User´s Manual

Model RAKD
Small Metal ROTAMETER

IM 01R01B30-00E-E

vigilantplant.™

YOKOGAWA

Rota Yokogawa GmbH & Co. KG
Rheinstr. 8
D-79664 Wehr
Germany

IM 01R01B30-00E-E
4th edition, April 2007

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1. Introduction

Before use, read this manual thoroughly and familiarize yourself fully with the features, operations and handling of Rotameter RAKD 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 instrumentin 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 explosionproof model, if you yourself repair or modify the instrument and then fail to return it to its original form, the explosionprotected 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:

WARNING

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..

CAUTION

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.

IMPORTANT

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.

NOTE

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

WARNING

- If the process fluid is harmful to personnel, handle Rotameter RAKD 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 8 " INSTRUCTIONS FOR EXPLOSION PROTECTED RAKD". The description in Chapter 8 is prior to other descriptions in this instruction manual.

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⚠ CAUTION

• When carrying Rotameter RAKD 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.

⚠ WARNING

- 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 8 " INSTRUCTIONS FOR EXPLOSION PROTECTED RAKD". The description in Chapter 8 is prior to other descriptions in this instruction manual..

Restriction on Use of Radio Transceiver

IMPORTANT

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 Template

Sending an instrument back to service
Installation and operation of the Rotameter RAKD in compliance with this manual is generally trouble-free. In case a RAKD 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 RAKD 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.

Receiver : Sender :

Delivery Note (for EU-Countries) Date :

Ref. REPAIR for comm. no. _____

We are sending following type of article
via forwarding agent : Yusen Air ; Raunheim/Frankfurt

Item	Article	Unit Price	Total Price
	Type (MS-Code) _____	€ _____	€_____ (nominal value)
	Charges for airworthy packing and delivery FOB		€_____
	Total value		€ _____
	Value for customs purpose only		€ _____ (current value)

Gross weight . _____kg
Net weight : _____kg
Customs Tariff No. : _____
Country og origin : Federal Republic of Germany

Delivery note 2-fold accompanis the goods

SPECIMEN Certificate

Company : _____ Address : _____
Department : _____ Name : _____
Telephone : _____ Fax : _____

Der beiliegende Durchflussmesser :

Type : _____ Comm. no.. _____

has been operated with following liquids:_____

Because the liquid is ☐ water-endangeringnd ☐ toxic ☐ caustic ☐ flammable
we have

☐ checked, that all cavities in the flowmeter are free fromsuch substances

☐ flushed out and neutralised all cavities in the flowmeter

Please check applicable description
We confirm that there is no risk to man or enviroment through any residual liquid containes in this flowmeter.

Date : _____ Signature : _____

Company stamp:

Receiver : Sender :

PROFORMA INVOICE (for Third-party-Countries) Date :

Ref. REPAIR for comm. no. _____

We are sending following type of article
via forwarding agent : Yusen Air ; Raunheim/Frankfurt

Item	**Article**	**Unit Price**	**Total Price**
	Type (MS-Code) _____	€ _____	€_____ (nominal value)
	Charges for airworthy packing and delivery FOB		€_____
	Total value		€ _____
	Value for customs purpose only		€ _____ (current value)

Gross weight . _____kg
Net weight : _____kg
Customs Tariff No. : _____
Country og origin : Federal Republic of Germany

Delivery note 2-fold accompanis the goods

SPECIMEN Certificate

Company : _____ Address : _____
Department : _____ Name : _____
Telephone : _____ Fax : _____

Der beiliegende Durchflussmesser :

Type : _____ Comm. No. _____

has been operated with following liquids:_____

Because the liquid is ☐ water-endangeringnd ☐ toxic ☐ caustic ☐ flammable
we have

☐ checked, that all cavities in the flowmeter are free fromsuch substances

☐ flushed out and neutralised all cavities in the flowmeter

Please check applicable description
We confirm that there is no risk to man or enviroment through any residual liquid containes in this flowmeter.

Date : _____ Signature : _____

Company stamp:

1.2 ATEX Documentation

This procedure is only applicable to the countries in European Union.

GB

All instruction manuals for ATEX Ex related products are available in English, German and French. Should you require Ex related instructions in your local language, you are to contact your nearest Yokogawa office or representative.

DK

Alle brugervejledninger for produkter relateret til ATEX Ex er tilgængelige på engelsk, tysk og fransk. Skulle De ønske yderligere oplysninger om håndtering af Ex produkter på eget sprog, kan De rette henvendelse herom til den nærmeste Yokogawa afdeling eller forhandler.

I

Tutti i manuali operativi di prodotti ATEX contrassegnati con Ex sono disponibili in inglese, tedesco e francese. Se si desidera ricevere i manuali operativi di prodotti Ex in lingua locale, mettersi in contatto con l'ufficio Yokogawa più vicino o con un rappresentante.

E

Todos los manuales de instrucciones para los productos antiexplosivos de ATEX están disponibles en inglés, alemán y francés. Si desea solicitar las instrucciones de estos artículos antiexplosivos en su idioma local, deberá ponerse en contacto con la oficina o el representante de Yokogawa más cercano.

NL

Alle handleidingen voor producten die te maken hebben met ATEX explosiebeveiliging (Ex) zijn verkrijgbaar in het Engels, Duits en Frans. Neem, indien u aanwijzingen op het gebied van explosiebeveiliging nodig hebt in uw eigen taal, contact op met de dichtstbijzijnde vestiging van Yokogawa of met een vertegenwoordiger.

SF

Kaikkien ATEX Ex -tyyppisten tuotteiden käyttöhjeet ovat saatavilla englannin-, saksan- ja ranskankielisinä. Mikäli tarvitsette Ex -tyyppisten tuotteiden ohjeita omalla paikallisella kielellännne, ottakaa yhteyttä lähimpään Yokogawa-toimistoon tai -edustajaan.

P

Todos os manuais de instruções referentes aos produtos Ex da ATEX estão disponíveis em Inglês, Alemão e Francês. Se necessitar de instruções na sua língua relacionadas com produtos Ex, deverá entrar em contacto com a delegação mais próxima ou com um representante da Yokogawa.

F

Tous les manuels d'instruction des produits ATEX Ex sont disponibles en langue anglaise, allemande et française. Si vous nécessitez des instructions relatives aux produits Ex dans votre langue, veuillez bien contacter votre représentant Yokogawa le plus proche.

D

Alle Betriebsanleitungen für ATEX Ex bezogene Produkte stehen in den Sprachen Englisch, Deutsch und Französisch zur Verfügung. Sollten Sie die Betriebsanleitungen für Ex-Produkte in Ihrer Landessprache benötigen, setzen Sie sich bitte mit Ihrem örtlichen Yokogawa-Vertreter in Verbindung.

S

Alla instruktionsböcker för ATEX Ex (explosionssäkra) produkter är tillgängliga på engelska, tyska och franska. Om Ni behöver instruktioner för dessa explosionssäkra produkter på annat språk, skall Ni kontakta närmaste Yokogawakontor eller representant.

GR

Ολα τα εγχειριδια λειτουργιαζ των προιουτϖυ με ATEX Ex διατιΘευται στα Αγγλικα, Γερμαυικα και Γαλλικα. Σε περιπτωση που χρειαζεοτε οδηγιεζ σχετικα με Ex στηυ τοπικη γλωσσα παρακαλουμε επικοιυωυηστε με το πλησιεστερο γραφειο τηζ Yokogawa η αντιπροσωπο τηζ.

SK

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

CZ

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.

LT

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.

LV

Visas ATEX Ex kategorijas izstrâdâjumu 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 pârstâvi.

EST

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.

PL

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.

SLO

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.

H

Az ATEX Ex mûszerek 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.

BG

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.

RO

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.

M

Il-manwali kollha ta' l-istruzzjonijiet għal prodotti marbuta ma' ATEX Ex huma disponibbli bl-Ingliż, bil-Ġermaniż u bil-Franċiż. Jekk tkun teħtieġ struzzjonijiet marbuta ma' Ex fil-lingwa lokali tiegħek, għandek tikkuntattja lill-eqreb rappreżentan jew uffiċċju ta' Yokogawa.

1.3 General description

This manual describes installation, operation and maintenance of the RAKD. 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 RAKD 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 com. no. 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..

1.4 Principle of measurement

The RAKD 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.

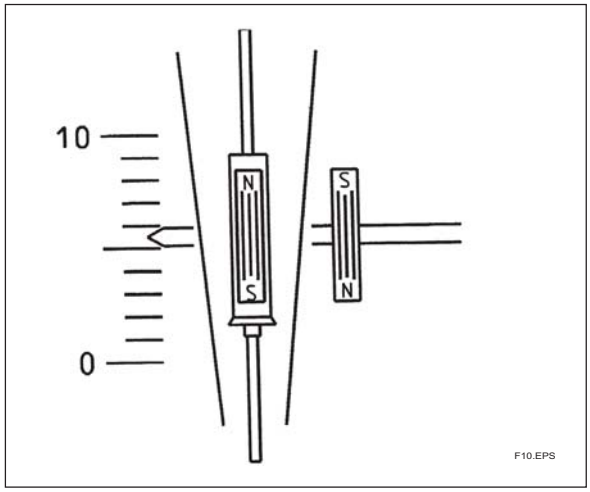
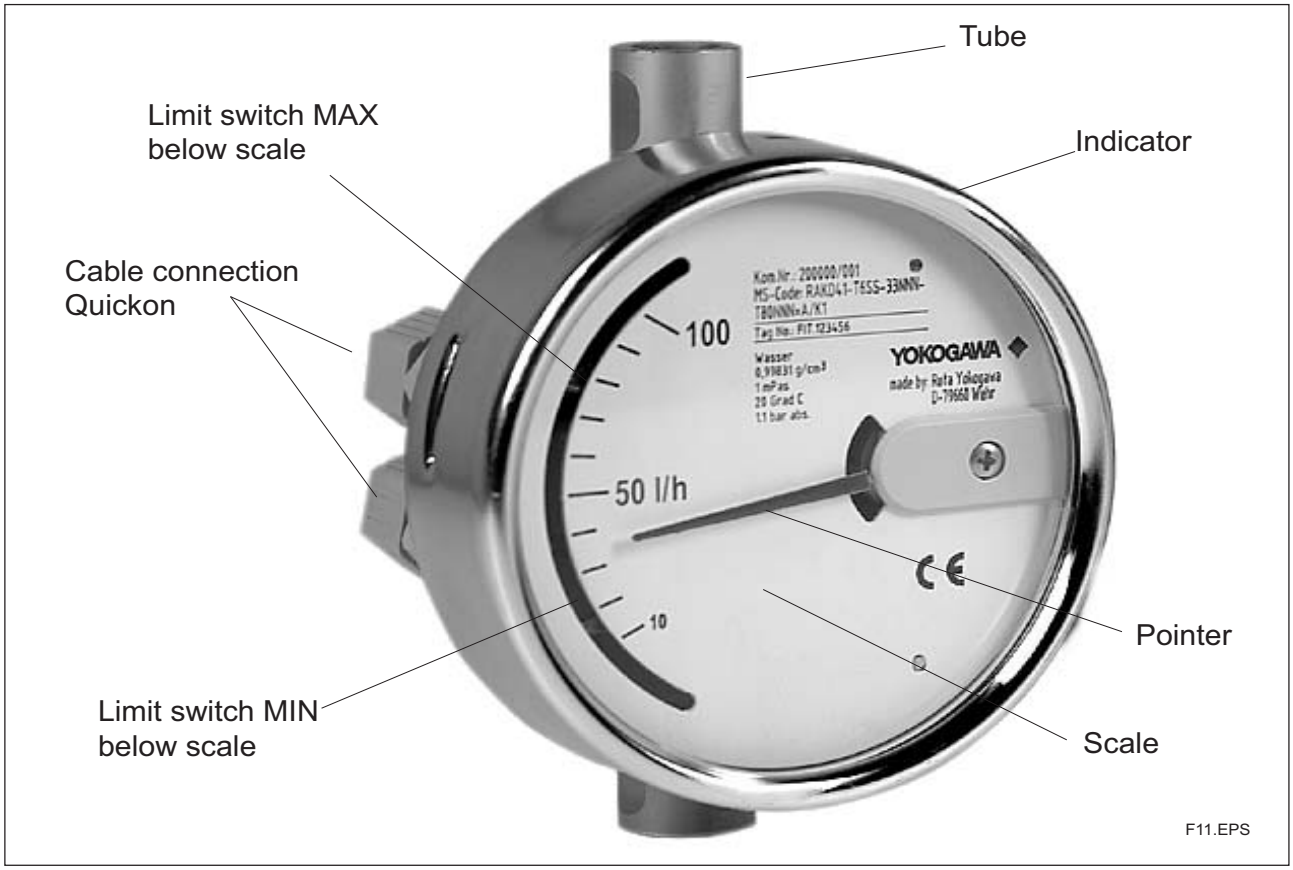


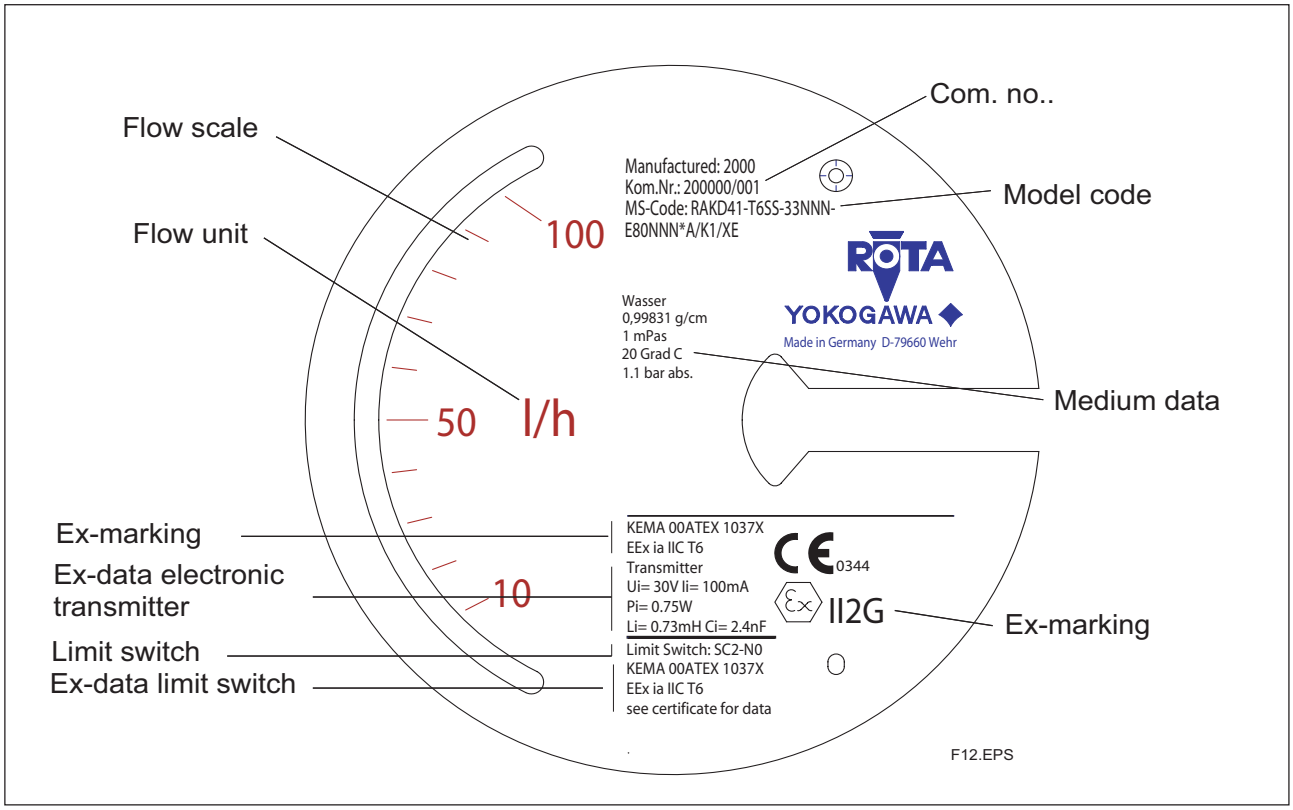
Fig. 1.1

All units are calibrated with water or air 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.

1.5 Overview



Skalenbeispiel :



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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 RAKD features a very solid construction, the instrument should not be exposed to strong vibration or impact stress.
Please note that the RAKD is magnetic sensing system can be influenced by external inhomogeneous magnetic fields (such as solenoid valves). Alternating magnetic fields (≥ 10Hz) as well as homogeneous, static magnetic fields (in the area of the RAKD), 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 RAKD.
To avoid interference, the distance between two adjacent RAKDs must be at least 300 mm.
Do not expose the unit to pressures higher than the indicated maximum operating pressure (refer to specifications)
Make sure that wetted parts are resistante against the process medium.
Ambient- and process-temperature may exceed specified maximum values. Note the temperature curves in fig. 2-1 and chapter 7 "Technical data".
The Rotameter must be mounted verticaly. The flow direction is upwards.

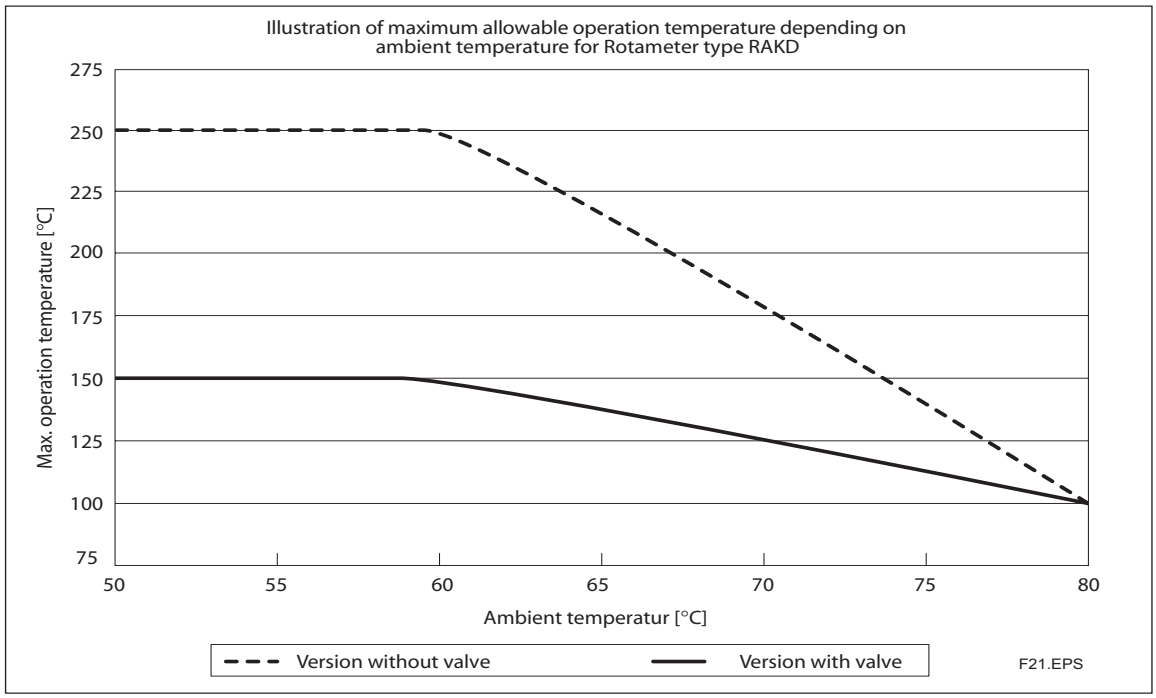


Fig. 2-1. For option /KS!1or /KN1 (Ex-version) the maximum values for ambient and process temperature according to the respective temperature class mentioned in fig. 3-2 and tables 7-2 to 7-5 must be regarded. The minimum ambient temperature is -25°C.

Check movability of the float (5)* by watching the pointer. The pointer should follow the movement of the float. If this is not the case, float and measuring tube (1;21) should be cleaned.
Check the movability of the pointer by careful moving it with your fingers and watching whether it responds to the scale value. If it does not work properly, the mechanical display unit (14) must be changed.
To avoid damage of the float and of the stopper do not use magnetic valves. In the phase of start up increase the flow slowly to the desired flow rate.If a sudden rise of the pressure can not be avoides (with use of magnetic valves) the flow must be limited to the maximum used value (e.g by valve).

*: Position numbers are illustrated in the explosion drawings in chapter 6.

3. Installation

3.1 Installation in the pipeline

The pipe has to be so stabilized that vibrations on the pipe are avoided. Additional recommendations can be found in guideline VDI/VDE 3513 sheet 3.
If pollution of the metering tube may appear a bypass-pipe is recommended, which permits the removal (see. chapter 6 “maintenance”) of the Rotameter for cleaning without interruption of the flow.

Before installing the Rotameter, make sure there are no parts of packing or securing inside the Rotameter.
It has to be taken care at the connection of units with internal thread that no residues of the sealing compound come into the tube (e.g. remains of the PTFE sealing compound).

In case of devices without valve but with process connection internal thread the float shaft of tubes with cone 44 and bigger sizes may move into the range of the threaded joint. Keep attention not to bend the guide bar when screwing up the connection. The inner diameter of the connector must be at least 8 mm for cone sizes 44 - 51 resp. 10 mm for cone sizes 52 and 53.

To avoid float bouncing in case of gas applications, attend to VDI/VDE 3515 sheet 3.
For devices without valve use a throttle either in the inlet or outlet (to install at that side with the bigger volume).
For installation of several instruments in parallel tubes take care that the distance between the middle axis is at least 300 mm to avoid magnetic influence. The distance to other ferritic material should not be less than 250 mm. Take care that the strength of external magnetic fields is approximately 0 mT.

3.2 Wiring

3.2.1 Connecting diagrams

Please regard the drawings of this chapter.

RAKD with electrinic transmitter or with limit switches have one or two Quickon connectors at the rear.
In the connecting diagramst he lower one is named "S" and the upper une "T".
Not used connector positions are closed with a blind plug.
The following table shows the connections for the respective equipment configuration.

	Type T without contact	**Type T with MIN** contact **/K1 or /K6**	**Type T with MAX** contact **/K2 or /K7**	**Type T with MIN/MAX** contact / **K3 or /K8**	**Type E without** contact **without pulse**	**Type E with MIN** contact **/K1 or /K6**	**Type E with MAX** contact **/K2 or /K7**	**Type E with** pulse output **/CP**
Quickon upper "T"	---	---	MAX contact	MAX contact	Current output	Current output	Current output	Current output
Quickon lower "S"	---	MIN contact	---	MIN contact	---	MIN contact	MAX contact	Puls output

T31.EPS

The load resistance of metering or indicating instruments, which are connected serial to the current output, may not exceed (U- 13.5 V) / 20 mA .

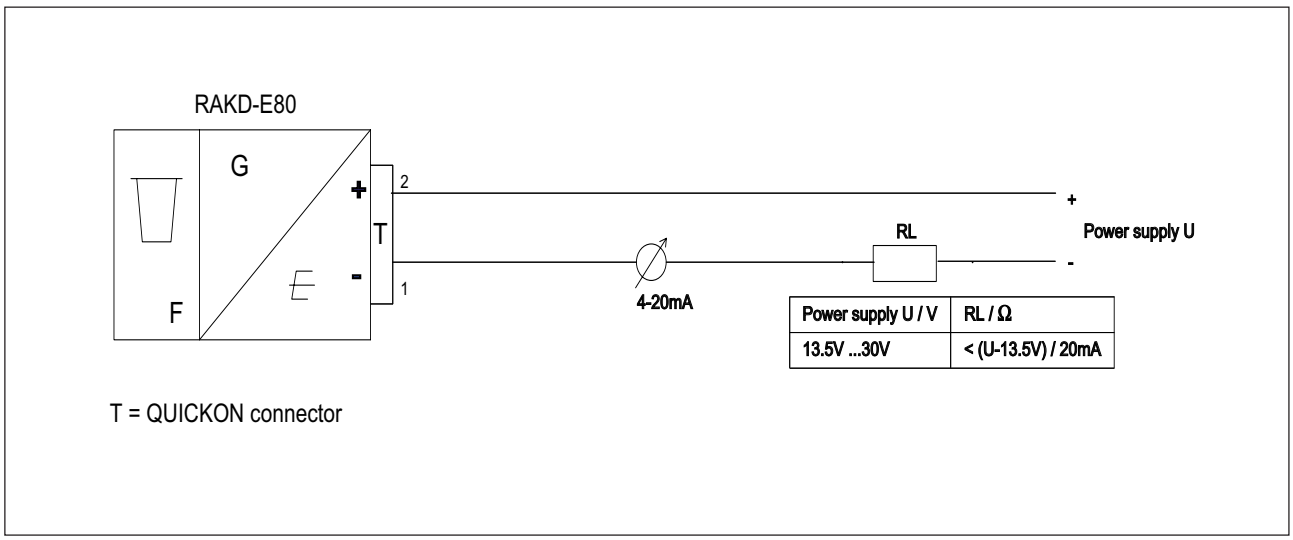


Fig. 3-1 RAKD with electronic Transmitter

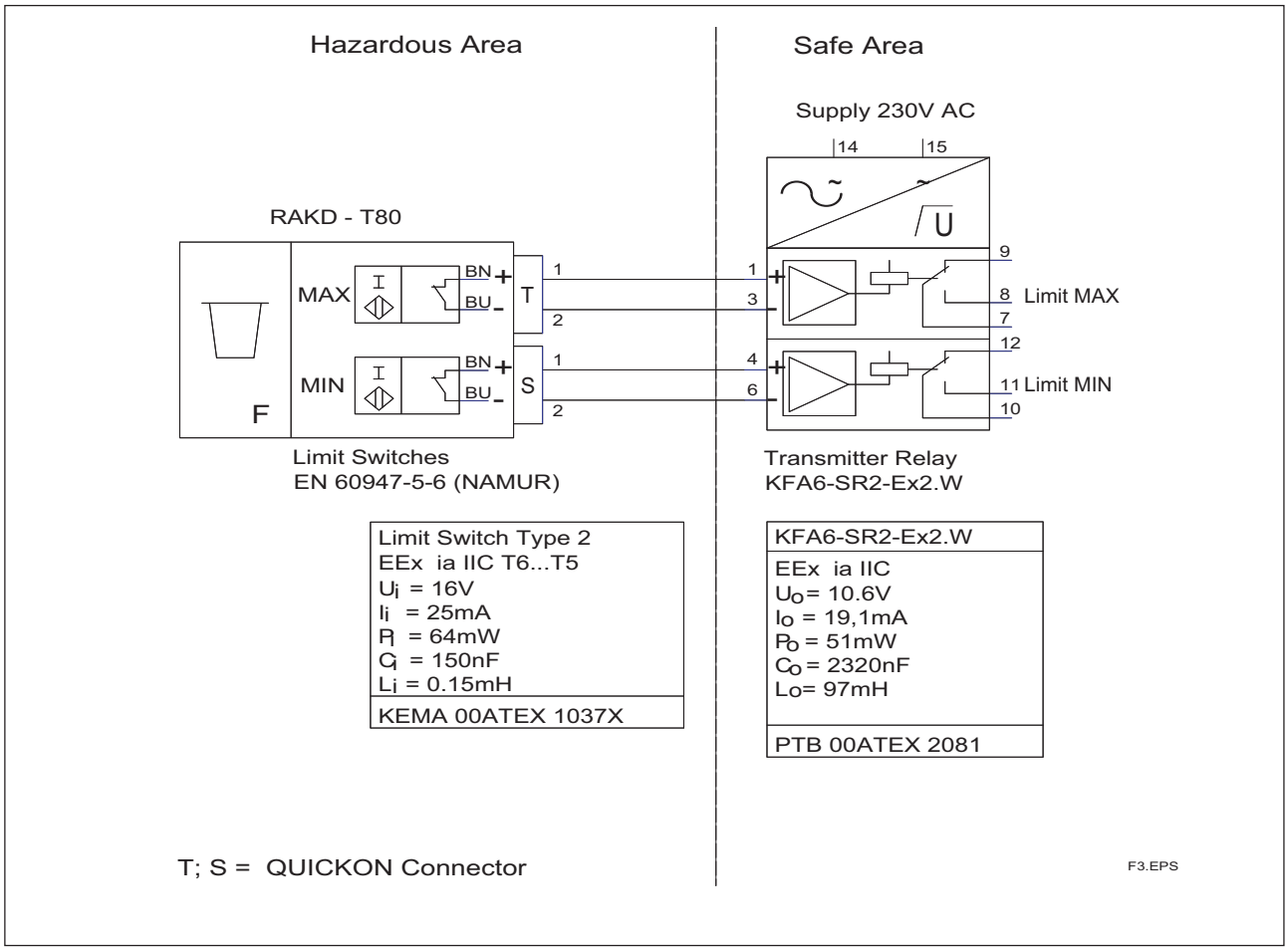


Fig. 3-2 RAKD with 2 limit switches in combination with transmitter relay in Ex- version

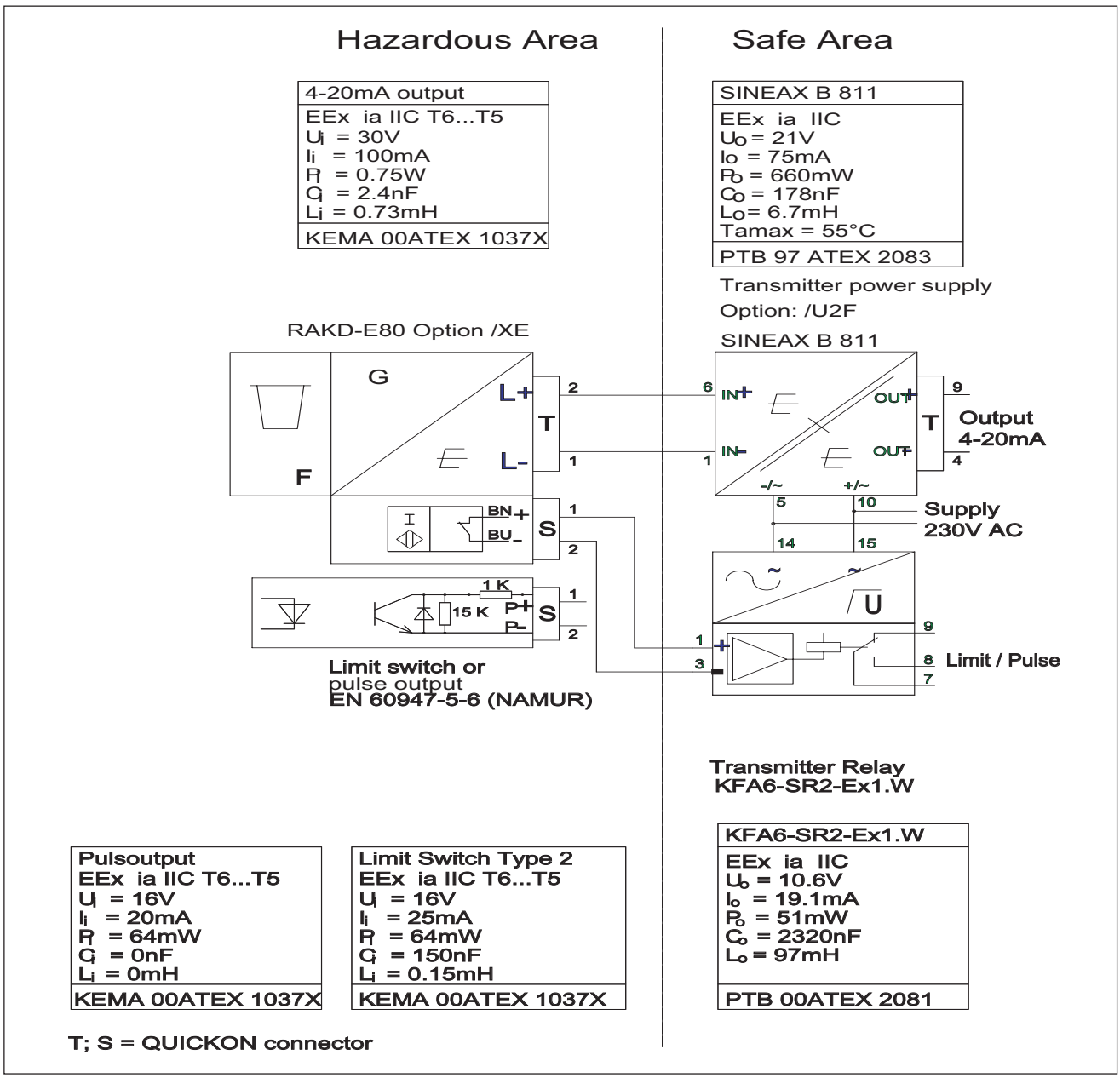


Fig. 3-3 **RAKD in Ex-version with electronic transmitter in combination with power supply and additional limt switch or pulse output with transmitter relay.**

3.2.2 Conductor connection (Quickon)

To connect the conductor, please observe in particular the following steps :

- Strip the sheath to a length of approx. 15 mm (fig. 3-4) and slide the union nut (1), the cap (2) and the rubber seal (3) onto the conductor.

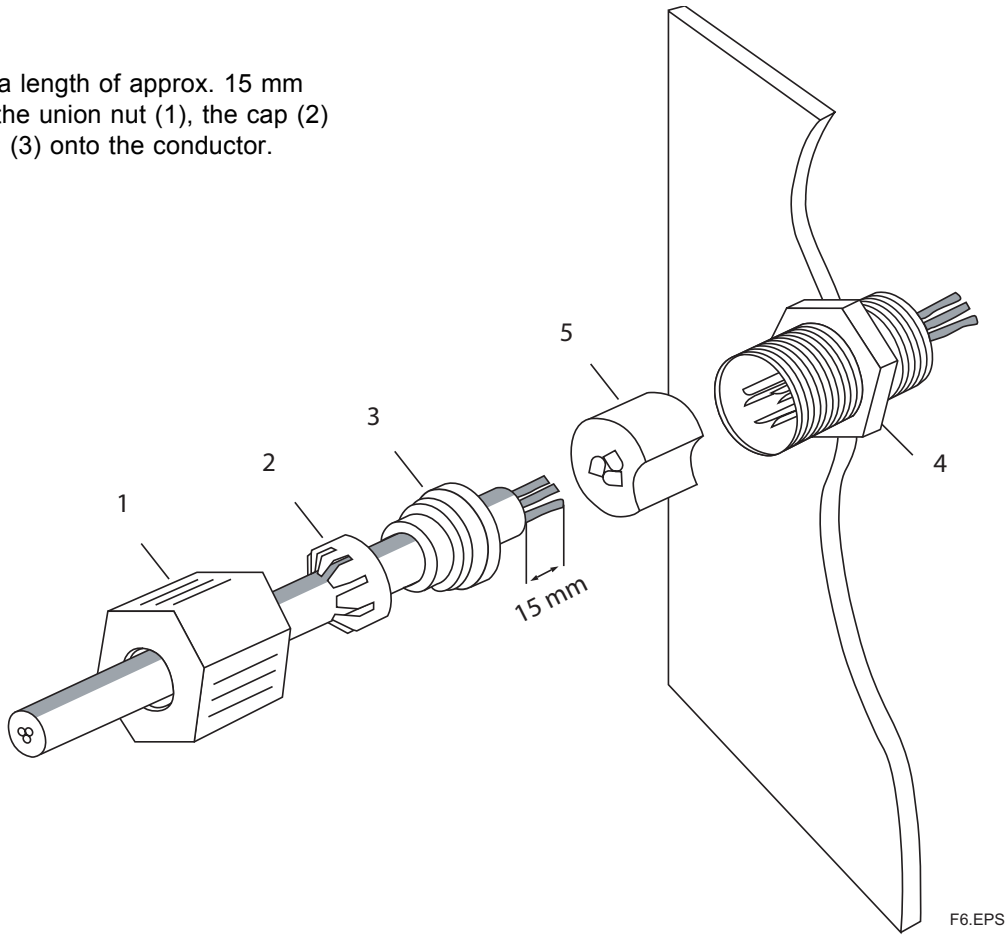


Fig. 3-4

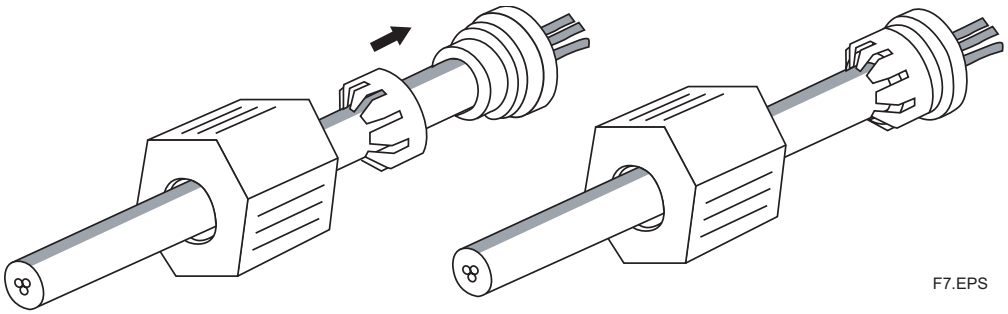
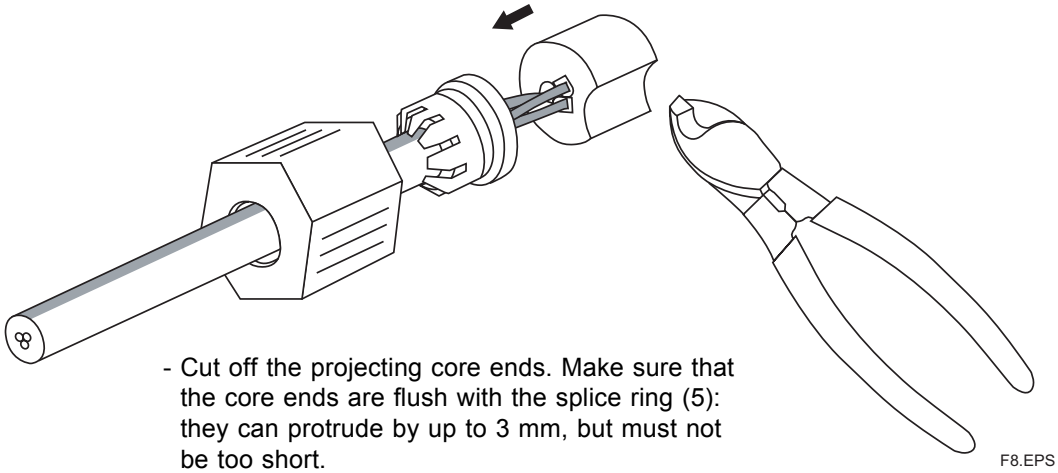


Fig. 3-5

- Slide the rubber seal as far as the rim of the insulation and then slide the cap onto the rubber seal. This provides the strain relief for the conductor (fig. 3-5).

- insert the core ends into the feed through of the splice ring (fig. 3-6). In order to guarantee a clear assignment of the cores, the individual core feed throughs of the splice ring are numbered (1, 2,…).

Fig. 3-6

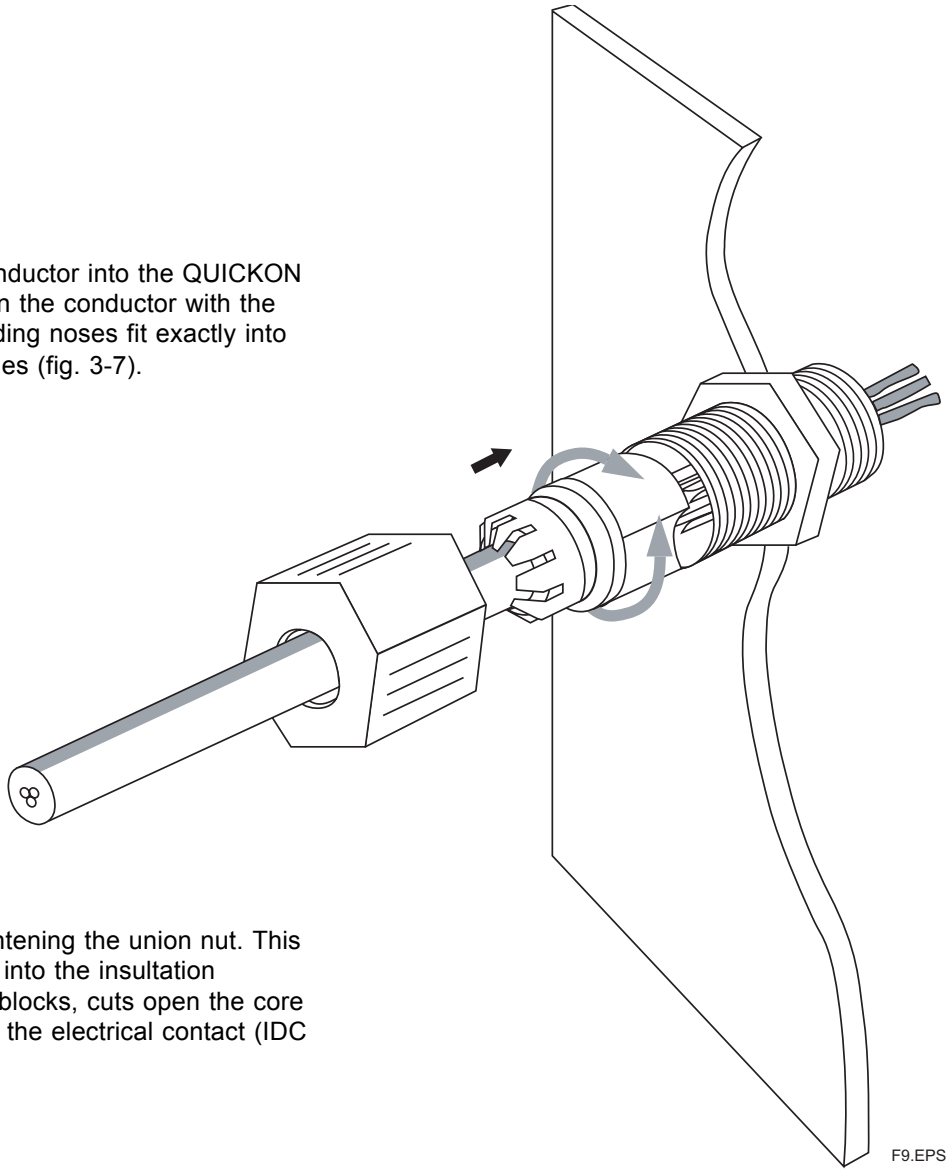


F8.EPS

- Cut off the projecting core ends. Make sure that the core ends are flush with the splice ring (5): they can protrude by up to 3 mm, but must not be too short.

- Insert the prepared conductor into the QUICKON contact carrier (4). Turn the conductor with the splice ring until the coding noses fit exactly into the corresponding guides (fig. 3-7).

Fig. 3-7



F9.EPS

- Close the gland by tightening the union nut. This presses the core ends into the insultation displacement terminal blocks, cuts open the core insultation and creates the electrical contact (IDC connection system).

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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 solidmass particles.
The RAKD 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 RAKD 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.

To establish a new scale, please refer to the folder “Anweisung zur Skalenumrechnung” (Instructions for Scale Conversion) as well as the conversion table or order a new scale.

4.2 Pulsation and pressure shock

Strong pressure impact or flow pulsations can impair measuring operation considerably and should be avoided (→ open valves slowly, raise operating pressure slowly).

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 RAMC is now ready for operation..
The transmitter is prepared and calibrated according to its model code as a 2 wire unit.

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5. Limit switches (Option /K1 to /K8)

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 (/W__) includes the respective transmitter relay.

These switches have been specified for hazadous area. However, the transmitter relay has to be installed outside any hazadous area.

The limit switches are connected to the transmitter relays via Quickon connectors as indicated in section 3-2. The terminals for the limit switches are on a small board on top of the transmitter case.

The MIN-MIN and MAX-MAX functions (refer to option /K3) 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 following table shows the assignment:

Function		Switching direction of transmitter relay	
Channel 1	Channel 2	Channel 1	Channel 2
MIN	MAX	normal	normal
MIN	MIN	normal	inverted
MAX	MAX	inverted	normal

T50.EPS

Note: switching direction “normal” means : inversion “OFF”
“inverted switching” means : inversion “ON”.

When using limit switches as a safety option, the switching directions hould be always set to normal (inversion “OFF”) on the transmitter relay.
To ensure functional safety the transmitter relay has to be applied as protection technology.

Please notice chapter 7.2 "Standard specifications".

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

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6. Maintenance

6.1 Function test

Checking free movement of pointer:
- Remove housing cover (4 screws).
- 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:
- Without flow, the output current must be 4 mA. At a flow rate of 100% the current must be 20 mA.

6.2 Measuring tube, float

The Rotameter does not normally require any maintenance. However cleaning is necessary if the measuring cone or flat has been contaminated by the process. To clean, the Rotameter must be removed from the pipeline.
For all kind of intervention in the Rotameter like tightening the packing of the valve the pressures in pressurized pipelines has to be reduced. Take care that the counter screw is tighten after screwing the valve.

Disassembling the tube
Please perform the following steps to clean the measuring tube and the float:
• Disassemble the Rotameter from the pipe
• Unscrew hollowed top threaded bolt (6) (for cone 31 – 43)
  resp. remove top snap ring and socket (for cone 44 – 51)
  resp. only top snap ring (for cone 52 – 53)
• Remove top float stop (3)
• Disassemble float – Attention: Do not bend the float
• For version with valve in the inlet remove first the top head pipe plug (8)
• For version with valve in the outlet remove first the lower head pipe plug;
  in that case the disassembling of all parts start from down to top
• Cleaning of metering tube and float
• To clean the valve loose screw nut (10) in the head. Afterwards you can unscrew spindle (12) with PTFE packing box plus thrust collar (9)

IMPORTANT

Please don’t expose the float to any strong magnetic alternating fields.The floating body and particularly its measuring edge may not be damaged.

Assembling the tube
Mounting starts in opposite sequence.
Assembling the float take care that the lower guide bar of the float is fixed in the middle boring of the lower stop. The guide bar should not be bended.

6.3 Explosion drawings

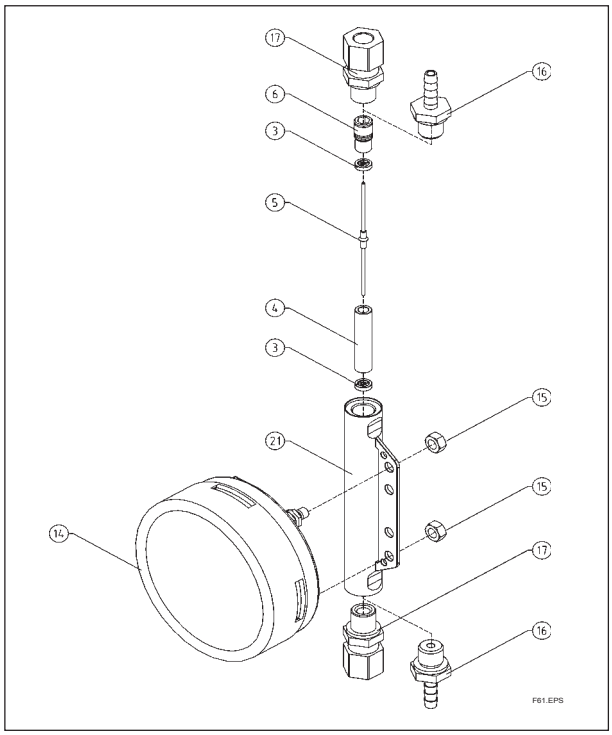

Fig. 6-1 RAKD without valve and controllerr

No. in Fig. 6-1 and 6-2	Part
1	Tube for unit with valve and controller
2	Socket
3	Float stop
4	Cone
5	Float
6	Threaded bolt
7	Gasket
8	Screw sealing plug
9 ; 10 ; 11 ; 12 ; 13	Packing for valve
14	Indicator
15	Nut M5
16 ; 19	Nozzle
17 ; 20	Cutting ring fitting
18	Controller
21	Tube for unit without valve and controller

T61.EPS

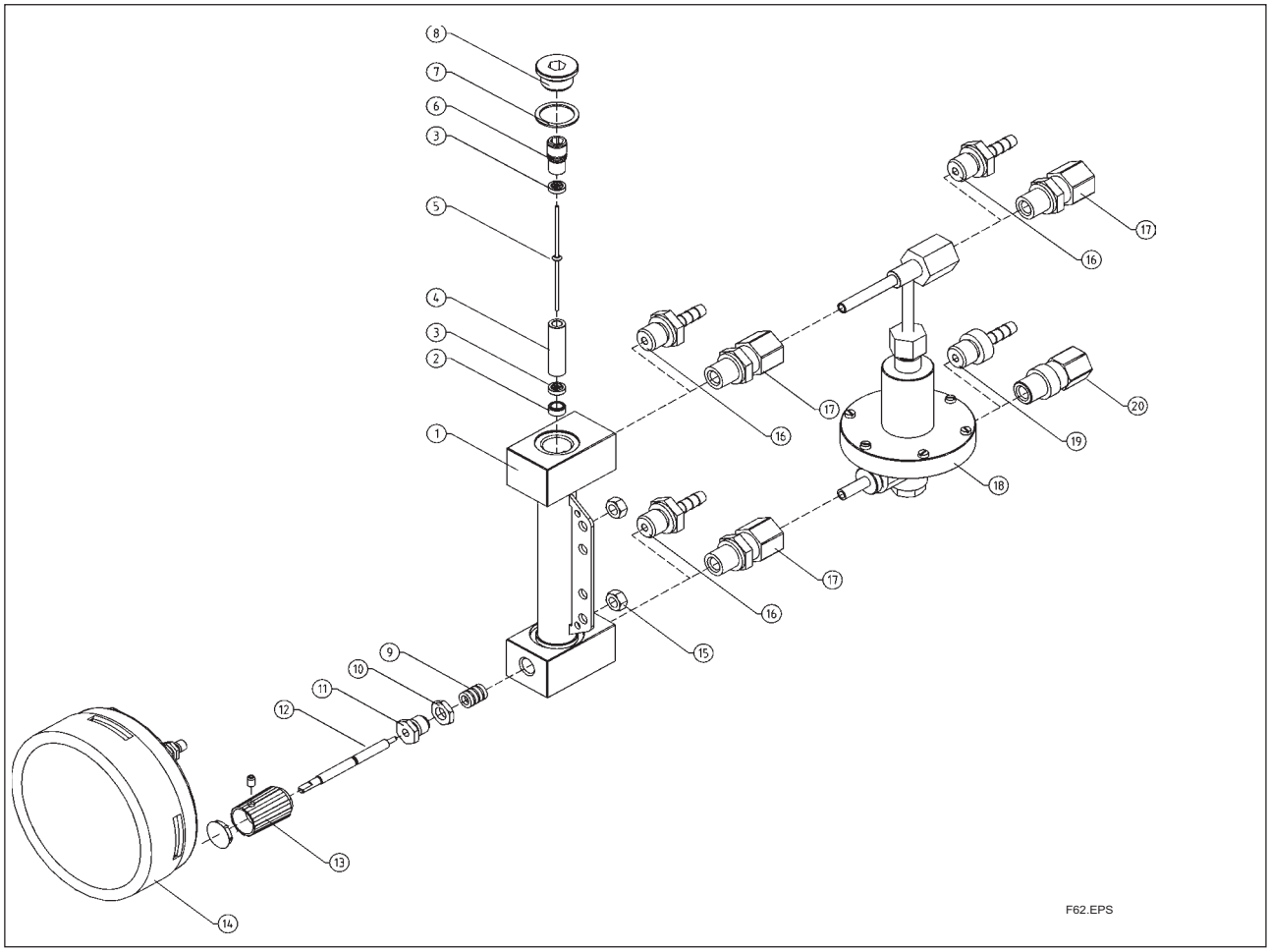

Fig. 6-2 RAKD with valve and

6.4 Electronic transmitter

The electronic transmitter is maintenance-free. The electronic section is sealed and can not be repaired. The transmitter is tuned with the mechanical components in factory, therefore sigle components can be replaced only by loss of accuracy.

6.5 Exchange of scale

Preparations :
- Check commision no., code, and data of new parts.
- Switch off power supply.
- Remove the cover of the indicator

IMPORTANT

Do not bend or twist the pointer on its axis !

Exchange of scale:
- Untighten the screw of the scala.
- Remove the screw and the small cover.
- Pull the scale out of the indicator to the left in which the scale raised on the right to raise it from the 2 pins.
- Shove the new scale correspondingly below the pointer from the left until the 2 pins click into the accompanying holes.
- Establish the small cover and fix the scale with the screw.

Final actions:
- Fix the cover of the indicator.
- Switch power on.
- Check the unit for a faultless function.

6.6 Exchange of indicator

The indicator can be replaced by the same type if the scale of the old unit is put into the new indicator, Procedure with RAKD with electronic transmitter (type "E"):
- Switch off power supply.
- Remove the cover of the indicator
- Disconnect the cables from the Quickon connectors.
- Remove the old scale and put in the new one.

IMPORTANT

- Please not the hints for exchange of schale
- Remove the old indicator from the tube und replace it by the new one.Please take care to mount the washers and spacers in the same positions as they were before dismantling.

6.7 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 acc. fig. 6-3

SIf 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.

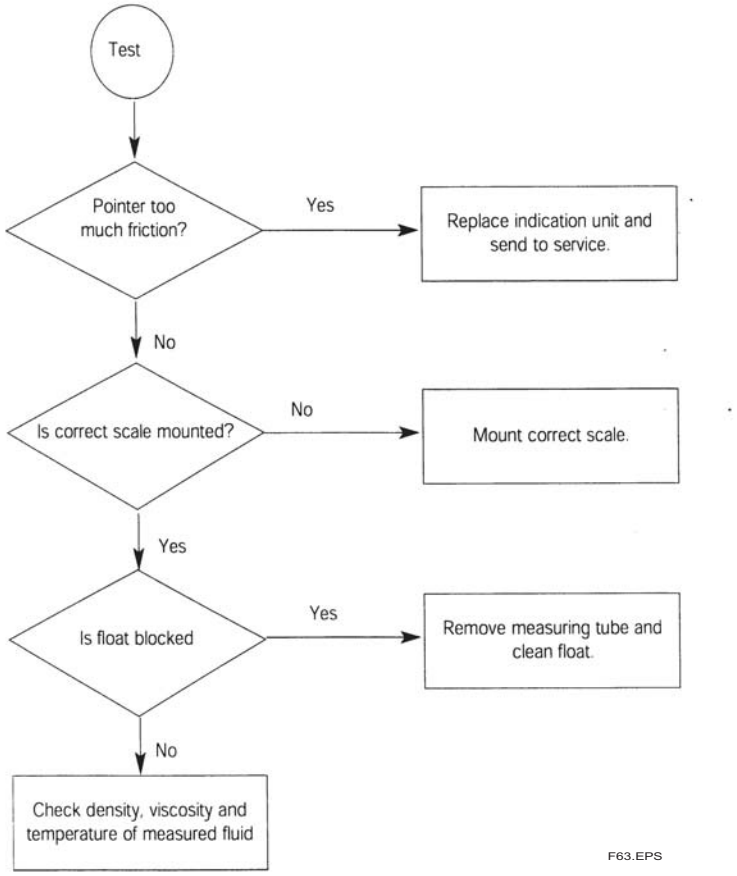

Fig. 6-3

7. Technical Data

7.1 RAKD Type-, Suffix-codes and Options

RAKD with valve and controller (option /R1 and /R3) 1.0 - 100 l/h water / 40 - 3250 l/h air:

R	A	KD			SS					/	options
									80		

Process connection

Internal thread:

Rp 1/4 PN 25	**41** **R3**
1/4 NPT PN 25	**41** **T3**

Cutting ring:

∅ 6 PN 25	**53** **C3**
∅ 8 PN 25	**54** **C3**
∅ 10 PN 25	**55** **C3**
∅ 12 PN 25	**56** **C3**

Swagelok:

∅ 6 PN 25	**53** **W3**
∅ 8 PN 25	**54** **W3**
∅ 10 PN 25	**55** **W3**
∅ 12 PN 25	**56** **W3**

Nozzle:

∅ 6 PN 10	**53** **P1**
∅ 8 PN 10	**54** **P1**

Material: 1.4571	**SS**

Max. Flow

Water (l/h)	Air (l/h)	Cone
1	40	**31**
1.6	60	**32**
2.5	100	**33**
4.0	150	**34**
6.0	200	**37**
10	325	**41**
16	500	**42**
25	800	**43**
40	1400	**44**
60	2000	**47**
100	3250	**51**

Cone	Δp mbar
31-37	6
41-43	8
44-51	11

Version

With valve in inlet

Gasket	Valve seat	
PTFE	Silver	**VSE**
PTFE	PCTFE	**VPE**

With valve in outlet

Gasket	Valve seat	
PTFE	Silber	**VSA**
PTFE	PCTFE	**VPA**

Indicator

Type:

Local indicator	**T**
Indicator with electric output	**E**

Housing type:

Stainless steel	**80**

Power supply:

none, for local indicator „T“	**NNN**
for electric type „E“, 24V DC, 2-wire, 4-20mA	**424**

For calculation to other fluids / process conditions please use our sizing program Durep_V.

T6.EPS

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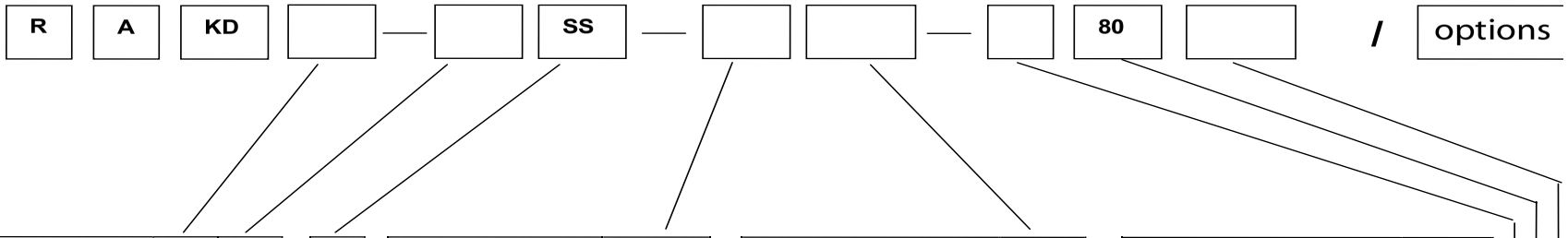
RAKD with valve 1.0 – 250 l/h water / 40 – 8000 l/h air:



Process connection		
Internal thread:		
G 1/4 PN 40	**41**	**G4**
G 1/4 PN 100	**41**	**G6**
1/4 NPT PN 40	**41**	**T4**
1/4 NPT PN 100	**41**	**T6**
Cutting ring:		
∅ 6 PN 40	**53**	**C4**
∅ 6 PN 100	**53**	**C6**
∅ 8 PN 40	**54**	**C4**
∅ 8 PN 100	**54**	**C6**
∅ 10 PN 40	**55**	**C4**
∅ 10 PN 100	**55**	**C6**
∅ 12 PN 40	**56**	**C4**
∅ 12 PN 100	**56**	**C6**
Swagelok:		
∅ 6 PN 40	**53**	**W4**
∅ 6 PN 100	**53**	**W6**
∅ 8 PN 40	**54**	**W4**
∅ 8 PN 100	**54**	**W6**
∅ 10 PN 40	**55**	**W4**
∅ 10 PN 100	**55**	**W6**
∅ 12 PN 40	**56**	**W4**
∅ 12 PN 100	**56**	**W6**
Nozzle:		
∅ 6 PN 10	**53**	**P1**
∅ 8 PN 10	**54**	**P1**

Materila: 1.4571
SS

Max. Flow		Cone
Water (l/h)	**Air (l/h)**	
1	40	**31**
1.6	60	**32**
2.5	100	**33**
4.0	150	**34**
6.0	200	**37**
10	325	**41**
16	500	**42**
25	800	**43**
40	1400	**44**
60	2000	**47**
100	3250	**51**
160	5000	**52**
250	8000	**53**

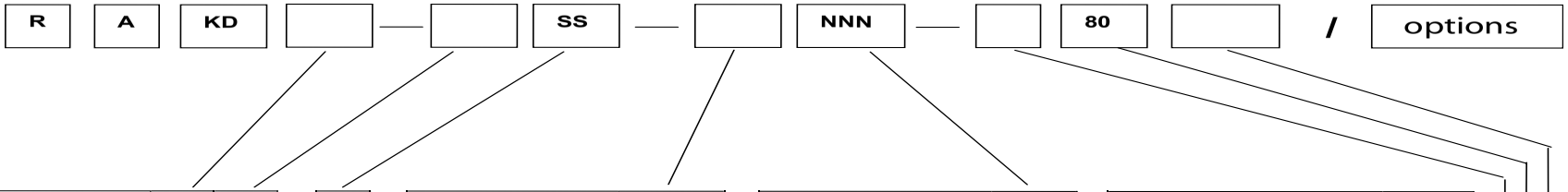
Konus	Δp mbar
31-37	6
41-43	8
44-51	11
52-53	13

Version	
With valve in input	
Gasket / Valve seat	
PTFE / Silver	
PTFE / PCTFE	
With valve in output	
Gasket / Valve seat	
PTFE / Silver	
PTFE / PCTFE	

Indicator	
Type:	
Local indicator	**T**
Indicator with electric output	**E**
Housing type:	
Stainless steel	**80**
Power supply:	
none, for local indicator „T“	**NNN**
for electric type „E“, 24V DC, 2 wire, -20mA	**424**

For calculation to other fluids / process conditions please use our sizing program Durep_V.

RAKD without valve 1.0 – 100 l/h water / 40 – 3250 l/h air:



Process connection		

Flange:		
DN 15 PN 40	01	D4
DN 25 PN 40	02	D4
ANSI ½ 150 lbs	01	A1
ANSI 1 150 lbs	02	A1
ANSI ½ 300 lbs	01	A2
ANSI 1 300 lbs	02	A2

Internal thread:		
G 1/4 PN 100	41	G6
G 1/4 PN 160	41	G7
1/4 NPT PN 100	41	T6
1/4 NPT PN 160	41	T7

Cutting ring:		
∅ 6 PN 100	53	C6
∅ 6 PN 160	53	C7
∅ 8 PN 100	54	C6
∅ 8 PN 160	54	C7
∅ 10 PN 100	55	C6
∅ 10 PN 160	55	C7
∅ 12 PN 100	56	C6
∅ 12 PN 160	56	C7

Swagelok:		
∅ 6 PN 100	53	W6
∅ 6 PN 160	53	W7
∅ 8 PN 100	54	W6
∅ 8 PN 160	54	W7
∅ 10 PN 100	55	W6
∅ 10 PN 160	55	W7
∅ 12 PN 100	56	W6
∅ 12 PN 160	56	W7

Nozzle:		
∅ 6 PN 10	53	P1
∅ 8 PN 10	54	P1

Material: 1.4571
SS

Max. Flow		Cone
Water (l/h)	Air (l/h)	
1	40	31
1.6	60	32
2.5	100	33
4.0	150	34
6.0	200	37
10	325	41
16	500	42
25	800	43
40	1400	44
60	2000	47
100	3250	51

Cone	Δp mbar
31-37	6
41-43	8
44-51	11

Version	
Without valve	NNN

Indicator	

Type:	
Local indicator	T
Indicator with electric output	E

Housing type:	
Stainless steel	80

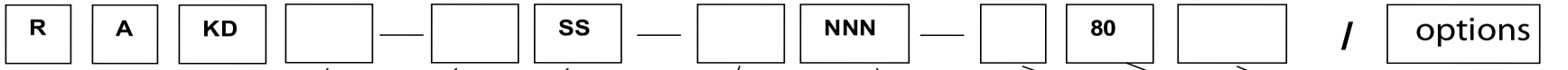
Power supply:	
none, for local indicator „T“	NNN
for electric type „E“, 24V DC, 2-wire, 4-20mA	424

For calculation to other fluids / process conditions please use our sizing program Durep_V.

T8.EPS

IM 01R01B30-00E-E
4th edition, April 2007

RAKD without valve 160 – 250 l/h water / 5000 – 8000 l/h air:



Process connection		

Flange:		
DN 15 PN 40	01	D4
DN 25 PN 40	02	D4
ANSI ½ 150 lbs	01	A1
ANSI 1 150 lbs	02	A1
ANSI ½ 300 lbs	01	A2
ANSI 1 300 lbs	02	A2

Internal thread:		
G 3/8 PN 100	42	G6
G 3/8 PN 160	42	G7
3/8 NPT PN 100	42	T6
3/8 NPT PN 160	42	T7

Cutting ring:		
∅ 12 PN 100	56	C6
∅ 12 PN 160	56	C7

Swagelok:		
∅ 12 PN 100	56	W6
∅ 12 PN 160	56	W7

Material: 1.4571
SS

Max. Flow		Cone
Water (l/h)	Air (l/h)	
160	5000	52
250	8000	53

Cone	Δp mbar
52-53	13

Version	
Without valve	NNN

Indicator	

Type:	
Local indicator	T
Indicator with electric output	E

Housing type:	
Stainless steel	80

Power supply:	
none, for local indicator „T“	NNN
for electric type „E“, 24V DC, 2-wire, 4-20mA	424

T9.EPS

For calculation to other fluids / process conditions please use our sizing program Durep_V.

Options	Option code	Description	Restrictions
Indicator	/A12	US-engineering units	Only for indicator E
Marking	/B1 /B4 /B8 /BG /BD	Tag plate (SS) fixed by wire and marking on scale Neutral version Customer provided marking on label Customer specific notes on scale Dual Scale	Plate 12 x 40 mm; max. 45 digits Not with option /P6 and Ex-proof type Max. 45 digits Adjustment only possible for 1 fluid
Limit switches	/K1 /K2 /K3 /K6 /K7 /K8	MIN-contact MAX-contact MIN-MAX-contact MIN-contact "Fail Safe"- version MAX-contact "Fail Safe"- version MIN-MAX-contact "Fail Safe"- version	 Only for indicator T Only for indicator T
Pulse output	/CP	Pulse output, acc. NAMUR EN50227	Only for indicator E; not with limit switches
Ex-proof type	/KS1 /KS2 /KN1 /CS1 /SS1 /NS1	ATEX intrinsically safe "ia" ATEX gas and dust proof limit switches, category 2G 1D ATEX category 3G "nL" / 3D CSA intrinsic safe approval for limit switches (US+CAN) SAA approval for limit switches (Australia) NEPSI approval (China)	Not for indicator T without limit switches Only for indicator T with limit switches Not for indicator T without limit switch Only for indicator T with limit switches Only for indicator T with limit switches Not for indicator T without limit switches
Test and certificates	/PP /P2 /P3 /P6 /PM1 /PM4 /PM5	Pressure test report measuring system Certificate of Compliance with the order acc. to EN 10204: 2004- 2.1 As /P2 +Test report acc. to EN 10204: 2004- 2.2 Material certificate acc. to EN 10204: 2004- 3.1 PAMI test (1 test point : metering tube) PAMI test (4 test points : metering tube, connection heads, sealing plug) PAMI test (5 test points : metering tube, connection pieces, slip on flanges)	 Only for tube, connection heads, screw sealing plug Only for models with valve Only for models with process connection D4, A1, A2
GOST approvals	/QR1 /QR2	Russian GOST approval Kasachian GOST approval	
Controlller	/R1 /R3	Pre pressure controller 1.4571 (only with valve in inlet; for gas with variable pre pressure and liquids with variable pre and back pressure) Back pressure controller 1.4571 (only with valve in outlet; for gas with variable back pressure)	Only for process connection R3, T3, C3, W3, P1; only with valve Only for process connection R3, T3, C3, W3, P1; only with valve
Power supply for electronic transmitter	/U2F /U3F	SINEAX B811, 85 - 250 V AC, EEx i SINEAX B811, 24 V AC/DC, EEx i	Only for indicator E Only for indicator E
Power supply for limit switch(es) (transmitter relay)	/W1A /W1B /W2A /W2B /W2E /W4A /W4B /W4E	KFA5-SR2-Ex1.W / 115 V AC, 1 channel KFA5-SR2-Ex2.W / 115 V AC, 2 channels KFA6-SR2-Ex1.W / 230 V AC, 1 channel KFA6-SR2-Ex2.W / 230 V AC, 2 channels KHA6-SH-Ex1 / 230 V AC, 1 channel, Fail Safe KFD2-SR2-Ex1.W / 24 V DC, 1 channel KFD2-SR2-Ex2.W / 24 V DC, 2 channels KHD2-SH-Ex1 / 24 V DC, 1 channel, Fail Safe	Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K6 + /K7 + /K8 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K1 + /K2 + /K3 Only for limit switches /K6 + /K7 + /K8
Instruction manuals	/IEn /IDn /IFn	Quantity of instruction manuals in English Quantity of instruction manuals in German Quantity of instruction manuals in French	n = 1 to 9 selectable *) n = 1 to 9 selectable *) n = 1 to 9 selectable *) *) if no instruction manual is selected, only a CD with instruction manuals is shipped with the flowmeter

7.2 Specifications

STANDARD SPECIFICATIONS

The responsiblity with respect to the suitability and according application of our flowmeter is only situated by the customer.

METERING TUBES

Materials of wetted parts : Stainless steel AISI 316Ti (1.4571)
other materials on request
Fluids to be measured : Liquid or gas
Measuring range : see flow table
Measuring range ratio : 10:1
Process connections :
– Inner thread : G 1/4; 1/4 NPT; G 3/8; 3/8 NPT
– Cutting ring : 6 mm; 8 mm; 10 mm; 12 mm
– Cutting ring (Swagelok) : 6 mm; 8 mm; 10 mm; 12 mm
– Nozzle : 6 mm; 8 mm
– Flange : - acc. EN 1092-1
DN15 and DN25 PN40;
- acc. ASME B 16.5 ½" and 1"
150lbs, 300lbs
Process pressure : depends on process connection; see model code
Process temperature : without valve -25°C to 250°C
with valve -25°C to 150°C
See also fig. 6. Lower temperatures on request.
Accuracy : class 4 acc. VDI/VDE 3513
± 4% f.s.
Installation :
– Installation position : vertical
– Flow direction : upwards
– Face to face length : 125 mm (with flange 250 mm)
Weight : see table 9
Process-/ Ambient temperature
: see fig. 6

LOCAL INDICATOR

(Indicator/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.
Indication scale : Flow units
Housing
– Material : Stainless steel AISI 304 (1.4301)
– Protection : IP 65
Transportation and storage condition
: - 40°C to +110°C

ELECTRONIC TRANSMITTER

(Indicator/Code -E)
Temperature range : -25°C to 65°C
Transportation and storage condition :
: - 40°C to +70°C
Power supply : 13.5-30 V DC
Load resistance : (U-13.5V) /20mA
Analog output : 4-20 mA
Linearity : ≤ ± 0.25% f.s.
Hysteresis : ≤ ± 0.15% f.s.
Repeatability : ≤ ± 0.16% f.s.
Influence of power supply : ≤ ± 0.1% f.s.
Temp. coefficient of analog output
: ≤ ± 0.5% /10 K f.s.
AC-part of analog output : ≤ ± 0.15% f.s.
Long time stability : ≤ ± 0.2% / year
Maximum output current : 21.5 mA
Output current in case of failure
: ≤ 3.6 mA (NAMUR NE 43)
Response time (99%) : appr. 1 s
Electrical connection : QUICKON
- Cable diameter : 4-6 mm
- Cable cross section : 0.34 to 0.75 mm²
Pulse output (Option /CP) : Electronic switch with galvanic isolation
acc. EN 60947-5-6 (NAMUR)
- Pulse length : 200 ms
- Max. frequency : 4 Hz
- Pulse rate : Qmax ≤ 1 → 0.0001
: 1 < Qmax ≤ 10 → 0.001 etc.
e.g.. Qmax = 1 m3/h →
1 Puls = 0.0001 m³ = 0.1 l

POWER SUPPLY FOR ELECTRONIC TRANSMITTER

(Option /U__)
Type : power supply with galvanically separated input and output
SINEAX B811
Supply voltage : 24 V to 60 V AC/DC
85 V to 230 V AC
Maximum load : 750 Ω
Output signal : 0/4 mA - 20 mA

LIMIT SWITCHES IN STANDARD VERSION

(option /K1 to /K3)
Type : Inductive proximity switch SC2-NO
acc. DIN EN 60947-5-6
Nominal voltage : 8V DC
Output signal : ≤ 1 mA or ≥ 3 mA
Hysteresis : < 0.5mm

LIMIT SWITCHES IN FAIL SAFE VERSION

(option /K6 to /K8)
Type : Inductive proximity switch SJ2-SN
acc. DIN EN 60947-5-6
Nominal voltage : 8V DC
Output signal : ≤ 1 mA or ≥ 3 mA
Hysteresis : < 0.5mm

POWER SUPPLY FOR LIMIT SWITCHES

(Option /W__)
Type : Transmitter relay
acc. DIN EN 50227 (NAMUR)
- KFA6-SR2-Ex1-W (230 VAC)
- KFA5-SR2-Ex1-W (115 VAC)
- KFD2-SR2-Ex1-W (24 V DC)
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. 250V AC, max. 2 A

SWITCHING LEVELS FOR LIMIT SWITCHES

Table 7-1

		SC 2-N0		SJ 2-SN		
Function	Pointer	Switch	Signal	Switch	Signal	Fail safe
MAX	above GW below GW	on off	1mA 3mA	on off	1mA 3mA	1mA
MIN	above GW below GW	off on	3mA 1mA	off on	3mA 1mA	1mA

GW = limit T1.EPS

CONTROLLER (Option /R1 and /R3)

Differential pressure controller for a constant flow at fluctuations of the process pressure.
These are no valves to reduce the pressure.

- **Controller /R1** for liquids with variable inlet or outlet pressure and for gases with variable inlet pressure and constan back pressure.
- **Controller /R3** for gases with fluctuations of the back pressure.

Max. liquid flow : 100 l/h
Max. gas flow : 3250 l/h
Max. pressure : 25 bar
Recommended differential pressure : >400 mbar
Temperature range : -25°C to + 80°C
Materials

	Housing	Diaphragm	Springs
R1 / R3	CrNi-Steel	PTFE	CrNi-Steel

T5.EPS

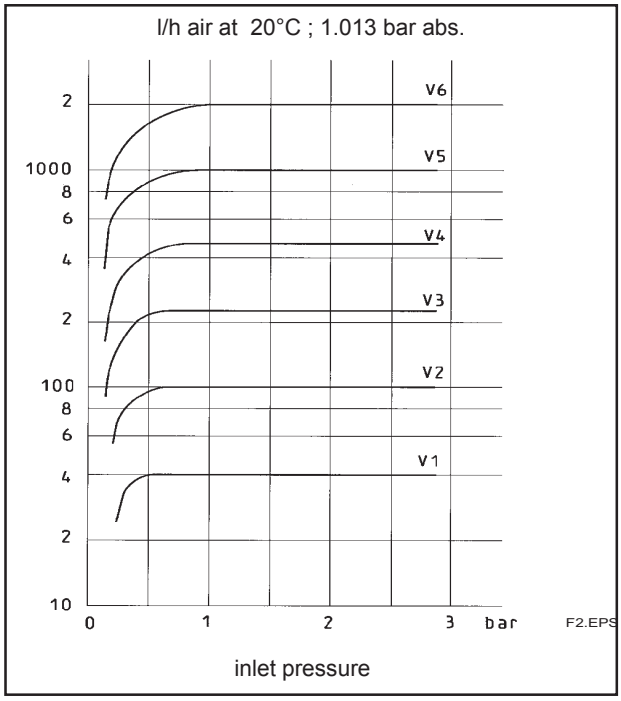


Fig. 7-1 Diagram controller characteristic

HAZARDOUS AREA SPECIFICATIONS

RAKD with ATEX- certification "intrinsic safe" (Option /KS1)

Certificate :
KEMA 00ATEX 1037X
Output signal :
4–20 mA
Explosion proof :
EEx ia IIC T6; group II ; category 2G

Entity parameter :
Table 7-2

	Analog output	Puls output	Limit switch Type 2	Limit switch Type 3
Ui [V]	30	16	16	16
Ii [mA]	100	20	25	52
Pi [mW]	750	64	64	169
Li [mH]	0.73	0	0.15	0.15
Ci [nF]	2.4	0	150	150

Tex1.EPS

Temperature specification :
Version 1: RAKD with indicator "T" and limit switch type 2 :
Table 7-3

Temperature class	T6	T5	T5	T4	T4
Max. ambient temperature	65°C	80°C	59°C	100°C	73°C
Max. process temperature	65°C	80°C	100°C	100°C	135°C

Tex2.EPS

Version 2: RAKD with indicator "T" and limit switch type 3::
Table 7-4

Temperature class	T6	T5	T5	T4	T4	T4
Max. ambient temperature	24°C	37°C	34°C	57°C	54°C	48°C
Max. process temperature	65°C	80°C	100°C	80°C	100°C	135°C

Tex3.EPS

Version 3 : RAKD with indicator "E" and with or without limit switch type 2 :
Table 7-5

Temperature class	T6	T5	T5	T4
Max. ambient temperature	65°C	50°C	45°C	38°C
Max. process temperature	65°C	80°C	100°C	135°C

Tex4.EPS

Version 4 : RAKD with indicator "E" with limit switch type 3:
The smaller environmental temperature must be found according to the available temperature class and the maximum process temperature from table 4 and 5.

RAKD "non incendive" (Option /KN1)

Type "n" (non incendive) acc. EN 60079-15.
Explosion proof :
EEx nL IIC T6 protection „nL"; group II ; category 3G
Dust proof :
EEx II 3D; group II ; category 3D
Max. surface temperature : 80°C
Entity parameter :
table 7-6

	Analog output	Pulse output /CP	Limit switch SC2-N0, /K1...3	Limit switch SJ2-SN, /K6...8
Ui [V]	30	16	20	20
Ii [mA]	100	20	25	25
Pi [mW]	750	64	64	64
Li [µH]	730	0	150	100
Ci [nF]	2,4	0	150	30

T12.EPS

RAKD with NEPSI- certification “intrinsic safe” (China) (with /NS1) :

Certificate :
GYJ05153
Output signal :
4–20 mA
Explosion proof :
Ex ia IIC T6
Max. Tamb. :
65°C
Entity parameter of electronic transmitter :
see ATEX in table 2
Limit switches :
option /K1 to /K8
Entity parameter of limit switches :
see certificate NEPSI GYJ06542X

Intrinsically safe and dust proof limit switches with ATEX-certification (only for indicator T with option /K1 .. /K8 with /KS2) :

Certificate :
- PTB 99 ATEX 2219X (SC2-NO)
- PTB 00 ATEX 2049X (SJ 2-S.N)
- ZELM 03 ATEX 0128X (for dust proof)

Explosion proof :
EEx ia IIC T6, group II category 2G
Dust proof:
EEx iaD 20 T 108 °C, group I I category 1D
Max. surface temperature : T108°C
Entity parameter :
see certificate of conformity

Intrinsically safe limit switches with SAA-certification (Australia)(only for indicator T with option /K1 .. /K8 with /SS1) :

Certificate :
AUS Ex 02.3838X
Explosion proof :
Ex ia IIC T1 ... T6
Entity parameter :
see certificate of conformity

Intrinsically safe limit switches with CSA-certification (USA + Canada) (only for indicator T with option /K1 .. /K8 with /CS1) :

Certificate :
1007121 (LR 96321-2)
Explosion proof :
Cl. I, Div. 1, Grp A, B, C, D
Cl. II, Div. 1, Grp. E, F, G
Cl. III, Div. 1
or
Class I, Zone 0, Gp. IIC T6 (Ta = 60°C)
Entity parameter :
see FM-control drawing 116-0165b

Power Supply for the intrinsically safe electronic transmitter (option /U__)

Type : Intrinsically safe power supply with galvanically separated input and output - SINEAX B811
Certificate : PTB 97 ATEX 2083
Supply voltage : - 24 V to 60 V AC/DC
- 85 V to 230 V AC
Maximum load impedance : 750 Ω
Output signal : 0/4 mA - 20 mA
Control circuit : Intrinsically safe [EEx ia] IIC group II, category (1)G
Entity parameters : see fig 5 or certificate

Power supply for intrinsically safe limit switches (option W__)

Type : - KFA6-SR2-Ex1-W (230 V AC)
- KFA5-SR2-Ex1-W (115 V AC)
- KFD2-SR2-Ex1-W (24 V DC)

Certificate : - PTB 00 ATEX 2081 (115/230 V AC)
- PTB 00 ATEX 2080 (24 V DC)

Control circuit : [EEx ia] IIC; group II ; category (1)GD
Entity parameter : see fig 3 or certificate

7.3 Dimensions and weights

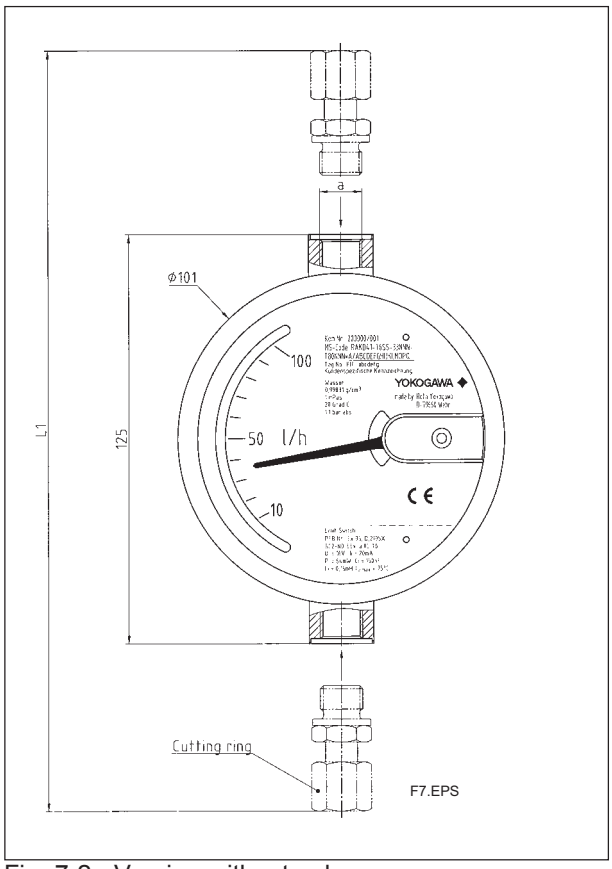


Fig. 7-2 Version without valve

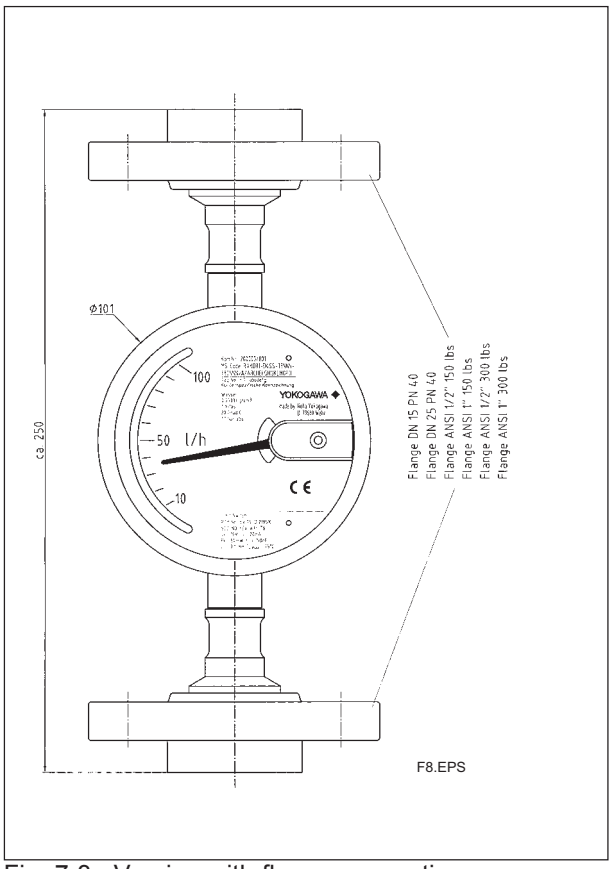


Fig. 7-3 Version with flange connection

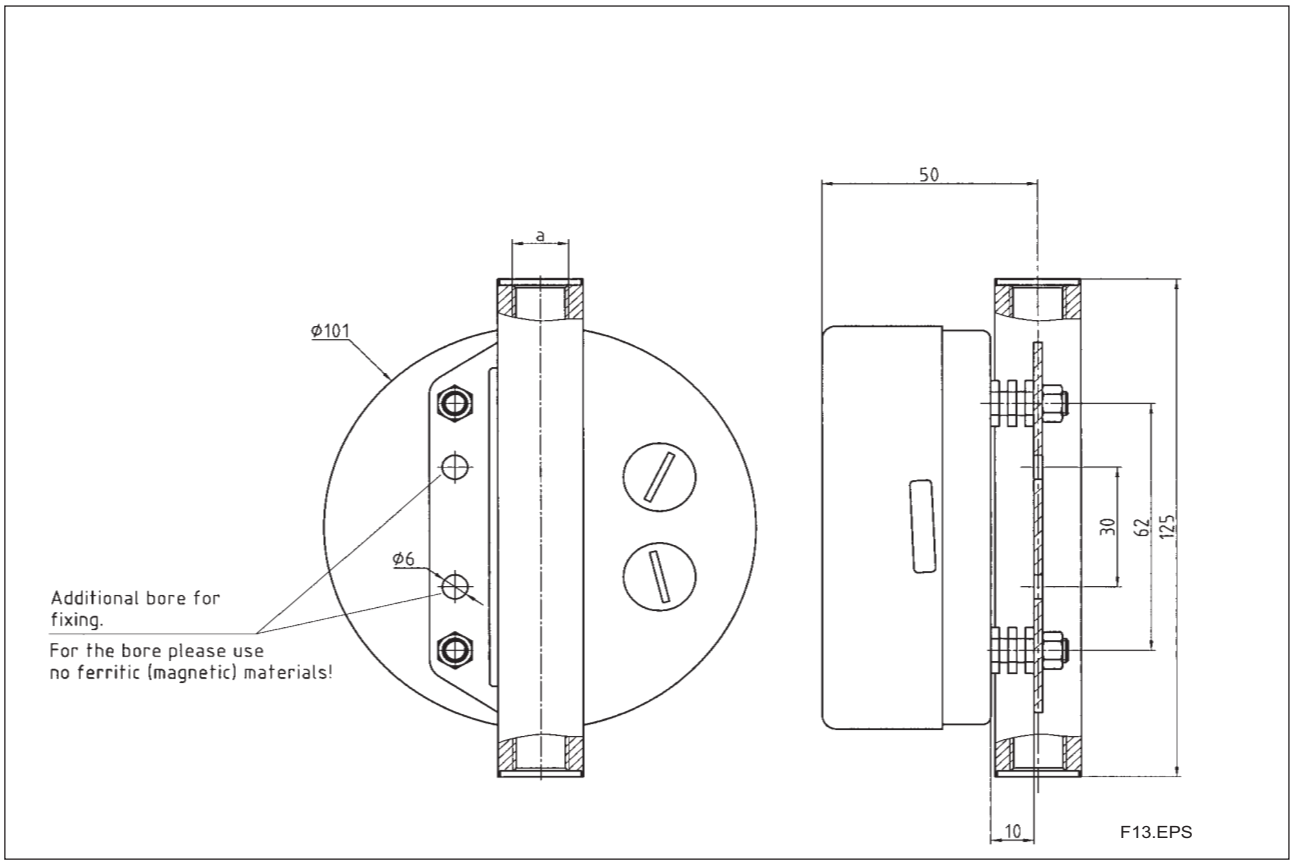


Fig. 7-4 Back view with mounting

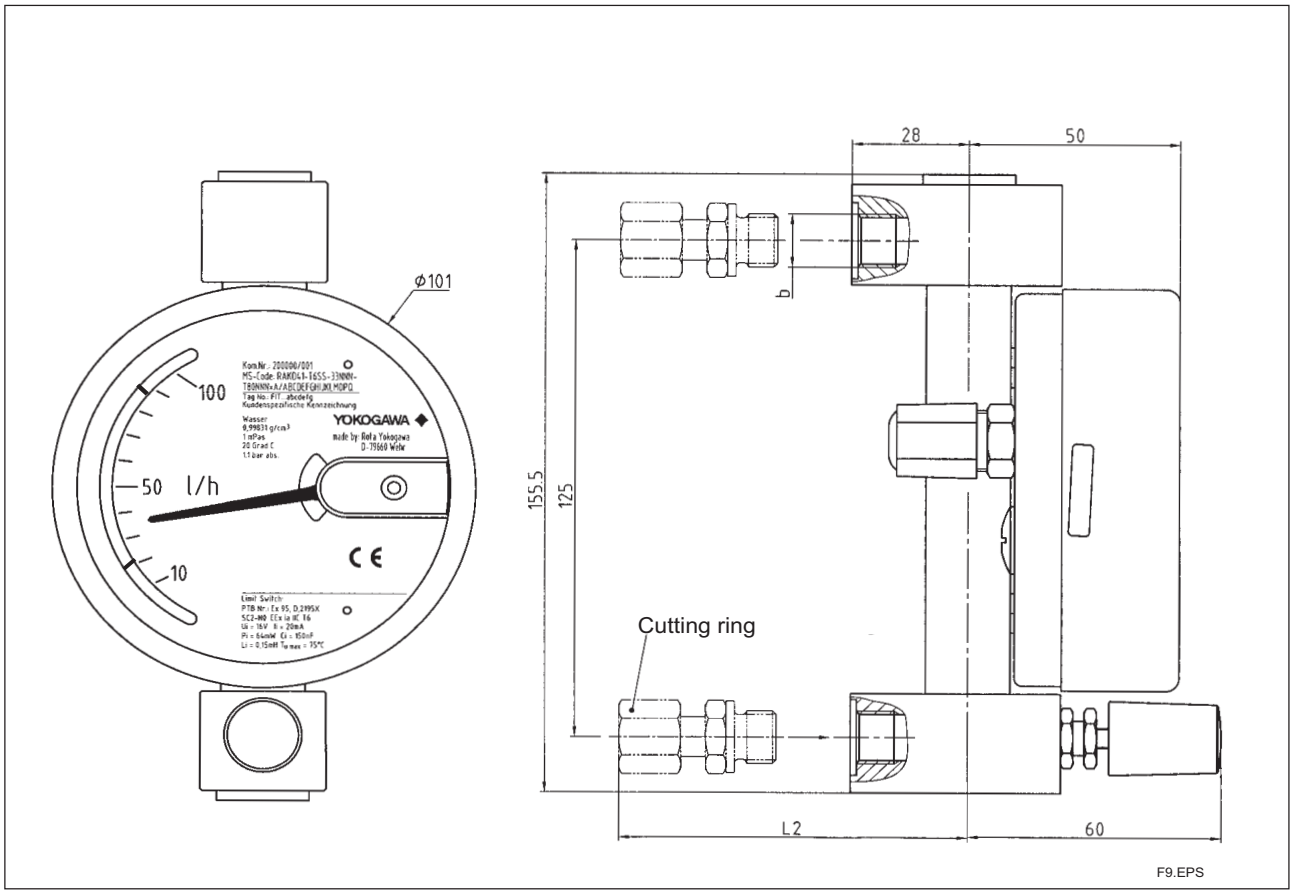


Fig. 7-5 Version with inlet valve

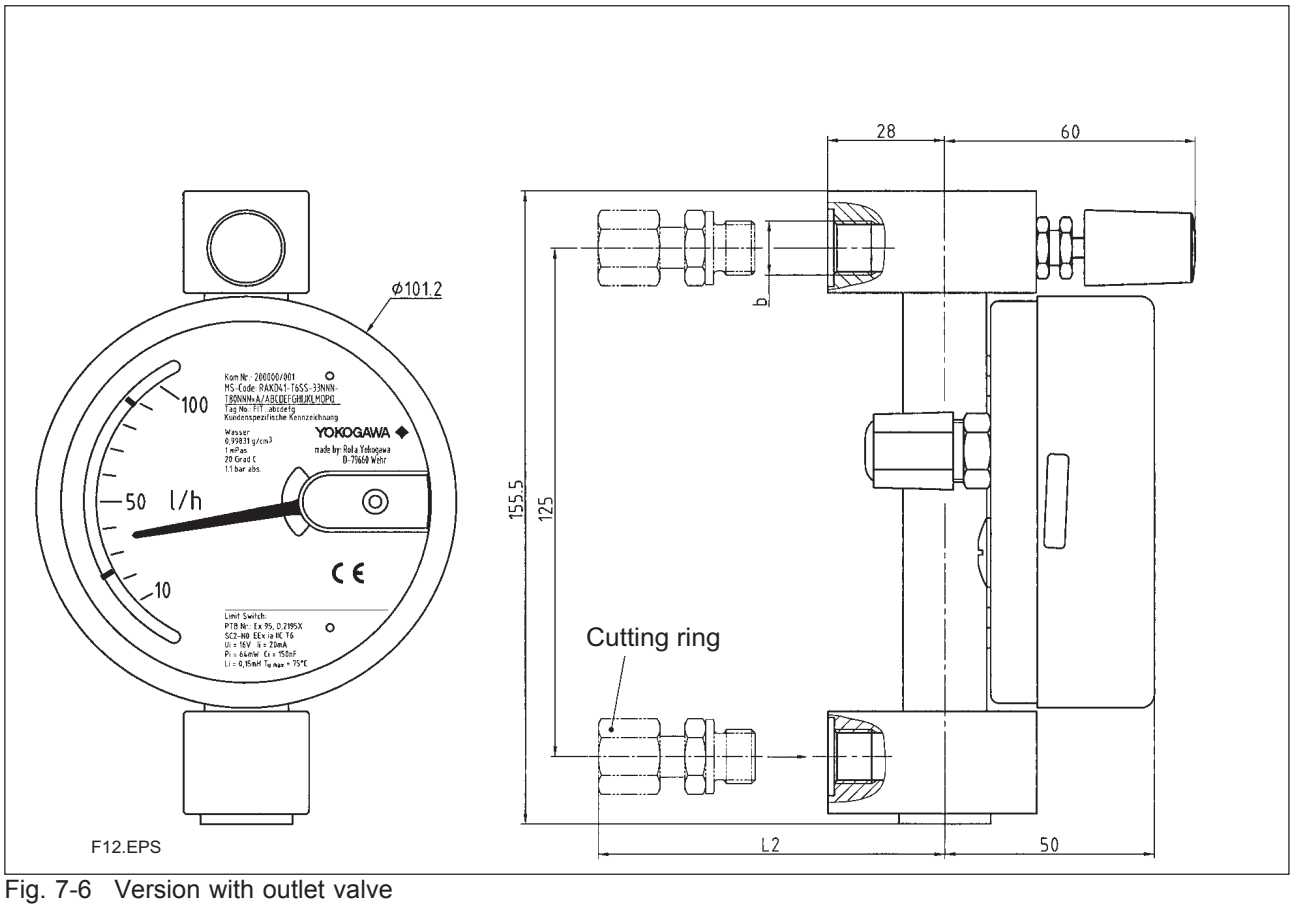


Fig. 7-6 Version with outlet valve

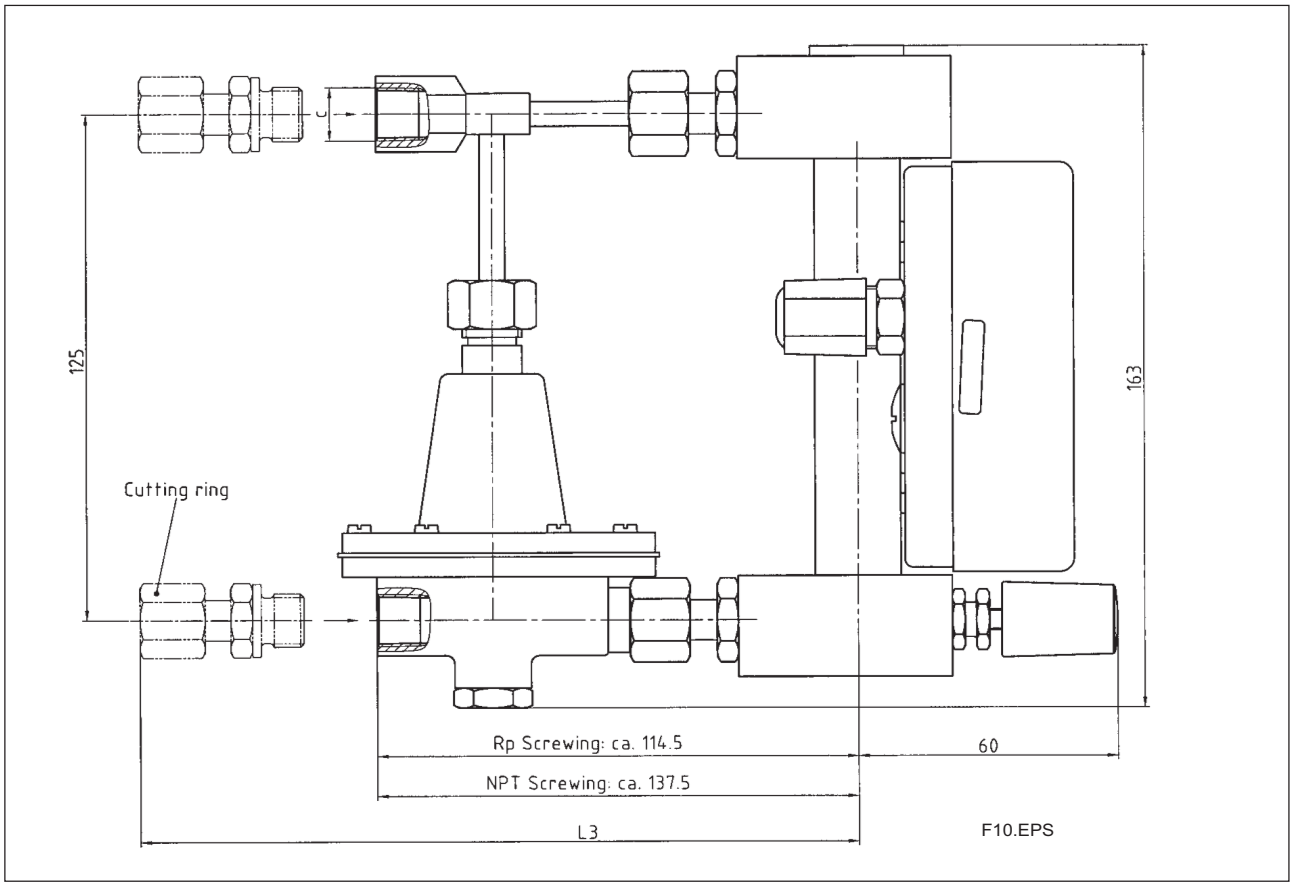


Fig. 7-7 Version with inlet valve and inlet controller

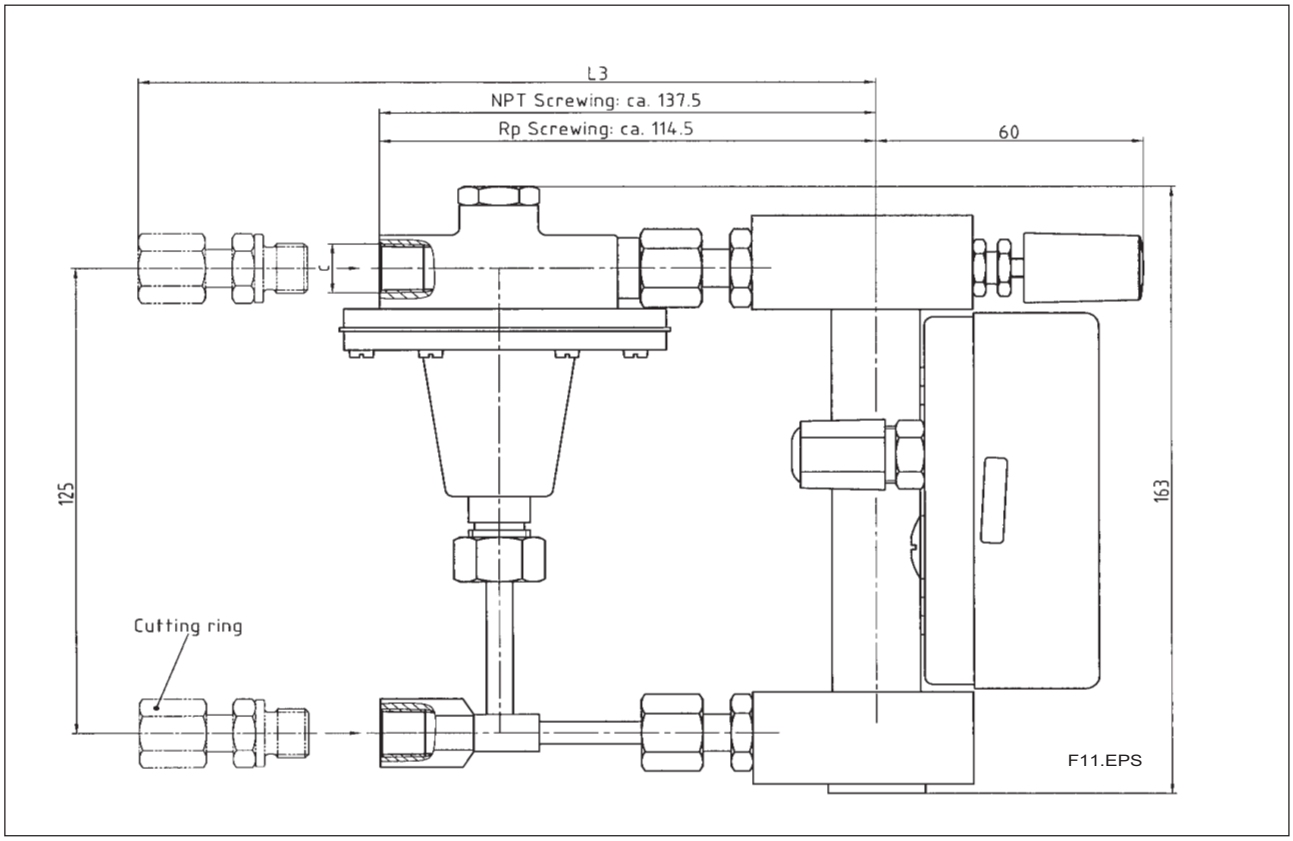


Fig. 7-8 Version with outlet valve and back pressure controller

CONNECTION TYPES

TABLE 7-7

Size	a		b	c
	Cone 31-51	Cone 52-53	Cone 31-53	Cone 31-51
Thread	G 1/4	G 3/8	G 1/4	Rp 1/4
	1/4 NPT	3/8 NPT	1/4 NPT	1/4 NPT

T2.EPS

INSTALLATION LENGTHS DEPENDING ON CONNECTION TYPE AND SIZE

TABLE 7-8

Size		L1		L2	L3
Process connection	**NW**	**Cone 31-51**	**Cone 52-53**	**Cone 31-53**	**Cone 31-51**
Cutting ring	6 mm	178 mm	----	54.5 mm	142.5 mm
	8 mm	172 mm	----	51.5 mm	139.5 mm
	10 mm	174 mm	----	52.5 mm	140.5 mm
	12 mm	174 mm	177 mm	52.5 mm	140.5 mm
Nozzle	6 mm	182 mm	----	56.5 mm	144.5 mm
	8 mm	182 mm	----	56.5 mm	144.5 mm

T3.EPS

WEIGHTS

TABLE 7-9

	without valve	**with valve**	**with controller**
Weight	approx. 600g	approx. 1000g	approx. 1800g

T4.EPS

7.4 Temperatue curves

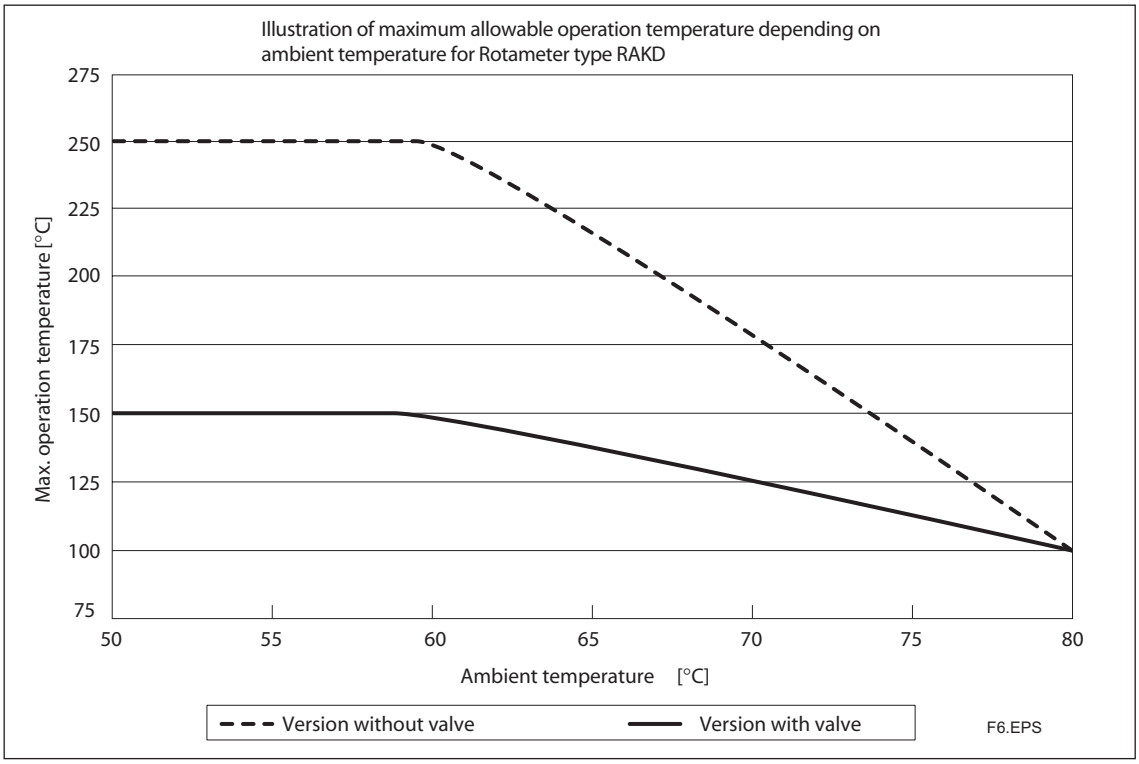


Fig. 7-9. For option /KS1 or /KN1 (Ex-version) the maximum values for ambient and process temperature according to the respective temperature class mentioned in fig. 3-3 and tables 7-2 to 7-5 must be regarded. The minimum ambient temperature is -25°C. Lower temperatures on request.

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8. Explosion-protected Type Instruments

8.1 General

WARNING

To ensure intrinsically safety, it is not permitted to repair or to modify the electronic transmitter and the limit switches

The RAKD with electronic transmitter type "E" as well the limit switches (option/ K_) is an intrinsically safe device. The RAKD (option /KS1) is ATEX certified for hazardous areas of zone 1 (category 2) and zone 2 (category 3). It is not homologated for zone 0 areas (category 1) (option /KS1 for category 2 and 3, option / KN1 only for category 3). The classification in brackets is given according to the EU regulation ATEX, 94/9/EG.

The limit switches but not the electronic transmitter are ATEX dust proof certified (option/KS2).

The RAKD with electronic transmitter type "E" as well as the limit switches (option/ K_) are also NEPSI certified for China (option /NS1)

The limit switches are also certified for USA and Canada by CSA (option /CS1) and for Australia by SAA (option /SS1).

The RAKD must be connected to an intrinsically safe, certified power supply with a maximum voltage and output power below the maximum values of the RAKD (refer to Technical data, section 7). The combined internal inductance and capacity of the RAKD 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. Power supply and transmitter relay are assigned devices and should be installed outside any hazardous zone.

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, section 7).

To ensure intrinsically safety, it is not permitted to repair or modify the measuring transmitter.

8.2 Intrinsically safe ATEX certified RAKD (/KS1)

8.2.1 Technical data

EC-Type Examination Certificate Nr.: KEMA 00ATEX1037X

The RAKD with electronic transmitter and limit switches 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).

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

CE 0344 Ex II 2 G

Data of electronic transmitter type -E :

Type of protection : Intrinsically safe EEx ia IIC T6
Ambient temperature : -25°C ... +65°C
Safety relevant maximum values:
Supply (current output):
- Maximum voltage : U_i = 30 V
- Maximum current : I_i = 100 mA
- Maximum power : P_i = 750 mW
- Inner inductance : L_i = 0.73 mH
- Inner capacity : C_i = 2.4nF

Pulse output:
- Maximum voltage : U_i = 16 V
- Maximum current : I_i = 20 mA
- Maximum power : P_i = 64 mW
- Inner inductance : L_i = 0 mH
- Inner capacity : C_i = 0nF

Data of limit switches :

Type of protection : Intrinsically safe EEx ia IIC T6
Safety relevant maximum values:

		Type 2	Type 3
Maximum voltage	: U_i =	16 V	16V
Maximum current (IIC)	: I_i =	25 mA	52 mA
Maximum power	: P_i =	64 mW	169 mW
Inner inductance	: L_i =	0.15 mH	0.15 mH
Inner capacity	: C_i =	150nF	150nF

Temperature specification:

Version 1: RAKD with indicator “T” and limit switch type 2 :
Table 1

Temperature class	T6	T5	T5	T4	T4
Max. ambient temperature	65°C	80°C	59°C	100°C	73°C
Max. process temperature	65°C	80°C	100°C	100°C	135°C

Tex2.EPS

Version 2: RAKD with indicator “T” and limit switch type 3::
Table 2

Temperature class	T6	T5	T5	T4	T4	T4
Max. ambient temperature	24°C	37°C	34°C	57°C	54°C	48°C
Max. process temperature	65°C	80°C	100°C	80°C	100°C	135°C

Tex3.EPS

Version 3 : RAKD with indicator “E” and with or without limit switch type 2 :
Table 3

Temperature class	T6	T5	T5	T4
Max. ambient temperature	65°C	50°C	45°C	38°C
Max. process temperature	65°C	80°C	100°C	135°C

Tex4.EPS

Version 4 : RAKD with indicator “E” with limit switch type 3:
The smaller environmental temperature must be found according to the available temperature class and the maximum process temperature from table 2 and 3.

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 transmittes as specified above.
For example the type SINEAX B811 (option (U__) according certificate PTB 97 ATEX 2083 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.

8.2.2 Installation

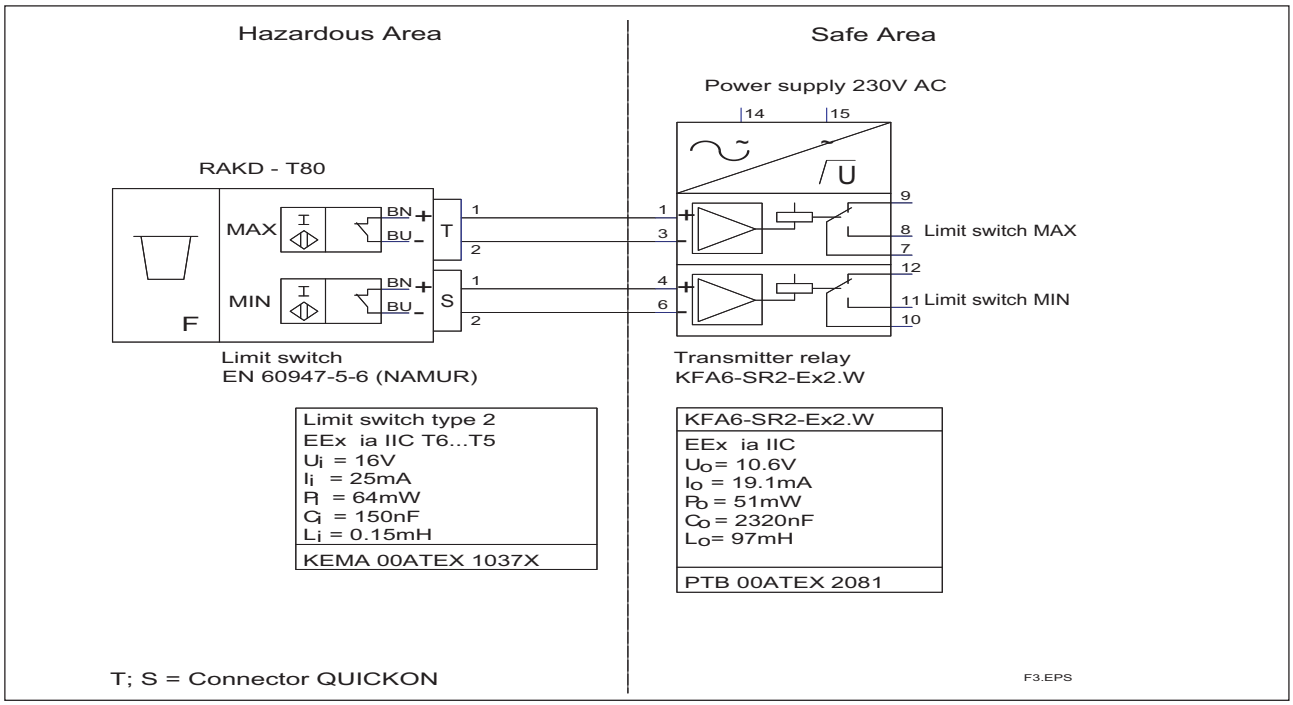


Fig. 8-1 Ex-Version acc. ATEX (Option /KS1) with 2 limit switches and transmitter relay

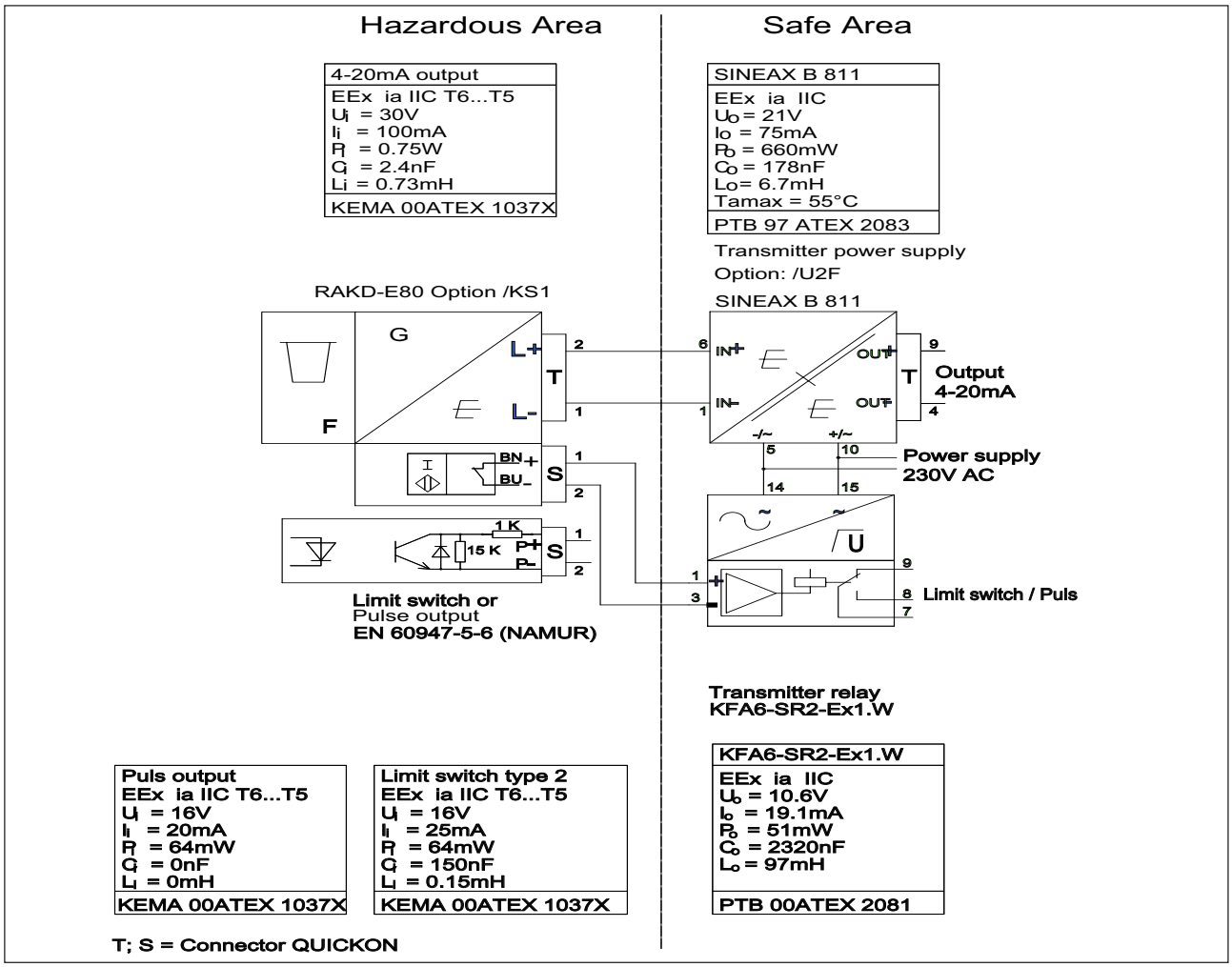


Fig. 8-2 Ex-Version acc. ATEX (Option /KS1) with electronic transmitter in combination with power supply and additional limit switch oe pulse output with transmitter relay

8.3 Non incendive RAKD for Category 3 (ATEX) (/KN1)

Der RAKD with /KN1 is a unit with protection „nL".
It may be used in hazardous areas of zone 2 (category 3)
The classification in brackets is given according to the EC regulation ATEX, 94/9/EG.
This version is same hardware as intrinsically safe type.

Protection : EEx nL IIC T6 X
n = non incendive
L = unit with limited energy

Explosion proof : EEx nL IIC T6 X protection „n"; group II ; category 3GD

Marking :

CE 0344 Ex II 3 GD

Ambient temperature : -25 °C < Ta < 65 °C :

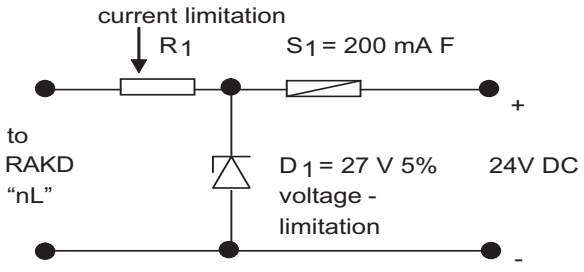
Entity parameter :

Table 8-5

	Analog output	Pulse output /CP	Limit switch SC2-N0, /K1...3	Limit switch SJ2-SN, /K6...8
Ui [V]	30	16	20	20
Ii [mA]	100	20	25	25
Pi [mW]	750	64	64	64
Li [µH]	730	0	150	100
Ci [nF]	2,4	0	150	30

T12.EPS

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



P_o = 0.7 W
I_o = 100 mA
U_o = 28.35 V
C_o = 260 nF
L_o = 8.0 mH
R_1 = 300 Ω, 5%, 3W

F1.EPS

8.4 Dust proofed limt switches (ATEX) (/KS2)

Certification by Pepperl & Fuchs :
EC-Type Examination Certificate Nr.: ZELM 02 ATEX 0128X
Identification in accordance with regulation 94/9/EG (ATEX) :

II 1 D

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").

8.5 Intrinsically safe SAA (Australia) certified limit switches (/SS1)

Certification by Pepperl & Fuchs :

Certificate No. : AUS Ex 02.3838X
Identification : Ex ia IIC T1...T5

The SAA- certified limit switches are only available if ordered without electronic transmitter (only with housing type "T").

8.6 Intrinsically safe CSA (USA + Canada) limit switches (/CS1)

The limit switches are intrinsically safe devices. They are certified by Pepperl & Fuchs for:
Intrinsically safe : Cl. I, Div. 1, GP. A, B, C, D
Cl. II, Div. 1, GP. E, F, G
Cl. III, Div. 1
or
Class I, Zone 0, Groups IIC T6 (Ta=60°C)
Non incendive: Cl. I, Zone 2, GP. IIC, IIB, IIA (Ta=50°C) T5
Cl. I, Div. 2, GP. A, B, C, D
Cl. II, Div. 1, GP. E, F, G
Cl. III, Div. 1 hazardous locations

Maximum Entity Field Wiring Parameters :

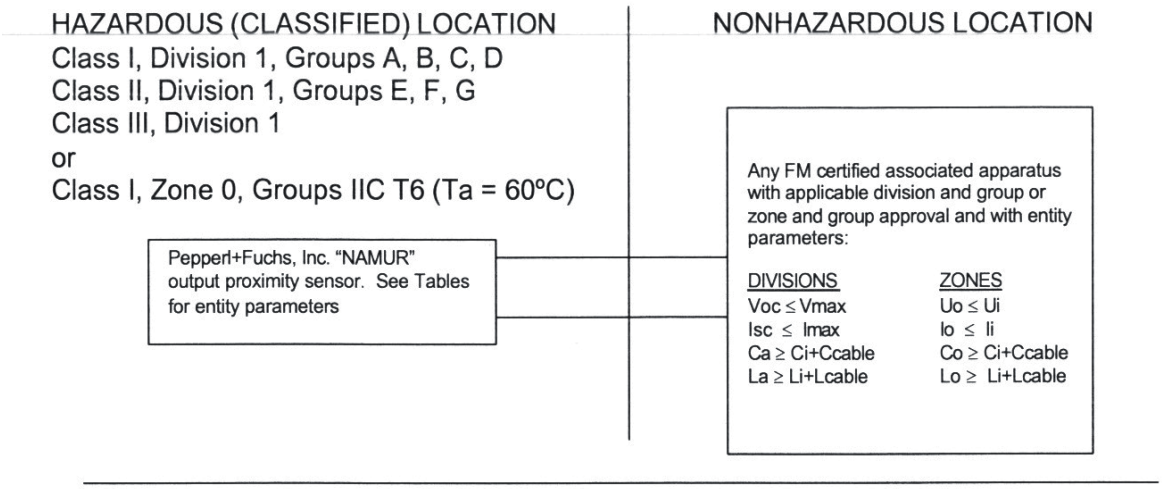
	Standard /K1... /K3	Fail Safe /K6 ... /K8
U_i [V]	16	16
I_i [mA]	25	25
P_i [mW]	34	34
C_i [nF]	150	30
L_i [µH]	150	100
max. ambient temp. [°C]	60	60

T104.EPS

The CSA- certified limit switches are only available if ordered without electronic transmitter (only with housing type "T").

Control Drawings

Limit switches intrisically safe



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.

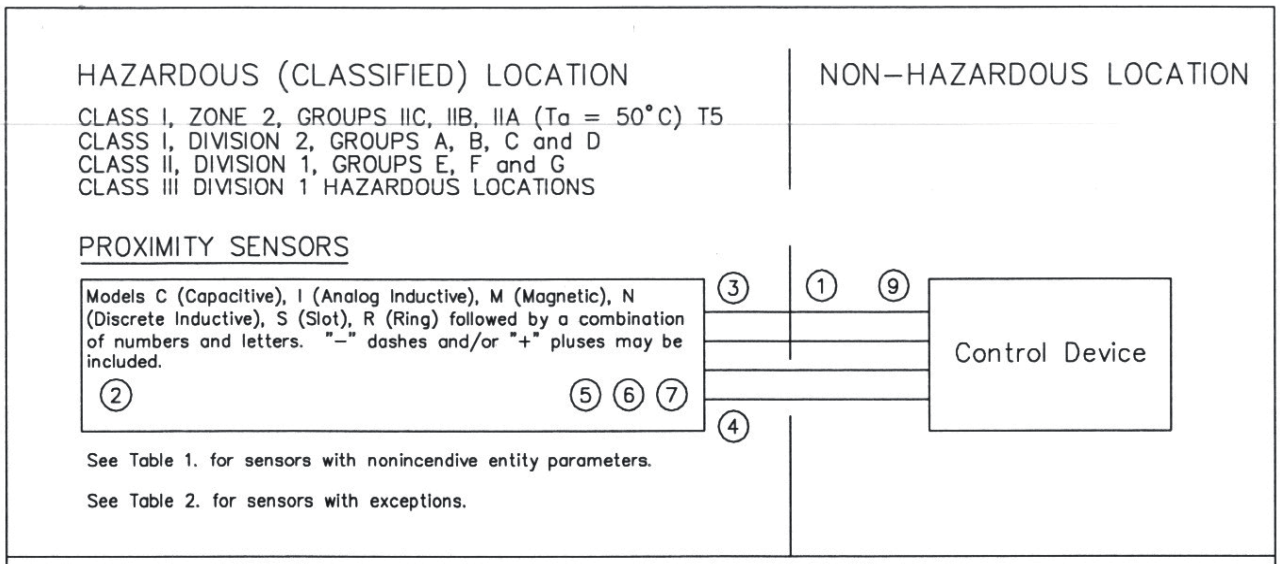
4. Note associated apparatus with only Zone 1 approved connections limits the mounting of the sensors to Zone 1.

5. 'a' in model number indicates option not affecting safety.

6. 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.

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 valid production documentation!			scale: 1:1	date: 2003-Jul-01
PEPPERL+FUCHS	Control Drawing	change notice	respons.	US.GMF	116-0165b
	NAMUR SENSORS – FM	150- 0192	approved	US.MPU	
Twinsburg			norm	US.WDB	sheet 1 of 7

Limit switches nonincendive



NOTES:

(1) Wiring methods must be in accordance with the National Electrical Code, ANSI/NFPA 70, Article 501-4(b) for Class I, Division 2; 502-4(a) for Class II, Division 1; 502-4(b) for Class II, Division 2; 503-3(a) for Class III, Division 1; 503-3(b) for Class III, Division 2. Zone 2 wiring requirements are equivalent to Division 2 wiring requirements. See manufacturer's instructions for connection of devices and electrical data.

(2) 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).

(3) 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 CONNECT OR DISCONNECT WHILE CIRCUIT IS LIVE UNLESS LOCATION IS KNOWN TO BE NONHAZARDOUS.

(5) The relay outputs of a proximity sensor must be supplied by a nonincendive source.

(6) Sensitivity adjustment should only be done when the area is known to be nonhazardous.

(7) A temperature rating of T5 applies for all nonincendive proximity sensors.

(8) The Entity Concept allows interconnection of nonincendive circuits with a nonincendive source when the approved values of Voc and Isc of the nonincendive source are less than or equal to Vmax and Imax of the nonincendive circuit and the approved values of Ca and La for the nonincendive source are greater than Ci + Ccable and Li + Lcable, respectively, for the nonincendive circuit.

(9) All Nonincendive sources must be FM approved.

TABLE 1 - NONINCENDIVE PARAMETERS (8)

MODEL NUMBER	Vmax (V)	Imax (mA)	C_i (UF)	L_i (mH)
NJ2-12GM40-E2	60.0	200	0	0
NJ5-18GM50-E2	60.0	200	0	0

TABLE 2 - EXCEPTIONS

MODEL NUMBER	RESTRICTION
NBN3-F25-E8	Do not use in a Class I, Division 1, Group E Hazardous Location

Certification Status			
Agency		Pending	Final
FM	X		X
CSA			
UL			

						Product Part No.		Title Control Drawing for Nonincendive sensors FM
						THIS DRAWING CONTAINS PROPRIETARY DATA. NO DISCLOSURE, REPRODUCTION, OR USE OF ANY PART MAY BE MADE EXCEPT BY WRITTEN PERMISSION.		
Revisions					ECO No.			
0	4-9-99	W.B.				Pepperl+Fuchs® Inc.	Repl.No.	Draw. No. 116-0155
In.	Date	Cons.	Resp.	Appr.		Twinsburg, OH 44087-2202	-	Sh. 1 of 1

8.7 Intrinsically safe NEPSI (China) certified RAKD (/NS1)

Certificate No. : GYJ05153

Type of protection : Intrinsically safe Ex ia

Group : IIC

Temperature Class : T6

Ambient temperature : -25°C ... +65 °C

Safety relevant maximum values of electronic transmitter :

- Maximum voltage : U_i = 30 V
- Maximum current : I_i = 100mA
- Maximum power : P_i = 750 mW
- Inner inductance : L_i = 0.73 mH
- Inner capacity : C_i = 2.4nF

Pulse output:

- Maximum voltage : U_i = 16 V
- Maximum current : I_i = 20 mA
- Maximum power : P_i = 64 mW
- Inner inductance : L_i = 0 mH
- Inner capacity : C_i = 0nF

Data of limit switches option /K1 to /K8 :

The following table shows the maximum safety parameters for intrinsic safe limit switches according the certificate NEPSI GYJ06542X :

	Standard /K1... /K3		Fail Safe /K6 ... /K10	
	Type 2	Type 3	Type 2	Type 3
U_i [V]	16	16	16	16
I_i [mA]	25	52	25	52
P_i [mW]	64	169	64	169
C_i [nF]	150	150	50	50
L_i [µH]	150	150	250	250
max. ambient temp. [°C] for T6	66	45	66	45
max. ambient temp. [°C] for T5	81	60	81	60
max. ambient temp. [°C] for T4-T1	100	89	100	89

T103.EPS

YOKOGAWA HEADQUARTERS
9-32, Nakacho 2-chome,
Musashinoshi
Tokyo 180
Japan
Tel. (81)-422-52-5535
Fax (81)-422-55-1202
E-mail: webinfo@mls.yokogawa.co.jp
www.yokogawa.com

YOKOGAWA CORPORATION OF AMERICA
2 Dart Road
Newnan GA 30265
United States
Tel. (1)-770-253-7000
Fax (1)-770-251-2088
E-mail: info@yca.com
www.yca.com

YOKOGAWA EUROPE B.V.
Databankweg 20
3821 AL AMERSFOORT
The Netherlands
Tel. +31-33-4641 611
Fax +31-33-4641 610
E-mail: info@nl.yokogawa.com
www.yokogawa.com/eu

YOKOGAWA ELECTRIC ASIA Pte. Ltd.
5 Bedok South Road
Singapore 469270
Singapore
Tel. (65)-241-9933
Fax (65)-241-2606
E-mail: webinfo@yas.com.sg
www.yokogawa.com.sg

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