52	25	52		
Pi [mW]	64	169	64	169		
Ci [nF]	150	150	30	30		
Li (µH)	150	150	100	100		
max. ambient temp. [°C] for T6	49	28	49	28		
max. ambient temp. [°C] for T5	61	40	61	40		
max. ambient temp. [°C] for T4 - T1	89	68	89	68		

# 10.9 Flame proof and dust proof ATEX certified RAMC (/KF1)

#### 10.9.1 Technical data

**Certificate :** IBExU 05 ATEX 1086 Flame proof : Ex d IIC T6 Gb Dust proof : Ex tb IIIC TX Db Max. surface temperature TX :corresp. process temperature Housing : Painted aluminium casting, type 91 Output signal (with electronic transmitter -E or -H) : 4-20 mA (2- wire unit, 3- wire unit) ; 0-20 mA (3- wire unit) Power supply (with electronic transmitter -E or -H) : 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 : - M20x1.5 (standard) - 1/2" NPT (option /A5) Degree of protection : IP66 / 67 Marking :



Temperature classification for gas application :

Temperature class	Standard	On extension (option /A16)	On extension (option /A16)
			and thermal insulation
Т6	85°C	85°C	85°C
T5	100°C	100°C	100°C
T4	120°C	135°C	135°C
Т3	120°C	200°C	200°C
T2	120°C	300°C	300°C
T1	120°C	370°C	350°C

#### 10.9.2 Installation

For use in category 2G or 3G the electrical connections to the electronic transmitter and to the limit switches must be made via suitable cable glands and / or conduit systems that satisfy the requirements of EN 60079-1 sections 13.1 and 13.2 and for which a separate test certificate is available. The cables, cable glands and stopping plugs must be specified for an ambient temperature of 100°C. Cable glands and entry fittings (screwed conduit entries) as well as stopping plugs of simple design may not be used. On connection of the RAMC /KF1 using a conduit entry approved for the purpose, the associated sealing facility must be arranged directly on the housing.

For use in category 2D or 3D the electrical connections to the electronic transmitter and to the limit switches must be made via suitable cable glands certified to the concerning dust category.

Unused openings shall be closed with certified stopping plugs in type of protection flame proof enclosure "d" (100°C) or dust proof depending on the existing category.

Secure cable glands, stopping plugs and the safety screw for the cover against twisting.

For installation in areas with combustible dust EN 61241-17 must be considered.

#### 

The RAMC with option /KF1 shall be connected to the local equipollently grounding system. Therefore a grounding screw is available outside on the indicator housing and inside the indicator .

The electronic transmitter and the limit switches shall be wired as described in chapter 3.2.

#### 10.9.3 Operation

If the cover of the indicator unit has to be opened, following instructions must be followed.

## 

- 1. Switch off the power supply.
- 2. Wait 15 minutes after power is turned off before opening the covers.
- 3. The cover is fixed with a special screw.
- 4. Be sure to lock the cover with special screw after tightening the cover.
- 5. Before starting the operation again, be sure to lock the cover with the locking screw.
- 6. Users are prohibited from making any modifications of specifications or physical configuration, such as adding or changing the configuration of external wiring ports.

#### 

The instrument modification or parts replacement by other than authorized representatives of YOKOGAWA is prohibited and will void the certification.

#### WARNING

If the window of the cover is damaged the RAMC must be set out of operation..

# 10.10 Flame proof and dust proof IECEx certified RAMC (/EF1)

#### 10.10.1 Technical data

**Certificate :** IECEx IBE12.0007 Flame proof : Ex d IIC T1-T6 Gb Dust proof : Ex tb IIIC TX Db Max. surface temperature TX :corresp. process temperature Housing : Painted aluminium casting, type 91 Output signal (with electronic transmitter -E or -H) : 4-20 mA (2- wire unit, 3- wire unit) ; 0-20 mA (3- wire unit) Power supply (with electronic transmitter -E or -H) : 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 : - M20x1.5 (standard) - 1/2" NPT (option /A5) Degree of protection : IP66 / 67 Temperature classification for gas application :

Temperature class	Standard	On extension (option /A16)	On extension (option /A16) and thermal insulation
T6	85°C	85°C	85°C
T5	100°C	100°C	100°C
T4	120°C	135°C	135°C
Т3	120°C	200°C	200°C
T2	120°C	300°C	300°C
T1	120°C	370°C	350°C

#### 10.10.2 Installation

For use in category 2G or 3G the electrical connections to the electronic transmitter and to the limit switches must be made via suitable cable glands and / or conduit systems that satisfy the requirements of IEC 60079-1 and for which a separate test certificate is available. The cables, cable glands and stopping plugs must be specified for an ambient temperature of 100°C. Cable glands and entry fittings (screwed conduit entries) as well as stopping plugs of simple design may not be used. On connection of the RAMC /EF1 using a conduit entry approved for the purpose, the associated sealing facility must be arranged directly on the housing.

For use in category 2D or 3D the electrical connections to the electronic transmitter and to the limit switches must be made via suitable cable glands certified to the concerning dust category.

Unused openings shall be closed with certified stopping plugs in type of protection flame proof enclosure "d" (100°C) or dust proof depending on the existing category.

Secure cable glands, stopping plugs and the safety screw for the cover against twisting.

### 

The RAMC with option /EF1 shall be connected to the local equipollently grounding system. Therefore a grounding screw is available outside on the indicator housing and inside the indicator .

The electronic transmitter and the limit switches shall be wired as described in chapter 3.2.

#### 10.10.3 Operation

If the cover of the indicator unit has to be opened, following instructions must be followed.

### 

- 1. Switch off the power supply.
- 2. Wait 15 minutes after power is turned off before opening the covers.
- 3. The cover is fixed with a special screw.
- 4. Be sure to lock the cover with special screw after tightening the cover.
- 5. Before starting the operation again, be sure to lock the cover with the locking screw.
- 6. Users are prohibited from making any modifications of specifications or physical configuration, such as adding or changing the configuration of external wiring ports.

#### 

The instrument modification or parts replacement by other than authorized representatives of YOKOGAWA is prohibited and will void the certification.

#### 

If the window of the cover is damaged the RAMC must be set out of operation..

# 10.11 Intrinsically safe ATEX certified components in dust proof RAMC-housing (/KS2)

#### Certificate :

PTB 12 ATEX 2003 (Intrinsically safe electronic transmitter) PTB 99 ATEX 2219X (Intrinsically safe limit switches) (Pepperl&Fuchs) PTB 00 ATEX 2049X (Intrinsically safe fail safe limit switches) (Pepperl&Fuchs) IBExU 05 ATEX 1086 (Dust proof RAMC)

Intrinsic safety :

Group II ; category 2G See chapter 10.1

#### Dust proof :

Group II ; category 2D See chapter 10.9



RAMC with /A5 (threads for cable gland 1/2´NPT) are delivered without cable glands. Please install suitable cable glands or blind stopper according to the dust category where the flowmeter is installed.

# 10.12 Intrinsically safe IECEx certified components in dust proof RAMC- housing (/ES2)

#### Certificate :

IECEx PTB12.0020 (Intrinsically safe electronic transmitter) IECEx PTB11.0091X (Intrinsically safe limit switches) (Pepperl&Fuchs) IECEx PTB11.0092X (Intrinsically safe fail safe limit switches) (Pepperl&Fuchs)

IECEx IBE12.0007 (Dust proof RAMC)

#### Intrinsic safety :

Group II ; category 2G See chapter 10.5

#### Dust proof :

Group II ; category 2D See chapter 10.9



RAMC with /A5 (threads for cable gland 1/2´NPT) are delivered without cable glands. Please install suitable cable glands or blind stopper according to the dust category where the flowmeter is installed.

# 10.13 Flame proof and dust proof NEPSI (China) certified RAMC (/NF1)

#### 10.13.1 Technical data

```
Certificate :
   GYJ071430
Flame proof :
   Ex d IIC T6
Dust proof :
   DIP A20 TA T1 - T6 IP67
   Max. surface temperature
   TA: corresponding process temperature
Housing :
   Painted aluminium casting type 91
Output signal (with electronic transmitter -E or -H) :
   4-20 mA (2- wire unit, 3- wire unit); 0-20 mA (3- wire unit)
Power supply (with electronic transmitter -E or -H) :
   2- or 3- wire unit
Limit switches :
   Options /K1 to /K10 possible
Ambient temperature :
   -20 °C to 60 °C
-20 °C to 55 °C (for use in zone 20)
Minimum process temperature :
   -20°C
Threads for cable glands :
   - M16x1.5 (standard)
   - 1/2" NPT (option /A5)
Temperature classification for gas application :
   see chapter 10.9
```

#### 10.13.2 Installation

For use in category 2G or 3G the electrical connections to the electronic transmitter and to the limit switches must be made via suitable cable glands and / or conduit systems that satisfy the requirements of IEC 60079-1 and for which a separate test certificate is available. The cables, cable glands and stopping plugs must be specified for an ambient temperature of 100°C. Cable glands and entry fittings (screwed conduit entries) as well as stopping plugs of simple design may not be used. On connection of the RAMC /NF1 using a conduit entry approved for the purpose, the associated sealing facility must be arranged directly on the housing.

For use in category 2D or 3D the electrical connections to the electronic transmitter and to the limit switches must be made via suitable cable glands certified to the concerning dust category.

Unused openings shall be closed with certified stopping plugs in type of protection flame proof enclosure "d" (100°C) or dust proof depending on the existing category.

Secure cable glands, stopping plugs and the safety screw for the cover against twisting.

# 

The RAMC with option /NF1 shall be connected to the local equipollently grounding system. Therefore a grounding screw is available outside on the indicator housing and inside the indicator .

The electronic transmitter and the limit switches shall be wired as described in chapter 3.2.

#### 10.13.3 Operation

If the cover of the indicator unit has to be opened, following instructions must be followed.



- 1. Switch off the power supply.
- 2. Wait 15 minutes after power is turned off before opening the covers.
- 3. The cover is fixed with a special screw.
- 4. Be sure to lock the cover with special screw after tightening the cover.
- 5. Before starting the operation again, be sure to lock the cover with the locking screw.
- 6. Users are prohibited from making any modifications of specifications or physical configuration, such as adding or changing the configuration of external wiring ports.

## 

The instrument modification or parts replacement by other than authorized representatives of YOKOGAWA is prohibited and will void the certification.



#### WARNING

If the window of the cover is damaged the RAMC must be set out of operation.

# **<u>11. Instructions for PED</u>**

The units are produced according the determinations of directive 97/23/EG (directive for Pressure - Equipment / PED ).

The units are classified as pipe according item 3, number 1, 3. letter, a) first dash or according diagram 6 after appendix II :

- Classification as pipe
- For Fluid Group 1 and 2 (article 9 chapter (2)). For fluid group 2 with a max. partial pressure of 1.5 bar at T<sub>max</sub>.
- Medium fluid and gas

The basic safety requests (for design, production and testing) for all units according to category I to III are generally determined for the requests of category III.

The units, which are not excluded by PED article 3 paragraph 3, are checked by a conformity-valuation-method according appendix III fmodule H<sup>2</sup>.

The complete quality assurance system according PED appendix III module H was certified by the notified body :

Lloyd's Register Nederland B.V. Energy; K.P. van der Mandelelaan 41a; NL-3062 MB Rotterdam ID-No. 0038

#### IMPORTANT

The user is responsible for the use of our flowmeters regarding suitability and use as agreed.

#### Marking Example e.g. 82 1.4404 / AISI 316L Cone Material Flowdirection ⇐ כ made by RY CE marking CE 0038 e.g. ch. 123456 Charge Commissioning No. e.g. Kom.Nr.20000 e.g. DN 100 nominal size nominal pressure e.g. PN 40 year of production e.g. 2002 e.g.TS-180°C/+370 temperature data see Instruction Man

PED-Data on RAMC

#### Dependence of the permissible max. effective pressure of the operating temperature:

The pressure relevant temperature limits of the RAMC are: -200 to 370°C for units made from 1.4571/1.4404. -80 to 130°C for units made from PTFE.

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

		Process temperature										
		-200°C	RT (20°C)	50°C	100°C	150°C	200°C	250°C	300°C	350°C	370°C	
	Process connection	on										
A1	Flange ASME 150lbs		15.9 bar	15.9 bar	15.3 bar	13.3 bar	12 bar	11.2 bar	10.5 bar	10 bar	8.4 bar	7.4 bar
A2	Flange ASME 300lbs		41.4 bar	41.4 bar	40.0 bar	34.8 bar	31.4 bar	29.2 bar	27.5 bar	26.1 bar	25.1 bar	24.8 bar
A3	Flange ASME 600lbs		82.7 bar	82.7 bar	80 bar	69.6 bar	62.8 bar	58.3 bar	54.9 bar	52.1 bar	50.1 bar	49.5 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		
						F	Process te	emperatur	e			
			-200°C	RT (20°C)	50°C	100°C	140°C	-				
		DAMOOO		40 h a r	40 h a r	10 h a r	40 h a r	-				
52	Clamp. DIN 11851	RAMC02		40 bar	40 bar	40 bar	40 bar	see	correspo	ondina sta	indard for	the
52	Clamp. DIN 11851	RAMC05		25 bar	25 bar	25 bar	25 bar		(	connectio	n	uio
52	Clamp. DIN 11851			25 Dar	25 Dar	25 bar	25 bar	-				
52	Clamp. DIN 11851			25 Dar	25 Dar	25 bar	25 bar	-				
52	Clamp. DIN 11851			25 Dar	25 Dar	25 Dar	25 Dar					
- 52	Clamp. Din 11851	NAMO 12		10 Dai	10 Dai	10 Dai	TODAI					
		-				F	Process te	emperatur	e			
		-	-200°C	RT	50°C	100°C	150°C					
		-		(20°C)				-				
S4	Clamp	BAMC02		16 har	16 har	16 bar	16 har	-				
S4	Clamp	BAMC03		16 bar	16 bar	16 bar	16 bar	1				
S4	Clamp	RAMC04		16 bar	16 bar	16 bar	16 bar	see corresponding standard for the connection			the	
S4	Clamp	RAMC05.		16 bar	16 bar	16 bar	16 bar					
S4	Clamp	RAMC06		10 bar	10 bar	10 bar	10 bar					
S4	Clamp	RAMC08		10 bar	10 bar	10 bar	10 bar					
S4	Clamp	RAMC10		10 bar	10 bar	10 bar	10 bar	1				
07		DAMOOS						1				
55	Rosista Flange	RAMC02.		10 bar		see	correspor	nding star	ndard for t	he conne	ction	
55	Hosista Flange	RAMC04		10 bar								

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# For special connections with Z-No. other values may be valid. The data are marked on the flowmeter.

		Process temperature								
	-200°C	RT (20°C)	50°C	100°C	150°C	200°C	250°C	300°C	350°C	370°C
Special connection										
Flange ASME > 300lbs	100%	100%	94.20%	83.30%	75.80%	69.50%	64.30%	60.80%	58.00%	56%
Flange EN PN	100%	100%	97.70%	89%	80%	73.20%	68%	64.50%	61.70%	60%
Other connections *)	100%	100%	97.70%	89%	80%	73.20%	68%	64.50%	61.70%	60%

\*) The figures relate only to the connection on the meter. Further restrictions by gaskets and customer connected parts are to be considered separately.

#### Change of the process connections:

The flanges change from

DIN 2526 facing form C into DIN-EN 1092-1 facing form B1

The connection measurements of the flanges remain the same. That means that DIN and EN fit one to another. The facing of the flanges has changed. This may effect the gaskets.

#### **Operation reductions:**

The operator is responsible, that no corrosion and/or erosion is caused by the medium, which reduces the safety of the unit as pressure vessel. In addition one has to take care, that no decomposition of unstable fluids may happen. Corrosion and erosion make the unit fail and can lead to the endangering of persons and facilities. If corrosion and erosion are possible, this has to be checked by control at the removed unit.

Note	In the following only the dangers, which may connection with the accompanying electronic precautions. Also precautions to reach the m	appear with the pressure load of the unit, a s additional risks may appear, which require easuring precision are not considered	re considered. In es corresponding
	Endangering by:	Description	Remarks
	Surface temperature	Surface temperature is hot in case of high process temperature. It is the sole responsibility of the user to stablish proper means to prevent touching of the measuring tube.	
	max. / min. process temperature	see chapter 9.3 and 11	
	max. process pressure	see chapter 9.3 and 11	
	Tightness of the wetted, PED relevant volume	A factory test is done before delivery	
Medium	Corrosion and erosion effects	It is the sole responsibility of the user to select proper wetted materials for the medium intended to use (see chapter 11)	
	Life time evaluation	Experience shows that the lifetime of the meas uring tube within the allowed operation conditions is more than 10 years.	Without erosion and corrosion.
	Temperature shock	Permanent temperature cycles of more than 100°C temp. difference have to be avoided. Tube failure can occur because of material wearing.	
	Instable fluids	If instable fluids are transported it is the sole responsibility of the user that in case of decomposition the design limits are not exceeded. (see chapter 11)	
	Process pressure / temp. relation	see chapter 11	
	Piping and support forces	see chapter 2.3 and 3.1	
	Cho ice of gaskets and pre-stress of the process connections	It is the sole responsibility of the user to select suitable gaskets and to screw the process connections with the necessary torques.	Refer to EN 1591 -1
	Use of closing and openings	see chapter 2.3	
	Pressure shock, water hammer and pressure surges	Dynamical exceeding of the given max. pressure at process temp. has to be avoided.	Water hammer can lead to tube failures.
Installation	Filling and emptying of the pipe work	The measuring tube is part of a pipe work. The pipe work has to be filled slowly (see chapter 4.2)	
	Disposal, cleaning and return	see chapter 1.1	
	Flow direction of the unit	upwards	
	Installation position of the unit	see chapter 2.2 and 3.1	A wrong installation position gives only measuring disturbances
	Pipe stress by weight of the instrument	see chapter 9.4, table 9.6 through 9.10	
	Permitted ambient conditions (temperature, humidity)	see chapter 2.2 and 9.3	
Outer influence	External fire	External fire can result in - Rise in pressure by temperature - Damage of gaskets It is in the sole responsibility of the user to implement suitable means to prevent large damage in the case of fire.	The instrument itself does not contain flammable materials.
	Earthquake resistance	- Damage of the mounting screws	Check by user

The following usages of the instruments are not permitted:

- use as climbing aid (e.g during assembling work on pipe system)
- use as support for external load (e.g. support for piping) or tray surface for heavy tools (e.g. during piping work)
- Material removal by any kind of machining (e.g. drilling, sawing etc.)
- Painting of the name-plate/scale
- Brazing or welding of parts to the instrument
- Any repair, modification or supplements or the installation of spare-parts is only permitted if it is done in accordance to this instruction manual. Other work must be agreed by YOKOGAWA beforehand.
   YOKOGAWA will not take over any liability for damages caused by unauthorized work on the instrument or prohibited usage of the instrument.

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# **APPENDIX 1. SOFTWARE CHANGE HISTORY**

Release date	Material number 1)	Index 1)	SW Rev <sup>2)</sup>	Changes	Instruction Manual
24.10.1996	16-8039	В	1.00	Initial Firmware	IM 1R1B2-E-H ed. 1
03.12.1996	16-8039	С	1.10	Angle adjustment improved	IM 1R1B2-E-H ed. 1
25.03.1997	16-8039	D	1.20	Measuring range changed	IM 1R1B2-E-H ed. 1
08.08.1997	16-8039	E	1.30	Totalizer value saving debugged	IM 1R1B2-E-H ed. 1
20.10.1997 11.11.1997	16-8039	F G	1.40	Totalizer saving concept improved	IM 1R1B2-E-H ed. 1
03.08.1998	16-8039	I	1.50	Pulse output as option implemented	IM 1R1B2-E-H ed. 2
21.10.1998	16-8039	J	1.60	Support of new micro controller	IM 1R1B2-E-H ed. 2
16.02.1999	16-8039	К	1.70	Float- Blocking- Detection function implemented	IM 1R1B2-E-H ed. 2
11.12.2001	16-8040	С	2.00	Support of new micro controller	IM 1R1B2-E-H ed. 3
07.03.2002	16-8040	E	2.20	3- wire version improved	IM 1R1B2-E-H ed. 4
07.11.2002	16-8040	G	2.30	Temperature measurement implemented	IM 1R1B2-E-H ed. 5
06.09.2007 11.01.2011	16-8040	H 1	2.50	Support of new COG display	IM 01R01B02-00E-E ed. 9

Table A1-1 S	oftware Ch	hange His	story for el	ectronic	transmitter	without	HART-commun	ication

<sup>1)</sup> on label of electronic transmitter

<sup>2)</sup> in software parameter F61: display e.g. F2.50, see also chapter 6.2.10

Table A1-2 Software Change History for electronic	c transmitter with HART-communication
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Release date	Material number <sup>1)</sup>	Index 1)	SW Rev <sup>2)</sup>	DD Rev 3)	Changes	Instruction Manual
05.12.2001	16-8041	С	2.10	Rev 01, DD 01	HART communication added, Basic HART function implemented	IM 1R1B2-E-H ed. 3
27.03.2003 01.12.2003	16-8041	F G	3.00	Rev 01,	Enhanced HART Functionality, support of Float- Blocking- Detection and diagnosis function	IM 1R1B2-E-H ed. 5
06.09.2007	16-8041	н	4.00	DD 02	Support of new COG display	IM 01R01B02-00E-E ed. 9
11.01.2011	16-8041	1	5.00		Support of new HART modem chip	IM 01R01B02-00E-E ed. 9

<sup>1)</sup> on label of electronic transmitter

<sup>2)</sup> in HART parameter "Detailed Setup / Device information / Revision #'s / FW rev.: x.xx (e.g.x.xx = 5.00), see also chapter 7.4.4 <sup>3)</sup> in HART- communicator Blank Page

# APPENDIX 2. Safety Instrumented Systems Installation

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The contents of this appendix are cited from exida.com safety manual on the Rotameter RAMC Flowmeter specifically observed for the safety transmitter purpose. When using the RAMC for Safety Instrumented Systems (SIS) application, the instructions and procedures in this section must be strictly followed in order to preserve the meter for that safety level.

# A2.1 Scope and Purpose

This document provides an overview of the user responsibilities for installation and operation of the Rota Yokogawa RAMC variable area flow meter in order to maintain the designed safety level. Items that will be addressed are proof testing, repair and replacement of the flow meter, reliability data, lifetime, environmental and application limits, and parameter settings.

# A2.2 Using RAMC for a SIS Application

#### A2.2.1 Safety Function

Suitable for use in Safety Instrumented Systems are the versions listed in table A2.1 only. The safety related data listed in this manual does not apply to other versions of RAMC.

Table A2.1 Versions of RAMC suitable for Safety Instrumented Systems

[V1]	RAMC with inductive limit switch(es) – Options /K1 to /K3 and /K6 to /K10
[V2]	RAMC with 4-20mA output – Code –E / -H

This variable area flow meter is intended for use as a volume flow monitoring component in a Safety Instrumented System. It has either inductive limit switches [V1] or a 4-20mA analog output [V2]. The flow meter may be used with the limit switches or the 4–20mA output to feed signals to a logic solver that is part of the safety instrumented function (SIF) as shown in Figure A2.1. The fault annunciation mechanism is a trip of one of the limit switches [V1] or an out of range analog current [V2]. In order to take credit for the automatic diagnostics in the flow meter, this annunciation mechanism must be connected.



Figure A2.1 Example Safety Instrumented Function

#### A2.2.2 Diagnostic Response Time

[V2]: The flow meter will report an internal failure within 5 minutes of fault occurrence for float blocking detection (time can be set to 15 minutes) and immediate for all other errors. [V1]: The limit switch will go to its safe fail state immediately.

#### A2.2.3 Setup

Normally a setup of the flow meter is not required. During installation the flow meter can be setup with engineering unit parameters [V2]. This is typically done with a handheld device. These parameters must be verified during the installation to insure that the correct parameters are in the flow meter. Engineering range parameters can be verified by reading these parameters from the optional local display or by checking actual calibration of the flow meter.

Calibration of the flow meter must be done after parameters are set.

#### A2.2.4 Proof Testing

The objective of proof testing is to detect failures within the flow meter that are not detected by the diagnostics of the flow meter. Of main concern are undetected failures that prevent the safety instrumented function from performing its intended function.

The frequency of the proof tests (or the proof test interval) is to be determined in the reliability calculations for the safety instrumented functions for which the flow meter is applied. The actual proof tests must be performed more frequently or as frequently as specified in the calculation in order to maintain required safety integrity of the safety instrumented function.

The following tests need to be specifically executed when a proof test is performed. The results of the proof test need to be documented and this documentation should be part of a plant safety management system. Failures that are detected should be reported to Yokogawa.

Step	Action
1	Take appropriate action to avoid a false trip
2	Inspect the device for any visible damage, corrosion or contamination
3	Force the variable area flow meter RAMC to reach a defined "MAX" threshold value and verify that the inductive limit switch goes into the safe state.
4	Force the variable area flow meter RAMC to reach a defined "MIN" threshold value and verify that the inductive limit switch goes into the safe state
5	Restore the loop to full operation
6	Restore normal operation

a) Proof test for variable area flow meter RAMC with inductive limit switches [V1]

#### b) Proof test for variable area flow meter RAMC with 4-20mA output [V2]

Step	Action
1	Bypass the safety PLC or take other appropriate action to avoid a false trip
2	Perform a two-point calibration of the variable area flow meter RAMC
3	Force the variable area flow meter RAMC to go to the high alarm current output and verify that the analog current reaches that value. Note: it is only possible to set RAMC to the high alarm current mode via HART communication! This tests for compliance voltage problems such as a low loop power supply voltage or increased wiring resistance. This also tests for other possible failures.
4	Force variable area flow meter RAMC to go to the low alarm current output and verify that the ana- log current reaches that value. This tests for possible quiescent current related failures
5	Restore the loop to full operation
6	Remove the bypass from the safety PLC or otherwise restore normal operation

When all the tests listed above are executed a proof test coverage of approximately 99% of possible DU failures in the variable area flow meter RAMC can be claimed.

The following tools need to be available to perform proof testing:

- Flow meter display or alternatively for digital communication ([V2] only): HART Handheld, PRM or FieldMate
- Measurement instrument to verify output status [V1] or output current [V2]

The person(s) performing the proof test of the Yokogawa RAMC variable area flow meter should be trained in SIS operations including bypass procedures, flow meter maintenance and company management of change procedures.

#### A2.2.5 Repair and replacement

Maintenance information can be found in section 8, Maintenance of the User's Manual Model RAMC Short Stroke ROTAMETER, IM 01R01B02-00E-E.

If repair is to be performed with the process online the Rota Yokogawa RAMC variable area flow meter will need to be bypassed during the repair. The user should setup appropriate bypass procedures for that. Contact the Yokogawa sales office if this instrument requires repair

The person(s) performing the repair and / or replacement of the Rota Yokogawa RAMC variable area flow meter should have a sufficient skill level.

#### A2.2.6 Startup Time

The flow meter will generate a valid signal within 3 seconds of power-on startup with the default 1 second dampening time. Increasing the configurable dampening time adds to the startup time.

#### A2.2.7 Firmware update

In case firmware updates are required they will be performed at factory. The replacement responsibilities are then in place. The user will not be required to perform any firmware updates.

#### A2.2.8 Reliability data

A detailed Failure Mode, Effects, and Diagnostics Analysis (FMEDA) report is available from Rota Yokogawa with all failure rates and failure modes. Rota Yokogawa RAMC variable area flow meter is intended for use in a Low Demand Mode. Low Demand Mode means the average interval between dangerous conditions occurs infrequently.

The Rota Yokogawa RAMC variable area flow meter is certified up to SIL2 for use in a simplex (1001) configuration, depending on the PFDAVG calculation of the entire Safety Instrumented Function.

#### A2.2.9 Lifetime limits

The expected lifetime of the Yokogawa Rota Yokogawa RAMC variable area flow meter is 10 years. The reliability data listed in A2.2.8 is only valid for this period. The failure rates of the Rota Yokogawa RAMC variable area flow meter may increase sometime after this period. Reliability calculations based on the data listed in A2.2.8 for Rota Yokogawa RAMC variable area flow meter lifetimes beyond 10 years may yield results that are too optimistic, i.e. the calculated Safety Integrity Level will not be achieved.

#### A2.2.10 Required parameter settings

The Float Blocking Detection System must be activated for 4-20mA Type [V2].

#### A2.2.11 Environmental limits

The environmental limits of Rota Yokogawa RAMC variable area flow meter are specified in the User's Manual, Model RAMC Short Stroke ROTAMETER IM 01R01B02-00E-E.

#### A2.2.12 Application limits

The application limits of the Rota Yokogawa RAMC variable area flow meter are specified in the User's Manual, Model RAMC Short Stroke ROTAMETER,

IM 01R01B02-00E-E. If the flow meter is used outside of the application limits the reliability data listed in A2.2.9 becomes invalid.

# **A2.3 Definitions and Abbreviations**

#### A2.3.1 Definitions

Safety Freedom from unacceptable risk of harm

Functional Safety	The ability of a system to carry out the actions necessary to achieve or to maintain a defined safe state for the equipment / machinery / plant / apparatus under control of the system
Basic Safety	The equipment must be designed and manufactured such that it protects against risk of damage to persons by electrical shock and other hazards and against resulting fire and explosion. The protection must be effective under all conditions of the nominal operation and under single fault condition
Verification	The demonstration for each phase of the life-cycle that the (output) deliverables of the phase meet the objectives and requirements specified by the inputs to the phase. The verification is usually executed by analysis and / or testing:
Validation	The demonstration that the safety-related system(s) or the combination of safety-related system(s) and external risk reduction facilities meet, in all respects, the Safety Requirements Specification. The validation is usually executed by testing
Safety Assessment	The investigation to arrive at a judgment - based on evidence - of the safety achieved by safety-related systems

Further definitions of terms used for safety techniques and measures and the description of safety related systems are given in IEC 61508-4.

#### A2.3.2 Abbreviations

FMEDA	Failure Mode, Effects and Diagnostic Analysis
SIF	Safety Instrumented Function
SIL	Safety Integrity Level
SIS	Safety Instrumented System
SLC	Safety Lifecycle

# **A2.4 Assessment results**

#### A2.4.1 Safety related parameters

The following results have been obtained from the assessment report Report No.: ROTA YOKOGAWA 05/04-20 R001 Version V4, Revision R1; August 2010 issued by exida.

Average PFD values have been calculated assuming a Diagnostic Coverage (DC) of 99%, a mission time of 10 years and a Mean Time To Restoration of 24 hours.

Table A2.2: Summary for RAMC ([V1]) with fail-safe limit switches <sup>3</sup> – Failure rates

	Profile 2	Profile 4
Fail Safe Detected (λSD)	0 FIT	0 FIT
Fail Safe Undetected (\U00c0SU)	143 FIT	197 FIT
Fail Dangerous Detected (λDD)	0 FIT	0 FIT
Fail Dangerous Undetected (ADU)	55 FIT	94 FIT
SFF ⁴	72.4%	67.8%
MTBF	528 years	349 years
SIL AC <sup>5</sup>	SIL2	SIL2

Safety metrics according to ISO 13849-1 <sup>6</sup>:

MTTF <sub>d</sub> (years)		207	6	1214
DC		0%	)	0%
Category (CAT)		CAT	1	CAT 1
Performance Level (required)		PL <sub>r</sub> = c		PL <sub>r</sub> = c
Performance Level (calculated)		5.50E-08 1/h		9.40E-08 1/h
T[Proof] = 1 year	T[Proof] = 5 years		T[Proof] = 10 years	
PFDAVG = 2.63E-04	PFDAVG = 1.22E-03		PFDAVG = 2.41E-03	

Table A2.3: Summary for RAMC ([V1]) with standard limit switches <sup>7</sup> – Failure rates

	Profile 2	Profile 4
Fail Safe Detected (λSD)	0 FIT	0 FIT
Fail Safe Undetected ( $\lambda$ SU)	174 FIT	228 FIT
Fail Dangerous Detected (ADD)	0 FIT	0 FIT
Fail Dangerous Undetected (ADU)	94 FIT	133 FIT
SFF <sup>4</sup>	65.0%	63.2%

SFF *	65.0%	63.2%	
MTBF	400 years	288 years	
SIL AC 5	SIL2	SIL2	

#### Safety metrics according to ISO 13849-1 <sup>6</sup>:

<b>7</b>	<u>v</u>			
MTTF <sub>d</sub> (years)		121	4	858
DC		0%	)	0%
Category (CAT)		CAT	1	CAT 1
Performance Level (required)		PL, = c		PL <sub>r</sub> = c
Performance Level (cal	culated)	9.40E-0	8 1/h	1.33E-07 1/h
T[Proof] = 1 year	T[Proof] = 5 years		T[Proof] = 10 years	
PFDAVG = 4.49E-04	PFDAVG = 2.08E-03		PFDAVG = 4.12E-03	

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Table A2.24: Summar	y for RAMC ([V2])	with 4-20mA c	output – Failure rates
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	Profile 2	Profile 4
Fail Safe Detected (\U00fcSD)	0 FIT	0 FIT
Fail Safe Undetected (λSU)	60 FIT	60 FIT
Fail Dangerous Detected (λDD)	260 FIT	344 FIT
Fail Dangerous Undetected (\lambda DU)	193 FIT	200 FIT
SFF ⁴	62.3%	66.8%
	57%	63%
MTBF	191 years	166 years

SIL AC ⁵	SIL1	SIL1

#### Safety metrics according to ISO 13849-1 6:

MTTF <sub>d</sub> (years)		252	2	210
DC		57%	/o	63%
Category (CAT)		CAT	1	CAT 2
Performance Level (required)		PL <sub>r</sub> = c		PL <sub>r</sub> = c
Performance Level (calo	culated)	4.53E-0	7 1/h	5.44E-07 1/h
T[Proof] = 1 year	T[Proof] = 5 years		T[Proof] = 10 years	
PFDAVG = 9.28E-04	PFDAVG = 4.28E-03		PFDAVG = 8.46E-03	

<sup>3</sup> The switching contact output is connected to a fail-safe NAMUR amplifier (e.g. Pepperl+Fuchs KF\*\*-SH-Ex1). The failure rates of the amplifier are not included in the listed failure rates

<sup>4</sup> The complete sensor subsystem will need to be evaluated to determine the overall Safe Failure Fraction. The number listed is for reference only.

<sup>5</sup> SIL AC (architectural constraints) means that the calculated values are within the range for hardware architectural constraints for the corresponding SIL but does not imply all related IEC 61508 requirements are fulfilled.

<sup>6</sup> Depending on the application and possible external diagnostics a higher DCD and therefore also a higher category might be possible to achieve.

<sup>7</sup> The switching contact output is connected to a standard switching amplifier (e.g. Pepperl+Fuchs KF\*\*-SR2-Ex\*.W). The failure rates of the amplifier are not included in the listed failure rates.

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