User's Manual

ROTAMASS 3 Series
FOUNDATION Fieldbus Communication Type Coriolis Mass Flow and Density Meter
Integral Type RCCT3
Remote Type RCCF31 + RCCS3

IM 01R04B05-00E-E, additional manual to IM 01R04B04-00x-E

vigilantplant.™

YOKOGAWA

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Germany

IM 01R04B05-00E-E

5th edition, April 2015 (Rü)

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1. INTRODUCTION

This instrument has been adjusted at the factory before shipment.

To ensure correct use of the instrument, please read this manual thoroughly and fully understand how to operate the instrument before operating it.

NOTE

This manual describes the hardware and software configurations of the Rotamass Coriolis Massflowmeter.

Regarding This User's Manual

- This manual should be provided to the end user.
- Before use, read this manual thoroughly to comprehend its contents.
- The contents of this manual may be changed without prior notice.
- All rights are reserved. No part of this manual may be reproduced in any form without Yokogawa's written permission.
- Yokogawa makes no warranty of any kind with regard to this material, including, but not limited to, implied warranties of merchantability and suitability for a particular purpose.
- All reasonable effort has been made to ensure the accuracy of the contents of this manual. However, if any errors or omissions are found, please inform Yokogawa.
- Yokogawa assumes no responsibilities for this product except as stated in the warranty.
- Please note that this user's manual may not be revised for any specification changes, construction changes or operating part changes that are not considered to affect function or performance.
- If the customer or any third party is harmed by the use of this product, Yokogawa assumes no responsibility for any such harm owing to any defects in the product which were not predictable, or for any indirect damages.

Safety and Modification Precautions

- The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific WARNINGS given elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Yokogawa assumes no liability for the customer's failure to comply with these requirements. If this instrument is used in a manner not specified in this manual, the protection provided by this instrument may be impaired.
- The following safety symbol marks are used in this user's manual and instrument.

WARNING

A WARNING sign denotes a hazard. It calls attention to procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in injury or death of personnel.

CAUTION

A CAUTION sign denotes a hazard. It calls attention to procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product.

IMPORTANT

An IMPORTANT sign denotes that attention is required to avoid damage to the instrument or system failure.

NOTE

A NOTE sign denotes information necessary for essential understanding of operation and features.

⏚ Protective grounding terminal

⏚ Functional grounding terminal
(This terminal should not be used as a protective grounding terminal.)

⏦ Alternating current

⎓ Direct current

1.1 Using the Coriolis Flowmeter Safely

⚠ **WARNING**

(1) Installation
- Installation of the Coriolis flowmeter must be performed by expert engineer or skilled personnel. No operator shall be permitted to perform procedures relating to installation.
- The Coriolis flowmeter is a heavy instrument. Be careful that no damage is caused to personnel through accidentally dropping it, or by exerting excessive force on the Coriolis flowmeter. When moving the Coriolis flowmeter, always use a trolley and have at least two people carry it.
- When the Coriolis flowmeter is processing hot fluids, the instrument itself may become extremely hot. Take sufficient care not to get burnt.
- Where the fluid being processed is a toxic substance, avoid contact with the fluid and avoid inhaling any residual gas, even after the instrument has been taken off the line for maintenance and so forth.
- All procedures relating to installation must comply with the electrical code of the country where it is used.

(2) Wiring
- The wiring of the Coriolis flowmeter must be performed by expert engineer or skilled personnel. No operator shall be permitted to perform procedures relating to wiring.
- When connecting the wiring, check that the supply voltage is within the range of the voltage specified for this instrument before connecting the power cable. In addition, check that no voltage is applied to the power cable before connecting the wiring.
- The protective grounding must be connected securely at the terminal with the ⏚ mark to avoid danger to personnel.

(3) Operation
- Do not open the cover until the power has been off for at least 10 minutes. Only expert engineer or skilled personnel are permitted to open the cover.

(4) Maintenance
- Maintenance on the Coriolis flowmeter should be performed by expert engineer or skilled personnel. No operator shall be permitted to perform any operations relating to maintenance.
- Always conform to maintenance procedures outlined in this manual. If necessary, contact Yokogawa.
- Care should be taken to prevent the build up of dirt, dust or other substances on the display panel glass or data plate. If these surfaces do get dirty, wipe them clean with a soft dry cloth.

(5) European Pressure Equipment Directive (PED)
- When using the instrument as a PED-compliant product, be sure to read Chapter 10 before use.

(6) Hazardous Duty Type Instruments
- For explosion proof type instruments the description in chapter 9 "EXPLOSION PROTECTED TYPE INSTRUMENT" has priority to the other descriptions in this instruction manual.
- 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 should contact your nearest Yokogawa office or representative.
- Only trained personal should install and maintain instruments in hazardous areas.
- The protective grounding terminal ⏚ must be connected to a suitable IS grounding system.
- Avoid mechanical generated sparks while working on the equipment and peripherally devices in hazardous areas.

FOUNDATION is a registered trademark of Fieldbus FOUNDATION.

1.2 Warranty

- The warranty terms of this instrument that are guaranteed are described in the quotation. We will make any repairs that may become necessary during the guaranteed term free of charge.
- Please contact our sales office if this instrument requires repair.
- If the instrument is faulty, contact us with complete details about the problem and the length of time it has been faulty, and state the model and serial number. We would appreciate the inclusion of drawings or additional information.
- The results of our examination will determine whether the meter will be repaired free of charge or on an at-cost basis.

The guarantee will not apply in the following cases:

- Damage due to negligence or insufficient maintenance on the part of the customer.
- Problems or damage resulting from handling, operation or storage that violates the intended use and specifications.
- Problems that result from using or performing maintenance on the instrument in a location that does not comply with the installation location specified by Yokogawa.
- Problems or damage resulting from repairs or modifications not performed by Yokogawa or someone authorized by Yokogawa.
- Problems or damage resulting from inappropriate installation after delivery.
- Problems or damage resulting from disasters such as fires, earthquakes, storms, floods, or lightning strikes and external causes.

1.3 Instruction according EMC

The ROTAMASS Coriolis flowmeter is conform to the European EMC Guideline and fulfills the following standards:

EN 61326-1: 2006;

EN 61326-2-3: 2006;

EN 61000-3-2: 2006;

EN 61000-3-3: 1995+A1+A2

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

Restriction on Use of Radio Transceiver :

IMPORTANT

Although the products has been designed to resist high frequency electrical noise, if a radio transceiver is used near the flowmeter or its 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 flowmeter, and observe the measurement loop for noise effects. Thereafter, always use the transceiver outside the area affected by noise.

Installation

CAUTION

The function ground terminal or the PE-terminal have to be connected to protective ground to ensure electro-magnetic interference protection.

To ensure the EMC specifications the following measures must be carried out :

1. Put the power cables through the ferrite core clamp before connecting to the terminals as shown in chapter ´ Installation ´(Power supply wiring).
2. Put the I/O- cables through the ferrite core clamp before connecting to the terminals as shown in chapter ´ Installation ´(Power supply wiring).
3. Connect protective ground conductor of power supply to PE-terminal in the terminal box (see chapter ´ Installation ´(Power supply wiring).
4. In case of Explosion proof type instrument, further requirements are described in chapter 9 “EXPLOSION PROTECTED TYPE INSTRUMENTS”. The description in this chapter is prior to other descriptions in this instruction manual.

1.4 ATEX Documentation

This 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

Όλα τα εγχειρίδια λειτουργίας των προϊόντων με ATEX Ex διατίθενται στα Αγγλικά, Γερμανικά και Γαλλικά. Σε περίπτωση που χρειάζεστε οδηγίες σχετικά με Ex στην τοπική γλώσσα παρακαλούμε επικοινωνήστε με το πλησιέστερο γραφείο της Yokogawa ή αντιπρόσωπο της.

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 angliščini, nemščini ter francoščini. Če 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.

1.5 Disposal, Cleaning and Return

For safe use

WARNING

If the process fluid is harmful to personnel, handle the instrument 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 skin and to avoid inhaling any residual gas. Before sending it to the Seller for examination and/or repair please clean the instrument thoroughly and make sure, that no harmful chemicals are in or at the meter. If the instrument contains unknown fluids the Seller will send it back to the Purchaser for cleaning on their cost.

WARNING

ROTAMASS might be heavy instruments. Please give attention to prevent that persons are not injured by carrying or installing. It is preferable when 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.

Warranty

The warranty of the instruments 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 no 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.

For disposal and recycling please refer to your national regulations.
Please find following help. After remove of all products rests the instruments can be disassembled and the parts treated different.

Naming: R = recycling, D = disposal, Sd = special disposal, Na = not applicable

Name of product	Body		Converter housing		Cover with window		Electronics
Rotamass	SS	R	Al	R	Al + Glass	D	Sd

In case of return of flowmeters to Yokogawa for testing or repair purposes please fillout one of the following forms and send it with the equipment to YOKOGAWA.

Receiver : Sender :

Delivery Note (for EU-Countries) Date :

Ref. REPAIR for serial 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 accompanies the goods

SPECIMEN Certificate

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

The attached flow meter:

Type : _____ Order- or Serial No. _____

has been operated with following liquids:_____

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

☐ checked, that all cavities in the flowmeter are free from such 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 serial 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 accompanies the goods

SPECIMEN Certificate

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

The attached flow meter:

Type : _____ Order- or Serial No. _____

has been operated with following liquids:_____

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

☐ checked, that all cavities in the flowmeter are free from such 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:

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2. AMPLIFIER FOR FOUNDATION FIELDBUS COMMUNICATION

Refer to IM 01R04B04-00E for the details of the amplifier. This section encompasses topics applicable to only the Fieldbus communication type.

(1) The FOUNDATION Fieldbus communication type has no local key access function.
(2) The FOUNDATION Fieldbus communication type has no HART terminal connection pin.
(3) The FOUNDATION Fieldbus communication type has a simulation function. The SIMULATE_ENABLE jumper is mounted on the amplifier. Refer to Section 6.3, “Simulation Function” for details of the simulation function.

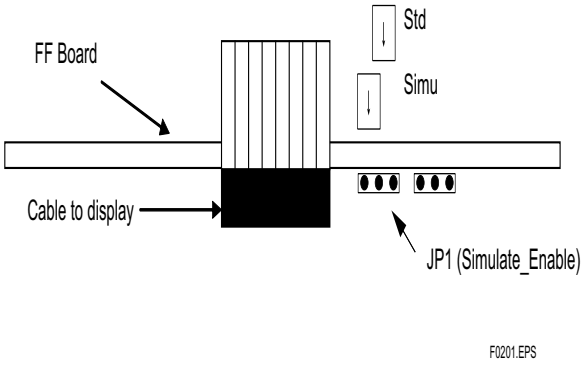

Figure 2.1 Amplifier for FOUNDATION Fieldbus Communication

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3. ABOUT FOUNDATION FIELDBUS

3.1 Outline

Fieldbus is a bi-directional digital communication protocol for field devices, which offers an advancement in implementation technologies for process control systems and is widely employed by numerous field devices.

The FOUNDATION Fieldbus communication type of the Rotamass employs the specification standardized by the FOUNDATION Fieldbus, and provides interoperability between Yokogawa devices and those produced by other manufacturers. Featuring 6 AI and two IT function blocks in each, the Fieldbus communication type's software enables a flexible instrumentation system to be implemented.

For information on other features, engineering, design, construction work, startup and maintenance of Fieldbus, refer to "Fieldbus Technical Information" (TI 38K3A01-01E).

3.2 Internal Structure of ROTAMASS

Each Rotamass contains two Virtual Field Devices (VFDs) that share the following functions.

3.2.1 System/Network Management VFD

- Sets node addresses and Physical Device tags (PD Tag) necessary for communication.
- Controls the execution of function blocks.
- Manages operation parameters and communication resources (Virtual Communication Relationship: VCR).

3.2.2 Function Block VFD

(1)Resource (RS) block

- Manages the status of Rotamass hardware.
- Automatically informs the host of any detected faults or other problems.

(2)Transducer (TB) block

- Converts the flow sensor output to the mass flow rate signal and transfers to an AI function block (AI1).
- Converts the flow sensor output to the process fluid density and transfers to an AI function block (AI3).
- Converts temperature sensor output to the process fluid temperature and transfers to an AI function block (AI4).
- Calculates the volumetric flow rate from the fluid density and the mass flow rate and transfers to an AI function block (AI2).

(3)AI function blocks (six)

- The AI blocks condition raw data from the transducer block, including scaling and damping (with a first-order lag), and allow input simulation.
- AI1 outputs mass flow rate signals, and AI2 outputs volumetric flow rate signals.
- AI3 outputs density signals, and AI4 outputs temperature signals.
- AI5 outputs concentration measurement signals (option), and AI6 outputs net flow rate signals (option).

(4)IT Integrator blocks (two)

- IT1 totalizes mass-, volume or net flow rate.
- IT2 totalizes mass-, volume or net flow rate.

(5)PID function block (optional)

- Performs the PID computation based on the deviation of the measured value from the setpoint.

3.3 Logical Structure of Each Block

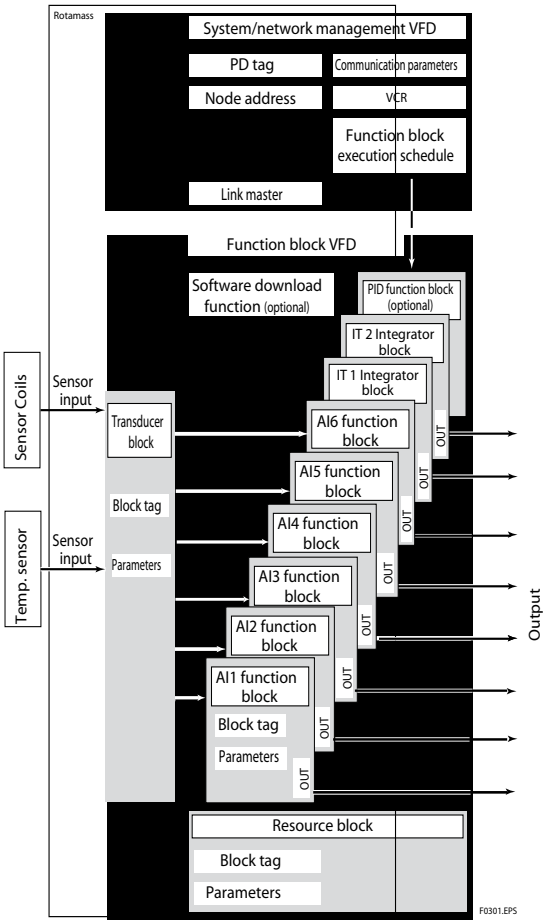


Figure 3.1 Logical Structure of Each Block

Various parameters, the node address, and the PD tag shown in Figure 3.1 must be set before using the device. Refer to Chapter 4 for the setting procedures.

3.4 Wiring System Configuration

The number of devices that can be connected to a single bus and the cable length vary depending on system design. When constructing systems, both the basic and overall design must be carefully considered to allow device performance to be fully exhibited.

4. Getting Started

Fieldbus is fully dependent upon digital communication
protocol and differs in operation from conventional 4 to 20 mA transmission and the HART communication protocol. It is recommended that novice users use fieldbus devices in accordance with the procedures described in this section. The procedures assume that fieldbus devices will be set up on a bench of an instrument shop.

4.1 Connection of Devices

The following instruments are required for use with Fieldbus devices:

- **Fieldbus Communication Signal:**
  Fieldbus requires a dedicated power supply. It is recommended that current capacity be well over the total value of the maximum current consumed by all devices (including the host). Conventional DC current cannot be used as is.

- **Terminator:**
  Fieldbus requires two terminators. Refer to the supplier for details of terminators that are attached to the host.

- **Field devices:**
  Connect your Fieldbus communication type ROTAMASS RCCT3 to a fieldbus. Two or more ROTAMASS RCCT3 and other field devices can be connected. For the terminal assignment on the ROTAMASS RCCT3, see Table 4.1.

Table 4.1 Terminal Connection for ROTAMASS RCCT3

Terminal Symbols	Description
N.C. N.C. N.C. N.C. N.C. N.C. FF out− FF out+	Fieldbus communication signal
L/+ N/- G	Power supply
⏚	Ground Terminal

F0401.EPS

- **Host:**
  Used for accessing field devices. A dedicated host (such as DCS) is used for an instrumentation line while dedicated communication tools are used for experimental purposes. For operation of the host, refer to the instruction manual for each host. No details of the host are explained in the rest of this manual.

- **Cable:**
  Used for connecting devices. Refer to “Fieldbus Technical Information” (TI 38K3A01-01E) for details of instrumentation cabling. If the total length of the cable is in a range of 2 to 3 meters for laboratory or other experimental use, the following simplified cable (a twisted pair wire with a cross section of 0.9 mm2 or more and cycle period of within 5 cm (2 inches) may be used). Termination processing depends on the type of device being deployed.
  For the ROTAMASS, clamp terminal are used. Some hosts require a connector.

Refer to Yokogawa when making arrangements to purchase the recommended equipment.

Connect the devices as shown in Figure 4.1. Connect the terminators at both ends of the trunk, with a minimum length of the spur laid for connection.

The polarity of signal and power must be maintained.

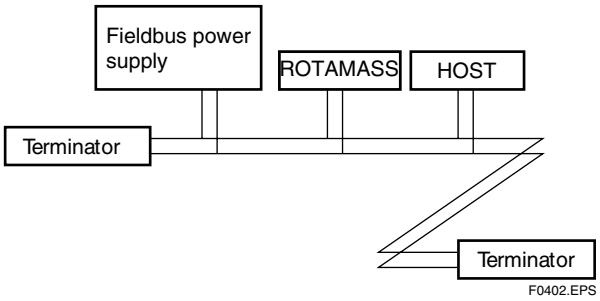


Figure 4.1 Device Connection

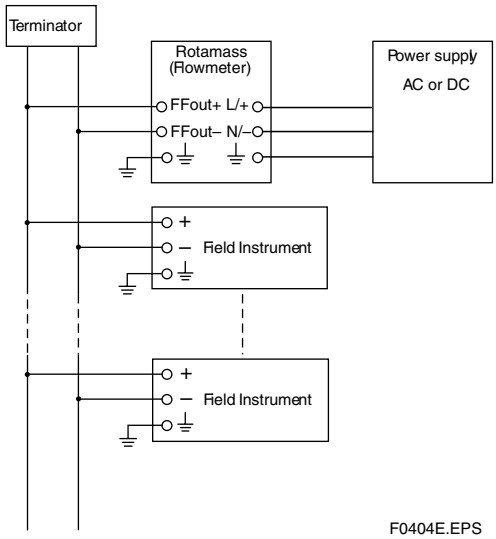
Before using a Fieldbus configuration tool other than the existing host, confirm it does not affect the loop functionality in which all devices are already installed in operation. Disconnect the relevant control loop from the bus if necessary.

IMPORTANT

Connecting a Fieldbus configuration tool to a loop with its existing host may cause communication datascrambles resulting in a functional disorder or a system failure.

Installation diagrams:

[Integral type]



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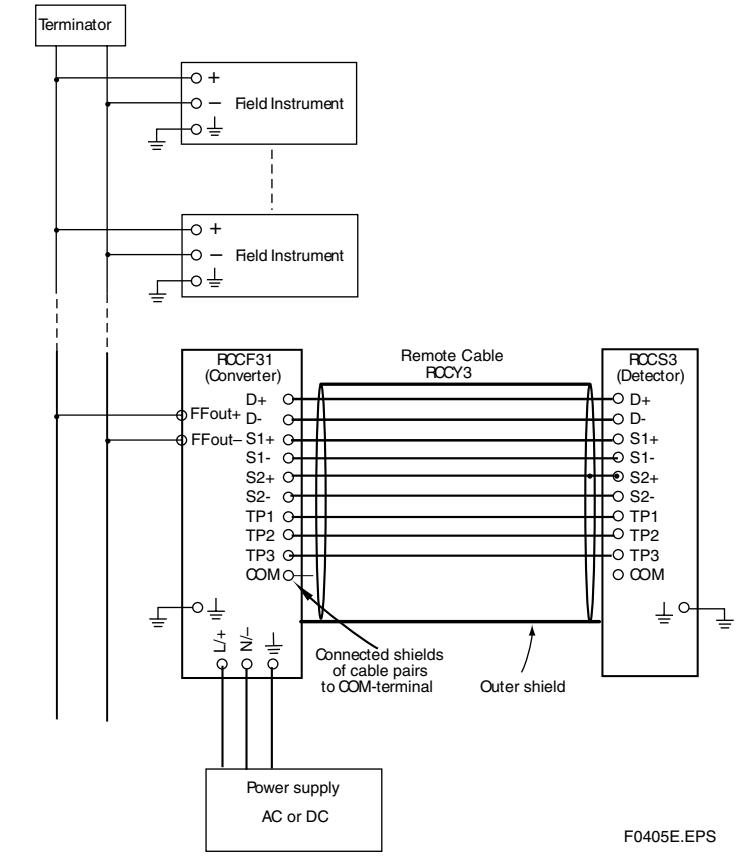
[Remote type]



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4.2 Host Setting

To activate Fieldbus, the following settings are required for the host.

IMPORTANT

Do not turn off the main power supply and fieldbus power supply immediately after setting. When the parameters are saved to the EEPROM, the redundant processing is executed for the improvement of reliability. If the power is turned off within 60 seconds after setting is made, the modified parameters are not saved and the settings may return to the original values.

Table 4.2 Operation Parameters

Symbol	Parameter	Description and Settings
V (ST)	Slot-Time	Set 4 or greater value.
V (MID)	Minimum-Inter-PDU-Delay	Set 4 or greater value.
V (MRD)	Maximum-Response-Delay	Set so that V (MRD) 3 V (ST) is 12 or greater
V (FUN)	First-Unpolled-Node	Indicate the address next to the address range used by the host. Set 0x15 or greater.
V (NUN)	Number-of-consecutive-Unpolled-Nodes	Unused address range. Rotamass addess is factory set to 0xF6. Set this address to be within the range of BASIC device in Figure 4.2.

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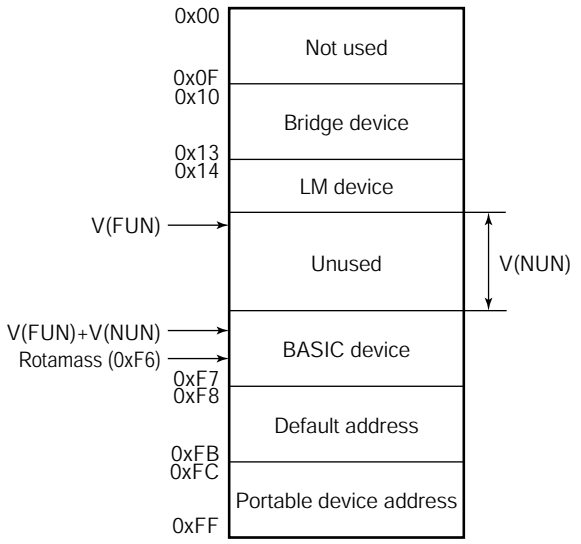

Note 1: LM device: with bus control function (Link Master function)
Note 2: BASIC device: without bus control function

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Figure 4.2 Available Address Range

4.3 Power-on of ROTAMASS and Bus

Turn on the power to the host, bus, and ROTAMASS. If any segments do not light, or if a current anomaly occurs, check the voltage of the power supply for the ROTAMASS.

Using the host device display function, check that the ROTAMASS is in operation on the bus. Unless otherwise specified, the following settings are in effect when shipped from the factory.

PD tag: FT1004
Node address: 246 (hexadecimal F6)
Device ID: 594543000Dxxxxxxxx (xxxxxxxx = a total of 8 alphanumeric characters)

If no ROTAMASS is detected, check the available address range. If the node address and PD Tag are not specified when ordering, default value is factory set. If two or more ROTAMASS are connected at a time with default value, only one ROTAMASS will be detected from host as ROTAMASS have the same initial address. Connect the ROTAMASS one by one and set a unique address for each.

4.4 Integration od DD

If the host supports DD (Device Description), the DD of the ROTA MASS needs to be installed. Check if host has the following directory under its default DD directory.

594543000D
(594543 is the manufacturer number of Yokogawa Electric Corporation, and 000D is the ROTAMASS device number, respectively.)
If this directory is not found, the DD for the ROTAMASS has not yet been installed. Create this directory and copy the DD files (0m0n.ffo and 0m0n.sym to be supplied separately where m and n are numerals) to it. If you do not have the DD files for the ROTA MASS, you can download them via Internet from
http://www.yokogawa.com/fld/FIELDBUS/fld-field-bus-01en.htm
Once the DD is installed in the directory, the name and attribute of all parameters of the ROTA MASS are displayed.

Off-line configuration is possible using the capabilities file.

When using a capabilities (CFF) file, make sure you use the right file for the intended device. The ROTA MASS is offered in two types in terms of capabilities:

(1) Without LC1 option: Featuring six AI function blocks and two IT function blocks
(2) With LC1 option: A PID function block is added

Using the wrong CFF file may result in an error when downloading the configured data to the device. Also, use the right DD files that accommodate the revision of the intended device.

4.5 Reading the Parameters

To read ROTAMASS parameters, select the AI block of the ROTAMASS from the host screen and read the OUT parameter. The current flow rate is displayed. Check that MODE_BLOCK of the function block and resource block is set to AUTO .

4.6 Continous Record of Values

If the host has a function of continuously recording the indications, use this function to list the indications (values). Depending on the host being used, it may be necessary to set the schedule of Publish (the function that transmits the indication on a periodic basis).

4.7 Generation of Alarm

If the host is allowed to receive alarms, generation of an alarm can be attempted from the ROTAMASS. In this case, set the reception of alarms on the host side. ROTAMASS's VCR-7 is factory-set for this purpose. For practical purposes, all alarms are placed in a disabled status; for this reason, it is recommended that you first use one of these alarms on a trial basis. Set the value of link object-3 (index 30002) as "0, 299, 0, 6, 0". Refer to section 5.6.1 Link Object for details. Since the LO_PRI parameter (index 4029) of the AI block is set to "0", try setting this value to "3". Select the Write function from the host in operation, specify an index or variable name, and write "3" to it.

The LO_LIM parameter (index 4030) of the AI block determines the limit at which the lower bound alarm for the process value is given. In usual cases, a very small value is set to this limit. Set smaller value than 100% value of XD_SCALE (same unit). Since the flow rate is almost 0, a lower bound alarm is raised. Check that the alarm can be received at the host. When the alarm is confirmed, transmission of the alarm is suspended.

This chapter briefly explained how to connect the ROTAMASS to a fieldbus and start using it. In order to take full advantage of the performance and functionality of the device, it is recommended that it be read together with Chapter 5, where describes how to use the ROTAMASS.

5. CONFIGURATION

This chapter contains information on how to adapt the function and performance of the ROTAMASS to suit specific applications. Because two or more devices are connected to Fieldbus, settings including the requirements of all devices need to be determined. Practically, the following steps must be taken.

(1)Network design

Determines the devices to be connected to Fieldbus and checks the capacity of the power supply.

(2)Network definition

Determines the PD tag and node addresses for all devices.

(3)Definition of combining function blocks

Determines the method for combination between each function block.

(4)Setting tags and addresses

Sets the PD Tag and node addresses one by one for each device.

(5)Communication setting

Sets the link between communication parameters and function blocks.

(6)Block setting

Sets the parameters for function blocks.

The following section describes each step of the procedure in the order given. Using a dedicated configuration tool allows the procedure to be significantly simplified. This section describes the procedure to be assigned for a host which has relatively simple functions. Refer to Appendix 6 when the ROTAMASS is used as Link Master (option).

5.1 Network Design

Select the devices to be connected to the Fieldbus network. The following instruments are necessary for operation of Fieldbus.

- **Power supply**

  Fieldbus requires a dedicated power supply. It is recommended that current capacity be well over the total value of the maximum current consumed by all devices (including the host). Conventional DC current cannot be used as power supply.

- **Terminator**

  Fieldbus requires two terminators. Refer to the supplier for details of terminators that are attached to the host.

- **Field devices**

  Connect the field devices necessary for instrumentation. the ROTAMASS has passed the interoperability test conducted by The Fieldbus Foundation. In order to properly start Fieldbus, it is recommended that the devices used satisfy the requirements of the above test.

- **Host**

  Used for accessing field devices. A minimum of one device with bus control function is needed.

- **Cable**

  Used for connecting devices. Refer to Fieldbus Technical Information (TI 38K3A01-01E) for details of instrumentation cabling. Provide a cable sufficiently long to connect all devices. For field branch cabling, use terminal boards or a connection box as required.

First, check the capacity of the power supply. The power supply capacity must be greater than the sum of the maximum current consumed by all devices to be connected to Fieldbus. For the ROTAMASS, the maximum current (power supply voltage: 9 to 32 VDC) is 15 mA. The cable must have the spur in a minimum length with terminators installed at both ends of the trunk.

5.2 Network Definition

Before connection of devices with Fieldbus, define the Fieldbus network. Allocate PD tags and node addresses to all devices (excluding such passive devices as terminators).

PD tags are the same as conventional tag numbers assigned to devices. Up to 32 alphanumeric characters may be used for definition of the PD tag for each device. Use hyphens as delimiters as required.

Node addresses are used to locate devices for communication purposes. Since a PD tag is too long for a data value, the host substitutes the node addressed for PD tags in communication. Node addresses can be set to numbers in a range of decimal 16 to 247 (hexadecimal 10 to F7). Assign devices having link master functionality (i.e., LM devices) from the smallest address number (0x10) in order, and other devices (i.e., basic devices) from the largest (0xF7). Assign an address in the range for basic devices to a ROTAMASS. Only when using a ROTAMASS with the optional LM functionality as an LM device, assign an address in the range for LM devices to it. These address ranges are determined by the following parameters.

Table 5.1 Parameters for Setting Address Range

Symbol	Parameters	Description
V (FUN)	First-Unpolled-Node	Indicates the address next to the address range used for the host or other LM device.
V (NUN)	Number-of-consecutive-Unpolled-Node	Unused address range

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Any devices within an address range written as "Unused" in Figure 5.1 cannot join the fieldbus. Other address ranges are periodically scanned to find any devices newly joining the fieldbus. Do not widen the available address ranges unnecessarily; the fieldbus communication performance may be severely degraded.

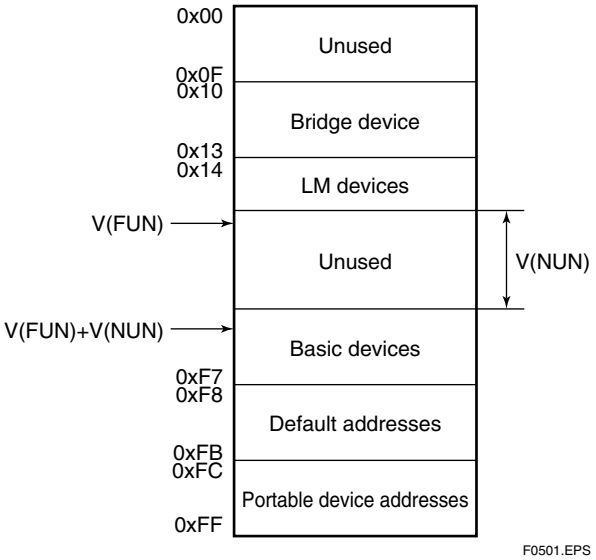

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Figure 5.1 Available Range of Node Addresses

To ensure stable operation of Fieldbus, determine the operation parameters and set them to the LM devices. While the parameters in Table 5.2 are to be set, the worst-case value of all the devices to be connected to the same Fieldbus must be used. Refer to the specification of each device for details. Table 5.2 lists ROTAMASS specification values.

Table 5.2 Operation Parameter Values of ROTAMASS to be Set to LM Device

Symbol	Parameters	Description and S ettings
V (ST)	Slot-Time	Indicates the time necessary for immediate reply of the device. Unit of time is in octets (256 µs). Set maximum specification for all devices. For a Rotamass, set a value of 4 or greater.
V (MID)	Minimum-Inter-PDU-Delay	Minimum value of communication data intervals. Unit of time is in octets (256 µs). Set the maximum specification for all devices. For a Rotamass, set a value of 4 or greater.
V (MRD)	Maximum-Response-Delay	The worst case time elapsed until a reply is recorded. The unit is Slot-time; set the value so that V (MRD) 3V (ST) is the maximum value of the specification for all devices. For a Rotamass, value of V(MRD)3V (ST) must be 12 or greater.

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5.3 Function Block Link Definitions

Link the input/output parameters of function blocks to each other as necessary. For a ROTAMASS, the output parameters of six AI blocks (OUTs), two integrator blocks and input/output parameters of an optional PID block should be linked to parameters of different function blocks. Specifically, link settings must be written to the link object in the ROTAMASS For details, refer to Section 5.6, "Block Setting." It is also possible to read values from the host at appropriate intervals instead of linking the outputs of ROTAMASS's function blocks to other blocks.

The linked blocks need to be executed synchronously with other blocks and the communication schedule. In this case, change the schedule of the ROTAMASS according to Table 5.3, in which factory settings are shown in parentheses.

Table 5.3 Function Block Execution Schedule of ROTAMASS

Index	Parameters	Setting (Factory Setting in Parentheses)
269 (SM)	MACROCYCLE_DURATION	Repetition period of control or measurement, i.e., macrocycle; to be set as a multiple of 1/32 ms (32000 = 1 second)
276 (SM)	FB_START_ENTRY.1	Start time of the AI1 block represented as the elapsed time from the start of each macrocycle; to be set as a multiple of 1/32 ms (0 = 0 ms)
277 (SM)	FB_START_ENTRY.2	Start time of the PID block (optional) represented as the elapsed time from the start of each macrocycle; to be set as a multiple of 1/32 ms (9600 = 300 ms)
278 (SM) to 289 (SM)	FB_START_ENTRY.3 to FB_START_ENTRY.14	Not set.

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A maximum of 30 ms is taken for execution of each AI block. Arrange the communication schedule for an AI block's data that is to be transferred to its downstream block in such a way that it starts after a lapse of longer than 30 ms.

Figure 5.3 shows typical function block and communication schedules for the loop shown in Figure 5.2.

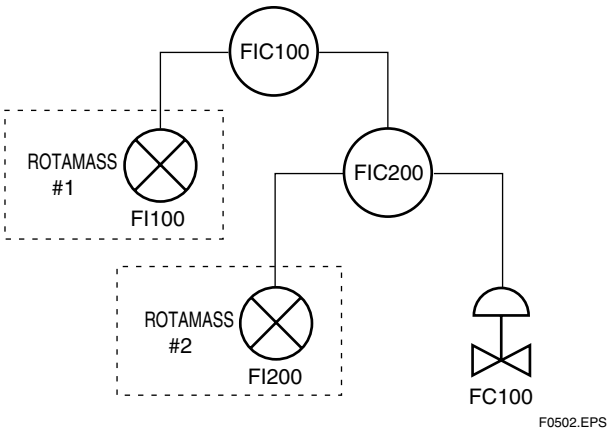

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Figure 5.2 Example of Loop Connecting Function Blocks of two ROTAMASS with other Devices

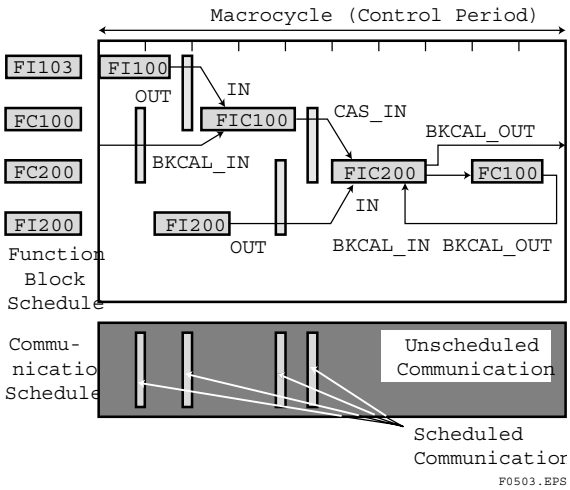

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Figure 5.3 Function Block Schedule and Communication Schedule

When the control period (macro cycle) is set to more than 4 seconds, set the following interval to be more than 1% of the control period.

- Interval between "end of block execution" and "start of sending CD from LAS"
- Interval between "end of block execution" and "start of the next block execution"

5.4 Setting of Tags and Addresses

This section describes the steps in the procedure to set the PD tags and node address in the ROTAMASS. There are three states of Fieldbus devices as shown in Figure 5.4, and if the state is other than the lowest SM_OPERATIONAL state, no function block is executed. Whenever you have changed the PD tag or address of a ROTAMASS, transfer its state to SM_OPERATIONAL.

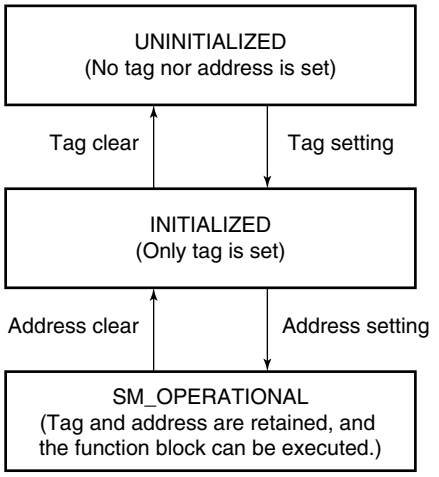

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Figure 5.4 Status Transition by Setting PD Tag and Node Address

In each ROTAMASS, the PD tag and node address are set to “FT1004” and 246 (hexadecimal F6), respectively, before shipment from the factory unless otherwise specified. To change only the node address, clear the address once and then set a new node address. To set the PD tag, first clear the node address and clear the PD tag, then set the PD tag and node address again.Devices whose node address was cleared will await at the default address (randomly chosen from a range of 248 to 251, or from hexadecimal F8 to FB). At the same time, it is necessary to specify the device ID in order to correctly specify the device. The device ID of the ROTAMASS is 594543000Dxxxxxxxx. (The xxxxxxxx at the end of the above device ID is a total of 8 alphanumeric characters.)

5.5 Communication Setting

To set the communication function, it is necessary to change the database residing in SM (System Management)-VFD.

5.5.1 VCR Setting

Set VCR (Virtual Communication Relationship), which specifies the called party for communication and resources. Each ROTAMASS has 33 VCRs whose application can be changed, except for the first VCR, which is used for management.

Each ROTAMASS has VCRs of four types:

Server (QUB) VCR
: A server responds to requests from a host. This communication needs data exchange. This type of communication is called QUB (Queued User-triggered Bidirectional) VCR.

Source (QUU) VCR
: A source multicasts alarms or trends to other devices. This type of communication is called QUU (Queued User-triggered Unidirectional) VCR.

Publisher (BNU) VCR
: A publisher multicasts outputs of the AI blocks, IT blocks, and PID block to other function blocks. This type of communication is called BNU (Buffered Network-triggered Unidirectional) VCR.

Subscriber (BNU) VCR
: A subscriber receives output of another function block(s) by PID block.

Each VCR has the parameters listed in Table 5.4. Parameters must be changed together for each VCR because modification for each parameter may cause a contradiction.

Table 5.4 VCR Static Entry

Sub-index	Parameter	Description
1	FasArTypeAndRole	Indicates the type and role of communication (VCR). The following 4 types are used for the Rotamass. 0x32: Server (Responds to requests from host.) 0x44: Source (Transmits alarm or trend.) 0x66: Publisher (Sends AI, DI block output to other blocks.) 0x76: Subscriber (Receives output of other blocks by PID block.)
2	FasDllLocalAddr	Sets the local address to specify a VCR in the Rotamass. A range of 20 to F7 in hexadecimal.
3	FasDllConfigured RemoteAddr	Sets the node address of the called party for communication and the address (DLSAP or DLCEP) used to specify VCR in that address. For DLSAP or DLCEP, a range of 20 to F7 in hexadecimal is used. Addresses in Subindex 2 and 3 need to be set to the same contents of the VCR as the called party (local and remote are reversed).
4	FasDllSDAP	Specifies the quality of communication. Usually, one of the following types is set. 0x2B: Server 0x01: Source (Alert) 0x03: Source (Trend) 0x91: Publisher/Subscriber
5	FasDllMaxConfirm DelayOnConnect	To establish connection for communication, a maximum wait time for the called party's response is set in ms. Typical value is 60 secounds (60000).
6	FasDllMaxConfirm DelayOnData	For request of data, a maximum wait time for the called party's response is set in ms. Typical value is 60 secounds (60000).
7	FasDllMaxDlsduSize	Specifies maximum DL Service Data unit Size (DLSDU). Set 256 for Server and Trend VCR, and 64 for other VCRs.
8	FasDllResidual ActivitySupported	Specifies whether connection is monitored. Set TRUE (0xff) for Server. This parameter is not used for other communication.
9	FasDllTimelinessClass	Not used for the Rotamass
10	FasDllPublisherTime WindowSize	Not used for the Rotamass.
11	FasDllPublisher SynchronizaingDlcep	Not used for the Rotamass.

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Sub-index	Parameter	Description
12	FasDllSubscriberTime WindowSize	Not used for the Rotamass.
13	FasDllSubscriber SynchronizationDlcep	Not used for the Rotamass.
14	FmsVfdId	Sets VFD for the Rotamass to be used. (0x1: System/network management VFD 0x1234: Function block VFD)
15	FmsMaxOutstanding ServiceCalling	Set 0 to Server. It is not used for other applications.
16	FmsMaxOutstanding ServiceCalled	Set 1 to Server. It is not used for other applications.
17	FmsFeatures Supported	Indicates the type of services in the application layer. In the Rotamass, it is automatically set according to specific applications.

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These 33 VCRs are factory-set as shown in Table 5.5.

Table 5.5 VCR List

Index (SM)	VCR Number	Factory S etting
293	1	For system management (Fixed)
294	2	Server (LocalAddr = 0xF3)
295	3	Server (LocalAddr = 0xF4)
296	4	Server (LocalAddr = 0xF7)
297	5	Trend Source (LocalAddr = 0x07, Remote Address=0x111)
298	6	Publisher (LocalAddr = 0x20)
299	7	Alert Source (LocalAddr = 0x07, Remote Address=0x110)
300	8	Server (LocalAddr = 0xF9)
301 to 325	9 to 33	Not set

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5.5.2 Function Block Execution Control

According to the instructions given in Section 5.3, set the execution cycle of the function blocks and schedule of execution.

5.6 Block Setting

Set the parameter for function block VFD.

5.6.1 Link Objects

A link object combines the data voluntarily sent by the function block with VCR. Each ROTAMASS has 40 link objects. A single link object specifies one combination. Each link object has the parameters listed in Table 5.6. Parameters must be changed together for each VCR because the modifications made to each parameter may cause inconsistent operation.

Table 5.6 Link Object Parameters

Sub-index	Parameters	Description
1	LocalIndex	Sets the index of function block parameters to be combined; set "0" for Trend and Alert.
2	VcrNumber	Sets the index of VCR to be combined. If set to "0", this link object is not used.
3	RemoteIndex	Not used in the Rotamass. Set to "0".
4	ServiceOperation	Set one of the following. Set only one each for link object for Alert or Trend. 0: Undefined 2: Publisher 3: Subscriber 6: Alert 7: Trend
5	StaleCountLimit	Set the maximum number of consecutive stale input values which may be received before the input status is set to BAD. To avoid the unnecessary mode transition caused when the data is not correctly received by subscriber, set this parameter to "2" or more.

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Link objects are not factory-set. Set link objects as shown in Table 5.7.

Table 5.7 Settings of Link Objects (example)

Index	Link Object #	Settings(example)
30000	1	AI. OUT → VCR#6
30001	2	Trend → VCR#5
30002	3	Alert → VCR#7
30003 to 30039	4 to 40	No used

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5.6.2 Trend Objects

It is possible to make settings so that a function block automatically transmits the trend. For this, each ROTAMASS has ten trend objects: eight for trends of analog parameters and two for discrete parameters. For each trend object, specify a single parameter, the trend of which is to be transmitted. Each trend object has the parameters listed in Table 5.8. For the first four parameters, setting is mandatory. Before writing parameter settings to a trend object, parameter WRITE_LOCK of the resource block must be modified to unlock the write-lock.

Table 5.8 Parameters for Trend Objects

Sub-index	Parameters	Description
1	Block Index	Sets the leading index of the function block that takes a trend.
2	Parameter Relative Index	Sets the index of parameters taking a trend by a value relative to the beginning of the function block. In the Rotamass, the following three types of trends are possible. 7: PV 8: OUT 19: FIELD_VAL
3	Sample Type	Specifies how trends are taken. Choose one of the following 2 types: 1: Sampled upon execution of a function block. 2: The average value is sampled.
4	Sample Interval	Specifies sampling intervals in units of 1/32 ms. Set the integer multiple of the function block execution cycle.
5	Last Update	The last sampling time.
6 to 21	List of Status	Status part of a sampled parameter.
21 to 37	List of Samples	Data part of a sampled parameter.

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Ten trend objects are not factory-set.

Table 5.9 Trend Objects

Index	Parameter	Factory Setting
32000 to 32007	TREND_FLT.1 to TREND_FLT.8	Not set.
32008	TREND_DIS.1	Not set (these parameters are used with a DI block or optional PID block).
32009	TREND_DIS.2	

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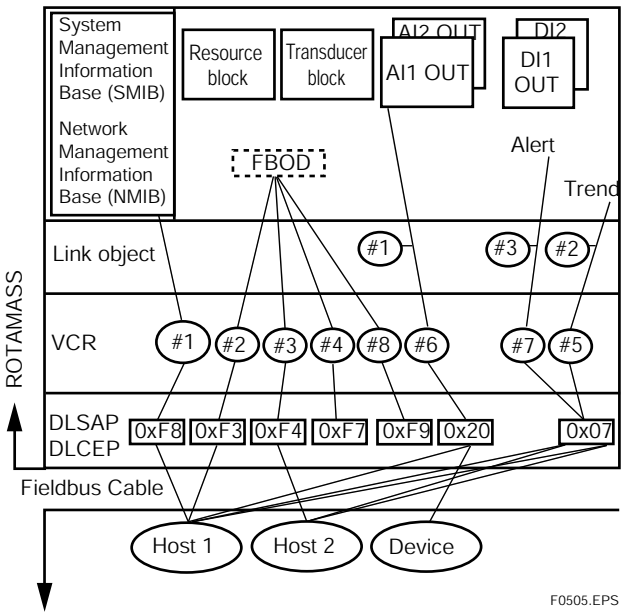

Figure 5.5 Examle of Default Configuration

5.6.3 View Objects

View objects are used to group parameters. This reduces the load of data transactions. Each ROTAMASS supports four view objects for each of the resource block, transducer block, six AI blocks, two IT blocks, and PID block (optional). Each view object contains a group of the parameters listed in Tables 5.11 to 5.14.

Table 5.10 Purpose of Each View Object

	Description
VIEW_1	Set of dynamic parameters required by operator for plant operation. (PV, SV, OUT, Mode etc.)
VIEW_2	Set of static parameters which need to be shown to plant operator at once. (Range etc.)
VIEW_3	Set of all the dynamic parameters.
VIEW_4	Set of static parameters for configuration or maintenance.

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Table 5.11 View Objects for Resource Block

Relative Index	Parameter Mnemonic	VIEW 1	VIEW 2	VIEW 3	VIEW 4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	RS_STATE	1		1	
8	TEST_RW				
9	DD_RESOURCE				
10	MANUFAC_ID				4
11	DEV_TYPE				2
12	DEV_REV				1
13	DD_REV				1
14	GRANT_DENY		2		
15	HARD_TYPES				2
16	RESTART				
17	FEATURES				2
18	FEATURE_SEL		2		
19	CYCLE_TYPE				1
20	CYCLE_SEL		1		
21	MIN_CYCLE_T				4
22	MEMORY_SIZE				2
23	NV_CYCLE_T		4		
24	FREE_SPA CE		4		
25	FREE_TIME	4		4	
26	SHED_RCAS		4		
27	SHED_ROUT		4		
28	FAIL_SAFE	1		1	
29	SET_FSAFE				
30	CLR_FSAFE				
31	MAX_NOTIFY				4
32	LIM_NOTIFY		4		
33	CONFIRM_TIME		4		
34	WRITE_LOCK		1		
35	UPDATE_EVT				
36	BLOCK_ALM				
37	ALARM_SUM	8		8	
38	ACK_OPTION				2
39	WRITE_PRI				1
40	WRITE_ALM				
41	ITK_VER				
42	SOFT_REV				
43	SOFT_DESC				
44	SIM_ENABLE_MSG				
45	DEVICE_STATUS_1			4	
46	DEVICE_STATUS_2			4	
47	DEVICE_STATUS_3			4	
48	DEVICE_STATUS_4			4	
49	DEVICE_STATUS_5			4	
50	DEVICE_STATUS_6			4	
51	DEVICE_STATUS_7			4	
52	DEVICE_STATUS_8			4	
	Total bytes	22	32	54	31

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Table 5.12 View Objects for Transducer Block

Index (Device Revision 2)	Index (Device Revision 1)	Parameter	VIEW_1	VIEW_2	VIEW_31	VIEW_32	VIEW_33	VIEW_41	VIEW_42	VIEW_43	VIEW_44	VIEW_45	VIEW_46	VIEW_47	VIEW_48	VIEW_49
1	1	ST_REV	2	2	2	2	2	2	2	2	2	2	2	2	2	2
2	2	TAG_DESC														
3	3	STRATEGY						2								
4	4	ALERT_KEY						1								
5	5	MODE_BLK	4		4											
6	6	BLOCK_ERR	2		2											
7	7	UPDATE_EVT														
8	8	BLOCK_ALM														
9	9	TRANSDUCER_DIRECTORY														
10	10	TRANSDUCER_TYPE	2	2	2			2								
11	11	XD_ERROR	1		1			1								
12	12	COLLECTION_DIRECTORY														
13	13	CAL_POINT_HI		4				4								
14	14	CAL_POINT_LO		4				4								
15	15	CAL_MIN_SPAN						4								
16	16	CAL_UNIT						2								
17	17	SENSOR_TYPE						2								
18	18	SENSOR_RANGE						11								
19	19	SENSOR_SN						32								
20	20	SENSOR_CAL_METHOD							1							
21	21	SENSOR_CAL_LOC							32							
22	22	SENSOR_CAL_DATE							7							
23	23	SENSOR_CAL_WHO							32							
24	24	LIN_TYPE							1							
25	25	MASS_FLOW_VALUE	5		5											
26	26	MASS_FLOW_VALUE_RANGE								11						
27	27	MASS_FLOW_VALUE_FTIME								4						
28	28	MASS_FLOW_LOWCUT								4						
29	29	VOLUME_FLOW _VALUE	5		5											
30	30	VOLUME_FLOW_VALUE_RANGE								11						
31	31	VOLUME_FLOW_VALUE_FTIME								4						
32	32	VOLUME_FLOW_LOWCUT								4						
33	33	DENSITY_VALUE	5		5											
34	34	DENSITY_VALUE_RANGE								11						
35	35	DENSITY_VALUE_FTIME								4						

Index (Device Revision 2)	Index (Device Revision 1)	Parameter	VIEW_1	VIEW_2	VIEW_ 3 1	VIEW_ 3 2	VIEW_ 3 3	VIEW_ 4 1	VIEW_ 4 2	VIEW_ 4 3	VIEW_ 4 4	VIEW_ 4 5	VIEW_ 4 6	VIEW_ 4 7	VIEW_ 4 8	VIEW_ 4 9
36	36	DENSITY_LOWCUT								4						
37	37	TEMPERATURE _VALUE	5		5											
38	38	TEMPERATURE _VALUE_RANGE								11						
39	39	TEMPERATURE_VALUE_FTIME								4						
40	40	CONCENTR_MEAS_VALUE	5		5											
41	41	CONCENTR_MEAS_VALUE_RANGE									11					
42	42	CONCENTR_MEAS_VALUE_FTIME									4					
43	43	CONCENTR_MEAS_LOWCUT									4					
44	44	NET_FLOW_VALUE	5		5											
45	45	NET_FLOW_VALUE_RANGE									11					
46	46	NET_FLOW_VALUE_FTIME									4					
47	47	NET_FLOW_LOWCUT									4					
48		VELOCITY_VALUE	4		4											
49		VELOCITY_UNITS_INDEX									2					
50	48	DISP_SELECT_1									1					
51	49	DISP_SELECT_2									1					
52	50	DISP_SELECT_3									1					
53	51	DISP_SELECT_4									1					
54	52	DISP_DECIMAL_MASS_FLOW									1					
55	53	DISP_DECIMAL_VOLUME_FLOW									1					
56	54	DISP_DECIMAL_DENSITY									1					
57	55	DISP_DECIMAL_TEMPERATURE									1					
58	56	DISP_DECIMAL_CONCENTR_MEAS									1					
59	57	DISP_DECIMAL_NET_FLOW									1					
60	58	DISP_DECIMAL_IT1									1					
61	59	DISP_DECIMAL_IT2									1					
62	60	DISP_IT1_UNITS_INDEX									2					
63	61	DISP_IT2_UNITS_INDEX									2					
64	62	DISP_CONTRAST									1					
65	63	DISP_PERIOD									1					
66	64	DISP_LANGUAGE									1					
67	65	FLOW_DIRECTION									1					
68	66	BI_DIRECTION									1					
69	67	AUTO_ZERO_TIME									1					
70	68	AUTO_ZERO_EXE									1					

Index (Device Revision 2)	Index (Device Revision 1)	Parameter	VIEW_1	VIEW_2	VIEW_31	VIEW_32	VIEW_33	VIEW_41	VIEW_42	VIEW_43	VIEW_44	VIEW_45	VIEW_46	VIEW_47	VIEW_48	VIEW_49
71	69	AUTOZERO_VALUE				4										
72	70	AUTOZERO_FLUCTUATION				4										
73	71	AZ_INIT_MASS_FLOW				4										
74	72	AZ_INIT_DENSITY				4										
75	73	AZ_INIT_TEMP				4										
76	74	MASS_FLOW_FIX_VAL_SEL									1					
77	75	MASS_FLOW_FIXED_VALUE									4					
78	76	DENSITY_FIX_VAL_SEL									1					
79	77	REFERENCE_DENSITY									4					
80		DENSITY_OFFSET									4					
81	78	TEMP_FIX_VAL_SELECT									1					
82	79	TEMP_FIXED_VALUE									4					
83	80	TEMP_GAIN									4					
84	81	SENSOR_MODEL										1				
85	82	SK20										4				
86	83	SKT										4				
87	84	RV										4				
88	85	QNOM			4											
89	86	KD										4				
90	87	FL20										4				
91	88	FTC1										4				
92	89	FTCK										4				
93	90	SKP										4				
94	91	FPC										4				
95		SKTK										4				
96		SKPT										4				
97		FPTC										4				
98		FQC1										4				
99		FQC2										4				
100	92	PRESSURE										4				
101	93	PRESSURE_UNIT										2				
102	94	SLUG_ALARM_SELECT										1				
103	95	DRIVE_GAIN			4											
104	96	SLUG_CRITERIA										4				
105	97	SLUG_DURATION										4				

Index (Device Revision 2)	Index (Device Revision 1)	Parameter	VIEW_1	VIEW_2	VIEW_ 3 1	VIEW_ 3 2	VIEW_ 3 3	VIEW_ 4 1	VIEW_ 4 2	VIEW_ 4 3	VIEW_ 4 4	VIEW_ 4 5	VIEW_ 4 6	VIEW_ 4 7	VIEW_ 4 8	VIEW_ 4 9
106	98	AFTER_SLUG										1				
107	99	DRIVE_GAIN_DAMPING										4				
108	100	EMPTY_ PIPE_ALM_SEL										1				
109	101	EMPTY_PIPE_CRIT										4				
110	102	AFTER_EMPTY_PIPE										1				
111	103	CORROSION_ALM_SEL										1				
112	104	CORROSION_CRIT										4				
113	105	CORROSION_DAMP										4				
114	106	FLUID_MAX_TEMP										4				
115	107	SELF_TEST										1				
116	108	INITIALIZE_EEPROM										2				
117	109	ERR_STATUS			4											
118	110	ALM_STATUS			4											
119	111	WARNG_STATUS			4											
120	112	HIST_ORD				20										
121	113	HIST_ABS_ERR				4										
122	114	HIST_ABS_ALM				4										
123	115	HIST_ABS_WARNG				4										
124	116	CLEAR_HIST				1										
125	117	ALARM_PERFORM											2			
126	118	ALARM_SUM											8			
127		REFERENCE_TEMPERATURE											4			
128		REFERENCE_DENSITY_CARRIER											4			
129		TEMP_COEFF_A_CARRIER											4			
130		TEMP_COEFF_B_CARRIER											4			
131		REFERENCE_DENSITY_PRODUCT											4			
132		TEMP_COEFF_A_PRODUCT											4			
133		TEMP_COEFF_B_PRODUCT											4			
134		RCCT_SERIAL_NO_DETECTOR											16			
135		RCCT_SERIAL_NO_CONVERTER											16			
136		RELEASE_DATE											10			
137		RELEASE_REVISION											20			
138	119	Test_1												1		
139	120	Test_2												1		
140	121	Test_3												1		

Index (Device Revision 2)	Index (Device Revision 1)	Parameter	VIEW_1	VIEW_2	VIEW_31	VIEW_32	VIEW_33	VIEW_41	VIEW_42	VIEW_43	VIEW_44	VIEW_45	VIEW_46	VIEW_47	VIEW_48	VIEW_49
141	122	Test_4												4		
142	123	Test_5												4		
143	124	Test_6												4		
144	125	Test_7												4		
145	126	Test_8												4		
146	127	Test_9				4										
147	128	Test_10												4		
148	129	Test_11												4		
149	130	Test_12												1		
150	131	Test_13				4										
151	132	Test_14				4										
152	133	Test_15				4										
153	134	Test_16				4										
154	135	Test_17				4										
155	136	Test_18												1		
156	137	Test_19												4		
157	138	Test_20												4		
158	139	Test_21				1										
159	140	Test_22												1		
160	141	Test_23				4										
161	142	Test_24												1		
162	143	Test_25												4		
163	144	Test_26												4		
164	145	Test_27												22		
165	146	Test_28				1										
166	147	Test_29				1										
167	148	Test_30				1										
168	149	Test_31				1										
169		Test_62												4		
170		Test_63												4		
171		Test_64												1		
172		Test_65												1		
173		Test_66												4		
174		Test_67				4										
175		Test_68												2		

Index (Device Revision 2)	Index (Device Revision 1)	Parameter	VIEW_1	VIEW_2	VIEW_31	VIEW_32	VIEW_33	VIEW_41	VIEW_42	VIEW_43	VIEW_44	VIEW_45	VIEW_46	VIEW_47	VIEW_48	VIEW_49
176		Test_69												4		
177		Test_70												1		
178	150	Test_32													2	
179	151	Test_33													4	
180	152	Test_34													1	
181	153	Test_35													1	
182	154	Test_36													1	
183	155	Test_37													2	
184	156	Test_38													1	
185	157	Test_39													1	
186	158	Test_40													4	
187	159	Test_41													4	
188	160	Test_42													4	
189	161	Test_43													4	
190	162	Test_44													4	
191	163	Test_45													4	
192	164	Test_46													1	
193	165	Test_47													4	
194	166	Test_48													1	
195		Test_71													4	
196		Test_72													4	
197		Test_73													4	
198		Test_74													4	
199		Test_75													4	
200		Test_76													4	
201		Test_77													4	
202		Test_78													4	
203		Test_79													4	
204		Test_80													4	
205		Test_81													4	
206		Test_82													4	
207	167	Test_49														32
208	168	Test_50														32
209	169	Test_51					32									
210	170	Test_52														2

Index (Device Revision 2)	Index (Device Revision 1)	Parameter	VIEW_1	VIEW_2	VIEW_ 3 1	VIEW_ 3 2	VIEW_ 3 3	VIEW_ 4 1	VIEW_ 4 2	VIEW_ 4 3	VIEW_ 4 4	VIEW_ 4 5	VIEW_ 4 6	VIEW_ 4 7	VIEW_ 4 8	VIEW_ 4 9
211	171	Test_53														4
212	172	Test_54														
213	173	Test_55														
214	174	Test_56														
215	175	Test_57														
216	176	Test_58					2									
217	177	Test_59					2									
218	178	Test_60														
219	179	Test_61														1
			45	12	65	92	38	67	75	74	87	101	102	98	93	73

Table 5.13 View Objects for the AI Function Blocks

Relative Index	Parameter Mnemonic	VIEW 1	VIEW 2	VIEW 3	VIEW 4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	OUT	5		5	
9	SIMULATE				
10	XD_SCALE		11		
11	OUT_SCALE		11		
12	GRANT_DENY		2		
13	IO_OPTS				2
14	STATUS_OPTS				2
15	CHANNEL				2
16	L_TYPE				1
17	LOW_CUT				4
18	PV_FTIME				4
19	FIELD_VAL	5		5	
20	UPDATE_EVP				
21	BLOCK_ALM				
22	ALARM_SUM	8		8	
23	ACK_OPTION				2
24	ALARM_HYS				4
25	HI_HI_PRI				1
26	HI_HI_LIM				4
27	HI_PRI				1
28	HI_LIM				4
29	LO_PRI				1
30	LO_LIM				4
31	LO_LO_PRI				1
32	LO_LO_LIM				4
33	HI_HI_ALM				
34	HI_ALM				
35	LO_ALM				
36	LO_LO_ALM				
	Totalbytes	31	26	31	46

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Table 5.14 View Objects for PID Function Block (Optional)

Relative Index	Parameter Mnemonic	VIEW 1	VIEW 2	VIEW 3	VIEW 4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	PV	5		5	
8	SP	5		5	
9	OUT	5		5	
10	PV_SCALE		11		
11	OUT_SCALE		11		
12	GRANT_DENY		2		
13	CONTROL_OPTS				2
14	STATUS_OPTS				2
15	IN			5	
16	PV_FTIME				4
17	BYPASS		1		
18	CAS_IN	5		5	
19	SP_RATE_DN				4
20	SP_RATE_UP				4
21	SP_HI_LIM		4		
22	SP_LO_LIM		4		
23	GAIN				4
24	RESET				4
25	BAL_TIME				4
26	RATE				4
27	BKCAL_IN			5	
28	OUT_HI_LIM		4		
29	OUT_LO_LIM		4		
30	BKCAL_HYS				4
31	BKCAL_OUT			5	
32	RCAS_IN			5	
33	ROUT_IN			5	
34	SHED_OPT				1
35	RCAS_OUT			5	
36	ROUT_OUT			5	
37	TRK_SCALE				11
38	TRK_IN_D	2		2	
39	TRK_VAL	5		5	
40	FF_VAL			5	

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Relative Index	Parameter Mnemonic	VIEW 1	VIEW 2	VIEW 3	VIEW 4
41	FF_SCALE				11
42	FF_GAIN				4
43	UPDATE_EVT				
44	BLOCK_ALM				
45	ALARM_SUM	8		8	
46	ACK_OPTION				2
47	ALARM_HYS				4
48	HI_HI_PRI				1
49	HI_HI_LIM				4
50	HI_PRI				1
51	HI_LIM				4
52	LO_PRI				1
53	LO_LIM				4
54	LO_LO_PRI				1
55	LO_LO_LIM				4
56	DV_HI_PRI				1
57	DV_HI_LIM				4
58	DV_LO_PRI				1
59	DV_LO_LIM				4
60	HI_HI_ALM				
61	HI_ALM				
62	LO_ALM				
63	LO_LO_ALM				
64	DV_HI_ALM				
65	DV_LO_ALM				
	Total bytes	43	43	83	104

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Table 5.15 Indexes to View Objects for Each Block

Block	VIEW 1	VIEW 2	VIEW 3	VIEW 4
Resource block	40100	40101	40102	40103
Transducer block	40200	40201	40202	40203
AI1 block	40400	40401	40402	40403
AI2 block	40410	40411	40412	40413
AI3 block	40420	40421	40422	40423
AI4 block	40430	40431	40432	40433
AI5 block	40440	40441	40442	40443
AI6 block	40450	40451	40452	40453
IT1 block	40600	40601	40602	40603
IT2 block	40610	40611	40612	40613
PID block (optional)	40800	40801	40802	40803

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5.6.4 AI Function Block Parameters

Parameters of the six AI function blocks can be read and written from the host. For a list of block parameters in each ROTAMASS, refer to Appendix 1, “List of Parameters for Each Block of ROTAMASS.” The following describes important parameters and how to set them. For a model with an option adding a PID function block and LM functionality, see Appendixes 5 and 6.

MODE_BLK:

Indicates the three types of function block modes; Out_Of_Service, Manual, and Auto. In Out_Of_Service mode, the AI block does not operate. The Manual mode does not allow values to be updated. The Auto mode causes the measured value to be updated. Under normal circumstances, set the Auto mode to take effect. The Auto mode is the factory default.

CHANNEL:

This is the parameter of the transducer block to be input to the AI block. AI1 block is assigned mass flow rate. AI2 block is assigned volume flow rate. AI3 block is asigned density. AI4 block is asigned temperature. AI5 is assigned concentration measurement. AI 6 is assigned net flow rate. Do not change this setting.

XD_SCALE:

Scale of input from the transducer block. Changing the unit (can be set only in mass flow rate) also causes the unit within the transducer block to be automatically changed. (The unit is automatically changed according to the unit selected by AI 1, 2, 3, 4, 5, 6. AI5.XD_SCALE.UNIT_INDEX depend on customer’s spec.) Units which can be set by XD_SCALE are shown Table 5.16.

Note: With the same setting, some units are represented differently between the FOUNDATION Fieldbus communication type and the HART communication type of a ROTAMASS. Each unit enclosed in brackets above shows the unit for the HART communication type of ROTAMASS corresponding to the preceding unit (for the Foundation Fieldbus communication type).

Table 5.16 Available Units

Item	Block		Available Units		
XD_SCALE	AI1 (Channel 1: PV)	Mass Flow	1318:g/sec 1319:g/min 1320:g/h 1322:kg/s 1323:kg/min 1324:kg/h 1327:t/min 1328:t/h 1330:lb/s 1331:lb/min 1332:lb/h		
	AI2 (Channel 2: SV)	Volume Flow	1511:cucm/s 1512:cucm/min 1513:cucm/h 1351:l/s 1352:l/min 1353:l/h 1347:cum/s 1348:cum/min 1349:cum/h 1362:gal/s 1363:gal/min 1364:gal/h 1356:cuft/s 1357:cuft/min 1358:cuft/h 1371:bbl/s 1372:bbl/min 1373:bbl/h 1374:bbl/d 1367:Impgal/s 1368:Impgal/min 1369:Impgal/h	Units selectable when 'FIXED DENSITY' is selected	Units selectable when 'Gas' measurement (/GA) is selected
		Standard Volume Flow	1537:Sl/s 1538:Sl/min 1539:Sl/h 65524:Scuft/s 1360:Scuft/min 1361:Scuft/h 1527:Scum/s 1528:Scum/min 1529:Scum/h		
		Normal Volume Flow	1532:Nl/s 1533:Nl/min 1534:Nl/h 1522:Ncum/s 1523:Ncum/min 1524:Ncum/h		
	AI3 (Channel 3: TV)	Density	1104:g/ml 1103:kg/l 1097:kg/cum 1108:lb/gal 1107:lb/cuft 1100:g/cc	'Gas' or 'Liquid'	When Concentration 'Standard' or 'Net Oil' is selected.
			1111:H-Baume 1112:L-Baume 1113:degAPI		
	AI4 (Channel 4: QV)	Temperature	1000:Kelvin 1001:degC 1002:degF		

XD_SCALE	AI5 (Channel 5: 5V)	Concentration	1426:degBrix (°Brix) 65520:WT-% 65521:Vol-% 1343:WT-% sol 1344:Vol-% sol	'Standard' or 'Net Oil'	'Advanced' (acc. to customer's spec, read only)
			1111:H-Baume 1112:L-Baume 1113:degAPI		
	AI6 (Channel 6: 6V)	Net Flow	1318:g/sec 1319:g/min 1320:g/h 1322:kg/s 1323:kg/min 1324:kg/h 1327:t/min 1328:t/h 1330:lb/s 1331:lb/min 1332:lb/h		
OUT_SCALE	AI1 to AI6		1342:%		

OUT_SCALE:

Sets the range of output (from 0% to 100%). Available units for OUT_SCALE are the Table 5.16 units for XD_SCALE.

L_TYPE:

Specifies the operation function of the AI blocks. The factory default is "Direct", so the input delivered to CHANNEL is directly reflected on OUT. If set to "Indirect", scaling by XD_SCALE and OUT_SCALE is carried out and is reflected on OUT. "Indirect SQRT" is not used for ROTAMASS.

PV_FTIME:

Sets the time constant of the damping function within the AI blocks (primary delay) in seconds.

Alarm Priority:

Indicates the priority of the process alarm. If a value of 3 or greater is set, an alarm is transmitted. The factory default is 0. Four types of alarm can be set: HI_PRI, HI_HI_PRI, LO_PRI, and LO_LO_PRI.

Alarm Threshold:

Sets the threshold at which a process alarm is generated. The factory default setting is a value that does not generate an alarm. Four types of alarm can be set: HI_LIM, HI_HI_LIM, LO_LIM, and LO_LO_LIM.

5.6.5 Transducer Block Parameters

The transducer block sets function specific to the flow rate measurement of the ROTAMASS. For a list of block parameters in each ROTAMASS, refer to Appendix 1, "List of Parameters for Each Block of ROTAMASS." The following describes important parameters and how to set them.

Parameters for Zero Tuning

1) **AUTO_ZERO_TIME**
(Relative Index 69)
Defines the duration of the auto zero function as follows:

1 = 3 Minute

2 = 30 Seconds

2) **AUTO_ZERO_EXE**
(Relative Index 70)
Starts the auto zero function to be performed as follows:

1 = Not Execute

2 = Execute

Parameters for Primary Variable

3) **MASS_FLOW_VALUE_FTIME**
(Relative Index 27)
Defines the damping time constant for the mass flow rate to be input to the flow rate calculation.

Setting range: 0.1 to 200 (seconds)

Default: 3 (seconds)

4) MASS_FLOW_LOWCUT
(Relative Index 28)
Sets the low cutoff mass flow rate level.

Setting range: Minimum flow rate 0 to 10% of MASS_FLOW_VALUE_RANGE. EU_100. The default value is 0 %.

Unit: As selected in AI1.XD_SCALE. UNITS_INDEX

Parameters for Secondary Variable

5) VOLUME_FLOW_VALUE_FTIME
(Relative Index 31)
Defines the damping time constant for the volume flow rate to be input to the flow rate calculation.

Setting range: 0.1 to 200 (seconds)

Default: 3 (seconds)

6) VOLUME_FLOW_LOWCUT
(Relative Index 32)
Sets the low cutoff volume flow rate level.

Setting range: Minimum flow rate 0 to 10% of VOLUME_FLOW_VALUE_RANGE. EU_100. The default value is 0 %.

Unit: As selected in AI2.XD_SCALE. UNITS_INDEX

Parameters for Tertiary Variable

7) DENSITY_VALUE_FTIME
(Relative Index 35)
Defines the damping time constant for the density to be input to the density calculation.

Setting range: 0.1 to 200 (seconds)

Default: 3 (seconds)

8) DENSITY_LOWCUT
(Relative Index 36)
Sets the low cutoff density level.

Setting range: Minimum value 0 to 10% of DENSITY_VALUE_RANGE.EU_100. The default value is 0 %.

Unit: As selected in AI3.XD_SCALE. UNITS_INDEX

Parameters for Quaternary Variable

9) TEMPERATUR_VALUE_FTIME
(Relative Index 39)
Defines the damping time constant for the temperature to be input to the temperature calculation.

Setting range: 0.1 to 200 (seconds)

Default: 3 (seconds)

Parameters for flow direction

10) FLOW_DIRECTION
(Relative Index 67)
Defines the direction of the flow and determines the sign of the calculated flow rate values.

Setting range: Forward; Reverse

Default: Forward

11) BI_DIRECTION
(Relative Index 68)
Enables the ROTAMASS to measure the flow in bi- or uni-direction mode. The sign of the calculated flow rate values depends on the flow direction.

Setting range: Bi-Direction; Uni-Direction

Default: Bi-Direction

Parameters for local Display

12) DISP_SELECT_1
(Relative Index 50)
Selects the data to be displayed on the first line of the LCD indicator, as follows (Default : Massflow) :

1 = AI1 OUT = Massflow:
Actual mass flow rate

2 = AI2 OUT = Volumeflow:
Actual volume flow rate

3 = AI3 OUT = Density:
Actual density value

4 = AI4 OUT = Temperature:
Actual temperature value

5 = AI5 OUT = Conc Meas:

Actual calculated concentration value

6 = AI6 OUT = Netflow:
Actual net flow rate

7 = IT1 OUT = IT1: Integrator 1 totalized value

8 = IT2 OUT = IT2: Integrator 2 totalized value

9 = VELOCITY: Actual medium´s velocity

13) DISP_SELECT_2

(Relative Index 51)
Selects the data to be displayed on the second line of the LCD indicator, as follows:

see DISP_SELECT_1

255 : None

14) DISP_SELECT_3
(Relative Index 52)
Selects the data to be displayed on the third line of the LCD indicator, as follows:

see DISP_SELECT_1

255 : None

15) DISP_SELECT_4
(Relative Index 53)
Selects the data to be displayed on the fourth line of the LCD indicator, as follows:

see DISP_SELECT_1

255 : None

16) DISP_DECIMAL_MASS_FLOW
(Relative Index 54)
Selects the format of the mass flow value to be displayed on the LCD indicator, as follows:

1 = xxxxxxx: No decimal point (7 digits)

2 = xxxxx.X: 1 digit after DP resolution

3 = xxxx.XX: 2 digit after DP resolution

4 = xxx.XXX: 3 digit after DP resolution

5 = xx.XXXX: 4 digit after DP resolution

6 = x.XXXXX: 5 digit after DP resolution

17) DISP_DECIMAL_VOLUME_FLOW
(Relative Index 55)
Selects the format of the volume flow value to be displayed on the LCD indicator, as follows:

see DISP_DECIMAL_MASS_FLOW

18) DISP_DECIMAL_DENSITY
(Relative Index 56)
Selects the format of the density value to be displayed on the LCD indicator, as follows:

see DISP_DECIMAL_MASS_FLOW

19) DISP_DECIMAL_TEMPERATURE
(Relative Index 57)
Selects the format of the temperature value to be displayed on the LCD indicator, as follows:

see DISP_DECIMAL_MASS_FLOW

20) DISP_DECIMAL_IT1
(Relative Index 60)
Selects the format of the interator 1 value to be displayed on the LCD indicator, as follows:

1 = xxxxxxxx: No decimal point (8 digits)

2 = xxxxxx.X: 1 digit after DP resolution

3 = xxxxx.XX: 2 digit after DP resolution

4 = xxxx.XXX: 3 digit after DP resolution

5 = xxx.XXXX: 4 digit after DP resolution

6 = xx.XXXXX: 5 digit after DP resolution

7 = x.XXXXXX: 6 digit after DP resolution

21) DISP_DECIMAL_IT2
(Relative Index 61)
Selects the format of the interator 2 value to be displayed on the LCD indicator, as follows:

see DISP_DECIMAL_IT1

22) DISPLAY_CONTRAST
(Relative Index 64)
Sets the display contrast of the LCD indicator.

Setting range: 0 to 23

Default: 4

23) DISPLAY_PERIOD
(Relative Index 65)
Sets the display refresh cycle of the LCD indicator.

Setting range: 0.5sec; 1sec; 2sec

Default: 1sec

24) DISPLAY_LANGUAGE
(Relative Index 66)
Sets the display language for the indication of error, alarms and warning on the LCD indicator.

Setting range: English; German; French

Default: English

25) VELOCITY_UNITS_INDEX

(Relative Index 49)

Defines the unit of the medium velocity in the tube. Velocity is zero if gas measurement is selected.

Setting range: m/s, ft/s

Default: m/s

Parameters for 5th Variable (Option /Cxx)

26) CONCENTR_MEAS_VALUE_FTIME

(Relative Index 42)

Defines the damping time constant for the concentration meas value to be input to the concentration calculation.

Setting range: 0.1 to 200 (seconds)

Default: 10 (seconds)

27) CONCENTR_MEAS_LOWCUT

(Relative Index 43)

Sets the low cutoff concentration level.

Setting range: Minimum flow rate 0 to 10% of CONCENTR_MEAS_VALUE_RANGE. EU_100. The default value is 0 %.

Unit: As selected in AI5.XD_SCALE. UNITS_INDEX

Parameters for 6th Variable (Option /Cxx)

28) NET_FLOW_VALUE_FTIME

(Relative Index 46)

Defines the damping time constant for the net flow rate to be input to the flow rate calculation.

Setting range: 0.1 to 200 (seconds)

Default: 3 (seconds)

29) NET_FLOW_VALUE_LOWCUT

(Relative Index 47)

Sets the low cutoff net flow rate level.

Setting range: Minimum flow rate 0 to 10% of NET_FLOW_VALUE_RANGE. EU_100. The default value is 0 %.

Unit: As selected in AI6.XD_SCALE. UNITS_INDEX

Parameter for indication of actual and history errors, alarms and warnings

TB120: HIST_ORD

Kind	Hex	Name	Description
None	0x0000	No error	
Error	0x0101	E-01	Frequency Fault
	0x0102	E-02	Signal Fault
	0x0103	E-03	EEPROM Fault
	0x0104	E-04	CPU Fault
	0x0105	E-05	DSP Fault
	0x0106	E-06	Sensor 1 Signal Fault
	0x0107	E-07	Sensor 2 Signal Fault
	0x0108	E-08	Temp Sensor Fault
Alarm	0x020E	A-14	Slug Detection
	0x020F	A-15	Empty Pipe Detection
	0x0210	A-16	Corrosion Detection
Warning	0x0301	W-01	Density Lower 0.3 kg/l
	0x0302	W-02	Fixed Dens selected (Density only)
	0x0303	W-03	Fixed Temp selected
	0x0304	W-04	Fixed Mass flow selected (MF only)
	0x0306	W-06	Autozero Value out of Range
	0x0307	W-07	Autozero Fluctuation out of Range

TB121: HIST_ABS_ERR and TB117: ERR_STATUS

Kind	Hex	Name	Description
Error	0x00000001	E-01	Frequency Fault
	0x00000002	E-02	Signal Fault
	0x00000004	E-03	EEPROM Fault
	0x00000008	E-04	CPU Fault
	0x00000010	E-05	DSP Fault
	0x00000020	E-06	Sensor 1 Signal Fault
	0x00000040	E-07	Sensor 2 Signal Fault
	0x00000080	E-08	Temp Sensor Fault

TB122: HIST_ABS_ALM and TB118: ALM_STATUS

Kind	Hex	Name	Description
Alarm	0x00002000	A-14	Slug Detection
	0x00004000	A-15	Empty Pipe Detection
	0x00008000	A-16	Corrosion Detection

TB123: HIST_ABS_WARNG and TB119: WARNG_STATUS

Kind	Hex	Name	Description
Warning	0x00000001	W-01	Density Lower 0.3 kg/l
	0x00000002	W-02	Fixed Dens selected (Density only)
	0x00000004	W-03	Fixed Temp selected
	0x00000008	W-04	Fixed Mass flow selected (MF only)
	0x00000020	W-06	Autozero Value out of Range
	0x00000040	W-07	Autozero Fluctuation out of Range
	0x00000000	No error/ alarm/ warning	

6. IN-PROCESS OPERATION

This chapter describes the procedure performed when changing the operation of the function block of the ROTAMASS in process.

6.1 Mode Transition

When the function block mode is changed to Out_Of_Service, the function block pauses and a block alarm is issued.

When the function block mode is changed to Manual, the function block suspends updating of output values. In this case alone, it is possible to write a value to the OUT parameter of the block for output. Note that no parameter status can be changed.

6.2 Generation of Alarm

6.2.1 Indication of Alarm

When the self-diagnostics function indicates that a device is faulty, an alarm (device alarm) is issued from the resource block. When an error (block error) is detected in each function block or an error in the process value (process alarm) is detected, an alarm is issued from each block. If an LCD indicator is installed, the error number is displayed as E-xx, the alarm number is displayed a A-xx and the warning is displayed as W-xx. If two or more alarms are issued, multiple error numbers are displayed in 2-second intervals.

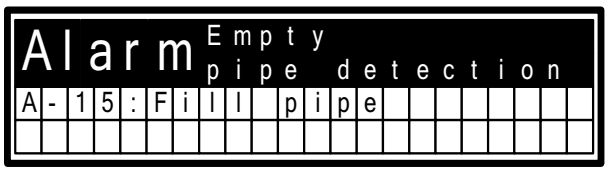

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Figure 6.1 Alarm Identification on Indicator

The error details corresponding to alarm indications on the LCD indicator and whether or not switches are provided to disable the corresponding alarms are shown in Table 6.1. For the alarms for which an alarm mask switch is provided, the default alarm settings are also shown. Those alarms for which an alarm mask switch is not provided are enabled at all times. For how to modify these mask switch statuses, see Appendix 3, “Operation of Each Parameter in Failure Mode.”

Table 6.1 Alarm Indications and Alarm Mask Switches

	Name	Alarm mask SW
E-01	Frequency Fault	Not provided
E-02	Signal Fault	Not provided
E-03	EEPROM Fault	Not provided
E-04	CPU Fault	Not provided
E-05	DSP Fault	Not provided
E-06	Sensor 1 Signal Fault	Not provided
E-07	Sensor 2 Signal Fault	Not provided
E-08	Temp Sensor Fault	Not provided
E-09	Download Incomplete	Not provided
E-10	Download Fail	Not provided
E-11	Serial Communication Error1	Not provided
E-12	Serial Communication Error2	Not provided
A-14	Slug Detection	Provided (OFF)
A-15	Empty Pipe Detection	Provided (OFF)
A-16	Corrosion Detection	Provided (OFF)
W-01	Density Lower 0.3kg/l	Not provided
W-02	Fixed Dens Selected	Provided (OFF)
W-03	Fixed Temp Selected	Provided (OFF)
W-04	Fixed Mass Flow Selected	Provided (OFF)
W-06	Autozero Value out of Range	Not provided
W-07	Autozero Fluctuation out of Range	Not provided
W-08	PD/Freq Simulation Active	Not provided
A-20	All FB Non-Schedule	Not provided
A-21	RS O/S Mode	Not provided
A-22	TB O/S Mode	Not provided
A-23	AI1 FB O/S Mode	Provided (ON)
A-24	AI2 FB O/S Mode	Provided (ON)
A-25	AI3 FB O/S Mode	Provided (ON)
A-26	AI4 FB O/S Mode	Provided (ON)
A-27	AI5 FB O/S Mode	Provided (ON)
A-28	AI6 FB O/S Mode	Provided (ON)
A-29	IT1 FB O/S Mode	Provided (ON)
A-30	IT2 FB O/S Mode	Provided (ON)
A-31	PID FB O/S Mode	Provided (OFF)
A-41	Display out of range	Provided (OFF)
W-21	AI1 FB Man Mode	Provided (OFF)
W-22	AI2 FB Man Mode	Provided (OFF)
W-23	AI3 FB Man Mode	Provided (OFF)
W-24	AI4 FB Man Mode	Provided (OFF)
W-25	AI5 FB Man Mode	Provided (OFF)
W-26	AI6 FB Man Mode	Provided (OFF)
W-27	IT1 FB Man Mode	Provided (OFF)
W-28	IT2 FB Man Mode	Provided (OFF)
W-41	AI1 Sim. enabled	Provided (OFF)
W-42	AI2 Sim. enabled	Provided (OFF)
W-43	AI3 Sim. enabled	Provided (OFF)
W-44	AI4 Sim. enabled	Provided (OFF)
W-45	AI5 Sim. enabled	Provided (OFF)
W-46	AI6 Sim. enabled	Provided (OFF)
W-51	AI1 Non-Schedule	Provided (OFF)
W-52	AI2 Non-Schedule	Provided (OFF)
W-53	AI3 Non-Schedule	Provided (OFF)
W-54	AI4 Non-Schedule	Provided (OFF)
W-55	AI5 Non-Schedule	Provided (OFF)
W-56	AI6 Non-Schedule	Provided (OFF)
W-57	IT1 Non-Schedule	Provided (OFF)
W-58	IT2 Non-Schedule	Provided (OFF)
W-61	PID Bypass Mode	Provided (OFF)
W-62	PID FB Error1	Provided (OFF)
W-63	PID FB Error2	Provided (OFF)
W-71	IT1 Low Clock Per	Provided (OFF)
W-72	IT2 Low Clock Per	Provided (OFF)
W-73	IT1 Last OUT Not Saved	Provided (OFF)
W-74	IT2 Last OUT Not Saved	Provided (OFF)

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6.2.2 Alarms and Events

Each ROTAMASS can report the following alarms and events as alerts.

Analog Alerts (Generated when a process value exceeds threshold)
- By AI Block: Hi-Hi Alarm, Hi Alarm, Low Alarm, Low-Low Alarm

Discrets Alerts (Generated when an abnormal condition is detected)
- By Resource Block: Block Alarm, Write Alarm
- By Transducer Block: Block Alarm
- By AI, IT, PID Block: Block Alarm

Update Alerts (Generated when a important (restorable) parameter is updated)
- By Resource Block: Update Event
- By Transducer Block: Update Event
- By AI, IT, PID Block: Update Event

An alert has the following structure:

Table 6.2 Alert Object

Subindex			Parameter Name	Explanation
Analog Alert	Discrete Alert	Update Alert		
1	1	1	Block Index	Index of block from which alert is generated
2	2	2	Alert Key	Alert Key copied from the block
3	3	3	Standard Type	Type of the alert
4	4	4	Mft Type	Alert Name identified by manufacturer specific DD
5	5	5	Message Type	Reason of alert notification
6	6	6	Priority	Priority of the alarm
7	7	7	Time Stamp	Time when this alert is first detected
8	8		Subcode	Enumerated cause of this alert
9	9		Value	Value of referenced data
10	10		Relative Index	Relative Index of referenced data
		8	Static Revision	Value of static revision (ST_REV) of the block
11	11	9	Unit Index	Unit code of referenced data

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6.3 Simulation Function

The simulation function simulates the input of a function block and lets it operate as if the data was received from the transducer block. It is possible to conduct testing for the downstream function blocks or alarm processes.

A SIMULATE_ENABLE jumper switch is mounted on the ROTAMASS amplifier. This is to prevent the accidental operation of this function. When this is switched on, simulation is enabled. (See Figure 6.2.) To initiate the same action from a remote terminal, if REMOTE LOOP TEST SWITCH is written to SIM_ENABLE_MSG (index 1044) parameter of the resource block, the resulting action is the same as is taken when the above switch is on. Note that this parameter value is lost when the power is turned off. In simulation enabled status, an alarm is generated from the resource block, and other device alarms will be masked; for this reason the simulation must be disabled immediately after using this function.

The SIMULATE parameter of AI block consists of the elements listed in Table 6.3 below.

Table 6.3 SIMULATE Parameter

Sub-index	Parameters	Description
1	Simulate Status	Sets the data status to be simulated.
2	Simulate Value	Sets the value of the data to be simulated.
3	Transducer Status	Displays the data status from the transducer block. It cannot be changed.
4	Transducer Value	Displays the data value from the transducer block. It cannot be changed.
5	Simulate En/Disable	Controls the simulation function of this block. 1: Disabled (standard) 2: Active(simulation)

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When Simulate En/Disable in Table 6.3 above is set to "Active", the applicable function block uses the simulation value set in this parameter instead of the data from the transducer block. This setting can be used for propagation of the status to the trailing blocks, generation of a process alarm, and as an operation test for trailing blocks.

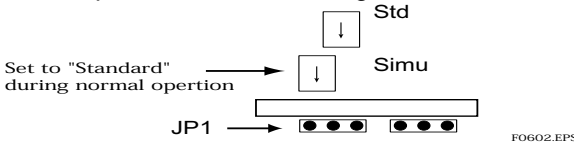

Figure 6.2 SIMULATE_ENABLE Jumper Position

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7. DEVICE STATUS

In a ROTAMASS, the current device statuses and error details are represented by parameters DEVICE_ STATUS_1 to DEVICE_STATUS_5 (indexes 1045 to 1048) inside the resource statuses.

Table 7.1 Contents of RS-DEVICE_STATUS_1 (Index 1045)

Hexadecimal	Display through DD	Description
0x02000000	E-10	Download Fail
0x01000000	E-09	Download Incomplete
0x00800000		Sim. enable Jumper On
0x00400000	A-21	RS in O/S mode
0x00080000	E-03	EEPROM (FB) fault
0x00008000		Link Obj.1/17/33 not open
0x00004000		Link Obj.2/18/34 not open
0x00002000		Link Obj.3/19/35 not open
0x00001000		Link Obj.4/20/36 not open
0x00000800		Link Obj.5/21/37 not open
0x00000400		Link Obj.6/22/38 not open
0x00000200		Link Obj.7/23/39 not open
0x00000100		Link Obj.8/24/40 not open
0x00000080		Link Obj.9/25 not open
0x00000040		Link Obj.10/26 not open
0x00000020		Link Obj.11/27 not open
0x00000010		Link Obj.12/28 not open
0x00000008		Link Obj.13/29 not open
0x00000004		Link Obj.14/30 not open
0x00000002		Link Obj.15/31 not open
0x00000001		Link Obj.16/32 not open

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Table 7.2 Contents of RS-DEVICE_STATUS_2 (Index 1046)

Hexadecimal	Display through DD	Description
0x20000000	E-12	Serial communication error2
0x10000000	E-11	Serial communication error1
0x00800000	E-08	Temp. Sensor Fault
0x00400000	E-07	Sensor 2 Signal Fault
0x00200000	E-06	Sensor 1 Signal Fault
0x00100000	E-05	DSP Fault
0x00080000	E-04	CPU Fault
0x00040000	E-03	EEPROM (HART) Fault
0x00020000	E-02	Signal Fault
0x00010000	E-01	Frequency Fault
0x00000200	W-08	PD/Freq. Simulation Active
0x00000100	W-07	Autozero Fluctuation out of Range
0x00000080	W-06	Autozero Value out of Range
0x00000040	W-04	Fixed Mass Flow Selected
0x00000020	W-03	Fixed Temp. Selected
0x00000010	W-02	Fixed Dens. Selected
0x00000008	W-01	Density lower 0.3kg/l
0x00000004	A-16	Corrosion Detection
0x00000002	A-15	Empty Pipe Detection
0x00000001	A-14	Slug Detection

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Table 7.3 Contents of RS-DEVICE_STATUS_3 (Index 1046)

Hexadecimal	Display through DD	Description
0x00800000	A-20	All FB Non-Schedule
0x00400000	A-22	TB O/S Mode
0x00010000	A-41	Display out of Range

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Table 7.4 Contents of RS-DEVICE_STATUS_4 (Index 1046)

Hexadecimal	Display through DD	Description
0x00800000	W-28	IT2 FB Man. Mode
0x00400000	W-27	IT1 FB Man. Mode
0x00200000	W-26	AI6 FB Man. Mode
0x00100000	W-25	AI5 FB Man. Mode
0x00080000	W-24	AI4 FB Man. Mode
0x00040000	W-23	AI3 FB Man. Mode
0x00020000	W-22	AI2 FB Man. Mode
0x00010000	W-21	AI1 FB Man. Mode
0x00000100	A-31	PID FB O/S Mode
0x00000080	A-30	IT2 FB O/S Mode
0x00000040	A-29	IT1 FB O/S Mode
0x00000020	A-28	AI6 FB O/S Mode
0x00000010	A-27	AI5 FB O/S Mode
0x00000008	A-26	AI4 FB O/S Mode
0x00000004	A-25	AI3 FB O/S Mode
0x00000002	A-24	AI2 FB O/S Mode
0x00000001	A-23	AI1 FB O/S Mode

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Table 7.5 Contents of RS-DEVICE_STATUS_5 (Index 1046)

Hexadecimal	Display through DD	Description
0x20000000	W-72	IT2 Low Clock Per.
0x10000000	W-71	IT1 Low Clock Per.
0x08000000	W-74	IT2 Last Out Not Saved
0x04000000	W-73	IT1 Last Out Not Savedt
0x00800000	W-58	IT2 Non-Schedule
0x00400000	W-57	IT1 Non-Schedule
0x00200000	W-56	AI6 Non-Schedule
0x00100000	W-55	AI5 Non-Schedule
0x00080000	W-54	AI4 Non-Schedule
0x00040000	W-53	AI3 Non-Schedule
0x00020000	W-52	AI2 Non-Schedule
0x00010000	W-51	AI1 Non-Schedule
0x00008000	W-63	PID FB Error2
0x00004000	W-62	PID FB Error1
0x00002000	W-61	PID Bypass mode
0x00000020	W-46	AI6 Sim. enabled
0x00000010	W-45	AI5 Sim. enabled
0x00000008	W-44	AI4 Sim. enabled
0x00000004	W-43	AI3 Sim. enabled
0x00000002	W-42	AI2 Sim. enabled
0x00000001	W-41	AI1 Sim. enabled

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8. GENERAL SPECIFICATIONS

PERFORMANCE SPECIFICATIONS

Model

- Remote detector RCCS30LR to 33: 2 tubes, low flow design
- Remote detector RCCS34 to 39/XR : 2 tube design
- Remote field-mount converter RCCF31
- Integral type RCCT34 to 39/XR: 2 tube design

Fluid to be measured : Liquid, gas or slurry

Measurement Items : Mass flow, density, temperature and derived from these values: concentration, volume flow and net flow

Mass Flow Measurement

Table 1: measuring range

Model		RCCS30 LR	RCCS30	RCCS31	RCCS32	RCCS33
Qmax	t/h	0.04	0.094	0.3	0.6	1.5
	lb/h	88	207	661	1322	3307
Qnom	t/h	0.021	0.045	0.17	0.37	0.95
	lb/h	46	99	374	815	2094

Model		RCC□34	RCC□36	RCC□38	RCC□39	RCC□39 /IR	RCC□39 /XR
Qmax	t/h	5	17	50	170	300	600
	lb/h	11023	37478	110231	374785	661386	1322773
Qnom	t/h	3	10	32	100	250	500
	lb/h	6613	22046	70547	220462	551155	1102311

Qnom is the water flow rate at about 1 bar pressure drop.
The flowmeter has a default low cut of 0.05% of Qnom.

Accuracy of mass flow (refer to table 2):
Liquid RCCS30LR - 39/XR:
± 0.1% of flow rate ± zero stability / flow rate *100%
Gas (option /GA):
± 0.5% of flow rate ± zero stability / flow rate *100%

Accuracy of volume flow :
SQRT ((mass flow error in %)² + (density error in %)²)

Accuracy based on the frequency output includes the combined effects of repeatability, linearity and hysteresis.

Repeatability for liquids: ± 0.05%
± (zero stability/2) / flow rate *100%

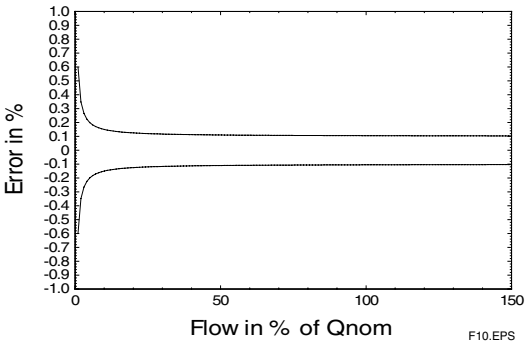


Table 2 : Zero Stability

Model	RCCS30 LR	RCCS30	RCCS31	RCCS32	RCCS33
kg/h	0.003	0.005	0.0085	0.019	0.048
lb/h	0.006	0.011	0.018	0.04	0.105

Model	RCC□34	RCC□36	RCC□38	RCC□39	RCC□39 /IR	RCC□39 /XR
kg/h	0.15	0.5	1.6	5	13	25
lb/h	0.33	1.1	3.5	11	28.6	55

Pressure Dependency

The stiffness of the ROTAMASS tubes is slightly line pressure dependent. The static pressure effect of mass flow and density can be corrected by setting the static pressure manually via menu.

Table 3 : Static pressure effect on mass flow (if not corrected)

Model		RCCS30 LR	RCCS30	RCCS31	RCCS32	RCCS33
% of rate per bar / (psi)	SH	0.00000 / (0.0)	0.00000 / (0.0)	0.00012 / (0.0017)	0.00246 / (0.0356)	0.0035 / (0.105)
	HC	----	----	----	----	----
Model		**RCC□34**	**RCC□36**	**RCCv38**	**RCC□39**	**RCC□39 /IR**
% of rate per bar / (psi)	SL	0.00081 / (0.011)	0.00346 / (0.050)	0.00950 / (0.137)	0.01058 / (0.153)	0.0047 / (0.068)
	HC	0.00084 / (0.012)	0.00336 / (0.048)	0.00896 / (0.129)	0.00808 / (0.117)	0.00287 / (0.041)
Model		**RCC□39 /XR**				
% of rate per bar / (psi)	SL	0.00740 / (0.107)				
	HC	----				

Density Measurement

Adjustment with water and air at calibration temperature.
Measuring range:
RCCS30LR - 38: 0.3 kg/l to 5 kg/l
RCC□39 -39/XR : 0.3 kg/l to 2 kg/l
No density measurement for gas applications.
With option /K4 thermal stabilization is acquired.
For further details about the option /K6 please refer to “special calibrations” on page 3.
Calibration condition standard
Density : 0.9 kg/l ≤ ρ ≤ 1.1 kg/l
Temp. Fluid : 22.5°C ± 12.5°C
Flow Rate : about 0.2 * Qnom as defined for each model
Calibration condition for /K6:
Density : 0.7 kg/l ≤ ρ ≤ 1.65 kg/l
Temp. Fluid : 20°C ≤ T ≤ 80°C
Temp. Ambient : 20°C ± 3K
Flow Rate : about 0.2 * Qnom as defined for each model

Table 4: Accuracy (at calibration conditions):

Model	Standard	Option /K4	Option /K6
RCCS30LR	0.02 g/cm³ *)	------	------
RCCS30	0.008 g/cm³ *)	------	------
RCCS31	0.004 g/cm³	0.001 g/cm³	------
RCCS32	0.004 g/cm³	0.001 g/cm³	0.0005 g/cm³
RCCS33	0.004 g/cm³	0.001 g/cm³	0.0005 g/cm³
RCC□34	0.003 g/cm³	0.001 g/cm³	0.0005 g/cm³
RCC□36	0.0022 g/cm³	0.001 g/cm³	0.0005 g/cm³
RCC□38	0.0015 g/cm³	0.001 g/cm³	0.0005 g/cm³
RCC□39	0.0015 g/cm³	0.001 g/cm³	0.0005 g/cm³
RCC□39/IR	0.0015 g/cm³	------	------
RCC□39/XR	0.0015 g/cm³	------	------

Repeatability:
RCCS32-33, RCC□34-39/XR : ± 0.0005 g/cm³ (Std, /K4)
Static pressure effect:
Compensated if static pressure is set in the menu.

Specification of high performance density measurement option /K6: Density calibration

Density range : 0.3 to 2.5 kg/l
Ambient temp. range : -10°C to 50°C (14°F to 122°F)
Process temp. range Standard: -50°C to 150°C (58°F to 302°F)
Process temp. range /HT: 150°C to 350°C (302°F to 662°F)
Minimum flow rate for specified accuracy:
- RCC□36 to RCC□39 : 700 kg/h (1543 lb/h)
- RCC□34 : 140 kg/h (308 lb/h)
- RCCS33 : 90 kg/h (198 lb/h)
- RCCS32 : 37 kg/h (81 lb/h)

Maximum flow rate : Q_{nom}
Repeatability : ±0.0002 g/cm³
Temperature measurement:
±(0.5°C+0.002*abs(T_{medium}-20°C)) (not /HT)
±(0.5°C+0.008*abs(T_{medium}-20°C)) (/HT)
Density accuracy : only for liquids, one phase
Process temperature influence :
±0.000015 g/cm³ * abs(T_{medium}-20°C)

Temperature Measurement

Temperature measuring range of converter :
Standard, /LT, /MT : -200°C to 230°C (-328°F to 448°F)
Option /HT : 0°C to 350°C (32°F to 662°F)
Accuracy:
Standard (-70°C to 150°C / -94°F to 302°F)
: ±(0.5°C+0.005*abs(T_{medium}-20°C))
Option /LT (-200°C to 150°C / -328°F to 302°F)
: ±(1.0°C+0.008*abs(T_{medium}-20°C))
Option /MT (-70°C to 260°C / -94°F to 500°F)
: ±(0.5°C+0.005*abs(T_{medium}-20°C))
Option /HT (0°C to 350°C / 32°F to 662°F)
: ±(1.0°C+0.008*abs(T_{medium}-20°C))
For process temperatures more than 80°C (176°F) higher/ lower than ambient temperature the detector should be insulated to maintain optimum accuracy.

Heat Tracing

Heating with heat carrier, insulation and protection housing. Typically the max. surface temperature at the protection housing from inner heating is 40°C (at Tamb = 20°C). Above 150°C (302°F) process temperature insulation from the manufacturer is recommended. However up to 230°C (446°F) process temperature the customer can insulate the detector himself. For this case order option /S2.
Option /T1 : only insulation and protection
Option /T2 : insulation, protection and heating line
Option /T3 : like /T2 but with ventilation
Process connection for the heat carrier fluid (see table 10):
for D-type flanges : EN DN 15 PN 40 Form B1
for A-type flanges : ANSI ½ - 150 lbs.
for J-type flanges : JIS DN15 10K
Max. pressure : PN 40
Protection class : IP54, install roof protected
For fluid temperatures below -70°C select option /LT.

Calibration for Liquids and Gases

The ROTAMASS flowmeters are always factory calibrated with water. Calibration Conditions:
- Water : 22.5°C ± 12.5°C (72.5°F ± 22.5°F)
- Ambient temperature : 22.5°C ± 12.5°C (72.5°F ± 22.5°F)
- Process pressure : 1 to 2 bar abs
- Installation: RCCS30LR to RCC□38 vertical
RCC□39 to RCCS□39/XR horizontal

All specifications are based on above mentioned calibration reference conditions, a flow calibration protocol is attached to each instrument.

Special Calibrations

- Mass-/Volume flow calibration with factory certificate (option /K2): Calibration with water at customer specified flow values according calibration order sheet.
- Mass-/Volume flow calibration with/DAkkS certificate EN17025 (option /K5): Calibration with water at customer specified flow values according calibration order sheet.
- Density calibration with factory certificate (option /K6): Adjustment and check with 3 different fluids, fluid temperature influence adjustment for low ambient temperature influence and thermal treatment for long term density measurement stability, improved temperature measurement accuracy (see also page 12).

Dual Seal Approval (Option /DS)

- Conform with ANSI/ISA-12.27.01.
- To be ordered if compliance with ANSI/ISA 12.27.01 is required.
- Up to ANSI class 900 line pressure.
- Only with FM approval option.
- For liquid application the leakage detection is realized by software in the converter.
- For gas application options /GA and /RD (rupture disk) are mandatory.
- Rupture disk is only for annunciation.

NORMAL OPERATING CONDITIONS

Ambient Temperature Ranges

- Remote detector RCCS3□:
Standard : -50°C to +80°C (-58°F to 176°F)
Option /LT : -50°C to +80°C (-58°F to 176°F)
Option /MT : -50°C to +80°C (-58°F to 176°F)
Option /HT : -50°C to +65°C (-58°F to 149°F)
(up to 280°C (536°F) medium temperature)
-50°C to +55°C (-58°F to 131°F)
(up to 350°C (662°F) medium temperature)
Terminal box temperature should not exceed 100°C
- Remote converter RCCF31 and integral type RCCT3□:
Display operating range
: -20°C to +55°C (-4°F to 131°F)
Electronic operating range
: -40°C to +55°C (-40°F to 131°F)
Cold start : above -30°C (-22°F)

Where meters are mounted in direct sunlight, it is recommended to install a sunshade. This is particularly important in countries with high ambient temperatures.

Ambient Humidity Range : 0 to 95% RH

Process Temperature Ranges

Detector :
- RCCS30LR to 33 : -50°C to 150°C (-58°F to 302°F)
- RCCS30LR to 33 /MT : -50°C to 260°C (-58°F to 500°F)
- RCCS34 to 39/XR : -70°C to 150°C (-94°F to 302°F)
- RCCS34 to 39/XR /LT : -200°C to 150°C (-328°F to 302°F)
- RCCS34 to 39/XR /MT : -70°C to 230°C (-94°F to 446°F)
(Range 150°C - 230°C (302°F to 446°F) recommended with /T□ option)
- RCCS34 to 39/IR /HT : 0°C to 350°C (32°F to 662°F)
(only with /T□ option or with /S2 and customer insulation)
- RCCS39/XR /HT : 0°C to 350°C (32°F to 662°F)
(only with /S2 and customer insulation)

Integral type :
- RCCT34 to 39/XR : -50°C to 150°C (-58°F to 302°F)

For use in hazardous area see “Hazardous Area Specifications”

Heat Carrier Fluid Temperature Ranges
(Option /T2 or /T3 only for remote type RCCS30LR to 39/IR)
- Standard : 0°C to 150°C (32°F to 302°F)
- With option /MT (RCCS30LR to 33) :
  0°C to 200°C (32°F to 392°F)
- With option /MT (RCCS34 to 39/IR) :
  0°C to 230°C (32°F to 446°F)
- With option /HT : 0°C to 350°C (32°F to 662°F)

Process Pressure Range
In dependance of the process connections s. table 9.
On request following maximum pressure up to 27°C (RT=Room Temp.):

Material wetted parts	SH [bar] / (psi)	SL [bar] / (psi)	HC [bar] / (psi)
RCCS30LR	400 / (5801)	----	----
RCCS30	400 / (5801)	----	----
RCCS31	350 / (5076)	----	----
RCCS32	285 / (4183)	----	----
RCCS33	285 / (4183)	----	----
RCCS34 / RCCT34	----	260 / (3770)	385 / (5583)
RCCS36 / RCCT36	----	210 / (3045)	315 / (4568)
RCCS38 / RCCT38	----	175 / (2538)	260 / (3770)
RCCS39 / RCCT39	----	135 / (1958)	260 / (3770)
RCCS39/IR / RCCT39/IR	----	110 / (1595)	180 / (2610)
RCCS39/XR / RCCT39/XR	----	95 / (1377)	----

For higher medium temperatures maximum tube pressure needs to be derated as follows :
up to 50°C (122°F) : 4% derating
51 to 100°C (123.8°F to 212°F) : 11% derating
101 to 150°C (213.8°F to 302°F) : 20% derating
151 to 230°C (303.8°F to 446°F) : 30% derating
231 to 350°C (447.8°F to 662°F) : 38% derating
Higher pressure on request.
Higher pressure on request.
The maximum process pressure of a single instrument is given by the lower value either of the process connections (table 9) or tubes. The maximum temperature and process pressure range of an instrument are marked on the nameplate as TS and PS.
The given temperature/pressure ranges are calculated and approved without corrosion or erosion effects. The customer is fully responsible of selecting proper materials which withstand corrosive or erosive conditions. In case of heavy corrosion and/or erosion the instrument may not withstand the pressure and an incident may happen with human and/or environmental harm. Yokogawa will not take any liability regarding damage caused by corrosion / erosion. If corrosion / erosion may happen, the user has to check periodically if the necessary wall thickness is still in place.

Gas Content Range for Liquid/Gas Mixtures
Gas content limit is defined as the amount of gas in a liquid/gas mixture which generates an error in the converter. The gas content limit is dependent on viscosity, surface tension and bubble size of the liquid/gas mixture. Furthermore it is highly flow rate dependent (the higher the flow rate, the lower the gas content range). The stated values are for a flow of 50% of Qnom and water/air without /HP:

Model	Gas content limit
RCCS30LR to RCCS32	no limitation
RCCS33 non-Ex type	no limitation
RCCS33 Ex type	approx. 35%
RCC□34	no limitation
RCC□36	approx. 50%
RCC□38	approx. 30%
RCC□39	approx. 7%
RCC□39/IR	approx. 3%
RCC□39/XR (with /HP)	approx. 2%

With option /HP the gas content range are improved.
With liquid/gas mixtures the specified mass flow accuracy will not be achieved.
For short time aeration a function can be activated to keep the current outputs constant during the aeration time.

Secondary Containment

Model	Typical rupture pressure	Option /J1 pressure test *)
RCCS30LR-33	65 bar / (942 psi)	---
RCC□34-36	120 bar / (1740 psi)	60 bar / (870 psi)
RCC□38	120 bar / (1740 psi)	40 bar / (580 psi)
RCC□39	80 bar / (1160 psi)	10 bar / (145 psi)
RCC□39/IR	50 bar / (725 psi)	---
RCC□39/XR	on request	---
RCC□39/XR/HT	50 bar / (725 psi)	---

*) Pressure test with safety factor S=1.1
If the detector housing is exposed to a pressure close to the rupture pressure it will deform and measurement will be strongly influenced. Therefore the pressure test of the housing (option /J1) can only be done at the pressure where deformation does not happen.

Other 2 Phase Flow, liquid/solid and liquid/liquid
Two phase flow can generate minus span errors. The errors are proportional to the difference in density between the 2 phases and the amount of the second phase. If the particles (or droplets) are very small no errors will be generated.

MECHANICAL SPECIFICATIONS

Protection Class
- RCCT3□ : IP66/67
- RCCF31 : IP66/67
- RCCS3□ : IP66/67

Materials
- Detector housing : Stainless steel 304/1.4301
- Detector terminal box : 316L/1.4404
- Detector gas filling plug: 1.4305
- Detector insulation housing : Stainless steel 304/1.4301
- Detector rupture disk (/RD) : 316L
- Field- mount converter housing : Aluminium alloy with Polyurethane corrosion-resistant coating or epoxy coating (option /X1)
- Field- mount converter mounting bracket: : Stainless steel 304/1.4301
- Name plates : Stainless steel 304/1.4301

Coating Color
- Converter case : Mint green

Wetted Parts
- RCCs30LR to 33 :
  Measuring tubes : Ni-Alloy C-22/2.4602
  Process connections : 316L / 1.4404
- RCC□34 to 39/IR :
  Measuring tubes and process connection : 316L / 1.4404/1.4435 or
  Measuring tubes and flange face : Ni-Alloy C-22/2.4602
- RCC□39/XR :
  Measuring tubes and process connection : 316L/1.4404/1.4435

Table 5 : Diameter of measuring tubes

Type		RCCS30 LR	RCCS30	RCCS31	RCCS32	RCCS33
Inner diameter	mm	0.9	1.2	2.1	3	4.5
	inches	0.035	0.047	0.083	0.118	0.177
Wall thickness	mm	0.15	0.2	0.25	0.25	0.4
	inches	0.006	0.008	0.009	0.009	0.016

Type		RCC□34	RCC□36	RCC□38	RCC□39	RCC□39 /IR	RCC□39 /XR
Inner diameter	mm	7.7	13.4	22.1	37.2	54.5	82.50
	inches	0.303	0.528	0.870	1.485	2.146	3.248
Wall thickness	mm	0.89	1.24	1.65	2.6	2.9	3.2
	inches	0.035	0.049	0.065	0.102	0.114	0.126

Pressure Equipment Directive 97/23/EC
Detectors comply with Directive 97/23EC on Pressure Equipment for fluid group 1 and 2.

CRN : CRN 0F12074.5
Approved process connections see table 12

Vibration Test : Acc. IEC 60068-2-64

ELECTRICAL SPECIFICATIONS

Power Supply
- AC- type : 90 V to 264 V
  90 V to 250 V for use in hazardous area
- DC- type : 20.5 V to 28.8 V

Power consumption : max. 25 VA / 10 W
External circuit breaker rating : 5 A, 250 V (The converter doesn't feature an installed power switch).

Fuse on Base Board :
- AC- type : 2 A, T, breaking capacity 1500A
- DC- type : 2 A, T, breaking capacity 1500A

Isolation Resistance of Converter
When surge arrestors are removed
- between power and ground terminal: 100 MΩ / 500 V DC
- between power and I/O terminals : 20 MΩ / 100 V DC
- between I/O terminals and ground : 20 MΩ / 100 V DC

Dielectric Strength
When surge arrestors are removed
- between power and ground terminal : 1,500 V AC for 1 minute

Lightning Protection
Arresters (2000 A) are inside the converter for power supply lines.

Vibration Test
Acc. IEC 60068-2-64

Electromagnetic Compatibility
Acc. EN 61326-1: 2006
EN 61326-2-3: 2006
EN 61000-3-2: 2006
EN 61000-3-3: 2008

Safety Requirement Standards
EN 61010-1: 2010
EN 61010-2-030: 2011
Overvoltage category: II
Pollution degree: 2

REMOTE CABLE RCCY03 SPECIFICATION

3x Coaxial + 1 x 3 AWG20, shielded, twisted; overall shielding; flame propagation acc. IEC 60332-1.
We recommend to use only the original cable provided by Yokogawa. In case of local cable purchasing, please contact Yokogawa for specification.
Table 6 : Cable specifications

Model code	Temperature range	Wire gauge	Resistance of loop	Capacitance wire/wire	Capacitance wire/shield	Inductance wire/wire
RCCY031	-50 to +105°C -58°F to 221°F	Coaxial AWG 20	37 Ω/km 70 Ω/km	120 nF/km 145 nF/km	132 nF/km 290 nF/km	0.175 mH/km 0.70 mH/km
RCCY032	-50 to +105°C -58°F to 221°F	Coaxial AWG 20	37 Ω/km 70 Ω/km	120 nF/km 145 nF/km	132 nF/km 290 nF/km	0.175 mH/km 0.70 mH/km
RCCY033	-50 to +105°C -58°F to 221°F	Coaxial AWG 20	37 Ω/km 70 Ω/km	120 nF/km 145 nF/km	132 nF/km 290 nF/km	0.175 mH/km 0.70 mH/km
RCCY034	-50 to +105°C -58°F to 221°F	Coaxial AWG 20	37 Ω/km 70 Ω/km	120 nF/km 145 nF/km	132 nF/km 290 nF/km	0.175 mH/km 0.70 mH/km

Supply Voltage of Communication Line
- 9 V to 32 V DC for general purpose and flame-proof (/KF3) type
- 9 V to 24 V DC for intrinsic safe FF-output type (Entity model)
- 9 V to 17.5 V DC for intrinsic safe FF-output type (FISCO model)

No performance effect of power supply.

Output and Input Signal
Digital communication signal based on FOUNDATION Fieldbus™ protocol.

Condition of Communication Line
- Supply voltage: 9 to 32 V DC
- Current draw: 15.0 mA (max)

Functional Specifications :
- Functional specifications for Fieldbus communication conform to the standard specification (H1) of FOUNDATION™ Fieldbus.

Function Block :
- Four AI function blocks:
  AI 1 monitors the mass flow rate
  AI 2 monitors the volume flow rate
  AI 3 monitors the density
  AI 4 monitors the temperature

- Two additional AI function blocks (with option /C□□):
  AI 5 monitors the measured concentration
  AI 6 monitors the net flow rate

- One PID block (for a model with /LC1 option)
- Two IT function blocks:
  IT 1 totalized mass-, volume- or net flow rate
  IT 2 totalized mass-, volume- or net flow rate

Update Period :
- Mass flow value: 100 ms
- Density, temperature: 100 ms

Function Block Execution Time

Block name	Number	Execution time	Note
AI	6	< 30 ms	For mass flow, Volume flow, Density, Temperature, Concentration measurement, Net flow
PID	1	< 50 ms	Applicable when option /LC1 is selected
IT	2	< 30 ms	For mass total, Volume total, Net total

Link Master function :
- Link Master (LM) function is supported.
  See 'Ordering information'.

Hazardous area specifications

ATEX

Remote detector RCCS30LR... 33 (Option /KS1):
- KEMA 01ATEX 1075 X
- Intrinsically safe
- II 2G Ex ib IIB/IIC T1 ... T6 Gb
- II 2D Ex ib IIIC Txxx Db
  (xxx = max. surface temperature see below)
- Max. surface temperature :
  Standard : 150°C (302°F)
  /MT : 260°C (500°F)
- Degree of protection : IP66/67
- Ambient humidity : 0 to 95% RH
- Ambient temperature range
  : -50°C to +80°C (-58°F to 176°F)
- Process temperature range :
  Standard : -50°C to 150°C (-58°F to 302°F)
  Option /MT : -50°C to 260°C (-58°F to 500°F)
- Heat carrier fluid temperature range
  Standard : 0°C to 150°C (32°F to 302°F)
  Option /MT : 0°C to 200°C (32°F to 392°F)

Remote detector RCCS34 ... 39/XR (Option /KS1):
- KEMA 01ATEX 1075 X
- Intrinsically safe
- II 2G Ex ib IIB/IIC T1 ... T6 Gb
- II 2D Ex ib IIIC Txxx Db
  (xxx = max. surface temperature see below)
- Max. surface temperature :
  Standard + /LT : 150°C (302°F)
  /MT : 220°C (500°F)
  /HT : 350°C (662°F)
- Degree of protection : IP66/67
- Ambient humidity : 0 to 95% RH
- Ambient temperature range
  Standard , option /LT and option /MT
  : -50°C to +80°C (-58°F to 176°F)
  Option /HT (process temperature < 280°C (536°F)
  : -50°C to +65°C (-58°F to 149°F)
  Option /HT (process temperature < 350°C (662°F)
  : -50°C to +55°C (-58°F to 131°F)
- Process temperature range :
  Standard : -50°C to 150°C (-58°F to 302°F)
  Option /LT : -200°C to 150°C (-328°F to 302°F)
  Option /MT : -50°C to 220°C (-58°F to 428°F)
  Option /HT : 0°C to 350°C (32°F to 662°F)
- Heat carrier fluid temperature range
  Standard : 0°C to 150°C -32°F to 302°F)
  Option /MT : 0°C to 220°C (32°F to 428°F)
  Option /HT : 0°C to 350°C (32°F to 662°F)

Remote converter RCCF31 (option /KF3) :
- KEMA 02ATEX 2183 X
- Flame proof with Intrinsically safe connection to detector (ib)
- II 2G Ex d [ib] IIC T6 Gb or Ex d e [ib] IIC T6 Gb
- II 2G Ex d [ib] IIB T6 Gb or Ex d e [ib] IIB T6 Gb with option /HP
- II 2D Ex tb [ib] IIIC T75°C Db
- Max. surface temperature : 75°C (167°F)
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz or 20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range: -40°C to +55°C (-40°F to 131°F)

Remote converter RCCF31 (Option /KF4) :
- KEMA 02ATEX 2183 X
- Flame proof with Intrinsically safe connection to detector (ib)
- Additional intrinsic safe FOUNDATION™ fieldbus..
- II 2 (1) G Ex d [ia Ga] [ib] IIC T6 Gb or Ex d e [ia Ga] [ib] IIC T6 Gb
- II 2 (1) G Ex d [ia IIC Ga] [ib] IIB T6 Gb or Ex d e [ia IIC Ga] [ib] IIB T6 Gb with option /HP
- II 2 (1) D Ex tb [ia Da] [ib] IIIC T75°C Db
- Max. surface temperature : 75°C (167°F)
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz or 20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range: -40°C to +55°C (-40°F to 131°F)

Integral type RCCT34 ... 39/XR (option /KF3) :
- KEMA 02ATEX 2183 X
- Flame proof with Intrinsically safe connection to detector (ib)
- II 2G Ex d ib IIC T6...T3 Gb or Ex d e ib IIC T6...T3 Gb
- II 2G Ex d ib IIB T6...T3 Gb or Ex d e ib IIB T6...T3 Gb with option /HP
- II 2D Ex ib tb IIIC T150°C Db
- Max. surface temperature : 150°C (302°F)
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz or 20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range: -40°C to +55°C (-40°F to 131°F)

Integral type RCCT34 ... 39/XR (option /KF4) :
- KEMA 02ATEX 2183 X
- Flame proof with Intrinsically safe connection to detector (ib)
- Additional intrinsic safe FOUNDATION™ fieldbus.
- II 2 (1) G Ex d ib [ia Ga] IIC T6...T3 Gb or Ex d e ib [ia Ga] IIC T6...T3 Gb
- II 2 (1) G Ex d ib [ia IIC Ga] IIB T6...T3 Gb or Ex d e ib [ia IIC Ga] IIB T6...T3 Gb with option /HP
- II 2 (1) D Ex ib tb [ia Da] IIIC T150°C Db
- Max. surface temperature : 150°C (302°F)
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz or 20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range: -40°C to +55°C (-40°F to 131°F)
- Process temperature range : -50°C to 150°C (-58°F to 302°F)

Electrical data remote detector RCCS30LR ... 33 :
- Driving circuit : terminals D+ and D
  Ex ib IIC : Ui = 16 V; Ii = 53 mA; Pi = 0.212 W
  Li = 4.2 mH; Ci = negligible small
  Ex ib IIB : Ui = 16 V; Ii = 153 mA; Pi = 0.612 W
  Li = 4.2 mH; Ci = negligible small
- Sensor circuits: terminals S1+ and S1- or S2+ and S2-
  Ex ib IIC : Ui = 16 V; Ii = 80 mA; Pi = 0.32 W
  Li = 4.2 mH; Ci = negligible small
- Temperature sensor circuit : terminals TP1, TP2, TP3
  Ex ib IIC : Ui = 16 V; Ii = 50 mA; Pi = 0.2 W
  Li = negligible small; Ci = negligible small

Electrical data remote detector RCCS34 ... 39/XR :
- Driving circuit : terminals D+ and D
  Ex ib IIC : Ui = 16 V; Ii = 53 mA; Pi = 0.212 W
  Li = 3.2 mH; Ci = negligible small
  Ex ib IIB : Ui = 16 V; Ii = 153 mA; Pi = 0.612 W
  Li = 3.2 mH; Ci = negligible small
- Sensor circuits: terminals S1+ and S1- or S2+ and S2-
  Ex ib IIC : Ui = 16 V; Ii = 80 mA; Pi = 0.32 W
  Li = 2.1 mH; Ci = negligible small
- Temperature sensor circuit : terminals TP1, TP2, TP3
  Ex ib IIC : Ui = 16 V; Ii = 50 mA; Pi = 0.2 W
  Li = negligible small; Ci = negligible small

Electrical data remote converter RCCF31 and converter of Intergral type RCCT3□ :
- Driving circuit : terminals D+ / D-
  Ex [ib] IIC : Uo = 14.5 V; Io = 47 mA; Po = 0.171 W
  Lo = 15 mH; Co = 0.65 µF
  Ex [ib] IIB : Uo = 11.7 V; Io = 124 mA; Po = 0.363 W
  Lo = 8 mH; Co = 10.3 µF
- Sensor circuits: terminals S1+/ S1- or S2+ / S2-
  Ex [ib] IIB/IIC : Uo = 14.5 V; Io = 47 mA; Po = 0.171 W
  Ex [ib] IIC : Lo = 15 mH; Co = 0.65 µF
  Ex [ib] IIB : Lo = 60 mH; Co = 4.07 µF
- Temperature sensor circuit : terminals TP1, TP2, TP3
  Ex [ib] IIB/IIC : Uo = 13.3 V; Io =40 mA; Po = 0.133 W
  Ex [ib] IIC : Lo = 20 mH; Co =0.91 µF
  Ex [ib] IIB : Lo = 80 mH; Co =5.6 µF
- Fieldbus output (only option /KF4) :
  FISCO model:
  Ex [ia] IIC: Ui = 17.5 V; Ii = 380 mA; Pi = 5.32 W
  Li = 1.6 µH; Ci = 2.7 nF
  Ex [ia] IIB: Ui = 17.5 V; Ii = 460 mA; Pi = 5.32 W
  Li = 1.6 µH; Ci = 2.7 nF
  Entity model:
  Ex [ia] IIC: Ui = 24 V; Ii = 250 mA; Pi = 1.2 W
  Li = 1.6 µH; Ci = 2.7 nF

For temperature classification see table 7.

FM (For USA and Canada)

Remote detector RCCS30LR ... 39/XR (option /FS1) :
- Intrinsically safe
- AEx ia IIC, Class 1, Zone 0
- IS Class I, Division 1, Groups A, B, C, D T6
- DIP Class II / III, Division 1, Groups E, F, G
- IP67 / NEMA 4X
- Ambient temperature range : -50°C to +80°C (-58°F to 176°F)

Remote converter RCCF31 (option /FF3) :
- Housing explosion proof
- Provides Intrinsically safe detector circuits
- AEx [ia] IIC, Class I, Zone 1, T6
- AEx [ia] IIB, Class I, Zone 1, T6 with option /HP
- Class I, Division 1, Groups A, B, C, D
- Class I, Division 1, Groups C, D with option /HP
- Class II / III, Division 1, Groups E, F, G
- AIS Class I / II / III, Division 1, Groups A, B, C, D, E, F, G
- AIS Class I / II / III, Division 1, Groups C, D, E, F, G with option /HP
- IP67 / NEMA 4X
- Ambient temperature range : -40°C to +50°C (-40°F to 122°F)

Integral type RCCT34 ... 39/XR (option /FF3) :
- Housing explosion proof
- AEx d [ia] IIC, Class I, Zone 1, T6
- AEx d [ia] IIB, Class I, Zone 1, T6 with option /HP
- Class I, Division 1, Groups A, B, C, D
- Class I, Division 1, Groups C, D with option /HP
- Class II / III, Division 1, Groups E, F, G
- IP67 / NEMA 4X
- Ambient temperature range : -40°C to +50°C

Process temperature range :
- Standard : -50°C to 150°C / -58°F to 302°F
- with option /LT : -200°C to 150°C / -328°F to 302°F
- with option /MT (RCCS30LR...33)
  : -50°C to 260°C / -58°F to 500°F
- with option /MT (RCC□34...39/XR)
  : -50°C to 220°C / -58°F to 428°F
- with option /HT : 0°C to 350°C / 32°F to 662°F

Heat carrier fluid temperature range :
- Standard : 0°C to 150°C / 32°F to 302°F
- with option /MT (RCCS30LR...33)
  : -50°C to 200°C / -58°F to 392°F
- with option /MT (RCC□34...39/XR)
  : -50°C to 220°C / -58°F to 428°F
- with option /HT : 0°C to 350°C / 32°F to 662°F

Electrical data remote detector RCCS30LR ... 33 :
- Driving circuit : terminals D+ and D
  Groups A-D: Ui = 16 V; Ii = 53 mA; Pi = 0.212 W
  Li = 4.2 mH; Ci = negligible small
  Groups C,D: Ui = 16 V; Ii = 153 mA; Pi = 0.612 W
  Li = 4.2 mH; Ci = negligible small
- Sensor circuits: terminals S1+ and S1- or S2+ and S2-
  Ui = 16 V; Ii = 80 mA; Pi = 0.32 W
  Li = 4.2 mH;Ci = negligible small
- Temperature sensor circuit : terminals TP1, TP2, TP3
  Ui = 16 V; Ii = 50 mA; Pi = 0.2 W
  Li = negligible small; Ci = negligible small

Electrical data remote detector RCCS34 ... 39/XR :
- Driving circuit : terminals D+ and D
  Groups A-D: Ui = 16 V; Ii = 53 mA; Pi = 0.212 W
  Li = 3.2mH; Ci = negligible small
  Groups C,D: Ui = 16 V; Ii = 153 mA; Pi = 0.612 W
  Li = 3.2mH; Ci = negligible small
- Sensor circuits: terminals S1+ and S1- or S2+ and S2-
  Ui = 16 V; Ii = 80 mA; Pi = 0.32 W
  Li = 2.1 mH;Ci = negligible small
- Temperature sensor circuit : terminals TP1, TP2, TP3
  Ui = 16 V; Ii = 50 mA; Pi = 0.2 W
  Li = negligible small; Ci = negligible small

Electrical data remote converter RCCF31, and converter of Intergral type RCCT3□ :
- Driving circuit : terminals D+ / D-
  Uo = 14.5 V; Io = 47 mA; Po = 0.171 W
  Lo = 15 mH; Co = 0.65 µF
- Driving circuit : terminals D+ / D- with option /HP
  Uo = 11.7 V; Io = 124 mA; Po = 0.363 W
  Lo = 8 mH; Co = 10.3 µF
- Sensor circuits: terminals S1+/ S1- or S2+ / S2-
  Uo = 14.5 V; Io = 47 mA; Po = 0.171 W
  Lo = 15 mH; Co = 0.65 µF
- Temperature sensor circuit : terminals TP1,TP2, TP3
  Uo = 13.3 V; Io = 40 mA; Po = 0.133 W
  Lo = 20 mH; Co = 0.91 µF

The remote converter RCCF31 has a T6 temperature class rating for operation at ambient temperature up to +50°C / +122°F.

Special conditions :
- ROTAMASS with FM approval is only available with ANSI 1/2" NPT cable conduit connection "A"
- The flowmeter must be connected to the potential equalization system.
- For AC-version maximum power supply is 250V AC.
- Use conduit seals within 18 inches for power supply- and IO- cable entries at RCCT3□ / RCCF31

For temperature classification see table 7.

IECEx APPROVAL

Certificate: IECEx KEM 06.0031X

Remote detector RCCS30LR ... 33 (Option /ES1):
- Intrinsically safe
- Ex ib IIB/IIC T1 ... T6 Gb
- Ex ib IIIC Txxx Db
  (xxx = max. surface temperature see below)
- Max. surface temperature :
  Standard : 150°C (302°F)
  /MT : 260°C (500°F)
- Degree of protection : IP66/67
- Ambient humidity : 0 to 95% RH
- Ambient temperature range
  : -50°C to +80°C (-58°F to 176°F)
- Process temperature range :
  Standard : -50°C to 150°C (-58°F to 302°F)
  Option /MT : -50°C to 260°C (-58°F to 500°F)
- Heat carrier fluid temperature range
  Standard : 0°C to 150°C (32°F to 302°F)
  Option /MT : 0°C to 200°C (32°F to 392°F)

Remote detector RCCS34 ... 39/XR (Option /ES1):
- Intrinsically safe
- Ex ib IIB/IIC T1 ... T6 Gb
- Ex ib IIIC Txxx Db
  (xxx = max. surface temperature see below)
-Max. surface temperature :
  Standard + /LT : 150°C (302°F)
  /MT : 220°C (500°F)
  /HT : 350°C (662°F)
- Degree of protection : IP66/67
- Ambient humidity : 0 to 95% RH
- Ambient temperature range
  Standard , option /LT and option /MT
  : -50°C to +80°C (-58°F to 176°F)
  Option /HT (process temperature < 280°C (536°F)
  : -50°C to +65°C (-58°F to 149°F)
  Option /HT (process temperature < 350°C (662°F)
  : -50°C to +55°C (-58°F to 131°F)
- Process temperature range :
  Standard : -50°C to 150°C (-58°F to 302°F)
  Option /LT : -200°C to 150°C (-328°F to 302°F)
  Option /MT : -50°C to 220°C (-58°F to 428°F)
  Option /HT : 0°C to 350°C (32°F to 662°F)
- Heat carrier fluid temperature range
  Standard : 0°C to 150°C (32°F to 302°F)
  Option /MT : 0°C to 220°C (32°F to 428°F)
  Option /HT : 0°C to 350°C (32°F to 662°F)

Remote converter RCCF31 (Option /EF3) :
- Flame proof with Intrinsically safe connection to detector (ib)
- Ex d [ib] IIC T6 Gb or Ex d e [ib] IIC T6 Gb
- Ex d [ib] IIB T6 Gb or Ex d e [ib] IIB T6 Gb with option /HP
- Ex tb [ib] IIIC T75°C Db
- Max. surface temperature : 75°C (167°F)
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz or 20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range: -40°C to +55°C (-40°F to 131°F)

Remote converter RCCF31 (option /EF4) :
- Flame proof with Intrinsically safe connection to detector (ib)
- Additional intrinsic FOUNDATION™ fieldbus.
- Ex d [ia Ga] [ib] IIC T6 Gb or
  Ex d e [ia Ga] [ib] IIC T6 Gb
- Ex d [ia IIC Ga] [ib] IIB T6 Gb or
  Ex d e [ia IIC Ga] [ib] IIB T6 Gb with option /HP
- Ex tb [ia Da] [ib] IIIC T75°C Db
- Max. surface temperature : 75°C (167°F)
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz or
  20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range: -40°C to +55°C (-40°F to 131°F)

Integral type RCCT34 ... 39/XR (option /EF3) :
- Flame proof with Intrinsically safe connection to detector (ib)
  Ex d e ib IIC T6...T3 Gb
- Ex d ib IIB T6...T3 Gb or
  Ex d e ib IIB T6...T3 Gb with option /HP
- Ex ib tb IIIC T150°C Db
- Max. surface temperature : 150°C (302°F)
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz or
  20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range: -40°C to +55°C (-40°F to 131°F)

Integral type RCCT34 ... 39/XR (option /EF4) :
- Flame proof with Intrinsically safe connection to detector (ib)
- Additional intrinsic safe FOUNDATION™ fieldbus.
- Ex d ib [ia Ga] IIC T6...T3 Gb or
  Ex d e ib [ia Ga] IIC T6...T3 Gb
- Ex d ib [ia IIC Ga] IIB T6...T3 Gb or
  Ex d e ib [ia IIC Ga] IIB T6...T3 Gb with option /HP
- Ex ib tb [ia Da] IIIC T150°C Db
- Max. surface temperature : 150°C (302°F)
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz or
  20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range: -40°C to +55°C (-40°F to 131°F)
- Process temperature range : -50°C to 150°C (-58°F to 302°F)

Electrical data remote detector RCCS30LR ... 33 :
- Driving circuit : terminals D+ and D
  Ex ib IIC : Ui = 16 V; Ii = 53 mA; Pi = 0.212 W
  Li = 4.2 mH; Ci = negligible small
  Ex ib IIB : Ui = 16 V; Ii = 153 mA; Pi = 0.612 W
  Li = 4.2 mH; Ci = negligible small
- Sensor circuits: terminals S1+ and S1- or S2+ and S2-
  Ex ib IIC : Ui = 16 V; Ii = 80 mA; Pi = 0.32 W
  Li = 4.2 mH; Ci = negligible small
- Temperature sensor circuit : terminals TP1, TP2, TP3
  Ex ib IIC : Ui = 16 V; Ii = 50 mA; Pi = 0.2 W
  Li = negligible small; Ci = negligible small

Electrical data remote detector RCCS34 ... 39/XR :
- Driving circuit : terminals D+ and D
  Ex ib IIC : Ui = 16 V; Ii = 53 mA; Pi = 0.212 W
  Li = 3.2 mH; Ci = negligible small
  Ex ib IIB : Ui = 16 V; Ii = 153 mA; Pi = 0.612 W
  Li = 3.2 mH; Ci = negligible small
- Sensor circuits: terminals S1+ and S1- or S2+ and S2-
  Ex ib IIC : Ui = 16 V; Ii = 80 mA; Pi = 0.32 W
  Li = 2.1 mH; Ci = negligible small
- Temperature sensor circuit : terminals TP1, TP2, TP3
  Ex ib IIC : Ui = 16 V; Ii = 50 mA; Pi = 0.2 W
  Li = negligible small; Ci = negligible small

Electrical data remote converter RCCF31 and converter of intergral type RCCT3 :
- Driving circuit : terminals D+ / D-
  Ex [ib] IIC : Uo = 14.5 V; Io = 47 mA; Po = 0.171 W
  Lo = 15 mH; Co = 0.65 µF
  Ex [ib] IIB : Uo = 11.7 V; Io = 124 mA; Po = 0.363 W
  Lo = 8 mH; Co = 10.3 µF
- Sensor circuits: terminals S1+/ S1- or S2+ / S2-
  Ex [ib] IIB/IIC :Uo = 14.5 V; Io = 47 mA; Po = 0.171 W
  Ex [ib] IIC : Lo = 15 mH; Co = 0.65 µF
  Ex [ib] IIB : Lo = 60 mH; Co = 4.0 7µF

- Temperature sensor circuit : terminals TP1, TP2, TP3
  Ex [ib] IIB/IIC :Uo = 13.3 V; Io =40 mA; Po = 0.133 W
  Ex [ib] IIC : Lo = 20 mH; Co =0.91 µF
  Ex [ib] IIB : Lo = 80 mH; Co =5.6 µF
- Fieldbus output (only option /EF4) :
  FISCO model:
  Ex [ia] IIC: Ui = 17.5 V; Ii = 380 mA; Pi = 5.32 W
  Li = 1.6 µH; Ci = 2.7 nF
  Ex [ia] IIB: Ui = 17.5 V; Ii = 460 mA; Pi = 5.32 W
  Li = 1.6 µH; Ci = 2.7 nF
  Entity model:
  Ex [ia] IIC: Ui = 24 V; Ii = 250 mA; Pi = 1.2 W
  Li = 1.6 µH; Ci = 2.7 nF

For temperature classification see table 7.

INMETRO APPROVAL (For Brazil)

RCCS3□ with option /US1 same as IECEx /ES1
RCCT3□ with options /UF3 ... /UF4 same as IECEx /EF3 ... /EF4
RCCF31 with options /UF3 ... /UF4 same as IECEx /EF3 ... /EF4
Same parameters and specifications as IECEx approval.

NEPSI APPROVAL (For China)

Certificate GYJ12.1381X
RCCS3□ with option /NS1, RCCT3□ with options /NF3 ... /NF4,
RCCF31 with options /NF3 ... /NF4
Same parameters and specifications as IECEx approval except NEPSI has no dust proof certification.

KOSHA APPROVAL (For Korea)

Same parameters and specifications as IECEx approval.
Meter with IECEx option must be ordered.

EAC APPROVAL (For Russia, Kazakhstan, Belorussia)

Certificate RU C-DE.ГБ08.B.00208
RCCS3□ with option /GS1
RCCT3□ with options /GF3 or /GF4
RCCF31 with options /GF3 or /GF4
Same parameters and specifications as IECEx approval.

METROLOGICAL REGULATION IN CIS AND EAC COUNTRIES

Russia, Kazakhstan, Uzbekistan, Ukraine and Belorussia are members of CIS.
ROTAMASS has “Pattern Approval Certificate of Measuring Instruments” and is registered as a measuring instrument in Russia, Kazakhstan, Uzbekistan.
Option /QR1 is for Russia.
Option /QR2 is for Kazakhstan .
Option /QR3 is for Uzbekistan.
For the Ukraine the test certificate of Rota Yokogawa is sufficient. Therefore no special option exists.
For Belorussia Rota Yokogawa has no “Pattern Approval Certificate”, that means devices which need primary verification should be calibrated in Belorussia by Belorussian special bodies. Therefore no special option exists.

Russia, Kazakhstan and Belorussia are covered by EAC.
For export to CIS and EAC countries please contact your Yokogawa representative.

Table 7 : Temperature classification for ATEX, FM, IECEx, INMETRO, NEPSI and KOSHA certified flowmeter

	RCCS30LR to RCCS33 without insulation		RCCS30LR to RCCS33 with factory insulation	
Temp. class	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature
T6	50°C / 122°F	60°C / 140°F	60°C / 140°F	60°C / 140°F
T5	50°C / 122°F	80°C / 176°F	80°C / 176°F	90°C / 194°F
T4	80°C / 176°F 50°C / 122°F	100°C / 212°F 120°C / 248°F	80°C / 176°F	130°C / 266°F
T3	80°C / 176°F	180°C / 356°F	80°C / 176°F	180°C / 356°F
T2	80°C / 176°F	260°C / 500°F	80°C / 176°F	260°C / 500°F
T1	80°C / 176°F	260°C / 500°F	80°C / 176°F	260°C / 500°F

	RCCS34 to RCCS39/XR without insulation		RCCS34 to RCCS39/XR with factory insulation		RCCT34 to RCCT39/XR	
Temp. class	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature
T6	40°C / 104°F	40°C / 104°F	65°C / 149°F	65°C / 149°F	55°C / 122°F	65°C / 149°F
T5	55°C / 131°F	55°C / 131°F	75°C / 167°F	75°C / 167°F	55°C / 122°F	80°C / 176°F
T4	80°C / 176°F 40°C / 104°F	100°C / 212°F 120°C / 248°F	70°C / 158°F	115°C / 239°F	55°C / 122°F	115°C / 239°F
T3	80°C / 176°F 40°C / 104°F	160°C / 320°F 180°C / 356°F	70°C / 158°F	180°C / 356°F	55°C / 122°F	150°C / 302°F
T2	80°C / 176°F	220°C / 428°F	65°C /149°F	275°C / 527°F	55°C / 122°F	150°C / 302°F
T1	80°C / 176°F	220°C / 428°F	45°C / 113°F	350°C / 662°F	55°C / 122°F	150°C / 302°F

For customer insulation of RCCS30LR to 39/XR the following must be regarded :
The table "with factory insulation" is calculated with 80 mm insulation and k-factor = 0.4 W/m²K.
If your insulation data are worse than these use table "without insulation" !

Planning and Installation Hints

Design Range
It is the responsibility of the user to use the instrument within the given design range. Erosion and corrosion influence the accuracy and may restrict the temperature / pressure range. Therefore corrosion and erosion should be avoided.

Installation
The flowmeter can be installed vertically, horizontally or in any other position, as long as the measuring tubes are completely filled with the measured liquid during measurement.

Redundant Installation
If two flowmeters of the same size are installed in series mutual interference called cross talk may take place. Cross talk occurs due to the fact that both meters have the same resonance frequency. If serial installation is planned please contact your Yokogawa representative who can ensure that a frequency adjustment is made to one of the meters at the factory.

Sizing
The measuring range and accuracy are virtually independent of fluid conditions and size of the connecting pipe. Select a suitable nominal size from pressure loss calculation. Check whether the measuring range and accuracy at minimal flow fit the application. The calculations of the pressure loss are based on newtonian fluids. For correct calculation please contact your local Yokogawa representative.

Sanitary Applications
For sanitary applications select process connection S2, S4 or S8. The wetted surface will be Ra ≤ 1.6µm. However, if option /SF□ is selected the surface roughness will be Ra < 0.8µm and with /SF2 a certificate with a 3- point roughness measurement is delivered. The EHEDG certificate shows that ROTAMASS conforms to the EHEDG criteria regarding the capability to be cleaned by a CIP process. The evaluation does not include the process connections and seals.

Cavitation
To avoid cavitation keep the back pressure of the fluid sufficiently above the vapor pressure of the fluid. For low viscous fluids following condition should be fulfilled at the given temperature:

$p_{back} > p_{vapor} + 0.7*\Delta p$

With Δp = pressure loss

Long Term Stability
To get stable deflection of the tubes by the coriolis forces the stiffness and therefore the wall thickness has to kept constant during measuring. With corrosion or erosion the meter factor is drifting with time and recalibration is necessary. Select the suitable resistant tube material for the process!

Recalibration Service
Yokogawa offers full recalibration service, if necessary with a certificate traceable to German national standards. Please contact your Yokogawa affiliate or directly Rota Yokogawa, Germany.

Heat Tracing and Insulation
Basically the detector can be insulated by the customer. To be sure not to overheat the connection box choose one of /T□ options (insulation or heat tracing from Yokogawa) or /S2. For process temperatures between 150°C (302°F) and 230°C (446°F) (RCCS34 - 39/XR) or 260°C (500°F) (RCC-S30LR - 33) choose /MT option and remote installation. If Rotamass detector with /MT or /HT is not insulated, the accuracy specification can not be guaranteed. The converter should not be exceeded more than 50°C (122°F). Therefore never insulate the converter and keep the neck free from insulation too. Yokogawa will not take any liability regarding customer insulation.

Relations between Options /MT, /HT, /S2 and /T□ (/T1, /T2, /T3)
The meters with high temperature options (/MT, /HT) can be insulated either by the customer by using option /S2 (prolonged neck) or by the factory through options /T□ The /T□ options already include the option /S2 so that the /S2 option can not be selected in case of the /T□ options. If the meter is not properly insulated by the customer, the accuracy specification can not be guaranteed.

Installation above 100°C (212°F) Process Temperature
To provide enough cooling the instrument should be installed vertically or horizontally with the converter down. This is recommended for size RCC□36 and larger without /T□ option.

Installation below 0°C (32°F) Process Temperature
The detector can be insulated to prevent ice capping either by the customer or by the manufacturer. Ask your Yokogawa representative for special insulation. If the customer wants to insulate by themselves a closed cell foam as insulation material is recommended to avoid water siphon. In this case option /S2 should be selected. For temperatures below -70°C (-94°F) option /LT is recommended (on request).

Zero Adjustment Function
Zero point can be adjusted by FF- communication when the fluid is stopped and the detector filled. To ensure no flow conditions isolation valves should be installed. To achieve the specified accuracy a zero should be performed at process conditions (temperature, pressure).

Pressure / Temperature dependencies of process connections
See also process pressure range in chapter "Normal operation conditions".

Concentration Measurement for Liquids
The Standard Concentration Measurement (option /CST) is suitable for concentration measurement of emulsions or suspensions, where the density of the solid is assumed to be fix. It can also be used for (mainly low concentration) solutions if the two fluids are not strongly interacting. The density change of the liquid components due to temperature can normally be described with a linear or quadratic function with very high accuracy within the desired measurement range. The coefficients of these function (linear and quadratic thermal expansion coefficients) must be either known or have to be determined prior to using this function. For interacting liquids the Advanced Concentration Measurement options should be used, these options can be ordered using the appropriate /C□□concentration measurement option. For more information please see TI 01R04B04-04E-E "Concentration Measurement with ROTAMASS".

Rupture Disk
The rupture disk is used as annunciation method in the case of tube rupture preferable for high pressure gas service. Practically a tube rupture (Dual Seal) of ROTAMASS is not known to the manufacturer. For large sizes it cannot be expected that the full line pressure can be released via the rupture disk. If this is requested please contact Yokogawa for a special execution.

Explosion Proof Concept
The detector is intrinsic safe Ex ib, the converter RCCT□ and RCCF31 are flame (explosion) proof. The driving power from converter to detector is limited and protected by an intrinsically safe barrier, which is part of the converter. The barrier is protecting the detector either for gas group IIC or IIB (option /HP).

Option /HP
With option /HP the detector driving power is higher which is benefit to 2 phase flow. This is also true for non hazardous applications.

Gas Measurement
For gas applications please choose the option /GA.
Density reading below 0.3 kg/l is not possible. Volume flow is calculated by using the fix density value stored in „Reference density". Based on the selection of the gas density, the following volume flow rates can be calculated; standard, reference, normal. Besides, the corresponding volume flow rate units can be selected. Some functions are unavailable for gas measurement, including concentration measurement, empty pipe, slug or corrosion detection.
Good and stress free installation is mandatory for a stable Zero. Attention to resonance phenomenons has to be taken if gas compressors are used in the pipe. Flow noise has to be avoided.

Batch Process
The specified mass flow accuracy applies if the batch process is >1 minute. For shorter batch time (Δt in s) the accuracy decreases with the quare root of 60/Δt.
For short batches the opening and closing times of the valves have to be greater than 2 seconds.

Density Measurement
There are 3 levels of density measurement. The standard adjustment and /K4 delivers an accuracy up to 0.001 g/cm³, if the fluid density is around 1 kg/l. However, at elevated temperatures the density error may increase. For option /K4 the instrument is preheated ensuring long term stability. However, if high density stability is needed at high temperatures option /HT is recommended. Option /K6 includes preheating, a full calibration at 3 different densities, increased temperature measurement specification and individual adjustment of the fluid temperature dependency. Multiphase flow can generate higher deviations. The higher the density differences of the single components are the more likely it is that a negative density error is generated. Aeration has to be avoided fully to receive good density measurement.
For more information please see TI 01R04B04-05E "Density Measurement with ROTAMASS".
Note: Density specification under calibration condition only with flow direction "forward" according the arrow on the meter.

Overview density-/volume flow measurement:

Option	Accuracy	Certificate	Description	Application
Standard	± 0.0015 g/cm³ to ± 0.008 g/cm³	Standard (mass flow) factory calibration certificate	- Standard adjustment with water and air - Density constants given in mass flow certificate	- Process medium and environment are approximately at room temperature, the density range is 0.9 kg/l to 1.1 kg/l
Option /K4	± 0.001 g/cm³	Standard (mass flow) factory calibration certificate	- Thermal treatment of the sensor and special hardware design - Standard adjustment with water and air - Density constants given in mass flow certificate	- Improved volume flow accuracy - Process medium up to 150°C, for higher temperature select option /MT or /HT - Density range is 0.9 kg/l to 1.1 kg/l
Option /K6	± 0.0005 g/cm³	Separate factory density calibration certificate	- Thermal treatment of the sensor and special hardware design - Density calibration with 3 different liquids - Individual adjustment of the fluid temperature dependency	- Density and concentration measurement in addition to the mass flow: - Process medium up to 150°C, for higher temperature select option /HT - Density range 0.3 kg/l to 2 kg/l - Best volume flow accuracy

8. GENERAL SPECIFICATIONS

Table 9 : Pressure rating

Type of process connection		Process Temperature							
		RT [3]	50°C	100°C	150°C	200°C	250°C	300°C	350°C
A1 [2]	Flange acc. ASME B16.5 Class 150	19 bar	18.4 bar	16.2 bar	14.8 bar	13.7 bar	12.1 bar	10.2 bar	8.4 bar
A2 [2]	Flange acc. ASME B16.5 Class 300	49.6 bar	48.1 bar	42.2 bar	38.5 bar	35.7 bar	33.4 bar	31.6 bar	30.3 bar
A3 [2]	Flange acc. ASME B16.5 Class 600 excl. RCC□39/XR	99.3 bar	96.2 bar	84.4 bar	77 bar	71.3 bar	66.8 bar	63.2 bar	60.7 bar
A3 [2]	Flange acc. ASME B16.5 Class 600 for RCC□39/XR	95 bar	89 bar	80 bar	73 bar	67 bar	62 bar	59 bar	58 bar
A4 [2]	Flange acc. ASME B16.5 Class 900 without /DS	148.9 bar	144.3 bar	126.6 bar	115.5 bar	107 bar	100.1 bar	94.9 bar	91 bar
A4 [2] [4]	Flange acc. ASME B16.5 Class 900 with /DS	130 bar	126 bar	110.5 bar	100.8 bar	93.4 bar	87.4 bar	82.9 bar	79.4 bar
A5 [2]	Flange acc. ASME B16.5 Class 1500 excl. RCC□36	248.2 bar	240.6 bar	211 bar	192.5 bar	178.3 bar	166.9 bar	158.1 bar	151.6 bar
A5 [2]	Flange acc. ASME B16.5 Class 1500 for RCC□36	210 bar	203 bar	176 bar	160 bar	148 bar	140 bar	133 bar	128 bar
D2 [1]	Flange acc. EN 1092-1 PN 16	16 bar	15.6 bar	14.2 bar	12.8 bar	11.7 bar	10.9 bar	10.3 bar	9.9 bar
D4 [1]	Flange acc. EN 1092-1 PN 40	40 bar	39.1 bar	35.6 bar	32.0 bar	29.3 bar	27.2 bar	25.8 bar	24.7 bar
D5 [1]	Flange acc. EN 1092-1 PN 63	63 bar	61.6 bar	56.0 bar	50.4 bar	46.2 bar	42.8 bar	40.6 bar	38.9 bar
D6 [1]	Flange acc. EN 1092-1 PN 100	100 bar	97.7 bar	94.7 bar	80.0 bar	73.3 bar	68.0 bar	64.4 bar	61.8 bar
G9 [1]	Internal thread RCCS30LR ... 33	285 bar	271 bar	247 bar	227 bar	208 bar	183 bar	----------	
T9 [1]	Internal thread NPT RCCS30LR ... 33	285 bar	271 bar	247 bar	227 bar	208 bar	183 bar	----------	
G9 [1] [4]	Internal thread RCCS34	260 bar	251 bar	231 bar	208 bar	190 bar	178 bar	167 bar	160 bar
T9 [1] [4]	Internal thread NPT RCCS34	260 bar	251 bar	231 bar	208 bar	190 bar	178 bar	167 bar	160 bar

		Process Temperature			
		up to 120°C	220°C	300°C	350°C
J1 [1]	Flange acc. JIS B 2220 10K	14 bar	12 bar	10 bar	------
J2 [1]	Flange acc. JIS B 2220 20K	34 bar	31 bar	29 bar	26 bar

		Process Temperature	
		up to 140°C *)	
S2 [1]	Pipe connection acc. DIN 11851 up to DN 40	40 bar	*) under the restriction using suitable gasket materials
	Pipe connection acc. DIN 11851 DN 50 to DN 100	25 bar	
	Pipe connection acc. DIN 11851 above DN 100	16 bar	

		Process Temperature	
		up to 150°C **)	
S4 [1]	Clamp connection acc. DIN 32676 up to DN 50	16 bar	**) under the restriction using suitable gasket materials
	Clamp connection acc. DIN 32676 above DN 50	10 bar	
S8 [1]	Clamp acc. Mini-Clamp up to 1/2"	16 bar	
	Clamp acc. Tri-Clamp® up to 2"	16 bar	
	Clamp acc. Tri-Clamp® above 2"	10 bar	

Type of process connection		Process Temperature							
		RT [3]	120°F	210°F	300°F	390°F	480°F	570°F	660°F
A1 [2]	Flange acc. ASME B16.5 Class 150	276 psi	267 psi	235 psi	215 psi	199 psi	175 psi	148 psi	122 psi
A2 [2]	Flange acc. ASME B16.5 Class 300	719 psi	698 psi	612 psi	558 psi	518 psi	484 psi	458 psi	439 psi
A3 [2]	Flange acc. ASME B16.5 Class 600 excl. RCC□39/XR	1440 psi	1395 psi	1224 psi	1117 psi	1034 psi	969 psi	917 psi	880 psi
A3 [2]	Flange acc. ASME B16.5 Class 600 for RCC□39/XR	1378 psi	1291 psi	1160 psi	1059 psi	972 psi	899 psi	856 psi	841 psi
A4 [2]	Flange acc. ASME B16.5 Class 900 without /DS	2160 psi	2093 psi	1836 psi	1675 psi	1552 psi	1452 psi	1376 psi	1320 psi
A4 [2] [4]	Flange acc. ASME B16.5 Class 900 with/DS	1885 psi	1827 psi	1602 psi	1461 psi	1354 psi	1267 psi	1202 psi	1151 psi
A5 [2]	Flange acc. ASME B16.5 Class 1500 excl. RCC□36	3600 psi	3490 psi	3060 psi	2792 psi	2586 psi	2421 psi	2293 psi	2199 psi
A5 [2]	Flange acc. ASME B16.5 Class 1500 for RCC□36	3046 psi	2944 psi	2553 psi	2321 psi	2147 psi	2031 psi	1929 psi	1856 psi
D2 [1]	Flange acc. EN 1092-1 PN 16	232 psi	226 psi	206 psi	186 psi	170 psi	158 psi	149 psi	144 psi
D4 [1]	Flange acc. EN 1092-1 PN 40	580 psi	567 psi	516 psi	464 psi	425 psi	394 psi	374 psi	358 psi
D5 [1]	Flange acc. EN 1092-1 PN 63	914 psi	893 psi	812 psi	731 psi	670 psi	621 psi	589 psi	564 psi
D6 [1]	Flange acc. EN 1092-1 PN 100	1450 psi	1417 psi	1417 psi	1160 psi	1063 psi	986 psi	934 psi	896 psi
G9 [1]	Internal thread RCCS30LR ... 33	4133 psi	3930 psi	3582 psi	3292 psi	3016 psi	2653 psi	----------	
T9 [1]	Internal thread NPT RCCS30LR ... 33	4133 psi	3930 psi	3582 psi	3292 psi	3016 psi	2653 psi	----------	
G9 [1] [4]	Internal thread RCCS34	3770 psi	3640 psi	3350 psi	3016 psi	2755 psi	2581 psi	2422 psi	2320 psi
T9 [1] [4]	Internal thread NPT RCCS34	3770 psi	3640 psi	3350 psi	3016 psi	2755 psi	2581 psi	2422 psi	2320 psi

		Process Temperature			
		up to 248°F	428°F	572°F	662°F
J1 [1]	Flange acc. JIS B 2220 10K	1203 psi	174 psi	145 psi	------
J2 [1]	Flange acc. JIS B 2220 20K	493 psi	449 psi	420 psi	377 psi

		Process Temperature	
		up to 284°F) *)	
S2 [1]	Pipe connection acc. DIN 11851 up to DN 40	580 psi	*) under the restriction using suitable gasket materials
	Pipe connection acc. DIN 11851 DN 50 to DN 100	362 psi	
	Pipe connection acc. DIN 11851 above DN 100	232 psi	

		Process Temperature	
		up to 302°F **)	
S4 [1]	Clamp connection acc. DIN 32676 up to DN 50	232 psi	**) under the restriction using suitable gasket materials
	Clamp connection acc. DIN 32676 above DN 50	145 psi	
S8 [1]	Clamp acc. Mini-Clamp up to 1/2"	232 psi	
	Clamp acc. Tri-Clamp® up to 2"	232 psi	
	Clamp acc. Tri-Clamp® above 2"	145 psi	

[1] process connection material: 1.4404 / 1.4435 (equivalent to group 2.3 material AISI 316L acc. ASME B16.5)
[2] process connection material: 1.4401/1.4404 AISI 316/316L
[3] RT = Room Temperature; EN1092: -10°C to 50°C; ASME B16.5: -29°C to 38°C
[4] for option /DS max. pressure according A4. ASME class 900 13% derated

Factory Setting

Item	Settings
Tag number (Tag plate, option /BG)	As specified in order [1]
Software tag (PD_TAG)	Set to “FT1004” by default unless otherwise specified when ordered [2]
Node address	Set to 0xF6 (246) by default unless otherwise specified when ordered [3]

[1] Specified tag number is engraved on the stainless steel plate: Up to 16 letters using any alphanumeric and symbols of {-},{.} and {/}.
[2] Specified software tag number is entered in the amplifier memory: Up to 32 letters using any alphanumeric and symbols of {-},{.} and {/}.
[3] Range of node address: 0x00 to 0xFF (0 to 255).

Item	Settings			
Operation Functional Class	Set to ‘BASIC” unless otherwise specified when ordered			
Analog Input Function Block	AI1 Mass Flow	AI2 Volume Flow	AI3 Density	AI4 Temperature
Upper and lower operating range range and unit (XD_SCALE)	The range range will be set to the mass flow rate range specified on the order sheet (/PS) or to 0 to Qmax [1] if the order sheet is not supplied.	The range range will be set to the volume flow rate range specified on the order sheet (/PS) or to 0 to Qvmax [2] if the order sheet is not supplied.	The range range will be set to the density range specified on the order sheet (/PS) or to 0 to 1.5 kg/l if the order sheet is not supplied.	The range range will be set to the temperature range specified on the order sheet (/PS) or to 0 to 150 °C if the order sheet is not supplied.
Upper and lower output range range and unit (OUT_SCALE)				
Damping time constant (TB-Block)	3 s	3 s	3 s	3 s
Analog Input Function Block	AI5 Concentration Measurement		AI6 Net Flow	
Upper and lower operating range range and unit (XD_SCALE)	The range range will be set to the concentration measurement range specified on the order sheet (/PS) or to 0 to 100 WT-% if the order sheet is not supplied. The unit depends on the selected concentration.		The range range will be set to the net flow rate range specified on the order sheet (/PS) or to 0 to Qmax *1 if the order sheet is not supplied.	
Upper and lower output range range and unit OUT_SCALE)				
Damping time constant (TB-Block)	10 s		3 s	
Output mode (L-Type)	“Direct” for all AI blocks unless otherwise specified when ordered			

[1] Qmax see table 1 [2] Qvmax = Qmax * 3.3 for liquids

Parameter legend:

(1) XD_SCALE: Defines the input values from the transducer block (input range of sensor) corresponding to 0% and 100% span values from the inside calculation of the AI function blocks.
The values set as the mass flow span, volume flow span, density span and temperature span are stored in this parameter in the RCCT3/RCCF31.
Concentration span and net flow span can be set in this parameter under option /Cxx.

(2) OUT_SCALE: Output scaling parameter. Defines the output values corresponding to 0% and 100% span values from the inside calculation of the AI function blocks.

(3) PV_FTIME: Time constant of the damping function within the AI blocks is set to 0 s.

(4) L_TYPE: Determines if the values passed by the transducer block to the AI block may be used directly (Direct) or if the value is in different units and must be converted linearly (Indirect Linear) using the input range defined by XD_SCALE and the associated output range (OUT_SCALE).

ORDERING INFORMATION

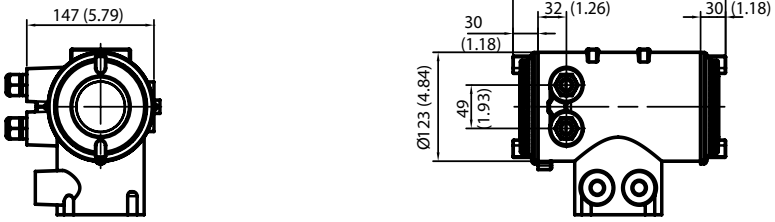
1. Model, suffix codes, and optional codes
2. Option /PS
   - Software Tag (PD_TAG)
   - Node Address
   - Operation Function Class: ‚Basic‘ or ‚Link Master‘
   - Operating Range and Units (XD_SCALE)
   - Operating Damping Time (TB: PV_FTIME)
   - Operating Lowcut Value (TB: LOWCUT)
   - Output Scale and Units (OUT_SCALE)
   - Output Mode (L_TYPE): ‚Direct‘ or ‚Indirect‘
   - TB Parameter LANGUAGE
   - TB Parameter DISP_SELECT_n
   - TB Parameter BI_DIRECTION

Alternatively, not in combination with /PS:
3. Option /BT3
   - Software Tag (PD_TAG)
   - Node Address

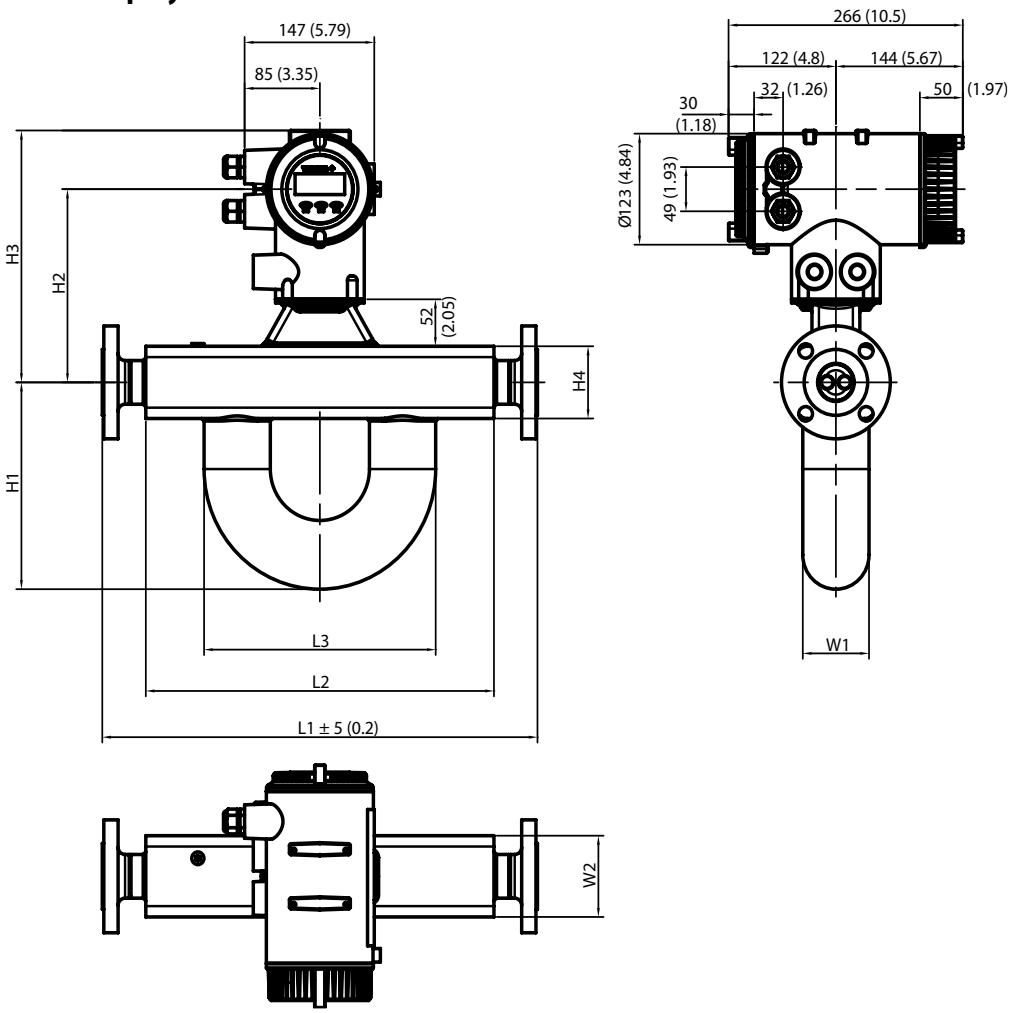
DIMENSIONS

Integral Type RCCT34, RCCT36, RCCT38, RCCT39

Without Display



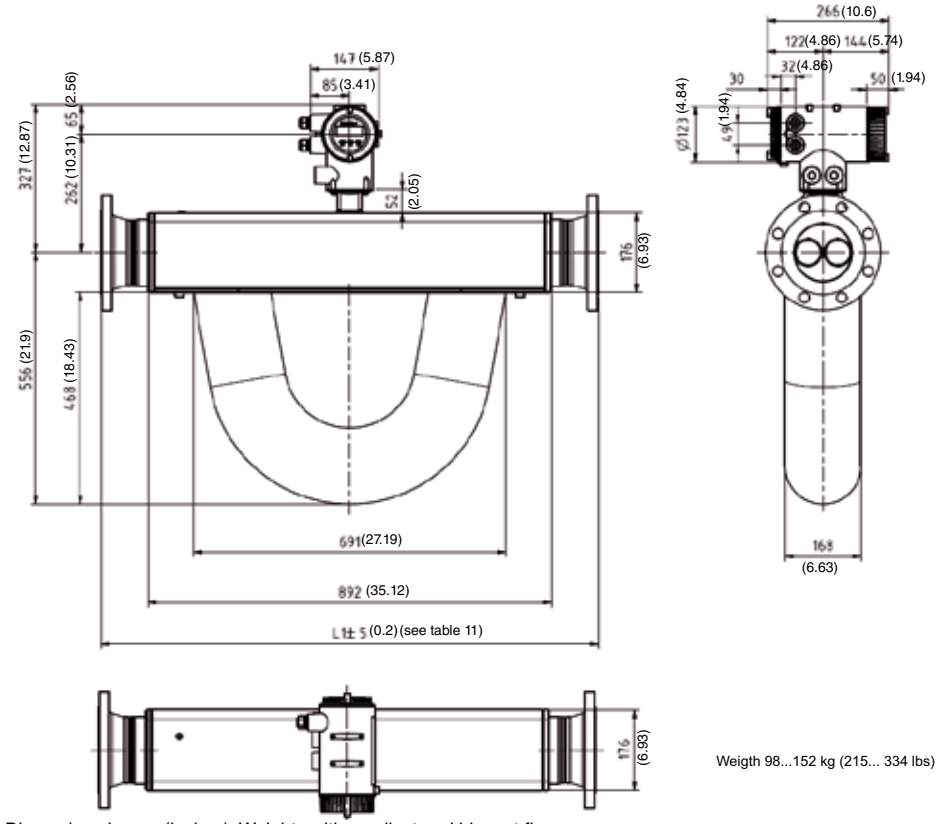
With Display



Note: The flange dimensions depend on size and pressure rating of the flange.

Model		L1	L2	L3	H1	H2	H3	H4	W1	W2	Weight
RCCT34	mm (inches)	see table 11	272 (10.7)	212 (8.35)	177 (6.97)	214 (8.43)	279 (11)	80 (3.15)	60 (2.36)	80 (3.15)	13-24 kg (29-53 lbs)
RCCT36	mm (inches)	see table 11	400 (15.7)	266 (10.5)	230 (9.06)	214 (8.43)	279 (11)	80 (3.15)	76 (2.99)	90 (3.54)	18-38 kg (40-84 lbs)
RCCT38	mm (inches)	see table 11	490 (19.3)	267 (10.5)	269 (10.6)	224 (8.82)	289 (11.4)	100 (3.94)	89 (3.5)	110 (4.33)	28-53 kg (62-117 lbs)
RCCT39	mm (inches)	see table 11	850 (33.5)	379 (14.9)	370 (14.6)	240 (9.45)	306 (12)	135 (5.31)	129 (5.08)	160 (6.3)	63-106 kg (139-233 lbs)
Dimensions in mm (inches). Weights with smallest and biggest flanges.											

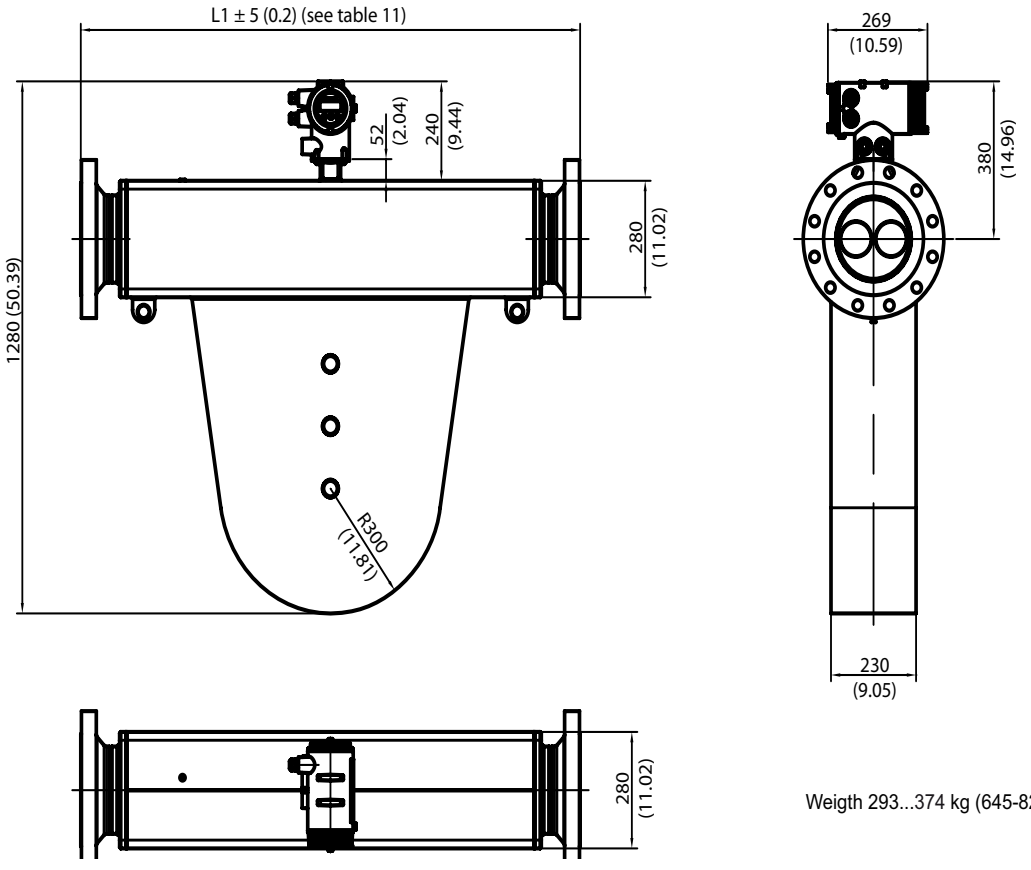
Integral Type RCCT39/IR-□□□□□□□□□□/V2



Weigth 98...152 kg (215... 334 lbs)

Dimensions in mm (inches). Weights with smallest and biggest flanges

Integral Type RCCT39/XR

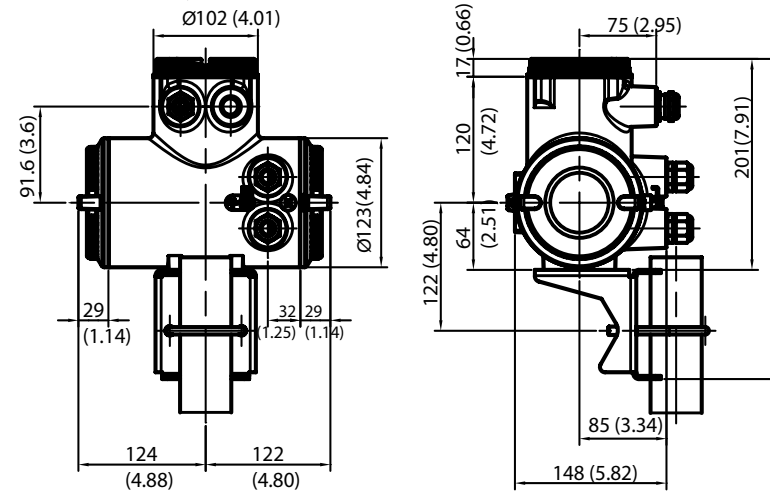


Weigth 293...374 kg (645-823 lbs)

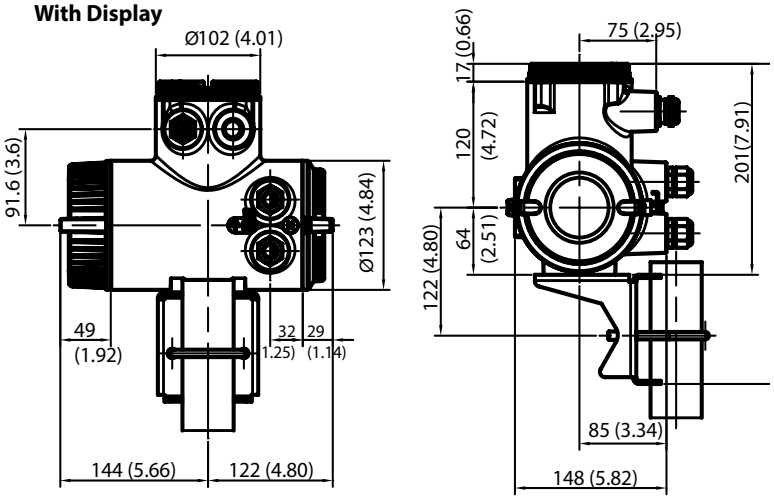
Dimensions in mm (inches). Weights with smallest and biggest flanges

Remote field-mount Converter RCCF31

Without Display



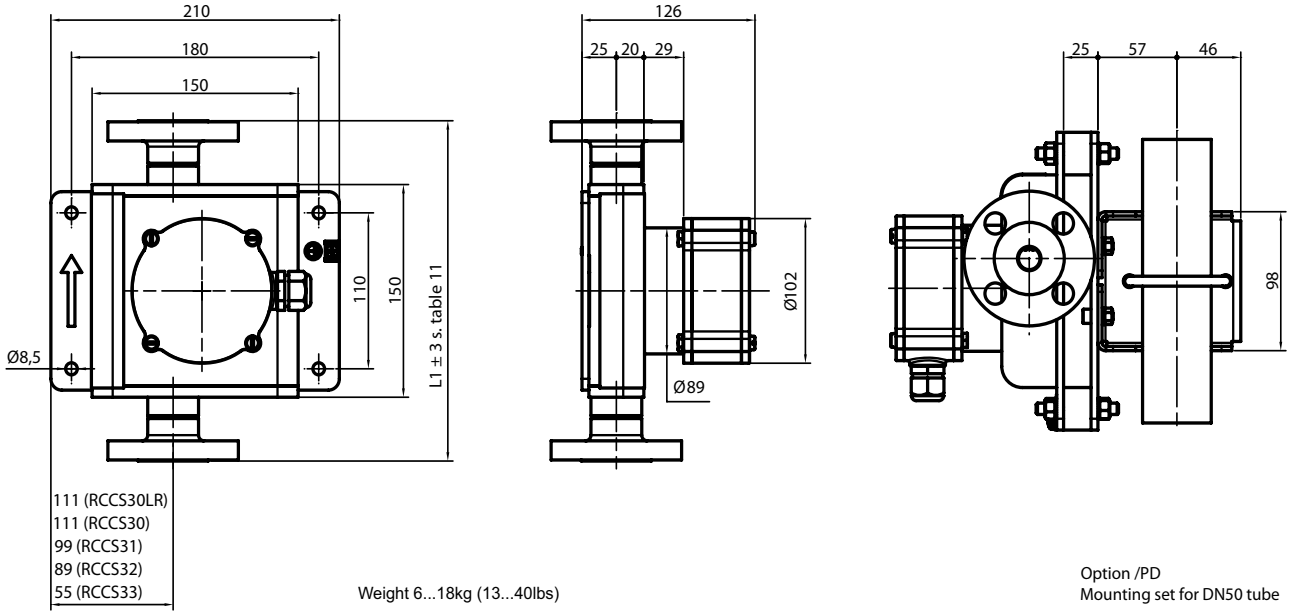
With Display



Weight with bracket: 5.5 kg (12.1 lbs) (depends on type)

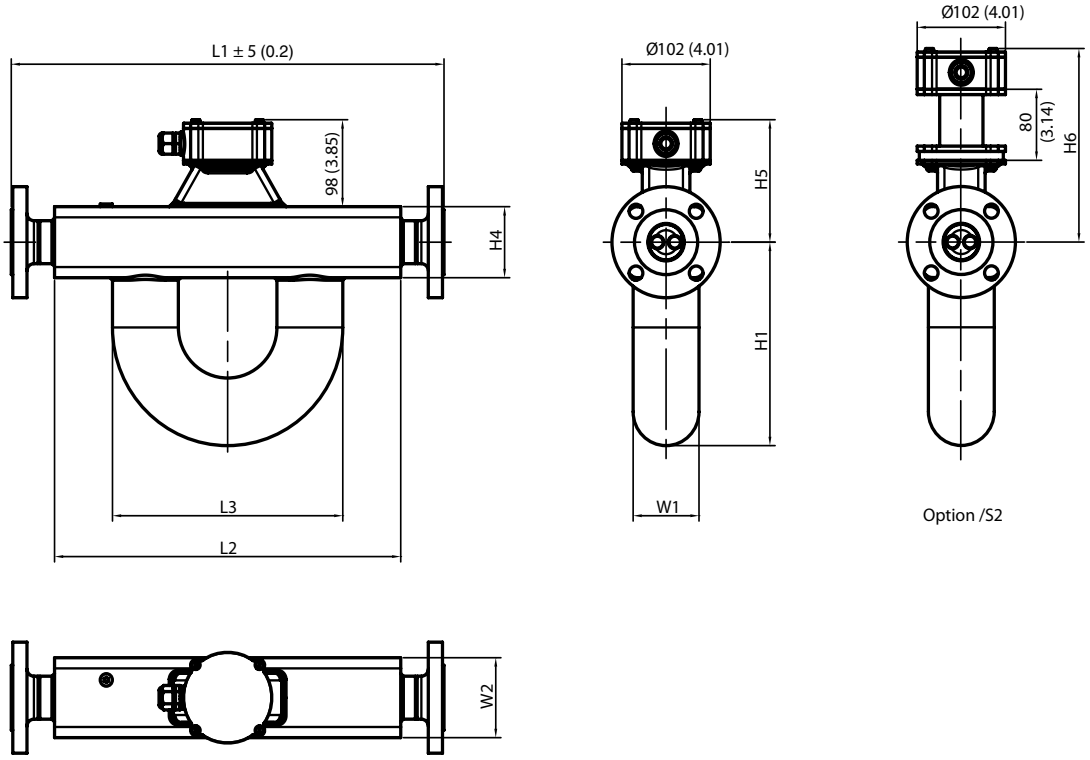
Dimensions in mm (inches)

Remote Detector RCCS30LR, RCCS30, RCCS31, RCCS32, RCCS33



Dimensions in mm

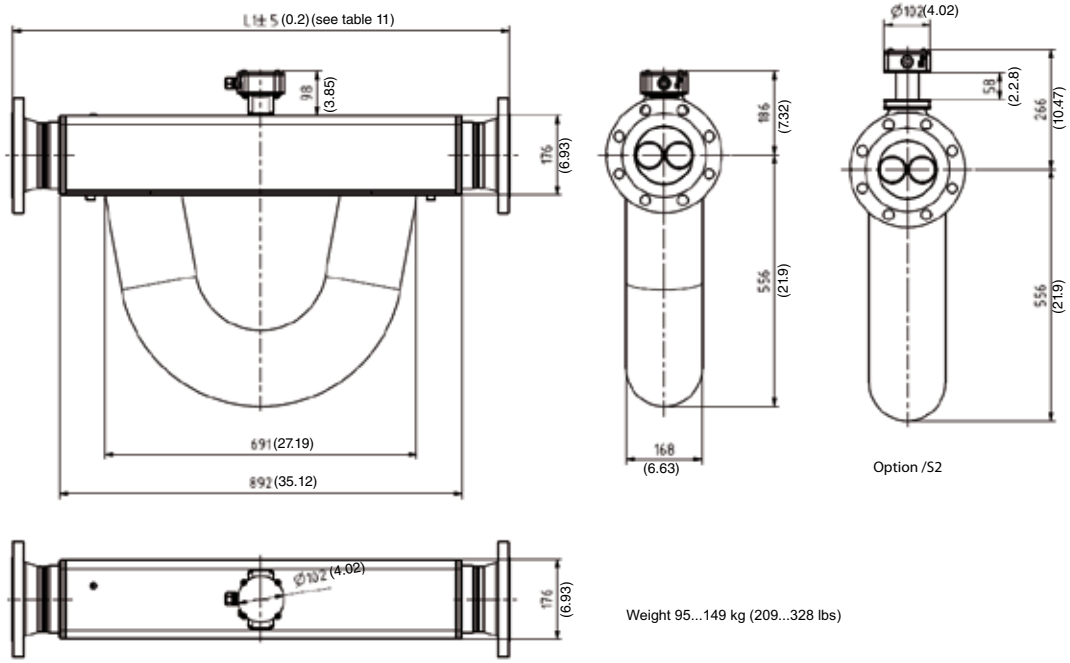
Remote Detector RCCS34, RCCS36, RCCS38, RCCS39



Note: The flange dimensions depend on size and pressure rating of the flange.

Model		L1	L2	L3	H1	W1	W2	H4	H5	H6	Weight
RCCS34	mm (inches)	see table 11	272 (10.7)	212 (8.35)	177 (6.97)	60 (2.36)	80 (3.15)	80 (3.15)	138 (5.43)	218 (8.58)	10-21 kg (22-46 lbs)
RCCS36	mm (inches)	see table 11	400 (15.7)	266 (10.5)	230 (9.06)	76 (2.99)	90 (3.54)	80 (3.15)	138 (5.43)	218 (8.58)	15-35 kg (33-77 lbs)
RCCS38	mm (inches)	see table 11	490 (19.3)	267 (10.5)	269 (10.6)	89 (3.5)	110 (4.33)	100 (3.94)	148 (5.82)	228 (8.97)	25-50 kg (55-110 lbs)
RCCS39	mm (inches)	see table 11	850 (33.5)	379 (14.9)	370 (14.6)	129 (5.08)	160 (6.3)	135 (5.31)	166 (6.53)	245 (9.65)	60-103 kg (132-227 lbs)
Dimensions in mm (inches)..Weights with smallest and biggest flanges.											

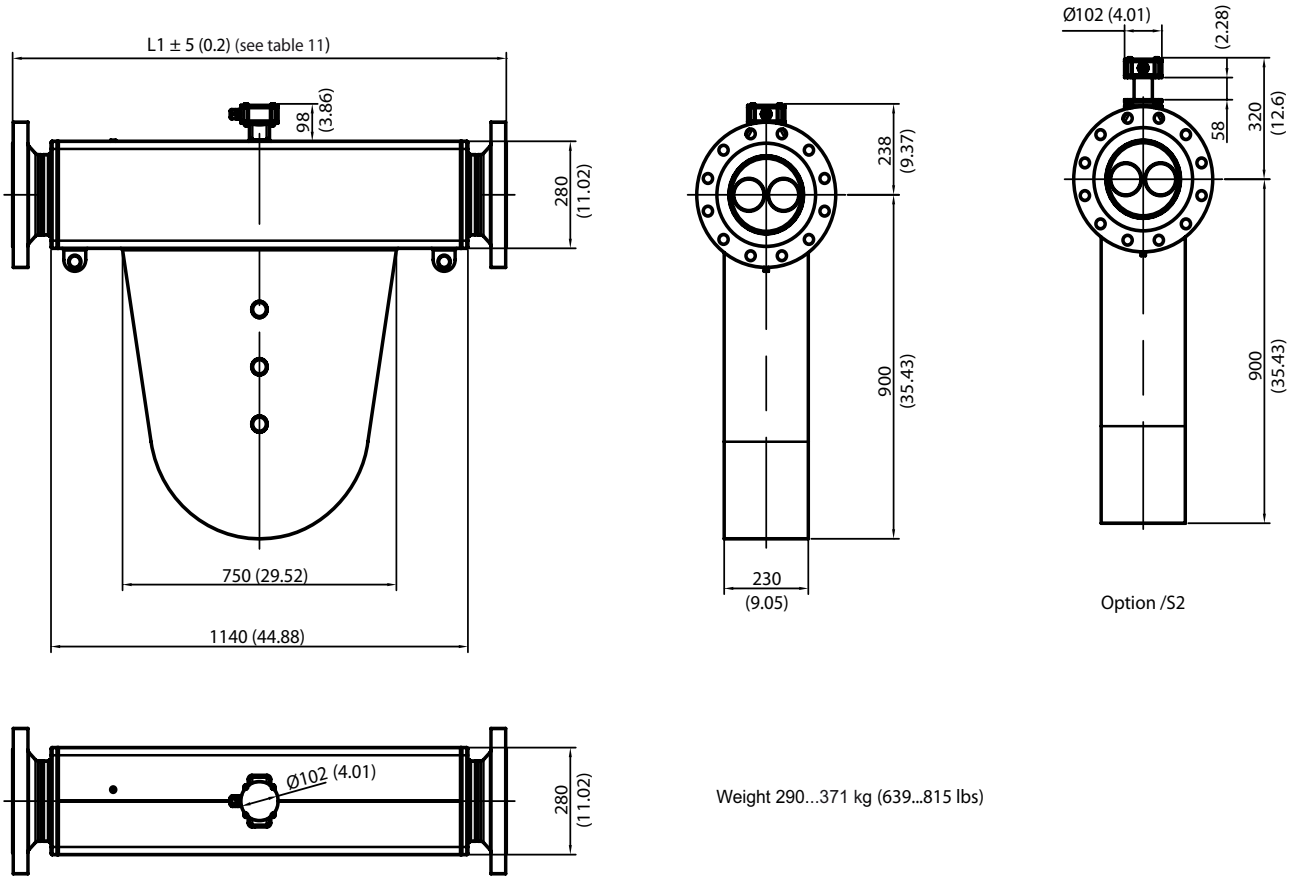
Remote Detector RCCS39/IR-□□□□□□□□□□ /V2



Weight 95...149 kg (209...328 lbs)

Dimensions in mm (inches). Weights with smallest and biggest flanges

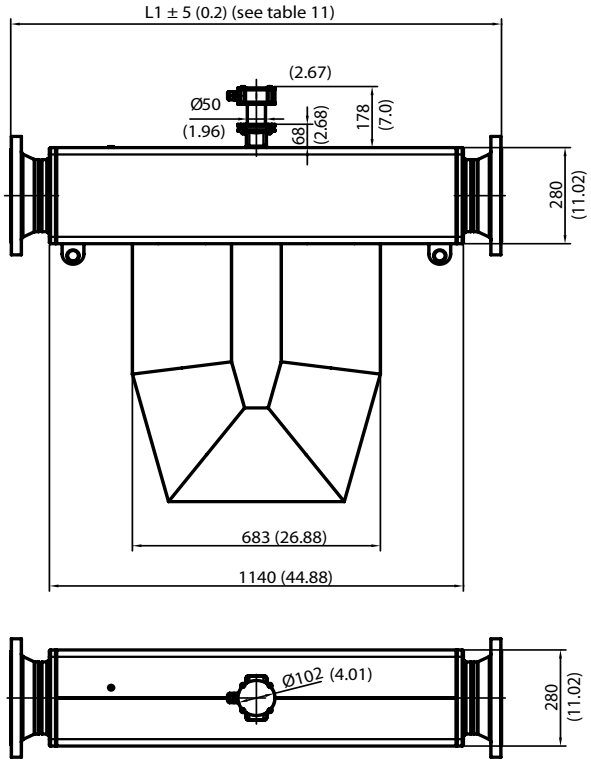
Remote Detector RCCS39/XR

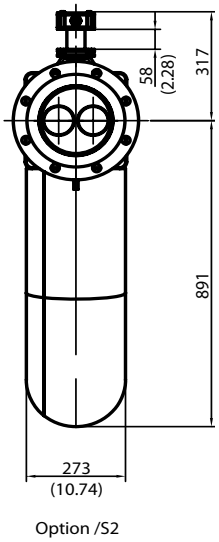


Weight 290...371 kg (639...815 lbs)

Dimensions in mm (inches). Weights with smallest and biggest flanges

Remote Detector RCCS39/XR with option /HT



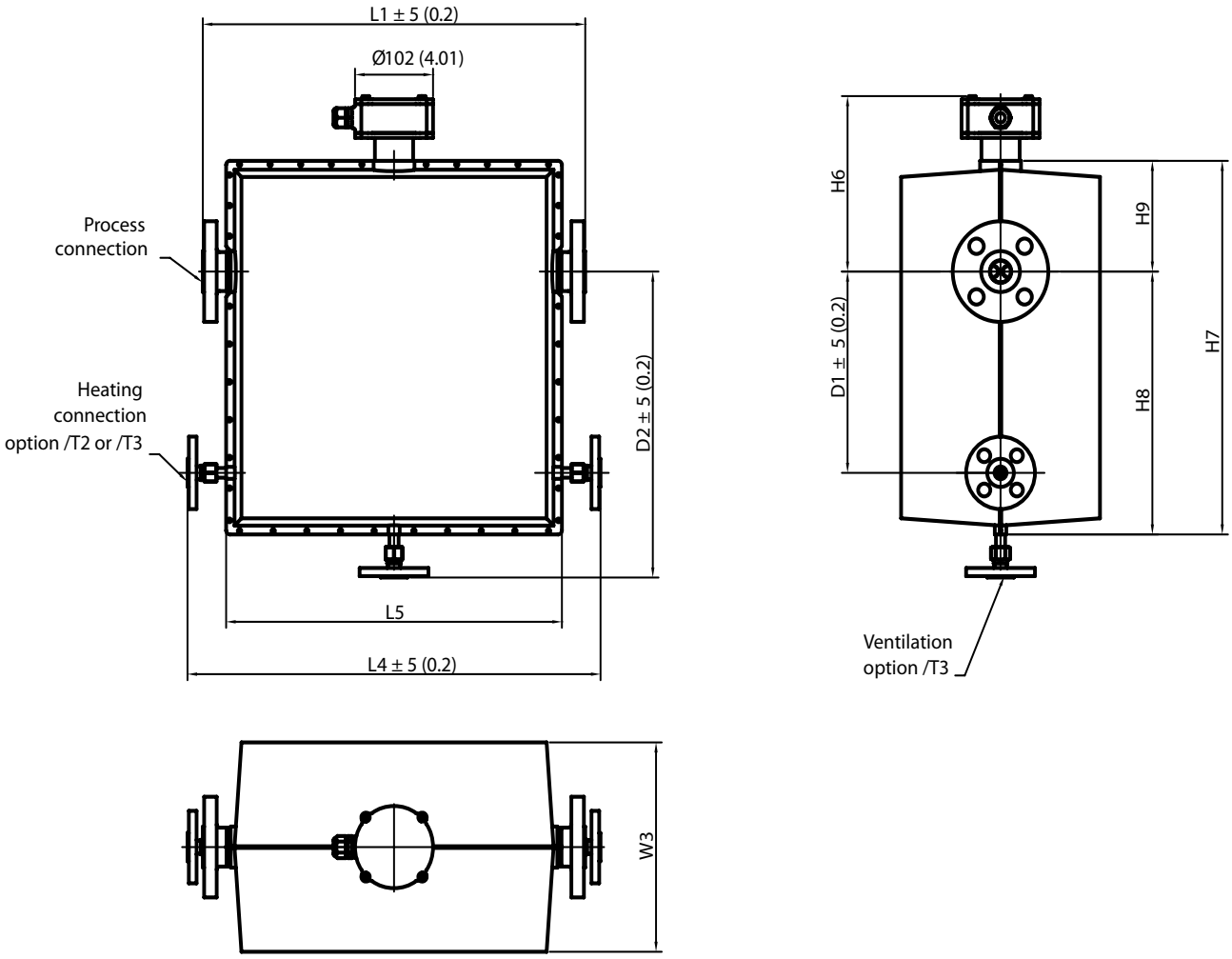


Option /S2

Weight 290...370 kg
(639...815 lbs)

Dimensions in mm (inches). Weights with smallest and biggest flanges

Remote Detector RCCS34, RCCS36, RCCS38, RCCS39, RCCS39/IR-□□□□□□□□□□ /V2 with option /T□ (Insulation / Heating)

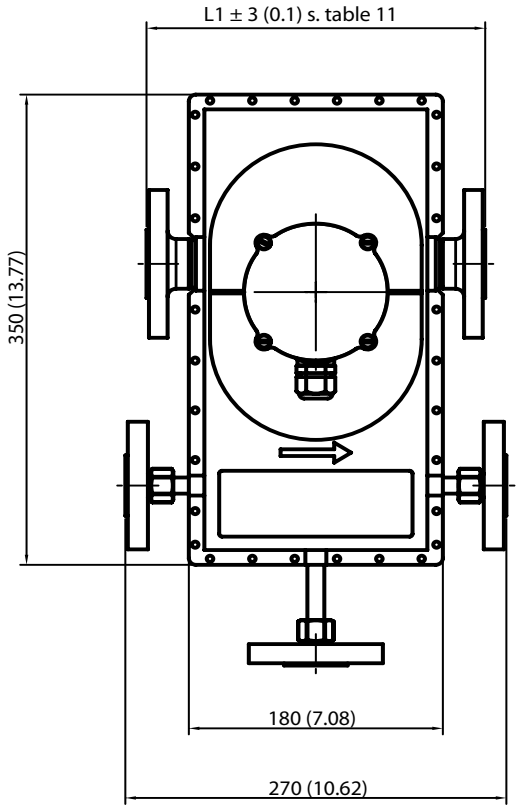


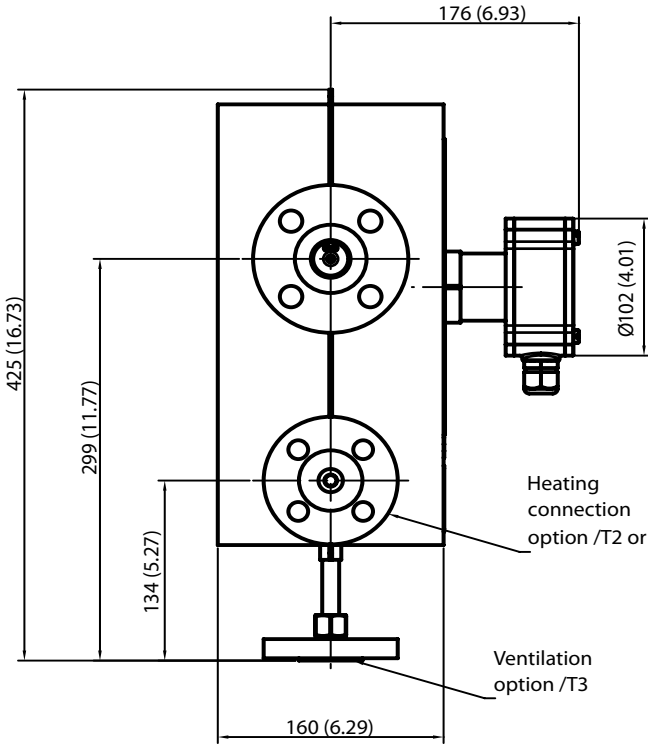
Note: The flange dimensions depend on size and pressure rating of the flange.

Model		L1	L4	L5	D1	D2	H6	H7	H8	H9	W3	Weight
RCCS34	mm (inches)	see table 11	420 (16.53)	310 (12.20)	200 (7.87)	330 (12.99)	218 (8.58)	411 (16.81)	273 (10.74)	138 (5.43)	240 (9.44)	19-33 kg (42-73 lbs)
RCCS36	mm (inches)	see table 11	540 (21.25)	439 (17.28)	250 (9.84)	380 (14.96)	218 (8.58)	464 (18.26)	326 (12.83)	138 (5.43)	260 (10.23)	27-50 kg (59-110 lbs)
RCCS38	mm (inches)	see table 11	640 (25.19)	530 (20.86)	250 (9.84)	430 (16.92)	228 (8.97)	524 (20.62)	376 (14.80)	148 (5.82)	260 (10.23)	39-67 kg (86-147 lbs)
RCCS39	mm (inches)	see table 11	1000 (39.37)	894 (35.19)	350 (13.77)	545 (21.45)	245 (9.65)	668 (26.29)	503 (19.80)	165 (6.49)	302 (11.88)	96-142 kg (211-312 lbs)
RCCS39/ IR	mm (inches)	see table 11	1050 (41.34)	944 (37.16)	350 (13.77)	677 (26.65)	266 (10.47)	944 (37.16)	625 (24.61)	193 (7.6)	342 (13.46)	138-195 kg (303-429 lbs)

Dimensions in mm (inches). Weights with smallest and biggest flanges including insulation cover and heat tracing.
Standard heating connection according table 10.

Remote Detector RCCS30LR, RCCS30, RCCS31, RCCS32, RCCS33 with option /T□ (Insulation / Heating)





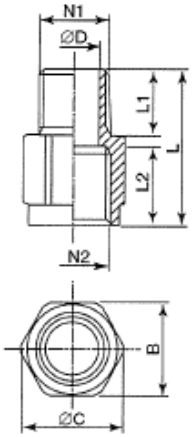
Weight in kg (lbs) without flange			Weight in kg (lbs) with flange (01A1)		
/T1	/T2	/T3	/T1	/T2	/T3
8.7 (19.2)	11.5 (25.3)	12.5 (27.5)	9.5 (21)	12.3 (27.1)	13.3 (29.3)

Table 10: Heat tracing connection types depending on process connection type

Process connection	Standard heating connection *)
A□	ASME ½" - 150
D□	EN DN 15 PN 40
J□	JIS 10K DN15
S2 ; S4	EN DN 15 PN 40
S8	ASME ½" - 150
G9	EN DN 15 PN 40
T9	ASME ½" - 150

*) others on request

Adapter 1/2" NPT - G1/2 (Option /AD2)



N1	N2	ØD [mm (in.)]	B [mm (in.)]	ØC [mm (in.)]	L1 [[mm (in.)]	L2 [mm (in.)]	L [mm (in.)]	Weight [kg (lbs)]
1/2´´ NPT	G1/2´´	15 (0.59)	27 (1.06)	30 (1.18)	19 (0.74)	23 (0.90)	45 (1.77)	0.07 (0.003)

MODEL, SUFFIX AND OPTION CODES

Integral Type RCCT3□, Model and Suffix Code :

Model	Suffix Code	Description	Restrictions
RCCT34		Nominal Value : 3 t/h = 50 kg/min (110,2 lbs/min)	
RCCT36		Nominal Value : 10 t/h = 170 kg/min (374.78 lbs/min)	
RCCT38		Nominal Value : 32 t/h = 533 kg/min (1175 lbs/min)	
RCCT39		Nominal Value : 100 t/h = 1670 kg/min (3681.72 lbs/min)	
RCCT39/IR		Nominal Value : 250 t/h = 4170 kg/min (9193.27 lbs/min)	only with /V2
RCCT39/XR		Nominal Value : 500 t/h = 8340 kg/min (18386.55 lbs/min)	only with /HP
Power supply	-A	90 - 264 V AC	
	-D	24 V DC	
Indicator direction	H1	Detector installation horizontal, tubes down, recom. for liquid service	
	H2	Detector installation horizontal, tubes up, recommended. for gas service /GA	
	V0	Detector installation vertical	
	N0	Without indicator	
Cable conduit connection	M	M20 x 1, female thread with cable glands	not with /FF3
	A	ANSI ½" NPT, female thread without cable glands	
Process connection size [1]	23	¾"	see table 11
	01	DN 15, ½"	see table 11
	02	DN 25, 1"	see table 11
	04	DN 40, 1½"	see table 11
	05	DN 50, 2"	see table 11
	06	DN 65, 2½"	see table 11
	08	DN 80, 3"	see table 11
	10	DN 100, 4"	see table 11
	12	DN 125, 5"	see table 11
	15	DN 150, 6"	see table 11
	20	DN 200, 8"	see table 11
Process connection rating and style [1]	A1	ASME flange class 150, process connection dim. + facing acc. ASME B16.5	see table 11
	A2	ASME flange class 300, process connection dim. + facing acc. ASME B16.5	see table 11
	A3	ASME flange class 600, process connection dim. + facing acc. ASME B16.5	see table 11
	A4	ASME flange class 900, process connection dim. + facing acc. ASME B16.5	see table 11
	A5	ASME flange class 1500, process connection dim. + facing acc. ASME B16.5	see table 11
	D2	EN flange PN 16, process connection dim. + facing acc. EN 1092-1 Form B1	see table 11
	D4	EN flange PN 40, process connection dim. + facing acc. EN 1092-1 Form B1	see table 11
	D5	EN flange PN 63, process connection dim. + facing acc. EN 1092-1 Form B2	see table 11
	D6	EN flange PN 100, process connection dim. + facing acc. EN 1092-1 Form B2	see table 11
	J1	JIS flange 10K, JIS B 2220	see table 11
	J2	JIS flange 20K, JIS B 2220	see table 11
	S2	Thread acc. DIN 11851	see table 11
	S4	Clamp, process connection dimensions acc. DIN 32676	see table 11
	S8	Clamp, process connection dim. acc. Tri-Clover® (Tri-Clamp®) and ½" Mini Clamp	see table 11
	G9	G, female thread	see table 11
	T9	NPT, female thread	see table 11
Material of wetted parts [1]	SL	Stainless steel 316L (1.4404)	
	HC	Hastelloy C-22 (2.4602)	only RCCT34 to 39/IR

[1] see selection table „Process connection and materials" (table 11)

Integral Type RCCT3□, Option Code :

Options	Option code	Description	Restrictions
Fieldbus Communication	/FB	Digital communication (FOUNDATION™ Fieldbus protocol)	
	/LC1	Provides a PID control function block	
	/EE	Provides software download capability	
	/BT3	With customer specified tag number of FF- communication + node address in converter	max. 32 digits software tag + node address; not with /PS
Hazardous Area Approvals	/KF3	ATEX Flame proof converter + Intrinsically safe detector	with /HP not for gas group IIC
	/KF4	ATEX Flame proof converter + Intrinsically safe detector + Intrinsically safe fieldbus	with /HP not for gas group IIC
	/FF3	FM approval for USA + Canada, Flame proof converter + Intrinsically safe detector	only with cable conduit "A"; with /HP not for groups A and B
	/EF3	IECEx Flame proof converter + Intrinsically safe detector	with /HP not for gas group IIC
	/EF4	IECEx Flame proof converter + Intrinsically safe detector + Intrinsically safe fieldbus	with /HP not for gas group IIC
	/UF3	INMETRO Flame proof converter + Intrinsically safe detector	with /HP not for gas group IIC
	/UF4	INMETRO Flame proof converter + Intrinsically safe detector + Intrinsically safe fieldbus	with /HP not for gas group IIC
	/NF3	NEPSI Flame proof converter + Intrinsically safe detector	with /HP not for gas group IIC
	/NF4	NEPSI Flame proof converter + Intrinsically safe detector + Intrinsically safe fieldbus	with /HP not for gas group IIC
	/GF3	EAC Flame proof converter + Intrinsically safe detector + FF-output	with /HP for gas group IIB; only with /VE
	/GF4	EAC Flame proof converter + Intrinsically safe detector + Intrinsically safe FF- output	with /HP for gas group IIB; only with /VE
GOST	/QR1	Primary Calibration and Test Confirmation valid in Russia	see page 10; only with /VE
	/QR2	Primary Calibration and Test Confirmation valid in Kazakhstan	see page 10; only with /VE
	/QR3	Primary Calibration and Test Confirmation valid in Uzbekistan	see page 10
Dual Seal Approval	/DS	Dual Seal approval (conform with ANSI/ISA-12.27.01)	only with /FF3; not with process connection A5;
	/RD	Rupture disk, rupture pressure 20 bar, nominal diameter 8 mm	preferable with /GA, mandatory if /DS+/GA is selected

Integral Type RCCT3□, Option Code (continued) :

Options	Option code	Description	Restrictions
High Driving Power	/HP	High Driving Power; recommended for RCCT36 to 39, strongly recommended for RCCT39/IR [1], Please see „ Hazardous Area Specifications“	mandatory for RCCT39/XR
Tag Number	/BG	With customer specified tag number on name plate	max. 16 digits; numbers 0 to 9, latin alphabet, characters: +,- ,* , / and space
Flange Facing	/DN /EN /FN /RJ	Flange with safety grooves acc. to EN 1092-1 form D Flange with spigot acc. to EN 1092-1 form E Flange with recess acc. to EN 1092-1 form F Ring Type Joint Flanges	only for D2 to D6; not HC only for D2 to D6; not HC only for D2 to D6; not HC only for A3, A4, A5; not HC
Gas Measurement	/GA	Gas measurement, special factory adjustments and settings	to be conform with ANSI/ISA-12.27.01 select /RD; not with /Q20
Special Calibration	/K2 [2] /K4 /K5 [2] /K6	Custom 5 pts mass-/volume-flow calibration using water with factory certificate (traceable to German national standards) Density adjustment + thermal treatment; (accuracy: 0.001 g/cm³) Custom 10 pts mass-/volume-flow calibration using water with DAkkS certificate (according EN-17025:2005) Density calibration with 3 different fluids incl. individual temperature compensation with certificate (accuracy: 0.0005 g/cm³)	 only RCCT34 to 39; not with /GA only RCCT34 to 39; not with /GA
Certificates	/P2 /P3 /P6 /P8 /H1 /WP /L2 /L3 /L4	Certificate of compliance with the order acc. to EN 10204:2004 -2.1 Test Report acc. to EN10204:2004-2.2(QIC) including the content of option /P2 Material certificate acc. to EN 10204: 2004 -3.1 Pressure test report measuring system Oil and fat free for wetted surface acc. to ASTM G93-03 level C WPS acc. DIN EN ISO 15609-1 (Welding Procedure Specification) WPQR acc. DIN EN ISO 15614-1 (Welding Procedure Qualification Record) WQC acc. DIN EN 287-1 (Welder Qualification Certificate) Calibration certificate level 2: Declaration and the Calibration Equipment List are issued Calibration certificate level 3: Declaration and the Primary Standard List are issued Calibration certificate level 4: Declaration and the Yokogawa Measuring Instruments Control System are issued	 only for butt weld between process connection and flow divider; not for material HC
Sanitary Type	/SF1 /SF2 /SA /SE	Surface roughness Ra = 0.8 µm As /SF1 + Test report roughness of wetted parts As /SF2 + 3A- declaration of conformity and 3A- mark As /SF2 + EHEDG certificate	only RCCT34 to 39; not with RCCT34 /K4 and RCCT34 / K6; only process connections S2, S4, S8; as /SF1 as /SF1, but not with process connection S2 as /SF1, but not with process connection S2
Customer Presetting	/PS	Presetting sheet with customer data	has to be issued with the order; not with /BT3
Housing Pressure Test	/J1	Rupture pressure proof test and certificate (see page 4)	not for RCCT39/XR
X-Ray Examination	/RT	X-ray examination of flange welding	RCCT34 with /K4 or /K6 only one-sided; not with HC
PMI Certificate	/PM6	PMI Test on wetted parts	
Dye Penetrant Test	/PT	Dye Penetrant Test acc. DIN EN ISO 3452-1 at the weldings of the process connection, with certificate	
Epoxy Coating	/X1	Epoxy coating of converter housing	
Concentration Measurement [3]	/CST /C□□	Standard concentration measurement Advanced concentration measurement, details see table „Advanced Concentration Measurement Options“	not with /GA, /C□□ not with /GA, /CST
Version IR	/V2	Version 2	always with RCCT39/IR
Delivery to Korea	/KC	With KC-mark for Korea	
Eurasian Conformity	/VE	With EAC- mark	with hazardous area approval only with /GF□
Cable glands	/AD2	2 pcs ANSI 1/2“ NPT / G1/2 adapter	only with cable conduit “A”
Instruction Manuals	/IE□ /ID□ /IF□	Quantity of instruction manuals in English Quantity of instruction manuals in German Quantity of instruction manuals in French	□ = 1 to 3 selectable [4] □ = 1 to 3 selectable [4] □ = 1 to 3 selectable [4]
Special order	/Z	Special design must be specification an extra sheet	

[1] For gas application /GA RCCT39/XR can also be ordered without /HP.
[2] Calibration order sheet must be delivered with the order. This is available on the Flow Center Page at Coriolis/RCC□3/Technical Information.
Volume calibration: Mass flow calibration converted by density to volume flow.
~~[3] Measuring tube PAMI test is performed per delivery batch.~~
[3] For detailed information please see TI 01R04B04-04E-E. Concentration measurement is recommended with option /K6.
[4] If no instruction manual is selected, only a DVD with instruction manuals is shipped with the instrument. More than 3 manuals of one language on request.

Remote Detector RCCS3□, Model and Suffix Code :

Model	Suffix Code		Description	Restrictions
RCCS30LR			Nominal Value : 0.021 t/h = 0.35 kg/min (0.77 lbs/min)	
RCCS30			Nominal Value : 0.045 t/h = 0.75 kg/min (1.65 lbs/min)	
RCCS31			Nominal Value : 0.17 t/h = 2.8 kg/min (6.17 lbs/min)	
RCCS32			Nominal Value : 0.37 t/h = 6.2 kg/min (13.66 lbs/min)	
RCCS33			Nominal Value : 0.95 t/h = 16 kg/min (35.27 lbs/min)	
RCCS34			Nominal Value : 3 t/h = 50 kg/min (110,2 lbs/min)	
RCCS36			Nominal Value : 10 t/h = 170 kg/min (374.78 lbs/min)	
RCCS38			Nominal Value : 32 t/h = 533 kg/min (1175 lbs/min)	
RCCS39			Nominal Value : 100 t/h = 1670 kg/min (3681.72 lbs/min)	
RCCS39/IR			Nominal Value : 250 t/h = 4170 kg/min (9193.27 lbs/min)	only with /V2
RCCS39/XR			Nominal Value : 500 t/h = 8340 kg/min (18386.55 lbs/min)	select affiliated RCCF31 with /HP
Cable conduit connection	-M		M20 x 1, female thread with cable glands	not with /FS1
	-A		ANSI ½" NPT, female thread only with cable gland for detector connection	
Process connection size [1]	41		¼"	see table 11
	01		DN 15, ½"	see table 11
	23		¾"	see table 11
	02		DN 25, 1"	see table 11
	04		DN 40, 1½"	see table 11
	05		DN 50, 2"	see table 11
	06		DN 65, 2½"	see table 11
	08		DN 80, 3"	see table 11
	10		DN 100, 4"	see table 11
	12		DN 125, 5"	see table 11
	15		DN 150, 6"	see table 11
	20		DN 200, 8"	see table 11
Process connection rating and style [1]	A1		ASME flange class 150, process connection dim. + facing acc. ASME B16.5	see table 11
	A2		ASME flange class 300, process connection dim. + facing acc. ASME B16.5	see table 11
	A3		ASME flange class 600, process connection dim. + facing acc. ASME B16.5	see table 11
	A4		ASME flange class 900, process connection dim. + facing acc. ASME B16.5	see table 11
	A5		ASME flange class 1500, process connection dim. + facing acc. ASME B16.5	see table 11
	D2		EN flange PN 16, process connection dim. + facing acc. EN 1092-1 Form B1	see table 11
	D4		EN flange PN 40, process connection dim. + facing acc. EN 1092-1 Form B1	see table 11
	D5		EN flange PN 63, process connection dim. + facing acc. EN 1092-1 Form B2	see table 11
	D6		EN flange PN 100, process connection dim. + facing acc. EN 1092-1 Form B2	see table 11
	J1		JIS flange 10K, JIS B 2220	see table 11
	J2		JIS flange 20K, JIS B 2220	see table 11
	S2		Thread acc. DIN 11851	see table 11
	S4		Clamp, process connection dimensions acc. DIN 32676	see table 11
	S8		Clamp, process connection dim. acc. Tri-Clover® (Tri-Clamp®) and ½" Mini Clamp	see table 11
	G9		G, female thread	see table 11
	T9		NPT, female thread	see table 11
Material of wetted parts [1]		SH	316L (1.4404) and Hastelloy C-22 (2.4602) for tube	only RCCS30LR to 33
		SL	Stainless steel 316L (1.4404)	only RCCS34 to 39/XR
		HC	Hastelloy C-22 (2.4602)	only RCCS34 to 39/IR

[1] see selection table „Process connection and materials" (table 11)

Remote Detector RCCS3□, Option Code :

Options	Option code	Description	Restrictions
Hazardous Area Approvals [1]	/KS1	ATEX intrinsicallyally safe approval	
	/FS1	FM intrinsicallyally safe approval for USA + Canada	only with cable conduit "A"
	/ES1	IECEx intrinsicallyally safe approval	
	/US1	INMETRO intrinsicallyally safe approval for Brazil	
	/NS1	NEPSI intrinsicallyally safe approval for China	
	/GS1	EAC intrinsicallyally safe approval	only with /VE
GOST [1]	/QR1	Primary Calibration and Test Confirmation valid in Russia	see page 10; not with RCCS30LR; only with /VE
	/QR2	Primary Calibration and Test Confirmation valid in Kazakhstan	see page 10; not with RCCS30LR; only with /VE
	/QR3	Primary Calibration and Test Confirmation valid in Uzbekistan	see page 10; not with RCCS30LR
Dual Seal Approval	/DS	Dual Seal approval (conform with ANSI/ISA-12.27.01)	only RCCS34 to 39/XR; only with /FS1; not with process connection A5
	/RD	Rupture disk, rupture pressure 20 bar, nominal diameter 8 mm	only RCCS34 to 39/XR, preferable with /GA, not with /T1, /T2, /T3, mandatory if /DS + /GA is selected
Tag Number	/BG	With customer specified tag number on name plate	max. 16 digits
Flange Facing	/DN	Flange with safety grooves acc. to EN 1092-1 form D	only for D2 to D6; not HC, for RCCS30LR only for 01D4 or 01D6
	/EN	Flange with spigot acc. to EN 1092-1 form E	only for D2 to D6; not HC, for RCCS30LR only for 01D4 or 01D6
	/FN	Flange with recess acc. to EN 1092-1 form F	only for D2 to D6; not HC, for RCCS30LR only for 01D4 or 01D6
	/RJ	Ring Type Joint Flanges	only for A3, A4, A5; not HC, for RCCS30LR only for 01A3 or 01A5
Gas Measurement	/GA	Gas measurement, special factory adjustments and settings	select affiliated RCCF31 with /GA; to be conform with ANSI/ISA-12.27.01 select /RD; not with /Q20
Low temperature version	/LT	-200°C ≤ T_{medium} ≤ 150°C (-328°F to 302°F)	for RCCS34 to 39/XR; not with /MT, /HT, /Q01, /T1, /T2, /T3 ; in combination with Hazardous Area Approval only with /S2
Extended temperature range	/MT	-70°C ≤ T_{medium} ≤ 230°C (-94°F to 446°F) -50°C ≤ T_{medium} ≤ 260°C (-58°F to 500°F)	for RCCS34 to 39/XR; always with /S2 or /T1, /T2, /T3 ; for RCCS30LR to 33, always with /S2 or /T1, /T2, /T3
High temperature version	/HT	T_{medium} up to 350°C (662°F)	RCCS34 to 39/XR; only with/T1, /T2, /T3 or /S2 (customer insulation required); RCCS39/XR only with /S2
Special Calibration	/K2 [3]	Custom 5 pts mass-/volume-flow calibration using water with factory certificate (traceable to German national standards)	only in combination with converter RCCF31
	/K4	Density adjustment + thermal treatment; (accuracy: 0.001 g/cm³)	only RCCS31 to 39; not with /GA
	/K5 [3]	Custom 10 pts mass-/volume-flow calibration using water with DAkkS certificate (according EN-17025:2005)	only in combination with converter RCCF31
	/K6	Density calibration with 3 different fluids incl. individual temperature compensation with certificate (accuracy: 0.0005 g/cm³)	only RCCS32 to 39; not with /GA; not with /LT; not with /MT; only available if converter is also ordered
Certificates	/P2	Certificate of compliance with the order acc. to EN 10204:2004 -2.1	
	/P3	Test Report acc. to EN10204:2004-2.2(QIC) including the content of option /P2	
	/P6	Material certificate acc to EN 10204: 2004 -3.1	
	/P8	Pressure test report measuring system	
	/H1	Oil and fat free for wetted surface acc. to ASTM G93-03 level C	
	/WP	WPS acc. DIN EN ISO 15609-1 (Welding Procedure Specification) WPQR acc. DIN EN ISO 15614-1 (Welding Procedure Qualification Record) WQC acc. DIN EN 287-1 (Welder Qualification Certificate)	only for butt weld between process connection and flow divider; not for HC
	/L2	Calibration certificate level 2: Declaration and the Calibration Equipment List are issued	
	/L3	Calibration certificate level 3: Declaration and the Primary Standard List are issued	
	/L4	Calibration certificate level 4: Declaration and the Yokogawa Measuring Instruments Control System are issued	
Sanitary Type	/SF1	Surface roughness Ra = 0.8 µm	only RCCS34 to 39; not with RCCS34 /K4, RCCS34 / K6 and RCCS34 /LT ; only process connections S2, S4, S8
	/SF2	As /SF1 + Test report roughness of wetted parts	as /SF1
	/SA	As /SF2 + 3A- declaration of conformity and 3A- mark	as /SF1, but not with process connection S2
	/SE	As /SF2 + EHEDG- certificate	as /SF1, but not with process connection S2
Mounting set	/PD	2 inch pipe mounting set, recommended for RCCS30LR and RCCS30	only RCCS30LR to 33; not with /T□
Housing Pressure Test	/J1	Rupture pressure proof test and certificate (see page 4)	not for RCCS30LR to 33 + RCCS39/XR
Customer insulation / Heating	/S2	Terminal box on extension for high or low process temperature	not with /T1, /T2, /T3
Factory Insulating / Heating	/T1	Insulation	not for RCCS39/XR
	/T2	Insulation + Heat carrier heating	not for RCCS39/XR
	/T3	Insulation + Heat carrier heating with ventilation (purge)	not for RCCS39/XR
X-Ray Examination	/RT	X-ray examination of flange welding	RCCS30LR to 33 and RCCS34 with /K4, /K6 or /LT only one-sided; not with HC
PMI Certificate	/PM4	PMI Test on wetted parts RCCS30LR to 33 [4]	not RCCS34 to 39/XR
	/PM6	PMI Test on wetted parts RCCS34 to 39/XR	not RCCS30LR to 33
Dye Penetrant Test	/PT	Dye Penetrant Test acc. DIN EN ISO 3452-1 at the weldings of the process connection, with certificate	
Stainless steel cable gland	/BS	Cable gland stainless steel	
Version IR	/V2	Version 2	always with RCCS39/IR
Delivery to Korea	/KC	With KC-mark for Korea	
Eurasian Conformity	/VE	With EAC- mark	with hazardous area approval only with /GS1
Special order	/Z	Special design must be specification an extra sheet	

[1] Select affiliated converter RCCF31 with the same approval type (e.g. ATEX).
[2] Calibration order sheet must be delivered with the order. This is available on the Flow Center Page at Coriolis/RCC□3/Technical Information.
Volume calibration: Mass flow calibration converted by density to volume flow.
[3] Measuring tube PMI test is performed per delivery batch.

Remote field-mount Converter RCCF31, Model, Suffix and Option Code :

Model	Suffix Code	Option Code	Description	Restrictions
RCCF31			Remote field-mount converter to be connected to RCCS3; when ordered without detector combination option /NC must be selected	
Power supply	-A -D		90 - 264 V AC 24 V DC	
Indicator direction	H2 N0		With indicator Without indicator	
Cable conduit connection	M A		M20 x 1, female thread with cable glands ANSI ½" NPT, female thread, only cable gland for detector connection	not with /FF3

Fieldbus Communication	/FB /LC1 /EE /BT3	Digital communication (Foundation™ Fieldbus protocol) Provides a PID control function block Provides software download capability With customer specified tag number of FF- communication + node address in converter	 max. 32 digits software tag + node address ; not with /PS
Hazardous Area Approvals [1]	/KF3 /KF4 /FF3 /EF3 /EF4 /UF3 /UF4 /NF3 /NF4 /GF3 /GF4	ATEX Flame proof converter + Intrinsically safe detector output ATEX Flame proof converter + Intrinsically safe detector + Intrinsically safe fieldbus FM approval for USA+Canada, Flame proof converter + Intrinsically safe detector IECEx Flame proof converter + Intrinsically safe detector IECEx Flame proof converter + Intrinsically safe detector + Intrinsically safe fieldbus INMETRO Flame proof converter + Intrinsically safe detector INMETRO Flame proof converter + Intrinsically safe detector + Intrinsically safe fieldbus NEPSI Flame proof converter + Intrinsically safe detector output NEPSI Flame proof converter + Intrinsically safe detector + Intrinsically safe fieldbus EAC Flame proof converter + Intrinsically safe detector output + FF output EAC Flame proof converter + Intrinsically safe detector output + Intrinsically safe FF- output	with /HP for gas group IIB with /HP for gas group IIB only with cable conduit "A"; with /HP not for groups A and B with /HP for gas group IIB with /HP for gas group IIB with /HP for gas group IIB with /HP for gas group IIB with /HP for gas group IIB with /HP for gas group IIB with /HP for gas group IIB, only with /VE with /HP for gas group IIB, only with /VE
GOST [1]	/QR1 /QR2 /QR3	Primary Calibration and Test Confirmation valid in Russia Primary Calibration and Test Confirmation valid in Kazakhstan Primary Calibration and Test Confirmation valid in Uzbekistan	see page 10; only with /VE see page 10; only with /VE see page 10
High Driving Power	/HP	High Driving Power, recommended for combination with RCCS36 to 39, strongly recommended for combination with RCCS39/IR, Please see „ Hazardous Area Specifications"	mandatory for combination with RCCS39/XR
Tag Number	/BG	With customer specified tag number on name plate	max. 16 digits; numbers 0 to 9, latin alphabet, characters: +,- ,* , / and space
Gas Measurement	/GA	Gas measurement, special factory adjustments and settings	select affiliated RCCS3 with /GA
Combination with RCCS39/XR	/XR	Combination with RCCS39/XR	mandatory for combination with RCCS39/XR
No Combination	/NC	No combination with detector	
Customer Presetting	/PS	Presetting sheet with customer data	has to be issued with the order; not with /BT3
Epoxy Coating	/X1	Epoxy coating of converter housing	
Cable glands	/AD2	2 pcs ANSI 1/2" NPT / G1/2 adapter	only with cable conduit "A"
Concentration Measurement [2]	/CST /C□□	Standard concentration measurement Advanced concentration measurement, details see table „Advanced Concentration Measurement Options"	not with /GA, /C□□ not with /GA, /CST
Delivery to Korea	/KC	With KC-mark for Korea	
Eurasian Conformity	/VE	With EAC- mark	with hazardous area approval only with /GF□
Certificates	/P2 /P3	Certificate of compliance with the order acc. to EN 10204:2004 -2.1 Test Report acc. to EN10204:2004-2.2(QIC) including the content of option /P2	
Instruction Manuals	/IE□ /ID□ /IF□	Quantity of instruction manuals in English Quantity of instruction manuals in German Quantity of instruction manuals in French	□ = 1 to 3 selectable [5] □ = 1 to 3 selectable [5] □ = 1 to 3 selectable [5]
Special order	/Z	Special design must be specification an extra sheet	

[1] Select affiliated RCCS3 with the same approval type (e.g. /KF □ with /KS1).
[2] For detailed information please see TI 01R04B04-04E-E. Option /K6 of RCCS3 is recommended with concentration measurement.
[3] If no instruction manual is selected, only a DVD with instruction manuals is shipped with the instrument. More than 3 manuals of one language on request.
[4] RCCF31 in combination with RCCS39/XR with gas application /GA can also be ordered without /HP.

Remote Cable RCCY03□ to connect RCCF31/CR31 with RCCS3□
Model, Suffix and Option Code :

Model	Suffix Code	Option Code	Description	Restrictions
RCCY031 RCCY032 RCCY033 RCCY034			Length in “meter” Length in “feet” Length in “meter” Length in “feet”	max. ambient temperature 70°C (158°F); with /FFx or /FS1: 50°C (122°F) max. ambient temperature 70°C (158°F); with /FFx or /FS1: 50°C (122°F) max. ambient temperature 105°C (221°F); with /FFx or /FS1: 85°C (185°F) max. ambient temperature 105°C (221°F); with /FFx or /FS1: 85°C (185°F)
Cable ends	-0 -1		No termination, with one termination kit Terminated	
Cable length	L□□□		Enter the length	max. 300m / 999ft the following lengths can be ordered (e.g. 3m = L003): RCCY031-0: 3m, 5m, 10m, 15m, 30m, 50m, 100m, 150m, 200m, 250m, 300m RCCY031-1: 3m, 5m, 10m, 15m, 30m, 50m RCCY032-0: 10ft, 15ft, 30ft, 50ft, 100ft, 150ft, 300ft, 500ft, 1000ft RCCY032-1: 10ft, 15ft, 30ft, 50ft, 100ft, 150ft RCCY033-0: 3m, 5m, 10m, 15m, 30m, 50m, 100m, 150m, 300m RCCY033-1: 3m, 5m, 10m, 15m, 30m, 50m RCCY034-0: 10ft, 15ft, 30ft, 50ft, 100ft, 150ft, 300ft, 500ft, 1000ft RCCY034-1: 10ft, 15ft, 30ft, 50ft, 100ft, 150ft
Options: Hazardous area installation Termination kits Quick delivery		 /KS1 /NS1 /TK□□ /QD	 Blue cable for Ex-i indication Blue cable for Ex-i indication (China) Quantity of additional termination kits Delivery within 24 hours from factory	 □□ = 01 to 99 only L003, L005, L010

Advanced Concentration Measurement Options (others on request), recommended with Option /K6:

Option	Display	Components	Concentration range	Temp. range	Source of concentration- / density table
/C00	---	---	---	---	Advanced concentration measurement function. There are no pre-defined concentration setups (coefficients are set to zero). The concentration coefficients will be set by customer making use of either FieldMate or the stand- alone concentration tool and manual entry by HHT. For more information, please contact your regional Yokogawa office.
/C01	°Brix	Sugar / Water	0 - 85 °Brix	0 - 80°C (32 - 176°F)	PTB- Messages 100 5/90: „The density of watery Saccarose solutions after the introduction of the international temperature scale of 1990 (ITS1990)“ Table 5
/C02	WT%	NaOH / Water	2 - 50 WT%	0 - 100°C (32 - 212°F)	D´Ans-Lax, Handbook for chemists and physicists Vol.1, 3rd edition, 1967
/C03	WT%	KOH / Water	0 - 60 WT%	54 - 100°C (129 - 212°F)	D´Ans-Lax, Handbook for chemists and physicists Vol.1, 3rd edition, 1967
/C04	WT%	NH_4NO_3 / Water	1 - 50 WT%	0 - 80°C (32 - 176°F)	Data table on request
/C05	WT%	NH_4NO_3 / Water	20 - 70 WT%	20 - 100°C (68 - 212°F)	Data table on request
/C06 [1)]	WT%	HCl / Water	22 - 34 WT%	20 - 40°C (68 - 104°F)	D´Ans-Lax, Handbook for chemists and physicists Vol.1, 3rd edition, 1967
/C07	WT%	HNO_3 / Water	50 - 67 WT%	10 - 60°C (50 - 140°F)	Data table on request
/C09	WT%	H_2O_2 / Water	30 - 75 WT%	4 - 44°C (39.2 - 111.2°F)	Data table on request
/C10	WT%	Ethylene Glycol / Water	10 - 50 WT%	-20 - 40°C (-4 - 104°F)	Data table on request
/C11	WT%	Amylum = starch / Water	33 - 43 WT%	35 - 45°C (95 - 113°F)	Data table on request
/C12	WT%	Methanol / Water	35 - 60 WT%	0 - 40°C (32 - 104°F)	Data table on request
/C20	VOL%	Alcohol / Water	55 - 100 VOL%	10 - 40°C (50 - 104°F)	Data table on request
/C21	°Brix	Sugar / Water	40 - 80 °Brix	75 - 100°C (167 - 212°F)	Data table on request
/C30	WT%	Alcohol / Water	66 - 100 WT%	15 - 40°C (59 - 104°F)	Standard Copersucar 1967
/C37	WT%	Alcohol / Water	66 - 100 WT%	10 - 40°C (50 - 104°F)	Brazilian Standard ABNT
/C38	VOL%	Alcohol / Water	73 - 100 VOL%	10 - 40°C (50 - 104°F)	Brazilian Standard ABNT

[1)] only with material HC

RELATED INSTRUMENTS

The customer should prepare instrument maintenance tool, terminator, fieldbus power supply etc.

Safety barrier for version with intrinsic safe FF-output (option /KF4, /EF4, /NF4, /GF4)
See web page www.yokogawa.com/fbs/Interoperability/fbs-accessories-en.htm

Table 11 : Selection Table Process Connection and Materials, Installation Length in mm

			RCCS 30LR	RCCS 30-33	RCCS34 RCCT34		RCCS36 RCCT36		RCCS38 RCCT38		RCCS39 RCCT39		RCCS39/IR RCCT39/IR		RCCS39/XR RCCT39/XR	
			SH	SH	SL	HC	SL	HC	SL	HC	SL	HC	SL	HC	SL	HC
Flanges according to ASME B16.5	01A1	½“-150	240	240	370	----	----	----	----	----	----	----	----	----	----	----
	01A2	½“-300	240	240	370	----	----	----	----	----	----	----	----	----	----	----
	01A3	½“-600	250	250	380	----	----	----	----	----	----	----	----	----	----	----
	01A5	½“-900/1500	270	270	400	----	----	----	----	----	----	----	----	----	----	----
	02A1	1“-150	----	240	370	390	500	----	----	----	----	----	----	----	----	----
	02A2	1“-300	----	240	370	390	500	----	----	----	----	----	----	----	----	----
	02A3	1“-600	----	260	390	390	520	----	----	----	----	----	----	----	----	----
	02A5	1“-900/1500	----	320	450	400	540	----	----	----	----	----	----	----	----	----
	04A1	1½“-150	----	250	380	390	500	520	600	----	----	----	----	----	----	----
	04A2	1½“-300	----	250	380	390	510	520	600	----	----	----	----	----	----	----
	04A3	1½“-600	----	270	400	400	530	530	620	----	----	----	----	----	----	----
	04A4	1½“-900	----	----	----	----	----	----	640	----	----	----	----	----	----	----
	04A5	1½“-900/1500	----	340	470	----	600	----	----	----	----	----	----	----	----	----
	05A1	2“-150	----	----	----	390	510	520	600	620	----	----	----	----	----	----
	05A2	2“-300	----	----	----	390	510	520	600	620	----	----	----	----	----	----
	05A3	2“-600	----	----	----	400	540	540	630	630	----	----	----	----	----	----
	05A4	2“-900	----	----	----	----	----	----	720	----	----	----	----	----	----	----
	05A5	2“-900/1500	----	----	----	----	660	----	----	----	----	----	----	----	----	----
	06A1	2½“-150	----	----	----	----	----	----	610	620	----	----	----	----	----	----
	06A2	2½“-300	----	----	----	----	----	----	610	620	----	----	----	----	----	----
	06A3	2½“-600	----	----	----	----	----	----	640	640	----	----	----	----	----	----
	06A4	2½“-900	----	----	----	----	----	----	760	----	----	----	----	----	----	----
	08A1	3“-150	----	----	----	----	----	----	610	620	1000	1020	----	----	----	----
	08A2	3“-300	----	----	----	----	----	----	620	620	1000	1020	----	----	----	----
	08A3	3“-600	----	----	----	----	----	----	640	640	1000	1025	----	----	----	----
	08A4	3“-900	----	----	----	----	----	----	760	----	----	----	----	----	----	----
	10A1	4“-150	----	----	----	----	----	----	----	----	1000	1020	1100	----	----	----
	10A2	4“-300	----	----	----	----	----	----	----	----	1000	1020	1100	----	----	----
	10A3	4“-600	----	----	----	----	----	----	----	----	1030	1030	1100	----	----	----
	12A1	5“-150	----	----	----	----	----	----	----	----	1000	1020	1100	1100	----	----
	12A2	5“-300	----	----	----	----	----	----	----	----	1000	1020	1100	1100	----	----
	12A3	5“-600	----	----	----	----	----	----	----	----	1040	1040	1160	1110	----	----
	15A1	6“-150	----	----	----	----	----	----	----	----	----	----	1100	1100	1350	----
	15A2	6“-300	----	----	----	----	----	----	----	----	----	----	1100	1100	1350	----
	15A3	6“-600	----	----	----	----	----	----	----	----	----	----	1200	1120	1390	----
	20A1	8“-150	----	----	----	----	----	----	----	----	----	----	1140	1100	1350	----
	20A2	8“-300	----	----	----	----	----	----	----	----	----	----	1140	1100	1350	----
	20A3	8“-600	----	----	----	----	----	----	----	----	----	----	----	----	1440	----
Flanges according to EN 1092-1	01D4	DN 15 PN 40	240	240	370	----	----	----	----	----	----	----	----	----	----	----
	01D6	DN 15 PN 100	250	250	380	----	----	----	----	----	----	----	----	----	----	----
	02D4	DN 25 PN 40	----	240	370	390	500	520	----	----	----	----	----	----	----	----
	02D6	DN 25 PN 100	----	260	390	----	520	----	----	----	----	----	----	----	----	----
	04D4	DN 40 PN 40	----	240	370	390	500	520	600	----	----	----	----	----	----	----
	04D6	DN 40 PN 100	----	320	450	----	560	----	620	----	----	----	----	----	----	----
	05D4	DN 50 PN 40	----	----	----	----	500	520	600	620	----	----	----	----	----	----
	05D5	DN 50 PN 63	----	----	----	----	520	----	620	----	----	----	----	----	----	----
	05D6	DN 50 PN 100	----	----	----	----	590	----	660	----	----	----	----	----	----	----
	05D7	DN 50 PN 160	----	----	----	----	590	----	660	----	----	----	----	----	----	----
	08D4	DN 80 PN 40	----	----	----	----	----	----	610	620	1000	1020	----	----	----	----
	08D5	DN 80 PN 63	----	----	----	----	----	----	620	----	1000	----	----	----	----	----
	08D6	DN 80 PN 100	----	----	----	----	----	----	730	----	1000	----	----	----	----	----
	10D2	DN 100 PN 16	----	----	----	----	----	----	----	----	1000	----	1100	----	----	----
	10D4	DN 100 PN 40	----	----	----	----	----	----	----	----	1000	1020	1100	----	----	----
	10D5	DN 100 PN 63	----	----	----	----	----	----	----	----	1000	----	1100	----	----	----
	10D6	DN 100 PN 100	----	----	----	----	----	----	----	----	1050	----	1100	----	----	----
	12D2	DN 125 PN 16	----	----	----	----	----	----	----	----	1000	1020	1100	1100	----	----
	12D4	DN 125 PN 40	----	----	----	----	----	----	----	----	1000	1020	1100	1100	----	----
	12D5	DN 125 PN 63	----	----	----	----	----	----	----	----	1000	----	1100	1100	----	----
	12D6	DN 125 PN 100	----	----	----	----	----	----	----	----	1100	----	1140	1100	----	----
	12D7	DN 125 PN 160	----	----	----	----	----	----	----	----	----	----	----	1100	----	----
	15D2	DN 150 PN 16	----	----	----	----	----	----	----	----	----	----	1100	1100	1350	----
	15D4	DN 150 PN 40	----	----	----	----	----	----	----	----	----	----	1100	1100	1350	----
	15D5	DN 150 PN 63	----	----	----	----	----	----	----	----	----	----	1140	----	1350	----
	15D6	DN 150 PN 100	----	----	----	----	----	----	----	----	----	----	1180	----	----	----
	20D2	DN 200 PN 16	----	----	----	----	----	----	----	----	----	----	----	----	1350	----
	20D4	DN 200 PN 40	----	----	----	----	----	----	----	----	----	----	----	----	1350	----
	20D5	DN 200 PN 63	----	----	----	----	----	----	----	----	----	----	----	----	1350	----

Table 11 : Selection Table Process Connection and Materials, Installation Length in mm (continued)

				RCCS 30-33	RCCS34 RCCT34		RCCS36 RCCT36		RCCS38 RCCT38		RCCS39 RCCT39		RCCS39/IR RCCT39/IR		RCCS39/XR RCCT39/XR	
				SH	SL	HC	SL	HC	SL	HC	SL	HC	SL	HC	SL	HC
Flanges according to JIS B 2220	01J1	DN 15 10K	----	240	370	----	----	----	----	----	----	----	----	----	----	----
	01J2	DN 15 20K	----	240	370	----	----	----	----	----	----	----	----	----	----	----
	02J1	DN 25 10K	----	240	370	390	500	----	----	----	----	----	----	----	----	----
	02J2	DN 25 20K	----	240	370	390	500	----	----	----	----	----	----	----	----	----
	04J1	DN 40 10K	----	240	370	390	500	520	600	----	----	----	----	----	----	----
	04J2	DN 40 20K	----	240	370	390	500	520	600	----	----	----	----	----	----	----
	05J1	DN 50 10K	----	----	----	----	500	520	600	620	----	----	----	----	----	----
	05J2	DN 50 20K	----	----	----	----	500	520	600	620	----	----	----	----	----	----
	08J1	DN 80 10K	----	----	----	----	----	----	600	620	1000	1020	----	----	----	----
	08J2	DN 80 20K	----	----	----	----	----	----	610	620	1000	1020	----	----	----	----
	10J1	DN 100 10K	----	----	----	----	----	----	----	----	1000	1020	1100	----	----	----
	10J2	DN 100 20K	----	----	----	----	----	----	----	----	1000	1020	1100	----	----	----
	12J1	DN 125 10K	----	----	----	----	----	----	----	----	1000	1020	1100	1100	----	----
	12J2	DN 125 20K	----	----	----	----	----	----	----	----	1000	1020	1100	1100	----	----
	15J1	DN 150 10K	----	----	----	----	----	----	----	----	----	----	1100	1100	----	----
	15J2	DN 150 20K	----	----	----	----	----	----	----	----	----	----	1100	1100	----	----
Clamp DIN	01S4	DN 15	----	240	----	----	----	----	----	----	----	----	----	----	----	----
	02S4	DN 25	----	240	370	----	----	----	----	----	----	----	----	----	----	----
	04S4	DN 40	----	240	370	----	500	----	----	----	----	----	----	----	----	----
	05S4	DN 50	----	----	----	----	500	----	600	----	----	----	----	----	----	----
	06S4	DN 65	----	----	----	----	----	----	600	----	----	----	----	----	----	----
	10S4	DN 100	----	----	----	----	----	----	----	----	1000	----	----	----	----	----
Tri-Clamp	01S8	½“	----	240	----	----	----	----	----	----	----	----	----	----	----	----
	02S8	1“	----	240	370	----	----	----	----	----	----	----	----	----	----	----
	04S8	1½“	----	240	370	----	500	----	----	----	----	----	----	----	----	----
	05S8	2“	----	----	----	----	500	----	600	----	----	----	----	----	----	----
	08S8	3“	----	----	----	----	----	----	600	----	----	----	----	----	----	----
	10S8	4“	----	----	----	----	----	----	----	----	1000	----	----	----	----	----
DIN11851	02S2	DN 25	----	240	370	----	----	----	----	----	----	----	----	----	----	----
	04S2	DN 40	----	----	----	----	500	----	----	----	----	----	----	----	----	----
	05S2	DN 50	----	----	----	----	----	----	600	----	----	----	----	----	----	----
	10S2	DN 100	----	----	----	----	----	----	----	----	1000	----	----	----	----	----
Thread	41G9	G¼“ female	----	260	----	----	----	----	----	----	----	----	----	----	----	----
	01G9	G½“ female	----	260	390	----	----	----	----	----	----	----	----	----	----	----
	23G9	G¾“ female	----	260	390	----	----	----	----	----	----	----	----	----	----	----
	41T9	NPT¼“ female	----	260	----	----	----	----	----	----	----	----	----	----	----	----
	01T9	NPT½“ female	----	260	390	----	----	----	----	----	----	----	----	----	----	----
	23T9	NPT¾“ female	----	260	390	----	----	----	----	----	----	----	----	----	----	----

Table 11 : Selection Table Process Connection and Materials, Installation Length in inch

			RCCS 30LR	RCCS 30-33	RCCS34 RCCT34		RCCS36 RCCT36		RCCS38 RCCT38		RCCS39 RCCT39		RCCS39/IR RCCT39/IR		RCCS39/XR RCCT39/XR	
			SH	SH	SL	HC	SL	HC	SL	HC	SL	HC	SL	HC	SL	HC
Flanges according to ASME B16.5	01A1	½"-150	9.45	9.45	14.57	----	----	----	----	----	----	----	----	----	----	----
	01A2	½"-300	9.45	9.45	14.57	----	----	----	----	----	----	----	----	----	----	----
	01A3	½"-600	9.84	9.84	14.96	----	----	----	----	----	----	----	----	----	----	----
	01A5	½"-900/1500	10.63	10.63	15.75	----	----	----	----	----	----	----	----	----	----	----
	02A1	1"-150	----	9.45	14.57	15.35	19.69	----	----	----	----	----	----	----	----	----
	02A2	1"-300	----	9.45	14.57	15.35	19.69	----	----	----	----	----	----	----	----	----
	02A3	1"-600	----	10.24	15.35	15.35	20.47	----	----	----	----	----	----	----	----	----
	02A5	1"-900/1500	----	12.6	17.72	15.75	21.26	----	----	----	----	----	----	----	----	----
	04A1	1½"-150	----	9.84	14.96	15.35	19.69	20.47	23.62	----	----	----	----	----	----	----
	04A2	1½"-300	----	9.84	14.96	15.35	20.08	20.47	23.62	----	----	----	----	----	----	----
	04A3	1½"-600	----	10.63	15.75	15.75	20.87	20.87	24.21	----	----	----	----	----	----	----
	04A4	1½"-900	----	----	----	----	----	----	25.2	----	----	----	----	----	----	----
	04A5	1½"-900/1500	----	13.39	18.5	----	23.62	----	----	----	----	----	----	----	----	----
	05A1	2"-150	----	----	----	15.35	20.08	20.47	23.62	24.21	----	----	----	----	----	----
	05A2	2"-300	----	----	----	15.35	20.08	20.47	23.62	24.21	----	----	----	----	----	----
	05A3	2"-600	----	----	----	15.75	21.26	21.26	24.8	24.8	----	----	----	----	----	----
	05A4	2"-900	----	----	----	----	----	----	28.35	----	----	----	----	----	----	----
	05A5	2"-900/1500	----	----	----	----	25.98	----	----	----	----	----	----	----	----	----
	06A1	2½"-150	----	----	----	----	----	----	24.02	24.21	----	----	----	----	----	----
	06A2	2½"-300	----	----	----	----	----	----	24.02	24.21	----	----	----	----	----	----
	06A3	2½"-600	----	----	----	----	----	----	25.2	25.2	----	----	----	----	----	----
	06A4	2½"-900	----	----	----	----	----	----	29.92	----	----	----	----	----	----	----
	08A1	3"-150	----	----	----	----	----	----	24.02	24.21	39.37	40.16	----	----	----	----
	08A2	3"-300	----	----	----	----	----	----	24.21	24.21	39.37	40.16	----	----	----	----
	08A3	3"-600	----	----	----	----	----	----	25.2	25.2	39.37	40.35	----	----	----	----
	08A4	3"-900	----	----	----	----	----	----	29.92	----	----	----	----	----	----	----
	10A1	4"-150	----	----	----	----	----	----	----	----	39.37	40.16	43.31	----	----	----
	10A2	4"-300	----	----	----	----	----	----	----	----	39.37	40.16	43.31	----	----	----
	10A3	4"-600	----	----	----	----	----	----	----	----	40.55	40.55	43.31	----	----	----
	12A1	5"-150	----	----	----	----	----	----	----	----	39.37	40.16	43.31	43.31	----	----
	12A2	5"-300	----	----	----	----	----	----	----	----	39.37	40.16	43.31	43.31	----	----
	12A3	5"-600	----	----	----	----	----	----	----	----	40.94	40.94	45.67	43.31	----	----
	15A1	6"-150	----	----	----	----	----	----	----	----	----	----	43.31	43.31	53.15	----
	15A2	6"-300	----	----	----	----	----	----	----	----	----	----	43.31	43.31	53.15	----
	15A3	6"-600	----	----	----	----	----	----	----	----	----	----	47.2	43.31	54.72	----
	20A1	8"-150	----	----	----	----	----	----	----	----	----	----	44.9	43.31	53.15	----
	20A2	8"-300	----	----	----	----	----	----	----	----	----	----	44.9	43.31	53.15	----
	20A3	8"-600	----	----	----	----	----	----	----	----	----	----	----	----	56.69	----
Flanges according to EN 1092-1	01D4	DN 15 PN 40	9.45	9.45	14.57	----	----	----	----	----	----	----	----	----	----	----
	01D6	DN 15 PN 100	9.84	9.84	14.96	----	----	----	----	----	----	----	----	----	----	----
	02D4	DN 25 PN 40	----	9.45	14.57	15.35	19.69	20.47	----	----	----	----	----	----	----	----
	02D6	DN 25 PN 100	----	10.24	15.35	----	20.47	----	----	----	----	----	----	----	----	----
	04D4	DN 40 PN 40	----	9.45	14.57	15.35	19.69	20.47	23.62	----	----	----	----	----	----	----
	04D6	DN 40 PN 100	----	12.6	17.72	----	22.05	----	24.41	----	----	----	----	----	----	----
	05D4	DN 50 PN 40	----	----	----	----	19.69	20.47	23.62	24.41	----	----	----	----	----	----
	05D5	DN 50 PN 63	----	----	----	----	20.47	----	24.41	----	----	----	----	----	----	----
	05D6	DN 50 PN 100	----	----	----	----	23.23	----	25.98	----	----	----	----	----	----	----
	05D7	DN 50 PN 160	----	----	----	----	23.23	----	25.98	----	----	----	----	----	----	----
	08D4	DN 80 PN 40	----	----	----	----	----	----	24.02	24.41	39.37	40.16	----	----	----	----
	08D5	DN 80 PN 63	----	----	----	----	----	----	24.41	----	39.37	----	----	----	----	----
	08D6	DN 80 PN 100	----	----	----	----	----	----	28.74	----	39.37	----	----	----	----	----
	10D2	DN 100 PN 16	----	----	----	----	----	----	----	----	39.37	----	43.31	----	----	----
	10D4	DN 100 PN 40	----	----	----	----	----	----	----	----	39.37	40.16	43.31	----	----	----
	10D5	DN 100 PN 63	----	----	----	----	----	----	----	----	39.37	----	43.31	----	----	----
	10D6	DN 100 PN 100	----	----	----	----	----	----	----	----	41.34	----	43.31	----	----	----
	12D2	DN 125 PN 16	----	----	----	----	----	----	----	----	39.37	40.16	43.31	43.31	----	----
	12D4	DN 125 PN 40	----	----	----	----	----	----	----	----	39.37	40.16	43.31	43.31	----	----
	12D5	DN 125 PN 63	----	----	----	----	----	----	----	----	39.37	----	43.31	43.31	----	----
	12D6	DN 125 PN 100	----	----	----	----	----	----	----	----	43.31	----	44.88	43.31	----	----
	12D7	DN 125 PN 160	----	----	----	----	----	----	----	----	----	----	----	43.31	----	----
	15D2	DN 150 PN 16	----	----	----	----	----	----	----	----	----	----	43.31	43.31	53.15	----
	15D4	DN 150 PN 40	----	----	----	----	----	----	----	----	----	----	43.31	43.31	53.15	----
	15D5	DN 150 PN 63	----	----	----	----	----	----	----	----	----	----	44.88	----	53.15	----
	15D6	DN 150 PN 100	----	----	----	----	----	----	----	----	----	----	46.46	----	----	----
	20D2	DN 200 PN 16	----	----	----	----	----	----	----	----	----	----	----	----	53.15	----
	20D4	DN 200 PN 40	----	----	----	----	----	----	----	----	----	----	----	----	53.15	----
	20D5	DN 200 PN 63	----	----	----	----	----	----	----	----	----	----	----	----	53.15	----

Table 11 : Selection Table Process Connection and Materials, Installation Length in inch (continued)

				RCCS 30-33	RCCS34 RCCT34		RCCS36 RCCT36		RCCS38 RCCT38		RCCS39 RCCT39		RCCS39 RCCT39/IR		RCCS39 RCCT39/XR	
				SH	SL	HC	SL	HC	SL	HC	SL	HC	SL	HC	SL	HC
Flanges according to JIS B 2220	01J1	DN 15 10K	----	9.45	14.57	----	----	----	----	----	----	----	----	----	----	----
	01J2	DN 15 20K	----	9.45	14.57	----	----	----	----	----	----	----	----	----	----	----
	02J1	DN 25 10K	----	9.45	14.57	15.35	19.69	----	----	----	----	----	----	----	----	----
	02J2	DN 25 20K	----	9.45	14.57	15.35	19.69	----	----	----	----	----	----	----	----	----
	04J1	DN 40 10K	----	9.45	14.57	15.35	19.69	20.47	23.62	----	----	----	----	----	----	----
	04J2	DN 40 20K	----	9.45	14.57	15.35	19.69	20.47	23.62	----	----	----	----	----	----	----
	05J1	DN 50 10K	----	----	----	----	19.69	20.47	23.62	24.41	----	----	----	----	----	----
	05J2	DN 50 20K	----	----	----	----	19.69	20.47	23.62	24.41	----	----	----	----	----	----
	08J1	DN 80 10K	----	----	----	----	----	----	23.62	24.41	39.37	40.16	----	----	----	----
	08J2	DN 80 20K	----	----	----	----	----	----	24.02	24.41	39.37	40.16	----	----	----	----
	10J1	DN 100 10K	----	----	----	----	----	----	----	----	39.37	40.16	43.31	----	----	----
	10J2	DN 100 20K	----	----	----	----	----	----	----	----	39.37	40.16	43.31	----	----	----
	12J1	DN 125 10K	----	----	----	----	----	----	----	----	39.37	40.16	43.31	43.31	----	----
	12J2	DN 125 20K	----	----	----	----	----	----	----	----	39.37	40.16	43.31	43.31	----	----
	15J1	DN 150 10K	----	----	----	----	----	----	----	----	----	----	43.31	43.31	----	----
	15J2	DN 150 20K	----	----	----	----	----	----	----	----	----	----	43.31	43.31	----	----
Clamp DIN	01S4	DN 15	----	9.45	----	----	----	----	----	----	----	----	----	----	----	----
	02S4	DN 25	----	9.45	14.57	----	----	----	----	----	----	----	----	----	----	----
	04S4	DN 40	----	9.45	14.57	----	19.69	----	----	----	----	----	----	----	----	----
	05S4	DN 50	----	----	----	----	19.69	----	23.62	----	----	----	----	----	----	----
	06S4	DN 65	----	----	----	----	----	----	23.62	----	----	----	----	----	----	----
	10S4	DN 100	----	----	----	----	----	----	----	----	39.37	----	----	----	----	----
Tri-Clamp	01S8	½“	----	9.45	----	----	----	----	----	----	----	----	----	----	----	----
	02S8	1“	----	9.45	14.57	----	----	----	----	----	----	----	----	----	----	----
	04S8	1½“	----	9.45	14.57	----	19.69	----	----	----	----	----	----	----	----	----
	05S8	2“	----	----	----	----	19.69	----	23.62	----	----	----	----	----	----	----
	08S8	3“	----	----	----	----	----	----	23.62	----	----	----	----	----	----	----
	10S8	4“	----	----	----	----	----	----	----	----	39.37	----	----	----	----	----
DIN11851	02S2	DN 25	----	9.45	14.57	----	----	----	----	----	----	----	----	----	----	----
	04S2	DN 40	----	----	----	----	19.69	----	----	----	----	----	----	----	----	----
	05S2	DN 50	----	----	----	----	----	----	23.62	----	----	----	----	----	----	----
	10S2	DN 100	----	----	----	----	----	----	----	----	39.37	----	----	----	----	----
Thread	41G9	G¼“ female	----	10.24	----	----	----	----	----	----	----	----	----	----	----	----
	01G9	G½“ female	----	10.24	15.35	----	----	----	----	----	----	----	----	----	----	----
	23G9	G¾“ female	----	10.24	15.35	----	----	----	----	----	----	----	----	----	----	----
	41T9	NPT¼“ female	----	10.24	----	----	----	----	----	----	----	----	----	----	----	----
	01T9	NPT½“ female	----	10.24	15.35	----	----	----	----	----	----	----	----	----	----	----
	23T9	NPT¾“ female	----	10.24	15.35	----	----	----	----	----	----	----	----	----	----	----

Table 12 : CRN approved process connections

			RCCS34 RCCT34		RCCS36 RCCT36		RCCS38 RCCT38		RCCS39 RCCT39		RCCS39/IR RCCT39/IR
			SL	HC	SL	HC	SL	HC	SL	HC	SL
Flanges according to ASME B16.5	01A1	½“-150	X	----	----	----	----	----	----	----	----
	01A2	½“-300	X	----	----	----	----	----	----	----	----
	01A3	½“-600	X	----	----	----	----	----	----	----	----
	01A5	½“-900/1500	X	----	----	----	----	----	----	----	----
	02A1	1“-150	X	X	X	----	----	----	----	----	----
	02A2	1“-300	X	X	X	----	----	----	----	----	----
	02A3	1“-600	X	----	X	----	----	----	----	----	----
	02A5	1“-900/1500	X	----	X	----	----	----	----	----	----
	04A1	1½“-150	X	X	X	X	X	----	----	----	----
	04A2	1½“-300	X	X	X	X	X	----	----	----	----
	04A3	1½“-600	X	----	X	----	X	----	----	----	----
	04A4	1½“-900	----	----	X	----	X	----	----	----	----
	04A5	1½“-900/1500	X	----	X	----	----	----	----	----	----
	05A1	2“-150	----	----	X	X	X	X	----	----	----
	05A2	2“-300	----	----	X	X	X	X	----	----	----
	05A3	2“-600	----	----	X	----	X	----	----	----	----
	05A4	2“-900	----	----	----	----	X	----	----	----	----
	05A5	2“-900/1500	----	----	X	----	----	----	----	----	----
	06A1	2½“-150	----	----	----	----	X	X	----	----	----
	06A2	2½“-300	----	----	----	----	X	X	----	----	----
	06A3	2½“-600	----	----	----	----	X	----	----	----	----
	06A4	2½“-900	----	----	----	----	X	----	----	----	----
	08A1	3“-150	----	----	----	----	X	X	X	X	----
	08A2	3“-300	----	----	----	----	X	X	X	X	----
	08A3	3“-600	----	----	----	----	X	----	----	----	----
	08A4	3“-900	----	----	----	----	X	----	----	----	----
	10A1	4“-150	----	----	----	----	----	----	X	X	X
	10A2	4“-300	----	----	----	----	----	----	X	X	X
	10A3	4“-600	----	----	----	----	----	----	----	----	----
	12A1	5“-150	----	----	----	----	----	----	X	X	X
	12A2	5“-300	----	----	----	----	----	----	X	X	X
	12A3	5“-600	----	----	----	----	----	----	----	----	----
	15A1	6“-150	----	----	----	----	----	----	----	----	X
	15A2	6“-300	----	----	----	----	----	----	----	----	X

9. EXPLOSION PROTECTED TYPE INSTRUMENTS

9.1 ATEX

In this section, further requirements and differences for explosion proof type instrument are described. For explosion proof type instrument, the description in this chapter is prior to other description in this Instruction Manual.

WARNING

- Only trained persons may use the instrument in industrial location.
- The instrument modification or parts replacement by other than an authorized Representative of Yokogawa is prohibited and will void the certification.
- Electrostatic charge may cause an exlosion hazard. Avoid any actions that cause the gerenation of eletrostatic charge, such as rubbing with a dry cloth on coating face of the converter.
- If it is mounted in an area where the use of category 2D apparatus is required, it shall be installed in such a way that the risk from electrostatic discharges and propagating brush discharges caused by rapid flow of dust is avoided.

ROTAMASS is produced by
Rota Yokogawa
Rheinstr. 8
D-79664 Wehr
Germany

9.1.1 Technical Data

Applicable standards:
RCCS3:
EN 60079-0: 2012; EN 60079-11: 2012;
EN 60079-31: 2009
RCCT3/RCCF31:
EN 60079-0: 2012; EN 60079-1: 2007;
EN 60079-7: 2007; EN 60079-11: 2012;
EN 60079-31: 2009

Remote detector RCCS30LR ... 33 (option /KS1):
- KEMA 01ATEX 1075 X
- Intrinsically safe
- II 2G Ex ib IIB/IIC T6 ... T1 Gb
- II 2D Ex ib IIIC T□□□ Db
  (□□□ = max. surface temperature see below)
- Max. surface temperature :
  Standard : 150°C
  /MT : 260°C
  /MT, not /T□ : 320°C
- Degree of protection: IP66/67
- Ambient humidity : 0 to 95% RH
- Ambient temperature range:
  -50°C to +80°C
- Process temperature limits :
  Standard : -50°C to 150°C
  /MT : -50°C to 260°C
  /MT, not /T□ : -50°C to 260°C
- Heat carrier fluid temperature limits :
  Standard : 0°C to 150°C
  Option /MT : 0°C to 260°C

Remote detector RCCS34 ... 39/XR (option /KS1):
- KEMA 01ATEX 1075 X
- Intrinsically safe
- II 2G Ex ib IIB/IIC T6 ... T1 Gb
- II 2D Ex ib IIIC T□□□ Db
  (□□□ = max. surface temperature see below)
-Max. surface temperature :
  Standard + /LT : 150°C
  /MT : 220°C
  /HT : 350°C
- Degree of protection: IP66/67
- Ambient humidity : 0 to 95% RH
- Ambient temperature range:
  -50°C to +80°C
  Option /HT (process temperature < 280°C):
  -50°C to +65°C
  Option /HT (process temperature < 350°C):
  -50°C to +55°C
- Process temperature limits :
  Standard : -50°C to 150°C
  Option /MT: : -50°C to 220°C
  Option /HT : 0°C to 350°C
  Option /LT : -200°C to 150°C
- Heat carrier fluid temperature limits :
  Standard : 0°C to 150°C
  Option /MT : 0°C to 220°C
  Option /HT : 0°C to 350°C

Remote converter RCCF31 (option /KF3):
- KEMA 02ATEX 2183 X
- Flame proof with intrinsic safe connection to detector (ib)
- II 2G Ex d [ib] IIC T6 Gb or Ex d e [ib] IIC T6 Gb
- II 2G Ex d [ib] IIB T6 Gb or Ex d e [ib] IIB T6 Gb with option /HP
- II 2D Ex tb [ib] IIIC T75°C Db
- Max. surface temperature: 75°C
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz
  20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range: -40°C to +55°C

Remote converter RCCF31 (option /KF4):
- KEMA 02ATEX 2183 X
- Flame proof with intrinsic safe connection to detector (ib)
- Additional intrinsic safe FF-output (ia).
  Ex d e [ia Ga] [ib] IIC T6 Gb
- II 2 (1) G Ex d [ia IIC Ga] [ib] IIB T6 Gb or Ex d e [ia IIC Ga] [ib] IIB T6 Gb with option /HP
- II 2 (1) D Ex tb [ia Da] [ib] IIIC T75°C Db
- Max. surface temperature: 75°C
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz
  20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range : -40°C to +55°C

Integral type RCCT34 ... 39/XR (option /KF3):
- KEMA 02ATEX 2183 X
- Flame proof with intrinsic safe connection to detector (ib)
- II 2G Ex d ib IIC T6...T3 Gb or Ex d e ib IIC T6...T3 G
- II 2G Ex d ib IIB T6...T3 Gb or Ex d e ib IIB T6...T3 Gb with option /HP
- II 2G Ex d ib op is IIC T6...T3 Gb
- II 2D Ex ib tb IIIC T150°C Db
- Max. surface temperature : 150°C
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz
  20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range : -40°C to +55°C
- Process temperature limits : -50°C to 150°C

Integral type RCCT34 ... 39/XR (option /KF4):
- KEMA 02ATEX 2183 X
- Flame proof with intrinsic safe connection to detector (ib)
- Additional intrinsic safe FF-output (ia).
- II 2 (1) G Ex d ib [ia Ga] IIC T6...T3 Gb or Ex d e ib [ia Ga] IIC T6...T3 Gb
- II 2 (1) G Ex d ib [ia IIC Ga] IIB T6...T3 Gb or Ex d e ib [ia IIC Ga] IIB T6...T3 Gb with option /HP
- II 2 (1) D Ex ib tb [ia Da] IIIC T150°C Db
- Max. surface temperature : 150°C
- Degree of protection : IP66/67
- Power supply: 90 to 250 V AC, 50/60 Hz
  20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range : -40°C to +55°C
- Process temperature limits : -50°C to 150°C

The electronics of RCCT3 and RCCF31 are placed in a pressure tight section of the converter housing Ex d.
The kind of protection of the terminal enclosure is “e”, but can become “d” by using Ex-d certified cable glands.

Electrical data remote detector RCCS30LR ... 33:
- Driving circuit : terminals D+ / D-
  Ex ib IIC : Ui = 16 V; Ii = 53 mA; Pi = 0.212 W
  Li = 4.2 mH; Ci = negl. small
  Ex ib IIB : Ui = 16 V; Ii = 153 mA; Pi = 0.612 W
  Li = 4.2 mH; Ci = negl. small
- Sensor circuits: terminals S1+/ S1- or S2+ / S2-
  Ex ib IIC : Ui = 16 V; Ii = 80 mA; Pi = 0.32 W
  Li = 4.2 mH; Ci = negl. small
- Temp. sensor circuit : terminals TP1, TP2, TP3
  Ex ib IIC : Ui = 16 V; Ii = 50 mA; Pi = 0.2 W
  Li = negligible small
  Ci = negligible small

Electrical data remote detector RCCS34 ... 39/XR :
- Driving circuit : terminals D+ / D
  Ex ib IIC : Ui = 16 V; Ii = 53 mA; Pi = 0.212 W
  Li = 3.2 mH; Ci = negligible small
  Ex ib IIB : Ui = 16 V; Ii = 153 mA; Pi = 0.612 W
  Li = 3.2 mH; Ci = negligible small
- Sensor circuits: terminals S1+/ S1- or S2+ / S2-
  Ex ib IIC : Ui = 16 V; Ii = 80 mA; Pi = 0.32 W
  Li = 2.1 mH; Ci = negligible small
- Temp. sensor circuit : terminals TP1, TP2, TP3
  Ex ib IIC : Ui = 16 V; Ii = 50 mA; Pi = 0.2 W
  Li = negligible small
  Ci = negligible small

Electrical data remote converter RCCF31 and converter of intergral type RCCT3:

- Driving circuit : terminals D+ / D-
  Ex ib IIC : Uo = 14.5 V; Io = 47 mA; Po = 0.171 W
  Lo = 15 mH; Co = 0.65 µF
  Ex ib IIB : Uo = 11.7 V; Io = 124 mA; Po = 0.363 W
  Lo = 8 mH; Co = 10.3 µF
- Sensor circuits: terminals S1+/ S1- or S2+ / S2-
  Ex ib IIC : Uo = 14.5 V; Io = 47 mA; Po = 0.171 W
  Lo = 15 mH; Co = 0.65 µF
- Temperature sensor circuit : terminals TP1,TP2, TP3
  Ex ib IIC : Uo = 13.3 V; Io = 40 mA; Po = 0.133 W
  Lo = 20 mH; Co =0.91 µF
- Fieldbus output (only option /KF4) :
  FISCO model:
  Ex [ia] IIC: Ui = 17.5 V; Ii = 380 mA; Pi = 5.32 W
  Li = 1.6 µH; Ci = 2.7 nF
  Ex [ia] IIB: Ui = 17.5 V; Ii = 460 mA; Pi = 5.32 W
  Li = 1.6 µH; Ci = 2.7 nF
  Entity model:
  Ex [ia] IIC: Ui = 24 V; Ii = 250 mA; Pi = 1.2 W
  Li = 1.6 µH; Ci = 2.7 nF

Coherence between temperature class, ambient- and medium temperature / temperature of heat carrier:

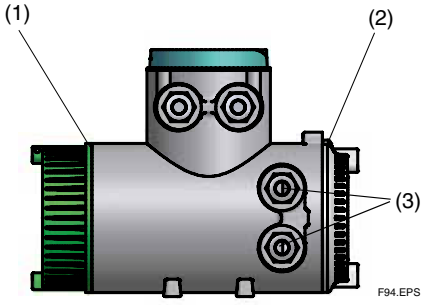
	RCCS30LR to RCCS33 without insulation		RCCS30LR to RCCS33 with factory insulation	
Temp. class	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature
T6	50°C / 122°F	60°C / 140°F	60°C / 140°F	60°C / 140°F
T5	50°C / 122°F	80°C / 176°F	80°C / 176°F	90°C / 194°F
T4	80°C / 176°F 50°C / 122°F	100°C / 212°F 120°C / 248°F	80°C / 176°F	130°C / 266°F
T3	80°C / 176°F	180°C / 356°F	80°C / 176°F	180°C / 356°F
T2	80°C / 176°F	260°C / 500°F	80°C / 176°F	260°C / 500°F
T1	80°C / 176°F	260°C / 608°F	80°C / 176°F	260°C / 500°F

	RCCS34 to RCCS39/XR without insulation		RCCS34 to RCCS39/XR with factory insulation		RCCT34 to RCCT39/XR	
Temp. class	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature
T6	40°C / 104°F	40°C / 104°F	65°C / 149°C	65°C / 149°F	50°C / 122°F	65°C / 149°C
T5	55°C / 131°F	55°C / 131°F	75°C / 167°F	75°C / 167°F	50°C / 122°F	80°C / 176°F
T4	80°C / 176°F 40°C / 104°F	100°C / 212°F 120°C / 248°F	70°C / 158°F	115°C / 239°F	50°C / 122°F	115°C / 239°F
T3	80°C / 176°F 40°C / 104°F	160°C / 320°F 180°C / 356°F	70°C / 158°F	180°C / 356°F	50°C / 122°F	150°C / 302°F
T2	80°C / 176°F	220°C / 428°F	65°C /149°F	275°C / 527°F		
T1			45°C / 113°F	350°C / 662°F		

NOTE

For customer insulation of RCCS30 to 39/XR the following must be regarded :
The table "with factory insulation" is calculated with 80 mm insulation and k-factor = 0.4 W/m²K.
If your insulation data are worse than these use table "without insulation" !

Flame proof (Ex d) relevant threads at converter housing and covers:



No.	Position of thread	Pitch	Thread form + quality of pitch	Threads engaged	Depth of engagement
(1) case	Thread on electronic/display side	2 mm	medium, 6H [1)]	≥ 6	12 mm
(1) cover	Thread on electronic/display side	2 mm	medium, 6g [1)]	≥ 6	12 mm
(2) case	Thread on terminal box side	2 mm	medium, 6H [1)]	≥ 6	12 mm
(2) cover	Thread on terminal box side	2 mm	medium, 6g [1)]	≥ 6	12 mm
(3) M	Thread for cable glands M20 x 1.5	1.5 mm	medium, 6H [1)]	≥ 10	17 mm
(3) A/F	Thread for cable glands 1/2 ´´ NPT	1.814 mm	[2)]	6.5 ± 1	13.605 mm

[1)] acc. ISO 965-1 and ISO 965-3 [2)] acc. ANSI B 1.20.1

If terminal enclosure is used as Ex e, the threads (2) and (3) in above table must be not be regarded.

Marking of Ex d covers

The cover with glass window is marked inside with an "Ex"- label as shown below:

9.1.2 Installation

Installation diagrams for ROTAMASS with/KF3 see in chapter 9.2.2.

Integral type RCCT3

WARNING

1. Ex type of ROTAMASS must be connected to the suitable IS earthing system (see installation diagram). Converter case must have connection to the potential equalisation facility. If the connecting process tubing is part of the potential equalisation, no additional connection is required.
2. Use the certified cable glands, suitable for the conditions of use. The delivered cable glands are only for Ex e use. For Ex d use d-type cable glands.
3. Please confirm that the ground terminal (inside the terminal enclosure) is firmly connected by means of a clip-on eye-let.
4. Ex-e terminals for power supply and I/O-lines are designed for cables with cross section of 0.08 mm² (AWG 28) to 2.5 mm² (AWG12). The strip length must be 5 to 6 mm (0.2 to 0.24 in).

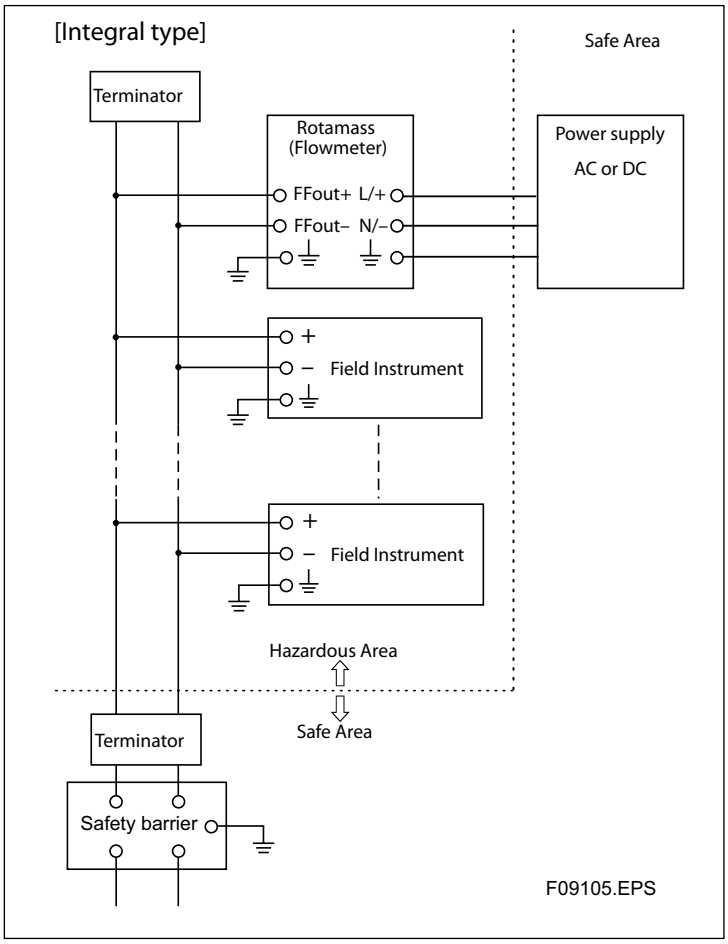
Cable glands for power- and I/O-cables :

RCCT3-□□□M : Ex e types are enclosed. These cable glands can also be used for “dust application” (D). Use ATEX-certified Ex d cable glands for Ex d condition.

RCCT3□-□□□A : No cable glands are enclosed. Use the ATEX-certified cable glands, suitable for the conditions of use (Ex de or Ex d or dust application).

For “dust application” (D) use cable glands with minimum IP67 protection !

Installation diagram /KF4 :



Remote type RCCF31 with RCCS3

WARNING

1. Ex type RCCF31 and RCCS3 must be connected to the suitable IS earthing system (see installation diagram). Converter and detector case must have connection to the potential equalisation facility.
2. Use the certified cable glands, suitable for the conditions of use.
3. Please confirm that the ground terminal (inside the terminal enclosure) is firmly connected by means of a clip-on eye-let.
4. Ex-e terminals for power supply and I/O-lines are designed for cables with cross section of 0.08 mm² (AWG 28) to 2.5 mm² (AWG22). The strip length must be 5 to 6 mm (0.2 to 0.24 in).
5. For EMC technical reasons the case of the detector is connected to the case of the converter via the shielding of the interconnecting cable.

Cable glands for power- and I/O-cables :

RCCF31-□□□M : Ex e types are enclosed. These cable glands can also be used for “dust application” (D). Use ATEX-certified Ex d cable glands for Ex d condition.

RCCF31-□□□A : No cable glands are enclosed. Use the ATEX-certified cable glands, suitable for the conditions of use (Ex de or Ex d or dust application)

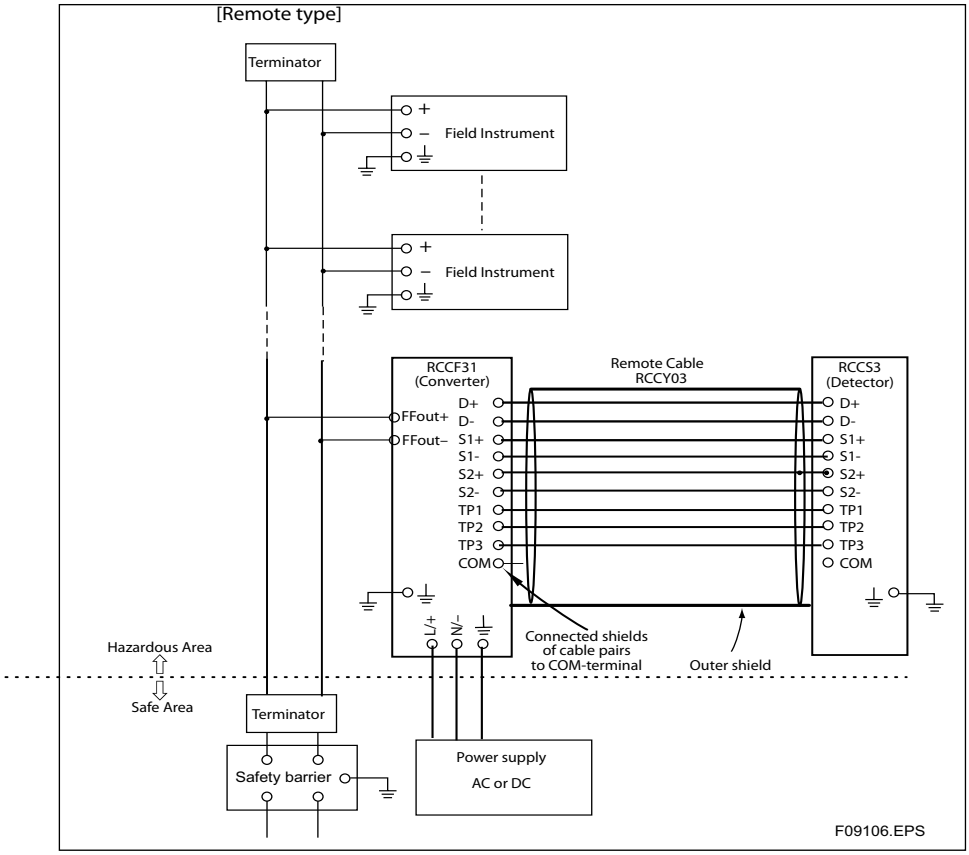
For “dust application” (D) use cable glands with minimum IP67 protection !

Cable glands for detector connection terminal :

RCCF31-□□□M : Cable glands are fitted in the concerning thread. This cable gland can be used for “dust application” (D).

RCCF31-□□□A : Cable glands are enclosed. This cable gland can also be used for “dust application” (D).

Installation diagram /KF4 :



The inner shields (shields of the cable pairs) are connected together to COM –terminal on converter side.
The outer shield of the cable is connected on both sides to the cases by cable gland.

9.1.3 Operation

If the cover of the converter case has to be opened, following instructions must be followed.

WARNING

1. Confirm that the power cables to the instrument are disconnected.
2. Wait 15 minutes after power is turned off before opening the covers.
3. The covers of display side and terminal box are fixed with special screws, please use Hexagonal Wrench to open the covers.
4. Be sure to lock the cover with special screw using the Hexagonal Wrench after tightening the cover.
5. Before starting the operation again, be sure to lock the cover with the locking screws.
6. Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations
7. Prohibition of specification changes and modifications. Users are prohibited from making any modifications of specifications or physical configuration, such as adding or changing the configuration of external wiring ports.

9.1.4 Maintenance and repair

WARNING

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

9.1.5 Ex-relevant marking on name plate

RCCT3 option /KF3:
KEMA 02 ATEX 2183X
II 2 G Ex d ib IIC T6...T3 Gb or
II 2 G Ex d e ib IIC T6...T3 Gb
II 2 D Ex ib tb IIIC T150°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc

TEMP. CLASS	T6	T5	T4	T3
PROCESS TEMP.	65	80	115	150°C

ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING

WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCT3 option /KF4:
KEMA 02 ATEX 2183X
II 2 (1) G Ex d ib [ia Ga] IIC T6...T3 Gb or
II 2 (1) G Ex d e ib [ia Ga] IIC T6...T3 Gb
II 2 (1) D Ex ib tb [ia Da] IIIC T150°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc

TEMP. CLASS	T6	T5	T4	T3
PROCESS TEMP.	65	80	115	150°C

ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING

WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCT3 option /KF3 + /HP:
KEMA 02 ATEX 2183X
II 2 G Ex d ib IIB T6...T3 Gb or
II 2 G Ex d e ib IIB T6...T3 Gb
II 2 D Ex ib tb IIIC T150°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc

TEMP. CLASS	T6	T5	T4	T3
PROCESS TEMP.	65	80	115	150°C

ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING

WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCT3 option /KF4 + /HP:
KEMA 02 ATEX 2183X
II 2 (1) G Ex d ib [ia IIC Ga] IIB T6...T3 Gb or
II 2 (1) G Ex d e ib [ia IIC Ga] IIB T6...T3 Gb
II 2 (1) D Ex ib tb [ia Da] IIIC T150°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc

TEMP. CLASS	T6	T5	T4	T3
PROCESS TEMP.	65	80	115	150°C

ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING

WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCF31 option /KF3:
KEMA 02 ATEX 2183X
II 2 G Ex d [ib] IIC T6 Gb or
II 2 G Ex d e [ib] IIC T6 Gb
II 2 D Ex tb [ib] IIIC T75°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc
ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCF31 option /KF4 with display:
KEMA 02 ATEX 2183X
II 2 (1) G Ex d [ia Ga] [ib] IIC T6 Gb or
II 2 (1) G Ex d e [ia Ga] [ib] IIC T6 Gb
II 2 (1) D Ex tb [ia Da] [ib] IIIC T75°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc
ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCS34 to 39/XR option /KS1:
KEMA 01 ATEX 1075X
II 2 G Ex ib IB/IIC T6...T1 Gb
II 2 D Ex ib IIIC T150°C Db IP66/67
SEE CERTIFICATE FOR DATA

RCCS34 to 39/XR option /KS1 + /MT:
KEMA 01 ATEX 1075X
II 2 G Ex ib IB/IIC T6...T1 Gb
II 2 D Ex ib IIIC T220°C Db IP66/67
SEE CERTIFICATE FOR DATA

RCCS34 to 39/XR option /KS1 + /HT:
KEMA 01 ATEX 1075X
II 2 G Ex ib IB/IIC T6...T1 Gb
II 2 D Ex ib IIIC T350°C Db IP66/67
SEE CERTIFICATE FOR DATA

RCCF31 option /KF3 + /HP:
KEMA 02 ATEX 2183X
II 2 G Ex d [ib] IIB T6 Gb or
II 2 G Ex d e [ib] IIB T6 Gb
II 2 D Ex tb [ib] IIIC T75°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc
ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCF31 option /KF4 + /HP with display:
KEMA 02 ATEX 2183X
II 2 (1) G Ex d [ia IIC Ga] [ib] IIB T6 Gb or
II 2 (1) G Ex d e [ia IIC Ga] [ib] IIB T6 Gb
II 2 (1) D Ex tb [ia Da] [ib] IIIC T75°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc
ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCS30LR to 33 option /KS1:
KEMA 01 ATEX 1075X
II 2 G Ex ib IB/IIC T6...T1 Gb
II 2 D Ex ib IIIC T150°C Db IP66/67
SEE CERTIFICATE FOR DATA

RCCS30LR to 33 option /KS1 + /MT:
KEMA 01 ATEX 1075X
II 2 G Ex ib IB/IIC T6...T1 Gb
II 2 D Ex ib IIIC T260°C Db IP66/67
SEE CERTIFICATE FOR DATA

Supposable Bus Cable

The cable used to interconnect the FF-devices needs to comply with the following parameters:

loop resistance R': 15...150 Ω/km
inductance per unit length Lc: 0.4...1 mH/km
capacitance per unit length Cc: 80...200 nF/km
C' = C' line/line + 0.5 C' line/screen, if both lines are floating
or
C' = C' line/line + C' line/screen, if the screen is connected to one line
length of spur cable: max. 30 m (IIC and IIB)
length of trunk cable: max. 1 km (IIC) or 5 km (IIB)

Terminators

The terminator must be certified by a notified body as FISCO model and at each end of the trunk cable an approved line terminator with the following parameters is suitable:

R = 90...100 Ω
C = 0...2.2 µF (0.8 ... 1.2 µF is required in operation)

The resistor must be infallible according to IEC 60079-11.

Number of Devices

The number of devices (max. 32) possible on a fieldbus link depends on factors such as the power consumption of each device, the type of cable used, use of repeaters, etc.

9.2 FM

Applicable standards:
FM3600: 2011, FM3610: 2010, FM3810: 2005, ANSI/NEMA 250: 1991, IEC 60529: 1999, ANSI/ISA 60079-0: 2009, ANSI/ISA 60079-11: 2009, CSA-C22.2 No.157,: 1992 CSA-C22.2 No.25: 1992, CSA-C22.2 No.30: 1988, CSA-C22.2 No.0.5: 1982, CSA-C22.2 No.142: 1987, CSA-C22.2 No.0.4: 1982, CSA-C22.2 No.94: 1991

9.2.1 Technical Data

Remote detector RCCS30 ... 39/XR (option /FS1):
- Intrinsically safe
- AEx ia IIC, Class 1, Zone 0
- IS Class I, Division 1, Groups A,B,C,D T6
- DIP Class II / III, Division 1, Groups E,F,G
- IP67 / NEMA 4X

Remote converter RCCF31 (option /FF3):
- Housing explosion proof
- Provides intrinsically safe detector circuits
- AEx [ia] IIC, Class I, Zone 1, T6
- AEx [ia] IIB, Class I, Zone 1, T6 with option /HP
- Class I, Division 1, Groups A,B,C,D
- Class I, Division 1, Groups C,D with option /HP
- Class II / III, Division 1, Groups E,F,G
- AIS Class I / II / III, Division 1, Groups A,B,C,D, E,F,G
- AIS Class I / II / III, Division 1, Groups C,D,E,F,G with /HP
- IP67 / NEMA 4X
- Ambient temperature range : –40°C to +50°C

Integral type RCCT34 .. 39/IR (option /FF3):
- Housing explosion proof
- AEx d [ia] IIC, Class I, Zone 1, T6
- AEx [ia] IIB, Class I, Zone 1, T6 with option /HP
- Class I, Division 1, Groups A,B,C,D
- Class I, Division 1, Groups C,D with option /HP
- Class II / III, Division 1, Groups E,F,G
- IP67 / NEMA 4X
- Ambient temperature range : –40°C to +50°C

Temperature classification :
The remote converter RCCF31 has a T6 temperature class rating for operation at ambient temperature up to +50°C / +122°F.
- Standard : -50°C to 150°C / -58°F to 302°F
- with option /LT : -200°C to 150°C / -328°F to 302°F
- with option /MT (RCCS30LR...33) : -50°C to 260°C / -58°F to 500°F
- with option /MT (RCCx34...39/XR) : -50°C to 220°C / -58°F to 428°F
- with option /HT : 0°C to 350°C / 32°F to 662°F

Electrical data Remote converter RCCF31,and converter of Integral type RCCT3 :
- Driving circuit : terminals D+ / D-
  Uo = 14.5 V; Io = 47 mA; Po = 0.171 W
  Lo = 15 mH; Co = 0.65 µF
- Driving circuit : terminals D+ / D- with option /HP
  Uo = 11.7 V; Io = 124 mA; Po = 0.363 W
  Lo = 8 mH; Co = 10.3 µF
- Sensor circuits: terminals S1+/ S1- or S2+ / S2-
  Uo = 14.5 V; Io = 47 mA; Po = 0.363 W
  Lo = 15 mH; Co = 0.65 µF
- Temperature sensor circuit : terminals TP1,TP2, TP3
  Uo = 13.3 V; Io =40 mA; Po = 0.133 W
  Lo = 20 mH; Co =0.91 µF

Electrical data Remote detector RCCS30 ... 33:
- Driving circuit : terminals D+ and D
  Ui = 16 V; Ii = 53 mA; Pi = 0.212 W
  Li = 4.2 mH; Ci = negligible small
- Driving circuit : terminals D+ / D- with option /HP
  Ui = 16 V; Ii = 153 mA; Pi = 0.612 W
  Li = 4.2 mH; Ci = negligible small
- Sensor circuits: terminals S1+ / S1- or S2+ /S2-
  Ui = 16 V; Ii = 80 mA; Pi = 0.32 W
  Li = 4.2 mH; Ci = negligible small
- Temperature sensor circuit : terminals TP1,TP2, TP3
  Ui = 16 V; Ii =50 mA; Pi = 0.2 W
  Li = negligible small; Ci = negligible small

Electrical data Remote detector RCCS34 ... 39/XR:
- Driving circuit : terminals D+ and D
  Ui = 16 V; Ii = 53 mA; Pi = 0.212 W
  Li = 3.2 mH; Ci = negligible small
- Driving circuit : terminals D+ / D- with option /HP
  Ui = 16 V; Ii = 153 mA; Pi = 0.612 W
  Li = 3.2 mH; Ci = negligible small
- Sensor circuits: terminals S1+ / S1- or S2+ /S2-
  Ui = 16 V; Ii = 80 mA; Pi = 0.32 W
  Li = 2.1 mH; Ci = negligible small
- Temperature sensor circuit : terminals TP1,TP2, TP3
  Ui = 16 V; Ii =50 mA; Pi = 0.2 W
  Li = negligible small; Ci = negligible small

Temperature classification :The remote converter RCCF31 has a T6 temperature class rating for operation at ambient temperature up to +50°C / +122°F.

Coherence between temperature class, ambient- and medium temperature / temperature of heat carrier:

	RCCS30LR to RCCS33 without insulation		RCCS30LR to RCCS33 with factory insulation	
Temp. class	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature
T6	50°C / 122°F	60°C / 140°F	60°C / 140°F	60°C / 140°F
T5	50°C / 122°F	80°C / 176°F	80°C / 176°F	90°C / 194°F
T4	80°C / 176°F 50°C / 122°F	100°C / 212°F 120°C / 248°F	80°C / 176°F	130°C / 266°F
T3	80°C / 176°F	180°C / 356°F	80°C / 176°F	180°C / 356°F
T2	80°C / 176°F	260°C / 500°F	80°C / 176°F	260°C / 500°F
T1	80°C / 176°F	260°C / 608°F	80°C / 176°F	260°C / 500°F

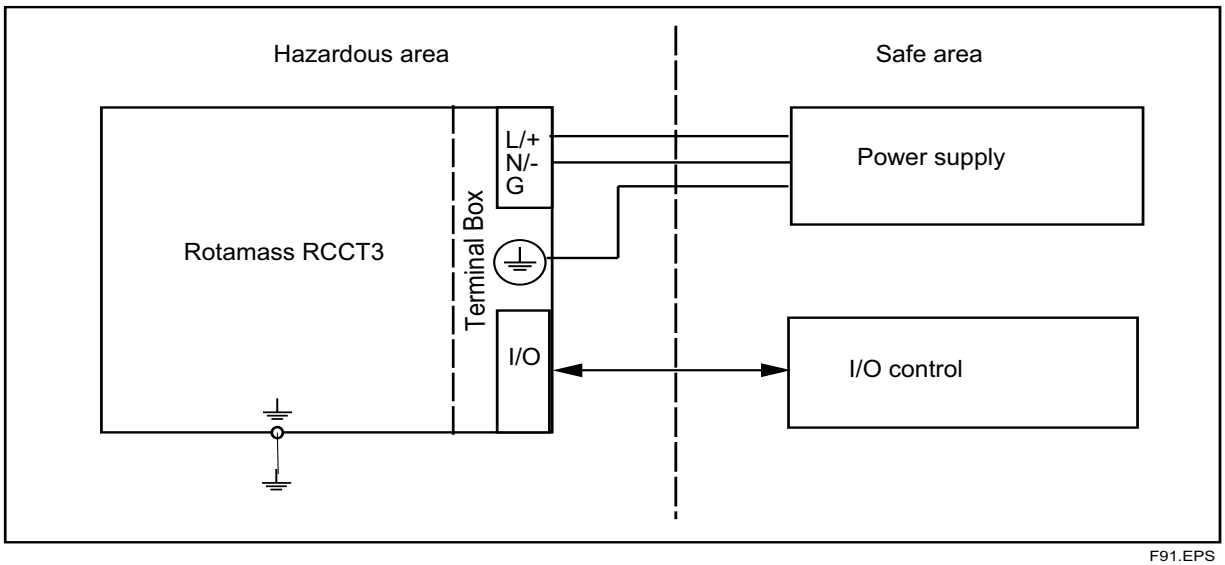
	RCCS34 to RCCS39/XR without insulation		RCCS34 to RCCS39/XR with factory insulation		RCCT34 to RCCT39/XR	
Temp. class	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature
T6	40°C / 104°F	40°C / 104°F	65°C / 149°C	65°C / 149°F	50°C / 122°F	65°C / 149°C
T5	55°C / 131°F	55°C / 131°F	75°C / 167°F	75°C / 167°F	50°C / 122°F	80°C / 176°F
T4	80°C / 176°F 40°C / 104°F	100°C / 212°F 120°C / 248°F	70°C / 158°F	115°C / 239°F	50°C / 122°F	115°C / 239°F
T3	80°C / 176°F 40°C / 104°F	160°C / 320°F 180°C / 356°F	70°C / 158°F	180°C / 356°F	50°C / 122°F	150°C / 302°F
T2	80°C / 176°F	220°C / 428°F	65°C /149°F	275°C / 527°F		
T1			45°C / 113°F	350°C / 662°F		

NOTE

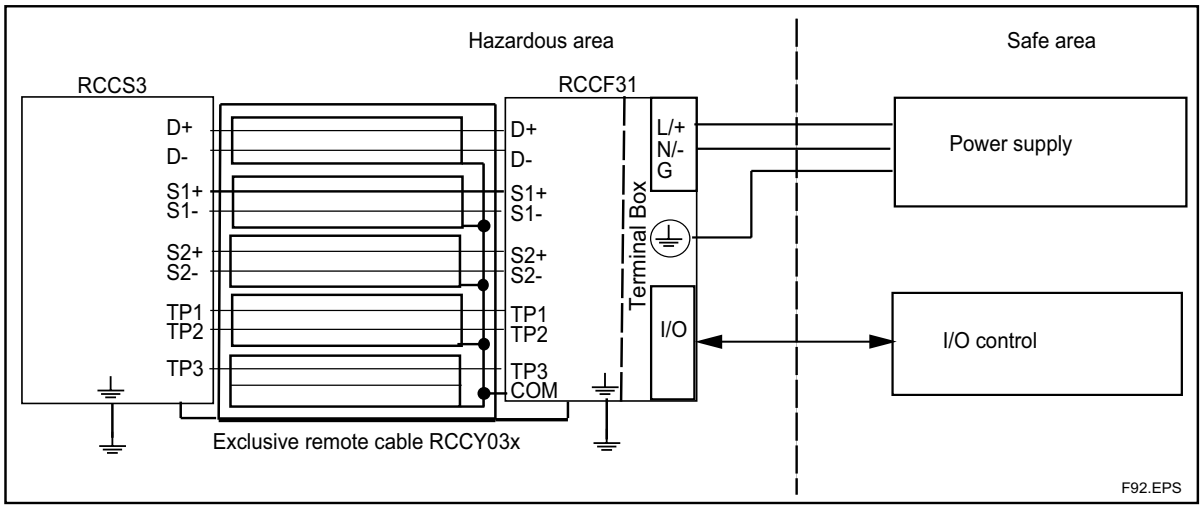
For customer insulation of RCCS34 to 39/IR the following must be regarded :
The table "with factory insulation" is calculated with 80 mm insulation and k-factor = 0.4 W/m^{2}K.
If your insulation data are worse than these use table "without insulation" !

9.2.2 Installation

Integral type RCCT3 :



Remote type RCCS3 with RCCF31 :



CAUTION

- The flowmeter must be connected to the potential equalization system. For remote type Converter and detector case must have connection to the potential equalisation facility
- For remote type at ambient temperature up to 60°C / 140°F use remote cable RCCY031 or RCCY032.
- For remote type at ambient temperature up to 80°C / 176°F use remote cable RCCY033.
- Maximum length of remote cable is 300 m/999 ft.
- Specified maximum ambient temperature of cables (power supply-, I/O- and remote cable) must be 20°C / 41°F above maximum ambient temperature of flowmeter.
- For AC-version maximum power supply is 250 V AC.
- Install according National Electrical Code. Intrinsically safe circuits must be installed according NEC ANSI / NPFA 70 amd ISA RP 12.6.
- Use certified XP (explosion proof) cable glands for power supply and I/O.
- Please confirm that the ground terminal (inside the terminal enclosure) is firmly connected by means of a clip-on eye-let.
- For EMC technical reasons the case of the detector is connected to the case of the converter via the shielding of the interconnecting cable.

Installation of separate intrinsic safe ground for Remote type RCCS3 with RCCF31 (see Control Drawing 8300027) :

- Remove the stopping plug on detector connecting side and replace it by a dust proofed cable gland.
- Open the cover on detector connecting side of RCCF31.
- Remove the cable between COM- terminal and the ground screw.
- Put the intrinsic safe ground cable through the new installed cable gland.
- Connect the IS-ground cable to the COM- terminal.
- Install the remote cable between detector RCCS3 and converter RCCF31 as shown in this chapter.

9.2.3 General warnings

WARNING

- Substitution of components may impair intrinsic safety !
- Only trained persons may use the instrument in industrial location.
- The instrument modification of parts replacement by other than authorized representatives of YOKOGAWA is prohibited and will void the certification.
- If the cover of the converter case has to be opened, following instructions must be followed:
- Confirm that the power cables to the instrument are disconnected.
- Wait 15 minutes after power is turned off before opening the covers.
- The covers of display side and terminal box are fixed with special screws, please use Hexagonal Wrench to open the covers.
- Be sure to lock the cover with special screw using the Hexagonal Wrench after tightening the cover .
- Before starting the operation again, be sure to lock the cover with the locking screws.
- Prohibition of specification changes and modifications. Users are prohibited from making any modifications of specifications or physical configuration, such as adding or changing the configuration of external wiring ports.

Marking of Ex d covers

The cover with glass window is marked inside with an "Ex"- label as shown below:

9.2.4 Ex-relevant marking on name plate

RCCT3 option /FF3:
Control Drawing No. 8300026
Class I, Division 1; Group A, B, C, D
Class II / III, Division 1, Group E, F, G
AEx d [ia] IIC, Class I, Zone 1, T6
Conduit Seals required within 18 inches.
Use Conductors rated 70°C
TYPE NEMA 4X, IP67

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCT3 option /FF3 /HP:
Control Drawing No. 8300026
Class I, Division 1; Group C, D
Class II / III, Division 1, Group E, F, G
AEx d [ia] IIB, Class I, Zone 1, T6
Conduit Seals required within 18 inches.
Use Conductors rated 70°C
TYPE NEMA 4X, IP67

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCF31 option /FF3:
Control Drawing No. 8300027
Class I, Division 1; Group A, B, C,D
AIS Class I / II / III, Division 1, Group A, B, C, D, E, F, G
Class II / III, Division 1, Group E, F, G
AEx d [ia] IIC, Class I, Zone 1, T6
Conduit Seals required within 18 inches.
Use Conductors rated 70°C
TYPE NEMA 4X, IP67

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCF31 option /FF3 /HP:
Control Drawing No. 8300027
Class I, Division 1; Group C, D
AIS Class I / II / III, Division 1, Group C, D, E, F, G
Class II / III, Division 1, Group E, F, G
AEx d [ia] IIB, Class I, Zone 1, T6
Conduit Seals required within 18 inches.
Use Conductors rated 70°C
TYPE NEMA 4X, IP67

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCT3 option /FF3 /DS:
Control Drawing No. 8300026
Class I, Division 1; Group A, B, C, D
Class II / III, Division 1, Group E, F, G
AEx d [ia] IIC, Class I, Zone 1, T6
Conduit Seals required within 18 inches.
Use Conductors rated 70°C
TYPE NEMA 4X, IP67

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.
Dual Seal

RCCT3 option /FF3 /HP /DS:
Control Drawing No. 8300026
Class I, Division 1; Group C, D
Class II / III, Division 1, Group E, F, G
AEx d [ia] IIB, Class I, Zone 1, T6
Conduit Seals required within 18 inches.
Use Conductors rated 70°C
TYPE NEMA 4X, IP67

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.
Dual Seal

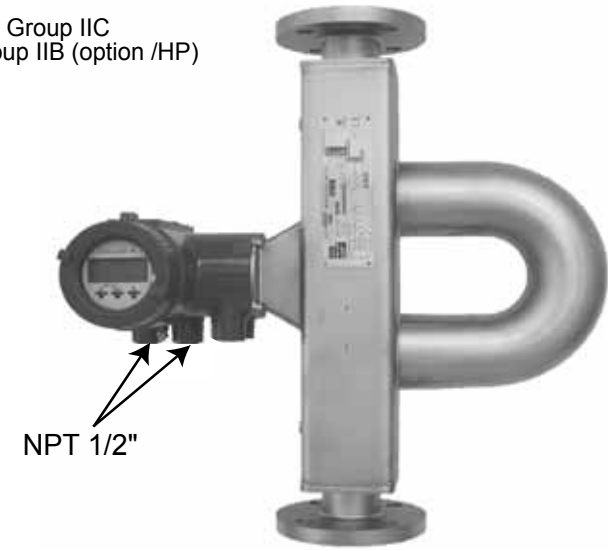
RCCS3 option /FS1:
Control Drawing No. 8300027
IS Class I, Division 1; Group A, B, C, D, T6
Class II / III, Division 1, Group E, F, G
AEx ia IIC, Class I, Zone 0
Use Conductors rated 20°C above max. ambient temperature
TYPE NEMA 4X, IP67
Temperature Class see Control Drawing

RCCS3 option /FS1 /DS:
Control Drawing No. 8300027
IS Class I, Division 1; Group A, B, C, D, T6
Class II / III, Division 1, Group E, F, G
AEx ia IIC, Class I, Zone 0
Use Conductors rated 20°C above max. ambient temperature
TYPE NEMA 4X, IP67
Temperature Class see Control Drawing
Dual Seal

9.2.5 Control drawings

Hazardous Locations :

Class I Division 1 Groups A,B,C,D or Class I Zone 1 Group IIC
Class I Division 1 Groups C,D or Class I Zone 1 Group IIB (option /HP)
and Class II and III Division 1 Groups E,F,G

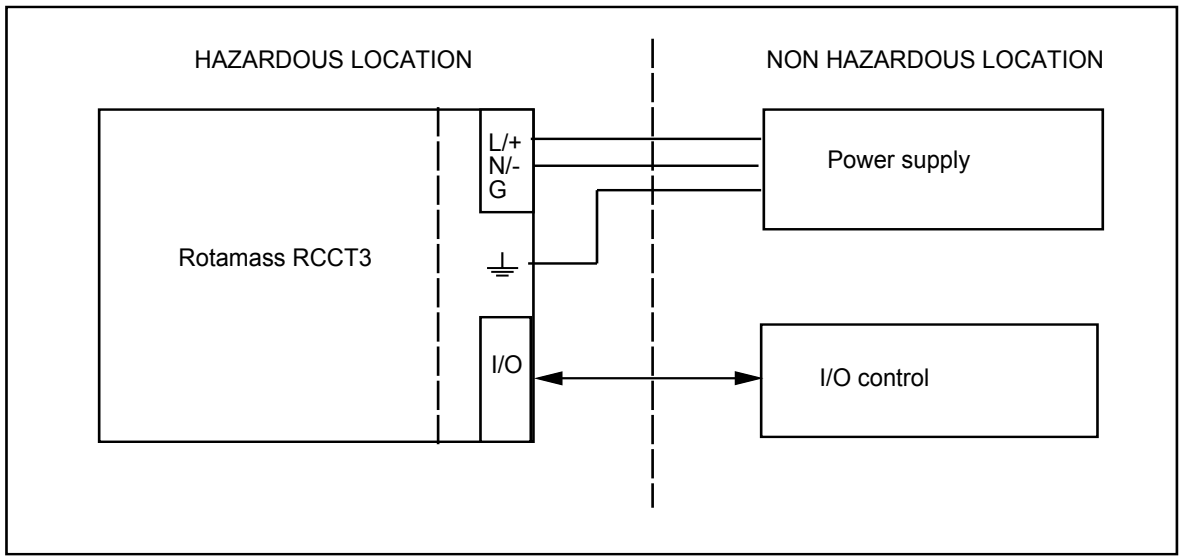


Temperature classification :

Temp. class	RCCT34 to RCCT39/XR	
	Max. Ambient temperature	Max. Medium temperature or temperature of heat carrier
T6	≤ 50°C / 122°F	≤ 65°C / 149°F
T5	≤ 50°C / 122°F	≤ 80°C / 176°F
T4	≤ 50°C / 122°F	≤ 115°C / 239°F
T3	≤ 50°C / 122°F	≤ 150°C / 302°F

The minimum ambient temperature is -40°C / -40°F

Installation :



Note :

- For AC-version maximum power supply is 250V AC.
- For DC-version maximum power supply is 28.8V DC.
- The installation must be in accordance with the national electrical code, NFPA70, article 504 to 510 and ANSI/ISA RP 12.06.01.
- The non intrinsically safe terminals must not be connected to any device that uses or generates more than 250Vrms or dc unless it has been determined that the voltage was adequately isolated.
- Installation must be in accordance with the Canadian Electrical Code, when installed in Canada.

WARNING : Substitution of components may impair intrinsic safety.

						DATE	NAME	TITEL:
					DRAWED	09.02.2005	Butz	FM/CSA CONTROL DRAWING ROTAMASS RCCT3
					CKECKED	09.02.2005	Rü	
c	----------	5.3.07	Butz	Rü	YOKOGAWA 79664 WEHR GERMANY			DWG. No.: 8300026
b	----------	1.9.05	Butz	Rü				1/1
a								
Rev.	UPDATE No.	DATE	EDITOR	CHECKED				

Hazardous Locations:

Remote Detector RCCS3: Class I Division 1 Groups A,B,C,D
Class II and III Division 1 Groups E,F,G

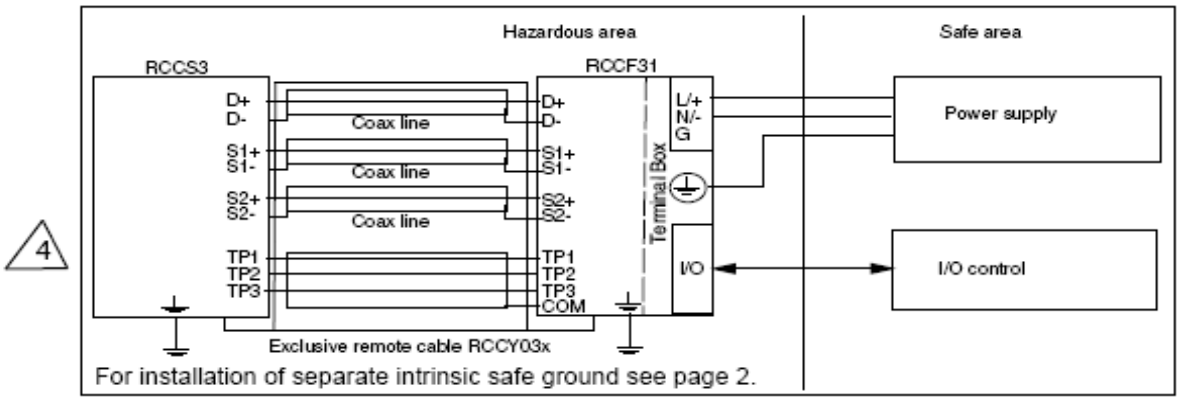
Remote Converter RCCF31: Class I Division 1 Groups A,B,C,D or Class 1 Zone 1 Group IIC
Class I Division 1 Groups C,D or Class 1 Zone 1 Group IIB (option /HP)
Class II and III Division 1 Groups E,F,G

Temperature Classification:

	RCCS30LR to RCCS33 without insulation		RCCS30LR to RCCS33 with factory insulation	
Temp. class	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature
T6	50°C / 122°F	60°C / 140°F	60°C / 140°F	60°C / 140°F
T5	50°C / 122°F	80°C / 176°F	80°C / 176°F	90°C / 194°F
T4	80°C / 176°F 50°C / 122°F	100°C / 212°F 120°C / 248°F	80°C / 176°F	130°C / 266°F
T3	80°C / 176°F	180°C / 356°F	80°C / 176°F	180°C / 356°F
T2	80°C / 176°F	280°C / 600°F	80°C / 176°F	280°C / 600°F
T1	80°C / 176°F	320°C / 608°F	80°C / 176°F	280°C / 600°F

	RCCS34 to RCCS39/XR without insulation		RCCS34 to RCCS39/XR with factory insulation	
Temp. class	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature
T6	40°C / 104°F	40°C / 104°F	65°C / 149°C	65°C / 149°F
T5	55°C / 131°F	55°C / 131°F	75°C / 167°F	75°C / 167°F
T4	80°C / 176°F 40°C / 104°F	100°C / 212°F 120°C / 248°F	70°C / 158°F	115°C / 239°F
T3	80°C / 176°F 40°C / 104°F	160°C / 320°F 180°C / 356°F	70°C / 158°F	180°C / 356°F
T2	80°C / 176°F	220°C / 428°F	65°C /149°F	275°C / 527°F
T1			45°C / 113°F	350°C / 662°F

The maximum ambient temperature for remote converter RCCF31 is 50°C / 122°F.
The minimum ambient temperature for remote converter RCCF31 is -40°C / -40°F.
The minimum ambient temperature for remote detector RCCS3 is -50°C / -58°F.



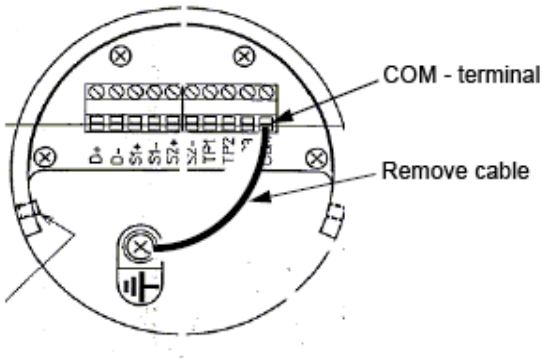
YOKOGAWA D-79664 Wehr (Germany)

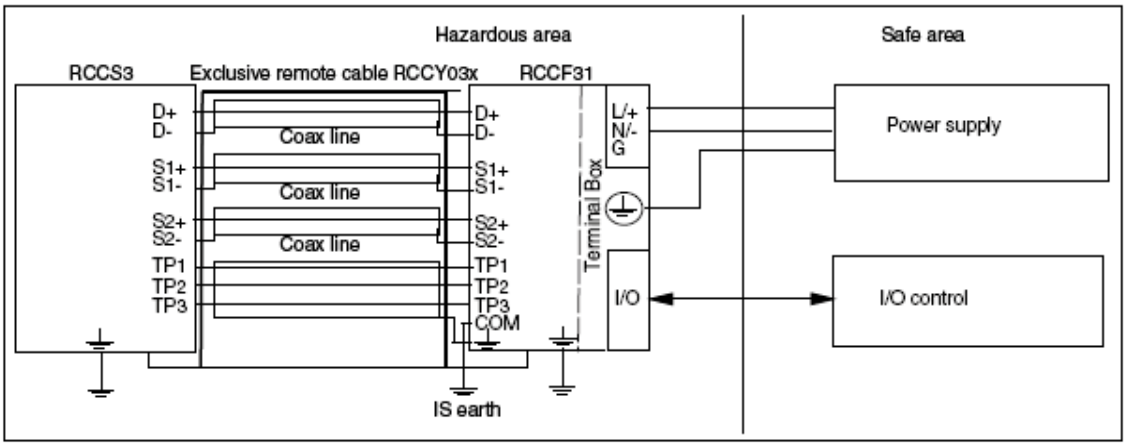
Document No.	Description:	
8300027	FM(US/C) Control Drawing, Rotamass Remote Type RCCF31 + RCCS3	**WARNING: Substitution of components may impair intrinsic safety**

Rev.	Rev.-No.	Date	Edited	Checked	Approved	Remarks
4	FZ2-512-03771	23.07.2013	Rüchel	Schm	Schmidt	
		Note: Ex related document !		Rü		
Original		Replaced for		Replaced by		ENG-028944 Page 1/2

Installation of intrinsic safe ground:

- Remove the stopping plug on detector connecting side of RCCF31 and replace it by a dust proofed cable gland.
- Open the cover on detector connecting side of RCCF31.
- Remove the cable between COM - terminal and the ground screw (see below picture).
- Put the intrinsic-safe-ground-cable through the new installed cable gland.
- Connect the IS-ground cable to the COM - terminal.
- Install the remote cable between Detector RCCS3 and Converter RCCF31 as shown below.





Note :

- For AC-version of RCCF31 maximum power supply is 250V AC.
- For DC-version maximum power supply is 28.8V DC.
- Install in accordance with NFPA 70
- Max. cable length of remote cable 300m / 999ft.
- Connect inner shield of remote cable together to COM-terminal on converter side.
- Connect outer shield of remote cable on both sides to case by cable gland.
- The installation must be in accordance with the national electrical code, NFPA70, article 504 to 510 and ANSI/ISA RP 12.06.01.
- The non intrinsically safe terminals must not be connected to any device that uses or generates more than 250Vrms or dc unless it has been determined that the voltage was adequately isolated.
- Installation must be in accordance with the Canadian Electrical Code, when installed in Canada

YOKOGAWA			D-79664 Wehr (Germany)			
Document No. 8300027		Description: FM(US/C) Control Drawing, Rotamass Remote Type RCCF31 + RCCS3		**WARNING: Substitution of components may impair intrinsic safety**		
4	FZ2-512-03771	23.07.2013	Rüchel	Schm	Schmidt	
Rev.	Rev.-No.	Date	Edited	Checked	Approved	Remarks
		Note: Ex related document !		Rü		
Original		Replaced for		Replaced by		ENG-028944 Page 2/2

9.3 IECEx

In this section, further requirements and differences for explosion proof type instrument are described. For explosion proof type instrument, the description in this chapter is prior to other description in this Instruction Manual.

WARNING

- Only trained persons may use the instrument in industrial location.
- The instrument modification or parts replacement by other than an authorized Representative of Yokogawa is prohibited and will void the certification.
- Electrostatic charge may cause an exlosion hazard. Avoid any actions that cause the gerenation of eletrostatic charge, such as rubbing with a dry cloth on coating face of the converter.
- If it is mounted in an area where the use of category 2D apparatus is required, it shall be installed in such a way that the risk from electrostatic discharges and propagating brush discharges caused by rapid flow of dust is avoided.

ROTAMASS is produced by
Rota Yokogawa
Rheinstr. 8
D-79664 Wehr
Germany

9.3.1 Technical Data

Applicable Standard:
RCCS3:
IEC 60079-0: 2011; IEC 60079-11: 2011;
IEC 60079-31:2008
RCCT3/RCCF31/RCCR31:
IEC 60079-0: 2011, IEC 60079-1: 2007,
IEC 60079-7: 2006, IEC 60079-11: 2011,
IEC 60079-31:2008
Certificate: IECEx KEM 06.0031X

Remote detector RCCS30LR ... 33 (option /ES1):
- Intrinsically safe
- Ex ib IIB/IIC T6 ... T1 Gb
- Ex ib IIIC T□□□ Db
  (□□□ = max. surface temperature see below)
- Max. surface temperature :
  Standard : 150°C
  /MT : 260°C
  /MT, not /T□ : 320°C
- Degree of protection: IP66/67
- Ambient humidity : 0 to 95% RH
- Ambient temperature range:
  -50°C to +80°C
- Process temperature limits :
  Standard : -50°C to 150°C
  /MT : -50°C to 260°C
  /MT, not /T□ : -50°C to 260°C
- Heat carrier fluid temperature limits :
  Standard : 0°C to 150°C
  Option /MT : 0°C to 260°C

Remote detector RCCS34 ... 39/XR (option /ES1):
- Intrinsically safe
- Ex ib IIB/IIC T6 ... T1 Gb
- Ex ib IIIC T□□□ Db
  (□□□ = max. surface temperature see below)
-Max. surface temperature :
  Standard + /LT : 150°C
  /MT : 220°C
  /HT : 350°C
- Degree of protection: IP66/67
- Ambient humidity : 0 to 95% RH
- Ambient temperature range:
  -50°C to +80°C
  Option /HT (process temperature < 280°C):
  -50°C to +65°C
  Option /HT (process temperature < 350°C):
  -50°C to +55°C
- Process temperature limits :
  Standard : -50°C to 150°C
  Option /MT: : -50°C to 220°C
  Option /HT : 0°C to 350°C
  Option /LT : -200°C to 150°C
- Heat carrier fluid temperature limits :
  Standard : 0°C to 150°C
  Option /MT : 0°C to 220°C
  Option /HT : 0°C to 350°C

Remote converter RCCF31 (option /EF3):
- Flame proof with intrinsic safe connection to detector (ib)
- Ex d [ib] IIC T6 Gb or Ex d e [ib] IIC T6 Gb
- Ex d [ib] IIB T6 Gb or Ex d e [ib] IIB T6 Gb with option /HP
- Ex tb [ib] IIIC T75°C Db
- Max. surface temperature: 75°C
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz
  20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range: -40°C to +55°C

Remote converter RCCF31 (option /EF4):
- Flame proof with intrinsic safe connection to detector (ib)
- Additional intrinsic safe FF- output (ia).
- Ex d [ib] [ia Ga] IIC T6 Gb or Ex d e [ib] [ia Ga] IIC T6 Gb
- Ex d [ib] [ia IIC Ga] IIB T6 Gb or Ex d e [ia IIC Ga] [ib] IIB T6 Gb with option /HP
- Ex tb [ia Da] [ib] IIIC T75°C Db
- Max. surface temperature: 75°C
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz
  20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range : -40°C to +55°C

Integral type RCCT34 ... 39/XR (option /EF3):
- Flame proof with intrinsic safe connection to detector (ib)
- Ex d ib IIC T6...T3 Gb or Ex d e ib IIC T6...T3 Gb
- Ex d ib IIB T6...T3 Gb or Ex d e ib IIB T6...T3 Gb with option /HP
- Ex ib tb IIIC T150°C Db
- Max. surface temperature : 150°C
- Degree of protection : IP66/67
- Power supply : 90 to 250 V AC, 50/60 Hz
  20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range : -40°C to +55°C
- Process temperature limits : -50°C to 150°C

Integral type RCCT34 ... 39/XR (option /EF4):
- Flame proof with intrinsic safe connection to detector (ib)
- Additional intrinsic safe FF- output (ia).
- Ex d ib [ia Ga] IIC T6...T3 Gb or Ex d e ib [ia Ga] IIC T6...T3 Gb
- Ex d ib [ia IICGa] IIB T6...T3 Gb or Ex d e ib [ia IIC Ga] IIB T6...T3 Gb with option /HP
- Ex ib tb [ia Da] IIIC T150°C Db
- Max. surface temperature : 150°C
- Degree of protection : IP66/67
- Power supply: 90 to 250 V AC, 50/60 Hz
  20.5 to 28.8 V DC
- Power consumption : max. 25 VA / 10 W
- Ambient humidity : 0 to 95% RH
- Ambient temperature range : -40°C to +55°C
- Process temperature limits : -50°C to 150°C

The electronics of RCCT3 and RCCF31 are placed in a pressure tight section of the converter housing Ex d.
The kind of protection of the terminal enclosure is “e”, but can become “d” by using Ex-d certified cable glands.

Electrical data remote detector RCCS30LR ... 33:
- Driving circuit : terminals D+ / D-
  Ex ib IIC : Ui = 16 V; Ii = 53 mA; Pi = 0.212 W
  Li = 4.2 mH; Ci = negl. small
  Ex ib IIB : Ui = 16 V; Ii = 153 mA; Pi = 0.612 W
  Li = 4.2 mH; Ci = negl. small
- Sensor circuits: terminals S1+/ S1- or S2+ / S2-
  Ex ib IIC : Ui = 16 V; Ii = 80 mA; Pi = 0.32 W
  Li = 4.2 mH; Ci = negl. small
- Temp. sensor circuit : terminals TP1, TP2, TP3
  Ex ib IIC : Ui = 16 V; Ii = 50 mA; Pi = 0.2 W
  Li = negligible small
  Ci = negligible small

Electrical data remote detector RCCS34 ... 39/XR :
- Driving circuit : terminals D+ / D
  Ex ib IIC : Ui = 16 V; Ii = 53 mA; Pi = 0.212 W
  Li = 3.2 mH; Ci = negligible small
  Ex ib IIB : Ui = 16 V; Ii = 153 mA; Pi = 0.612 W
  Li = 3.2 mH; Ci = negligible small
- Sensor circuits: terminals S1+/ S1- or S2+ / S2-
  Ex ib IIC : Ui = 16 V; Ii = 80 mA; Pi = 0.32 W
  Li = 2.1 mH; Ci = negligible small
- Temp. sensor circuit : terminals TP1, TP2, TP3
  Ex ib IIC : Ui = 16 V; Ii = 50 mA; Pi = 0.2 W
  Li = negligible small
  Ci = negligible small

Electrical data remote converter RCCF31, RCCR31 and converter of Intergral type RCCT3:

- Driving circuit : terminals D+ / D-
  Ex ib IIC : Uo = 14.5 V; Io = 47 mA; Po = 0.171 W
  Lo = 15 mH; Co = 0.65 µF
  Ex ib IIB : Uo = 11.7 V; Io = 124 mA; Po = 0.363 W
  Lo = 8 mH; Co = 10.3 µF
- Sensor circuits: terminals S1+/ S1- or S2+ / S2-
  Ex ib IIC : Uo = 14.5 V; Io = 47 mA; Po = 0.171 W
  Lo = 15 mH; Co = 0.65 µF
- Temperature sensor circuit : terminals TP1,TP2, TP3
  Ex ib IIC : Uo = 13.3 V; Io = 40 mA; Po = 0.133 W
  Lo = 20 mH; Co =0.91 µF
- Fieldbus output (only option /KF4) :
  FISCO model:
  Ex [ia] IIC: Ui = 17.5 V; Ii = 380 mA; Pi = 5.32 W
  Li = 1.6 µH; Ci = 2.7 nF
  Ex [ia] IIB: Ui = 17.5 V; Ii = 460 mA; Pi = 5.32 W
  Li = 1.6 µH; Ci = 2.7 nF
  Entity model:
  Ex [ia] IIC: Ui = 24 V; Ii = 250 mA; Pi = 1.2 W
  Li = 1.6 µH; Ci = 2.7 nF

Marking of Ex d covers

The cover with glass window is marked inside with an "Ex"- label as shown below:

Temperature classification :The remote converter RCCF31 has a T6 temperature class rating for operation at ambient temperature up to +50°C.

Coherence between temperature class, ambient- and medium temperature / temperature of heat carrier:

	RCCS30LR to RCCS33 without insulation		RCCS30LR to RCCS33 with factory insulation	
Temp. class	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature
T6	50°C / 122°F	60°C / 140°F	60°C / 140°F	60°C / 140°F
T5	50°C / 122°F	80°C / 176°F	80°C / 176°F	90°C / 194°F
T4	80°C / 176°F 50°C / 122°F	100°C / 212°F 120°C / 248°F	80°C / 176°F	130°C / 266°F
T3	80°C / 176°F	180°C / 356°F	80°C / 176°F	180°C / 356°F
T2	80°C / 176°F	260°C / 500°F	80°C / 176°F	260°C / 500°F
T1	80°C / 176°F	260°C / 608°F	80°C / 176°F	260°C / 500°F

	RCCS34 to RCCS39/XR without insulation		RCCS34 to RCCS39/XR with factory insulation		RCCT34 to RCCT39/XR	
Temp. class	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature	Max. ambient temperature	Max. process temperature
T6	40°C / 104°F	40°C / 104°F	65°C / 149°C	65°C / 149°F	50°C / 122°F	65°C / 149°C
T5	55°C / 131°F	55°C / 131°F	75°C / 167°F	75°C / 167°F	50°C / 122°F	80°C / 176°F
T4	80°C / 176°F 40°C / 104°F	100°C / 212°F 120°C / 248°F	70°C / 158°F	115°C / 239°F	50°C / 122°F	115°C / 239°F
T3	80°C / 176°F 40°C / 104°F	160°C / 320°F 180°C / 356°F	70°C / 158°F	180°C / 356°F	50°C / 122°F	150°C / 302°F
T2	80°C / 176°F	220°C / 428°F	65°C /149°F	275°C / 527°F		
T1			45°C / 113°F	350°C / 662°F		

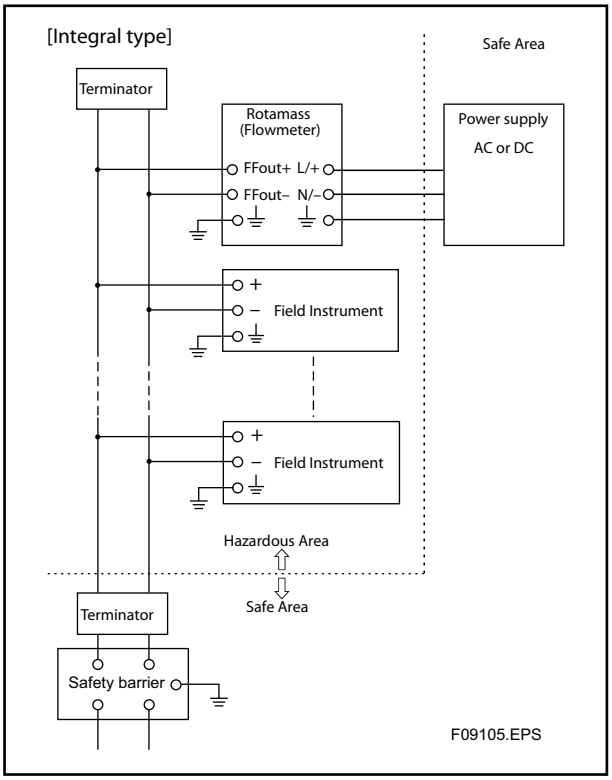
NOTE

For customer insulation of RCCS34 to 39/IR the following must be regarded :
The table "with factory insulation" is calculated with 80 mm insulation and k-factor = 0.4 W/m²K.
If your insulation data are worse than these use table "without insulation" !

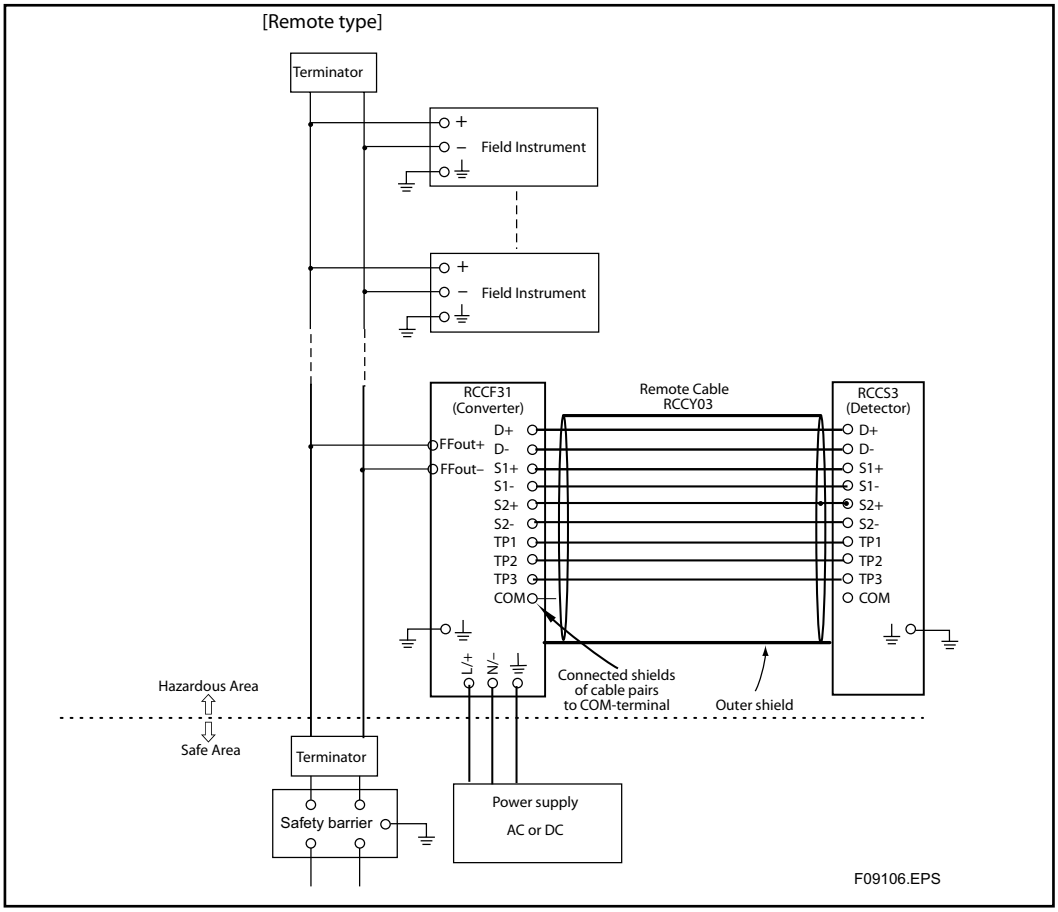
9.3.2 Installation

Installation for ROTAMASS with /EF3 see in chapter 9.2.2.

Integral type RCCT3 /EF4



Remote type RCCF31 /EF4 with RCCS3 /ES1



9.3.3 Operation

If the cover of the converter case has to be opened, following instructions must be followed.

CAUTION

1. Confirm that the power cables to the instrument are disconnected.
2. Wait 15 minutes after power is turned off before opening the covers.
3. The covers of display side and terminal box are fixed with special screws, please use Hexagonal Wrench to open the covers.
4. Be sure to lock the cover with special screw using the Hexagonal Wrench after tightening the cover.
5. Before starting the operation again, be sure to lock the cover with the locking screws.
6. Prohibition of specification changes and modifications. Users are prohibited from making any modifications of specifications or physical configuration, such as adding or changing the configuration of external wiring ports.

9.3.4 Maintenance and repair

WARNING

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

9.3.5 Ex-relevant marking on name plate

RCCT3 option /EF3:
IECEx KEM 06.0031X
Ex d ib IIC T6...T3 Gb or
Ex d e ib IIC T6...T3 Gb
Ex ib tb IIIC T150°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc

TEMP. CLASS	T6	T5	T4	T3
PROCESS TEMP.	65	80	115	150°C

ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCT3 option /EF3 + /HP:
IECEx KEM 06.0031X
Ex d ib IIB T6...T3 Gb or
Ex d e ib IIB T6...T3 Gb
Ex ib tb IIIC T150°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc

TEMP. CLASS	T6	T5	T4	T3
PROCESS TEMP.	65	80	115	150°C

ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCT3 option /EF4 with display:
IECEx KEM 06.0031X
Ex d ib [ia Ga] IIC T6...T3 Gb or
Ex d e ib [ia Ga] IIC T6...T3 Gb
Ex ib tb [ia Da] IIIC T150°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc

TEMP. CLASS	T6	T5	T4	T3
PROCESS TEMP.	65	80	115	150°C

ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCT3 option /EF4 + /HP with display:
IECEx KEM 06.0031X
Ex d ib [ia IIC Ga] IIB T6...T3 Gb or
Ex d e ib [ia IIC Ga] IIB T6...T3 Gb
Ex ib tb [ia Da] IIIC T150°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc

TEMP. CLASS	T6	T5	T4	T3
PROCESS TEMP.	65	80	115	150°C

ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCF31 option /EF3:
IECEx KEM 06.0031X
Ex d [ib] IIC T6 Gb or
Ex d e [ib] IIC T6 Gb
Ex tb [ib] IIIC T75°C Db
ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCF31 option /EF4:
IECEx KEM 06.0031X
Ex d [ib] [ia Ga] IIC T6 Gb or
Ex d e [ib] [ia Ga] IIC T6 Gb
Ex tb [ia Da] [ib] IIIC T75°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc
ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCS34 to 39/XR option /ES1:
IECEx KEM 06.0031X
Ex ib IIB/IIC T6...T1 Gb
Ex ib IIIC T150°C Db IP66/67
SEE CERTIFICATE FOR DATA

RCCS34 to 39/XR option /ES1 + /MT:
IECEx KEM 06.0031X
Ex ib IIB/IIC T6...T1 Gb
Ex ib IIIC T220°C Db IP66/67
SEE CERTIFICATE FOR DATA

RCCS34 to 39/XR option /ES1 + /HT:
IECEx KEM 06.0031X
Ex ib IIB/IIC T6...T1 Gb
Ex ib IIIC T350°C Db IP66/67
SEE CERTIFICATE FOR DATA

RCCF31 option /EF3 + /HP:
IECEx KEM 06.0031X
Ex d i[b[IIB T6 Gb or
Ex d e [ib] IIB T6 Gb
Ex tb [ib] IIIC T75°C Db
ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCF31 option /EF4 + /HP:
IECEx KEM 06.0031X
Ex d [ib] [ia IIC Ga] IIB T6 Gb or
Ex d e [ib] [ia IIC Ga] IIB T6 Gb
Ex tb [ia Da] [ib] IIIC T75°C Db
DIODE SAFETY BARRIER Um : 250Vac/dc
ENCLOSURE: IP66/67
SEE CERTIFICATE FOR DATA

WARNING
WAIT 15 MIN. AFTER POWER-DISCONNECTION BEFORE OPENING THE ENCLOSURE.

RCCS30LR to 33 option /ES1:
IECEx KEM 06.0031X
Ex ib IIB/IIC T6...T1 Gb
Ex ib IIIC T150°C Db IP66/67
SEE CERTIFICATE FOR DATA

RCCS30LR to 33 option /ES1 + /MT:
IECEx KEM 06.0031X
Ex ib IIB/IIC T6...T1 Gb
Ex ib IIIC T260°C Db IP66/67
SEE CERTIFICATE FOR DATA

9.3.6 I.S. fieldbus system complying with FISCO (only /EF4)

The criterion for such interconnection is that the voltage (Ui), the current (Ii) and the power (Pi), which intrinsically safe apparatus can receive, must be equal or greater than the voltage (Uo), the current (Io) and the power (Po) which can be provided by the associated apparatus (supply unit).
Po ≤ Pi, Uo ≤ Ui, Io≤ Ii.

In addition, the maximum unprotected residual capacitance (Ci) and inductance (Li) of each apparatus (other than the terminators) connected to the fieldbus line must be equal or less than 5 nF and 10 µH respectively.
Ci ≤ 5 nF, Li ≤ 10uH

Supply unit

The supply unit must be certified by a notify body as FISCO model and following trapezoidal or rectangular output characteristic is used.

Uo = 14... 17.5 V (I.S. maximum value)

Io based on spark test result or other assessment,

ex. 133 mA for Uo = 15 V (Group IIC, rectangular characteristic)

No specification of Lo and Co in the certificate and on the label.

Cable

The cable used to interconnect the devices needs to comply with the following parameters:

loop resistance R': 15...150 Ω/km
inductance per unit length Lc: 0.4...1 mH/km
capacitance per unit length Cc: 80...200 nF/km
C' = C' line/line + 0.5 C' line/screen, if both lines are floating or
C' = C' line/line + C' line/screen, if the screen is connected to one line
length of spur cable: max. 30 m (IIC and IIB)
length of trunk cable: max. 1 km (IIC) or 5 km (IIB)

Terminators

The terminator must be certified by a notified body as FISCO model and at each end of the trunk cable an approved line terminator with the following parameters is suitable:

R = 90...100 Ω
C = 0...2.2 µF (0.8 ... 1.2 µF is required in operation)
The resistor must be infallible according to IEC 60079-11.

Number of Devices

The number of devices (max. 32) possible on a fieldbus link depends on factors such as the power consumption of each device, the type of cable used, use of repeaters, etc.

9.4 INMETRO (Brazil)

RCCS3□ with option /US1 same as IECEx /ES1
RCCT3□ with options /UF3 ... /UF4 same as IECEx EF3 ... /EF4
RCCF31 with options /UF3 ... /UF4 same as IECEx EF3 ... /EF4
Same parameters and specifications as IECEx approval.
See chapter 9.3.

9.5 NEPSI (China)

Certificate GYJ12.1381X
RCCS3□ with option /NS1 same as IECEx /ES1
RCCT3□ with options /NF3 ... /NF4 same as IECEx EF3 ... /EF4
RCCF31 with options /NF3 ... /NF4 same as IECEx EF3 ... /EF4
Same parameters and specifications as IECEx approval except NEPSI approval does not cover dust proof.

9.6 EAC (Russia, Kazakhstan, Belorussia)

Certificate RU C-DE.ГБ08.B.00208
RCCS3□ with option /GS1,
RCCT3□ with options /GF3 or /GF4,
RCCF31 with options /GF3 or /GF4.
Same parameters and specifications as ATEX approval with the exception that EAC approval does not cover dust proof.

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APPENDIX 1. LIST OF PARAMETERS FOR EACH BLOCK OF ROTAMASS

Note: The Write Mode column contains the modes in which each parameter is write enabled.
O/S: Write enabled in O/S mode.
MAN: Write enabled in Man mode and O/S mode.
AUTO: Write enabled in Auto mode, Man mode, and O/S mode.

A1.1 Resource Block

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
0	1000	Block Header	Tag: “RS”	Block Tag=O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc.
1	1001	ST_REV	-	-	The revision level of the static data associated with the resource block. The revision value will be incremented each time a static parameter value in this block is changed.
2	1002	TAG_DESC	(Spaces)	AUTO	The user description of the intended application of the block
3	1003	STRATEGY	1	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	1004	ALERT_KEY	1	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	1005	MODE_BLK	-	AUTO	The actual, target, permitted, and normal modes of the block.
6	1006	BLOCK_ERR	0	-	This parameter reflects the error status associated with hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	1007	RS_STATE	-	-	State of the resource block state machine.
8	1008	TEST_RW	0	AUTO	Read /write test parameter used only for conformance testing and simulation
9	1009	DD_RESOURCE	(SPACES)	-	String identifying the tag of the resource which contains the Device Description for this resource
10	1010	MANUFAC_ID	0x594543	-	Manufacturer identification number-used by an interface device to locate the DD file for the resource.
11	1011	DEV_TYPE	13	-	Manufacturer`s model number associated with the resource-used by interface devices to locate the DD file for the resource.
12	1012	DEV_REV	2 *	-	Manufacturer revision number associated with the resource-used by an interface device to locate the DD file for the resource.
13	1013	DD_REV	1 *	-	Revision of the DD associated with the resource-used by an interface device to locate the DD file for the resource.
14	1014	GRANT_DENY	-	AUTO	Options for controlling access of host computer and local control panels to operating, tuning and alarm parameters of the block
15	1015	HARD_TYPES	0x0001 (Scalar input)	-	The types of hardware available as channel number bit0: Scalar input bit1: Scalar output bit2: Discrete input bit3: Discrete output
* Status on July 2010; xxx_REV can change due to further development					

16	1016	RESTART	-	-	Allows a manual restart to be initiated. Several degrees of restart are possible. They are 1: Run, 2: Restart resource, 3: Restart with defaults and 4: Restart processor.
17	1017	FEATURES	0x000a (Soft write lock supported Report supported)	-	Used to show supported resource block options. for the Rotamass.
18	1018	FEATURE_SEL	0x000a (Soft write lock supported Report supported)	AUTO	Used to select resource block options, bit0: Scheduled bit2: Event driven bit2: Manufacturer specified
19	1019	CYCLE_TYPE	0x0001 (Sched-uled)	-	Identifies the block execution methods available for this resource.
20	1020	CYCLE_SEL	0x0001 (Sched-uled)	AUTO	Used to select the block execution method for this resource.
21	1021	MIN_CYCLE_T	3200	-	Time duration of the shortest cycle interval of which the resource is capable.
22	1022	MEMORY_SIZE	0	-	Available configuration memory in the empty resource. To be checked before attempting a down load.
23	1023	NV_CYCLE_T	0	-	Interval between writing copies of NV parameters to non-volatile memory. Zero means never.
24	1024	FREE_SPACE	0	-	Percent of memory available for further configuration. ROTAMASS has zero which means a preconfigured resource.
25	1025	FREE_TIME	0	-	Percent of the block processing time that is free to process additional blocks. Supported only with PID function.
26	1026	SHED_RCAS	640000 (20s)	AUTO	Time duration at which to give up on computer writes to function block Rcas locations. Supported only with PID function.
27	1027	SHED_ROUT	640000 (20s)	AUTO	Time duration at which to give up on computer writes to function block Rout locations. Supported only with PID function.
28	1028	FAULT_STATE	1	-	Condition set by loss of communication to an output block, failure promoted to an output block or a physical contact. When fail-safe condition is set, then output function blocks will perform their FSAFE actions. Supported only with PID function.
29	1029	SET_FSTATE	1 (OFF)	AUTO	Allows the fail-safe condition to be manually initiated by selecting Set. Supported only with PID function.
30	1030	CLR_FSTATE	1 (OFF)	AUTO	Writing a Clear to this parameter will clear the device fail-safe state if the field condition, if any, has cleared. Supported only with PID function.
31	1031	MAX_NOTIFY	3	-	Maximum number of unconfirmed notify messages possible.
32	1032	LIM_NOTIFY	3	AUTO	Maximum number of unconfirmed alert notify messages allowed.
33	1033	CONFIRM_TIME	640000 (20s)	AUTO	The minimum time between retries of alert reports.
34	1034	WRITE_LOCK	Not locked	AUTO	If set, no writes from anywhere are allowed, except to clear WRITE_LOCK. Block inputs will continue to be updated. 1: Not locked, 2: Locked
35	1035	UPDATE_EVT	-	-	This alert is generated by any change to the static data.

36	1036	BLOCK_ALM	-	-	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the sub code has changed.
37	1037	ALARM_SUM	-	-	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
38	1038	ACK_OPTION	0xffff	AUTO	
39	1039	WRITE_PRI	0	AUTO	Priority of the alarm generated by clearing the write lock. 0, 1, 3 to 15
40	1040	WRITE_ALM	-	-	This alert is generated if the write lock parameter is cleared.
41	1041	ITK_VER	5 *	-	Version number of inter operability test by Fieldbus Foundation applied to Rotamass.
42	1042	SOFT_REV	-	-	Rotamass software revision number.
43	1043	SOFT_DESC		-	Yokogawa internal use.
44	1044	SIM_ENABLE_MSG	(Spaces)	AUTO	Software switch for simulation function.
45	1045	DEVICE_STATUS_1	-	-	Device Status (VRC setting etc.)
46	1046	DEVICE_STATUS_2	-	-	Sensor failure etc.
47	1047	DEVICE_STATUS_3	-	-	Device status (function block setting)
48	1048	DEVICE_STATUS_4	-	-	Device status (function block setting)
49	1049	DEVICE_STATUS_5	-	-	Device status (function block setting)
50	150	DEVICE_STATUS_6	-	-	Not used for Rotamass.
51	1051	DEVICE_STATUS_7	-	-	Not used for Rotamass.
52	1052	DEVICE_STATUS_8	-	-	Not used for Rotamass.
53	1053	SOFTDWN_PROTECT	0x01	-	Defines whether to accept software downloads. 0x01: unprotected 0x01: protected
54	1054	SOFTDWN_FORMAT	0x01	-	Selects the software download method. 0x01: Standard
55	1055	SOFTDWN_COUNT	0	-	Indicates the number of times the internal FlashROM was erased.
56	1056	SOFTDWN_ACT_AREA	0	-	Indicates the ROM number of the currently working FlashROM.
57	1057	SOFTDWN_MOD_REV	1,0,0,0,0,0,0,0	-	Indicates the software module revision erature value on the LCD display.
58	1058	SOFTDWN_ERROR	0	-	Indicates the error during a software download.
* Status on July 2010; ITK_VER can change due to further development					

A1.2 AI Function Block

Parameter for massflow (AI1), volumeflow (AI2), density (AI3) and temperature (AI4) :

Rel. Index	Index				Parameter Name	Factory Default	Write Mode	Explanation
	AI1	AI2	AI3	AI4				
0	4000	4100	4200	4300	Block Header	TAG: AI1, AI2, AI3 or AI4	Block Tag = O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc.
1	4001	4101	4201	4301	ST_REV	0	—	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
2	4002	4102	4202	4302	TAG_DESC	(spaces)	AUTO	The user description of the intended application of the block.
3	4003	4103	4203	4303	STRATEGY	1	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	4004	4104	4204	4304	ALERT_KEY	1	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	4005	4105	4205	4305	MODE_BLK	AUTO	AUTO	The actual, target, permitted, and normal modes of the block.
6	4006	4106	4206	4306	BLOCK_ERR	0	—	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	4007	4107	4207	4307	PV	0	—	Either the primary analog value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK value of an AO block.
8	4008	4108	4208	4308	OUT	0	Value = MAN	The primary analog value calculated as a result of executing the function.
9	4009	4109	4209	4309	SIMULATE	Disabled	AUTO	Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulation is disabled, the simulate value and status track the actual value and status. 1=Disabled, 2=Active
10	4010	4110	4210	4310	XD_SCALE	Specified at the time of order	O/S	The high and low scale values, engineering units code, and number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel. Refer to 5.6.4 AI Function Block Parameters for the unit available. 0 to 65535 (The number lies except decimal point)
11	4011	4111	4211	4311	OUT_SCALE	Specified at the time of order	O/S	The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT. Refer to 5.6.4 AI Function Block Parameters for the unit available.
12	4012	4112	4212	4312	GRANT_DENY	0x00	AUTO	Options for controlling access of host computers and local control panels to operating, tuning and alarm parameters of the block.
13	4013	4113	4213	4313	IO_OPTS	0x0000	O/S	Options which the user may select to alter input and output block processing. bit 6: Low cutoff
14	4014	4114	4214	4314	STATUS_OPTS	0	O/S	Options which the user may select in the block processing of status. bit 3: Propagate Failure Forward, bit 8: Uncertain if Man mode.
15	4015	4215	4115	4315	CHANNEL	1 (AI1) 2 (AI2) 3 (AI3) 4 (AI4)	O/S	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.
16	4016	4116	4216	4316	L_TYPE	Direct (1)	MAN	Determines if the values passed by the transducer block to the AI block may be used directliy (Direct (1)) or if the value is in different units and must be converted lineary (Indirect (2), or with square root (Ind Sqr Root (3)) using the input range defined by the transducer and the associated output range. "Indirect Square Root" is not used for Rotamass.

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Rel. Index	Index AI1	AI2	AI3	AI4	Parameter Name	Factory Default	Write Mode	Explanation
17	4017	4117	4217	4317	LOW_CUT	0.0 (AI1) 0.0 (AI2) 0.0 (AI3) 0.0 (AI4)	AUTO	Sets low cut point of output. This low cut value become available by setting "Low cutoff" to "IO-OPTS".
18	4018	4118	4218	4318	PV_FTIME	0	AUTO	Time constant of a single exponential filter for the PV, in seconds.
19	4019	4119	4219	4319	FIELD_VAL	—	—	Raw value of the field device in percent of thePV range, with a status reflecting the Transducer condition, before signal characterization (L_TYPE), filtering (PV_FTIME), or low cut (LOW_CUT).
20	4020	4120	4220	4320	UPDATE_EVT	—	—	This alert is generated by any change to the static data
21	4021	4121	4221	4321	BLOCK_ALM	—	—	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
22	4022	4122	4222	4322	ALARM_SUM	—	—	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
23	4023	4123	4223	4323	ACK_OPTION	0xffff	AUTO	Selection of whether alarms associated with the block will be automatically acknowledged.
24	4024	4124	4224	4324	ALARM_HYS	0.5%	AUTO	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm Hysteresis is expressed as a percent of the PV span. 0 to 50
25	4025	4125	4225	4325	HI_HI_PRI	0	AUTO	Priority of the high high alarm. 0, 1, 3 to 15
26	4026	4126	4226	4326	HI_HI_LIM	1. #INF [1)]	AUTO	The setting for high high alarm in engineering units.
27	4027	4127	4227	4327	HI_PRI	0	AUTO	Priority of the high alarm. 0, 1, 3 to 15
28	4028	4128	4228	4328	HI_LIM	1. #INF [1)]	AUTO	The setting for high alarm in engineering units.
29	4029	4129	4229	4329	LO_PRI	0	AUTO	Priority of the low alarm. 0, 1, 3 to 15
30	4030	4130	4230	4330	LO_LIM	-1. #INF [1)]	AUTO	The setting for the low alarm in engineering units.
31	4031	4131	4231	4331	LO_LO_PRI	0	AUTO	Priority of the low low alarm. 0, 1, 3 to 15
32	4032	4132	4232	4332	LO_LO_LIM	-1. #INF [1)]	AUTO	The setting of the low low alarm in engineering units
33	4033	4133	4233	4333	HI_HI_ALM	—		The status for high high alarm and its associated time stamp
34	4034	4134	4234	4334	HI_ALM	—		The status for high alarm and its associated time stamp
35	4035	4135	4235	4335	LO_ALM	—		The status of the low alarm and its associated time stamp
36	4036	4136	4236	4336	LO_LO_ALM	—		The status of the low low alarm and its associated time stamp.

[1)] Initial value: All limits are set to plus or minus infinity (+INF or -INF), which is the same as no limit. IEEE 754-1985 defines the floating point representation of plus and minus infinity.

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Parameter for option /Cxx concentration measurement (AI5) and netflow (AI6) :

Rel. Index	Index AI5	Index AI6			Parameter Name	Factory Default	Write Mode	Explanation
0	4400	4500			Block Header	TAG : AI5 or AI6	Block Tag = O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc.
1	4401	4501			ST_REV	0	—	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
2	4402	4502			TAG_DESC	(spaces)	AUTO	The user description of the intended application of the block.
3	4403	4503			STRATEGY	1	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	4404	4504			ALERT_KEY	1	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	4405	4505			MODE_BLK	AUTO	AUTO	The actual, target, permitted, and normal modes of the block.
6	4406	4506			BLOCK_ERR	0	—	This parameter reflects the error status associated with the hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	4407	4507			PV	0	—	Either the primary analog value for use in executing the function, or a process value associated with it. May also be calculated from the READBACK value of an AO block.
8	4408	4508			OUT	0	Value = MAN	The primary analog value calculated as a result of executing the function.
9	4409	4509			SIMULATE	Disabled	AUTO	Allows the transducer analog input or output to the block to be manually supplied when simulate is enabled. When simulation is disabled, the simulate value and status track the actual value and status. 1=Disabled, 2=Active
10	4410	4510			XD_SCALE	Specified at the time of order	O/S	The high and low scale values, engineering units code, and number of digits to the right of the decimal point used with the value obtained from the transducer for a specified channel. Refer to 5.6.4 AI Function Block Parameters for the unit available. 0 to 65535 (The number lies except decimal point)
11	4411	4511			OUT_SCALE	Specified at the time of order	O/S	The high and low scale values, engineering units code, and number of digits to the right of the decimal point to be used in displaying the OUT parameter and parameters which have the same scaling as OUT. Refer to 5.6.4 AI Function Block Parameters for the unit available.
12	4412	4512			GRANT_DENY	0x00	AUTO	Options for controlling access of host computers and local control panels to operating, tuning and alarm parameters of the block.
13	4413	4513			IO_OPTS	0x0000	O/S	Options which the user may select to alter input and output block processing. bit 6: Low cutoff
14	4414	4514			STATUS_OPTS	0	O/S	Options which the user may select in the block processing of status. bit 3: Propagate Failure Forward, bit 8: Uncertain if Man mode.
15	4415	4515			CHANNEL	5 (AI5) 6 (AI6)	O/S	The number of the logical hardware channel that is connected to this I/O block. This information defines the transducer to be used going to or from the physical world.
16	4416	4516			L_TYPE	Direct (1)	MAN	Determines if the values passed by the transducer block to the AI block may be used directliy (Direct (1)) or if the value is in different units and must be converted lineary (Indirect (2), or with square root (Ind Sqr Root (3)) using the input range defined by the transducer and the associated output range. "Indirect Square Root" is not used for Rotamass.

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Rel. Index	Index AI5	Index AI6			Parameter Name	Factory Default	Write Mode	Explanation
17	4417	4517			LOW_CUT	0.0 (AI5) 0.0 (AI6)	AUTO	Sets low cut point of output. This low cut value become available by setting "Low cutoff" to "IO-OPTS".
18	4418	4518			PV_FTIME	0	AUTO	Time constant of a single exponential filter for the PV, in seconds.
19	4419	4519			FIELD_VAL	—	—	Raw value of the field device in percent of thePV range, with a status reflecting the Transducer condition, before signal characterization (L_TYPE), filtering (PV_FTIME), or low cut (LOW_CUT).
20	4420	4520			UPDATE_EVT	—	—	This alert is generated by any change to the static data
21	4421	4521			BLOCK_ALM	—	—	The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the subcode field. The first alert to become active will set the Active status in the Status attribute. As soon as the Unreported status is cleared by the alert reporting task, another block alert may be reported without clearing the Active status, if the subcode has changed.
22	4422	4522			ALARM_SUM	—	—	The current alert status, unacknowledged states, unreported states, and disabled states of the alarms associated with the function block.
23	4423	4523			ACK_OPTION	0xffff	AUTO	Selection of whether alarms associated with the block will be automatically acknowledged.
24	4424	4524			ALARM_HYS	0.5%	AUTO	Amount the PV must return within the alarm limits before the alarm condition clears. Alarm Hysteresis is expressed as a percent of the PV span. 0 to 50
25	4425	4525			HI_HI_PRI	0	AUTO	Priority of the high high alarm. 0, 1, 3 to 15
26	4426	4526			HI_HI_LIM	1. #INF [1)]	AUTO	The setting for high high alarm in engineering units.
27	4427	4527			HI_PRI	0	AUTO	Priority of the high alarm. 0, 1, 3 to 15
28	4428	4528			HI_LIM	1. #INF [1)]	AUTO	The setting for high alarm in engineering units.
29	4429	4529			LO_PRI	0	AUTO	Priority of the low alarm. 0, 1, 3 to 15
30	4430	4530			LO_LIM	-1. #INF [1)]	AUTO	The setting for the low alarm in engineering units.
31	4431	4531			LO_LO_PRI	0	AUTO	Priority of the low low alarm. 0, 1, 3 to 15
32	4432	4532			LO_LO_LIM	-1. #INF [1)]	AUTO	The setting of the low low alarm in engineering units
33	4433	4533			HI_HI_ALM	—		The status for high high alarm and its associated time stamp
34	4434	4534			HI_ALM	—		The status for high alarm and its associated time stamp
35	4435	4535			LO_ALM	—		The status of the low alarm and its associated time stamp
36	4436	4536			LO_LO_ALM	—		The status of the low low alarm and its associated time stamp.

[1)] Initial value: All limits are set to plus or minus infinity (+INF or -INF), which is the same as no limit. IEEE 754-1985 defines the floating point representation of plus and minus infinity.

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A1.3 Transducer Block

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
0	2000	Block Header	Tag: TB	Block Tag=O/S	Information on this block such as Block Tag, DD Revision, Execution Time etc.
1	2001	ST_REV		-	The revision level of the static data associated with the function block. The revision value will be incremented each time a static parameter value in the block is changed.
2	2002	TAG_DESC	(Spaces)	AUTO	The user description of the intended application of the block
3	2003	STRATEGY	1	AUTO	The strategy field can be used to identify grouping of blocks. This data is not checked or processed by the block.
4	2004	ALERT_KEY	1	AUTO	The identification number of the plant unit. This information may be used in the host for sorting alarms, etc.
5	2005	MODE_BLK	AUTO	AUTO	The actual, target, permitted, and normal modes of the block.
6	2006	BLOCK_ERR	0	-	This parameter reflects the error status associated with hardware or software components associated with a block. It is a bit string, so that multiple errors may be shown.
7	2007	UPDATE_EVT	-		This alert is generated by any change to the static data
8	2008	BLOCK_ALM	-		The block alarm is used for all configuration, hardware, connection failure or system problems in the block. The cause of the alert is entered in the sub-code field. The first alert to become active will set the Active status in the Status attribute.
9	2009	TRANSDUCER_DIRECTORY	1,2010	-	A directory that specifies the number and starting indices of the device.
10	2010	TRANSDUCER_TYPE	Standard flow with calibration (104)	-	Identifies the device type, which is “Standard Flow with Calibration” for the Rotamass.
11	2011	XD_ERROR	0 (No Error)	-	Indicates the error code of the error of the highest priority from among the errors currently occurring in the transducer block. 0=No failure, Range 127 (CPU-failure) to 100 (Autozero out of Range)
12	2012	COLLECTION_DIRECTORY		-	A directory that specifies the number, starting indices, and DD Item IDS of the data collections in each transducer within a transducer block.
13	2013	CAL_POINT_HI	*)	O/S	The highest calibrated value. To set within the range of SENSOR_RANGE.
14	2014	CAL_POINT_LO	0	O/S	The lowest calibrated value. To set within the range of SENSOR_RANGE.
15	2015	CAL_MIN_SPAN	1500	-	The minimum calibration span value allowed. 10% of SENSOR_RANGE.
16	2016	CAL_UNIT	kg/h	-	The engineering unit for the calibrated sensor.
17	2017	SENSOR_TYPE	Coriolis (101)	-	Indicates the sensor type, which is “Coriolis” for the Rotamass.
18	2018	SENSOR_RANGE	*)	-	The high and low range limits values, engineering units code and the number of digits to the right of the decimal point for the sensor.
19	2019	SENSOR_SN	Serial No.	-	The serial number of the connected sensor.
20	2020	SENSOR_CAL_METHOD	Dynamic weigh (102)	O/S	The method of the last sensor calibration
21	2021	SENSOR_CAL_LOC	YOKOGAWA	O/S	Sets/indicates the location of the last sensor calibration.

*) Depends on detector size. For RCCF31 not combined with detector, data for RCCS36 are stored.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
22	2022	SENSOR_CAL_DATE	-	O/S	Sets/indicates the dates of the last sensor calibration.
23	2023	SENSOR_CAL_WHO	YOKOGAWA	O/S	Sets/indicates the name of the person responsible for the last sensor calibration.
24	2024	LIN_TYPE	linear with input(1)	-	The linearization type of sensor output. Rotamass is “linear with input”.
25	2025	MASS_FLOW_VALUE	0	-	Mass flow value
26	2026	MASS_FLOW_VALUE_RANGE	*)	-	Mass flow value range. Depends on detector size.
27	2027	MASS_FLOW_VALUE_FTIME	3 s	-	Time constant of damping for the mass flow rate calculation. Setting range: 0.1 to 200 s
28	2028	MASS_FLOW_LOWCUT	0	O/S	Low cut value of the mass flow. Setting range 0 to 10% of MASS_FLOW_VALUE_RANGE.EU100
29	2029	VOLUME_FLOW_VALUE	-	-	Volume flow value
30	2030	VOLUME_FLOW_VALUE_RANGE	*)	-	Volume flow value range. Depends on detector size.
31	2031	VOLUME_FLOW_VALUE_FTIME	3 s		Time constant of damping for the volume flow rate calculation. Setting range: 0.1 to 200 s
32	2032	VOLUME_FLOW_LOWCUT	0	O/S	Lowcut value of the volume flow. Setting range 0 to 10% of VOLUME_FLOW_VALUE_RANGE.EU100
33	2033	DENSITY_VALUE	-	-	Density flow value
34	2034	DENSITY _VALUE_RANGE	5 kg/l	-	Density value range
35	2035	DENSITY_VALUE_FTIME	3 s	-	Time constant of damping for the density calculation. Setting range: 0.1 to 200s
36	2036	DENSITY_LOWCUT	0	O/S	Lowcut value of the density. Setting range 0 to 10% of DENSITY_VALUE_RANGE. EU100
37	2037	TEMPERATURE_VALUE	-	-	Temperature value
38	2038	TEMPERATURE _VALUE_RANGE	230°C	-	Range of temperature value. Standard version: -200 to 230°C; High temperature version: 0 to 400°C.
39	2039	TEMPERATURE _VALUE_ FTIME	3 s	-	Time constant of damping for the temperature calculation. Setting range: 0.1 to 200s
40	2040	CONCENTR_MEAS_VALUE	-	-	Concentration measurement value
41	2041	CONCENTR_MEAS_VALUE_RANGE	100	-	Range of concentration measurement.
42	2042	CONCENTR_MEAS_VALUE_ FTIME	10s	-	Time constant of damping for the concentration measurement calculation. Setting range: 0.1 to 200 s
43	2043	CONCENTR_MEAS_ LOWCUT	0	O/S	Lowcut value of the concentration measure-ment. Setting range 0 to 10% of CONCENTR_ MEAS_VALUE_RANGE.EU100
44	2044	NET_FLOW_VALUE	-	-	Net flow value
45	2045	NET_FLOW_VALUE_RANGE	*)	-	Netflow value range. Depend on detector size.
46	2046	NET_FLOW_VALUE_ FTIME	3s	-	Time constant of damping for the net flow rate calculation. Setting range: 0.1 to 200s
47	2047	NET_FLOW_ LOWCUT	0	O/S	Low cut value of the net flow. Setting range 0 to 10% of NET_FLOW_VALUE_RANGE. EU100
48	2048	VELOCITY_VALUE	0.0	–	The Velocity of the Medium Not available for gas measurement (/GA)
49	2049	VELOCITY_UNITS_INDEX	m/sec	O/S	This parameter shows the unit of the Velocity; Range: m/s or ft/s
50	2050	DISPLAY_SELECT_1	Mass flow	-	Value displayed on the 1st line of the LCD display.
51	2051	DISPLAY_SELECT_2	Volume flow	-	Value displayed on the 2nd line of the LCD display.
52	2052	DISPLAY_SELECT_3	Density	-	Value displayed on the 3rd line of the LCD display.
53	2053	DISPLAY_SELECT_4	Temperature	-	Value displayed on the 4th line of the LCD display.

*) Depends on detector size. For RCCF31 not combined with detector, data for RCCS36 are stored.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
54	2054	DISP_DECIMAL_MASS_FLOW	xxxx.XX	-	The decimal point position of the mass flow value on the LCD display.
55	2055	DISP_DECIMAL_VOLUME_FLOW	xxxx.XX	-	The decimal point position of the volume flow value on the LCD display.
56	2056	DISP_DECIMAL_DENSITY	xx.XXXX	-	The decimal point position of the density value on the LCD display.
57	2057	DISP_DECIMAL_TEMPERATURE	xxxxx.X	-	The decimal point position of the temperature value on the LCD display.
58	2058	DISP_DECIMAL_CONCENTR_MEAS	xxxx.XX	-	The decimal point position of the concentration measurement value on the LCD display.
59	2059	DISP_DECIMAL_NET_FLOW	xxxx.XX	-	The decimal point position of the net flow value on the LCD display.
60	2060	DISP_DECIMAL_IT1	xxxxx.XX	-	The decimal point position of the OUT value of IT1 block on the LCD display.
61	2061	DISP_DECIMAL_IT2	xxxxx.XX	-	The decimal point position of the OUT value of IT2 block on the LCD display.
62	2062	DISP_IT1_UNITS_INDEX	None	-	The unit index of the OUT value of IT1 block on the LCD display.
63	2063	DISP_IT2_UNITS_INDEX	None	-	The unit index of the OUT value of IT2 block on the LCD display.
64	2064	DISP_CONTRAST	4	-	The contrast of the LCD display.
65	2065	DISP_PERIOD	1 s	-	The update cycle of the LCD display.
66	2066	DISP_LANGUAGE	English	-	The language on the LCD display.
67	2067	FLOW_DIRECTION	Forward	O/S	Direction of flow
68	2068	BI_DIRECTION	Bi-direction	O/S	Selects the Bi-direction mode (bi-direction/ uni-direction).
69	2069	AUTO_ZERO_TIME	3 min	O/S	Defines the execution time of the autozero function.
70	2070	AUTO_ZERO_EXE	Not Execute	O/S	A user can execute the autozero performing by this parameter. After autozero execution is completed, this value returns to “Not Execute” automatically. The execution time is defined by AUTO_ ZERO_TIME.
71	2071	AUTO_ZERO_VALUE	Set after adjust-ment	-	Indicates the result value of the autozero execution.
72	2072	AUTO_ZERO_FLUCTUATION	Set after adjust-ment	-	Indicates the factory autozero range.
73	2073	AZ_INIT_MASS_FLOW	Set after adjust-ment	-	Indicates the last autozero value for mass flow.
74	2074	AZ_INIT_DENSITY	Set after adjust-ment	-	Indicates the density at the last autozero for mass flow.
75	2075	AZ_INIT_TEMP	Set after adjust-ment	-	Indicates the temperature at the last autozero for mass flow.
76	2076	MASS_FLOW_FIX_VAL_SEL	Inhibit	O/S	This parameter enables the function of MASS_FLOW_FIXED_VALUE. When the value is “Inhibit”, the function of MASS_FLOW_FIXED_VALUE does not perform. When the value is “Enable”, the function of MASS_FLOW_FIXED_VALUE performs.
77	2077	MASS_FLOW_FIXED_VALUE	0.0 t/h	O/S	This parameter indicates a fix mass flow value. The set value is added to the autozero value.
78	2078	DENSITY_FIX_VAL_SEL	Inhibit	O/S	This parameter enables the function of REFERENCE_DENSITY. When the value is “Inhibit” the function does not perform. When the value is “Enabled” the function performs. If gas measurement (/GA) is ordered, this parameter is “Enabled”.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
79	2079	REFERENCE_DENSITY	1.0 kg/l	O/S	This parameter indicates a reference density value. When the value of DENSITY_FIX_VAL is "Inhibit" users can not change this value and this function does not perform. When the value is "Enabled" users can change this value and this parameter is used as reference density for calculation of volume flow.
80	2080	DENSITY_OFFSET	0 g/l	O/S	This parameter indicates a density offset value.
81	2081	TEMP_FIX_VAL_SELECT	Inhibit	O/S	This parameter enables the function of TEMP_FIXED_VALUE. When the value is "Inhibit", the function of TEMP_FIXED_VALUE does not perform. When the value is "Enable", the function of TEMP_FIXED_VALUE performs.
82	2082	TEMP_FIXED_VALUE	30°C	O/S	This parameter indicates a fix temperature value. When the value of TEMP_FIX_VAL is "Inhibit" users can not change this value and this function does not perform. When the value of TEMP_FIX_VAL is "Enable" users can change this value and this parameter is set to the temperature value.
83	2083	TEMP_GAIN	1.00	O/S	This parameter defines the value of temperature gain. The function allows correction of the temperature measurement for better accuracy in mass flow and density for very high and low temperatures.
84	2084	SENSOR_MODEL	*)		This parameter defines the sensor model. When a user changes the value the following parameters return to default automatically: SENSOR_RANGE, MASS_FLOW_VALUE_RANGE, VOLUME_FLOW_VALUE_RANGE, NET_FLOW_VALUE_RANGE, SK20, SKT, RV, QNOM, KD, FL20, FTC1, FTCK, SKP, FPC, SKTK, SKPT, FPTC, FQC1, FQC2, AUTOZERO_RANGE, FLUCTUATION_RANGE
85	2085	SK20	*)	O/S	Defines the sensor constant at 20°C. The valid range and the default value depend on the selected sensor model.
86	2086	SKT	*)	O/S	Defines a linear temperature coefficient of the sensor constant SK20. The valid range and the default value depend on the selected sensor model.
87	2087	RV	*)	O/S	Defines a density correction factor. The valid range and the default value depend on the selected sensor model.
88	2088	QNOM	*)	O/S	Defines the water flow rate of about 1 bar pressure drop. The valid range and the default value depend on the selected sensor model.
89	2089	KD	*)	O/S	Defines a density calibration constant. The valid range and the default value depend on the selected sensor model.
90	2090	FL20	*)	O/S	Defines a response frequency of the tubes filled with air at 20°C. The valid range and the default value depend on the selected sensor model.

*) Depends on detector size. For RCCF31 not combined with detector, data for RCCS36 are stored.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
91	2091	FTC1	*)	O/S	Defines a linear temperature coefficient of the frequency at roh = 1. The valid range and the default value depend on the selected sensor model.
92	2092	FTCK	*)	O/S	Defines a quadratic temperature coefficient of the frequency at roh = 1. The valid range and the default value depend on the selected sensor model.
93	2093	SKP	*)	O/S	Defines a linear pressure coefficient of the sensor constant SK20. The valid range and the default value depend on the selected sensor model.
94	2094	FPC	*)	O/S	Defines a linear pressure coefficient of the frequency. The valid range and the default value depend on the selected sensor model.
95	2095	SKTK	*)	O/S	Defines a quadratic temperature coefficient of the sensor constant SK20. The valid range and the default value depend on the selected sensor model.
96	2096	SKPT	*)	O/S	Defines a quadratic pressure coefficient of the sensor constant SK20. The valid range and the default value depend on the selected sensor model.
97	2097	FPTC	*)	O/S	Defines a temperature - pressure coefficient of the frequency. The valid range and the default value depend on the selected sensor model.
98	2098	FQC1	*)	O/S	Defines a linear flow coefficient of the frequency. The valid range and the default value depend on the selected sensor model.
99	2099	FQC2	*)	O/S	Defines a quadratic flow coefficient of the frequency. The valid range and the default value depend on the selected sensor model.
100	2100	PRESSURE	0.0 bar	O/S	Sets the pressure value for correction with SKP and FPC.
101	2101	PRESSURE_UNIT	bar	O/S	This parameter shows the unit of PRESSURE; range bar or psi.
102	2102	SLUG_ALARM_SELECT	Not apply	O/S	This parameter enables the following functions. DRIVE_GAIN, SLUG_CRITERIA SLUG_DURATION AFTER_SLUG DRIVE_GAIN_DAMPING When the value is “Not Apply”, they do not perform. When the value is “Apply”, they perform. If gas measurement is ordered, this parameter is not available. The value is “Not apply”.
103	2103	DRIVE_GAIN	-	-	This parameter indicates a drive gain value. When the value of SLUG_ALARM_SELECT is “Not Apply” this function does not perform.
104	2104	SLUG_CRITERIA	11 V	O/S	This parameter indicates a level of drive gain when an alarm should happen. When the value of SLUG_ALARM_SELECT is “Not Apply”, users can not change this value. Range 0 to 11 V.

*) Depends on detector size. For RCCF31 not combined with detector, data for RCCS36 are stored.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
105	2105	SLUG_DURATION	1 s	O/S	Indicates a slug duration time. When the value of SLUG_ALARM_SELECT is “Not Apply”, users cannot change this value. Range 0 to 120sec.
106	2106	AFTER_SLUG	Measured value	O/S	Selects the behaviour of the output mass flow after slug alarm has happened. When the parameter is selected -“Measured Value”, the output mass flow is the measured value. -“Hold”, the output mass flow is the value before the slug alarm happened. When the value of SLUG_ALARM_SELECT is “Not Apply”, users cannot change this value.
107	2107	DRIVE_GAIN_DAMPING	1 s	O/S	Indicates a drive gain damping time to get a constant drive gain level. When the value of SLUG_ALARM_SELECT is “Not Apply”, users can not change this value. Range 0 to 200sec.
108	2108	EMPTY_PIPE_ALM_SEL	Inhibit	O/S	When the value is set to “Empty Pipe sel” this parameter enables: EMPTY_PIPE_CRIT (Crit < density), AFTER_EMPTY_PIPE. When the value is set to “Dual Seal Sel”, this parameter enables: EMPTY_PIPE_CRIT (Crit > density), AFTER_EMPTY_PIPE. When the value is “Inhibit” they do not perform. If gas measurement (/GA) is ordered, this parameter is not available.
109	2109	EMPTY_PIPE_CRIT	0.0 kg/l	O/S	Indicates the empty pipe criteria when EMPTY_PIPE_ALM_SELECT is set to “Empty Pipe Sel” (Crit < actual density). Indicates the dual seal criteria when EMPTY_PIPE_ALM_SELECT is set to “Dual Seal Sel” (Crit > actual density).
110	2110	AFTER_EMPTY_PIPE	Mass flow = zero	O/S	Selects the behaviour of the output mass flow after empty pipe alarm or dual seal alarm has happened. When the parameter is selected -“Mass flow=zero”, the output mass flow is zero. -“Measured Value”, the output mass flow is the measured value. -“Hold”, the output mass flow is the value before the empty pipe alarm happened. When the value of EMPTY_PIPE_ALM_SELECT is “Not Apply”, users cannot change this value.
111	2111	CORROSION_ALM_SEL	Not Apply	O/S	This parameter enables the functions of CORROSION_CRIT and CORROSION_DAMP. When this value is “Not Apply” they do not perform. When this value is “Apply” they do perform. If gas measurement is ordered, this parameter is not available. The value is “Not Apply”.
112	2112	CORROSION_CRIT	1.5 kg/l	O/S	Indicate the corrosion criteria value. When the value of CORROSION_ALM_SEL is “Not Apply”, users cannot change this value. Range 0 to 5kg/l. Unit depends on DENSITY_VALUE_RANGE units index.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
113	2113	CORROSION_DAMP	10 h	O/S	Indicates the corrosion damping time. When the value of CORROSION_ALM_SEL is “Not Apply”, users cannot change this value. Range to 0 to 10 hours.
114	2114	FLUID_MAX_TEMP	0.0	-	This parameter indicates the maximum reached fluid temperature since the last reset. User cannot reset this value, only in service.
115	2115	SELF_TEST	Not Execute	O/S	A user can execute the SELF_TEST function by this parameter. After executing the ERR_ STATUS, ALM_STATUS and WARNG_ STATUS parameter will be updated.
116	2116	INITIALIZE_EEPROM	Not Execute	O/S	A user can execute the initialization of EEP-ROM by this parameter. After a user enters a password, parameters return to default values.
117	2117	ERR_STATUS	-	-	This parameter indicates the actual error situation in RCCT3/FB.
118	2118	ALM_STATUS	-	-	This parameter indicates the actual alarm situation in RCCT3/FB.
119	2119	WARNG_STATUS	-	-	This parameter indicates the actual warning situation in RCCT3/FB.
120	2120	HIST_ORD	-	-	This parameter indicates the last 10 errors, alarms, warning events/status in their order of occurrences. The oldest will be removed after an 11th occur (first in-first out function). This parameter can be cleared by CLEAR_ HIST Parameter.
121	2121	HIST_ABS_ERR	-	-	This parameter indicates all error events/ status absolute after occurrences. This parameter can be cleared by CLEAR_ HIST.
122	2122	HIST_ABS_ALM	-	-	This parameter indicates all alarm events/ status absolute after occurrences. This parameter can be cleared by CLEAR_ HIST parameter.
123	2123	HIST_ABS_WARNG	-	-	This parameter indicates all warning events/ status absolute after occurrences. This parameter can be cleared by CLEAR_ HIST parameter.
124	2124	CLEAR_HIST	Not Execute	O/S	This parameter clear entries in the HIST_ORD, HIST_ABS_ERR, HIST_ABS_ALM, and HIST_ABS_WARNG parameter.
125	2125	ALARM_PERFORM	-	-	This parameter clears alarm/Warning information about each function block, temporarily. If a user writes 0 to a/some with this param-eter, the corresponding alarm and warning will be cleared.
126	2126	ALARM_SUM	0	-	The parameter shows current alarm.
127	2127	REFERENCE_TEMPERATURE	25°C	O/S	Indicates the temperature where the reference density of both components of the mixture has been determined.
128	2128	REFERENCE_DENSITY_CARRIER	0.997039 kg/l	O/S	Indicates the density of the carrier liquid de-termined at the reference temperature.
129	2129	TEMP_COEFF_A_CARRIER	-0.261 E-3/K	O/S	Indicates the linear temperature coefficient of the density of the carrier liquid.
130	2130	TEMP_COEFF_B_CARRIER	-0.36 E-5/K²	O/S	Indicates the quadratic temperature coefficient of the density of the carrier liquid.
131	2131	REFERENCE_DENSITY_PRODUCT	0.0 kg/l	O/S	Indicates the density of the product determined at the reference temperature.
132	2132	TEMP_COEFF_A_PRODUCT	0.0 E-3/K	O/S	Indicates the linear temperature coefficient of the density of the product.
133	2133	TEMP_COEFF_B_PRODUCT	0.0 E-5/K²	O/S	Indicates the quadratic temperature coefficient of the density of the product.

Relative Index	Index	Parameter Name	Factory Default	Write Mode	Explanation
134	2134	RCCT_SERIAL_NO_DETECTOR	-	O/S	This parameter indicates the serial number of the detector.
135	2135	RCCT_SERIAL_NO_CONVERTER	-	O/S	This parameter indicates the serial number of the converter.
136	2136	RELEASE_DATE	-	-	This parameter indicates the release date of the converter.
137	2137	RELEASE_REVISION	-	-	This parameter indicates the release revision of the converter.
138 to 219	TEST_1 to TEST_82				Service parameters, not open to customer

A1.4 Integrator (IT) Block

The Integrator (IT) block adds two main inputs and integrates them for output. The block compares the integrated and accumulated value of TOTAL_SP and PRE_TRIP and generates discrete output signals. OUT_TRIP or OUT_PTRIP when the limits are reached.
The output ia as represented by the following equation (for counting upward and rate conversion).

OUT.Value = Integration start value + Total
Total = Total + Current Integral
Current Integral = (x + y) *Δt
x: IN_1 value whose unit has been converted
y: IN_2 value whose unit has been converted
Δt: block execution period

A1.4.1 Schematic Diagram of Integrator Block

The following shows the schematic diagram of the integrator block

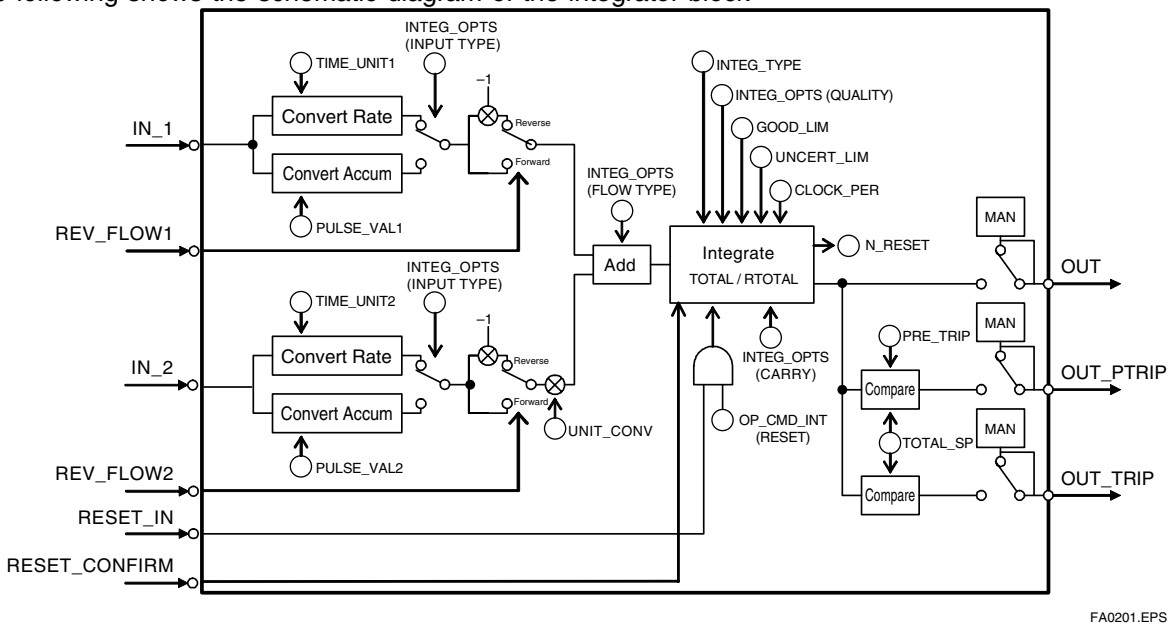

Figure A2.1 Integrator block

IN_1: Block input 1 (value and status)
IN_2: Block input 2 (value and status)
REV_FLOW1: Indicates whether the sign of IN_1 is reversed. It is a discrete signal.
REV_FLOW2: Indicates whether the sign of IN_2 is reversed. It is a discrete signal.
RESET_IN: Resets the integrated values. It is a discrete signal.
RESET_CONFIRM: Reset confirmation input. It is a discrete signal.
OUT: Block output (value and status)
OUT_PTRIP: Set if the target value exceeds
PRE_TRIP: It is a discrete signal
OUT_TRIP: Set if the target value exceeds
TOTAL_SP (or 0): It is a discrete signal.
The integration block is classified into the following five sections for each function:

- Input process section: Determines the input value status, converts the rate and accumulation, and determines the input flow direction.
- Adder: Adds the two inputs.
- Integrator: Integrates the result of the adder into the integrated value.
- Output process section: Determines the status and value of teach output parameter.
- Reset process section: Resets the integrated values.

A1.4.2 Input process Section

When executed, the Integrator block first performs input processing in the order of:
"Determining input status" ==> Converting rate or Accum ==> " Determining the input flow direction"

Switching between Convert Rate and Convert Accum is made using bit 0 (for IN_1) or bit 1 (for IN_2) of INTEG_OPTS. INTEG_OPTS is one of the system parameters and should be set by the user. The values of IN_1 and IN_2 are not retained if the power is turned OFF.

A1.4.2.1 Determining Input Value Statuses

The following shows the correlation between the statuses of input parameters (IN_1 , IN_2) and the statuses if Input values used in the Integration block.

Statuses of Input Parameters (IN_1, IN_2)	Bit 4 of INTEG_OPTS (Use Uncertain)	Bit 5* of INTEG_OPTS (Use Bad)	Status of Input Values Handled in IT Block
Good	Irrelevant	Irrelevant	Good
Bad	Irrelevant	H (=1)	Good
Bad	Irrelevant	L (=0)	Bad
Uncertain	H (=1)	Irrelevant	Good
Uncertain	L (=0)	Irrelevant	Bad

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For addition (see A2.3), if the status of an input value is "BAD" the "GOOD" value just before the status changed to "BAD" is used.

* Even if the Use Bad option is used, changing the internal status to "GOOD" the value of "GOOD" just before the status change to "BAD" is used.

A1.4.2.2 Converting the Rate

The following describes an example of rate conversion.

In rate conversion, firstly convert the unit of two inputs to that based on seconds.

Next, convert the unit of the inputs to the same units to be added together. The unit of IN_2 is standardized to that of IN_1. Then, calculates a weight, volume or energy by multiplying each input value and block execution time. Because unit information is not input to the Integrator block as an input value, the user must input in advance tuned values to the TIME_UNIT1/2 and UNIT_CONV parameters.

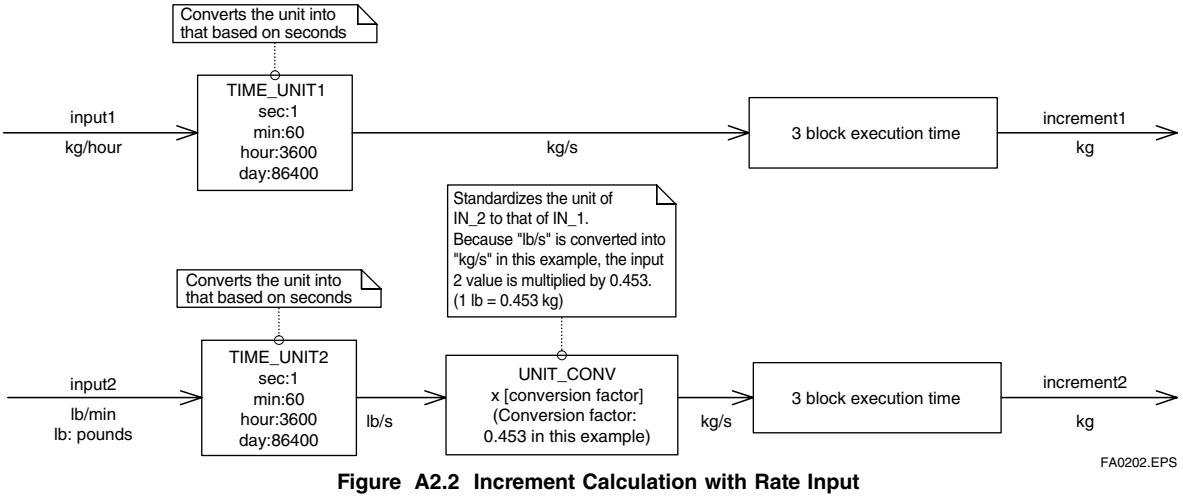

Figure A2.2 Increment Calculation with Rate Input

A1.4.2.3 Converting Accumulation

This following describes an example of accumulation conversion.

In accumulation conversion the difference between the value executed previously and the value executed this time is integrated or accumulated. This conversion applies when the output of a function block used as a counter is input to the input process of the Integrator block.

In order to convert the rate of change of an input to a value with an engineering unit, the user must configure the factor of conversion to the appropriate engineering unit in the PULSE_VAL1 and PULSE_VAL2 parameters.

Moreover, the unit of IN_2 is standardized to that of IN_1 in the same way as rate conversion. Thus, the user must also set an appropriate value to UNIT_CONV.

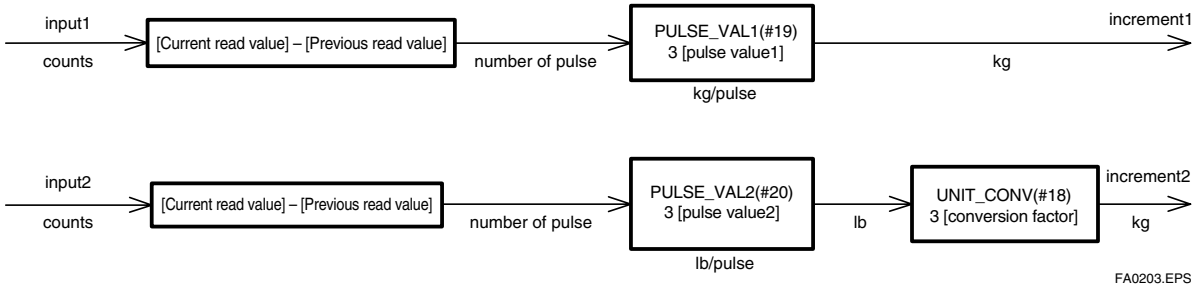

Figure A2.3 Increment Calculation with Counter Input

A1.4.2.4 Determining the Input Flow Direction

The Integrator block also considers the input flow direction. Information about the input flow direction is contained in REV_FLOW1 ans REV_FLOW2 (0: FORWARD, 1: REVERSE).

In input processing, the sign of the value after rate and accumulation conversion is reversed if the REV_FLOW1 and REV_FLOW2 parameters are set to REVERSE. When determination of the flow direction of two input values is complete, these two inputs are passed to the adder. The settings in REV_FLOW will be retained even if power is turned OFF.

A1.4.3 Adder

When input processing is complete, two arguments that have been rate and accumulate converted will be passed to the adder. The adder adds these two values according to the option.

A1.4.3.1 Status of Value after Addition

If one of the statuses of two arguments is "BAD" or if two of them are both "BAD", the status of the value after addition becomes "BAD". In this case, the value of "GOOD" just before the status changed to "BAD" is used as the addition value (see A2.1).

When the statuses of two arguments are both "GOOD" the status of the value after addition becomes "GOOD". In this case, the status of the value after addition will be used for the status applied to Integration.

A1.4.3.2 Addition

The following three options are available for additions.

- TOTAL: Adds two arguments values as is.
- FORWARD: Adds two argument values, regarding a negative value as "0".
- REVERSE: Adds two argument values, regarding a positive value as "0".

You can choose these options using bit 2 and bit 3 of INTEG_OPTS as follows:

Bit 2 of INTEG_OPTS (Flow Forward)	Bit 3 of INTEG_OPTS (Flow Reverse)	Adder Options
H	H	TOTAL
L	L	TOTAL
H	L	FORWARD
L	H	REVERSE

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The result of the adder is passed to the integrator. If only one of the inputs is connected, the value of s non-connected input will be ignored.

When bit 7 of INTEG_OPTS (Add zero if bad) has been set, if the status of a value after addition is "BAD", the value after addition (increment) becomes "0".

A1.4.4 Integrator

When addition is complete, its result will be passed to the integrator.
Integration consists of combination of a reset method and counting au/down. These are the following seven integration types, which can be set using INTEG_TYPE.

1. UP_AUTO: Counts up with automatic reset when TOTALSP is reached.
2. UP_DEM: Counts up with demand reset.
3. DN_AUTO: Counts down with automatic reset when zero is reached.
4. DN_DEM: Counts down with demand reset.
5. PERIODIC: Counts up and is reset periodically according to CLOCK_PER.
6. DEMAND: Counts up and is reset on demand.
7. PER&DEM: Counts up and is reset periodically or on demand.

Each type of integration is independently run as a function.

These are the following 4 types of integration values:

1. Total: Integrates the result of the adder as is
2. ATotal: Integrates the absolute value of the result of the adder.
3. Rtotal: Integrates the absolute value of the result of the adder only if the status of the result is "BAD".
   This value is used for the RTOTAL value.
4. AccTotal: Am extension function. The result of the adder is integrated as is and will not be reset.

The value is used for the ACCUM_TOTAL (expand parameter) value.
The table A2.1 shows the details of INTEG_TYPE.

Table A2.1 INTEG_TYPE

Name	Integration Method	Integration Range	Reset Trigger (Reset if one of the following conditions is established)	Trip Output
UP_AUTO(1)	Counting up Starting from "0"	-INF< Total <TOTAL_SP 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• OUT reaches TOTAL_SP. • RESET_IN = 1 • OP_CMD_INT = 1	s
UP_DEM(2)	Counting up Starting from "0"	-INF< Total <+INF 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• RESET_IN = 1 • OP_CMD_INT = 1	s
DN_AUTO(3)	Counting down Starting from TOTAL_SP	0< Total <+INF 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• OUT reaches "0." • RESET_IN = 1 • OP_CMD_INT = 1	s
DN_DEM(4)	Counting down Starting from TOTAL_SP	-INF< Total <+INF 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• RESET_IN = 1 • OP_CMD_INT = 1	s
PERIODIC(5)	Counting up Starting from "0"	-INF< Total <+INF 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• At the period specified by CLOCK_PER • OP_CMD_INT = 1	3
DEMAND(6)	Counting up Starting from "0"	-INF< Total <+INF 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• RESET_IN = 1 • OP_CMD_INT = 1	3
PER&DEM(7)	Counting up Starting from "0"	-INF< Total <+INF 0< ATotal <+INF 0< RTotal <+INF -INF< AccTotal <+INF	• At the period specif. by CLOCK_PER • RESET_IN = 1 • OP_CMD_INT = 1	3

Legend s: Trip output is made. 3: No trip output is made.

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A1.4.5 Output Process

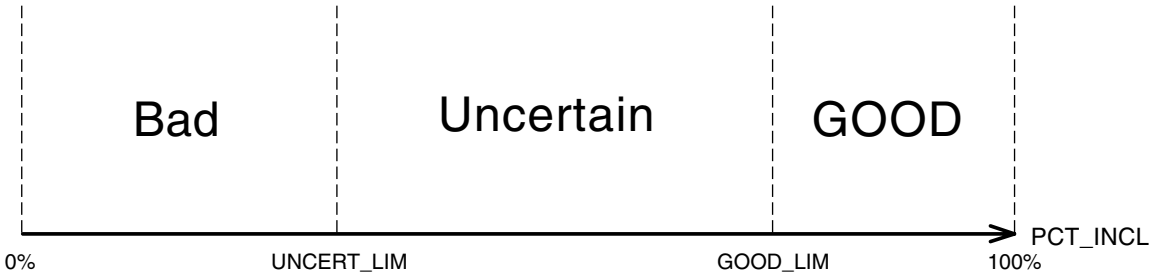
There are the following three output parameters:

1. OUT
2. OUT_TRIP
3. OUT_PTRIP

Parameters OUT_TRIP and OUT_PTRIP are used only when INTEG_TYPE is a value from 1 to 4. In case of Integrator block related memory failed, the status of OUT_TRIP, OUT_PTRIP becomes "Bad-Device-Failure".

A1.4.5.1 Status Determination

The same criteria for determining the status of the output of the Integrator block are used in common for the above three parameters.



PCT_INCL=1003(1 - (msp of RTotal)/(msp of ATotal))

msp of RTotal: RTotal value that is converted into a short floating-point number
msp of ATotal: ATotal value that is converted into a short floating-point number
RTotal: Integrated value of the absolute values of the increments whose status is bad
ATotal: Integrated value of the absolute values of the increments regardless of the output status

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Figure A2.4 Status of OUT_TRIP and OUT_PTRIP Outputs

OUT.Value, OUT_TRIP.Status and OUT_PTRIP. Status are determined by the ratio of the "GOOD" integrated values to all integrated values, which is stored in PCT_INCL (0% to100%). The user must set the threshold value of each status to UNCERT_LIM and GOOD_LIM.

The integrator block determines the status of the output using the three parameters:
PCT_LIM, UNCERT_LIM and GOOD_LIM.

- PCT_INCL >= GOODLIM ==> Good
- UNCERT_LIM <= PCT_INCL < GOOD_LIM ==> Uncertain
- PCT_INCL < UNCERT-LIM ==> Bad

If INTEG_TYPE is 5, 6 or 7, the status of the trip output becomes "Good-NS-Constant".

A1.4.5.2 Determining the Output Value

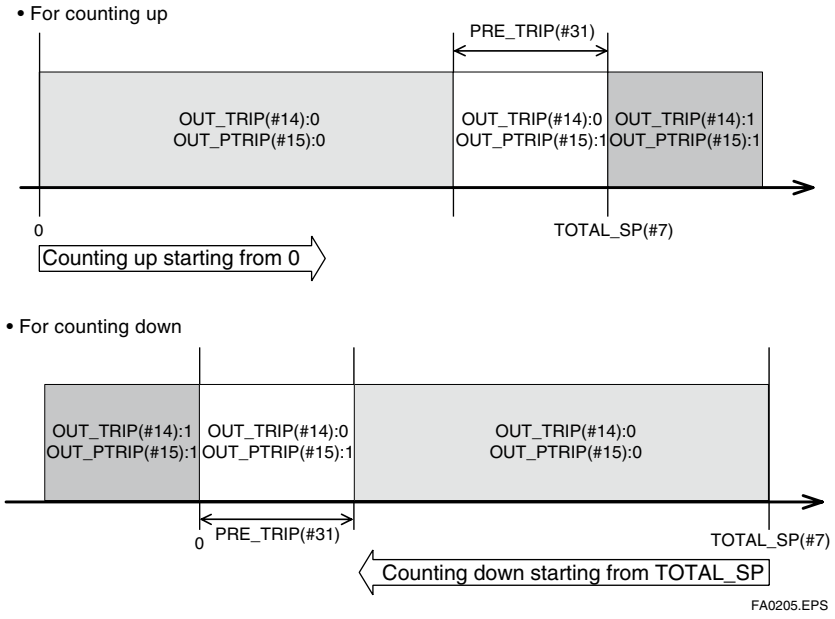
The value of OUT.Value is determined as follows:

- For counting up
  OUT = integration start value (0) + Total
- For counting down
  OUT = integration start value (TOTAL_SP) - Total

Total: Total of integrated values. This value is retained even if INTEG_TYPE is changed during integration (in AUTO).

If OUT is rewritten in the MAN mode, integration starts with the value rewritten in MAN mode after the mode wa returned to AUTO.

The values OUT_TRIP and OUT_PTRIP are determined according to the correlation between OUT and TOTAL_SP/PRE_TRIP.



For counting up, the OUT value is follows:

- OUT < TOTAL_SP - PRE_TRIP
  ==> OUT_TRIP = 0, COUNT_PTRIP = 0
- TOTAL_SP - PRE_TRIP <= OUT < TOTAL_SP
  ==> OUT_TRIP = 0, COUNT_PTRIP = 1
- TOTAL_SP <= OUT
  ==> OUT_TRIP = 1, COUNT_PTRIP = 1

For counting down, the OUT value is follows:

- PTRIP < OUT
  ==> OUT_TRIP = 0, COUNT_PTRIP = 0
- 0 < OUT <=PRE_TRIP
  ==> OUT_TRIP = 0, COUNT_PTRIP = 1
- OUT <= 0
  ==> OUT_TRIP = 1, COUNT_PTRIP = 1

Note that the given conditions do not apply to the following cases:

- If INTEG_TYPE is 5, 6 or 7, OUT_TRIP and OUT_PTRIP always output "0".
- IF INTEG_TYPE is 1 to 3, occurrence of AutoRESET (reset caused if the threshold is exceeded) causes OUT_TRIP to hold "1" fir five seconds.

A1.4.5.3 Mode Handling

Mode	Action	Output
Automatic (AUTO)	Normal action	Normal output
Manual (MAN)	Integration calculation is stopped. OUT will not be updated unless you set a value to it. No reset is accepted.	You may rewrite a value in OUT. If no value is rewritten, the value just before running in AUTO is held. When the mode returns to AUTO, integration starts with the written value or the value just before running in AUTO.
Out of Service (O/S)		

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If you rewrite the value in OUT and RTOTAL, while the mode is in MAN or O/S, N_RESET is incremented.

A1.4.6 Reset

A1.4.6.1 Reset Trigger

There are the following five types of reset triggers:

1. An integrated value exceeds TOTAL_SP.
2. An integrated value fall below "0".
3. RESET_IN is "H".
4. Every period specified in CLOCK_PER (for more information see CLOCK_PER in A2.6.2.).
5. OP_CMD_INT is "1".

The table A2.2 shows the correlation between INTEG_TYPE and RESET triggers.

Table A2.2 RESET Triggers

	(1)	(2)	(3)	(4)	(5)
1:UP_AUTO	○	×	○	×	○
2:UP_DEM	×	×	○	×	○
3:DN_AUTO	×	○	○	×	○
4:DN_DEMO	×	×	○	×	○
5:PERIODIC	×	×	×	○	○
6:DEMAND	×	×	○	×	○
7:PER&DEM	×	×	○	○	○

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When OP_CMD_INT has become "H" and a reset was made, OP_CMD_INT automatically returns to "L".

Even if RESET_IN becomes "H", activating a reset, RESET_IN does not automatically return to "L".

The RESET_IN setting will not be retained if the power is turned to OFF.

A1.4.6.2 Reset Timing

All items are reset during execution of the function block. Therefore, the minimum period of a reset is the block execution period.

- 5- second rule

If a reset is made, the next reset will not be accepted for 5 seconds after that.
Even if UP_AUTO (or DN_AUTO) is activated and TOTAL_SP (or 0) is reached within 5 seconds, the next reset will nit be made for 5 secondes from the previous reset.

- CLOCK_PER

If INTEG_TYPE is PERIODIC (5) or PER&DEM (7) a reset is made at the period (sec) set to the CLOCK_PER parameter.
If the value in CLOCK_PER is smaller than the function block´s execution period. bit 1 of BLOCK_ERR "Block Configuration Error) is set.

A1.4.6.3 Reset Process

The basic reset process sequence is as follows.

1. Snapshot
2. Clearing the integrated values
3. Reset count increment
4. Judging OUT_TRIP and OUT_PTRIP (see A2.5)

1) Snapshot

Saves the following values in the specified parameters before clearing the integrated values. These values will be retained until the next reset is made.

STOTAL = Total

SRTOTAL = RTotal

SSP = TOTAL_SP

2) Clearing the integrated values

The reset process clears the total. ATotal and RTotal values in the internal registers.

Total = 0

ATotal = 0

RTotal = 0

3) Reset count increment

Each time a reset is made, the N_RESET parameter will be incremented.

The high limit is 999,999 and if this limit is exceeded, the count returns to "0".

4) Judging OUT_TRIP and OUT_PTRIP (see A2.5)

OUT_TRIP and OUT_PTRIP are judged again on the basis of the cleared integrated values.

There atre three options relating to a reset:

i Confirm reset (bit 8 of INTEG_OPTS)

ii Carry (bit 6 of INTEG_OPTS)

iii Generate reset event (bit 9 of INTEG_OPTS)

i Confirm reset (bit 8 of INTEG_OPTS)

If this option is enabled, the next reset is rejected until "1" is set to RESET_CONFIRM.

ii Carry (bit 6 of INTEG_OPTS)

If this option is enabled while INTEG_TYPE is UP_AUTO or DN_AUTO, the value exceeding the threshold at a reset will bw carried into the next integration.

If INTEG_TYPE is any setting other than UP_AUTO or DN_AUTO, this option is irrelevant.

iii Generate reset event (bit 9 of INTEG_OPTS)

If this option is enabled, an alert event is generated if a reset occurs.

A1.4.7 List of Integrator Block Parameters

Index	Parameter Name	Initial Value	Write Mode	View 1	View 2	View 3	View 4	Definition
0	BLOCK_HEADER	IT1:TAG="IT1" IT2:TAG="IT2"	Block Tag =o/s					Information relating to this function block, such as block tag, DD revision, execution time
1	ST_REV	0	—	2	2	2	2	The revision level of the set parameters associated with the Integrator block
2	TAG_DESC	Spaces						Stores comments describing tag information.
3	STRATEGY	1					2	The strategy field is used by a high-level system to identify the function block.
4	ALERT_KEY	1					1	Key information used to identify the location at which an alert occurred
5	MODE_BLK			4		4		Integrator block mode. O/S, MAN, and AUTO are supported.
6	BLOCK_ERR	0	—	2		2		Indicates the active error conditions associated with the function block in bit strings.
7	TOTAL_SP	1000000.0	Auto	4		4		The setpoint of an integrated value or a start value for counting down
8	OUT		MAN	5		5		The block output
9	OUT_RANGE	1000000.0 0.0 m3(1034) 0			11			Set scaling for output display. This does not affect operation of the function block. It is used for making memos.
10	GRANT_DENY	0			2			The parameter for checking if various operations have been executed
11	STATUS_OPTS	0	OS				2	Allows you to select a status-related option. The Integrator block uses "Uncertain if Man mode" only.
12	IN_1	0.0	Auto	5		5		Inputs flow (Rate, Accum) signals from the AI block or PI block.
13	IN_2	0.0	Auto	5		5		
14	OUT_TRIP	0		2		2		An output parameter informing the user that the integrated value has exceeded the setpoint
15	OUT_PTRIP	0		2		2		An output parameter informing the user that the integrated value is reaching the setpoint
16	TIME_UNIT1	sec(1)	MAN		1			Set the time unit of the rate (kg/s, lb/min, kg/h ... etc.) of the corresponding IN.
17	TIME_UNIT2	sec(1)	MAN		1			
18	UNIT_CONV	1.0	Auto				4	Specify the unit conversion factor for standardizing the unit of IN_2 into that of IN_1.
19	PULSE_VAL1	1.0	MAN				4	Set the factor for converting the number of pulses for the corresponding IN into an appropriate engineering unit.
20	PULSE_VAL2	1.0	MAN				4	
21	REV_FLOW1	0	Auto	2		2		Selector switch used to specify the fluid flow direction (forward/reverse) with respect to the corresponding IN
22	REV_FLOW2	0	Auto	2		2		
23	RESET_IN	0	Auto	2		2		The parameter that receives a reset request from an external block to reset the integrated values
24	STOTAL	0.0				4		Indicates the snapshot of OUT just before a reset.
25	RTOTAL	0.0	MAN	4		4		Indicates the integrated value of the absolute values of the increments if the input status is "Bad."
26	SRTOTAL	0.0				4		Indicates the snapshot of RTOTAL just before a reset.
27	SSP	0.0				4		Indicates the snapshot of TOTAL_SP just before a reset.
28	INTEG_TYPE	UP_AUTO (1)	Auto				1	Integration Type Setting
29	INTEG_OPTS	030004	Auto				2	Specifies an integration optional function.

Integration Type Setting

Value	Name	Description
1	UP_AUTO	Counts up and is automatically reset when TOTAL_SP is reached.
2	UP_DEM	Counts up and is reset as demanded.
3	DN_AUTO	Counts down and is automatically reset when "0" is reached.
4	DN_DEM	Counts down and is reset as demanded.
5	PERIODIC	Counts up and is reset at periods specified in CLOCK_PER.
6	DEMAND	Counts up and is reset as demanded.
7	PER&DEM	Reset periodically or as demanded.

Specifies an integration optional function.

bit	Option Name	Description
0	Input 1 accumulate	Selects Rate or Accum input of IN_1.
1	Input 2 accumulate	Selects Rate or Accum input of IN_2.
2	Flow forward	Integrates forward flow (interprets reverse flow as zero).*
3	Flow reverse	Integrates reverse flow (interprets forward flow as zero).*
4	Use uncertain	Uses an input value of IN_1 or IN_2 whose status is "Uncertain" regarding it as a value of "Good."
5	Use bad	Uses an input value of IN_1 or IN_2 whose status is "Bad" regarding it as a value of "Good."
6	Carry	Carries over an excess exceeding the threshold at reset to the next integration. (Note that this does not apply to UP_AUTO or DN_AUTO.)
7	Add zero if bad	Interprets an increment as zero if the status of the increment is "Bad."
8	Confirm reset	After a reset, rejects the next reset until "Confirm" is set to RESET_CONFIRM.
9	Generate reset event	Generates an alert event at reset.
10z15	Reserved	

* If both forward and reverse flows are enabled or disabled, both forward and reverse flows are integrated.

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Index	Parameter Name	Initial Value	Write Mode	View				Definition
				1	2	3	4	
30	CLOCK_PER	86400.0[sec]	Auto				4	Specify the period at which a periodic reset is made.
31	PRE_TRIP	100000.0	Auto				4	Set an allowance applied before an integrated value exceeds the setpoint.
32	N_RESET	0.0		4		4		Indicates the number of resets in the range of 0 to 999999.
33	PCT_INCL	0.0[%]		4		4		The ratio of "the integrated values of the absolute values of the increments whose status is Good" to the "integrated values of the absolute values of the increments irrelevant to the status" (Equation)
34	GOOD_LIM	0.0[%]	Auto				4	The threshold value of the ratio of "the integrated values of the increments whose status is Good" to all integrated values in which the status of OUT is "Good"
35	UNCERT_LIM	0.0[%]	Auto				4	The threshold value of the ratio of "the integrated values of the increments whose status is Good" to all the integrated values in which the status of OUT is "Uncertain"
36	OP_CMD_INT	0	Auto	1		1		Operator command that resets integrated values
37	OUTAGE_LIM	0.0	Auto				4	Maximum time for which values can be retained in the event of power failure. It does not effect the block operation.
38	RESET_CONFIRM	0	Auto	2		2		Reset confirmation input, which is enabled when the Confirm reset option of INTEG_OPTS is chosen
39	UPDATE_EVT	1 1 0 0 0						Indicates event information if an update event occurs.
40	BLOCK_ALM	1 1 0 0 0						Indicates alarm information if a block alarm occurs.
41	ACCUM_TOTAL	0.0	Auto			4		Accumulated integrated values (no extension parameter is reset)

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APPENDIX 2. APPLICATION, SETTING AND CHANGE OF BASIC PARAMETERS

A2.1 Applications and Selection of Basic Parameters

Setting Item (applicable parameters)	Summary
Tag numbers	Set the physical (PD) tag and blocking tags. Up to 32 alphanumeric characters can be set for each of these tags. refer to Section 5.4, „Setting of tags and Addresse“.
Calibration range setup (XD_SCALE of AI block)	Sets the range of inputs from the transducer block corresponding to the 0% and 100% points in operation within the AI1 function block. The maximumflow rate range on an order sheet is the factoty default setting. Set four data: the unit of the range, the input value at the 0% point (always for Rotamass), the input value at the 100% point (equal to the flow span), and the decimal point position.
Output scale setup (OUT_SCALE of AI block)	Set the scale of output corresponding to the 0% and 100% points in operation with the AI function block. It is possible to set a unit, and scale that differ from the measuring range. Set four data: the unit of the scale, the output value at the 0% point (i.e. the lower output scale limit), the output value at the 100% point (i.e the upper output scale limit), and the decimal point position.
Output mode setup (L- TYPE of AI block)	Select the calculation function of each AI function block from the following: - Direct: The output function of the transducer block is directly output only via filtering without scaling and square root extraction (in the range set in XD_SCALE). - Indirect: Proportional scaling is applied to the the input of AI function bloc, and the result is output (in the range set in OUT_SCALE). -IndirectSQRT:Squre root extraction is applied to the the input of AI function bloc, and the result is output (in the range set in OUT_SCALE). This setting is not used for Rotamass. This output mode setting also applies to the scale and unit of indications on the LCD-indicator.
Damping time constant setup (MASS_FLOW_VALUE_FTIME of TB block)	Set the time constant of damping in seconds. Thesetting of MASS_FLOW_VALUE_FTIME affects not only the flow rate but also the totalization. In comparison, the setting of parameter PV_TIME in an AI function block works as the damping time constant for the AI Blockr's OUT. As the damping feature of the flowmeter itself, it is advisable to use MASS_FLOW_VALUE_FTIME.
Output signal low cut mode setup (MASS_FLOW_LOW_CUT of TB block)	This setup is used for zeroing flow rate readings in a low flow rate area. The value of MASS_FLOW_LOW_CUT (the cutoff level) is set in the same unit as that for MASS_FLOW_VALUE_RANGE. In comparision, the setting of parameter LOW_CUT in in an AI function block works as a low cutoff level setting the AI blockr's OUT. As the low cutoff feature of the flowmeter itself, it is advisible to us MASS_FLOW_LOW_CUT.
Simulation setup (SIMULATE of AI/DI block)	Simulation of each AI/IT block can be performed in such a way that the value and status of the input to the block can be set arbitrarily. Use this function for loop checks or the like. Refer to Section 6.3, „Simulation Function“.
LCD display setup (DISP_PERIOD of TB block)	Set the units of data to be displayedon the LCD, and the display refresh cycle. Adjust DISPLAY_PERIOD to improve legibility such as when used in a low temperature enviroment causing hard-to-read indications.

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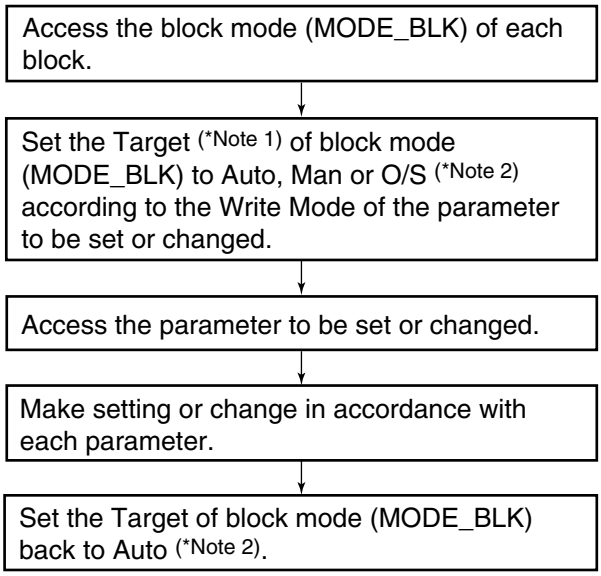
A2.2 Setting and Change of Basic Parameters

This section describes the procedure taken to set and change the parameters for each block. Obtaining access to each parameter differs depending on the configuration system used. For details, refer to the instruction manual for each configuration system.



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Note 1: Block mode consists of the following four modes that are controlled by the universal parameter that displays the running condition of each block.
- Target: Sets the operating condition of the block.
- Actual: Indicates the current operating condition.
- Permit: Indicates the operating condition that the block is allowed to take.
- Normal: Indicates the operating condition that the block will usually take.

Note 2: The followings are the operating conditions which the individual blocks will take.

	AI Function Blocks	Transducer Block	Resource Block
Automatic (Auto)	Yes	Yes	Yes
Manual (Man)	Yes		
Out of Service (O/S)	Yes	Yes	Yes

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Note: Refer to Appendix 1, “List of parameters for each block of ROTAMASS” for details of the Write Mode for each block.

A2.3 Setting the AI Function Blocks

Each ROTAMASS contains six AI function blocks (AI1 to AI6) having independent parameters.Set up the parameters of each AI block you use, individually as necessary.

The AI1 block performs the mass flow rate output calculation.

(1)-1. Setting the calibration range

Access the XD_SCALE parameter.
Set the required unit in Unit Index of XD_SCALE.
Set the upper range limit in EU at 100% of XD_SCALE.
Set the lower range limit in EU at 0% of XD_SCALE.

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Example:
To measure 0 to 100t/h,
Set t/h (1328)*1 in Units Index of XD_SCALE,
Set 100 in EU at 100% of XD_SCALE, and
Set 0 in EU at 0% of XD_SCALE.

(1)-2. Setting the output scale

Access the OUT_SCALE parameter.
Set the required unit in Unit Index of OUT_SCALE.
Set the output value corresponding to the upper range limit in EU at 100% of OUT_SCALE.
Set the output value corresponding to the lower range limit in EU at 0% of OUT_SCALE.

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Example:
To set the output range to 0.00 to 100000.00kg/h,
Set kg/h(1324)*1 in Units Index of OUT_SCALE,
Set 100000 in EU at 100% of OUT_SCALE,
Set 0 in EU at 0% of OUT_SCALE.

The AI2 block performs the volume flow output calculation.

(2)-1. Setting the calibration range

Access the XD_SCALE parameter.
Set the required unit in Unit Index of XD_SCALE.
Set the upper range limit in EU at 100% of XD_SCALE.
Set the lower range limit in EU at 0% of XD_SCALE.

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Example:
To measure 0 to 10m³/h,
Set m³/h (1349)*1 in Units Index of XD_SCALE,
Set 10 in EU at 100% of XD_SCALE, and
Set 0 in EU at 0% of XD_SCALE.

(2)-2. Setting the output scale

Access the OUT_SCALE parameter.
Set the required unit in Unit Index of OUT_SCALE.
Set the output value corresponding to the upper range limit in EU at 100% of OUT_SCALE.
Set the output value corresponding to the lower range limit in EU at 0% of OUT_SCALE.

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Example:
To set the output range to 0.00 to 10000.00l/h,
Set l/h (1353)*1 in Units Index of OUT_SCALE,
Set 10000 in EU at 100% of OUT_SCALE,
Set 0 in EU at 0% of OUT_SCALE.

The AI3 block performs the density output calculation.

(3)-1. Setting the calibration range

Access the XD_SCALE parameter.
Set the required unit in Unit Index of XD_SCALE.
Set the upper range limit in EU at 100% of XD_SCALE.
Set the lower range limit in EU at 0% of XD_SCALE.

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Example:
To measure 0.0 to 1.5kg/l,
Set kg/l (1103)*1 in Units Index of XD_SCALE,
Set 1.5 in EU at 100% of XD_SCALE, and
Set 0 in EU at 0% of XD_SCALE.

(3)-2. Setting the output scale

Access the OUT_SCALE parameter.
Set the required unit in Unit Index of OUT_SCALE.
Set the output value corresponding to the upper range limit in EU at 100% of OUT_SCALE.
Set the output value corresponding to the lower range limit in EU at 0% of OUT_SCALE.

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Example:
To set the output range to 0 to 1500kg/m³,
Set kg/m³ (1097)*1 in Units Index of OUT_SCALE,
Set 1500 in EU at 100% of OUT_SCALE,
Set 0 in EU at 0% of OUT_SCALE.

The AI4 block performs the temperature output calculation

(4)-1. Setting the calibration range

Access the XD_SCALE parameter.
Set the required unit in Unit Index of XD_SCALE.
Set the upper range limit in EU at 100% of XD_SCALE.
Set the lower range limit in EU at 0% of XD_SCALE.

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Example:
To measure 0 to 200°C,
Set °C (1001)*1 in Unit Index of XD_SCALE.
Set 200 in EU at 100% of XD_SCALE.
Set 0 in EU at 0% of XD_SCALE.

(4)-2. Setting the output scale

Access the OUT_SCALE parameter.
Set the required unit in Unit Index of OUT_SCALE
Set the output value corresponding to the upper range limit in EU at 100% of OUT_SCALE.
Set the output value corresponding to the lower range limit in EU at 0% of OUT_SCALE.

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Example:
To set the output range to 0 to 200°C,
Set °C (1001)*1 in Unit Index of XD_SCALE.
Set 200 in EU at 100% of XD_SCALE.
Set 0 in EU at 0% of XD_SCALE.
*1: Each unit is expressed using a 4-digit numeric code. Refer to Section 5.6.4, "AI Function Block Parameters."

(5) Setting the output mode

Access the L_TYPE parameter
Set the output mode :
1: Direct (Sensor output value)
2 : Indirect (Linear output value)

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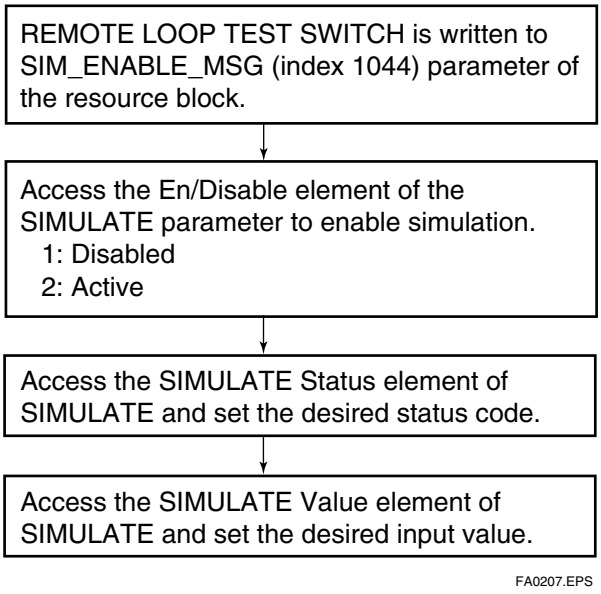
(6) Simulation

Perform simulation of each AI function block by setting the desired value and status of the input to the block.



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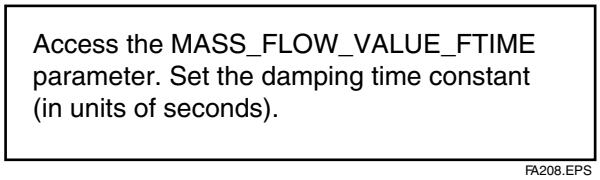
If simulation is enabled, AI block uses SIMULATE Status and SIMULATE Value as the input, and if disabled, the AI block uses Transducer Status and Transducer Value as input. Refer to Section 6.3, “Simulation Function.”

A2.4 Setting the Transducer Block

To access the ROTAMASS-specific functions in the transducer block, the Device Description (DD) for the ROTAMASS needs to have been installed in the configuration tool used. For installation, refer to Section 4.4, “Integration of DD.”

(1) Setting the damping time constant



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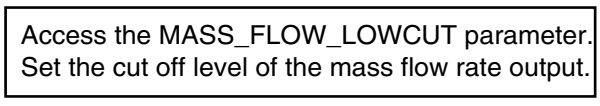
(2) Setting the output low cutoff level



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(3) Continue with setting of

VOL

DENS

TEMP

according (1) and (2)

(4) Setting up the LCD display

Select the data to be displayed on the LCD indicator and the display refresh cycle.

First select the data to be displayed on the four lines of the LCD. Use the DISP_SELECT_1/2/3/4 parameter and select an item:

1: Mass flow rate	Actual mass flow rate in the specified unit
2: Volume flow rate	Actual volume flow rate in the specified unit
3: Density value	Actual density value in the specified unit
4: Temperature	Actual temperature value in the specified unit
5: Concentration (Option)	Actual concentration value in the specified unit
6: Net flow rate (Option)	Actual net flow rate in the specified unit
7: Integrator 1	Totalized value of mass, volume or net in the specified unit
8: Integrator 2	Totalized value of mass, volume or net in the specified unit
9: Velocity	The velocity of the medium (for liquids only)
10: None	No value will be displayed (Not possible for line 1)

The DISP_SELECT_1, DISP_SELECT_2, DISP_SELECT_3 and DISP_SELECT_4 parameter settings in the transducer (TR) block, and the L_TYPE settings in the AI1, AI2, AI3, AI4, AI5 and AI6 blocks determine which data items, and their values and units, are displayed on the LCD indicator, as shown in the following tables. Please refer to A4.1.

Display on Upper Row of LCD Indicator

DISP_SELECT_x	Displayed Value, Display Unit, and Display Format		
MASSFLOW RATE	L_TYPE of AI1	= DIRECT	= INDIRECT
	Value	OUT.Value of AI1	OUT.Value of AI1 (scaled based on XD_SCALE and OUT_SCALE)
	Unit	As specified by XD_SCALE Units Index of AI1	As specified by OUT_SCALE Units Index of AI1
	Format	As specified by the parameter DISP_DECIMAL_MASS_FLOW	As specified by the parameter DISP_DECIMAL_MASS_FLOW
VOLUMEFLOW RATE	L_TYPE of AI2	= DIRECT	= INDIRECT
	Value	OUT.Value of AI2	OUT.Value of AI2 (scaled based on XD_SCALE and OUT_SCALE)
	Unit	As specified by XD_SCALE Units Index of AI2	As specified by OUT_SCALE Units Index of AI2
	Format	As specified by the parameter DISP_DECIMAL_VOLUME_FLOW	As specified by the parameter DISP_DECIMAL_VOLUME_FLOW
DENSITY	L_TYPE of AI3	= DIRECT	= INDIRECT
	Value	OUT.Value of AI3	OUT.Value of AI3 (scaled based on XD_SCALE and OUT_SCALE)
	Unit	As specified by XD_SCALE Units Index of AI3	As specified by OUT_SCALE Units Index of AI3
	Format	As specified by the parameter DISP_DECIMAL_DENSITY	As specified by the parameter DISP_DECIMAL_DENSITY
TEMPERATURE	L_TYPE of AI4	= DIRECT	= INDIRECT
	Value	OUT.Value of AI4	OUT.Value of AI4 (scaled based on XD_SCALE and OUT_SCALE])
	Unit	As specified by XD_SCALE Units Index of AI4	As specified by OUT_SCALE Units Index of AI4
	Format	As specified by the parameter DISP_DECIMAL_TEMPERATURE	As specified by the parameter DISP_DECIMAL_TEMPERATURE
CONCENTRATION MEASUREMENT (option Cxx)	L_TYPE of AI5	= DIRECT	= INDIRECT
	Value	OUT.Value of AI5	OUT.Value of AI5 (scaled based on XD_SCALE and OUT_SCALE)
	Unit	As specified by Concentr_Meas_Unit in TB (Factory set)	As specified by OUT_SCALE Units Index of AI5
	Format	As specified by the parameter DISP_DECIMAL_CONCENTRATION	As specified by the parameter DISP_DECIMAL_CONCENTRATION
NETFLOWRATE (option Cxx)	L_TYPE of AI6	= DIRECT	= INDIRECT
	Value	OUT.Value of AI6	OUT.Value of AI6 (scaled based on XD_SCALE and OUT_SCALE)
	Unit	As specified by XD_SCALE Units Index of AI6	As specified by OUT_SCALE Units Index of AI6
	Format	As specified by the parameter DISP_DECIMAL_NET_FLOW	As specified by the parameter DISP_DECIMAL_NET_FLOW

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APPENDIX 3. OPERATION OF EACH PARAMETER IN FAILURE MODE

1. Parameter Values upon Failure

See table on next pages.

** Transducer Block... PV = MassFlow, SV = VolumeFlow, TV = Dencity, QV = Temperture, 5V = Concentration, 6V = NetFlow

ALARM Display	Content	RS Block	TB Block	Function	Function	Function	Function	Function	Function
				Block AI 1	Block AI 2	Block AI 3	Block AI 4	Block AI 5	Block AI 6
E-01	Frequency Failure (f < Freq low limit or f > Freq high limit)		BLOCK_ERR= Other XD_ERROR = Frequency Failure	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	_	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status
			PV. STATUS= BAD: Sensor Failure	PV. STATUS=BAD: Sensor Failure					
			OUT.STATUS= BAD Sensor Failure	OUT.STATUS= BAD Sensor Failure					
			SV. STATUS=BAD: Sensor Failure	PV. STATUS=BAD: Sensor Failure					
				OUT.STATUS= BAD Sensor Failure					
			TV. STATUS=BAD: Sensor Failure		PV. STATUS=BAD: Sensor Failure				
					OUT.STATUS= BAD Sensor Failure				
			_				_		
							_		
			5V. STATUS=BAD: Sensor Failure					PV. STATUS=BAD: Sensor Failure	
								OUT.STATUS= BAD Sensor Failure	
			6V. STATUS=BAD: Sensor Failure						PV. STATUS=BAD: Sensor Failure
									OUT.STATUS= BAD Sensor Failure
E-02	Signal Failure ($\Delta\phi$ < P D low limit or $\Delta\phi$ > P D high limit)		BLOCK_ERR= Other XD_ERROR = Signal Failure	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	_	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status
			PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure						
			SV. STATUS=BAD: Sensor Failure	PV.STATUS=BAD: Sensor Failure					
				OUT.STATUS= BAD Sensor Failure					
			TV. STATUS=BAD: Sensor Failure		PV. STATUS=BAD: Sensor Failure				
					OUT.STATUS= BAD Sensor Failure				
			_				_		
							_		
			5V. STATUS=BAD: Sensor Failure					PV. STATUS=BAD: Sensor Failure	
								OUT.STATUS= BAD Sensor Failure	
			6V. STATUS=BAD: Sensor Failure						PV. STATUS=BAD: Sensor Failure
									OUT.STATUS= BAD Sensor Failure
E-03	EEPROM Failure	BLOCK_ERR =Lost Static Data or Lost NV Data	BLOCK_ERR= Other XD_ERROR = EEPROM Failure	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status
			PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure					
			SV. STATUS=BAD: Device Failure		PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure				
			TV. STATUS=BAD: Device Failure			PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure			
			QV. STATUS=BAD: Device Failure				PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure		
			5V. STATUS=BAD: Device Failure					PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure	
			6V. STATUS=BAD: Device Failure						PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure

E-04	CPU Failure		BLOCK_ERR= Other XD_ERROR = CPU Failure	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status
			PV. STATUS=BAD: Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure						
			SV. STATUS=BAD: Device Failure		PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure					
			TV. STATUS=BAD: Device Failure			PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure				
			QV. STATUS=BAD: Device Failure				PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure			
			5V. STATUS=BAD: Device Failure					PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure		
			6V. STATUS=BAD: Device Failure						PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure	
E-05	DSP Failure		BLOCK_ERR= Other XD_ERROR = DSP Failure	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status
			PV. STATUS=BAD :Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure						
			SV. STATUS=BAD: Device Failure		PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure					
			TV. STATUS=BAD: Device Failure			PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure				
			QV. STATUS=BAD: Device Failure				PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure			
			5V. STATUS=BAD: Device Failure					PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure		
			6V. STATUS=BAD: Device Failure						PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure	
E-06	Sensor1 Signal Failure (S1 < 7% of normal Drive Amplitude)		BLOCK_ERR= Other XD_ERROR = Sensor 1 Signal fault	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	_	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status
			PV. STATUS=BAD: Sensor Failure	PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure						
			SV. STATUS=BAD: Sensor Failure		PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure					
			TV. STATUS=BAD: Sensor Failure			PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure				
			_				_ _ _			
			5V. STATUS=BAD: Sensor Failure					PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure		
			6V. STATUS=BAD: Sensor Failure						PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure	
E-07	Sensor2 Signal Failure (S2 < 7% of normal Drive Amplitude)		BLOCK_ERR= Other XD_ERROR = Sensor 2 Signal fault	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	_	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status
			PV. STATUS=BAD: Sensor Failure	PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure						
			SV. STATUS=BAD: Sensor Failure		PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure					
			TV. STATUS=BAD: Sensor Failure			PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure				
			_				_ _ _			
			5V. STATUS=BAD: Sensor Failure					PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure		
			6V. STATUS=BAD: Sensor Failure						PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure	

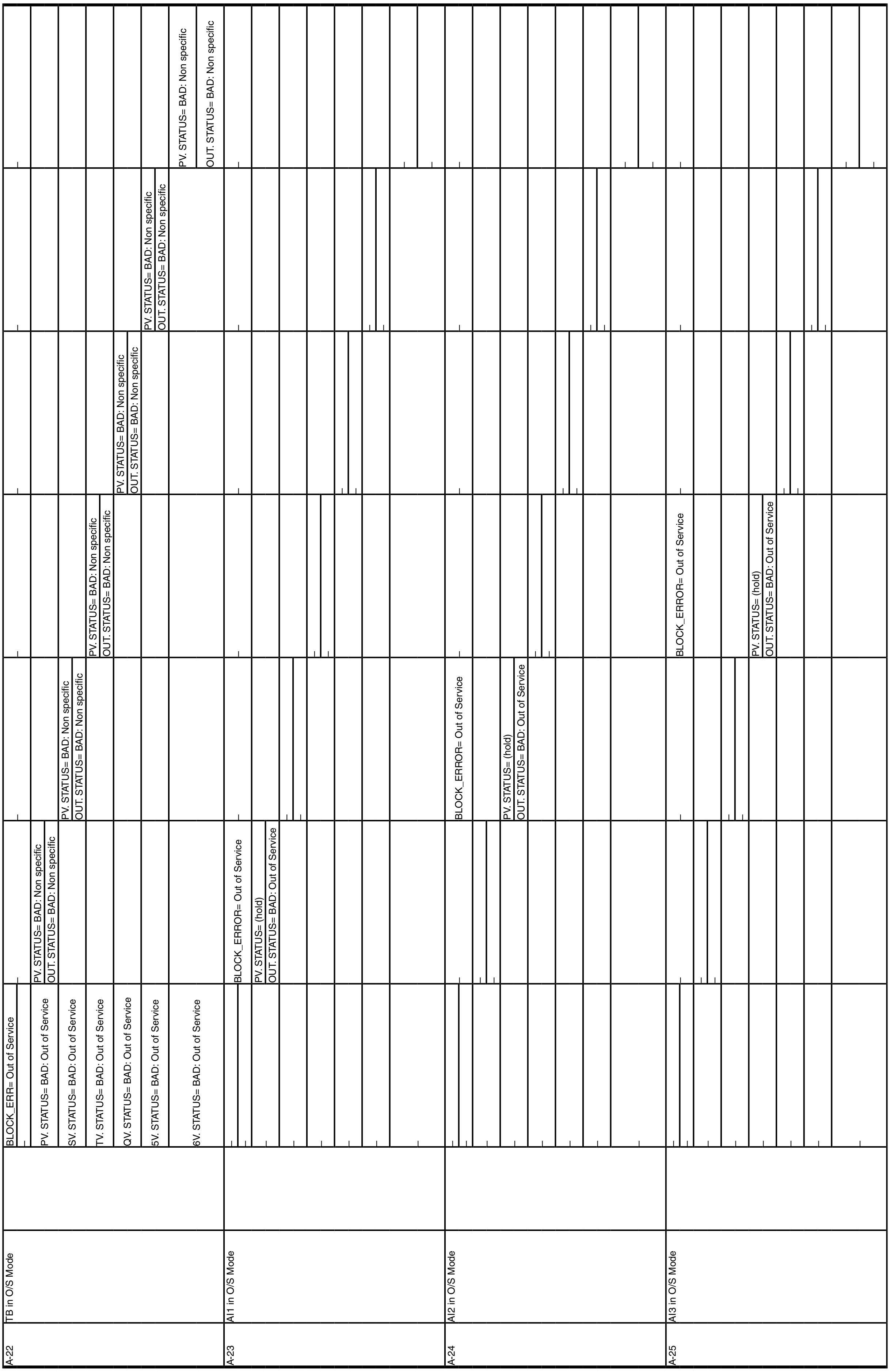
E-08	Temp Sensor Failure (T<-210°C or T>450°C)		BLOCK_ERR= Other XD_ERROR = Temp Sensor fault	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status
			PV. STATUS=BAD: Sensor Failure	PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure							
			SV. STATUS=BAD Sensor Failure	PV.STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure							
			TV. STATUS=BAD Sensor Failure		PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure						
			QV. STATUS=BAD: Sensor Failure			PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure					
			5V. STATUS=BAD: Sensor Failure				PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure				
			6V. STATUS=BAD: Sensor Failure					PV. STATUS=BAD: Sensor Failure OUT.STATUS= BAD Sensor Failure			
E-09	SoftDL Incomplete	BLOCK_ERR = Memory Failure									
E-10	SoftDL Failure	BLOCK_ERR = Memory Failure									
E-11	Serial Com. Error1		BLOCK_ERR=other XD_ERROR = Serial Communication Error1	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status
			PV. STATUS=BAD: Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure							
			SV. STATUS=BAD: Device Failure	PV.STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure							
			TV. STATUS=BAD: Device Failure		PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure						
			QV. STATUS=BAD: Device Failure			PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure					
			5V. STATUS=BAD: Device Failure				PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure				
			6V. STATUS=BAD: Device Failure					PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure			

E-12	Serial Com. Error2		BLOCK_ERR=other XD_ERROR = Serial Communication Error2	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status
			PV. STATUS=BAD: Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure				
			SV. STATUS=BAD: Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure				
			TV. STATUS=BAD: Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure				
			QV. STATUS=BAD: Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure			
			5V. STATUS=BAD: Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure		
			6V. STATUS=BAD: Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure	PV. STATUS=BAD: Device Failure OUT.STATUS= BAD Device Failure
		Abnormal Boot Process	BLOCK_ERR = Memory Failure					
		Sim.enable Jmpr On (Simulation Switch ON)	BLOCK_ERR = Simulation Active					

A-14	Slug Detection		BLOCK_ERR= Other XD_ERROR= Slug detected									
			PV. STATUS= UNCERTAIN: Sensor Conversion not Accurate	PV. STATUS= UNCERTAIN: Sensor Conversion not Accurate OUT. STATUS= UNCERTAIN: Sensor Conversion not Accurate								
			SV. STATUS= UNCERTAIN: Sensor Conversion not Accurate	PV. STATUS= UNCERTAIN: Sensor Conversion not Accurate OUT. STATUS= UNCERTAIN: Sensor Conversion not Accurate								
			TV. STATUS= UNCERTAIN: Sensor Conversion not Accurate		PV. STATUS= UNCERTAIN: Sensor Conversion not Accurate OUT. STATUS= UNCERTAIN: Sensor Conversion not Accurate							
			_			_ _ _						
			5V. STATUS= UNCERTAIN: Sensor Conversion not Accurate						PV. STATUS= UNCERTAIN: Sensor Conversion not Accurate OUT. STATUS= UNCERTAIN: Sensor Conversion not Accurate			
			6V. STATUS= UNCERTAIN: Sensor Conversion not Accurate							PV. STATUS= UNCERTAIN: Sensor Conversion not Accurate OUT. STATUS= UNCERTAIN: Sensor Conversion not Accurate		
A-15	Empty Pipe Detection (Flow tube is not filled with fluid.)		BLOCK_ERR= Other XD_ERROR= Empty pipe detected	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	_			BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status		
			PV. STATUS= BAD: Non specific	PV. STATUS= BAD: Non specific								
			OUT. STATUS= BAD: Non specific	OUT. STATUS= BAD: Non specific								
			SV. STATUS= BAD: Non specific	PV. STATUS= BAD: Non specific								
				OUT. STATUS= BAD: Non specific								
			TV. STATUS= BAD: Non specific		PV. STATUS= BAD: Non specific							
					OUT. STATUS= BAD: Non specific							
			_			_ _ _						
			5V. STATUS= BAD: Non specific						PV. STATUS= BAD: Non specific			
									OUT. STATUS= BAD: Non specific			
			6V. STATUS= BAD: Non specific							PV. STATUS= BAD: Non specific OUT. STATUS= BAD: Non specific		
A-16	Corrosion Detection		BLOCK_ERR= Other XD_ERROR= Corrosion detected									
W-01	Density Lower 0.3kg/l Active if: "_TB108: EMPTY_PIPE_ALM_SEL" is set to "Empty Pipe set"		BLOCK_ERR= Other XD_ERROR= Density lower 0.3 kg/l	BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status	_			BLOCK_ERR = Input Failure/BAD status	BLOCK_ERR = Input Failure/BAD status		
			PV. STATUS= BAD: Non specific	PV. STATUS= BAD: Non specific								
			OUT. STATUS= BAD: Non specific	OUT. STATUS= BAD: Non specific								
			SV. STATUS= BAD: Non specific	PV. STATUS= BAD: Non specific								
				OUT. STATUS= BAD: Non specific								
			TV. STATUS= BAD: Non specific		PV. STATUS= BAD: Non specific							
					OUT. STATUS= BAD: Non specific							
			_			_ _ _						
			5V. STATUS= BAD: Non specific						PV. STATUS= BAD: Non specific			
									OUT. STATUS= BAD: Non specific			
			6V. STATUS= BAD: Non specific							PV. STATUS= BAD: Non specific OUT. STATUS= BAD: Non specific		

W-02	Fixed Dens Selected								
			TV. STATUS= GOOD: Non-Specific, CONST			PV. STATUS= GOOD: Non-Specific, CONST OUT. STATUS= GOOD: Non-Specific, CONST			
W-03	Fixed Temp Selected								
			QV. STATUS= GOOD: Non-Specific, CONST				PV. STATUS= GOOD: Non-Specific, CONST OUT. STATUS= GOOD: Non-Specific, CONST		
W-04	Fixed Mass Flow Selected		PV. STATUS= GOOD: Non-Specific, CONST	PV. STATUS= GOOD: Non-Specific, CONST OUT. STATUS= GOOD: Non-Specific, CONST					
W-06	Autozero Value out of Range		BLOCK_ERR= Other XD_ERROR = Autozero value out of range						

W-07	Autozero Fluct out of Range		BLOCK_ERR= Other						
			XD_ERROR = Autozero fluctuation out of range						
			–	– –					
			–		– –				
			–			– –			
			–				– –		
			–					– –	
			–						– –
W-08	PD / Freq Simulation Active		– –	–	–	–	–	–	–
			–	– –					
			–		– –				
			–			– –			
			–				– –		
			–					– –	
			–						– –
A-20	All FB Non-Schedule		–	–	–	–	–	–	–
A-21	RS in O/S Mode	BLOCK_ERR =Out of Service	– –	–	–	–	–	–	–
			PV. STATUS= BAD: Non specific	PV. STATUS= (hold) OUT. STATUS= BAD: Out of Service					
			SV. STATUS= BAD: Non specific		PV. STATUS= (hold) OUT. STATUS= BAD: Out of Service				
			TV. STATUS= BAD: Non specific			PV. STATUS= (hold) OUT. STATUS= BAD: Out of Service			
			QV. STATUS= BAD: Non specific				PV. STATUS= (hold) OUT. STATUS= BAD: Out of Service		
			5V. STATUS= BAD: Non specific					PV. STATUS= (hold) OUT. STATUS= BAD: Out of Service	
			6V. STATUS= BAD: Non specific						PV. STATUS= (hold) OUT. STATUS= BAD: Out of Service



W-24	AI4 in Man Mode		–	–	–	–	–	–	–
W-25	AI5 in Man Mode		–	–	–	–	–	–	–
W-26	AI6 in Man Mode		–	–	–	–	–	–	–
W-27	IT1 in Man Mode		–	–	–	–	–	–	–
W-28	IT2 in Man Mode		–	–	–	–	–	–	–
			–	–	–	–	–	–	–
W-41	AI1 Simulation Active	BLOCK_ERR = Simulation Active	–	BLOCK_ERR= Simulation Active	–	–	–	–	–
W-42	AI2 Simulation Active	BLOCK_ERR = Simulation Active	–	–	BLOCK_ERR= Simulation Active	–	–	–	–
W-43	AI3 Simulation Active	BLOCK_ERR = Simulation Active	–	–	–	BLOCK_ERR= Simulation Active	–	–	–
W-44	AI4 Simulation Active	BLOCK_ERR = Simulation Active	–	–	–	–	BLOCK_ERR= Simulation Active	–	–
W-45	AI5 Simulation Active	BLOCK_ERR = Simulation Active	–	–	–	–	–	BLOCK_ERR= Simulation Active	–
W-46	AI6 Simulation Active	BLOCK_ERR = Simulation Active	–	–	–	–	–	–	BLOCK_ERR= Simulation Active
W-51	AI1 Not Scheduled		–	–	–	–	–	–	–
W-52	AI2 Not Scheduled		–	–	–	–	–	–	–
W-53	AI3 Not Scheduled		–	–	–	–	–	–	–
W-54	AI4 Not Scheduled		–	–	–	–	–	–	–
W-55	AI5 Not Scheduled		–	–	–	–	–	–	–
W-56	AI6 Not Scheduled		–	–	–	–	–	–	–
W-57	IT1 Not Scheduled		–	–	–	–	–	–	–
W-58	IT2 Not Scheduled		–	–	–	–	–	–	–
W-61	PID in Bypass Mode		–	–	–	–	–	–	–
W-62	PID FB Error1		–	–	–	–	–	–	–
W-63	PID FB Error2		–	–	–	–	–	–	–
W-71	IT1 Conf. Err		–	–	–	–	–	–	–
W-72	IT2 Conf. Err		–	–	–	–	–	–	–
W-73	IT1 Total Backup Err		–	–	–	–	–	–	–
W-74	IT2 Total Backup Err		–	–	–	–	–	–	–

2. Alarm Mask Switch Settings

Some alarms can be disabled and enabled using switches in parameter ALARM_PERFORM inside the transducer block as explained below.

(1) Setting

As shown in the following table, the individual bits of ALARM_PERFORM at relative index 125 act as switches to disable and enable particular alarms. Write zeros to the respective bits to disable desired alarms, or write ones to enable them.

(2) Default Values

See the table below. .

Bit in ALARM_PERFORM	Corresponding Alarms	Factory Default (0 = Disable; 1 = Enable)
Bit 15	unused bit	
Bit 14	unused bit	
Bit 13	unused bit	
Bit 12	unused bit	0
Bit 11	unused bit	0
Bit 10	unused bit	0
Bit 9	unused bit	0
Bit 8	PID	0
Bit 7	IT2	0
Bit 6	IT1	0
Bit 5	AI6	0
Bit 4	AI5	0
Bit 3	AI4	0
Bit 2	AI3	0
Bit 1	AI2(A-24,W-22,W-42,W52)	0
Bit 0	AI1(A-23,W-21,W-41,W51)	0

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These default bit statuses comprise 0xxxxx as the default value of ALARM_PERFORM

APPENDIX 4. FUNCTION DIAGRAMS OF FUNCTION BLOCKS

A4.1 AI Function Block

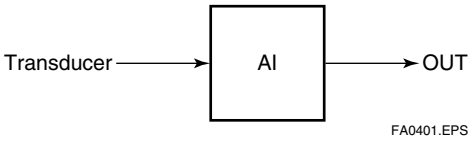

Figure A4-1. Input/Output of AI Block

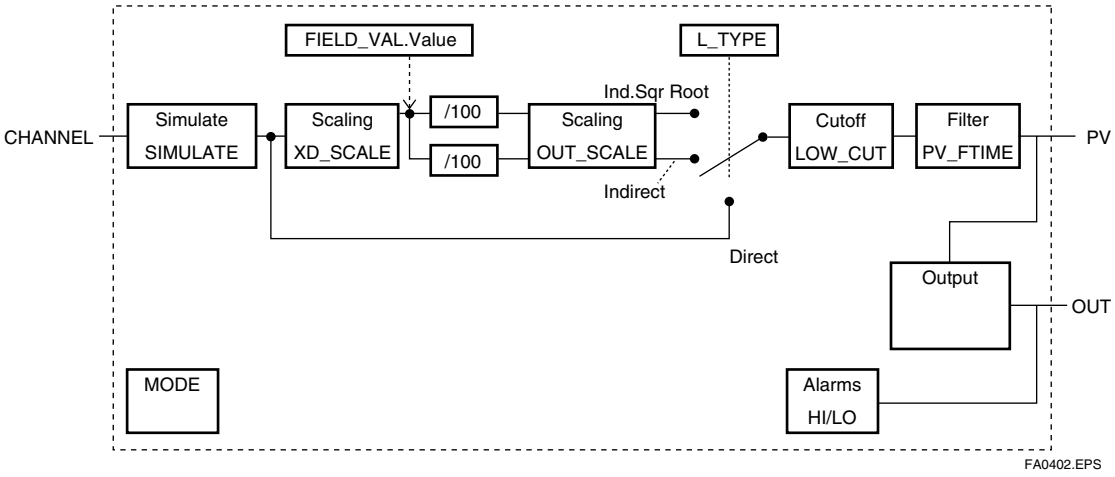

Figure A4-2. Function Diagram of AI Block

Calculation of Output value:

FIELD_VAL.Value
= 100*(TB value - XD_SCALE.EU0) / (XD_SCALE.EU100 - XD_SCALE.EU0)

AI Parameter L_TYPE (Relative Index 16):
Direct: PV.Value (OUT.Value)
= TB value
Indirect: PV.Value (OUT.Value)
= (FIELD_VAL.Value/100) * (OUT_SCALE.EU100 - OUT_SCALE.EU0) + OUT_SCALE.EU0
Indirect Sqr Root: PV.Value (OUT.Value)
= sqrt(FIELD_VAL.Value/100) * (OUT_SCALE.EU100 - OUT_SCALE.EU0)+ OUT_SCALE.EU0

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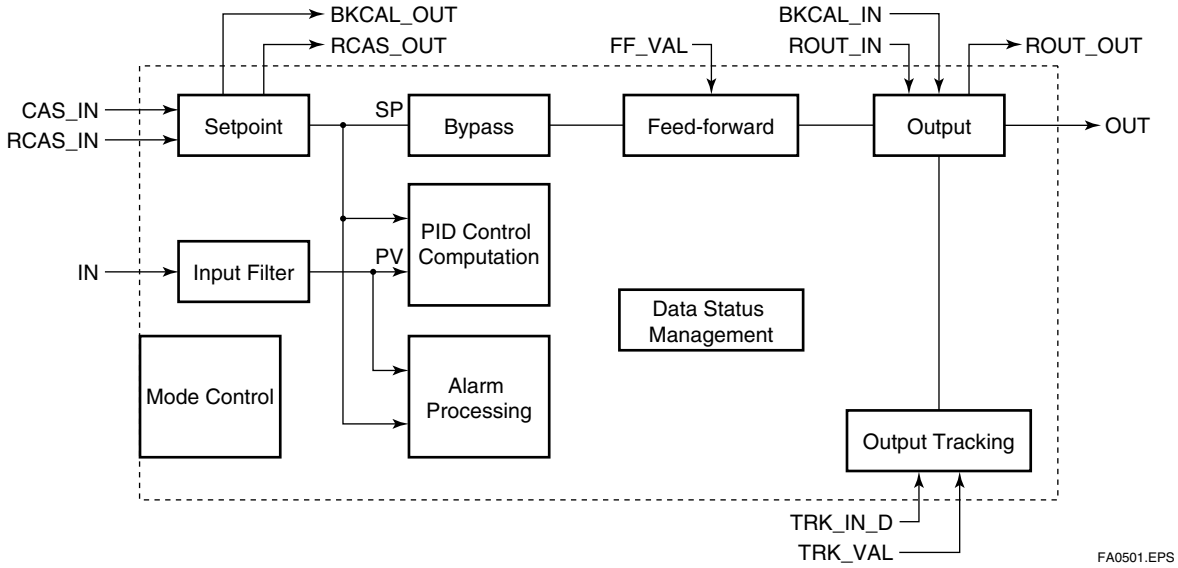
APPENDIX 5. PID BLOCK

A PID block performs the PID control computation based on the deviation of the measured value (PV) from the setpoint (SV), and is generally used for constant-setpoint and cascaded-setpoint control.

A5.1 Function Diagram

The figure below depicts the function diagram of a PID block.



A5.2 Functions of PID Block

The table below shows the functions provided in a PID block.

Function	Description
PID control computation	Computes the control output in accordance with the PID control algorithm.
Control output	Converts the change in control output DMV to the manipulated value MV that is to be actually output.
Switching of direction of control action	Switches over the direction of control action between direct and reverse, i.e., the direction of changes in the control output depending on the changes in the deviation.
Control action bypass	When the bypass is on, the value of the SP is scaled to the range of the OUT and output as the OUT.
Feed-forward	Adds the value of the FF_VAL (input to the PID block) to the output from the PID computation.
Measured-value tracking	Equalizes the setpoint SP to the measured value PV.
Setpoint limiters	Limit the value of setpoint SP within the preset upper and lower levels as well as limit the rate of change when the PID block is in Auto mode.
External-output tracking	Performs the scaling of the value of TRK_VAL to the range of the OUT and outputs it as the OUT.
Mode change	Changes the block mode between 8 modes: O/S, IMan, LO, Man, Auto, Cas, RCas, ROut.
Bumpless transfer	Prevents a sudden change in the control output OUT at changes in block mode and at switching of the connection from the control output OUT to the cascaded secondary function block.
Initialization and manual fallback	Changes the block mode to IMan and suspends the control action when the specified condition is met.
Manual fallback	Changes the block mode to Man and aborts the control action.
Auto fallback	Changes the block mode to Auto when it is Cas, and continues the control action with the setpoint set by the operator.
Mode shedding upon computer failure	Changes the block mode in accordance with the SHED_OPT setting upon a computer failure.
Alarm processing	Generates block alarms and process alarms, and performs event updates.

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A5.3 Parameters of PID Block

NOTE: In the table below, the **Write** column shows the modes in which the respective parameters can be written. A blank in the Write column indicates that the corresponding parameter can be written in all modes of the PID block. A dash (–) indicates that the corresponding parameter cannot be written in any mode.

Index	Parameter Name	Default (factory setting)	Write	Valid Range	Description
0	Block Header	TAG: "PID"	Block Tag = O/S		Same as that for an AI block.
1	ST_REV		—		Same as that for an AI block.
2	TAG_DESC	(blank)			Same as that for an AI block.
3	STRATEGY	0			Same as that for an AI block.
4	ALERT_KEY	1		1 to 255	Same as that for an AI block.
5	MODE_BLK				
6	BLOCK_ERR		—		Same as that for an AI block.
7	PV		—		Measured value; the non-dimensional value that is converted from the input (IN) value based on the PV_SCALE values and filtered.
8	SP	0	AUTO	PV_SCALE 10%	Setpoint
9	OUT		MAN		Output
10	PV_SCALE	100 0 1342 (%) 1	O/S		Upper and lower scale limit values used for scaling of the input (IN) value.
11	OUT_SCALE	100 0 1342 (%) 1	O/S		Upper and lower scale limit values used for scaling of the control output (OUT) value to the values in the engineering unit.
12	GRANT_DENY	0	AUTO		Same as that for an AI block.
13	CONTROL_OPTS	0	O/S		Setting for control action. See Section A5.13 for details.
14	STATUS_OPTS	0	O/S		See Section A5.15 for details.
15	IN	0			Controlled-value input
16	PV_FTIME	0sec	AUTO	Non-negative	Time constant (in seconds) of the first-order lag filter applied to IN
17	BYPASS	1 (off)	MAN	1, 2	Whether to bypass the control computation. 1 (off): Do not bypass. 2 (on): Bypass.
18	CAS_IN	0			Cascade setpoint
19	SP_RATE_DN	1.#INF [1)]		Positive	Rate-of-decrease limit for setpoint (SP)
20	SP_RATE_UP	1.#INF [1)]		Positive	Rate-of-increase limit for setpoint (SP)
21	SP_HI_LIM	100		PV_SCALE 10%	Upper limit for setpoint (SP)
22	SP_LO_LIM	0		PV_SCALE 10%	Lower limit for setpoint (SP)
23	GAIN	1			Proportional gain (= 100 / proportional band)
24	RESET	10			Integration time (seconds)
25	BAL_TIME	0		Positive	Unused
26	RATE	0		Positive	Derivative time (seconds)
27	BKCAL_IN	0			Read-back of control output
28	OUT_HI_LIM	100		OUT_SCALE 10%	Upper limit for control output (OUT)
29	OUT_LO_LIM	0		OUT_SCALE 10%	Lower limit for control output (OUT)
30	BKCAL_HYS	0.5 (%)		0 to 50%	Hysteresis for release from a limit for OUT.status
31	BKCAL_OUT	0	—		Read-back value to be sent to the BKCAL_IN in the upper block
32	RCAS_IN	0			Remote setpoint set from a computer, etc.
33	ROUT_IN	0			Remote control output value set from a computer, etc.

[1)] Initial value: All limits are set to plus or minus infinity (+INF or -INF), which is the same as no limit. IEEE 754-1985 defines the floating point representation of plus and minus infinity.

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Index	Parameter Name	Default (factory setting)	Write	Valid Range	Description
34	SHED_OPT	0			Action to be performed in the event of mode shedding. SHED_OPT defines the changes to be made to MODE.BLK.target and MODE.BLK.actual when the value of RCAS_IN.status or ROUT_IN.status becomes Bad if MODE_BLK.actual = RCas or ROut. See Section A5.17.1 for details.
35	RCAS_OUT	0	—		Remote setpoint sent to a computer, etc.
36	ROUT_OUT	0	—		Remote control output value
37	TRK_SCALE	100 0 1342 1	MAN		Upper and lower scale limits used to convert the output tracking value (TRK_VAL) to non-dimensional.
38	TRK_IN_D	0			Switch for output tracking. See Section A5.12 for details.
39	TRK_VAL	0			Output tracking value (TRK_VAL) When MODE_BLK.actual = LO, the value scaled from the TRK_VAL value is set in OUT.
40	FF_VAL	0			Feedforward input value. The FF_VAL value is scaled to a value with the same scale as for OUT, multiplied by the FF_GAIN value, and then added to the output of the PID computation.
41	FF_SCALE	100 0 1342 1	MAN		Scale limits used for converting the FF_VAL value to a non-dimensional value.
42	FF_GAIN	0	MAN		Gain for FF_VAL
43	UPDATE_EVT		—		Same as that for an AI block.
44	BLOCK_ALM		—		Same as that for an AI block.
45	ALARM_SUM	Enable			Same as that for an AI block.
46	ACK_OPTION	0			Same as that for an AI block.
47	ALARM_HYS	0.5%		0 to 50%	Hysteresis for alarm detection and resetting to prevent each alarm from occurring and recovering repeatedly within a short time.
48	HI_HI_PRI	0		0 to 15	Priority order of HI_HI_ALM alarm
49	HI_HI_LIM	1. #INF [1)]		PV_SCALE	Setting for HI_HI_ALM alarm
50	HI_PRI	0		0 to 15	Priority order of HI_ALM alarm
51	HI_LIM	1. #INF [1)]		PV_SCALE	Setting for HI_ALM alarm
52	LO_PRI	0		0 to 15	Priority order of LO_ALM alarm
53	LO_LIM	-1. #INF [1)]		PV_SCALE	Setting for LO_ALM alarm
54	LO_LO_PRI	0		0 to 15	Priority order of LO_LO_ALM alarm
55	LO_LO_LIM	-1. #INF [1)]		PV_SCALE	Setting for LO_LO_ALM alarm
56	DV_HI_PRI	0		0 to 15	Priority order of DV_HI_ALM alarm
57	DV_HI_LIM	1. #INF [1)]			Setting for DV_HI_ALM alarm
58	DV_LO_PRI	0		0 to 15	Priority order of DV_LO_ALM alarm
59	DV_LO_LIM	-1. #INF [1)]			Setting for DV_LO_ALM alarm
60	HI_HI_ALM	—	—		Alarm that is generated when the PV value has exceeded the HI_HI_LIM value and whose priority order* is defined in HI_HI_PRI. * Priority order: Only one alarm is generated at a time. When two or more alarms occur at the same time, the alarm having the highest priority order is generated. When the PV value has decreased below [HI_HI_LIM – ALM_HYS], HI_HI_ALM is reset.
61	HI_ALM	—	—		As above
62	LO_ALM	—	—		As above Reset when the PV value has increased above [LO_LIM + ALM_HYS].
63	LO_LO_ALM	—	—		As above
64	DV_HI_ALM	—	—		Alarm that is generated when the value of [PV - SP] has exceeded the DV_HI_LIM value. Other features are the same as HI_HI_ALM.
65	DV_LO_ALM	—	—		Alarm that is generated when the value of [PV - SP] has decreased below the DV_LO_LIM value. Other features are the same as LO_LO_ALM.

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[1)] Initial value: All limits are set to plus or minus infinity (+INF or -INF), which is the same as no limit. IEEE 754-1985 defines the floating point representation of plus and minus infinity.

A5.4 PID Computation Details

For PID control, the PID block in a ROTAMASS employs the PV-proportional and -derivative type PID control algorithm (referred to as the I-PD control algorithm), or the PV-derivative type PID control algorithm (referred to as the PI-D control algorithm) depending on the mode, as described below.

A5.4.1 PV-proportional and -derivative Type PID (I-PD) Control Algorithm versus PV-derivative Type PID (PI-D) Control Algorithm

The I-PD control algorithm, which is expressed by the equation below, ensures control stability against sudden changes in the setpoint, such as when the user enters a new setpoint value. The I-PD algorithm also ensures excellent controllability by performing proportional, integral, and derivative control actions in response to changes of characteristics in the controlled process, changes in load, and occurrences of disturbances.

When the PID block is in Auto or RCas mode, this I-PD algorithm is used for control. In Cas mode, however, the PV-derivative type PID (PI-D) algorithm takes over since the response to setpoint changes is more important. The control algorithm in use thus switches over automatically in line with the mode transitions. The following shows the basic computation formulas of these algorithms.

PV-proportional and -derivative (I-PD) control algorithm:

$$\Delta MVn = K\left\{\Delta PVn + \frac{\Delta T}{Ti}(PVn - SPn) + \frac{Td}{\Delta T}\Delta(\Delta PVn)\right\}$$

PV-derivative (PI-D) control algorithm:

$$\Delta MVn = K\left\{\Delta(PVn - SPn) + \frac{\Delta T}{Ti}(PVn - SPn) + \frac{Td}{\Delta T}\Delta(\Delta PVn)\right\}$$

Where,

- ΔMVn = change in control output
- ΔPVn = change in measured (controlled) value = PVn - PVn-1
- ΔT = control period = period_of_execution in Block Header
- K = proportional gain = GAIN (= 100/proportional band)
- TI = integral time = RESET
- T_D = derivative time = RATE

The subscripts, n and n-1, represent the time of sampling such that PVn and PVn-1 denote the PV value sampled most recently and the PV value sampled at the preceding control period, respectively.

A5.4.2 PID Control Parameters

The table below shows the PID control parameters.

Parameter	Description	Valid Range
GAIN	Proportional gain	0.05 to 20
RESET	Integral time	0.1 to 10,000 (seconds)
RATE	Derivative time	0 to infinity (seconds)

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A5.5 Control Output

The final control output value, MV, is computed based on the change in control output ĐMVn, which is calculated at each control period in accordance with the aforementioned algorithm. The PID block in a ROTAMASS performs the velocity type output action for the control output.

A5.5.1 Velocity Type Output Action

The PID block determines the control output (OUT) value by adding the change in control output calculated in the current control period, ΔMVn, to the value read back from the output destination, BKCAL_IN. This velocity type output action can be expressed as:

$$OUT = BKCAL\_IN - \Delta MVn'$$

where $\Delta MVn'$ is ΔMVn scaled based on PV_SCALE and OUT_SCALE.

Note: MV indicates the PID computation result.

A5.6 Direction of Control Action

The direction of the control action is determined by the Direct Acting setting in CONTROL_OPTS.

Value of Direct Acting	Resulting Action
True	The output increases when the input PV is greater than the setpoint SP.
False	The output decreases when the input PV is greater than the setpoint SP.

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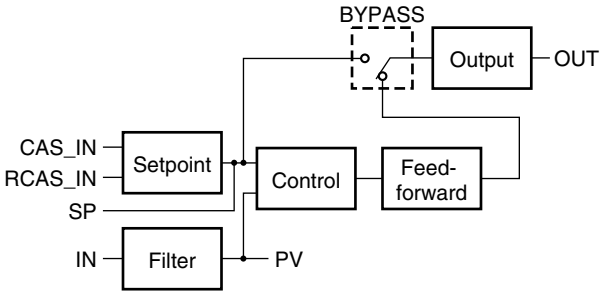
A5.7 Control Action Bypass

The PID control computation can be bypassed so as to set the SP value in the control output OUT as shown below. Setting BYPASS to “On” bypasses the PID control computation.



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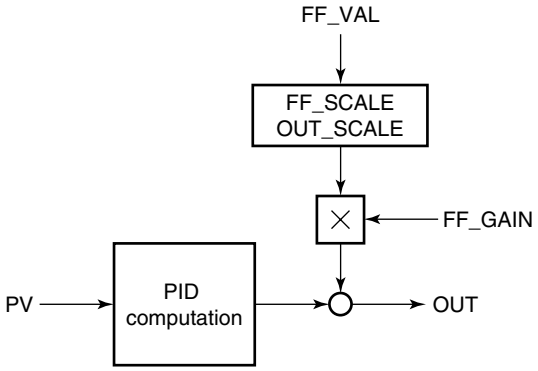
A5.8 Feed-forward

Feed-forward is an action to add a compensation input signal FF_VAL to the output of the PID control computation, and is typically used for feed-forward control. The following figure illustrates the action.



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A5.9 Block Modes

The block mode is set in the parameter MODE_BLK.

MODE_BLK	Target	Stipulates the target mode to which the PID block transfers.
	Actual	Indicates the current mode of the PID block.
	Permitted	Stipulates all the modes that the PID block can enter. The PID block is prohibited to enter any mode other than those set in this element.
	Normal	Stipulates the mode in which the PID block normally resides.

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There are eight modes for a PID block as shown below.

Block Mode	Description
ROut	Remote output mode, in which the PID block outputs the value set in ROUT_IN.
RCas	Remote cascade mode, in which the PID block carries out the PID control computation based on the setpoint (SP) set via the remote cascade connection, such as from a computer, and outputs the computed result.
Cas	Cascade mode, in which the PID block carries out the PID control computation based on the setpoint (SP) set from another fieldbus function block, and outputs the computed result.
Auto	The PID block carries out automatic control and outputs the result computed by the PID control computation.
Man	Manual mode, in which the PID block outputs the value set by the user manually.
LO	The PID block outputs the value set in TRK_VAL.
IMan	Initialization and manual mode, in which the control action is suspended. The PID block enters this mode when the specified condition is met (see Section A5.14).
O/S	Out of service mode, in which neither the control computation nor action is carried out, and the output is kept at the value that was output before the PID block entered into O/S mode.

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A5.9.1 Mode Transitions

Transition Destination Mode	Condition	NOT Conditions
O/S	1. If O/S is set in MODE_ BLK.target (or if O/S is set in target inside the resource block)	
IMan	2. If the specified condition is met (see Section A5.14)	NOT if condition 1 is met
LO	3. If Track Enable is specified in CONTROL_OPTS and the value of TRK_IN_D is true	NOT if either or both of conditions 1 and 2 are met
Man	4. If Man is set in MODE_ BLK.target or if IN.status (input status) is Bad	NOT if any one or more of conditions 1 to 3 are met
Auto*	5. If Auto is set in MODE_ BLK.target - AND - if IN.status (input status) is not Bad	NOT if any one or more of conditions 1 to 3 are met
Cas*, **	6. If Cas is set in MODE_ BLK.target - AND - if neither IN.status (input status) nor CAS_IN.status is Bad.	NOT if any one or more of conditions 1 to 3 are met
RCas*, **	7. If RCas is set in MODE_ BLK.target - AND - if neither IN.status (input status) nor RCAS_IN.status is Bad.	NOT if any one or more of conditions 1 to 3 are met.
ROut*, **	8. If ROut is set in MODE_ BLK.target - AND - if ROUT_IN.status (input status) is not Bad	NOT if any one or more of conditions 1 to 3 are met.
In accordance with the SHED_OPT setting	9. If RCAS_IN.status or ROUT_ IN.status is Bad (indicating a computer failure; see Section A5.17.1 for details)	

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* To activate mode transitions to AUTO, CAS, RCAS, and ROUT, the respective target modes must be set beforehand to MODE_BLK. permitted.

** A transition to CAS, RCAS, or ROUT requires that initialization of the cascade connection has been completed.

A5.10 Bumpless Transfer

Prevents a sudden change in the control output OUT at changes in block mode (MODE_BLK) and at switching of the connection from the control output OUT to the cascaded secondary function block. The action to perform a bumpless transfer differs depending on the MODE_BLK values.

A5.11 Setpoint Limiters

Active setpoint limiters that limit the changes in the SP value, differ depending on the block mode as follows.

A5.11.1 When PID Block Is in AUTO Mode

When the value of MODE_BLK is AUTO, the four types of limiters are in force: high limit, low limit, rate-of-increase limit, and rate-of-decrease limit.

Setpoint High/Low Limits

- A value larger than the value of SP_HI_LIM cannot be set for SP.
- A value smaller than the value of SP_LO_LIM cannot be set for SP.

Setpoint Rate Limits

The setpoint rate limits are used to restrict the magnitude of changes in the SP value so as to change the SP value gradually towards a new setpoint.

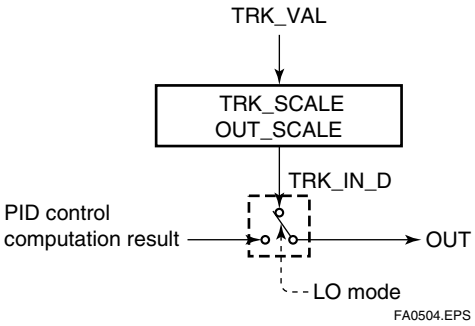
- An increase of the SP value at each execution period (period of execution in the Block Header) is limited to the value of SP_RATE_UP.
- A decrease of the SP value at each execution period (period of execution in the Block Header) is limited to the value of SP_RATE_DOWN.

A5.11.2 When PID Block Is in CAS or RCAS Mode

By selecting Obey SP Limits if Cas or RCas in CONTROL_OPTS (see Section A5.13.1), the setpoint high/low limits can be put into force also when the value of MODE_BLK is CAS or RCAS.

A5.12 External-output Tracking

External tracking is an action of outputting the value of the remote output TRK_VAL set from outside the PID block, as illustrated in the figure below. External tracking is performed when the block mode is LO.



To change the block mode to LO:

(1) Select Track Enable in CONTROL_OPTS.
(2) Set TRK_IN_D to true.

However, to change the block mode from MAN to LO, Track in Manual must also be specified in CONTROL_OPTS.

A5.13 Measured-value Tracking

Measured-value tracking, also referred to as SP-PV tracking, is an action to equalize the setpoint SP to the measured value PV when the block mode (MODE_BLK.actual) is MAN in order to prevent a sudden change in control output from being caused by a mode change to AUTO.

While a cascade primary control block is performing the automatic or cascade control (in the AUTO or CAS mode), when the mode of its secondary control block is changed from CAS to AUTO, the cascade connection is opened and the control action of the primary block stops. The SP of the primary controller can be equalized to its cascade input signal CAS_IN also in this case.

The settings for measured-value tracking are made in the parameter CONTROL_OPTS, as shown in the table below.

A5.13.1 CONTROL_OPTS

Options in CONTROL_OPTS	Description
Bypass Enable	This parameter allows BYPASS to be set.
SP-PV Track in Man	Equalizes SP to PV when MODE_BLK.target is set to Man.
SP-PV Track in ROut	Equalizes SP to PV when MODE_BLK.target is set to ROut.
SP-PV Track in LO or IMan	Equalizes SP to PV when actual is set to LO or IMAN.
SP-PV Track retained Target	Equalizes SP to RCAS_IN when MODE_BLK.target is set to RCas, and to CAS_IN when MODE_BLK.target is set to Cas when the actual mode of the block is IMan, LO, Man or ROut.
Direct Acting	Set the PID block to a direct acting controller.
Track Enable	This enables the external tracking function. The value in TRK_VAL will replace the value of OUT if TRK_IN_D becomes true and the target mode is not Man.
Track in Manual	This enables TRK_VAL to replace the value of OUT when the target mode is Man and TRK_IN_D is true. The actual mode will then be LO.
Use PV for BKCAL_OUT	Sets the value of PV in BKCAL_OUT and RCAS_OUT, instead of the value of SP.
Obey SP limits if Cas or RCas	Puts the setpoint high/low limits in force in the Cas or RCas mode.
No OUT limits in Manual	Disables the high/low limits for OUT in the Man mode.

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A5.14 Initialization and Manual Fallback (IMAN)

Initialization and manual fallback denotes a set of actions in which a PID block changes mode to IMAN (initialization and manual) and suspends the control action. Initialization and manual fallback takes place automatically as a means of abnormality handling when the following condition is met:

- The quality component of BKCAL_IN.status is Bad.

- OR -

- The quality component of BKCAL_IN.status is Good (c)
  - AND -
  The sub-status component of BKCAL_IN.status is FSA, LO, NI, or IR.

The user cannot manually change the mode to IMAN. A mode transition to IMAN occurs only when the condition above is met.

A5.15 Manual Fallback

Manual fallback denotes an action in which a PID block changes mode to MAN (manual) and suspends the control action. Manual fallback takes place automatically as a means of abnormality handling when the following condition is met:

- IN.status is Bad except when the control action bypass is on.

To enable the manual fallback action to take place when the above condition is met, Target to Manual if BAD IN must be specified beforehand in STATUS_OPTS.

The table below shows the options in STATUS_OPTS.

A5.15.1 STATUS_OPTS

Options in STATUS_OPTS	Description
IFS if BAD IN	Sets the sub-status component of OUT.status to IFS if IN.status is Bad except when PID control bypass is on.
IFS if BAD CAS IN	Sets the sub-status component of OUT.status to IFS if CAS_IN.status is Bad.
Use Uncertain as Good	Does not regard IN as being in Bad status when IN.status is Uncertain (to prevent mode transitions from being affected when it is Uncertain).
Target to Manual if BAD IN	Automatically changes the value of MODE_BLK.target to MAN when IN falls into Bad status.
Target to next permitted mode if BAD CAS IN	Automatically changes the value of MODE_BLK.target to Auto (or to Man if Auto is not set in Permitted) when CAS_IN falls into Bad status.

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A5.16 Auto Fallback

Auto fallback denotes an action in which a PID block changes mode from CAS (cascade) to AUTO (automatic) and continues automatic PID control with the user-set setpoint. Auto fallback takes place automatically when the following condition is met:

- IN.status (data status of IN) is Bad except when the control action bypass is on.

To enable the manual fallback action to take place when the above condition is met:

- Target to next permitted mode if BAD CAS IN must be previously specified in STATUS_OPTS.

- AND -

- AUTO must be previously set in MODE_BLK. permitted.

A5.17 Mode Shedding upon Computer Failure

When the data status of RCAS_IN or ROUT_IN, which is the setting received from a computer as the setpoint SP, falls to Bad while the PID block is running in the RCAS (remote cascade) or ROUT (remote output) mode, the mode shedding occurs in accordance with the settings in SHED_OPT.

A5.17.1 SHED_OPT

The SHED_OPT setting stipulates the specifications of mode shedding as shown below. Only one can be set.

Available Setting for SHED_OPT	Actions upon Computer Failure
Normal shed, normal return	Sets MODE_BLK.actual to Cas*, and leaves MODE_BLK.target unchanged.
Normal shed, no return	Sets both MODE_BLK.actual and MODE_BLK.target to Cas*.
Shed to Auto, normal return	Sets MODE_BLK.actual to Auto**, and leaves MODE_BLK.target unchanged.
Shed to Auto, no return	Sets both MODE_BLK.actual and MODE_BLK.target to Auto**.
Shed to Manual, normal return	Sets MODE_BLK.actual to Man, and leaves MODE_BLK.target unchanged.
Shed to Manual, no return	Sets both MODE_BLK.actual and MODE_BLK.target to Man.
Shed to retained target, normal return	If Cas is in MODE_BLK.target, sets MODE_BLK.actual to Cas*, and leaves MODE_BLK.target unchanged. If Cas is not set in MODE_BLK.target, sets MODE_BLK.actual to Auto**, and leaves MODE_BLK.target unchanged.
Shed to retained target, no return	If Cas is set in MODE_BLK.target, sets both MODE_BLK.actual and MODE_BLK.target to Cas*. If Cas is not set in MODE_BLK.target, sets MODE_BLK.actual to Auto**, and MODE_BLK.target to Cas.

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* The modes to which a PID block can transfer are limited to those set in MODE_BLK.permitted, and the priority levels of modes are as shown below. In fact, if Normal shed, normal return is set for SHED_OPT, detection of a computer failure causes MODE_BLK.actual to change to CAS, AUTO, or MAN, whichever is set in MODE_BLK.permitted and has the lowest priority level.

MAN — Higher priority level
AUTO
CAS
RCAS
ROUT — Lower priorty level

** Only if Auto is included in MODE_BLK.permitted. If the block upstream of the PID block in question is a control block, mode transitions of the PID block to CAS occur in the following sequence due to initialization of the cascade connection: RCAS or ROUT ∅ AUTO ∅ CAS.

A5.18 Alarms

There are two kinds of alarms generated by a PID block: block and process alarms.

A5.18.1 Block Alarm (BLOCK_ALM)

The block alarm BLOCK_ALM is generated upon occurrence of either of the following errors (values set in BLOCK_ERR) and notifies the content of BLOCK_ERR.

Value of BLOCK_ERR	Condition
Input Failure	IN.status of the PID block is either of the following: • Bad-Device Failure • Bad-Sensor Failure
Out of Service	MODE_BLK.target of the PID block is O/S.

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A5.18.2 Process Alarms

There are six types of process alarms. Only one process alarm can be generated at the same time, and the process alarm having the highest priority level from among those occurring at the same time is generated. The priority level is set for each process alarm type.

Process Alarm	Cause of Occurrence	Parameter Containing Priority Level Setting
HI_HI_ALM	Occurs when the PV increases above the HI_HI_LIM value.	HI_HI_PRI
HI_ALM	Occurs when the PV increases above HI_LIM value.	HI_PRI
LO_ALM	Occurs when the PV decreases below the LO_LIM value.	LO_PRI
LO_LO_ALM	Occurs when the PV decreases below the LO_LO_LIM value.	LO_LO_LIM
DV_HI_ALM	Occurs when the value of [PV - SP] increases above the DV_HI_LIM value.	DV_HI_PRI
DV_LO_ALM	Occurs when the value of [PV - SP] decreases below the DV_LO_LIM value.	DV_LO_PRI

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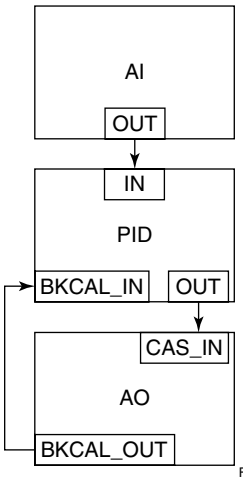
A5.19 Example of Block Connections



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When configuring a simple PID control loop by combining a ROTAMASS with a fieldbus valve positioner that contains an AO block, follow the procedure below to make the settings of the corresponding fieldbus function blocks:

1. Connect the AI block and PID block of the ROTAMASS, and the AO block of the valve positioner as shown above.
2. Set MODE_BLK.target of the PID block to O/S, and then set GAIN, RESET, and RATE to appropriate values.
3. Check that the value of MODE_BLK.actual of the AI block is AUTO.
4. Set MODE_BLK.target of the AO block to CAS|AUTO (meaning "CAS and AUTO").
5. Check that the value of BKCAL_IN.status of the PID block is not Bad.
6. Check that the value of IN.status of the PID block is not Bad.
7. Check that AUTO is set in MODE_BLK.permitted of the PID block.
8. Set MODE_BLK.target of the PID block to AUTO.

When finishing all steps in order, the PID block and AO block exchange the respective information and initialize the cascade connection. Consequently, the value of MODE_BLK.actual of the PID block changes to AUTO and automatic PID control starts.

APPENDIX 6. SOFTWARE DOWNLOAD

A6.1 Benefits of Software Download

This function enables you to download software to field devices via a FOUNDATION Fieldbus to update their software.
Typical uses are to add new features such as function blocks and diagnostics to existing devices, and to optimize existing field devices for your plant.

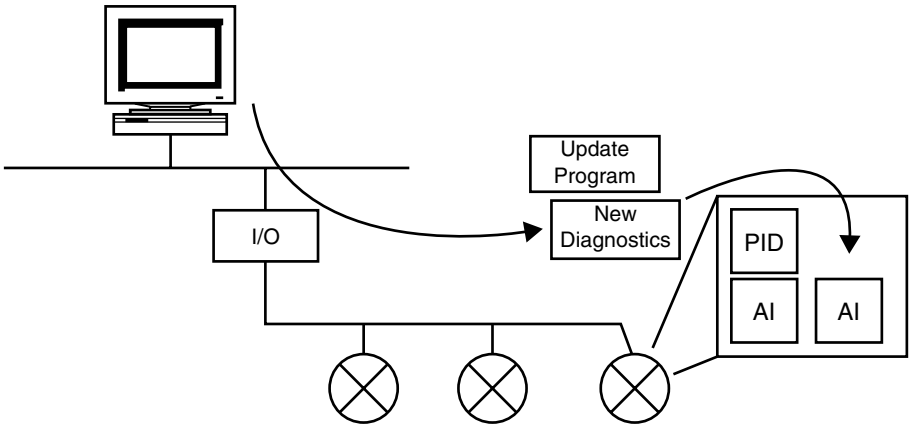

Figure A6.1 Concept of Software Downloading

A6.2 Specifications

Steady-state current: Max. 15 mA

Current Draw (Steady-state): 15mA (max)

Current Draw (Software Download state): 24mA (max)

Current during FlashROM blanking time:
Max. 24 mA additional to steady-state current

Based on Fieldbus Foundation Specification
Download class: Class 1

NOTE

Class 1 devices can continue the specified measurement and/or control actions even while software is being downloaded to them. Upon completion of a download, however, the devices will be reset internally to make the new, downloaded software take effect, and this will halt fieldbus communication and function block executions for about one minute.

A6.3 Preparations for Software Downloading

For software downloading, you need to prepare the following:

- Software download tool
- Software for downloading file for each of the target field devices

For the software download tool, use only a program developped for that purpose. For details, see the software's User's Manual. For information about updates of software binary files for field devices and how to obtain them, visit the following web site.

http://www.yokogawa.com/fld/fld-top-en.htm

CAUTION

Do not hook up the software download tool to a fieldbus segment while the plant is in operation, as it may temporarily disturb the communication. Always connect the tool before starting operation.

NOTE

The download tool can not execute downloading during other system connects to the system/network management VFD of the device.

A6.4 Software Download Sequence

The flowchart below outlines the software download procedure. Although the time taken for the entire procedure varies depending on the size of the field bus device's software, it generally take about 20 minutes where there is a one-to-one connection between a fieldbus device and download tool, and longer when multiple field devices are connected to the fieldbus.

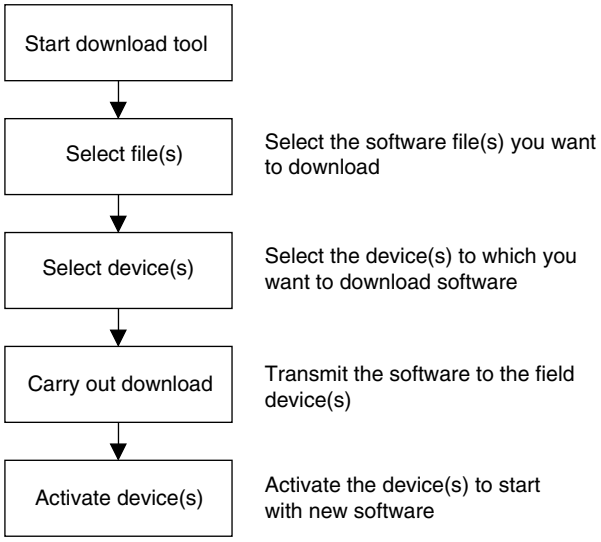

Figure A6.2 Flow of Software Download Procedure

CAUTION

Carrying out a software download leaves the PD tag, node address, and transducer block calibration parameters that are retained in the nonvolatile memory inside the target device, but may reset other parameters to the defaults (except a minor update that does not change the number of parameters). Hence, where necessary, save the parameters using an engineering tool, parameter setting utility, or the like before carrying out a software download, and then reconfigure the field device(s) after the download. For details, see Section A6.6.

CAUTION

The current dissipation of the target field device increases transitorily immediately after a download due to erasing of the FlashROM's contents. Use a fieldbus power supply which has sufficient capacity to cover such increases in feed current.

CAUTION

Upon completion of the activation, the target fieldbus device performs resetting internally, which temporarily halts fieldbus communication and function block executions. Be especially careful about a valve positioner; the output air pressure will fall to the minimum level (i.e., zero).

CAUTION

Do not turn off the power to a field device or disconnect the download tool during a download or activation. The device may fail as a result.

NOTE

Be careful about the noise on the fieldbus link. If the fieldbus is noisy, the downloading may take a very long time or fail.

A6.5 Download Files

Download files have the following filenames (with the filename extension of ".ffd"). Take care to choose the correct download file for the target field device:

"594543" + device family + "_" + device type + "_" + domain name + "_" + software name + "_" + software revision + ".ffd"

For example, the name of the download file for the Rotamass may have the following name:

594543000D_000D_ROTAMASS_ORIGINAL_R201.ffd

Refer to A6.10(3) DOMAIN_HEADER about each keyword of the file name.

The device type is "000D" for the Rotamass .

The software name is “ORIGINAL” or “UPDATE.” The former indicates an original file and the latter an update file. Whenever performing a download to update the device revision, obtain the original file. In general, an addition to the parameters or blocks requires a device revision update.

A6.6 Steps after Activating a Field Device

When the communication with a field device has recovered after activating the device, check using the download tool that the software revision of the field device has been updated accordingly. The value of SOFT_REV of the resource block indicates the software revision.

The PD tag, node address, and transducer block calibration parameters that are retained in the nonvolatile memory inside the target device will remain unchanged after a software download. However, after a software update which causes an addition to the block parameters or blocks, or to the system/network management VFD parameters, some parameters may be reset to the defaults, thus requiring parameter setup and engineering again. For details, see the table below.

Also note that a change in the number of parameters or blocks requires the DD and capabilities files corresponding to the new software revision.

Table A6.1 Actions after Software Update

Contents of Software Update	Action
Does not change the number of parameters.	Re-setup of parameters not needed.
Adds a block parameter.	Setup of the added parameter needed.
Adds a block.	Reengineering and setup of the added block’s parameters needed.
Changes the number of system/network management VFD parameters.	Reengineering needed.

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A6.7 Troubleshooting

For information on the download tool's error messages, see also the software's User's Manual.

Table A6.2 Problems after Software Update

Symptom	Cause	Remedy
An error occurs before starting a download, disabling the download.	The selected download file is not for the selected field device.	Check SOFTDWN_ERROR in the resource block and obtain the correct file.
An error occurs after starting a download, disabling the download.	You attempted to update the device revision by downloading a file which is not an original file.	Check SOFTDWN_ERROR in the resource block and obtain the original file.
	The selected field device does not support software downloading.	Check whether the option code /EE is included in the model and suffix codes of the device.
	The voltage on the fieldbus segment falls below the specified limit (9 volts).	Check the capacity of the field bus power supply used and the voltage at the terminal.
	There was an error in a checksum or the number of transmission bytes.	Check SOFTDWN_ERROR in the resource block and obtain the correct file.
	The download tool does not allow download with same software revision.	Check the setting of the download tool.
The download takes far longer than expected or fails frequently.	The fieldbus segment is noisy.	Check the noise level on the fieldbus segment.
An error occurs after activation.	Transient error caused by the internal resetting of the field device	Check whether communication with the field device has recovered after a while.
The new software does not work after the activation.	The file of the current revision was downloaded.	Obtain the correct file.
	Failure of the memory in field device, etc.	Check SOFTDWN_ERROR in the resource block, and re-try downloading. If fails, place a service call.

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A6.8 Resource Block's Parameters Relating to Software Download

Table A6.3 Additional Parameters of Resource Block

Relative Index	Index	Parameter Name	(Factory Set)	Write Mode	Description
53	1053	SOFTDWN_PROTECT	0x01		Defines whether to accept software downloa 0x01: Unprotected 0x02: Protected
54	1054	SOFTDWN_FORMAT	0x01		Selects the software download method. 0x01: Standard
55	1055	SOFTDWN_COUNT	0	—	Indicates the number of times the internal FlashROM was erased.
56	1056	SOFTDWN_ACT_AREA	0	—	Indicates the ROM number of the currently working FlashROM. 0: FlashROM #0 working 1: FlashROM #1 working
57	1057	SOFTDWN_MOD_REV	1, 0, 0, 0, 0, 0, 0, 0, 0	—	Indicates the software module revision.
58	1058	SOFTDWN_ERROR	0	—	Indicates an error during a software downloa See Table A6.4.

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Table A6.4 Download Error Codes

Error Code	Detail
0	No error
32768	Unsupported header version
32769	Abnormal header size
32770	Abnormal manufacturer ID
32771	Abnormal device family
32772	Abnormal device revision
32773	Abnormal vendor specification version
32774	Abnormal number of modules
32775	Abnormal number of bytes in module 1
32776	Abnormal number of bytes in module 2
32777	Device error in module 1
32778	Checksum error in module 1
32779	Checksum error in file
32780	Unused
32781	Write-prohibited area in FlashROM
32782	Verification error during FlashROM writing
32783	Polling error during FlashROM erasing
32784	Polling time-out during FlashROM erasing
32785	Polling error during FlashROM writing
32786	Polling time-out during FlashROM writing
32787	FlashROM driver undefined number error
32788	File endcode error
32789	File type error (UPDATE, ORIGINAL)
32790	FlashROM driver undefined number error
32791	On-start state error (other than DWNLD_NOT_READY)
32792	Start segment error in module 1
32793	Binary file error
32794	Binary file error
32795	Device error in module 2
32796	Detection of EEPROM state other than backup after activation
32797	Checksum error in module 2
32798	Not in DWNLD_READY state when receiving GenericDomainInitiate
32799	Not in DWNLD_OK state when receiving GenericDomainTerminate
32800	Not in DOWNLOADING state when receiving GenericDomainSegment
32801	Firmware error
36863	Unused

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A6.9 System/Network Management VFD Parameters Relating to Software Download

Table A6.5 System/Network Management VFD Parameters

Write Mode: R/W = read/write; R = read only

Index (SM)	Parameter Name	Sub Index	Sub-parameter Name	Default (Factory Set)	Write Mode	Remarks
400	DWNLD_PROPERTY	0			R	
		1	Download Class	1		
		2	Write Rsp Returned For ACTIVATE	1		
		3	Write Rsp Returned For PREPARE	1		
		4	Reserved	0		
		5	ReadyForDwnld Delay Secs	300		
		6	Activation Delay Secs	60		
410	DOMAIN_DESCRIPTOR	0			R/W	Read/write-permitted only for sub-index 1
		1	Command	3		
		2	State	1		
		3	Error Code	0		
		4	Download Domain Index	440		
		5	Download Domain Header Index	420		
		6	Activated Domain Header Index	430		
		7	Domain Name	(Device name)		
420	DOMAIN_HEADER.1	0				
		1	Header Version Number	0		
		2	Header Size	0		
		3	Manufacturer ID			
		4	Device Family			
		5	Device Type			
		6	Device Revision	0		
		7	DD Revision	0		
		8	Software Revision			
		9	Software Name			
		10	Domain Name			
430	DOMAIN_HEADER.2	0				
		1	Header Version Number	1		
		2	Header Size	44		
		3	Manufacturer ID	0x594543		
		4	Device Family	(DEV_TYPE of RB)		
		5	Device Type	(DEV_TYPE of RB)		
		6	Device Revision	(DEV_REV of RB)		
		7	DD Revision	(DD_REV of RB)		
		8	Software Revision	(SOFT_REV of RB)		
		9	Software Name	ORIGINAL		
		10	Domain Name	(Device name)		
440	DOMAIN					Read/write: prohibited Get-OD: permitted

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A6.10 Comments on System/Network Management VFD Parameters Relating to Software Download

IMPORTANT

Do not turn off the power to a field device immediately after changing parameter settings. Data writing actions to the EEPROM are dual redandant to ensure reliability. If the power is turned off within 60 seconds after setup, the parameters may revert to the previous settings.

(1) DWNLD_PROPERTY

Sub Index	Element	Size (Bytes)	Description
1	Download Class	1	Indicates the download class. 1: Class 1
2	Write Rsp Returned For ACTIVATE	1	Indicates whether a write response is returned to the ACTIVATE command. 1: Write Response Returned
3	Write Rsp Returned For PREPARE	1	Indicates whether a write response is returned to the PREPARE command. 1: Write Response Returned
4	Reserved	1	(Reserved)
5	ReadyForDwnld Delay Secs	2	Indicates the maximum delay after receipt of the PREPARE_FOR_DWNLD command to proceed to transition from DWNLD_NOT_READY to DWNLD_READY.
6	Activation Delay Secs	2	Indicates the maximum delay after receipt of the ACTIVATE command to proceed to transition from DWNLD_OK to DWNLD_NOT_READY.

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(2) DOMAIN_DESCRIPTOR

Sub Index	Element	Size (Bytes)	Description
1	Command	1	Reads/writes software download commands. 1: PREPARE_FOR_DWNLD (instruction of download preparation) 2: ACTIVATE (activation instruction) 3: CANCEL_DWNLD (instruction of download cancellation)
2	State	1	Indicates the current download status. 1: DWNLD_NOT_READY (download not ready) 2: DWNLD_PREPARING (download under preparation) 3: DWNLD_READY (ready for download) 4: DWNLD_OK (download complete) 5: DOWNLOADING (download underway) 6: CHECKSUM_FAIL (not used in this product) 7: FMS_DOWNLOAD_FAIL (failure during download) 8: DWNLD_INCOMPLETE (download error detected at restart) 9: VCR_FAIL (not used in this product) 10: OTHER (download error other than 6 and 7 detected)
3	Error Code	2	Indicates the error during a download and activation. 0: success, configuration retained (download successfully completed) 32768 - 65535: Download error (See Table 4 for error codes.)
4	Download Domain Index	4	Indicates the index number of the domain for software downloading.
5	Download Domain Header Index	4	Indicates the index number of the domain header to which the download is performing.
6	Activated Domain Header Index	4	Indicates the index numbers of the domain header currently running.
7	Domain Name	8	Indicates the domain name. With this product, Domain Name indicates the field device name.

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(3) DOMAIN_HEADER

Sub Index	Element	Size (Bytes)	Description
1	Header Version Number	2	Indicates the version number of the header.
2	Header Size	2	Indicates the header size.
3	Manufacturer ID	6	Indicates the value of resource block's MANUFAC_ID (manufacturer ID) as character string data.
4	Device Family	4	Indicates the device family. With this product, Device Family indicates the value of resource block's DEV_TYPE as character string data.
5	Device Type	4	Indicates the value of resource block's DEV_TYPE as character string data.
6	Device Revision	1	Indicates the value of resource block's DEV_REV.
7	DD Revision	1	Indicates the value of resource block's DD_REV.
8	Software Revision	8	Indicates the value of resource block's SOFT_REV.
9	Software Name	8	Indicates the attribute of the binary file. With this product, Software Name indicates either of the following: "ORIGINAL" followed by one space: Original file "UPDATE" followed by two spaces: Update file
10	Domain Name	8	Indicates the domain name. With this product, Domain Name indicates the field device name.

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APPENDIX 7. LINK MASTER FUNCTIONS

A7.1 Link Active Scheduler

A link active scheduler (LAS) is a deterministic, centralized bus scheduler that can control communications on an H1 fieldbus segment. There is only one LAS on an H1 fieldbus segment.

A ROTAMASS supports the following LAS functions.

- PN transmission: Identifies a fieldbus device newly connected to the same fieldbus segment. PN is short for Probe Node.
- PT transmission: Passes a token governing the right to transmit, to a fieldbus device on the same segment. PT is short for Pass Token.
- CD transmission: Carry out a scheduled transmission to a fieldbus device on the same segment. CD is short for Compel Data.
- Time synchronization: Periodically transmits the time data to all fieldbus devices on the segment and returns the time data in response to a request from a device.
- Live list equalization: Sends the live list data to link masters on the same segment.
- LAS transfer: Transfers the right to be the LAS on the segment to another link master.

A7.2 Link Master

A link master (LM) is any device containing a link active scheduler. There must be at least one LM on a segment. When the LAS on a segment has failed, another LM on the same segment starts working as the LAS.

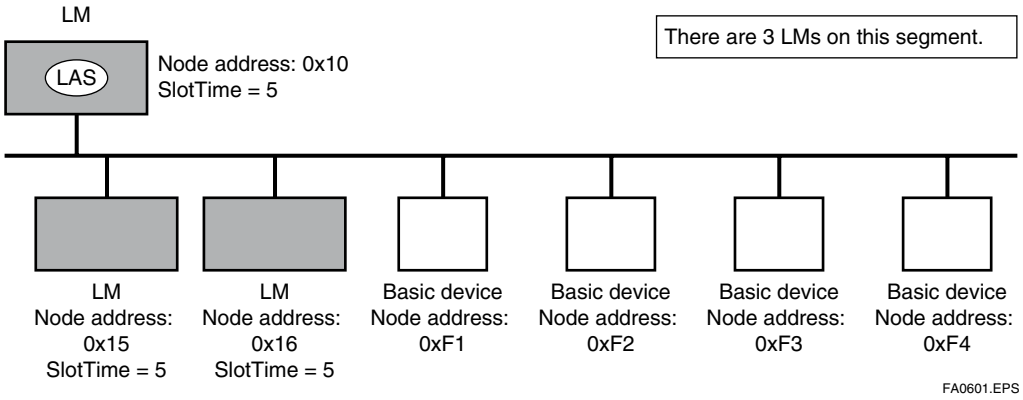

Figure A7-1. Example of Fieldbus configuration-3 LMs on Same Segment

A7.3 Transfer of LAS

There are two procedures for an LM to become the LAS:

- If the LM whose value of [V(ST)3V(TN)] is the smallest on a segment, with the exception of the current LAS, judges that there is no LAS on the segment, in such a case as when the segment has started up or when the current LAS has failed, the LM declares itself as the LAS, then becomes the LAS. (With this procedure, an LM backs up the LAS as shown in the following figure.)
- The LM whose value of [V(ST)3V(TN)] is the smallest on a segment, with the exception of the current LAS, requests the LAS on the same segment to transfer the right of being the LAS, then becomes the LAS.

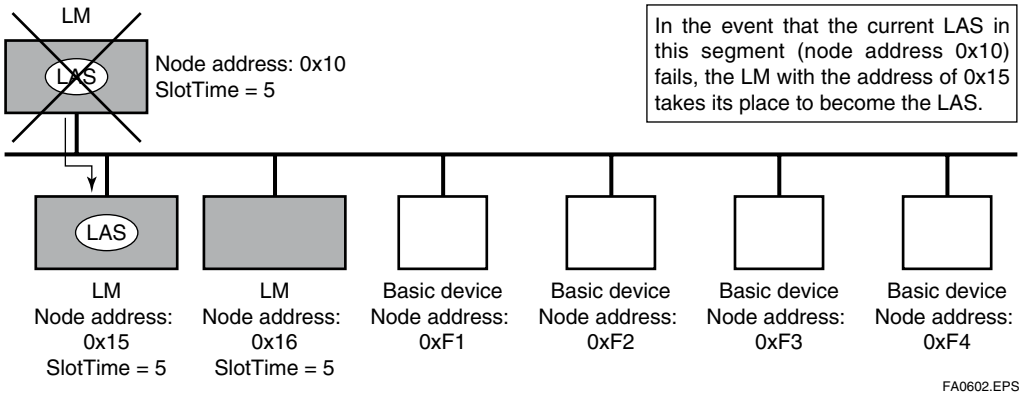

Figure A7-2. Backup of LAS

To set up a ROTAMASS as a device that is capable of backing up the LAS, follow the procedure below.

NOTE: When changing the settings in a ROTAMASS, add the ROTAMASS to the segment in which an LAS is running. After making changes to the settings, do not turn off the power to the ROTAMASS for at least 60 seconds.

(1) Set the node address of the ROTAMASS. In general, use an address from 0x10 to [V(FUN) – 1].

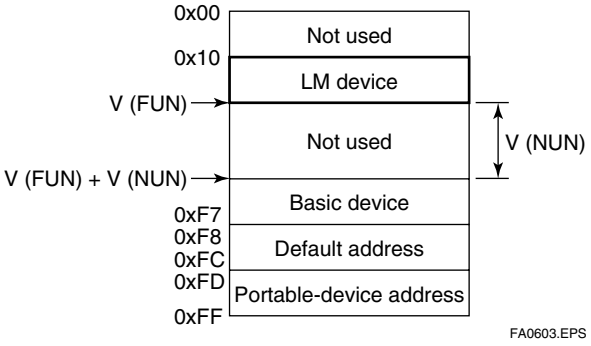

Figure A7-3. Node Address Ranges

(2) In the LAS settings of the ROTAMASS, set the values of V(ST), V(MRD), and V(MID) to the same as the respective lowest capability values in all the devices within the segment. An example is shown below.

DlmeBasicInfo (Rotamass Index xxx (SM)

Sub-index	Element	Rota-mass	Device 1	Device 2	Device 3	Description
1	SlotTime	4	8	10	20	Capability value for V(ST)
3	MaxResponse Delay	3	6	3	5	Capability value for V(MRD)
6	MinInterPdu Delay	4	8	12	10	Capability value for V(MID)

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In this case, set SlotTime, MaxResponseTime, and MinInterPduDelay as follows:

Configu redLink Settings Record (Rotamass Index xxx (SM)

Subinde x	Element	Setting (Default)	Description
1	SlotTime	20 (4095)	V (ST)
3	MaxResponseDelay	6 (5)	V (MRD)
6	MinInterPduDelay	12 (12)	V (MID)

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(3) In the LAS settings of the ROTAMASS, set the values of V(FUN) and V(NUN) so that they include the node addresses of all nodes within the same segment. (See also Figure A7-3.)

ConfiguredLink Settings Record
(Rotamass Index xxx (SM)

Subindex	Element	Default Value	Description
4	FirstUnpolledNodeId	0x25	V (FUN)
7	NumConsecUnpolledNodeId	0xBA	V (NUN)

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A7.4 LM Functions

No.	Function	Description
1	LM initialization	When a fieldbus segment starts, the LM with the smallest [V(ST) × V(TN)] value within the segment becomes the LAS. At all times, each LM is checking whether or not a carrier is on the segment.
2	Startup of other nodes (PN and Node Activation SPDU transmissions)	Transmits a PN (Probe Node) message, and Node Activation SPDU message to devices which return a new PR (Probe Response) message.
3	PT transmission (including final bit monitoring)	Passes a PT (Pass Token) message to devices included in the live list sequentially, and monitors the RT (Return Token) and final bit returned in reply to the PT.
4	CD transmission	Transmits a CD (Compel Data) message at the scheduled times.
5	Time synchronization	Supports periodic TD (Time Distribution) transmissions and transmissions of a reply to a CT (Compel Time).
6	Domain download server	Sets the schedule data. The schedule data can be equalized only when the Domain Download command is carried out from outside the LM in question. (The version of the schedule is usually monitored, but no action takes place, even when it changes.)
7	Live list equalization	Transmits SPDU messages to LMs to equalize live lists.
8	LAS transfer	Transfers the right of being the LAS to another LM.
9	Reading/writing of NMIB for LM	See Section A6.5.
10	Round Trip Delay Reply (RR) Reply to DLPDU	Not yet supported in the current version.
11	Long address	Not yet supported in the current version.

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A7.5 LM Parameters

A7.5.1 LM Parameter List

The tables below show LM parameters of a ROTAMASS.

Meanings of Access column entries: RW = read/write possible; R = read only

Index (SM)	Parameter Name	Sub-parameter Name (Sub Index)	Default Factory Setting	Access	Remarks
362	DLME_LINK_MASTER_CAPABILITIES_VARIABLE		0x04	RW	
363	DLME_LINK_MASTER_INFO_RECORD	0		RW	
		1 MaxSchedulingOverhead	0		
		2 DefMinTokenDelegTime	100		
		3 DefTokenHoldTime	300		
		4 TargetTokenRotTime	4096		
		5 LinkMaintTokHoldTime	400		
		6 TimeDistributionPeriod	5000		
		7 MaximumInactivityToClaimLasDelay	8		
		8 LasDatabaseStatusSpduDistributionPeriod	6000		
364	PRIMARY_LINK_MASTER_FLAG_VARIABLE		–	RW	LAS: True = 0xFF; non-LAS: False = 0x00
365	LIVE_LIST_STATUS_ARRAY_VARIABLE		–	R	
366	MAX_TOKEN_HOLD_TIME_ARRAY	0	0x0000×16, 0x012c×16	RW	
		1 Element1	0x012c×5, 0x0000×27		
		2 Element2	0x0000×32		
		3 Element3	0x0000×32		
		4 Element4	0x0000×32		
		5 Element5	0x0000×32		
		6 Element6	0x0000×31, 0x012c		
		7 Element7	0x012c×32		
		8 Element8	0x02		
367	BOOT_OPERAT_FUNCTIONAL_CLASS			RW	0x01 (basic device); 0x02 (LM)
368	CURRENT_LINK_SETTING_RECORD	0		R	Settings for LAS
		1 SlotTime			
		2 PerDlpduPhlOverhead			
		3 MaxResponseDelay			
		4 FirstUnpolledNodeId			
		5 ThisLink			
		6 MinInterPduDelay			
		7 NumConseeUnpolledNodeId			
		8 PreambleExtension			
		9 PostTransGapExtension			
		10 MaxInterChanSignalSkew			
		11 TimeSyncClass			
369	CONFIGURED_LINK_SETTING_RECORD	0		RW	
		1 SlotTime	4095		
		2 PerDlpduPhlOverhead	4		
		3 MaxResponseDelay	5		
		4 FirstUnpolledNodeId	37		
		5 ThisLink	0		
		6 MinInterPduDelay	12		
		7 NumConseeUnpolledNodeId	186		
		8 PreambleExtension	2		
		9 PostTransGapExtension	1		
		10 MaxInterChanSignalSkew	0		
		11 TimeSyncClass	4		

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Index (SM)	Parameter Name	Sub-parameter Name (Sub Index)	Default Factory Setting	Access	Remarks
370	PLME_BASIC_ CHARACTERISTICS	0		R	
		1 ChannelStatisticsSupported	0x00		
		2 MediumAndDataRatesSupported	0x4900000000000000		
		3 IecVersion	1 (0x1)		
		4 NumOfChannels	1 (0x1)		
		5 PowerMode	0 (0x0)		
371	CHANNEL_STATES	0		R	
		1 channel-1	0 (0x0)		
		2 channel-2	128 (0x80)		
		3 channel-3	128 (0x80)		
		4 channel-4	128 (0x80)		
		5 channel-5	128 (0x80)		
		6 channel-6	128 (0x80)		
		7 channel-7	128 (0x80)		
		8 channel-8	128 (0x80)		
372	PLME_BASIC_INFO	0		R	
		1 InterfaceMode	0 (0x0)		
		2 LoopBackMode	0 (0x0)		
		3 XmitEnabled	1 (0x1)		
		4 RcvEnabled	1 (0x1)		
		5 PreferredReceiveChannel	1 (0x1)		
		6 MediaTypeSelected	73 (0x49)		
		7 ReceiveSelect	1 (0x1)		
373	LINK_SCHEDULE_ACTIVATION_VARIABLE			RW	
374	LINK_SCHEDULE_LIST_ CHARACTERISTICS_ RECORD	0		R	
		1 NumOfSchedules	0		
		2 NumOfSubSchedulesPerSchedule	1		
		3 ActiveScheduleVersion	0		
		4 ActiveSheduleOdIndex	0		
	DLME_SCHEDULE_	5 ActiveScheduleStartingTime	0		
375	DESCRIPTOR.1	0		R	
		1 Version	0		
		2 MacrocycleDuration	0		
	DLME_SCHEDULE_	3 TimeResolution	0		
376	DESCRIPTOR.2	0		R	
		1 Version	0		
		2 MacrocycleDuration	0		
	DOMAIN.1	3 TimeResolution	0		
377	DOMAIN.2				Read/write impossible. Get-OD possible.
378					Read/write impossible. Get-OD possible.

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A7.5.2 Descriptions for LM Parameters

The following describes LM parameters of a ROTAMASS transmitter.

NOTE: Do not turn off the power to the ROTAMASS for 60 seconds after making a change to its parameter settings.

(1) DlmeLinkMasterCapabilitiesVariable

Bit Position	Meaning	Description	Value
B3: 0x04	LAS Schedule in Non-volatile Memory	Whether the LAS schedule can (= 1) or cannot (= 0) be saved to the non-volatile memory	1
B2: 0x02	Last Values Record Supported	Whether to support (= 1) or not to support (= 0) LastValuesRecord.	0
B1: 0x01	Link Master Statistics Record Supported	Whether to support (= 1) or not to support (= 0) DlmeLinkMasterStatisticsRecord.	0

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(2) DlmeLinkMasterInfoRecord

Sub-index	Element	Size [bytes]	Description
1	MaxSchedulingOverhead	1	V(MSO)
2	DefMinTokenDelegTime	2	V(DMDT)
3	DefTokenHoldTime	2	V(DTHT)
4	TargetTokenRotTime	2	V(TTRT)
5	LinkMaintTokHoldTime	2	V(LTHT)
6	TimeDistributionPeriod	4	V(TDP)
7	MaximumInactivityToClaimLasDelay	2	V(MICD)
8	LasDatabaseStatusSpduDistributionPeriod	2	V(LDDP)

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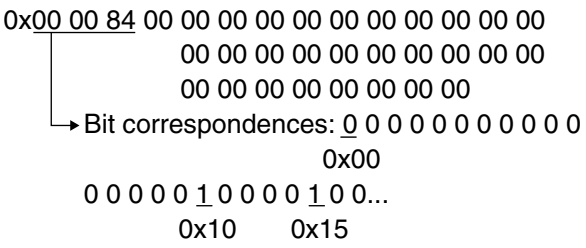
(3) PrimaryLinkMasterFlagVariable

Explicitly declares the LAS. Writing “true” (0xFF) to this parameter in a device causes that device to attempt to become the LAS. However, a request of writing “true” to this parameter in a device is rejected if the value of the same parameter in any other device that has a smaller node address within the same segment is true.

(4) LiveListStatusArrayVariable

A 32-byte variable, in which each bit represents the status of whether a device on the same segment is live or not. The leading bit corresponds to the device address 0x00, and final bit to 0xFF. The value of LiveListStatusArrayVariable in the case where devices having the addresses 0x10 and 0x15 in the fieldbus segment is shown below.



(5) MaxTokenHoldTimeArray

An 8- by 64-byte array variable, in which each set of 2 bytes represents the delegation time (set as an octet time) assigned to a device. The delegation time denotes a time period that is given to a device by means of a PT message sent from the LAS within each token circulation cycle.

The leading 2 bytes correspond to the device address 0x00, and the final 2 bytes to the device address 0xFF. Specify the subindex to access this parameter.

(6) BootOperatFunctionalClass

Writing 1 to this parameter in a device and restarting the device causes the device to start as a basic device. On the contrary, writing 2 to this parameter and restarting the device causes the device to start as an LM.

(7) CurrentLinkSettingRecord and ConfiguredLinkSettingsRecord

CurrentLinkSettingRecord indicates the bus parameter settings currently used. ConfiguredLinkSettingsRecord indicates the bus parameter settings to be used when the device becomes the LAS. Thus, when a device is the LAS, its CurrentLinkSettingRecord and ConfiguredLinkSettingsRecord have the same values.

Sub-index	Element	Size [bytes]	Description
1	SlotTime	2	V(ST)
2	PerDlpduPhlOverhead	1	V(PhLO)
3	MaxResponseDelay	1	V(MRD)
4	FirstUnpolledNodeId	1	V(FUN)
5	ThisLink	2	V(TL)
6	MinInterPduDelay	1	V(MID)
7	NumConsecUnpolledNodeId	1	V(NUN)
8	PreambleExtension	1	V(PhPE)
9	PostTransGapExtension	1	V(PhGE)
10	MaxInterChanSignalSkew	1	V(PhIS)
11	TimeSyncClass	1	V(TSC)

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(8) DlmeBasicInfo

Sub-index	Element	Size [bytes]	Description
1	SlotTime	2	Indicates the capability value for V(ST) of the device.
2	PerDlpduPhlOverhead	1	V(PhLO)
3	MaxResponseDelay	1	Indicates the capability value for V(MRD) of the device.
4	ThisNode	1	V(TN), node address
5	ThisLink	2	V(TL), link-id
6	MinInterPduDelay	1	Indicates the capability value for V(MID) of the device.
7	TimeSyncClass	1	Indicates the capability value for V(TSC) of the device.
8	PreambleExtension	1	V(PhPE)
9	PostTransGapExtension	1	V(PhGE)
10	MaxInterChanSignalSkew	1	V(PhIS)

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(9) PlmeBasicCharacteristics

Sub-index	Element	Size [bytes]	Value	Description
1	Channel Statistics Supported	1	0	Statistics data are not supported.
2	Medium AndData Rates Supported	8	0x4900000000000000	Wire medium, voltage mode, and 31.25 kbps are supported.
3	IceVersion	2	0x0403	IEC 4.3 is supported.
4	NumOf Channels	1	1	
5	Power Mode	1	0	0: Bus-powered; 1: Self-powered

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(10) ChannelStates

Sub-index	Element	Size [bytes]	Value	Description
1	Channel 1	1	0x00	In Use, No Bad since last read, No Silent since last read, No Jabber since last read, Tx Good, Rx Good
2	Channel 2	1	0x80	Unused
3	Channel 3	1	0x80	Unused
4	Channel 4	1	0x80	Unused
5	Channel 5	1	0x80	Unused
6	Channel 6	1	0x80	Unused
7	Channel 7	1	0x80	Unused
8	Channel 8	1	0x80	Unused

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(11) PlmeBasicInfo

Sub-index	Element	Size [bytes]	Value	Description
1	InterfaceMode	1	0	0: Half duplex; 1: Full duplex
2	LoopBackMode	1	0	0: Disabled; 1: MAU; 2: MDS
3	XmitEnabled	1	0x01	Channel 1 is enabled.
4	RcvEnebled	1	0x01	Channel 1 is enabled.
5	PreferredReceive Channel	1	0x01	Channel 1 is used for reception.
6	MediaType Selected	1	0x49	Wire medium, voltage mode, and 31.25 kbps are selected.
7	ReceiveSelect	1	0x01	Channel 1 is used for reception.

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(12) LinkScheduleActivationVariable

Writing the version number of an LAS schedule, which has already been downloaded to the domain, to this parameter causes the corresponding schedule to be executed. On the other hand, writing 0 to this parameter stops execution of the active schedule.

(13) LinkScheduleListCharacteristicsRecord

Sub-index	Element	Size [bytes]	Description
1	NumOf Schedules	1	Indicates the total number of LAS schedules that have been downloaded to the domain.
2	NumOfSub SchedulesPer Schedule	1	Indicates the maximum number of sub-schedules an LAS schedule can contain. (This is fixed to 1 in the Yokogawa communication stacks.)
3	ActiveSchedule Version	2	Indicates the version number of the schedule currently executed.
4	ActiveSchedule OdIndex	2	Indicates the index number of the domain that stores the schedule currently executed.
5	ActiveSchedule StaringTime	6	Indicates the time when the current schedule began being executed.

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(14) DlmeScheduleDescriptor

This parameter exists for the same number as the total number of domains, and each describes the LAS schedule downloaded to the corresponding domain. For the domain to which a schedule has not yet been downloaded, the values in this parameter are all zeros.

Sub-index	Element	Size [bytes]	Description
1	Version	2	Indicates the version number of the LAS schedule downloaded to the corresponding domain.
2	Macrocycle Duration	4	Indicates the macro cycle of the LAS schedule downloaded to the corresponding domain.
3	TimeResolution	2	Indicates the time resolution that is required to execute the LAS schedule downloaded to the corresponding domain.

TA0614.EPS

(15) Domain

Read/write: impossible; get-OD: possible

Carrying out the GenericDomainDownload command from a host writes an LAS schedule to the domain.

A7.6 FAQs

Q1. When the LAS stops, a ROTAMASS does not back it up by becoming the LAS. Why?

A1-1. Is that ROTAMASS running as an LM? Check that the value of BootOperatFunctionalClass (index 367) is 2 (indicating that it is an LM).

A1-2. Check the values of V(ST) and V(TN) in all LMs on the segment and confirm that the following condition is met:

ROTAMASS		Other LMs
V(ST) 3 V(TN)	<	V(ST) 3 V(TN)

Q2. How can I make a ROTAMASS become the LAS?

A2-1. Check that the version numbers of the active schedules in the current LAS and the ROTAMASS are the same by reading:

LinkScheduleListCharacteristicsRecord

(index 374 for a ROTAMASS)

- ActiveScheduleVersion (subindex 3)

A2-2. Make the ROTAMASS declare itself as and become the LAS by writing:

- 0x00 (false) to PrimaryLinkMasterFlagVariable in the current LAS; and
- 0xFF (true) to PrimaryLinkMasterFlagVariable (index 364) in the ROTAMASS.

Q3. On a segment where a ROTAMASS works as the LAS, another device cannot be connected. Why?

A3-1. Check the following bus parameters that indicate the bus parameter as being the LAS for the ROTAMASS and the capabilities of being the LAS for the device that cannot be connected:

- V(ST), V(MID), and V(MRD) of ROTAMASS: ConfiguredLinkSettingsRecord (index 369)
- V(ST), V(MID), and V(MRD) of problematic device: DlmeBasicInfo

Then, confirm that the following conditions are met:

ROTAMASS		Problematic Device
V(ST)	>	V(ST)
V(MID)	>	V(MID)
V(MRD)	>	V(MRD)

A3-2. Check that the node address of the problematic device does not lie within either 0x00 to 0x10 or the range of unused (unpolled) node addresses determined by the ROTAMASS LM parameter settings, which is 0x00 to 0x10 or V(FUN) to V(FUN) + V(NUM). (Refer to Section 5.2, “Network Definition.”)

Q4. The LCD keeps showing “— — —”. It is presumed that an LAS does not exist on the bus or the ROTAMASS cannot establish communication with the LAS. What should be done?

A4-1. Check that an LAS is connected on the bus. (When using the ROTAMASS as the LAS [which requires an option], perform steps (1) to (3) in Section A6-3.)

A4-2. Make the parameters in the current LAS match the capabilities parameter in the

ROTAMASS as follows (refer to Section 5.2, “Network Definition”):

LAS		ROTAMASS
V(ST)	>	V(ST) ž 4
V(MID)	>	V(MID) ž 4
V(MRD)	>	V(MRD) ž 12

A4-3. Check that the ROTAMASS is assigned an appropriate address. The address of the ROTAMASS must not lie within either 0x00 to 0x10 or the range of unused (unpolled) node addresses determined by the current LAS’s LM parameter settings, which is V(FUN) to V(FUN) + V(NUM). (Refer to Section 5.2, “Network Definition.”)

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APPENDIX 8. DEVICEVIEWER WINDOW EXECUTED FROM FIELDMATE AND PRM (Plant Resource Manager)

With DeviceViewer, it is possible to display whether or not the hardware status and configuration are normal as the result of self-diagnosis performed by an FF-H1 device. (Please refer to IM 33Y05Q10-01E.)

The following figure shows an example of the DeviceViewer window displayed for the ROTAMASS module.

Figure A8.1 Hardware Failure

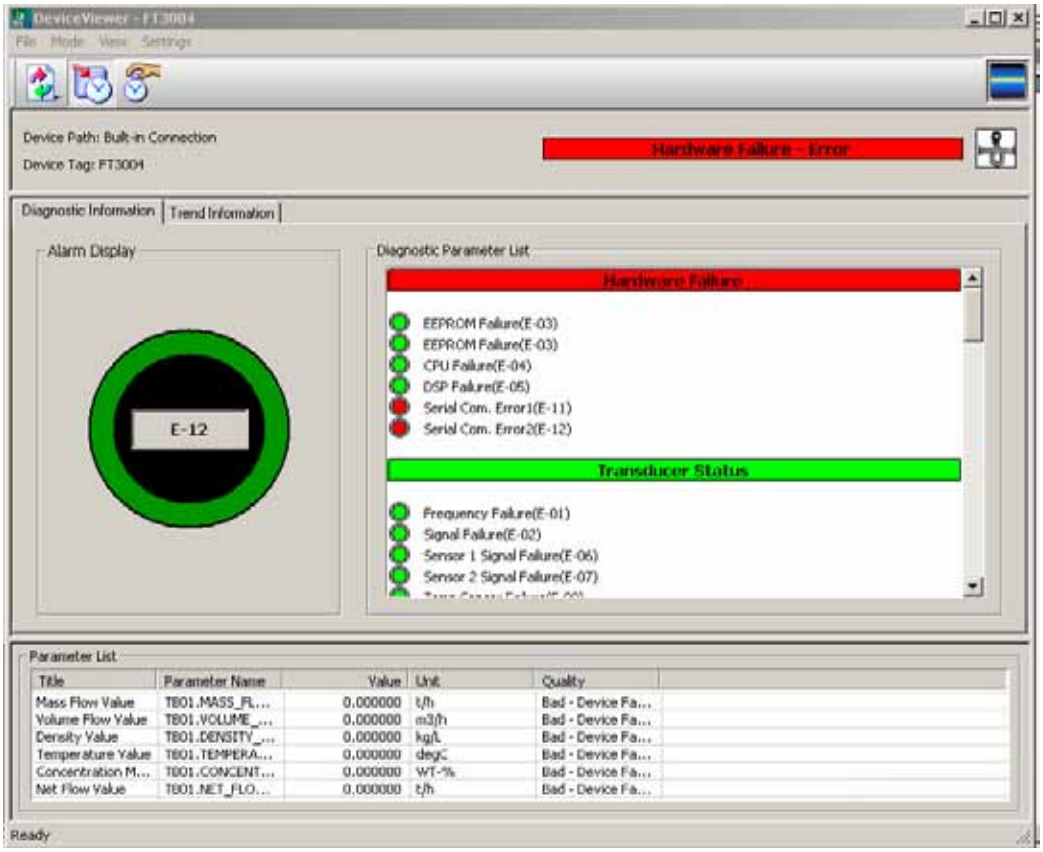

Table A8.1 Hardware Failure

EEPROM Failure(E-03)	Error	EEPROM (Fieldbus) failed. (E-03) [Remedy]: Contact the nearest office or service center.
EEPROM Failure(E-03)	Error	EEPROM (HART) failed. (E-03) [Remedy]: Contact the nearest office or service center.
CPU Failure(E-04)	Error	CPU Microprocessor failed. (E-04) [Remedy]: Contact the nearest office or service center.
DSP Failure(E-05)	Error	DSP Microprocessor failed. (E-05) [Remedy]: Contact the nearest office or service center.
Serial Com. Failure1(E-11)	Error	Serial communication 1 failed. (E-11) [Remedy]: Contact the nearest office or service center.
Serial Com. Failure2(E-12)	Error	Serial communication 2 failed. (E-12) [Remedy]: Contact the nearest office or service center.

Figure A8.2 Transducer Status

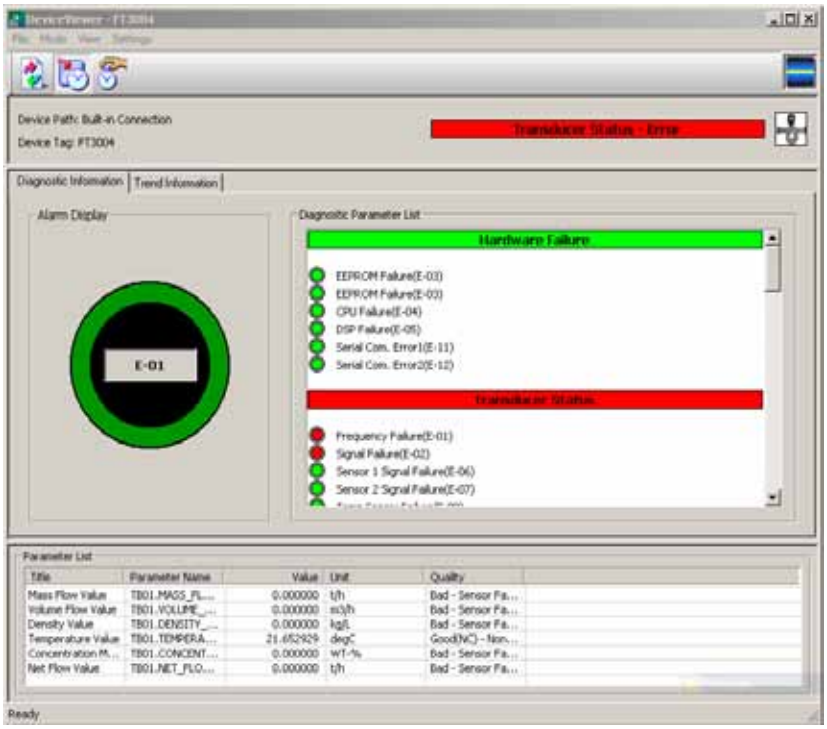

Table A8.2 Transducer Status

Frequency Failure(E-01)	Error	Driving frequency out of range. (E-01). (f < Frequency low limit, or f > Frequency high limit) [Remedy]: Check cable (remote) and detector.
Signal Failure(E-02)	Error	Phase difference out of range. (E-02). (deltaPHI < Phase Difference low limit, or deltaPHI > Phase Difference high limit) [Remedy]: Check cable (remote) and detector.
Sensor 1 Signal Failure(E-06)	Error	Sensor 1 signal too small. (E-06). (S1 < 7% of Drive Amplitude for 3 min) [Remedy]: Check cable (remote) and detector.
Sensor 2 Signal Failure(E-07)	Error	Sensor 2 signal too small. (E-07). (S2 < 7% of Drive Amplitude for 3 min) [Remedy]: Check cable (remote) and detector.
Temp Sensor Failure(E-08)	Error	Temperature sensor failed. (E-08). (T<-210degC, or T>450degC) [Remedy]: Check cable (remote) and detector. Check temperature.
SoftDL Incomplete(E-09)	Error	Software download is incomplete. (E-09) [Remedy]: Check the cables, power and RB Softdown Error(RB.SOFTDWN_ERROR).
SoftDL Failure(E-10)	Error	Software download failed. (E-10) [Remedy]: Check the download file and RB Softdown Error(RB.SOFTDWN_ERROR).
Abnormal Boot Process	Error	Abnormal boot processing was detected at the time of starting. [Remedy]: Check the cables, power and RB Softdown Error(RB.SOFTDWN_ERROR).
Slug Detection(A-14)	Alarm	Slug criterion is reached. (A-14) [Remedy]: Reduce gas bubbles in medium.
Empty Pipe Detection(A-15)	Alarm	Empty Pipe criterion is reached. (A-15) [Remedy]: Fill pipe.
Corrosion Detection(A-16)	Alarm	Corrosion criterion is reached. (A-16) [Remedy]: Change detector.
Density Lower 0.3kg/l(W-01)	Warning	Density lower than 0.3kg/l. (W-01) [Remedy]: Fill detector with fluid.
Fixed Dens Selected(W-02)	Warning	Reference density is enabled. (W-02) [Remedy]: Set TB Density Fixed Value Selection (TB.DENSITY_FIX_VAL_SEL) to inhibit.
Fixed Temp Selected(W-03)	Warning	Temperature fixed value is enabled. (W-03) [Remedy]: Set TB Temperature Fixed Value Selection (TB.TEMP_FIX_VAL_SELECT) to inhibit.
Fixed Mass Flow Selected(W-04)	Warning	Mass flow fixed value is enabled. (W-04) [Remedy]: Set TB Mass Flow Fixed Value Selection (TB.MASS_FLOW_FIX_VAL_SEL) to inhibit.
Autozero Value out of Range(W-6)	Warning	Autozero value is out of the internal detector depending range. (W-06) [Remedy]: Stop flow during autozero. Check detector installation.
Autozero Fluct out of Range(W-7)	Warning	Autozero fluctuation is out of the internal detector depending range. (W-07) [Remedy]: Stop flow during autozero. Check electrical installation, vibration and density.
PD/Freq Simulation Active(W-08)	Warning	Fixed frequency or fixed phase difference is enabled. (W-08) [Remedy]: Set TB Sensor Simulation (TB.SENSOR_SIMULATION) to inhibit.

Figure A8.3 Configuration (Mandatory)

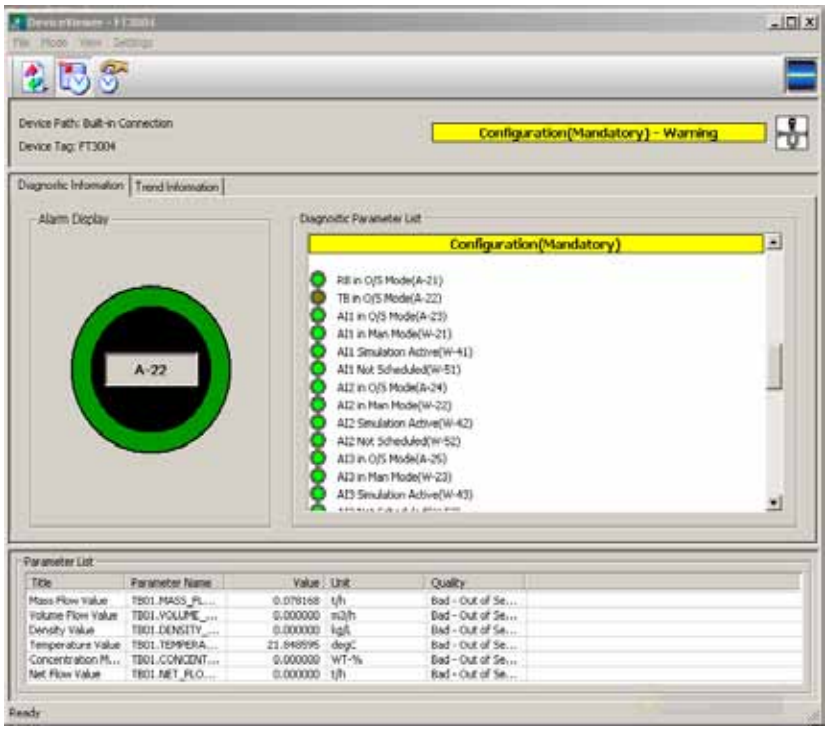

Table A8.3 Configuration (Mandatory)

RB in O/S Mode(A-21)	Alarm	Resource Block is in O/S mode. (A-21) [Remedy]: Change the RB Block Mode.Target(RB.MODE_BLK.Target) to Auto mode.
TB in O/S Mode(A-22	Alarm	Transducer Block is in O/S mode. (A-22) [Remedy]: Change the TB Block Mode.Target(TB.MODE_BLK.Target) to Auto mode.
AI1 in O/S Mode(A-23)	Alarm	AI1 Block is in O/S mode. (A-23) [Remedy]: Change the AI1 Block Mode.Target(AI1.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode.Actual(RB.MODE_BLK.Actual) is set to Auto mode. If it is an unused function, set ALARM_PERFORM bit0 to 0.
AI2 in O/S Mode(A-24)	Alarm	AI2 Block is in O/S mode. (A-24) [Remedy]: Change the AI2 Block Mode.Target(AI2.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode.Actual(RB.MODE_BLK.Actual) is set to Auto mode. If it is an unused function, set ALARM_PERFORM bit1 to 0.
AI3 in O/S Mode(A-25)	Alarm	AI3 Block is in O/S mode. (A-25) [Remedy]: Change the AI3 Block Mode.Target(AI3.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode.Actual(RB.MODE_BLK.Actual) is set to Auto mode. If it is an unused function, set ALARM_PERFORM bit2 to 0.
AI4 in O/S Mode(A-26)	Alarm	AI4 Block is in O/S mode. (A-26) [Remedy]: Change the AI4 Block Mode.Target(AI4.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode.Actual(RB.MODE_BLK.Actual) is set to Auto mode. If it is an unused function, set ALARM_PERFORM bit3 to 0.
Display out of Range(A-41)	Alarm	Display value is out of range. (A-41) [Remedy]: Change decimal point.
AI1 in Man Mode(W-21)	Warning	AI1 Block is in Man mode. (W-21) [Remedy]: Change the AI1 Block Mode.Target(AI1.MODE_BLK.Target) to Auto or other mode.
AI2 in Man Mode(W-22)	Warning	AI2 Block is in Man mode. (W-22) [Remedy]: Change the AI2 Block Mode.Target(AI2.MODE_BLK.Target) to Auto or other mode.
AI3 in Man Mode(W-23)	Warning	AI3 Block is in Man mode. (W-23) [Remedy]: Change the AI3 Block Mode.Target(AI3.MODE_BLK.Target) to Auto or other mode.
AI4 in Man Mode(W-24)	Warning	AI4 Block is in Man mode. (W-24) [Remedy]: Change the AI4 Block Mode.Target(AI4.MODE_BLK.Target) to Auto or other mode.
AI1 Simulation Active(W-41)	Warning	AI1 Block is simulation mode. (W-41) [Remedy]: Change the AI1 Simulation En/Disable(AI1.SIMULATE.SIMULATE_ENABLE) to Disabled.
AI2 Simulation Active(W-42)	Warning	AI2 Block is simulation mode. (W-42) [Remedy]: Change the AI2 Simulation En/Disable(AI2.SIMULATE.SIMULATE_ENABLE) to Disabled.
AI3 Simulation Active(W-43)	Warning	AI3 Block is simulation mode. (W-43) [Remedy]: Change the AI3 Simulation En/Disable(AI3.SIMULATE.SIMULATE_ENABLE) to Disabled.
AI4 Simulation Active(W-44)	Warning	AI4 Block is simulation mode. (W-44) [Remedy]: Change the AI4 Simulation En/Disable(AI4.SIMULATE.SIMULATE_ENABLE) to Disabled.

AI1 Not Scheduled(W-51)	Warning	AI1 Block is not scheduled. (W-51) [Remedy]: Make a schedule of AI1 Block.
AI2 Not Scheduled(W-52)	Warning	AI2 Block is not scheduled. (W-52) [Remedy]: Make a schedule of AI2 Block.
AI3 Not Scheduled(W-53)	Warning	AI3 Block is not scheduled. (W-53) [Remedy]: Make a schedule of AI3 Block.
AI4 Not Scheduled(W-54)	Warning	AI4 Block is not scheduled. (W-54) [Remedy]: Make a schedule of AI4 Block.

Figure A8.4 Configuration (Optional)

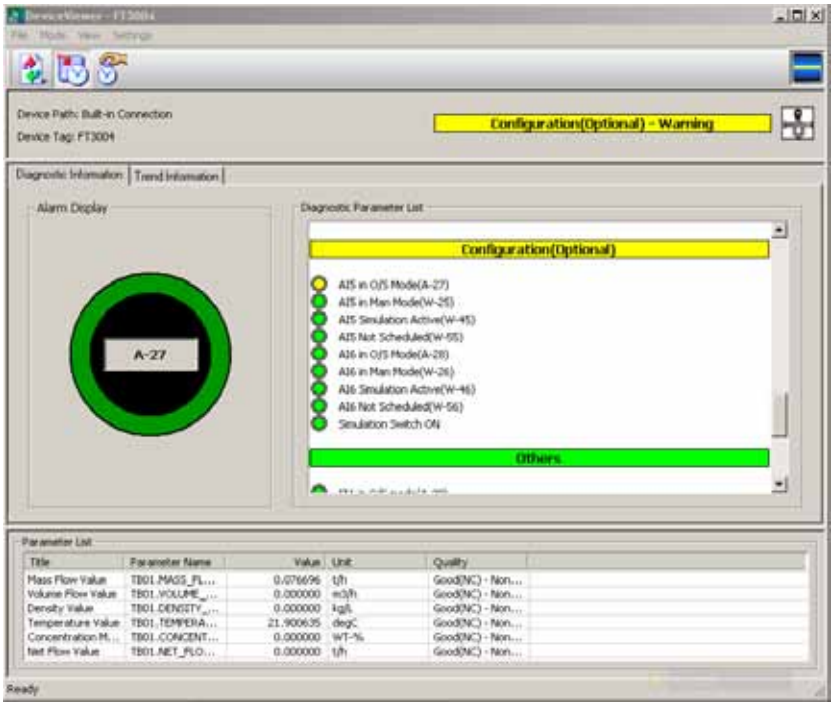

Table A8.4 Configuration (Optional)

AI5 in O/S Mode(A-27)	Alarm	AI5 Block is in O/S mode. (A-27) [Remedy]: Change the AI5 Block Mode.Target(AI5.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode.Actual(RB.MODE_BLK.Actual) is set to Auto mode. If it is an unused function, set ALARM_PERFORM bit4 to 0.
AI5 in Man Mode(W-25)	Warning	AI5 Block is in Man mode. (W-25) [Remedy]: Change the AI5 Block Mode.Target(AI5.MODE_BLK.Target) to Auto or other mode.
AI5 Simulation Active(W-45)	Warning	AI5 Block is simulation mode. (W-45) [Remedy]: Change the AI5 Simulation En/Disable(AI5.SIMULATE.SIMULATE_ENABLE) to Disabled.
AI5 Not Scheduled(W-55)	Warning	AI5 Block is not scheduled. (W-55) [Remedy]: Make a schedule of AI5 Block.
AI6 in O/S Mode(A-28)	Alarm	AI6 Block is in O/S mode. (A-28) [Remedy]: Change the AI6 Block Mode.Target(AI6.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode.Actual(RB.MODE_BLK.Actual) is set to Auto mode. If it is an unused function, set ALARM_PERFORM bit5 to 0.
AI6 in Man Mode(W-26)	Warning	AI6 Block is in Man mode. (W-26) [Remedy]: Change the AI6 Block Mode.Target(AI6.MODE_BLK.Target) to Auto or other mode.
AI6 Simulation Active(W-46)	Warning	AI6 Block is simulation mode. (W-46) [Remedy]: Change the AI6 Simulation En/Disable(AI6.SIMULATE.SIMULATE_ENABLE) to Disabled.
AI6 Not Scheduled(W-56)	Warning	AI6 Block is not scheduled. (W-56) [Remedy]: Make a schedule of AI6 Block.
Simulation Switch ON	Warning	Software or hardware simulation switch is ON. [Remedy]: Change the value of RB Sim Enable Message(RB.SIM_ENABLE_MSG) or turn off the hardware simulation switch.

Figure A8.5 Others

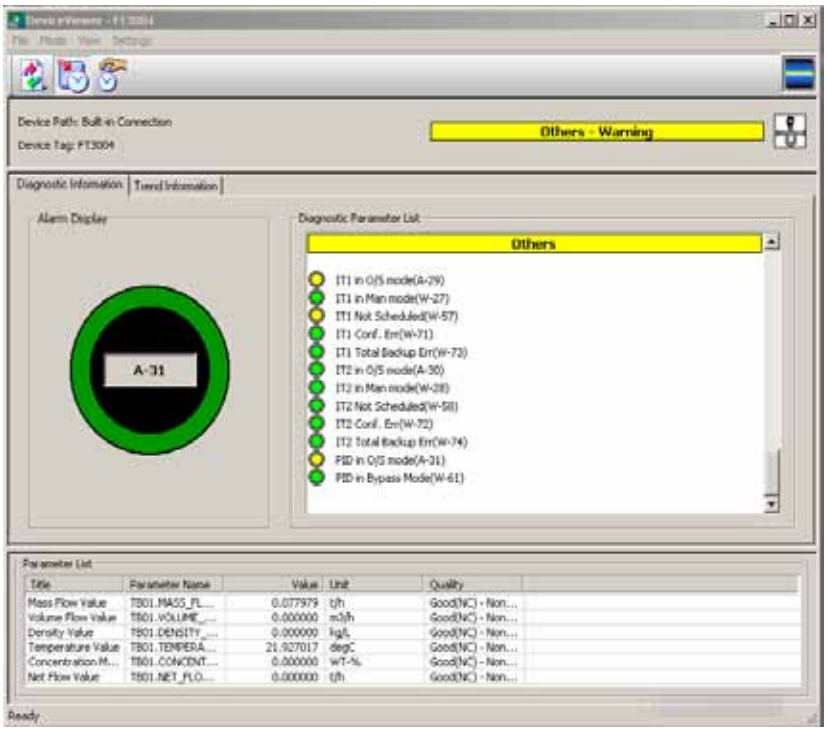

Table A8.5 Others

IT1 in O/S mode(A-29)	Alarm	IT1 Block is in O/S mode. (A-29) [Remedy]: Change the IT1 Block Mode.Target(IT1.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode.Actual(RB.MODE_BLK.Actual) is set to Auto mode. If it is an unused function, set ALARM_PERFORM bit6 to 0.
IT1 in Man mode(W-27)	Warning	IT1 Block is in Man mode. (W-27) [Remedy]: Change the IT1 Block Mode.Target(IT1.MODE_BLK.Target) to Auto or other mode.
IT1 Not Scheduled(W-57)	Warning	IT1 Block is not scheduled. (W-57) [Remedy]: Make a schedule of IT1 Block.
IT1 Conf. Err(W-71)	Warning	IT1 Clock Period(IT1.CLOCK_PER) is smaller than IT1 Period of Execution(EXECUTION_PERIOD). (W-71) [Remedy]: Change the value as IT1 Clock Period(IT1.CLOCK_PER) is larger than IT1 Period of Execution(EXECUTION_PERIOD).
IT1 Total Backup Err(W-73)	Warning	IT1 Total Backup failed. Last IT1 Output.Value(IT1.LAST.VALUE) could not save. (W-73) [Remedy]: Contact the nearest office or service center.
IT2 in O/S mode(A-30)	Alarm	IT2 Block is in O/S mode. (A-30) [Remedy]: Change the IT2 Block Mode.Target(IT2.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode.Actual(RB.MODE_BLK.Actual) is set to Auto mode. If it is an unused function, set ALARM_PERFORM bit7 to 0.
IT2 in Man mode(W-28)	Warning	IT2 Block is in Man mode. (W-28) [Remedy]: Change the IT2 Block Mode.Target(IT2.MODE_BLK.Target) to Auto or other mode.
IT2 Not Scheduled(W-58)	Warning	IT2 Block is not scheduled. (W-58) [Remedy]: Make a schedule of IT2 Block.
IT2 Conf. Err(W-72)	Warning	IT2 Clock Period(IT2.CLOCK_PER) is smaller than IT2 Period of Execution(EXECUTION_PERIOD). (W-72) [Remedy]: Change the value as IT2 Clock Period(IT2.CLOCK_PER) is larger than IT2 Period of Execution(EXECUTION_PERIOD).
IT2 Total Backup Err(W-74)	Warning	IT2 Total Backup failed. Last IT2 Output.Value(IT2.LAST.VALUE) could not save. (W-74) [Remedy]: Contact the nearest office or service center.
PID in O/S mode(A-31)	Alarm	PID Block is in O/S mode. (A-31) [Remedy]: Change the PID Block Mode.Target(PID.MODE_BLK.Target) to Auto or other mode. In addition, check that RB Block Mode.Actual(RB.MODE_BLK.Actual) is set to Auto mode. If it is an unused function, set ALARM_PERFORM bit8 to 0.
PID in Bypass Mode(W-61)	Warning	PID Block is in Bypass mode. (W-61) [Remedy]: Change the value of Bypass(PID.BYPASS) to OFF.

Table A8.6 Additional Information

Mass Flow Value	TB01.MASS_FLOW_VALUE	FLOAT	Mass flow value with status in Transducer Block
Volume Flow Value	TB01.VOLUME_FLOW_VALUE	FLOAT	Volume flow value with status in Transducer Block
Density Value	TB01.DENSITY_VALUE	FLOAT	Density value with status in Transducer Block
Temperature Value	TB01.TEMPERATURE_VALUE	FLOAT	Temperature value with status in Transducer Block
Concentration Meas. Value	TB01.CONCENTR_MEAS_VALUE	FLOAT	Concentration meas. value with status in Transducer Block. (Option /Cxx)
Net Flow Value	TB01.NET_FLOW_VALUE	FLOAT	Net flow value with status in Transducer Block. (Option /Cxx)

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