User's Manual

ADMAG AXR

AXR
Two-wire
Magnetic Flowmeter
Integral Flowmeter

[Style:S2]

IM 01E30D01-01EN

YOKOGAWA
Yokogawa Electric Corporation

IM 01E30D01-01EN
7th Edition

AXR
Two-wire Magnetic Flowmeter
Integral Flowmeter

IM 01E30D01-01EN 7th Edition

Contents

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 configuration of AXR integral flowmeter.

NOTE

When describing the model name like AXR□□□C in this manual, "□□□" means any of the following.
025, 040, 050, 065, 080, 100, 150, 200

WARNING

When using the AXR in a Safety Instrumented Systems (SIS) application, read Appendix 1 in this manual. The instructions and procedures in the appendix must be strictly followed in order to maintain the designed safety integrity of the flowmeter.

Model	Style Code
AXR□□□G	S2
AXR□□□C	

■ 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.
- There is no description on this manual which is for special specifications.
- 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.
- Yokogawa will not be liable for malfunctions or damage resulting from any modification made to this instrument by the customer.
- 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.

Class A grounding terminal
Functional grounding terminal
Direct current

1.1 Using the Magnetic Flowmeter Safely

(1) Installation

WARNING

- Installation of the magnetic flowmeter must be performed by expert engineer or skilled personnel. No operator shall be permitted to perform procedures relating to installation.
- The magnetic flowmeter must be installed within the specification conditions.
- The magnetic 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 magnetic flowmeter. When moving the magnetic flowmeter, always use a trolley and have at least two people carry it.
- When the magnetic 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 piping line for maintenance and so forth.
- Do not apply excessive weight, for example, a person stepping on the magnetic flowmeter.
- All procedures relating to installation must comply with the electrical code of the country where it is used.

(2) Wiring

WARNING

- The wiring of the magnetic 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.

(3) Operation

WARNING

- Do not open the cover in wet weather or humid environment. When the cover is open, stated enclosure protection is not applicable.
- Before opening the cover, it is important to ensure that at least 5 minutes have passed since the power was turned off. Furthermore, opening of the cover must also be carried out by expert engineer or skilled personnel.
- Be sure to set parameters as “Protect” on the write protect function after finish of parameter setting work.

(4) Maintenance

WARNING

- Maintenance of the magnetic flowmeter should be performed by the trained personnel having knowledge of safety standard. No operator shall be permitted to perform any operations relating to maintenance.
- Do not open the cover in wet weather or humid environment. When the cover is open, stated enclosure protection is not applicable.
- When opening the cover, wait for more than 5 minutes after turning off the power.
- 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 name plate. If these surfaces do get dirty, wipe them clean with a soft dry cloth.

(5) Explosion Proof Type Instrument

WARNING

- Magnetic flowmeters with the model name AXR□□□C are products which have been certified as explosion proof type instruments. Strict limitations are applied to the structures, installation locations, external wiring work, maintenance and repairs, etc. of these instruments. Sufficient care must be taken, as any violation of the limitations may cause dangerous situations.
  Be sure to read Chapter 14 before handling the instruments. The description in Chapter 14 is prior to the other description in this user’s manual.
  For TIIS flameproof type instruments, be sure to read “INSTALLATION AND OPERATING PRECAUTIONS FOR TIIS FLAMEPROOF EQUIPMENT” at the end of this manual.
- Only trained persons use this instrument in the industrial location.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

(6) European Pressure Equipment Directive (PED)

WARNING

- When using the instrument in compliance with PED, be sure to read Chapter 13 before use.

(7) Modification

Yokogawa will not be liable for malfunctions or damage resulting from any modification made to this instrument by the customer.

(8) Product Disposal

The instrument should be disposed of in accordance with local and national legislation/ regulations.

(9) Authorized Representative in EEA

In relation to the CE Marking, The authorized representative for this product in the EEA (European Economic Area) is:
Yokogawa Europe B.V.
Euroweg 2, 3825 HD Amersfoort,
The Netherlands

1.2 Warranty

- The 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 concrete 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 reinstallation after delivery.
- Problems or damage resulting from disasters such as fires, earthquakes, storms, floods, or lightning strikes and external causes.

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- ADMAG and AXR are registered trademarks of Yokogawa Electric Corporation.
  Company names and product names used in this material are registered trademarks or trademarks of their respective owners.
- All other company and product names mentioned in this manual are trade names, trademarks or registered trademarks of their respective companies.
- In this manual, trademarks or registered trademarks are not marked with ™ or ®.

1.3 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 języku, 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. Èe so Ex sorodna navodila potrebna v vašem tukejnjem jeziku, kontaktirajte vaš najbliši Yokogawa office ili predstaunika.

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

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

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

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

2. HANDLING PRECAUTIONS

This instrument has been inspected carefully at the factory before shipment. When the instrument is delivered, visually check that no damage has occurred during transportation.
Read this section carefully as it contains important information on handling this instrument. Read the relevant sections for information not contained in this section. If you have any problems or questions, please contact Yokogawa sales office.

2.1 Checking Model and Specifications

The model code and specifications are found on the name plate located on the outside of the case. Check that the model code and specifications match what you have ordered.
Be sure you have your model number and serial number available when contacting Yokogawa.

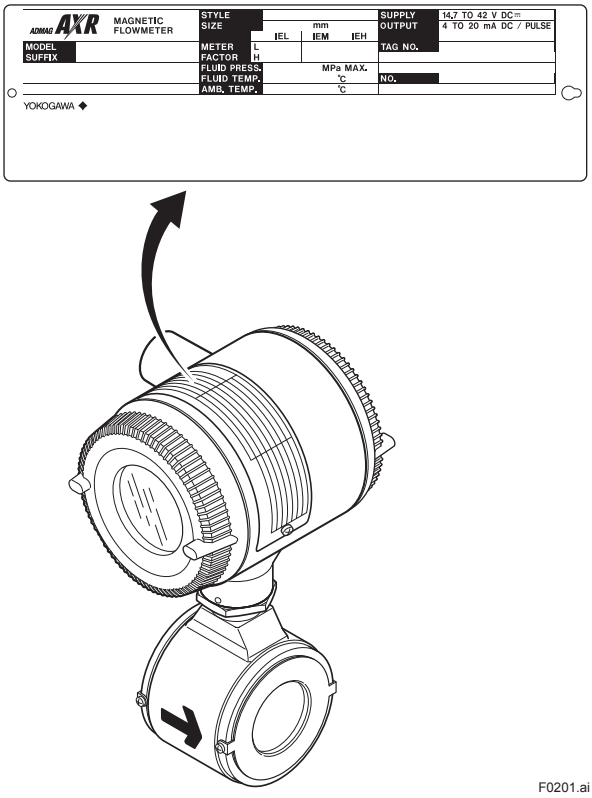


Figure 2.1.1 Name Plate (Integral Flowmeter Type)

2.2 Accessories

Check that the parts shown below are included in the package:

- Centering device (wafer type only): 1 pc.
- Plug: 1 pc.

2.3 Storage Precautions

If the instrument is to be stored for a long period of time after delivery, observe the following points.

- The instrument should be stored in its original packing condition in the storage location.
- Select a storage location that fulfils the following conditions:
  - A place where it will not be exposed to rain or water
  - A place subject to minimal vibrations or shocks
  - Temperature and humidity levels should be as follows:
    Temperature: -30 to 70°C
    Humidity: 5 to 80% RH (no condensation)
    The preferred ambient temperature and humidity levels are 25°C and approximately 65% RH.
- If the AXR magnetic flowmeter is transferred to the installation site and stored without being installed, its performance may be impaired due to the infiltration of rainwater and so forth. Be sure to install and wire the AXR magnetic flowmeter as soon as possible after transferring it to the installation location.

2.4 Installation Location Precautions

Select the installation location with consideration to the following items to ensure long-term stable operation of the instrument.

- **Ambient Temperature:**

  Avoid installing the instrument in locations with constantly fluctuating temperatures. If the location is subject to radiant heat from the plant, provide heat insulation or improve ventilation.

- **Atmospheric Condition:**

  Avoid installing the instrument in a corrosive atmosphere. In situations where this is unavoidable, consider ways to improve ventilation and to prevent rainwater from entering and being retained in the conduit pipes.

- **Vibrations or Shocks:**

  Avoid installing the instrument in a place subject to shocks or vibrations.

- **Explosion proof type:**

  Explosion proof types can be installed in hazardous areas according to the types of gases for which they are certified. Read the description in Chapter 14 and “INSTALLATION AND OPERATING PRECAUTIONS FOR TIIS FLAMEPROOF EQUIPMENT” at the end of this manual.

3. INSTALLATION

3.1 Piping Design Precautions

WARNING

Installation of the magnetic flowmeter must be performed by expert engineer or skilled personnel. No operator shall be permitted to perform procedures relating to installation.

IMPORTANT

Design piping correctly, read the following to prevent damage to flowtubes and to assure accurate measuring.

(1) Location

IMPORTANT

Install the flowmeter in a location where it is not exposed to direct sunlight. The minimum ambient temperature is limited by the minimum fluid temperature of the flowtube. For more information, read Chapter 12. The flowmeter may be used in an ambient humidity where the relative humidity ranges from 0 to 100%. However, avoid long-term continuous operation at relative humidity above 95%.

(2) Noise Avoidance

IMPORTANT

The flowmeter should be installed away from electrical motors, transformers, inverters and other power sources in order to avoid interference with measurement.

(3) Required Lengths of Straight Runs

To maintain accurate measurement, read JIS B 7554 which explains the requirements for upstream piping conditions of magnetic flowmeters.

The piping conditions we recommend as shown in Figure 3.1.1 are based on JIS B7554 and on our piping condition test data.

When installing two or more magnetic flowmeters on a single pipe, provide a run of at least 10D between them.

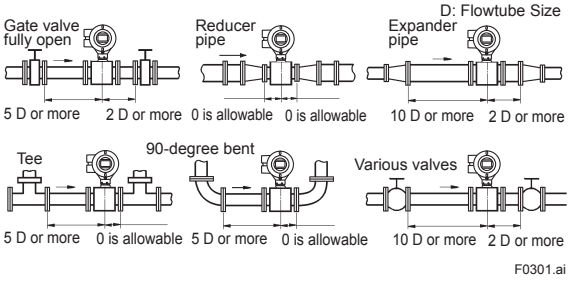


Figure 3.1.1 Required Lengths of Straight Runs

*1: Do not install anything in the vicinity that may interfere with the magnetic field, induced signal voltages, or flow velocity distributions of the flowmeter.

*2: A straight run may not be required on the downstream side of the flowmeter. However, if a downstream valve or other fitting causes irregularity or deviation in flows, provide a straight run of 2D to 3D on the downstream side.

*3: Highly recommend to mount valves on the downstream side so that deviated flows do not occur in the flowtube and to avoid startup from an empty condition.

(4) Maintaining Stable Fluid Conductivity

IMPORTANT

Do not install the flowmeter where fluid conductivity tends to become uneven. If chemicals are fed near the upstream side of a magnetic flowmeter, they may affect the flow rate's indications. To avoid this situation, it is recommended that the chemical feed ports be located on the downstream side of the flowmeter. If it is unavoidable that chemicals must be fed on the upstream side, provide a sufficient length of straight run (approximately 50D or more) to ensure the proper mixture of fluids.

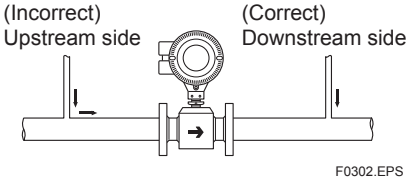


Figure 3.1.2 Chemical Injection

(5) Precautions for Use of Liquid Sealing Compounds

IMPORTANT

Care must be taken in using liquid sealing compounds on the piping, as it may have a negative influence on the flow indications by flowing out and covering the surfaces of an electrode or grounding ring. In particular, care must be taken if a liquid sealing compound is used in the case of vertical piping.

(6) Service Area

Select locations where there is adequate space to service installing, wiring, overhauling, etc.

(7) Bypass Line

It is recommended to install a bypass line to facilitate maintenance and zero adjustment.

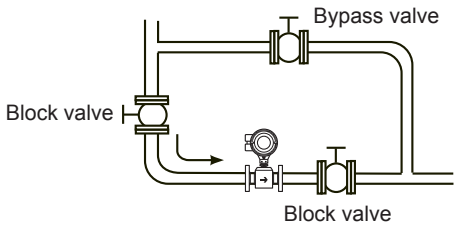


Figure 3.1.3 Bypass Line

(8) Supporting the Flowmeter

CAUTION

Do not secure the flowmeter separately to prevent the vibrations, shocks, and expansion and contraction forces of the piping from affecting it. Fix the pipes first, then support the flowmeter with the pipes.

(9) Mounting Positions

- **Pipes must be fully filled with liquids.**

IMPORTANT

If the pipe is empty, the output fluctuates or the Process Alarm (Signal Overflow) occurs. The pipe must be fully filled with liquid.

Piping shall be designed so as to maintain the interior of the flowtube filled with fluids.

Vertical mounting is effective in such cases as when fluids tend to separate or solid matter may be precipitated. When employing vertical mounting, direct the fluids from the bottom to the top to ensure that the pipes remain fully filled.

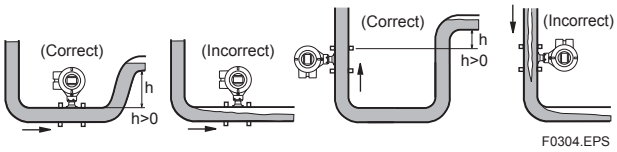


Figure 3.1.4 Mounting Positions

- **Avoid air bubbles.**

IMPORTANT

If air bubbles enter a measurement pipe, flow rate indications may be affected and measurement errors may be caused.

In cases where fluids contain air bubbles, piping must be designed to prevent them from accumulating in the measurement pipe of a flowtube.

If a valve exists near the flowmeter, try to mount the flowmeter on the valve's upstream side in order to prevent a possible reduction of pressure inside the pipe, thereby avoiding the possibility of air bubbles.

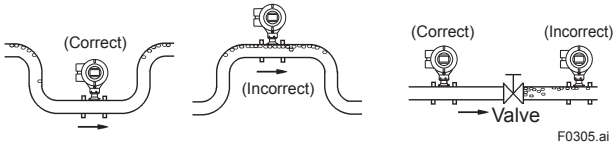


Figure 3.1.5 Avoiding Air Bubbles

• **Mounting orientation**

IMPORTANT

If electrodes are perpendicular to the ground, air bubbles near the top or precipitates at the bottom may cause measurement errors. Ensure that the converter of an integral flowmeter are mounted above the piping to prevent water from entering them.

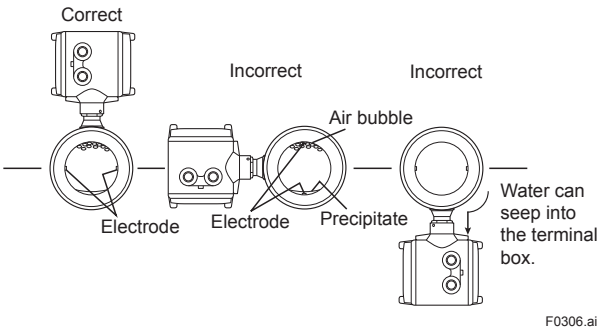


Figure 3.1.6 Mounting Orientation

(10) Application

IMPORTANT

- For a fluid containing high concentration slurries or hard solids (such as earth and sand, metal powder, and fiber), contact of the solids on the electrode surface will make the output fluctuate. Therefore, two-wire magnetic flowmeters are not suitable for measuring such fluids. It is recommended to use the AXF four-wire magnetic flowmeter.
- In the vicinity of an electrolysis bath, strong stray current may flow in the fluid. It is recommended to use the AXF four-wire magnetic flowmeter in such an application.

3.2 Handling Precautions

WARNING

The magnetic 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 magnetic flowmeter. When moving the magnetic flowmeter, always use a trolley and have at least two people carry it.

3.2.1 General Precautions

(1) Precaution during Transportation

The magnetic flowmeter is packed tightly. When it is unpacked, pay attention to prevent damaging the flowmeter. To prevent accidents while it is being transported to the installing location, transport it to the site in its original packing.

CAUTION

In order to lift a magnetic flowmeter that is fitted with eyebolts, proceed as in Figure 3.2.1. Never lift it using a bar passed through the flowtube as this damages the liner severely.

(2) Avoid Shocks from Impact

CAUTION

Care should be taken not to drop the flowmeter or expose it to excessive shock. In particular, be careful not to subject the flange surface to shock. This may lead to liner damage which will result in inaccurate readings.

(3) Flange Protection Covers

IMPORTANT

Keep the protective covering (i.e. the corrugated cardboard or other cushioning material) in place over the flange except when mounting the flowmeter to the pipe.

(4) Terminal Box Cover

IMPORTANT

As it is possible that the insulation will deteriorate, do not open the terminal box cover until it is time to wire it.

(5) Long-term Non-use

IMPORTANT

It is not desirable to leave the flowmeter unused for a long term after installation. If this situation is unavoidable, take care of the flowmeter by observing the following.

- **Confirmation of sealing conditions for the flowmeter**

Confirm that the terminal box screw and wiring ports are well sealed. Equip the conduit piping with drain plugs or waterproof glands to prevent moisture or water from penetrating into the flowmeter through the conduit.

- **Regular inspections**

Inspect the sealing conditions as mentioned above, and the inside of the terminal box at least once a year. Also, due to rain, etc. when it is suspected that water may have penetrated into the inside flowmeter perform supplementary inspections.

3.2.2 Flowmeter Piping

CAUTION

Misaligned or slanted piping can lead to leakage and damage to the flanges.

(1) Correct any misaligned or slanted piping, and any gaps that may exist between mounting flanges before installing the flowmeter (Read Figure 3.2.1).

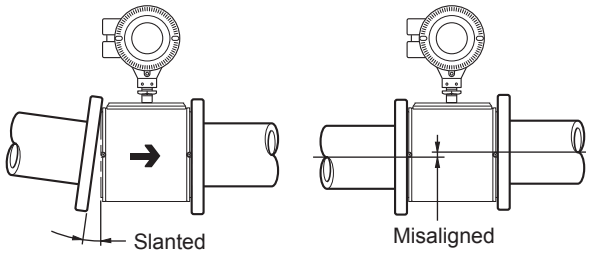


Figure 3.2.1 Slanted and Misaligned Flowmeter Piping

(2) Inside a newly installed pipeline, there may be some foreign substances such as residue from welding or wood chips. Remove them by flushing the piping before mounting the flowmeter. This prevents the lining from being damaged, as well as the occurrence of erroneous measured signals resulting from foreign substances passing through the flowtube during measurement.

3.3 Mounting Procedures

NOTE

- The tightening torque value to which gaskets must be tightened varies depending on the type and external dimensions of the lining and the gasket. In this section, the tables indicating tightening torque values include the corresponding gasket types. The internal diameters of the gaskets are close to those of the grounding rings.
- For fluids capable of potentially permeating PFA linings (such as nitric acid, hydrofluoric acid, or sodium hydrate at high temperatures), different tightening torque values must be applied. The tables of these torque values is indicated in this section.
- For both lay length code 1 and lay length code 2, the tightening torque values in the tables can be applied if their process connections, the lining types, and the nominal sizes are the same.

3.3.1 Nominal Diameter 25 mm (1.0 in.) to 40 mm (1.5 in.), Wafer Type

IMPORTANT

Use bolts and nuts in compliance with the flange ratings. When stud-type through-bolts are used, be sure the outside diameter of the shank is smaller than that of the thread ridge. Be sure to choose a gasket with inner and outer diameters that does not protrude inside the piping (Read Subsection 3.3.4). If the inner diameter of the gasket is too large, or outer diameter of the gasket is too small, fluid leakage may result.

(1) Mounting Direction

Mount the flowmeter so that the flow direction of the fluid to be measured is in line with the direction of the arrow mark on the flowmeter.

IMPORTANT

If it is impossible to match the direction of the arrow mark, the direction of the electrical connection can be changed. Read Section 11.1 to do this properly.
In case the fluid being measured flows against the arrow direction, read the parameter **J20: Flow Direction** in this user's manual.

(2) Mounting Centering Devices

To maintain concentricity of the flowmeter with the pipes, install centering devices on the Mini-flanges of the flowmeter. Use the appropriate centering devices according to the nominal diameter and the flange ratings.

(3) Positioning the Flowmeter

Pass two through-bolts through the adjacent holes of both flanges and position the flowmeter so that the Mini-flanges and the centering devices come in close contact with each other. Pass the other through-bolts through the other holes (Read Figure 3.3.1). In case stud-type through-bolts are used, position them in such a way that the centering devices come in contact with the bolt threads.

(4) Tightening Nuts

Tighten the nuts according to the torque values for metal piping in Table 3.3.1. For PVC piping, select an optional code of /GA, /GC, or /GD, use rubber gaskets and tighten the nuts to the torque values for PVC piping in Table 3.3.2.
For permeable fluids (such as nitric acid, hydrofluoric acid, or sodium hydrate at high temperatures), tighten the nuts according to the torque values in Table 3.3.3.

CAUTION

For a flowmeter with fluorocarbon PFA lining, it is possible that the nuts may loosen as time passes, so tighten them regularly. Be sure to tighten the nuts according to the prescribed torque values. Tighten them diagonally with the same torque values, step by step up to the prescribed torque value.

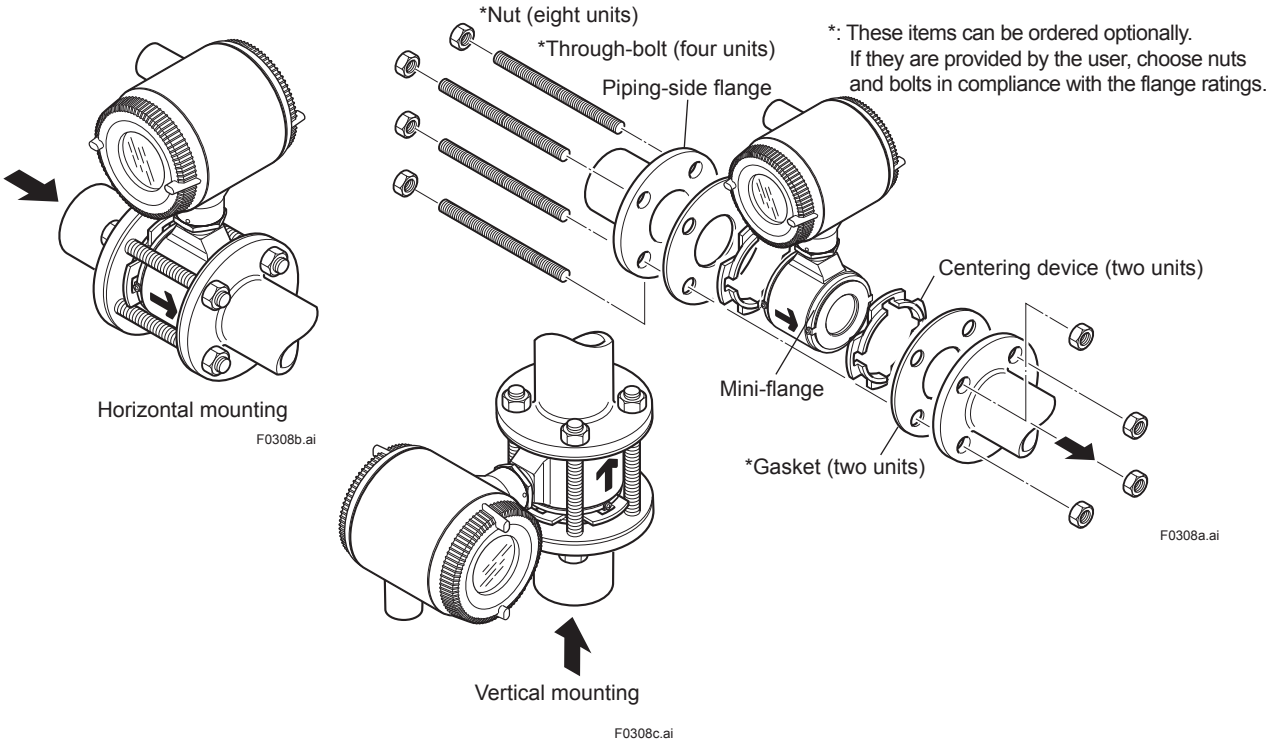


Figure 3.3.1 Mounting Procedure for Wafer Type (size: 25 (1.0) and 40 mm (1.5 in.))

Table 3.3.1 Wafer Type Tightening Torque Values for Metal Piping

Tightening torque values for PFA lining type (N-m / {kgf-cm} / [in-lbf])			
Gasket types within flowtube	No gasket (standard)		
Gasket types for user's flange	Non-asbestos fiber gasket, PTFE-sheathed non-asbestos gasket (optional code BSF), or the equivalent in hardness		
Flange ratings / Size mm (inch)	JIS 10K, ANSI Class 150, and DIN PN10	JIS 20K, ANSI Class 300, and DIN PN16	DIN PN40
25 (1.0)	23.5 to 27.3 / {239.6 to 278.4} / [208 to 241.6]	23.7 to 27.3 / {241.7 to 278.4} / [209.8 to 241.6]	22.3 to 27.3 / {227.4 to 278.4} / [197.4 to 241.6]
40 (1.5)	36.2 to 42.4 / {369.1 to 432.4} / [320.4 to 375.3]	36.9 to 42.4 / {376.3 to 432.4} / [326.6 to 375.3]	39.1 to 42.4 / {398.7 to 432.4} / [346.1 to 375.3]

Table 3.3.2 Wafer Type Tightening Torque Values for PVC Piping

Tightening torque values for PFA lining type (N-m / {kgf-cm} / [in-lbf])			
Gasket types within flowtube	Fluororubber gasket (optional codes GA, GC, and GD)		
Gasket types for user's flange	Fluororubber gasket, chloroprene rubber gasket (optional code BSC), or the equivalent in hardness		
Flange ratings / Size mm (inch)	JIS 10K, ANSI Class 150, and DIN PN10	JIS 20K, ANSI Class 300, and DIN PN16	DIN PN40
25 (1.0)	4.9 to 8.1 / {49.97 to 82.6} / [43.37 to 71.69]	5.0 to 8.3 / {50.99 to84.64 } / [44.25 to 73.46]	4.3 to 7.2 / {43.85 to 73.42} / [38.06 to 63.72]
40 (1.5)	7.7 to 12.9 / {78.52 to 131.5} / [68.15 to 114.2]	8.1 to 13.4 / {82.6 to 136.6} / [71.69 to 118.6]	7.5 to 12.5 / {76.48 to 127.5} / [66.38 to 110.6]

Table 3.3.3 Wafer Type Tightening Torque Values for Metal Piping and Permeable Fluids

Tightening torque values for PFA lining type (N-m / {kgf-cm} / [in-lbf])			
Gasket types within flowtube	No gasket (standard)		
Gasket types for user's flange	PTFE-sheathed non-asbestos gasket (optional code BSF), or the equivalent in hardness		
Flange ratings / Size mm (inch)	JIS 10K, ANSI Class 150, and DIN PN10	JIS 20K, ANSI Class 300, and DIN PN16	DIN PN40
25 (1.0)	34.9 to 40.1 / {355.9 to 408.9} / [308.9 to 354.9]	35.2 to 40.1 / {358.9 to 408.9} / [311.5 to 354.9]	32.3 to 37.1 / {329.4 to 378.3} / [285.9 to 328.4]
40 (1.5)	53.5 to 61.5 / {545.5 to 627.1} / [473.5 to 544.3]	54.2 to 61.5 / {552.7 to 627.1} / [479.7 to 544.3]	56.4 to 61.5 / {575.1 to 627.1} / [499.2 to 544.3]

3.3.2 Nominal Diameter 50 mm (2.0 in.) to 200 mm (8.0 in.), Wafer Type

IMPORTANT

Use bolts and nuts in compliance with the flange ratings. When stud-type through-bolts are used, be sure the outside diameter of the shank is smaller than that of the thread ridge. Be sure to choose a gasket with inner and outer diameters that does not protrude inside the piping (Read Subsection 3.3.4). If the inner diameter of the gasket is too large, or outer diameter of the gasket is too small, fluid leakage may result.

(1) Mounting Direction

Mount the flowmeter so that the flow direction of the fluid to be measured is in line with the direction of the arrow mark on the flowmeter.

IMPORTANT

If it is impossible to match the direction of the arrow mark, the direction of the electrical connection can be changed. Read Section 11.1 to do this properly.
In case the fluid being measured flows against the arrow direction, read this parameter **J20: Flow Direction** in this user's manual.

(2) Mounting Centering Devices

To maintain concentricity of the flowmeter with the pipes, install centering devices. From the process piping side, pass two through-bolts through the four centering devices (two for each bolt) and the adjacent two holes (the lower two holes for horizontal mounting) of both of the flanges (Read Figure 3.3.2). Use the appropriate centering devices according to the nominal diameter and the flange ratings. The centering devices are engraved with an identifying character. Use the appropriate ones which meet the required specifications by reading Table 3.3.7 and Table 3.3.8.

(3) Positioning the Flowmeter

Position the flowmeter so that the Mini-flanges and the centering devices come in close contact with each other. Be careful to prevent the four centering devices from coming into contact with the housing. If stud-type through-bolts are used, position them in such a way that the four centering devices come in contact with the bolt threads (Read Figure 3.3.2). Pass the other through-bolts through from the process piping side.

(4) Tightening Nuts

Tighten the nuts according to the torque values for metal piping in Table 3.3.4. For PVC piping, select an optional code of GA, GC, or GD, use rubber gaskets and tighten the nuts to the torque values for PVC piping in Table 3.3.5.
For permeable fluids (such as nitric acid, hydrofluoric acid, or sodium hydrate at high temperatures), tighten the nuts according to the torque values in Table 3.3.6.

CAUTION

For a flowmeter with fluorocarbon PFA lining, it is possible that the nuts may loosen as time passes, so tighten them regularly. Be sure to tighten the nuts according to the prescribed torque values. Tighten them diagonally with the same torque values, step by step up to the prescribed torque value.

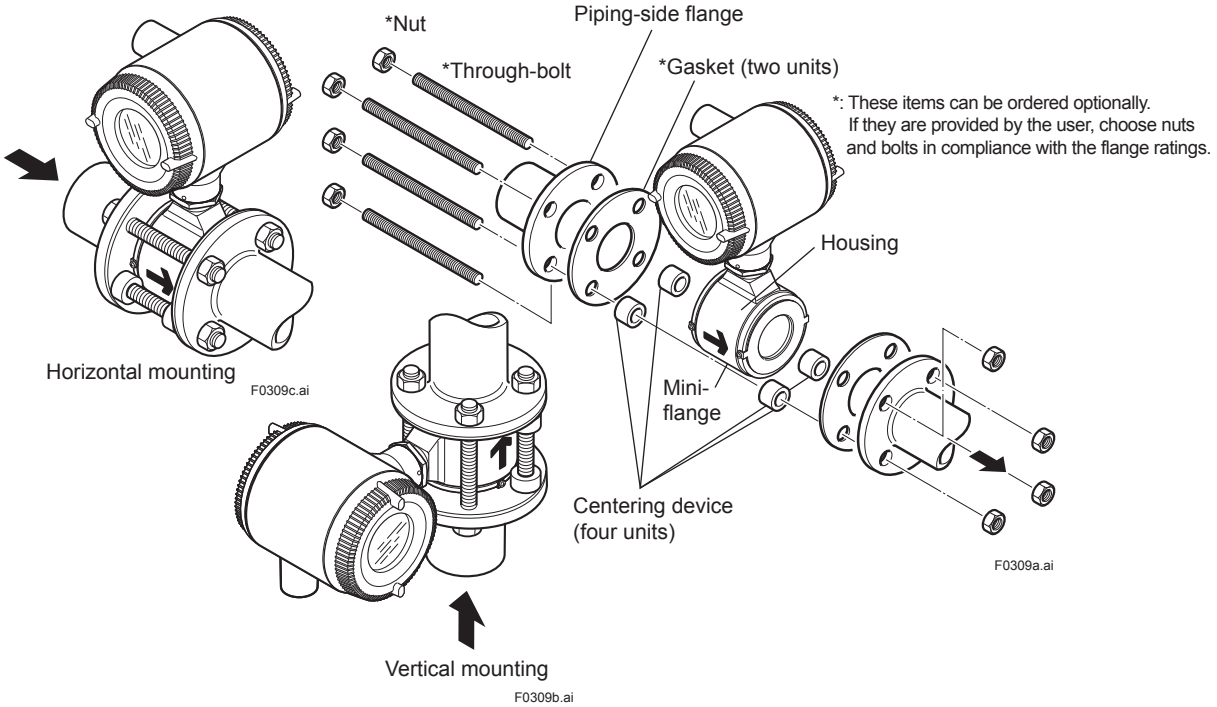


Figure 3.3.2 Mounting Procedure for Wafer Type (size: 50 mm (2 in.) to 200 mm (8.0 in.))

Table 3.3.4 Wafer Type Tightening Torque Values for Metal Piping

Tightening torque values for PFA lining type								Unit: N-m {kgf-cm} [in-lbf]
Gasket types within flowtube	No gasket (standard)							
Gasket types for user's flange	Non-asbestos fiber gasket, PTFE-sheathed non-asbestos gasket (optional code BSF), or the equivalent in hardness							
Flange ratings / Size mm (inch)	JIS 10K	ANSI Class 150	DIN PN10	JIS20K	ANSI Class 300	DIN PN16	DIN PN40	JIS F12 (JIS 75M)
50 (2.0)	45.0 to 56.8 {4 58.9 to 579.2} [398.3 to 502.7]	45.0 to 56.8 {458.9 to 579.2} [398.3 to 502.7]	—	22.5 to 25.9 {229.4 to 264.1} [199.1 to 229.2]	22.5 to 25.9 {229.4 to 264.1} [199.1 to 229.2]	—	50.0 to 57.5 {509.9 to 586.3} [442.5 to 508.9]	—
65 (2.5)	61.3 to 70.5 {625.1 to 718.9} [542.5 to 624.0]	61.3 to 70.5 {625.1 to 718.9} [542.5 to 624.0]	—	30.8 to 35.4 {314.1 to 361.0} [272.6 to 313.3]	30.8 to 35.4 {314.1 to 361.0} [272.6 to 313.3]	56.1 to 70.8 {572.1 to 722.0} [496.5 to 626.6]	—	—
80 (3.0)	35.0 to 40.3 {356.9 to 410.9} [309.8 to 356.7]	76.0 to 80.9 {775.0 to 825.0} [672.6 to 716.0]	—	39.9 to 45.9 {406.9 to 468.1} [353.1 to 406.2]	39.9 to 45.9 {406.9 to 468.1} [353.1 to 406.2]	39.9 to 45.9 {406.9 to 468.1} [353.1 to 406.2]	—	68.4 to 78.7 {697.5 to 802.5} [605.4 to 696.5]
100 (4.0)	46.1 to 53 {470.1 to 540.5} [408.0 to 469.1]	46.1 to 53 {470.1 to 540.5} [408.0 to 469.1]	—	52.9 to 60.8 {539.4 to 620.0} [468.2 to 538.1]	52.9 to 60.8 {539.4 to 620.0} [468.2 to 538.1]	52.9 to 60.8 {539.4 to 620.0} [468.2 to 538.1]	—	88.6 to 101.9 {903.5 to 1039} [784.1 to 901.9]
150 (6.0)	85.4 to 98.2 {870.8 to 1001} [755.8 to 869.1]	85.4 to 98.2 {870.8 to 1001} [755.8 to 869.1]	—	61.0 to 70.2 {622.0 to 715.8} [539.9 to 621.3]	61.0 to 70.2 {622.0 to 715.8} [539.9 to 621.3]	91.2 to 96.3 {930.0 to 982.0} [807.2 to 852.3]	—	86.3 to 99.2 {880.0 to 1012} [763.8 to 878.0]
200 (8.0)	78.8 to 90.6 {803.5 to 923.9} [697.4 to 801.8]	113.6 to 135.8 {1158 to 1385} [1005 to 1202]	113.6 to 135.8 {1158 to 1385} [1005 to 1202]	87.5 to 100.6 {892.3 to 1026} [774.4 to 890.3]	87.5 to 100.6 {892.3 to 1026} [774.4 to 890.3]	87.5 to 100.6 {892.3 to 1026} [774.4 to 890.3]	—	88.6 to 101.9 {903.5 to 1039} [784.1 to 901.9]

Table 3.3.5 Wafer Type Tightening Torque Values for PVC Piping

Tightening torque values for PFA lining type								Unit: N-m {kgf-cm} [in-lbf]
Gasket types within flowtube	Fluororubber gasket (optional codes GA, GC, and GD)							
Gasket types for user's flange	Fluororubber gasket, chloroprene rubber gasket (optional code BSC), or the equivalent in hardness							
Flange ratings / Size mm (inch)	JIS 10K	ANSI Class 150	DIN PN10	JIS20K	ANSI Class 300	DIN PN16	DIN PN40	JIS F12 (JIS 75M)
50 (2.0)	9.9 to 16.5 {101.0 to 168.3} [87.6 to 146.0]	9.9 to 16.5 {101.0 to 168.3} [87.6 to 146.0]	—	10.6 to 17.6 {108.1 to 179.5} [93.8 to 155.8]	10.6 to 17.6 {108.1 to 179.5} [93.8 to 155.8]	—	9.5 to 15.9 {96.9 to 162.1} [84.1 to 140.7]	—
65 (2.5)	14.2 to 23.7 {144.8 to 241.7} [125.7 to 209.8]	14.2 to 23.7 {144.8 to 241.7} [125.7 to 209.8]	—	15.5 to 25.9 {158.1 to 264.1} [137.2 to 229.2]	15.5 to 25.9 {158.1 to 264.1} [137.2 to 229.2]	28.2 to 51.8 {287.6 to 528.2} [249.6 to 458.4]	—	—
80 (3.0)	8.0 to 13.3 {81.6 to 135.6} [70.8 to 117.7]	17.4 to 26.7 {177.4 to 272.3} [154.0 to 236.3]	—	9.7 to 16.1 {98.9 to 164.2} [85.8 to 142.5]	9.7 to 16.1 {98.9 to 164.2} [85.8 to 142.5]	9.7 to 16.1 {98.9 to 164.2} [85.8 to 142.5]	—	15.4 to 25.6 {157.0 to 261.0} [136.3 to 226.6]
100 (4.0)	11.3 to 18.8 {115.2 to 191.7} [100.0 to 166.4]	11.3 to 18.8 {115.2 to 191.7} [100.0 to 166.4]	—	14.2 to 23.6 {144.8 to 240.7} [125.7 to 208.9]	14.2 to 23.6 {144.8 to 240.7} [125.7 to 208.9]	14.2 to 23.6 {144.8 to 240.7} [125.7 to 208.9]	—	21.1 to 35.1 {215.2 to 357.9} [186.7 to 310.6]
150 (6.0)	22.5 to 37.6 {229.4 to 383.4} [199.1 to 332.8]	22.5 to 37.6 {229.4 to 383.4} [199.1 to 332.8]	—	27.2 to 45.3 {277.4 to 461.9} [240.7 to 400.9]	27.2 to 45.3 {277.4 to 461.9} [240.7 to 400.9]	40.7 to 62.1 {415.0 to 633.2} [360.2 to 549.6]	—	21.8 to 36.3 {222.3 to 370.2} [192.9 to 321.3]
200 (8.0)	22.1 to 36.9 {225.4 to 376.3} [195.6 to 326.6]	31.9 to 55.3 {325.3 to 563.9} [282.3 to 489.4]	31.9 to 55.3 {325.3 to 563.9} [282.3 to 489.4]	27.3 to 45.3 {278.4 to 461.9} [241.6 to 400.9]	27.3 to 45.3 {278.4 to 461.9} [241.6 to 400.9]	27.3 to 45.3 {278.4 to 461.9} [241.6 to 400.9]	—	23.8 to 39.6 {242.7 to 403.8} [210.6 to 350.5]

Table 3.3.6 Wafer Type Tightening Torque Values for Metal Piping and Permeable Fluids

Tightening torque values for PFA lining type								Unit: N-m {kgf-cm} [in-lbf]
Gasket types within flowtube	No gasket (standard)							
Gasket types for user's flange	PTFE-sheathed non-asbestos gasket (optional code BSF), or the equivalent in hardness							
Flange ratings / Size mm (inch)	JIS 10K	ANSI Class 150	DIN PN10	JIS20K	ANSI Class 300	DIN PN16	DIN PN40	JIS F12 (JIS 75M)
50 (2.0)	66.2 to 76.1 {675.1 to 776.0} [585.9 to 673.5]	66.2 to 76.1 {675.1 to 776.0} [585.9 to 673.5]	—	33.1 to 38.0 {337.5 to 387.5} [292.9 to 336.3]	33.1 to 38.0 {337.5 to 387.5} [292.9 to 336.3]	—	71.2 to 118.6 {726.0 to 1209} [630.1 to 1050]	—
65 (2.5)	89.5 to 102.9 {912.6 to 1049} [792.1 to 910.7]	89.5 to 102.9 {912.6 to 1049} [792.1 to 910.7]	—	44.9 to 51.6 {457.9 to 526.2} [397.4 to 456.7]	44.9 to 51.6 {457.9 to 526.2} [397.4 to 456.7]	81.8 to 103.2 {834.1 to 1052} {724.0 to 913.4]	—	—
80 (3.0)	51.3 to 59.0 {523.1 to 601.6} [454.0 to 522.2]	111.3 to 118.4 {1135 to 1207} [985.0 to 1048]	—	58.1 to 66.8 {592.5 to 681.2} [514.2 to 591.2]	58.1 to 66.8 {592.5 to 681.2} [514.2 to 591.2]	58.1 to 66.8 {592.5 to 681.2} {514.2 to 591.2]	—	100.8 to 115.9 {1028 to 1182} [892.1 to 1026]
100 (4.0)	66.7 to 76.7 {680.2 to 782.1} [590.3 to 678.8]	66.7 to 76.7 {680.2 to 782.1} [590.3 to 678.8]	—	76.1 to 87.5 {776.0 to 892.3} [673.5 to 774.4]	76.1 to 87.5 {776.0 to 892.3} [673.5 to 774.4]	76.1 to 87.5 {776.0 to 892.3} {673.5 to 774.4]	—	129.8 to 149.3 {1324 to 1522} [1149 to 1321]
150 (6.0)	122.0 to 140.5 {1246 to 1433} [1082 to 1243]	122.0 to 140.5 {1246 to 1433} [1082 to 1243]	—	86.8 to 99.8 {885.1 to 1018} [768.2 to 883.3]	86.8 to 99.8 {885.1 to 1018} [768.2 to 883.3]	129.8 to 136.9 {1324 to 1396} [1149 to 1212]	—	125.6 to 144.4 {1281 to 1472} [1112 to 1278]
200 (8.0)	111.6 to 128.3 {1138 to 1308} [987.7 to 1136]	161.0 to 192.3 {1642 to 1961} [1425 to 1702]	161.0 to 192.3 {1642 to 1961} [1425 to 1702]	122.0 to 140.3 {1244 to 1431} [1080 to 1242]	122.0 to 140.3 {1244 to 1431} [1080 to 1242]	122.0 to 140.3 {1244 to 1431} [1080 to 1242]	—	128.0 to 147.2 {1305 to 1501} [1133 to 1303]

Table 3.3.7 Centering Device Identification (AXR Lay length code 1, PFA lining)

Flange ratings / Size mm (inch)	JIS			ANSI		DIN		
	10K	20K	F12 (75M)	150	300	PN10	PN16	PN40
80 (3.0)	B	F	H	F	C	—	G	—
100 (4.0)	B	F	H	C	H	—	F	—
150 (6.0)	C	D	D	C	E	—	C	—
200 (8.0)	C	D	D	D	E	C	C	—

*: Each centering device is engraved with a character as identification.

Table 3.3.8 Centering Device Identification (AXR Lay length code 2, PFA lining)

Flange ratings / Size mm (inch)	JIS			ANSI		DIN		
	10K	20K	F12 (75M)	150	300	PN10	PN16	PN40
50 (2.0)	B	B	—	B	F	—	—	F
65 (2.5)	B	B	—	B	G	—	F	—
80 (3.0)	B	F	H	F	C	—	G	—
100 (4.0)	B	F	H	C	H	—	F	—
150 (6.0)	C	D	D	C	E	—	C	—
200 (8.0)	C	D	D	D	E	C	C	—

*: Each centering device is engraved with a character as identification.

3.3.3 Nominal Diameter 25 mm (1.0 in.) to 200 mm (8.0 in.), Flange Type

IMPORTANT

Use bolts and nuts in compliance with the flange ratings. Be sure to choose a gasket with inner and outer diameters that does not protrude inside the piping (Read Subsection 3.3.4). If the inner diameter of the gasket is too large, or outer diameter of the gasket is too small, fluid leakage may result.

(1) Mounting Direction

Mount the flowmeter so that the flow direction of the fluid to be measured is in line with the direction of the arrow mark on the flowmeter.

IMPORTANT

If it is impossible to match the direction of the arrow mark, the direction of the electrical connection can be changed. Read Section 11.1 to do this properly.
In case the fluid being measured flows against the arrow direction, read the parameter **J20: Flow Direction** in this user's manual.

(2) Tightening Nuts

Tighten the bolts according to the torque values for the metal piping in Table 3.3.9. For PVC piping, select an optional code of GA, GC, or GD, use rubber gaskets and tighten the nuts to the torque values for the PVC piping in Table 3.3.10.
For permeable fluids (such as nitric acid, hydrofluoric acid, or sodium hydrate at high temperatures), tighten the nuts according to the torque values in Table 3.3.11.

CAUTION

For a flowmeter with fluorocarbon PFA lining, it is possible that the nuts may loosen as time passes, so tighten them regularly. Be sure to tighten the nuts according to the prescribed torque values. Tighten them diagonally with the same torque values, step by step up to the prescribed torque value.

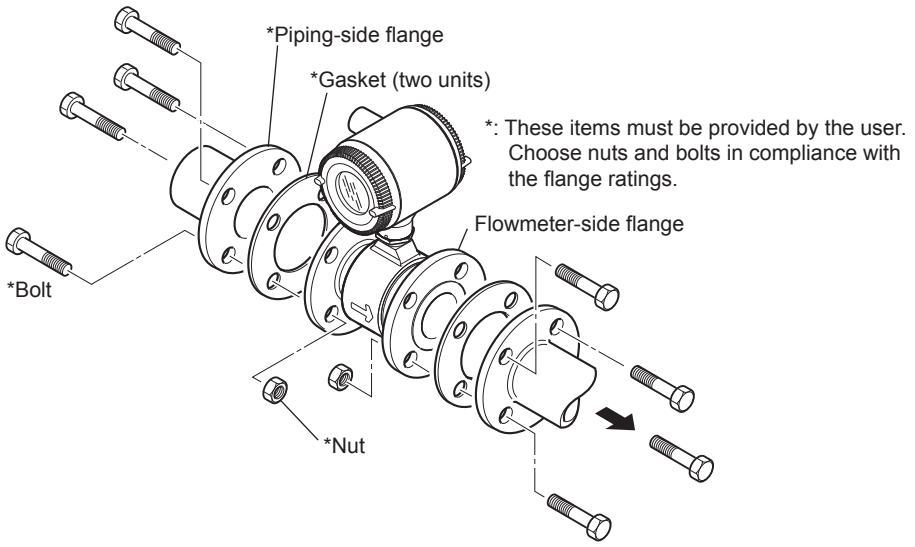


Figure 3.3.3 Mounting Procedure for Flange Type (size: 25 mm (1.0 in.) to 200 mm (8.0 in.))

Table 3.3.9 Flange Type Tightening Torque Values for Metal Piping

Tightening torque values for PFA lining type								Unit: N-m {kgf-cm} [in-lbf]
Gasket types within flowtube	**No gasket (standard)**							
Gasket types for user's flange	**Non-asbestos gasket, PTFE-sheathed non-asbestos gasket, or the equivalent in hardness**							
Flange ratings / Size mm (inch)	**JIS 10K**	**ANSI Class 150**	**DIN PN10**	**JIS20K**	**ANSI Class 300**	**DIN PN16**	**DIN PN40**	**JIS F12 (JIS 75M)**
25 (1.0)	13.1 to 15.1 {133.6 to 154.0} [115.9 to 133.6]	13.1 to 15.1 {133.6 to 154.0} [115.9 to 133.6]	—	13.2 to 15.2 {134.6 to 155.0} [116.8 to 134.5]	13.2 to 15.2 {134.6 to 155.0} [116.8 to 134.5]	—	11.9 to 13.7 {121.3 to 139.7} [105.3 to 121.3]	—
40 (1.5)	21.9 to 25.2 {223.3 to 257.0} [193.8 to 223.0]	21.9 to 25.2 {223.3 to 257.0} [193.8 to 223.0]	—	22.2 to 25.5 {226.4 to 260.0} [196.5 to 225.7]	22.2 to 25.5 {226.4 to 260.0} [196.5 to 225.7]	—	15.0 to 17.3 {153.0 to 176.4} [132.8 to 153.1]	—
50 (2.0)	28.0 to 32.2 {285.5 to 328.3} [247.8 to 285.0]	28.0 to 32.2 {285.5 to 328.3} [247.8 to 285.0]	—	27.8 to 32.0 {283.5 to 326.3} [246.0 to 283.2]	27.8 to 32.0 {283.5 to 326.3} [246.0 to 283.2]	—	23.2 to 26.7 {236.6 to 272.3} [205.3 to 236.3]	—
65 (2.5)	41.6 to 47.8 {424.2 to 487.4} [368.2 to 423.0]	41.6 to 47.8 {424.2 to 487.4} [368.2 to 423.0]	—	19.5 to 28.5 {198.8 to 290.6} [172.6 to 252.2]	19.5 to 28.5 {198.8 to 290.6} [172.6 to 252.2]	41.4 to 47.6 {422.2 to 485.4} [366.4 to 421.3]	28.8 to 33.1 {293.7 to 337.5} [254.9 to 293.0]	—
80 (3.0)	23.2 to 26.7 {236.6 to 272.3} [205.3 to 236.3]	52.7 to 53.6 {536.9 to 546.2} [466.0 to 474.1]	—	26.1 to 30.0 {266.1 to 305.9} [231.0 to 265.5]	26.1 to 30.0 {266.1 to 305.9} [231.0 to 265.5]	26.1 to 30.0 {266.1 to 305.9} [231.0 to 265.5]	—	46.0 to 52.9 {469.1 to 539.4} [407.1 to 468.2
100 (4.0)	30.9 to 35.5 {315.1 to 362.0} [273.5 to 314.2]	30.9 to 35.5 {315.1 to 362.0} [273.5 to 314.2]	—	34.8 to 40.0 {354.9 to 407.9} [308.0 to 354.0]	34.8 to 40.0 {354.9 to 407.9} [308.0 to 354.0]	34.8 to 40.0 {354.9 to 407.9} [308.0 to 354.0]	—	60.9 to 70.0 {621.0 to 713.8} [539.0 to 619.5]
150 (6.0)	64.5 to 74.2 {657.7 to 756.6} [570.8 to 656.7]	64.5 to 74.2 {657.7 to 756.6} [570.8 to 656.7]	—	44.8 to 51.5 {456.8 to 525.2} [396.5 to 455.8]	44.8 to 51.5 {456.8 to 525.2} [396.5 to 455.8]	66.7 to 80.8 {680.2 to 823.9} [590.3 to 715.1]	—	67.5 to 77.6 {688.3 to 791.3} [597.4 to 686.8]
200 (8.0)	59.2 to 68.1 {603.7 to 694.4} [523.9 to 602.7]	100.3 to 102.1 {1023 to 1041} [887.8 to 903.3]	100.3 to 102.1 {1023 to 1041} [887.8 to 903.3]	63.6 to 73.1 {648.5 to 745.4} [562.9 to 647.0]	63.6 to 73.1 {648.5 to 745.4} [562.9 to 647.0]	63.6 to 73.1 {648.5 to 745.4} [562.9 to 647.0]	—	69.9 to 80.4 {712.8 to 819.9} [618.6 to 711.6]

Table 3.3.10 Flange Type Tightening Torque Values for PVC Piping

Tightening torque values for PFA lining type								Unit: N-m {kgf-cm} [in-lbf]
Gasket types within flowtube	Fluororubber gasket (optional codes GA, GC, and GD)							
Gasket types for user's flange	Fluororubber gasket, chloroprene rubber gasket, or the equivalent in hardness							
Flange ratings / Size mm (inch)	JIS 10K	ANSI Class 150	DIN PN10	JIS20K	ANSI Class 300	DIN PN16	DIN PN40	JIS F12 (JIS 75M)
25 (1.0)	2.7 to 4.5 {27.53 to 45.89} [23.9 to 39.83]	2.7 to 4.5 {27.53 to 45.89} [23.9 to 39.83]	—	2.7 to 4.5 {27.53 to 45.89} [23.9 to 39.83]	2.7 to 4.5 {27.53 to 45.89} [23.9 to 39.83]	—	2.3 to 3.9 {23.45 to 39.77} [20.36 to 34.52]	—
40 (1.5)	4.5 to 7.6 {45.89 to 77.5} [39.83 to 67.26]	4.5 to 7.6 {45.89 to 77.5} [39.83 to 67.26]	—	4.7 to 7.8 {47.93 to 79.54} [41.6 to 69.03]	4.7 to 7.8 {47.93 to 79.54} [41.6 to 69.03]	—	4.4 to 7.4 {44.87 to 75.46}] [38.94 to 65.49]	—
50 (2.0)	5.9 to 9.8 {60.16 to 99.93} [52.22 to 86.74]	5.9 to 9.8 {60.16 to 99.93} [52.22 to 86.74]	—	2.9 to 4.8 {29.57 to 48.95 } [25.67 to 42.48]	2.9 to 4.8 {29.57 to 48.95 } [25.67 to 42.48]	—	5.5 to 9.2 {56.08 to 93.81 } [48.68 to 81.43]	—
65 (2.5)	9.0 to 15.0 {91.8 to 153.0} [79.7 to 132.8]	9.0 to 15.0 {91.8 to 153.0} [79.7 to 132.8]	—	2.1 to 4.4 {21.4 to 44.9} [18.6 to 38.9]	2.1 to 4.4 {21.4 to 44.9} [18.6 to 38.9]	4.4 to 7.3 {44.9 to 74.4} [38.9 to 64.6]		—
80 (3.0)	4.9 to 8.1 {50.0 to 82.6} [43.4 to 71.7]	11.1 to 16.3 {113.2 to 166.2} [98.2 to 144.3]	—	5.5 to 9.1 {56.1 to 92.8} [48.7 to 80.5]	5.5 to 9.1 {56.1 to 92.8} [48.7 to 80.5]	5.5 to 9.1 {56.1 to 92.8} [48.7 to 80.5]	—	9.7 to 12.2 {98.9 to 124.4} [85.8 to 108.0]
100 (4.0)	6.7 to 11.2 {68.3 to 114.2} [59.3 to 99.1]	6.7 to 11.2 {68.3 to 114.2} [59.3 to 99.1]	—	7.5 to 12.6 {76.5 to 128.5} [66.4 to 111.5]	7.5 to 12.6 {76.5 to 128.5} [66.4 to 111.5]	7.5 to 12.6 {76.5 to 128.5} [66.4 to 111.5]	—	13.3 to 22.2 {135.6 to 226.4} [117.7 to 196.5]
150 (6.0)	14.4 to 24.0 {146.8 to 244.7} [127.4 to 212.4]	14.4 to 24.0 {146.8 to 244.7} [127.4 to 212.4]	—	9.8 to 16.3 {99.9 to 166.2} [86.7 to 144.3]	9.8 to 16.3 {99.9 to 166.2} [86.7 to 144.3]	14.6 to 25.6 {148.9 to 261.0} [129.2 to 226.6]	—	15.2 to 25.3 {155.0 to 258.0} [134.5 to 223.9]
200 (8.0)	13.4 to 22.3 {136.6 to 227.4} [118.6 to 197.4]	22.7 to 33.4 {231.5 to 340.6} [200.9 to 295.6]	22.7 to 33.4 {231.5 to 340.6} [200.9 to 295.6]	14.6 to 24.3 {148.9 to 247.8} [129.2 to 215.1]	14.6 to 24.3 {148.9 to 247.8} [129.2 to 215.1]	14.6 to 24.3 {148.9 to 247.8} [129.2 to 215.1]	—	16.1 to 26.9 {164.2 to 274.3} [142.5 to 238.1]

Table 3.3.11 Flange Type Tightening Torque Values for Metal Piping and Permeable Fluids

Tightening torque values for PFA lining type								Unit: N-m {kgf-cm} [in-lbf]
Gasket types within flowtube	No gasket (standard)							
Gasket types for user's flange	Non-asbestos gasket, PTFE-sheathed non-asbestos gasket, or the equivalent in hardness							
Flange ratings / Size mm (inch)	JIS 10K	ANSI Class 150	DIN PN10	JIS20K	ANSI Class 300	DIN PN16	DIN PN40	JIS F12 (JIS 75M)
25 (1.0)	19.6 to 22.5 {199.9 to 229.4} [173.5 to 199.1]	19.6 to 22.5 {199.9 to 229.4} [173.5 to 199.1]	—	19.7 to 22.7 {200.9 to 231.5} [174.4 to 200.9]	19.7 to 22.7 {200.9 to 231.5} [174.4 to 200.9]	—	17.5 to 20.1 {178.5 to 205.0} [154.9 to 177.9]	—
40 (1.5)	32.5 to 37.4 {331.4 to 381.4} [287.6 to 331.0]	32.5 to 37.4 {331.4 to 381.4} [287.6 to 331.0]	—	32.8 to 37.7 {334.5 to 384.4} [290.3 to 333.7]	32.8 to 37.7 {334.5 to 384.4} [290.3 to 333.7]	—	33.8 to 38.9 {344.7 to 396.7} [229.2 to 344.3]	—
50 (2.0)	41.3 to 47.5 {421.1 to 484.4} [365.5 to 420.4]	41.3 to 47.5 {421.1 to 484.4} [365.5 to 420.4]	—	20.6 to 23.7 {210.1 to 241.7} [182.3 to 209.8]	20.6 to 23.7 {210.1 to 241.7} [182.3 to 209.8]	—	42.2 to 48.5 {430.3 to 494.6} [373.5 to 429.3]	—
65 (2.5)	61.2 to 70.4 {624.1 to 717.9} [541.6 to 623.1]	61.2 to 70.4 {624.1 to 717.9} [541.6 to 623.1]	—	14.3 to 21.0 {145.8 to 214.1} [126.6 to 185.9]	14.3 to 21.0 {145.8 to 214.1} [126.6 to 185.9]	30.5 to 35.1 {311.0 to 357.9} [269.9 to 310.6]	—	—
80 (3.0)	34.2 to 39.3 {348.7 to 400.7} [302.7 to 347.8]	77.6 to 78.8 {791.3 to 803.5} [686.8 to 697.4]	—	38.5 to 44.3 {392.6 to 451.7} [340.7 to 392.1]	38.5 to 44.3 {392.6 to 451.7} [340.7 to 392.1]	38.5 to 44.3 {392.6 to 451.7} [340.7 to 392.1]	—	68.1 to 78.3 {694.4 to 798.4} [602.7 to 693.0]
100 (4.0)	45.2 to 52.0 {460.9 to 530.3} [400.0 to 460.2]	45.2 to 52.0 {460.9 to 530.3} [400.0 to 460.2]	—	51.0 to 58.7 {520.1 to 598.6} [451.4 to 519.5]	51.0 to 58.7 {520.1 to 598.6} [451.4 to 519.5]	51.0 to 58.7 {520.1 to 598.6} [451.4 to 519.5]	—	89.6 to 103.0 {913.7 to 1050} [793.0 to 911.6]
150 (6.0)	93.9 to 108.8 {957.5 to 1109} [831.1 to 962.9]	93.9 to108.8 {957.5 to 1109} [831.1 to 962.9]	—	65.4 to 75.2 {666.9 to 766.8} [578.8 to 665.5]	65.4 to 75.2 {666.9 to 766.8} [578.8 to 665.5]	97.3 to 118.0 {992.2 to 1203} [861.1 to 1044]	—	98.8 to 113.6 {1007 to 1158} [874.4 to 1005]
200 (8.0)	85.8 to 98.7 {874.9 to 1006} [759.4 to 873.5]	145.4 to 147.9 {1483 to 1508} [1287 to 1309]	145.4 to 147.9 {1483 to 1508} [1287 to 1309]	91.5 to 105.2 {933.0 to 1073} [809.8 to 931.1]	91.5 to 105.2 {933.0 to 1073} [809.8 to 931.1]	91.5 to 105.2 {933.0 to 1073} [809.8 to 931.1]	—	101.8 to 117.1 {1038 to 1194} [901.0 to 1036]

3.3.4 Gaskets Size

Be sure to choose a gasket with an inner and outer diameter that does not protrude inside the piping. If the inner diameter of the gasket is too large, or outer diameter of the gasket is too small, fluid leakage may result.

Table 3.3.12 Inner Diameters of Grounding Ring, Outer Diameter for Effective Sealing, Recommended Inner Diameter of Gasket

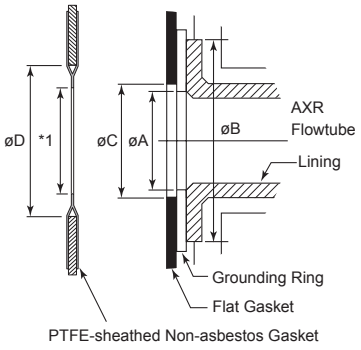
Lay length code 1; **Unit: mm (in.)**

Size	PFA lining			
	Wafer, Flange			
	Inner Diameter of Grounding Ring [øA]	Outer Diameter for Effective Sealing [øB]	Recommended Inner Diameter of Gasket	
			Flat Gasket [øC]	PTFE-sheathed Non-asbestos Gasket [øD]
25 (1.0)	28 (1.10)	53 (2.09)	35 (1.38)	
40 (1.5)	41 (1.61)	71 (2.80)	49 (1.93)	
50 (2.0)	53 (2.09)	84 (3.31)	61 (2.40)	
65 (2.5)	66 (2.60)	103 (4.06)	84 (3.31)	
80 (3.0)	77 (3.03)	114 (4.49)	90 (3.54)	
100 (4.0)	102 (4.02)	140 (5.51)	115 (4.53)	
150 (6.0)	146.1 (5.75)	190 (7.48)	167 (6.57)	
200 (8.0)	193.6 (7.62)	240 (9.45)	218 (8.58)	

Lay length code 2; **Unit: mm (in.)**

Size	PFA lining			
	Wafer			
	Inner Diameter of Grounding Ring [øA]	Outer Diameter for Effective Sealing [øB]	Recommended Inner Diameter of Gasket	
			Flat Gasket [øC]	PTFE-sheathed Non-asbestos Gasket [øD]
25 (1.0)	28 (1.10)	53 (2.09)	35 (1.38)	
40 (1.5)	41 (1.61)	71 (2.80)	49 (1.93)	
50 (2.0)	53 (2.09)	84 (3.31)	61 (2.40)	
65 (2.5)	66 (2.60)	103 (4.06)	84 (3.31)	
80 (3.0)	77 (3.03)	114 (4.49)	90 (3.54)	
100 (4.0)	102 (4.02)	140 (5.51)	115 (4.53)	
150 (6.0)	140.7 (5.54)	190 (7.48)	167 (6.57)	
200 (8.0)	188.9 (7.44)	240 (9.45)	218 (8.58)	

Size of Inner Diameter of Grounding Ring, Outer Diameter for Effective Sealing and Recommended Inner Diameter of Gasket:



*1: Do not have this length be smaller than the inner diameter of grounding ring (øA).

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4. WIRING

This section describes the wiring of the integral flowmeter.

WARNING

The wiring of the magnetic flowmeter must be performed by expert engineer or skilled personnel. No operator shall be permitted to perform procedures relating to wiring.

CAUTION

Once all wiring is complete, check the connections before applying power to the instrument. Improper arrangements or wiring may cause a unit malfunction or damage.

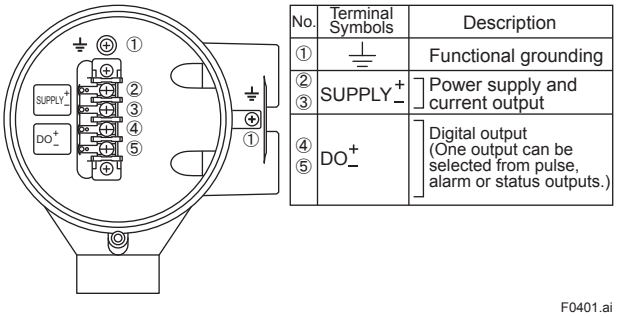
4.1 Wiring Precautions

Be sure to observe the following precautions when wiring:

CAUTION

- Do not connect cables outdoors in wet weather in order to prevent damage from condensation and to protect the insulation, e.g. inside the terminal box of the flowmeter.
- All the cable ends must be provided with round crimp-on terminals and be securely wired.
- The cable must be routed in steel conduit tube 16 (JIS C 8305) or flexible conduit tubes 15 (JIS C 8309). Keep the conduits or flexible tubes watertight using sealing tape.
- When waterproof glands or union equipped waterproof glands are used, avoid tightening the glands with an excessive torque.
- A plug is provided. Use this plug to cover the unused wiring port when wiring the instrument with only one.
- Be sure to turn the power off before opening the terminal box cover.
- Before turning the power on, tighten the terminal box cover securely.
- The terminal box cover is locked by the special screw. In case of opening the terminal box cover, use the hexagonal wrench (nominal size 3). For handling the locking screw, read Section 4.5.
- Be sure to lock the cover by the special screw using the hexagonal wrench (nominal size 3) after installing the cover. For handling the locking screw, read Section 4.5.
- Explosion proof types must be wired in accordance with specific requirement (and, in certain countries, legal regulations) in order to preserve the effectiveness of their explosion proof features.

4.2 Terminal Configuration and Terminal Wiring



No.	Terminal Symbols	Description
①	⏚	Functional grounding
② ③	SUPPLY+ −	Power supply and current output
④ ⑤	DO+ −	Digital output (One output can be selected from pulse, alarm or status outputs.)

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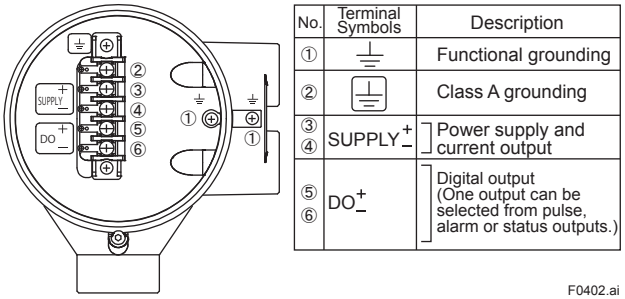
Figure 4.2.1 Terminal Configuration/Terminal Wiring (General-purpose Use/Explosion Proof Type except TIIS)



No.	Terminal Symbols	Description
①	⏚	Functional grounding
②	⏚	Class A grounding
③ ④	SUPPLY+ −	Power supply and current output
⑤ ⑥	DO+ −	Digital output (One output can be selected from pulse, alarm or status outputs.)

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Figure 4.2.2 Terminal Configuration/Terminal Wiring (TIIS Explosion Proof Type)

Recommended Power and Output Cable:
JIS C3401 control cable equivalent
JIS C3312 power cable equivalent
14 AWG Belden 8720 equivalent

Outer Diameter:
With no gland option:
6.5 to 12 mm (0.26 to 0.47 in.)
With gland options EG and EU:
10.5 or 11.5 mm (0.41 to 0.45 in.)
With gland options EP:
6 to 12 mm (0.24 to 0.47 in.)
Nominal Cross Section:
Single wire; 0.5 to 2.5 mm^2
Stranded wire; 0.5 to 1.5 mm^2

NOTE

- For power cables, always use a crimp terminal with an insulation cover.
- Use crimp tools from the manufacturer of the crimp terminal you want to use to connect the crimp terminal and cable.
- Use crimp tools that are appropriate for the diameter of the cable to be connected.

4.3 Wiring Ports

This instrument is of watertight construction as stipulated in JIS C0920. It is shipped with a wiring bracket (waterproof gland or waterproof gland with union) or a plastic gland attached, only in cases where an optional specification is selected for the wiring port.
In case of the explosion proof type, read Chapter 14.

IMPORTANT

The wiring port is sealed with a cap (not waterproof). Use the plug which is packed for the unused wiring port. If waterproof property is necessary, please use waterproof glands.

(1) When waterproof property is unnecessary (When there are no particular optional specifications)

The wiring port is sealed with a cap (not waterproof) that must be removed before wiring. At this time, handle the wiring port in accordance with the JIS C0920 mentioned above. Use the plug which is packed for the unused wiring port.

(2) When waterproof property is necessary (Wiring using waterproof glands)

IMPORTANT

To prevent water or condensation from entering the converter housing, waterproof glands are recommended. Do not over-tighten the glands or damage to the cables may result. Tightness of the gland can be checked by confirming that the cable is held firmly in place.

For working on the electric wire tubes or the flexible tubes (G1/2), remove the waterproof gland and attach them directly to the wiring port.

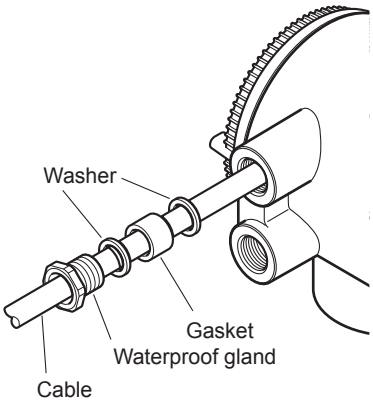


Figure 4.3.1 Waterproof Gland (Optional code EG)

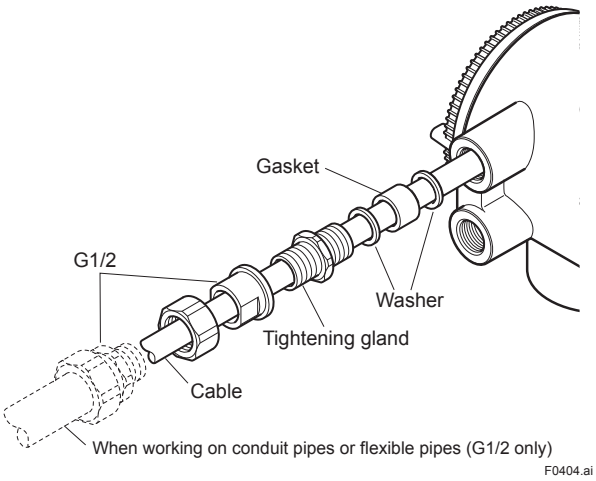


Figure 4.3.2 Waterproof Gland with Union Joint (Optional code EU)

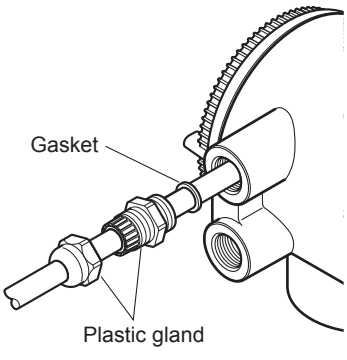


Figure 4.3.3 Plastic Gland (Optional code EP)

(3) Conduit Wiring

When wiring the conduits, pass the conduit through the wiring connection port, and utilize the waterproof gland to prevent water from flowing in. Place the conduit pipe on an angle as shown in Figure 4.3.4. Install a drain valve at the low end of the vertical pipe, and open the valve regularly.

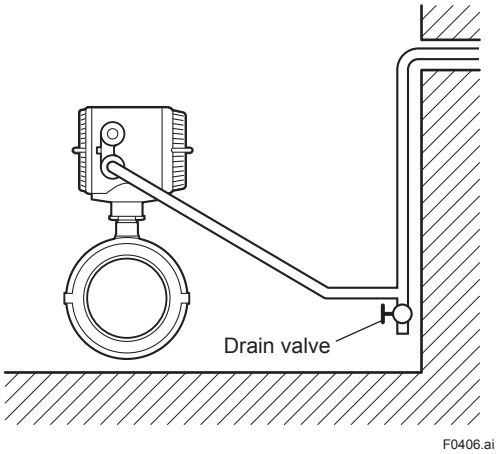


Figure 4.3.4 Conduit Wiring

4.4 Grounding Connection

IMPORTANT

- In case of General-purpose Use, grounding resistance of 100 Ω or less is necessary. When the optional code A is selected, grounding resistance of 10 Ω or less shall be required.
- In case of TIIS explosion proof type, grounding resistance of 10 Ω or less is necessary for class A grounding terminal. Grounding resistance of 100 Ω or less is necessary for Functional grounding terminal. When the optional code A is selected, grounding resistence of 10 Ω or less is necessary for Functional grounding terminal.
- For explosion proof type except TIIS, follow the domestic electrical requirements as regulated in each country.

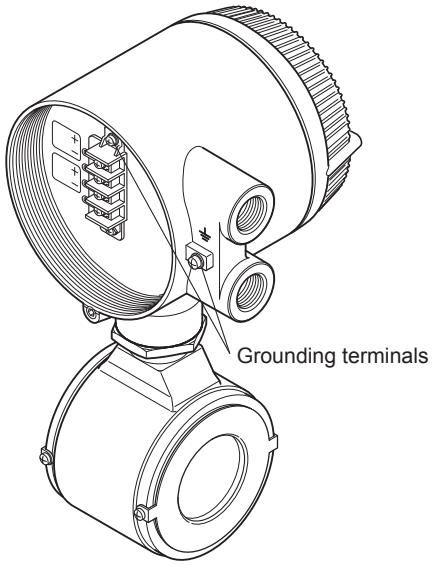


Figure 4.4.1 Functional Grounding Terminal Location (General - purpose Use/ Explosion Proof Type except TIIS)

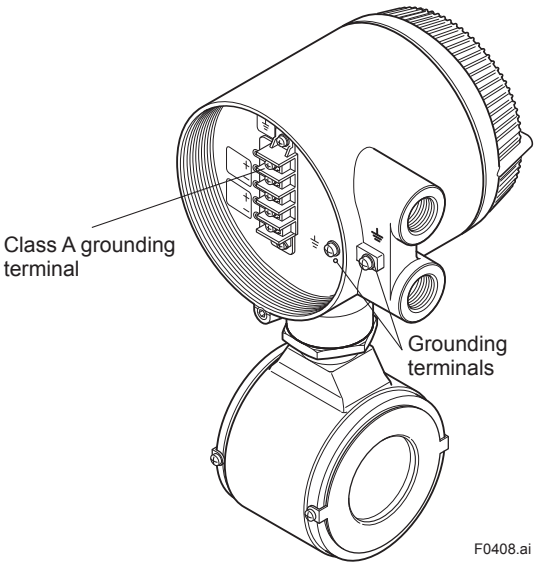


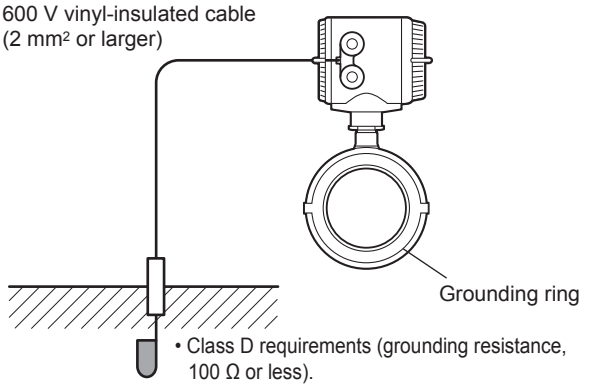
Figure 4.4.2 Functional Grounding Terminal Location (TIIS Explosion Proof Type)

IMPORTANT

Improper grounding can have an adverse effect on the flow measurement. Ensure that the instrument is properly grounded.

The electromotive force of the magnetic flowmeter is minute and it is easily affected by noise, and the reference electric potential is the same as that of the measuring fluid. Therefore, the reference electric potential (terminal potential) of the flowtube and converter also need to be the same as that of the measuring fluid. Moreover, the potential must be the same as the ground. The magnetic flowmeter is equipped with a grounding ring that makes a connection with the charge of the measured fluid for grounding and protects the lining. The flowmeter should be grounded by certain specifications (grounding resistance of 100 Ω or less, or 10 Ω or less) according to Figure 4.4.3.
Grounding is mandatory especially for insulated piping such as PVC-sheathed pipes. If not, the magnetic flowmeter measures the flow incorrectly because the reference electrical potential is floating. Moreover, grounding is also mandatory in the simultaneous outputs of current and pulse. If not, the flowmeter causes a large measurement error because the outputs interfere with each other.

[General - purpose Use/Explosion Proof Type except TIIS]



- Class D requirements (grounding resistance, 100 Ω or less).
  Optional code A (lightning protector): Class C requirements (grounding resistance, 10 Ω or less).
- Explosion proof type except TIIS: Domestic electrical requirements as regulated in each country.

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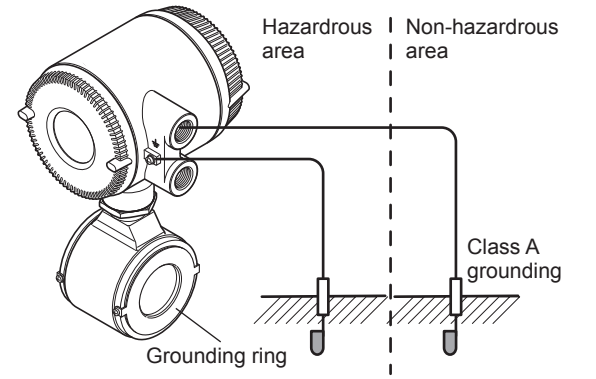
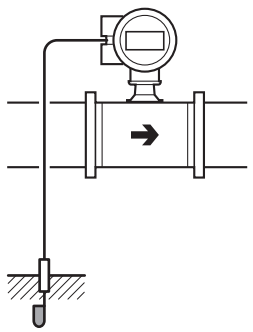
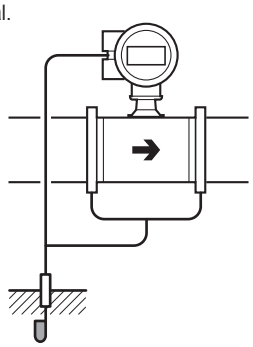
[TIIS Explosion Proof Type]



- TIIS Explosion Proof Type: Grounding resistance of 10 Ω or less is necessary for class A grounding terminal.
  Grounding resistance of 100 Ω or less is necessary for Functional grounding terminal.
  When the optional code A is selected, grounding resistance of 10 Ω or less is necessary for Functional grounding terminal.



In case grounding rings are used.



In case grounding rings are not used.
(Available only for metal piping)

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Figure 4.4.3 Grounding

IMPORTANT

Class A grounding should be installed in non-hazardous area.

4.5 Wiring Connections

(1) Removing Cover

The cover has the locking screws in front and behind it as shown in Figure 4.5.1 in case of explosion proof type. This is used for the cover-lock system. Loosen cover locking screws clockwise using a hexagonal wrench (nominal size 3) to unlock the cover. (Upon shipment from the manufacturing plant, the cover is unlocked.)
Hold the flowmeter with your hand and remove the cover by turning it in the direction of the arrow as shown below (both explosion proof and general purpose types).

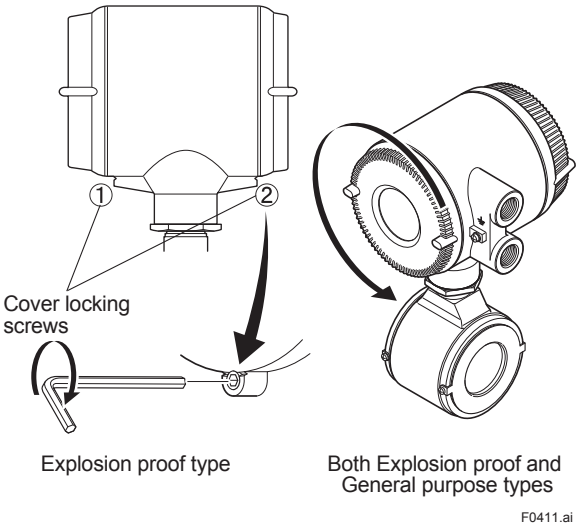


Figure 4.5.1 Removing the Terminal Box Cover

(2) Terminal Configuration (General - purpose Use/Explosion Proof Type except TIIS)

When the cover is removed, the connection terminals will be visible.

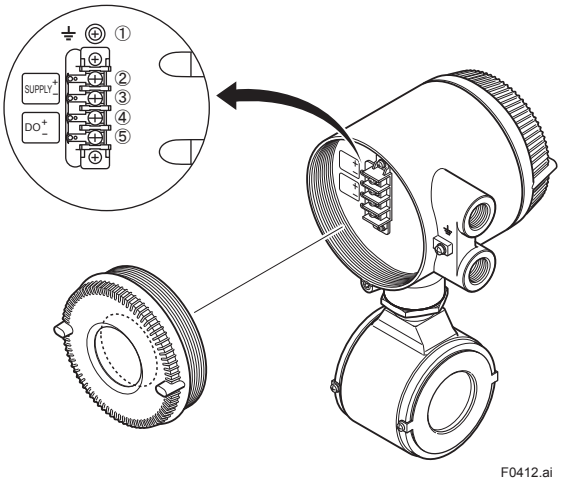


Figure 4.5.2 Terminal Configuration

The description of the terminal symbols is shown in Table 4.5.1.

Table 4.5.1 Terminal Symbols

No.	Terminal Symbols	Description
①	⏚	Functional grounding
② ③	SUPPLY + −	Power supply and current output
④ ⑤	DO + −	Digital output (One output can be selected from pulse, alarm or status outputs.)

(3) Terminal Configuration (TIIS Explosion Proof Type)

When the cover is removed, the connection terminal will be visible.

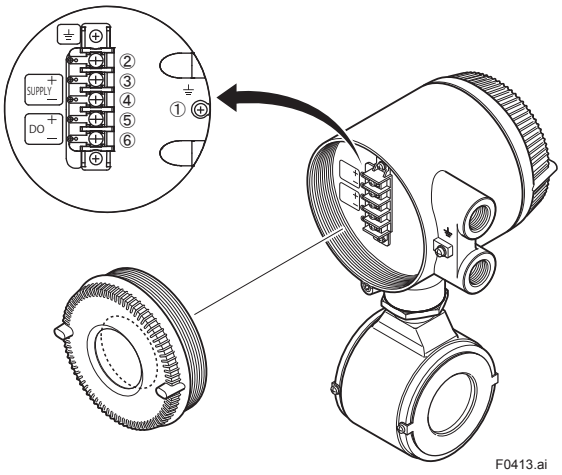


Figure 4.5.3 Terminal Configuration

The description of the terminal symbols is shown in Table 4.5.2.

Table 4.5.2 Terminal Symbols

No.	Terminal Symbols	Description
①	⏚	Functional grounding
②	⏚	Class A grounding
③ ④	SUPPLY + −	Power supply and current output
⑤ ⑥	DO + −	Digital output (One output can be selected from pulse, alarm or status outputs.)

4.6 Wiring Procedure

(1) Power supply and Current output

This instrument uses the same two wires for both, the signal and power supply. A DC power supply is required in a transmission loop.
The allowable power supply voltage is described below.

- 14.7 to 42V DC for general-purpose use and explosion proof type
- 14.7 to 32V DC for lightning Protector (optional code A)

Wire the AXR according to Figure 4.6.1 or Figure 4.6.2.

WARNING

Before wiring with external instruments, be sure to turn off the external instruments.

IMPORTANT

This instrument normally outputs a current of 12 mA for several seconds just after turning on the power.
Warm up this instrument for at least 30 minutes. Perform flow measurement 30 minutes after turning on the power.

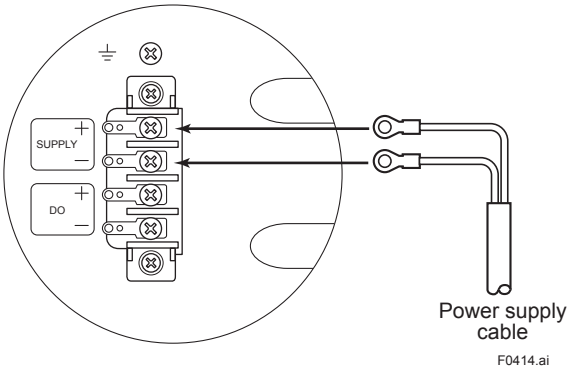


Figure 4.6.1 Electric Cable Wiring (General - purpose Use/Explosion Proof Type except TIIS)

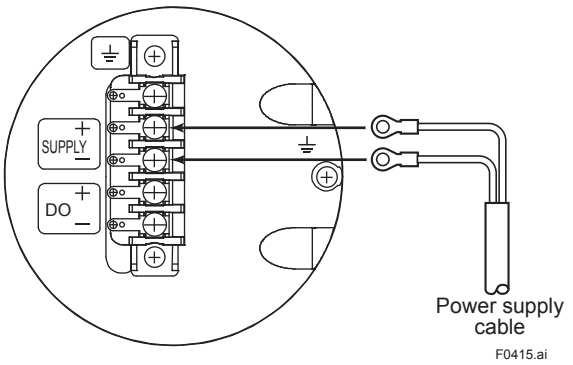


Figure 4.6.2 Electric Cable Wiring (TIIS Explosion Proof Type)

IMPORTANT

- Connecting with the commercial AXR power supply will damage the flowmeter. Be sure to use the DC power supply in the predetermined range.
- Do not connect power supply with reversed polarities.
  SUPPLY + terminal: connect +
  SUPPLY - terminal: connect -

NOTE

Supply voltage means the voltage necessary to provide between the power terminals of the magnetic flowmeter.

Read Table 4.6.2 to Table 4.6.4 for wiring examples in case of general - purpose use/explosion proof type except TIIS.
Read Table 4.6.5 to Table 4.6.7 for wiring examples in case of TIIS explosion proof type.
The ADMAG AXR can be connected with almost all distributors, signal conditioner cards, and I/O modules except certain devices.
Read the Table 4.6.1 for Yokogawa's devices, choose an appropriate connecting device and the corresponding length of cable.
For devices other than Table 4.6.1, decide on the connection by reading the supply voltage specifications and the description of wiring examples as shown in Table 4.6.2 to Table 4.6.7.

Table 4.6.1 Connecting device and Applicable maximum cable length (guideline)

Connecting device		Maximum length of cable (rough guideline)	
Name	Model	Cable with cross section of 2 mm²	Cable with cross section of 1.25 mm²
Signal Conditioner Card	EA1 EA2	2 km	2 km
I/O Module	AAM11 AAM11B	2 km	2 km
Analog I/O Module (for FIO)	AAI143	2 km	2 km
	AAI141 AAI841 AAI135 AAI835	Not applicable	Not applicable
Analog I/O Module (for Prosafe-RS)	SAI143	1.4 km	0.8 km
Distributor	SDBT SDBS	2 km	2 km
JUXTA	VJA1 VJA4 VJA7	2 km	2 km

Communication Requirement:

BRAIN

Communication signal:

BRAIN communication signal (superimposed on 4 to 20 mA DC signals)

Conditions of Communication Line:

Supply Voltage: 20.6 to 42 V DC

Load Resistance: 250 to 600 Ω (including cable resistance)

Read Figure 4.6.3.

Communication Distance:

Up to a distance of 2km when a CEV cable is used (Read Table 4.6.2 to Table 4.6.7)

Load Capacitance: 0.22 µF or less

Load Inductance: 3.3 mH or less

Distance from other Power line:

15 cm (6 in.) or more (Avoid parallel wiring)

Input Impedance of Communicating Device:

10 kΩ or more at 2.4 kHz

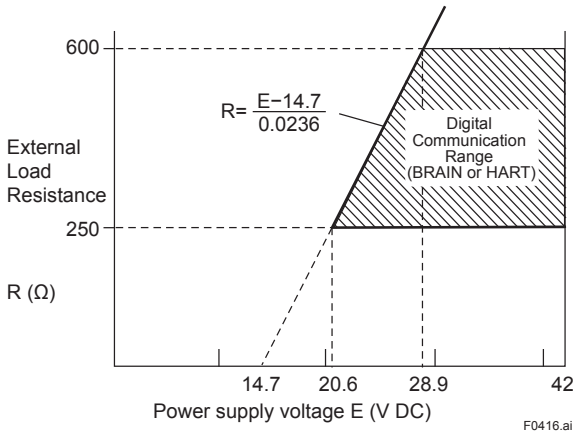


Figure 4.6.3 Relationship between Power supply voltage and external load resistance

HART

Communication signal:

HART communication signal (superimposed on 4 to 20 mA DC signals)

Note: HART is a registered trademark of the FieldComm Group. Use the setting tool that has the same protocol revision as AXR. It is not possible to communicate with HART7 AXR in using HART 5 or HART 6 setting tool.

Conditions of Communication Line:

Supply Voltage: 20.6 to 42 V DC

Load Resistance: 250 to 600 Ω (including cable resistance)

Read Figure 4.6.3.

HART Protocol Revision

HART protocol revision can be selected from 5 or 7 when ordering. (“-J” only)

The protocol revision can be changed by user configuration.

The HART protocol revision at the time of shipment is shown by the last number at the serial number column of the name plate.

Note: Protocol revision supported by HART configuration tool must be the same or higher than that of AXR.

Selection of HART 5/ HART 7

Output Signal Code		-E	-J	
Ordering Information		–	Specify “5”	Specify “7”
HART Protocol Revision		HART 5		HART 7
Selection guide	Requirement for HART 7 functionality	NO		YES Be sure to confirm the protocol revision of the HART configuration tool shown in Note 2.
	Other conditions	Not available to switch to HART 7 protocol after delivery.	Available to switch to HART 7 protocol after delivery by user-configuration.	Available to switch to HART 5 protocol after delivery by user-configuration.
Remarks		Note 1	Note 2	Note 2

Note 1: "-E" is HART5 exclusive model and will be terminated.
"-J" is recommended for HART communication.
Note 2: HART protocol revision for the device and HART configuration tool
HART 7 communication is supported by FieldMate R2.04 or later.

	Protocol revision supported by HART configuration tool	
	5	7
AXR, HART 5	Available	Available
AXR, HART 7	Not available	Available

(2) Pulse Output, Status Output, Alarm Output

One Output can be selected from pulse, alarm, or status through the parameter setting.
Read Table 4.6.2 or Table 4.6.5 as wiring examples.

Digital Output:

Transistor contact output, open collector
Contact rating: 30 V DC, 120 mA DC
Low level: 0 to 2 V DC (Read Figure 4.6.4)

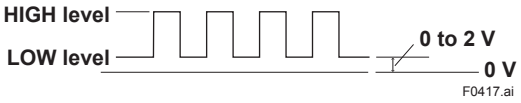


Figure 4.6.4 High and Low levels (transistor contact output)

IMPORTANT

Precaution for Pulse Output

- As this is a transistor contact (insulated type), give attention to proper voltage and polarity when wiring.
- Do not apply a voltage larger than 30 V DC or a current larger than 120 mA in order to prevent damage to the instrument.
- When input filter constant of the electronic counter is large in relation to the pulse width, the signal will decrease and the count will not be accurate.
- If the input impedance of the electronic counter is large, an induction noise from the power supply may result in inaccurate counts. Use a shield cable or sufficiently reduce the input impedance of the electronic counter within the electromagnetic flowmeter pulse output specification range.
- The load resistance for pulse output is necessary. Read Table 4.6.3 or Table 4.6.6.
- Neither no load resistance nor too small value of load resistance for pulse output will give a damage to the instrument.

IMPORTANT

Precaution for Status Output and Alarm Output

- As this is a transistor contact (insulated type), give attention to proper voltage and polarity when wiring.
- Do not apply a voltage larger than 30V DC or a current larger than 120 mA in order to prevent damage to the instrument.
- This output cannot switch an AC load. To switch an AC load, an intermediate relay must be inserted as shown in Table 4.6.2 or Table 4.6.5.

* The alarm output operates from open (normal) to closed (alarm occurrence) in the default value (as setup upon plant shipment). Changes can be made via the parameter settings.

NOTE

Precaution for Pulse Output
For pulse output from the DO terminal, parameters must be set. Read Chapter 6 in this manual.

NOTE

Precaution for Status Output and Alarm Output
For status output and alarm output from the DO terminal, parameters must be set. Read Chapter 6 in this manual.

(3) Simultaneous Current-Pulse Output

When simultaneous output of current and pulse output are used, no communication is possible in some cases.
Read Table 4.6.3 or Table 4.6.6 as wiring examples.
Read (2) for specifications and precautions of the pulse output.

(4) The Wiring of Digital External Indicator Using Current Output

Read Table 4.6.4 or Table 4.6.7 as wiring examples.

■ Wiring Examples (General - purpose Use/Explosion Proof Type except TIIS)

Table 4.6.2 Current Output, Pulse Output, Status Output and Alarm Output (General - purpose Use/Explosion Proof Type except TIIS)

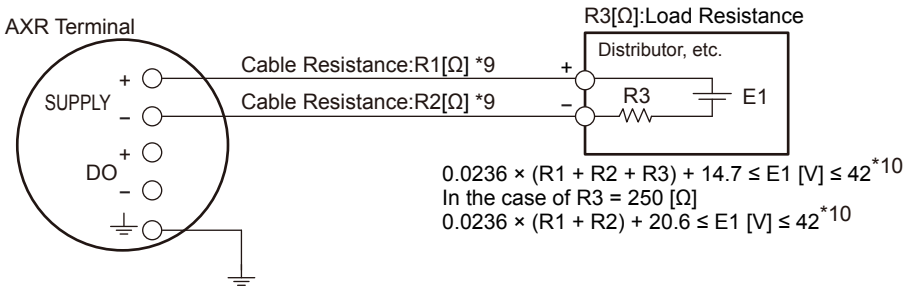
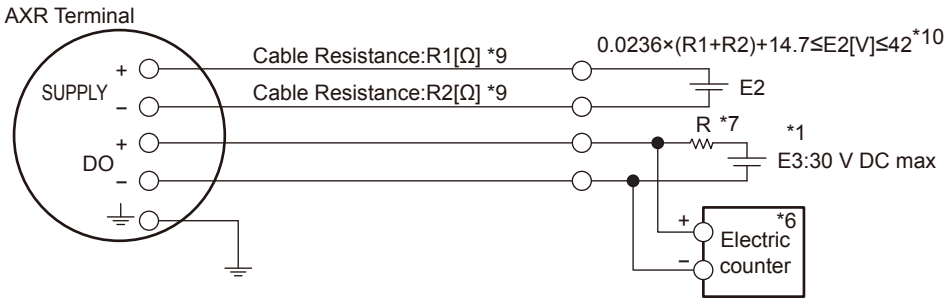
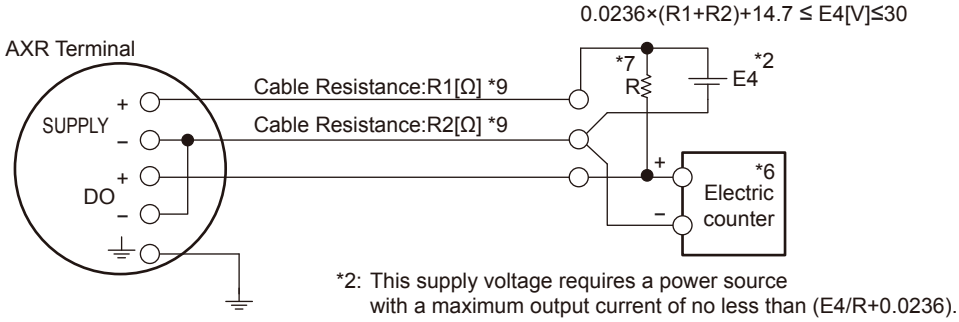
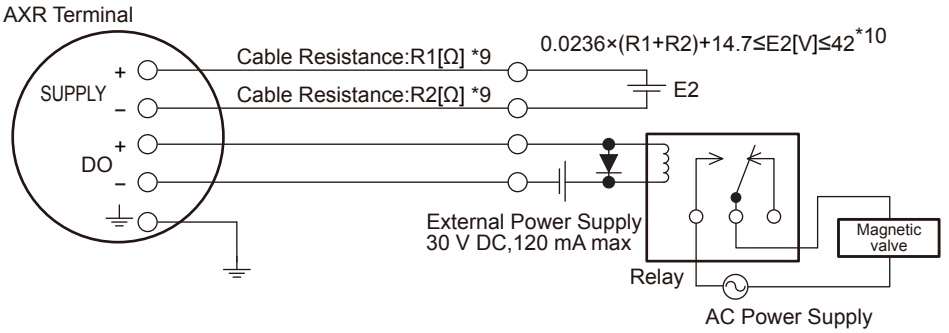
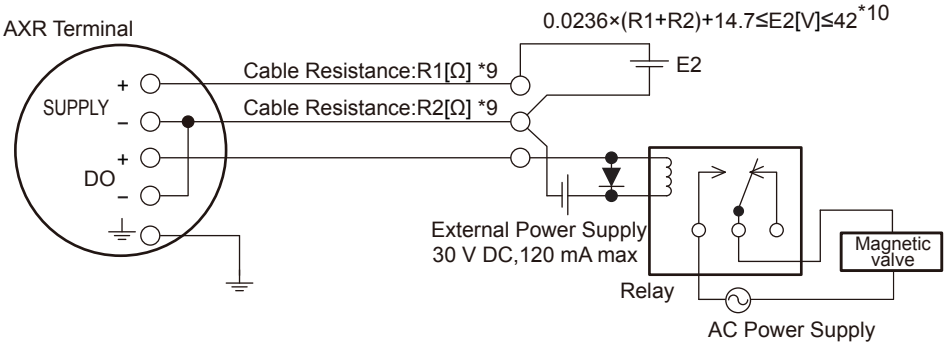
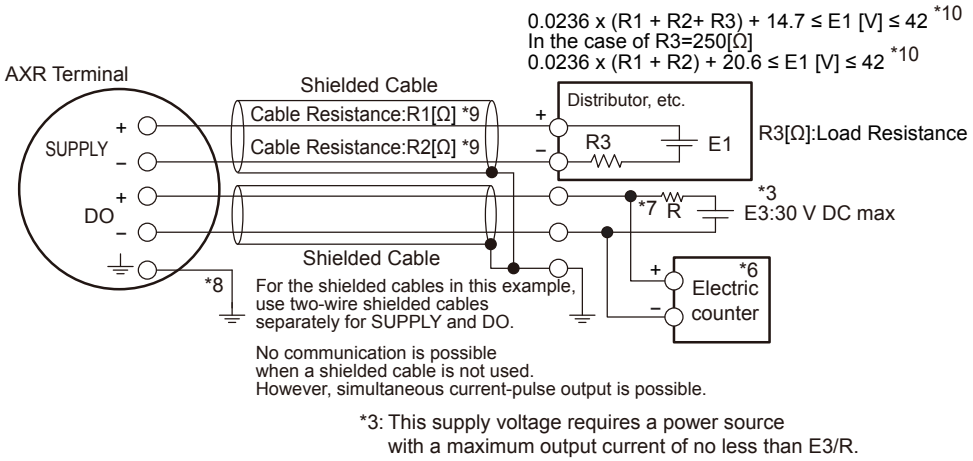
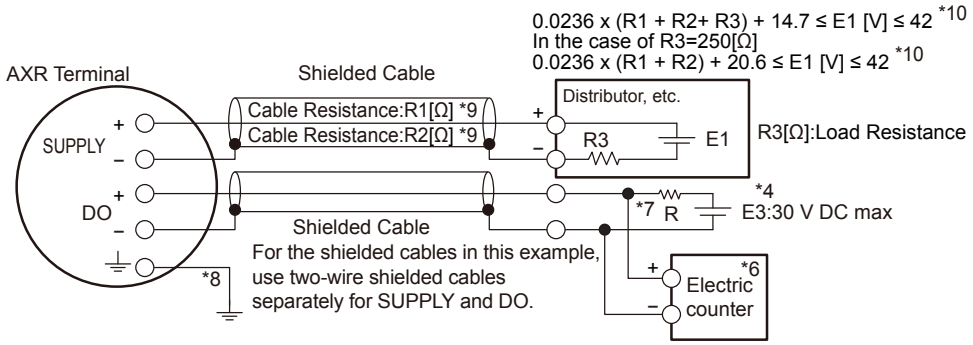
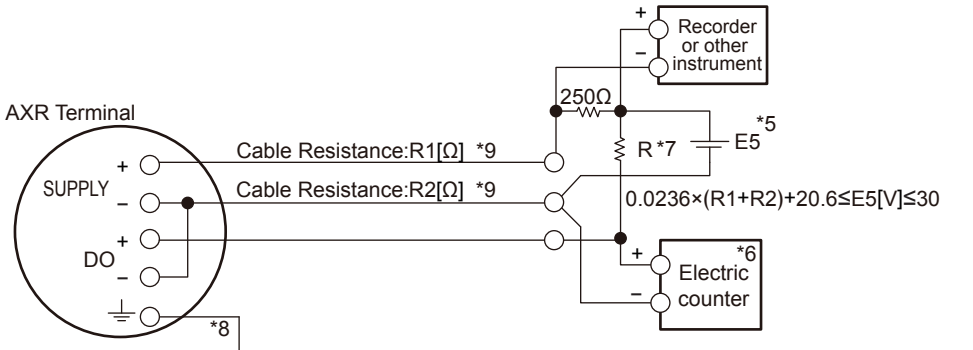
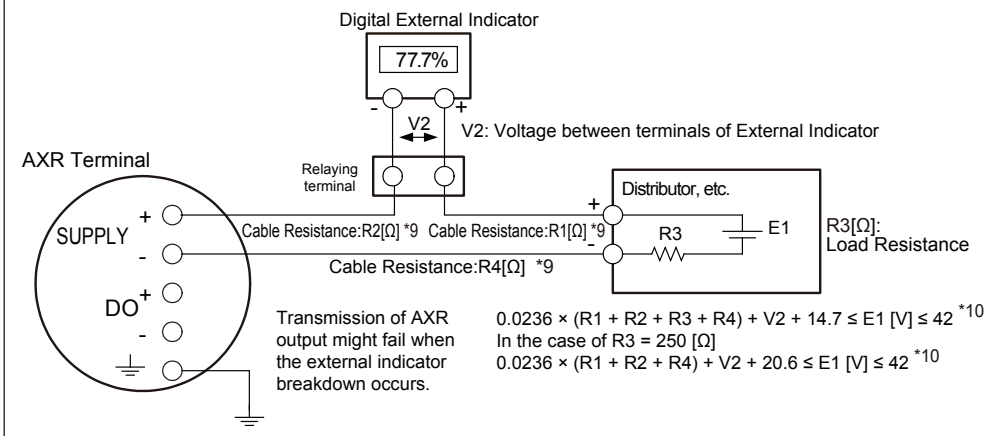
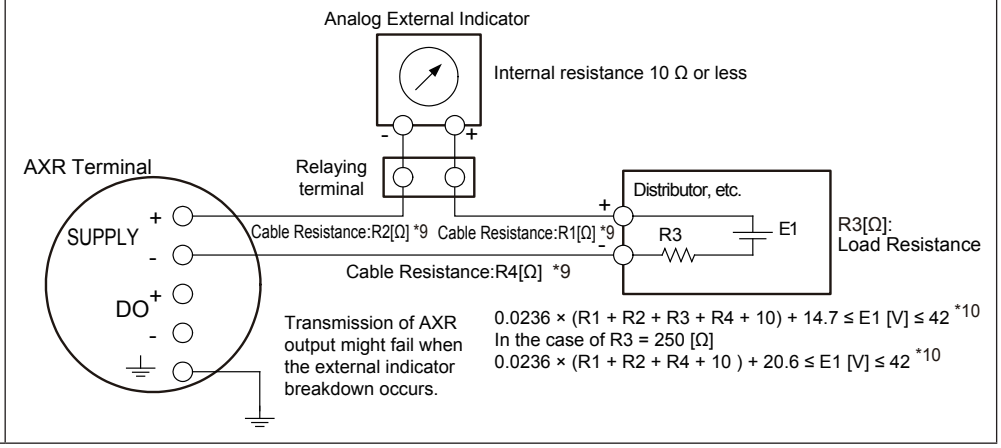
Connection	Description
Current Output In this case, Communication is possible (up to a distance of 2 km when a CEV cable is used.)	
Pulse Output In this case, No communication is possible when a four-wire cable is used.	 *1: This supply voltage requires a power source with a maximum output current of no less than E3/R.
Pulse Output In this case, No communication is possible when a three-wire cable is used.	 *2: This supply voltage requires a power source with a maximum output current of no less than (E4/R+0.0236).
Status Output **Alarm Output** In this case, No communication is possible when a four-wire cable is used.	
Status Output **Alarm Output** In this case, No communication is possible when a three-wire cable is used.	

Table 4.6.3 Simultaneous Current-Pulse Output (General - purpose Use/Explosion Proof Type except TIIS)

Connection	Description
Simultaneous Current-Pulse Output	When simultaneous output of current and pulse output are used, no communication is possible in some cases. Read the following example 1 to 3.
Example 1 In this case, Communication is possible (up to a distance of 2 km when a CEV cable is used) and when a two-wire shielded cable is used.	 *3: This supply voltage requires a power source with a maximum output current of no less than E3/R.
Example 2 In this case, Communication is possible (up to a distance of 2 km when a CEV cable is used) and when a one-wire shielded cable is used.	 *4: This supply voltage requires a power source with a maximum output current of no less than E3/R.
Example 3 In this case, No communication is possible when a three-wire cable is used.	 *5: This supply voltage requires a power source with a maximum output current of no less than (E5/R+0.0236).
The range of load resistance R for the pulse output	The range of load resistance R for the pulse output must basically be 1 kΩ and 2 W. The load resistance should be selected by calculation as shown below when proper transmission is impossible due to the length of cable or frequency of pulse output. $\frac{E\ (V)}{120} \leq R\ (k\Omega) \leq \frac{0.1}{C\ (\mu F) \times f\ (kHz)}$ ··· (1) $P\ (mW) = \frac{E^2(V)}{R\ (k\Omega)}$ ·····(2) E: Supply voltage (V) f: Frequency of pulse output (kHz) R: Value of load resistance (kΩ) C: Cable capacitance (μF) P: Electrical power of the load resistance (mW) Note: C ≒ 0.1 (μF/km) for CEV cable

Note: • The communication is possible though it might not meet a part of the HART communication specification depending on use conditions.
• When using current and pulse output simultareously, the HART communication may be influenced by noise comparing analog output only.

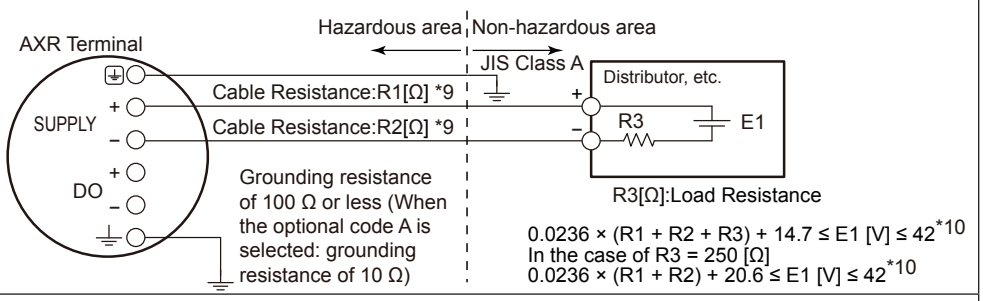
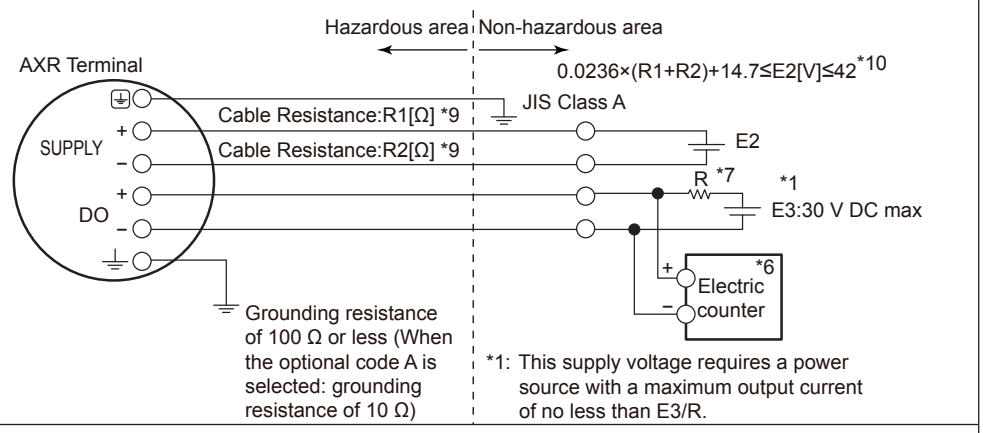
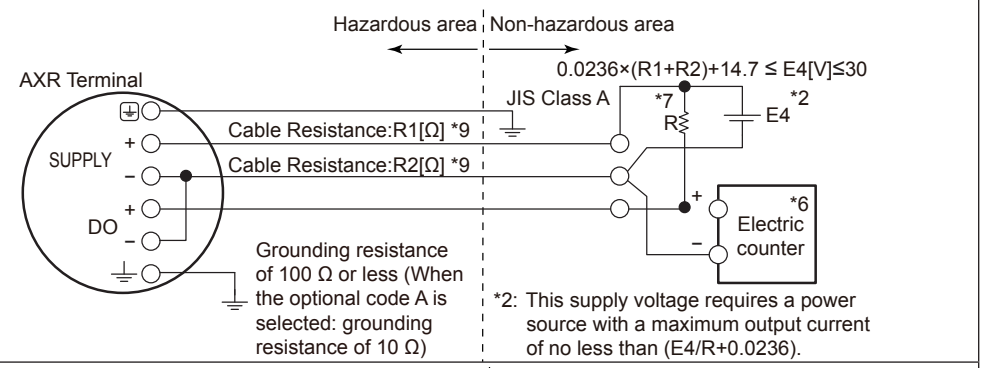
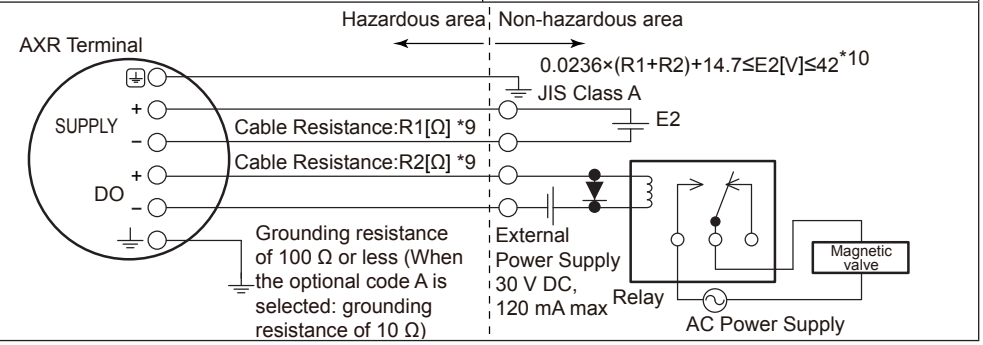
Table 4.6.4 Digital External Indicator Using Current Output (General - purpose Use/Explosion Proof Type except TIIS)

Connection	Description
Current Output **Example 1** Connection to digital external indicator	
Example 2 Connection to analog external indicator	

*6: To avoid the influence of external noise, use an electric counter which fits to the pulse frequency.
*7: Resistor is not necessary in the case of an electric counter which can receive contact pulse signal directly.
*8: Ground the AXR to avoid the current output error in simultaneous current-pulse output.
*9: Calculate the cable resistance by using the following as a rough guideline: 10.9 Ω per 1 km for the cable with the cross section of 2 mm^2, 19.5 Ω per 1 km for the cable with the cross section of 1.25 mm^2.
*10: The maximum voltage is 32 V DC in the case of Lightning Protector specification (optional code A).

■ WIRING EXAMPLE (TIIS Explosion Proof Type)

Table 4.6.5 Current Output, Pulse Output, Status Output and Alarm Output (TIIS Explosion Proof Type)

Connection	Description
Current Output In this case, Communication is possible (up to a distance of 2 km when a CEV cable is used.)	
Pulse Output In this case, No communication is possible when a five-wire cable is used.	
Pulse Output In this case, No communication is possible when a four-wire cable is used.	
Status Output **Alarm Output** In this case, No communication is possible when a five-wire cable is used.	

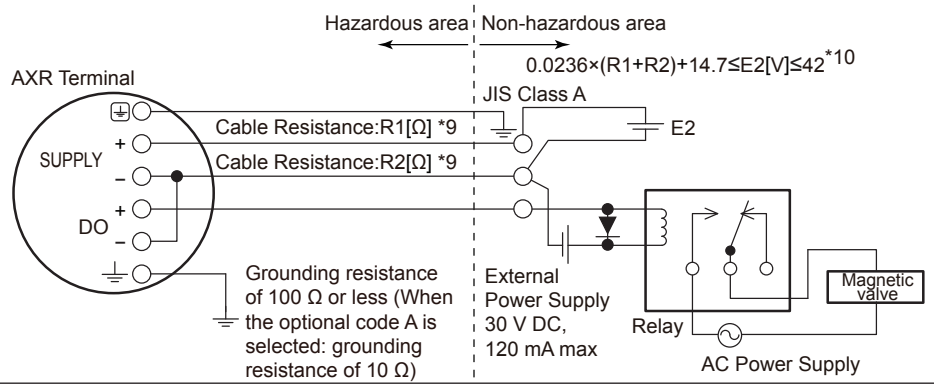
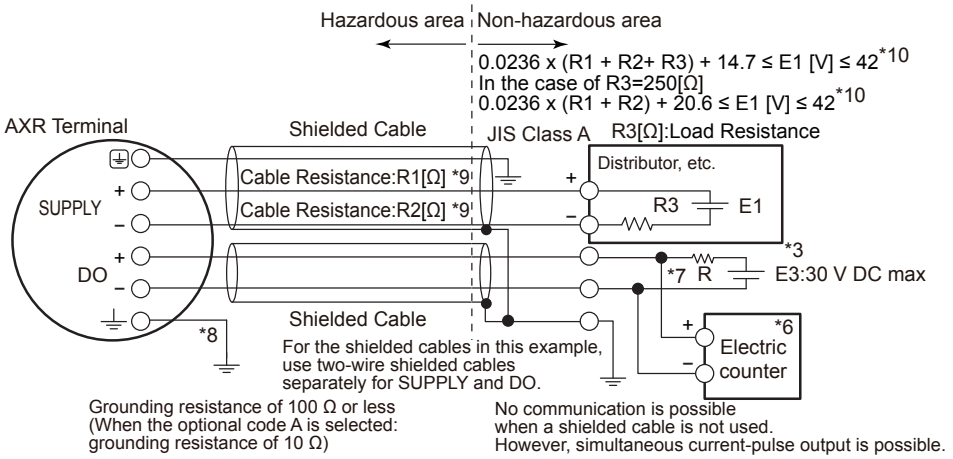
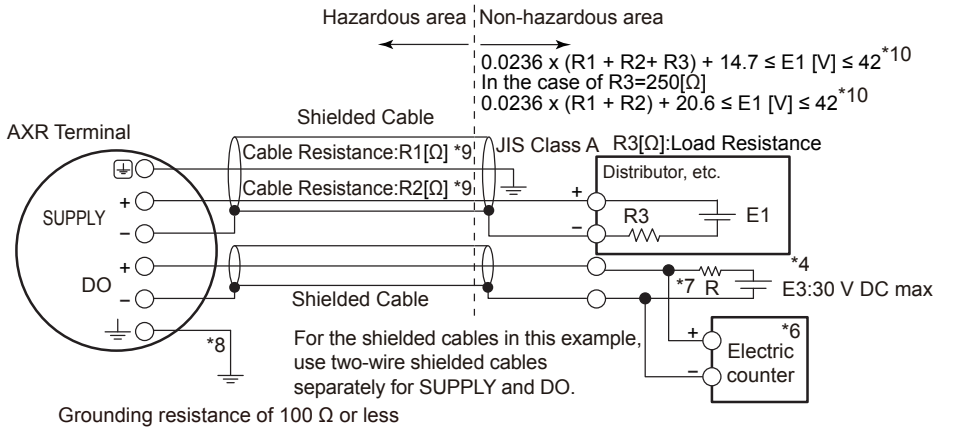
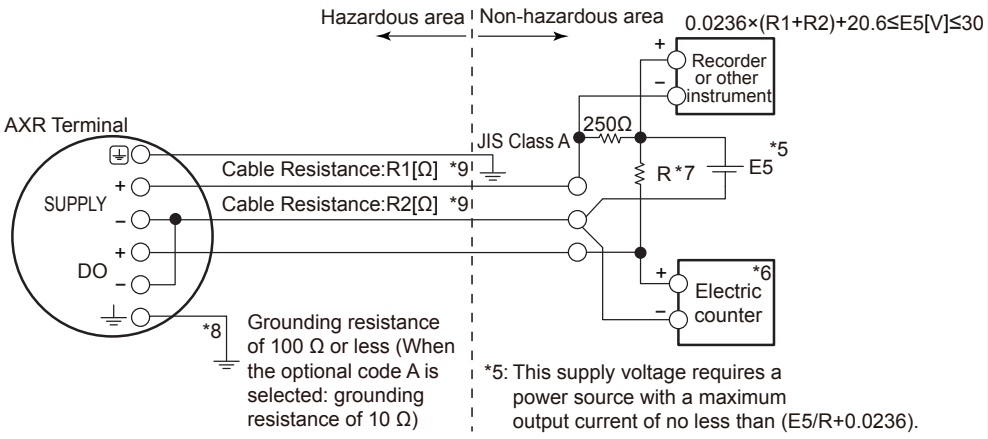
Connection	Description
Status Output **Alarm Output** In this case, No communication is possible when a four-wire cable is used.	

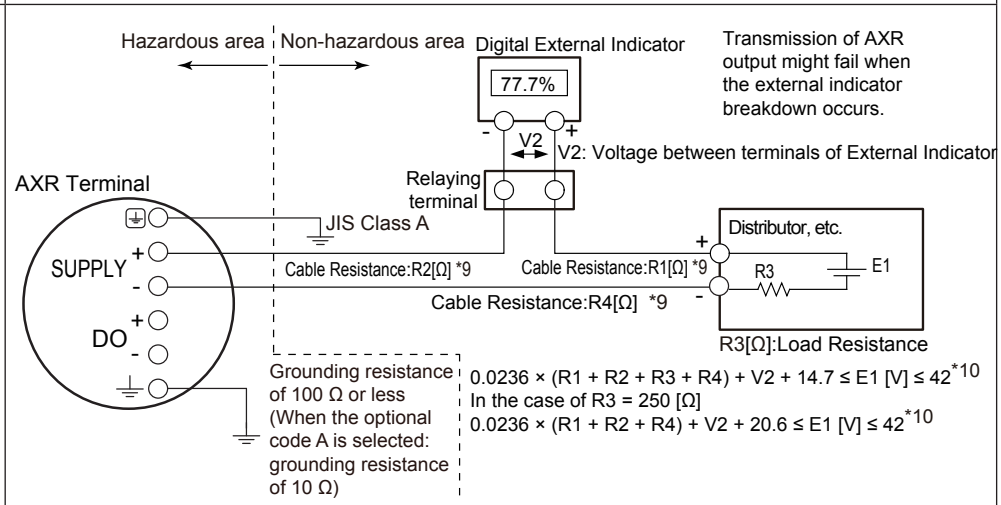
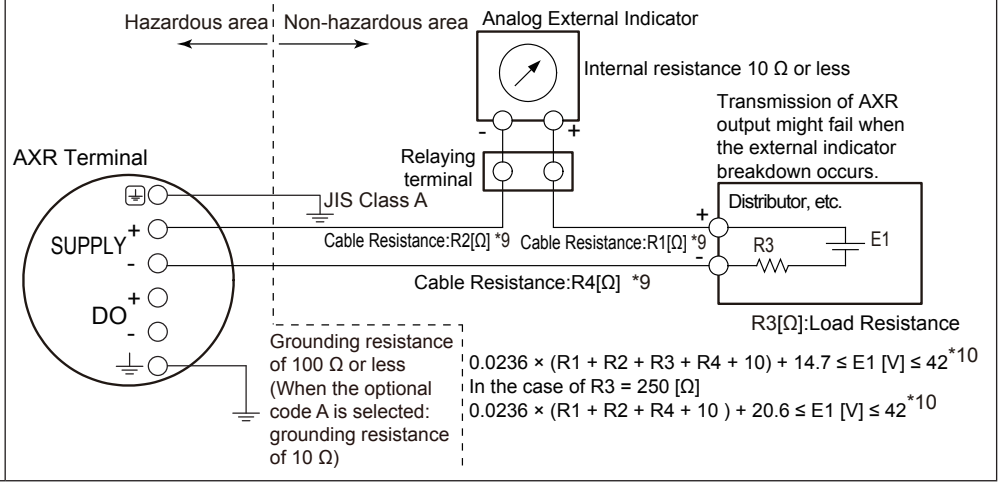
Table 4.6.6 Simultaneous Current-Pulse Output (TIIS Explosion Proof Type)

Connection	Description
Simultaneous Current-Pulse Output	When simultaneous output of current and pulse output are used, no communication is possible in some cases. Read the following example 1 to 3.
Example 1 In this case, Communication is possible (up to a distance of 2 km when a CEV cable is used) and when a two-wire or three-wire shielded cable is used.	 *3: This supply voltage requires a power source with a maximum output current of no less than E3/R.
Example 2 In this case, Communication is possible (up to a distance of 2 km when a CEV cable is used) and when a one-wire or two-wire shielded cable is used.	 *4: This supply voltage requires a power source with a maximum output current of no less than E3/R.

Connection	Description
Example 3 In this case, No communication is possible when a four-wire cable is used.	
The range of load resistance R for the pulse output	The range of load resistance R for the pulse output must basically be 1 kΩ and 2 W. The load resistance should be selected by calculation as shown below when proper transmission is impossible due to the length of cable or frequency of pulse output. $\frac{E\ (V)}{120} \leq R\ (k\Omega) \leq \frac{0.1}{C\ (\mu F) \times f\ (kHz)}$ … (1) $P\ (mW) = \frac{E^2(V)}{R\ (k\Omega)}$ ……(2) E: Supply voltage (V) f: Frequency of pulse output (kHz) R: Value of load resistance (kΩ) C: Cable capacitance (μF) P: Electrical power of the load resistance (mW) Note: C ≒ 0.1 (μF/km) for CEV cable

Note: • The communication is possible though it might not meet a part of the HART communication specification depending on use conditions.
• When using current and pulse output simultanously, the HART communication may be influenced by noise comparing analog output only.

Table 4.6.7 Digital External Indicator Using Current Output (TIIS Explosion Proof Type)

Connection	Description
Current Output **Example 1** Connection to digital external indicator	
Example 2 Connection to analog external indicator	

*6: To avoid the influence of external noise, use an electric counter which fits to the pulse frequency.
*7: Resistor is not necessary in the case of an electric counter which can receive contact pulse signal directly.
*8: Ground the AXR to avoid the current output error in simultaneous current-pulse output.
*9: Calculate the cable resistance by using the following as a rough guideline: 10.9 Ω per 1 km for the cable with the cross section of 2 mm^2, 19.5 Ω per 1 km for the cable with the cross section of 1.25 mm^2.
*10: The maximum voltage is 32 V DC in the case of Lightning Protector specification (optional code A).

(5) Installing the Cover

Install the cover to the flowmeter by turning it in the direction of the arrow as shown below. Tighten cover locking screws counterclockwise using a hexagonal wrench (nominal size 3) to lock the cover (in case of explosion proof type).

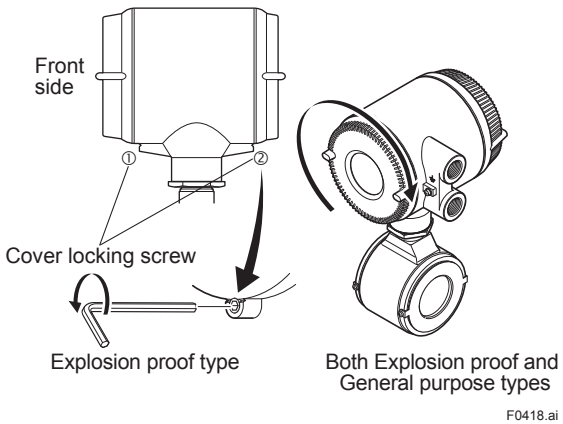


Figure 4.6.5 Installing the Terminal Box Cover

5. BASIC OPERATING PROCEDURES (USING THE DISPLAY UNIT)

Both of four push button and magnet switches can be used for setting. The magnet switches can be used to set parameters without opening the case cover.

The magnet switches need operational magnets (optional code BM). These are also available as part number F9840PA.

Users can choose a language on indicator from English, Japanese, German, French, Italian, and Spanish.

This chapter will provide a description of basic data configuration and the methods to be used with the four setting switches. The AXR can also be operated using a configuration tool (Such as handheld Brain Terminal (BT200), a HART Configuration Tool or FieldMate, etc.). (Read Chapter 7 to Chapter 9.)

WARNING

Be sure to set parameters as “Protect” on the write protect function after finish of parameter setting work.
Read Chapter 6 Menu P and Subsection 11.3.2, how to use the write protect function in detail.

CAUTION

When using this instrument for a long time in conditions of high temperature and humidity, the visibility of the display unit may deteriorate. In this case, it is necessary to replace the display unit.

CAUTION

Precautions for Push Button Switches

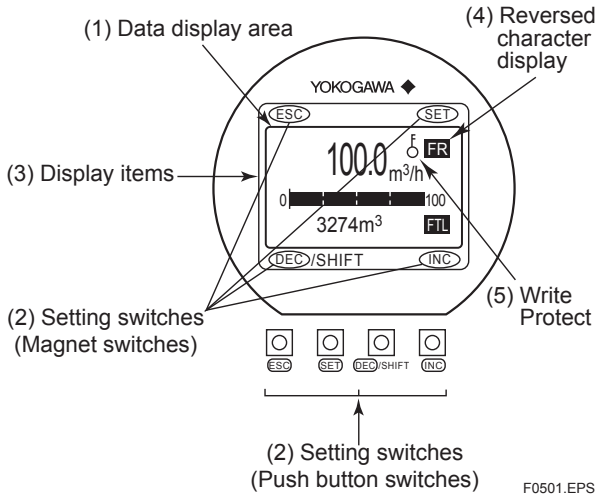
- Open the cover when operating push button switches. Read Section 11.2 for details on opening the cover.
- Do not open the cover in wet weather or high humidity in order to prevent condensation. The push button switches cannot be used in these conditions as the cover would need to be opened. In this case, use magnet switches to set parameters.
- Do not touch the push button switches with wet or dirty hands.

NOTE

Precaution for Magnet Switches and Operational Bar-Magnet

(1) A bar-magnet with its case is attached with an AXR when the optional code BM is chosen at the same time. This bar-magnet with its case is also available as part number F9840PA.
(2) The bar-magnet should be used for the parameter setting of AXR from its outside glass window only.
(3) The switch operation should be done under the condition of closing the cover case outside its glass window.
(4) Do not hit the bar-magnet to the glass of the cover so strongly.
(5) If dirt, dust or other substances surfaces on the display panel glass, wipe them clean with a soft dry cloth.
(6) Do not make a condition of closing the bar-magnet to the flowtube of AXR in order to prevent giving an influence of magnetic distribution inside the flowtube and of the accuracy of AXR.
(7) Do not bring the bar-magnet near equipment susceptible to magnetic field such as magnetic cards, medical equipment, etc.
(8) Keep the bar-magnet in the case because of the powerful magnetic force.

5.1 Operating Panel Configuration and Functions



(1) Data display area

1st line (Display Select1), 2nd line (Display Select2) and 3rd line (Display Select3) can be displayed using parameter settings. The content corresponding to selected items is shown with the reversed-character on the right of the line.

(2) Setting switch operation

Push switch	Magnet switch	Explanation of Operation
ESC	ESC	Move the layer up
SET	SET	Move the layer down, select and confirm
DEC/SHIFT	DEC/SHIFT	Move the cursor up (for selection-type parameters)
		Move the cursor to the right(for numeric-type parameters)
INC	INC	Move the cursor down (for selection-type parameters)
		Increase values (for numeric-type parameters)

(3) Display items

○ : Display, × : Not display

Displayed items and reversed-character indication		Content	Disp Select1	Disp Select2 Disp Select3
Instantaneous flow rate: %	FR	Displays the instantaneous flow rate for the span as a percentage.	○	○
Actual instantaneous flow rate	FR	Displays the actual reading for instantaneous flow rate.	○	○
Instantaneous flow rate: mA	FR	Displays the instantaneous flow rate for the span as a current output value.	○	○
Bar graph indicating instantaneous flow rate	None	Displays the instantaneous flow rate for the span as a percentage using bar graph.	×	○
Totalized forward-direction flow rate	FTL	Displays the totalized value for flow rate in the forward direction.	○	○
Totalized reverse-direction flow rate	RTL	Displays the totalized value for flow rate in the reverse direction.	○	○
Totalized differential flow rate	DTL	Displays the differential totalized value for flow rate between forward totalization and reverse totalization.	○	○
Tag number	TAG	Display the tag number (using up to 16 characters).	×	○
Diagnosis of electrode adhesion	ADH	Displays the adhesion condition in the form of a bar graph. (Read the description for parameters K10 through K17 from Chapter 6 for more details.)	×	○
Communication	COM	Displays the communication type.	×	○

(4)

(5) Write Protect

The mark " ⚷ " is displayed in the "Major item parameter search mode" and "Sub-item parameter search mode" during acting the write protection. Regarding the procedure for moving to "Parameter search mode", read Subsection 5.2.1. Regarding "Write Protect", read Chapter 6 Menu P and Subsection 11.3.2.

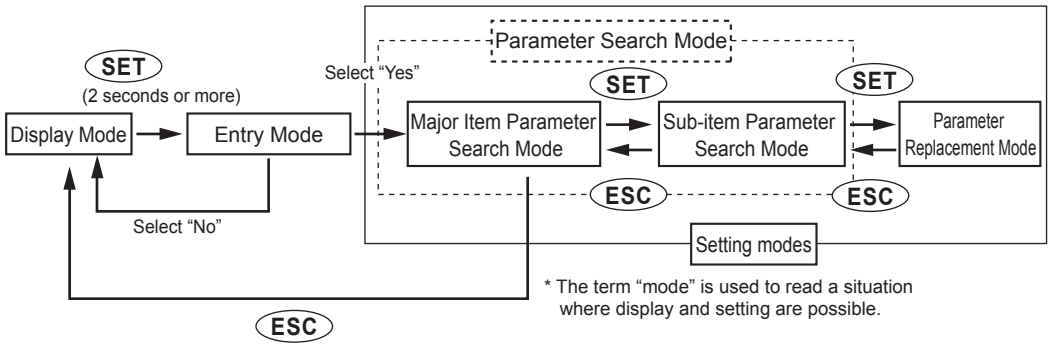
5.2 Display Unit Setting Methods

NOTE

Before changing any settings, be sure to check the corresponding setting details in Chapter 6.

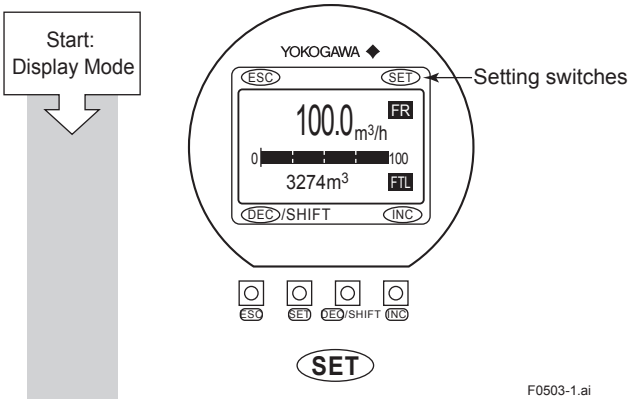
5.2.1 Display Mode → Setting Mode

Display Mode will be adopted when the power is turned on, and the Setting Mode can be activated using the following procedure.



F0502.EPS

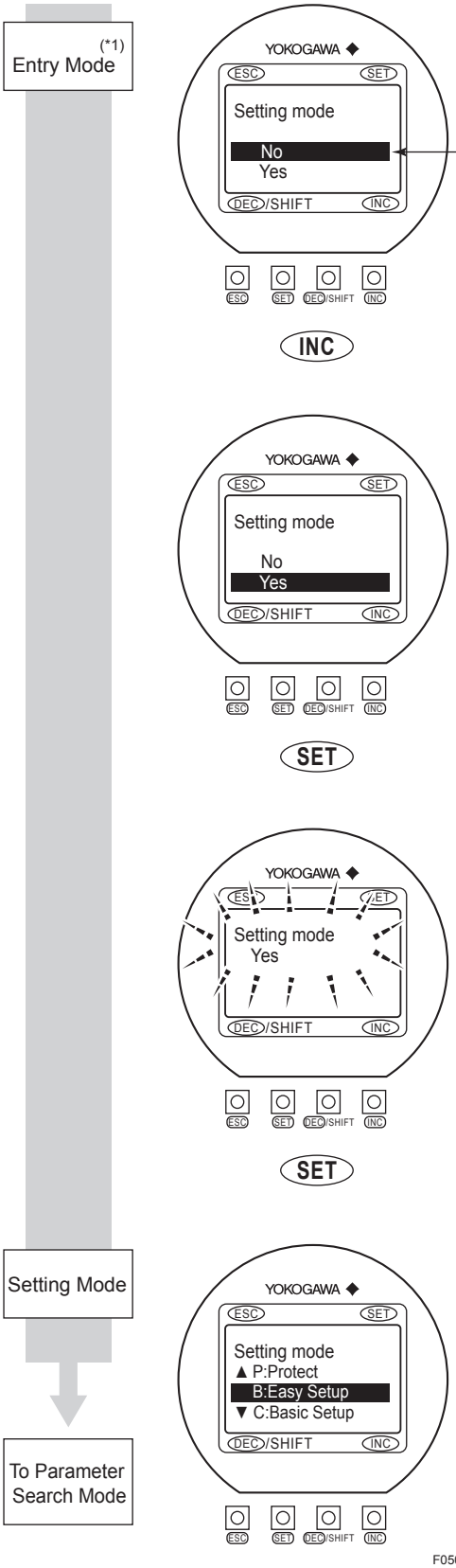
Sample Display: Procedure for moving from Display Mode to Setting Mode



F0503-1.ai

1st line: Actual instantaneous flow rate [FR]
2nd line: Bar graph indicating instantaneous flow rate
3rd line: Totalized forward flow rate [FTL]

Hold the SET switch for 2 seconds.



F0503-2.ai

A screen is displayed to confirm whether or not the system is to enter Setting Mode.
Press the INC switch and select [Yes].

NOTE (*1)

The Major Item Parameter which is set just before will be shown when entrying the Setting Mode again within 1 minute after returning from Setting Mode to Display Mode.

When [Yes] has been selected, touch the SET switch.

NOTE

When no operations in this display are carried out for 20 seconds, the system will automatically return to the Display Mode.
When the operations except SET switch are carried out, the system will automatically return to the Display Mode.

In order to request confirmation, the entire display flashes on and off.
Touch the SET switch once again at this time to fix your selection.

NOTE

When no operations in the flashed display are carried out for 20 seconds, the system will automatically return to the Display Mode.
When the operations except SET are carried out, the system will automatically return to the Display Mode.

The system enters Setting Mode.
Parameters to be set can be selected.

This completes the procedure for changing from the Display Mode to the Parameter Search Mode.

5.2.2 Setting Mode

When the Setting Mode has been activated using the procedure from Subsection 5.2.1, parameters can be selected for setting.

NOTE

If no operations are carried out for a period of 10 minutes in Setting Mode, the system will automatically return to the Display Mode.

Format for Parameter Data

Depending on the type of parameter, data is formatted in one of the following three ways.

Format	Typical display	Content
(i) Selection-type	B21:Base Flow Unit m^3 ▲ m^3 ▼ kl(Kiloliter)	The desired data item is selected from a predefined list.
(ii) Numeric-type	B23:Flow Span 100 l/min 0000100. l/min Rng:0.00001 → 32000	Data is set using the values in each digit and using the decimal point.
(iii) Alphanumeric-type	C10:Tag No FI-1101 FI-1201	Data is composed using alphanumeric characters (in the case of tag numbers, special units, and the like). With this format, setting can be carried out using up to 16 of the characters shown below.

Regarding the alphanumeric-type format (iii), the following alphanumerics are displayed in the following sequence:

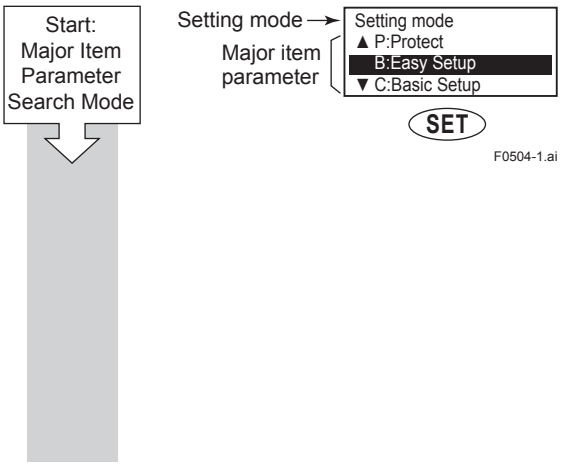
#%&*+-./0123456789:<>ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz[space]

5.3 Parameter Setting Procedure

Once the system is in Setting Mode, the parameters for setting can be selected. Parameters that are frequently used have been grouped together in Easy Setup in Menu B. This section provides a description of the parameter setting procedure using **B: Easy Setup** and **C: Basic Setup**.
For more details regarding parameter content, read Chapter 6.

5.3.1 Setting Example for Selection-Type Data: Flow rate units

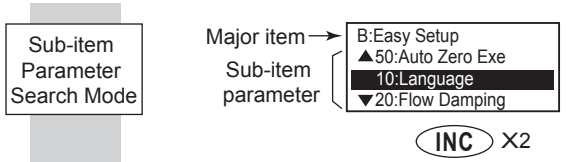
This example describes the setting of the flow rate units for the selection-type parameter **B21: Base Flow Unit** from m^3 to l (Liter).



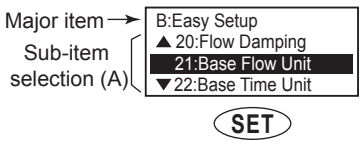
Major Item Parameter Search Mode has been accessed in this screen.
Touch the SET switch to access **B: Easy Setup**.

NOTE

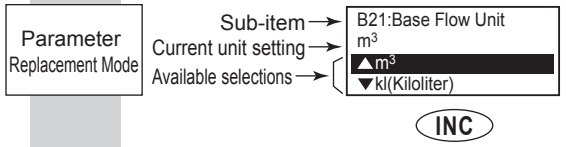
The ▲ and ▼ symbols to the left of the parameters indicate that additional setting items to those being currently displayed may also be selected. Use the INC switch to cycle through these items.



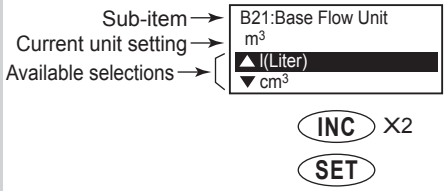
Sub-item Parameter Search Mode has been accessed in this screen.
Touch the INC switch to move the cursor to **B21: Base Flow Unit**.



The cursor has been moved to **B21: Base Flow Unit** in this screen. (Sub-item selection screen (A))

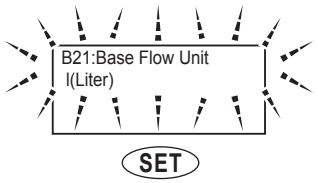


In this screen, Parameter Replacement Mode has been called up using the SET switch.



Touch the INC switch to move the cursor to the unit item for selection. In this example, the INC switch is touched twice to select l (Liter)

When l (Liter) has been selected, touch the SET switch.



In order to request confirmation, the entire display flashes on and off. Touch the SET switch once again at this time to fix your selection.

NOTE

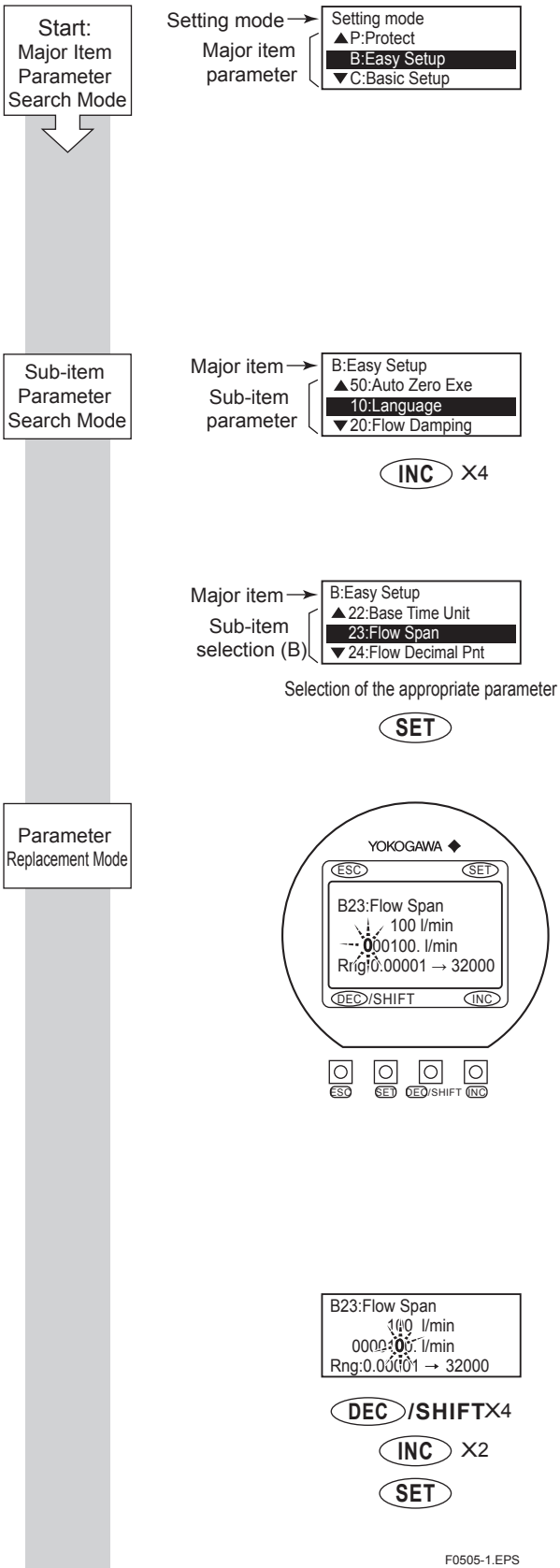
When no operations are carried out for 20 seconds in the flashing state, the system will automatically return to the Sub-item Parameter Search Mode.
When the operations except SET are carried out, the parameter cannot be set.

The system automatically returns to sub-item selection screen (A).

F0504-2.EPS

5.3.2 Setting Example for Numeric-Type Data: Flow rate span

This example describes the setting of the flow rate span for the numeric-type parameter **B23: Flow Span** from 100 l/min to 120 l/min.



Setting Mode Condition

Touch the SET switch to access **B: Easy Setup**.

NOTE

The ▲ and ▼ symbols to the left of the parameters indicate that additional setting items to those being currently displayed may also be selected. Use the INC switch to cycle through these items.

Sub-Item Parameter Search Mode has been accessed in this screen.
Touch the INC switch to move the cursor to **B23: Flow Span**.

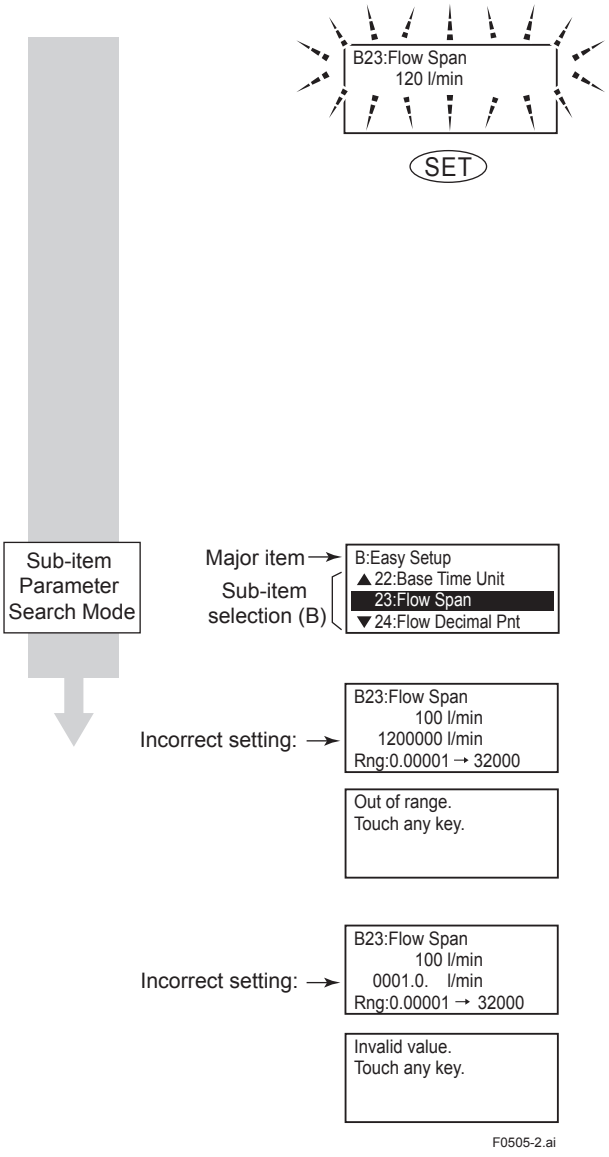
The cursor has been moved to **B23: Flow Span** in this screen. (Sub-item selection screen (B))
Touch the SET switch to access Parameter Replacement Mode.

Once Parameter Replacement Mode has been selected, the digit that can be replaced will be flashed on and off. When in this condition, confirm the relevant setting range as displayed at the bottom of the screen and then set the parameter as required.
In this example, the parameter will be set to “120 l/min.”

NOTE

When setting a new value, use the DEC /SHIFT switch to move from digit to digit, and use the INC switch to cycle through values for each individual digit. In addition to digit, it is also possible to select a decimal point, and this allows the position of the decimal point to be changed.

Modify the value to “120 l/min” as follows:
Touch the DEC /SHIFT switch to move the cursor to the position for multiples of 10. Then, touch the INC switch to change the value at this position from “0” to “2.”
When the value of “120” has been setup, touch the SET switch.



When the SET switch is touched, the entire display flashes on and off. Confirm that the setting has been correctly changed to "120," and then fix this value by touching the SET switch once again.

NOTE

When no operations are carried out for 20 seconds in the flashing state, the system will automatically return to the Sub-item Parameter Search Mode.
When the operations except SET are carried out, the parameter cannot be set.

The system automatically returns to sub-item selection screen (B).

NOTE

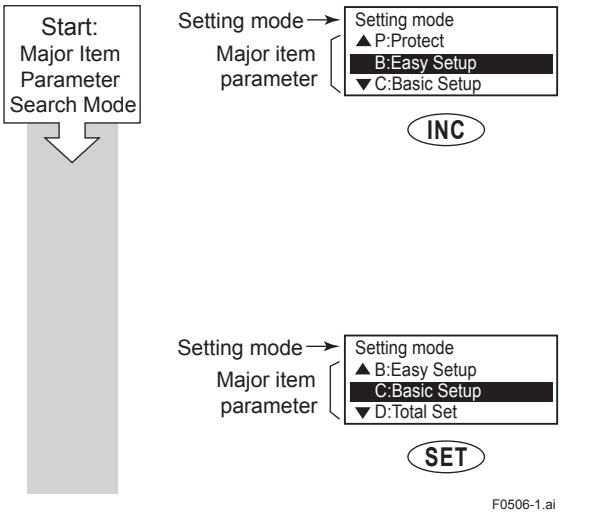
If the input value is outside the valid selection range, the message "Out of range. Touch any key." will be displayed. In such a case, touch any switch to return to Parameter Replacement Mode and redo the setting.

NOTE

If more than one decimal point has been input, the message "Invalid value. Touch any key." will be displayed. In such a case, touch any switch to return to Parameter Replacement Mode and redo the setting.

5.3.3 Setting Example for Alphanumeric-Type Data: Tag number

This example describes the setting of the tag number for the alphanumeric-type parameter **C10: Tag No**. from "FI-1101" to "FI-1201."



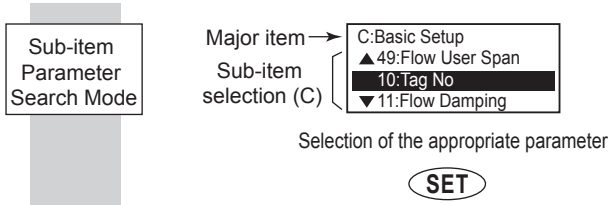
Setting Mode Condition

Touch the INC switch to access **C: Basic Setup**.

NOTE

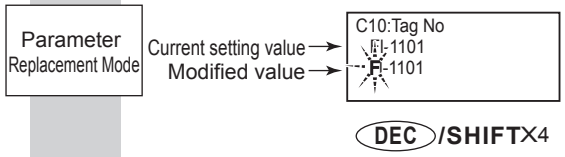
The ▲ and ▼ symbols to the left of the parameters indicate that additional setting items to those being currently displayed may also be selected. Use the INC switch to cycle through these items.

The cursor has been moved to **C: Basic Setup** in this screen.
Touch the SET switch to enter **C: Basic Setup**.

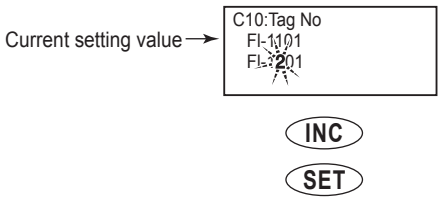


Upon selection of **C: Basic Setup**, the cursor will be positioned at **C10: Tag No**. (Sub-item selection screen (C))

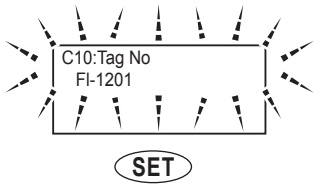
Touch the (SET) switch to access Parameter Replacement Mode.



The cursor will flash on and off on the left of the tag number. As “FI-1201” is to be setup in this example, touch the (DEC) /SHIFT switch to move the cursor to the position for multiples of 100.



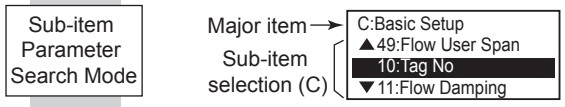
At the position for multiples of 100, touch the (INC) switch to change the “1” to “2.” When the setting has been changed to “FI-1201,” touch the (SET) switch.



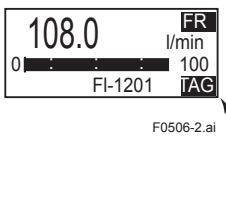
When the (SET) switch is touched, the entire display flashes on and off. Confirm that the setting has been correctly changed to “FI-1201,” and then fix this setting by touching the (SET) switch once again.

NOTE

When no operations are carried out for 20 seconds in the flashing state, the system will automatically return to the Sub-item Parameter Search Mode.
When the operations except (SET) are carried out, the parameter cannot be set.



The system automatically returns to sub-item selection screen (C).



After returning to Display Mode by touching using the ((ESC)) twice as escape switches, it will be possible to confirm the modified content (if Display Select has been setup to display the tag number.)

Indicates selection of Tag No display for B42: Display Select3.

6. PARAMETER DESCRIPTION

6.1 Parameters

With the exception of parameters that were specified by the customer upon ordering, all of the internal parameters will initially be set to default values. Actions such as the modification of display details can then be carried out whenever necessary.

IMPORTANT

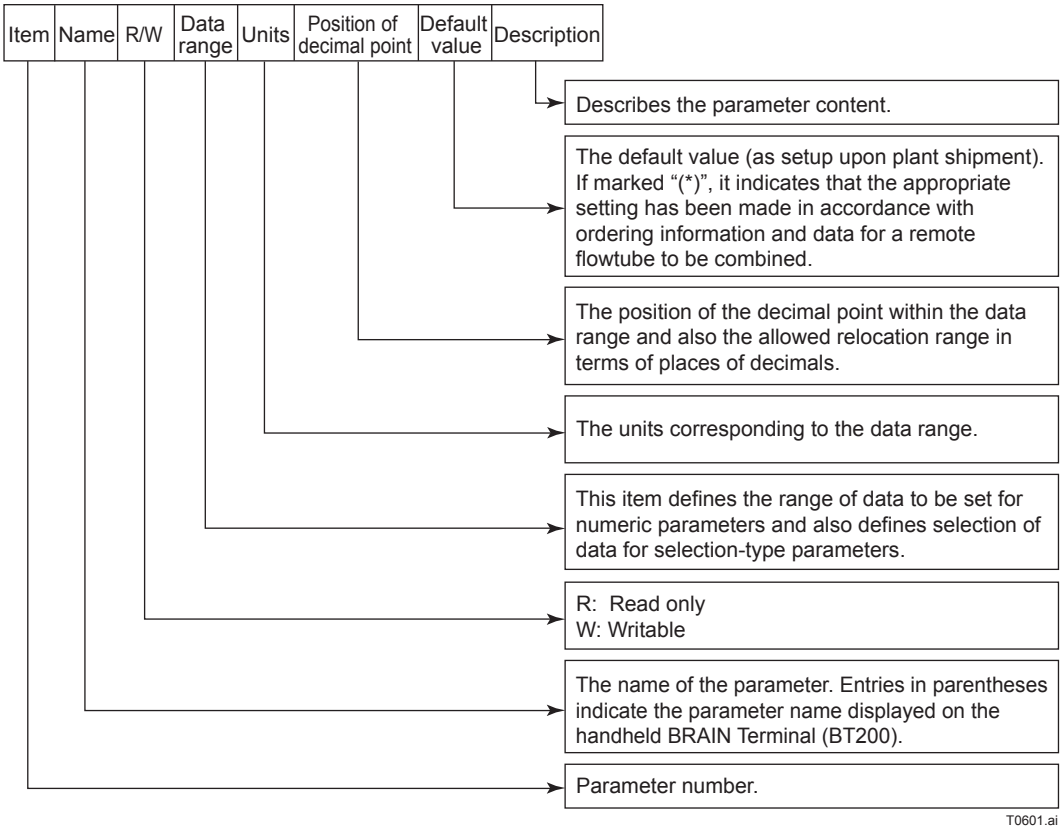
Make sure to keep the instrument's power on at least for 30 seconds after you set the parameters. If you turn the power off immediately after the parameters are set, the settings will be canceled.

NOTE

In order to ensure that correct flow rate data can be acquired, it is crucial that the nominal size, flow rate span, and meter factor of the combined flowtube are set. When the AXR integral flowmeter is ordered, the nominal size and meter factor will be set upon shipment from the manufacturing plant, and these will not require additional setting.
If a flow rate span was specified upon ordering, this will be set before shipment. If this is not the case, however, it will be necessary for the appropriate value to be set by the user.

6.2 Parameter Lists

Parameter lists are comprised of the following items.



6.3 Parameter List Overview

(1) Item A (Menu A): Display items

Menu A contains the instantaneous flow rate, totalization values, and other items relevant to display.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
A00	Display (DISPLAY)						
A10	FR (FLOW RATE (%))	R	-103.1 to 103.1	%	1		For Display Mode only
A20	FR (FLOW RATE)	R	-999999 to 999999	B21/B22 (C40/C41)	0 to 3		For Display Mode only
A21	FR (FLW RATE (mA))	R	3.800 to 20.500	mA	3		For Display Mode only
A30	FTL (TOTAL)	R	0 to 99999999	B30 (D10)	0 to 7		For Display Mode only
A31	RTL (REV TOTAL)	R	0 to 99999999	B30 (D10)	0 to 7		For Display Mode only
A32	DTL (DIF TOTAL)	R	-99999999 to 99999999	B30 (D10)	0 to 7		For Display Mode only
A60	— (SELF CHECK)	R	Good Error				Read Section 6.5 “Alarm Functions”.

(2) Item B (Menu B): Easy Setup items

Those parameters with a high frequency of use have been grouped together in Menu B. All basic functions can be controlled using only the parameters from this block.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
B00	Easy Setup (EASY SETUP)						
B10	Language (LANGUAGE)	W	English Japanese French German Italian Spanish			English	Selects the language used for the display unit. Linked with H30.
B20	Flow Damping (FLOW DAMPING)	W	1.0 to 200.0	s	1	5.0 s	Sets damping time. Linked with C11.
B21	Base Flow Unit (FLOW UNIT)	W	Ml(Megaliter) m^3 kl (Kiloliter) l (Liter) cm^3 m t kg g kcf cf mcf Mgal (US) kgal (US) gal (US) mgal (US) kbbl (US Oil) bbl (US Oil) mbbl (US Oil) ubbl (US Oil) kbbl (US Beer) bbl (US Beer) mbbl (US Beer) ubbl (US Beer) ft klb (US) lb (US)			m (*)	Selects flow units for the flow rate span. Linked with C40.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
B22	Base Time Unit (TIME UNIT)	W	/s /min /h /d			/s (*)	Selects time units for the flow rate span. Linked with C41.
B23	Flow Span (FLOW SPAN)	W	0.00001 to 32000	B21/B22 (C40/C41)	0 to 4	1 m/s (*)	Sets flow rate span (with units from B21 and B22). Linked with C42.
B24	Flow Decimal Pnt (FLOW DECIMAL)	W	Auto 0 1 2 3			Auto (*)	Selects decimal point position for the display unit's instantaneous flow rate. Linked with C43.
B30	Total Unit (TOTAL UNIT)	W	n Unit/P u Unit/P m Unit/P Unit/P k Unit/P M Unit/P Pulse/s			Pulse/s (*)	Selects the flow rate unit per one pulse as used for totalization display. Linked with D10.
B31	Total Scale (TOTAL SCALE)	W	0 to 32000	B30 (D10)	0 to 4	0 (*)	Sets the flow rate per one pulse as used for the totalization display. Linked with D11.
B32	Pulse Unit (PULSE UNIT)	W	n Unit/P u Unit/P m Unit/P Unit/P k Unit/P M Unit/ Pulse/s			Pulse/s (*)	Selects the flow rate unit per one pulse as used for pulse output. Linked with E10.
B33	Pulse Scale (PULSE SCALE)	W	0 to 32000	B32 (E10)	0 to 4	0 (*)	Sets the flow rate per one pulse as used for pulse output. Linked with E11.
B40	Display Select1 (DISP SELECT1)	W	Flow Rate(%) Flow Rate Flow Rate(mA) Forward Total Reverse Total Dif Total			Flow Rate	Selects content of the first line for Display Mode. Linked with H10.
B41	Display Select2 (DISP SELECT2)	W	Off Flow Rate(%) Flow Rate Flow Rate(mA) Flow Rate(Bar) Forward Total Reverse Total Dif Total Adhesion Check Communication (*1) Tag No Long Tag No(Hi) (*2) Long Tag No(Lo) (*2)			Off	Selects content of the second line for Display Mode. Linked with H11. (*1) Displays communication type according to Output Signal and Communication code: ●-D: BRAIN ●-E: HART5 ●-J: HART5 or HART7 (*2) Long tag No(Hi) and Long Tag No (Lo) are only for HART 7.
B42	Display Select3 (DISP SELECT3)	W	Same as B41 (Display Select2)			Off	Selects content of the third line for Display Mode. Linked with H12.
B50	Auto Zero Exe (AUTOZERO EXE)	W	No Execution Execution			No Execution	Selects whether or not automatic zero adjustment is carried out. Linked with M10.
B60	— (SELF CHECK)	R	Good Error				Read Section 6.5 "Alarm Functions".

(3) Item C (Menu C): Basic Setting items

Menu C principally contains the basic setting items for the flowtube.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
C00	Basic Setup (BASIC SETUP)						
C10	Tag No (TAG NO)	W	ASCII 16 or ASCII 8 (*1) characters				Sets Tag number up to 16 or 8 characters. (*1) In case of the HART configuration tool, up to 8 characters.
C11	Flow Damping (FLOW DAMPING)	W	1.0 to 200.0	s	1	5.0 s	Sets damping time. Linked with B20.
C20	Low MF(IEL) (LOW MF(IEL))	W	0.0100 to 3.0000		4	1.0000 (*)	Sets low-frequency meter factor (Excitation current (Low))
C21	High MF(IEL) (HIGH MF(IEL))	W	0.0100 to 3.0000		4	1.0000 (*)	Sets high-frequency meter factor (Excitation current (Low))
C22	Low MF(IEM) (LOW MF(IEM))	W	0.0100 to 3.0000		4	1.0000 (*)	Sets low-frequency meter factor (Excitation current (Middle))
C23	High MF(IEM) (HIGH MF(IEM))	W	0.0100 to 3.0000		4	1.0000 (*)	Sets high-frequency meter factor (Excitation current (Middle))
C24	Low MF(IEH) (LOW MF(IEH))	W	0.0100 to 3.0000		4	1.0000 (*)	Sets low-frequency meter factor (Excitation current (High))
C25	High MF(IEH) (HIGH MF(IEH))	W	0.0100 to 3.0000		4	1.0000 (*)	Sets high-frequency meter factor (Excitation current (High))
C30	Nominal Size Unit (SIZE UNIT)	W	mm inch			mm inch	Selects the nominal size units for the flowtube.
C31	Nominal Size (NOMINAL SIZE)	W	0.01 to 3000.0 0.01 to 120.1	mm inch	0 to 5	100 (*)	Sets flowtube nominal size in selected unit at C30.
C40	Base Flow Unit (FLOW UNIT)	W	Ml(Megaliter) m^3 kl(Kiloliter) l(Liter) cm^3 m t kg g kcf cf mcf Mgal (US) kgal (US) gal (US) mgal (US) kbbl (US Oil) bbl (US Oil) mbbl (US Oil) ubbl (US Oil) kbbl (US Beer) bbl (US Beer) mbbl (US Beer) ubbl (US Beer) ft klb (US) lb (US)			m (*)	Selects flow units for the flow rate span. Linked with B21.
C41	Base Time Unit (TIME UNIT)	W	/s /min /h /d			/s (*)	Selects time units for the flow rate span. Linked with B22.
C42	Flow Span (FLOW SPAN)	W	0.00001 to 32000	C40/C41 (B21 /B22)	0 to 4	1 m/s (*)	Sets flow rate span (with units from C40 and C41). Linked with B23.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
C43	Flow Decimal Pnt (FLOW DECIMAL)	W	Auto 0 1 2 3			Auto (*)	Selects decimal point position for the display unit's instantaneous flow rate. Linked with B24.
C44	Velocity Check (VELOCITY CHK)	R	0.000 to 99.999	m/s	3		Display of the span setting using flow velocity (m/s).
C45	Density Unit (DENSITY UNIT)	W	kg/m^3 lb/gal lb/cf			kg/m^3	Sets units for density when mass flow rate is selected.
C46	Mass Flow Density (MASS DENSITY)	W	0 to 32000	C45	0 to 4	0	Sets density when mass flow rate is selected (with units from C45).
C50	User Span Select (USER SPN SEL)	W	No Yes			No	Selects whether or not special units are used for flow rate units.
C51	Flow User Unit (FL USER UNIT)	W	8 alphanumeric characters				Sets the special flow rate units.
C52	Flow User Span (FL USER SPAN)	W	0.00001 to 32000	C51	0 to 4	100	Sets span when using special flow rate units.
C60	— (SELF CHECK)	R	Good Error				Read Section 6.5 "Alarm Functions".

(4) Item D (Menu D): Total Setting items

Menu D contains setting items such as the totalization scale and the forward/reverse totalized values.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
D00	Total Set (TOTAL SET)						
D10	Total Unit (TOTAL UNIT)	W	n Unit/P u Unit/P m Unit/P Unit/P k Unit/P M Unit/P Pulse/s			Pulse/s (*)	Selects the flow rate unit per one pulse as used for totalization display. Linked with B30.
D11	Total Scale (TOTAL SCALE)	W	0 to 32000	D10 (B30)	0 to 4	0 (*)	Sets the flow rate per one pulse as used for totalization display. Linked with B31.
D12	Total Decimal Pnt (TL DECIMAL)	W	0 1 2 3 4 5 6 7			0	Selects position of decimal point for totalization display
D13	Total Low Cut (TOTAL LOWCUT)	W	0 to 100	%	0	3 %	Sets the range in vicinity of 0% within which the totalization display will be halted.
D14	Total Rate Check (TL RATE CHK)	R	0 to 999999	Pulse/s	0 to 5	0.0	Displays the totalization rate in “Pulse/s”
D20	Total Execution (TOTAL EXEC)	W	Start Stop Preset Total Preset Rev Total			Start	Executes “Start” or “Stop” of the totalization function, or executes “Preset Total” or “Preset Rev Total”.
D21	Ttl Set Val Lower (TL SET VAL L)	W	0 to 999999		0	0	Sets the totalization preset value in the lower 6 digits of the 8-digit totalized value.
D22	Ttl Set Val Upper (TL SET VAL U)	W	0 to 99		0	0	Sets the totalization preset value in the upper 2 digits of the 8-digit totalized value.
D23	Ttl Switch Lower (TL SWITCH LO)	W	0 to 999999		0	0	Sets the totalization switch value in the lower 6 digits of the 8-digit totalized value.
D24	Ttl Switch Upper (TL SWITCH UP)	W	0 to 99		0	0	Sets the totalization switch value in the upper 2 digits of the 8-digits totalized value.
D30	Ttl User Select (TL USER SEL)	W	No Yes			No	Selects whether or not special units are used as totalized units.
D31	Ttl User Unit (TL USER UNIT)	W	8 alphanumeric characters				Sets the special totalized units.
D60	— (SELF CHECK)	R	Good Error				Read Section 6.5 “Alarm Functions”.

(5) Item E (Menu E): Pulse Setting items

Menu E contains items relevant to pulse output. This is used to set parameters such as the pulse scale and width.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
E00	Pulse Set (PULSE SET)						
E10	Pulse Unit (PULSE UNIT)	W	n Unit/P u Unit/P m Unit/P Unit/P k Unit/P M Unit/P Pulse/s			Pulse/s (*)	Selects the flow rate unit per one pulse as used for pulse output. Linked with B32.
E11	Pulse Scale (PULSE SCALE)	W	0 to 32000	E10 (B32)	0 to 4	0 (*)	Sets the flow rate per one pulse as used for pulse output. Linked with B33.
E12	Pulse Width (PULSE WIDTH)	W	50% Duty 0.05 ms 0.1 ms 0.5 ms 1 ms 20 ms 33 ms 50 ms 100 ms 200 ms 330 ms 500 ms 1000 ms 2000 ms			50% Duty	Selects the pulse width for pulse output.
E13	Pulse Low Cut (PULSE LOWCUT)	W	0 to 100	%	0	3 %	Sets the range in vicinity of 0% within which pulse output will be halted.
E14	Pulse Rate Check (PLS RATE CHK)	R	0 to 999999	Pulse/s	0 to 5	0.0	Displays the pulse output rate in “Pulse/s”
E60	— (SELF CHECK)	R	Good Error				Read Section 6.5 “Alarm Functions”.

(6) Item F (Menu F): Status Functions Setting items

Menu F contains items relevant to multiplex range output and other status Output.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
F00	Status Function (STATUS FUNC)						
F10	DO Function (DO FUNCTION)	W	No Function Pulse Output Alarm Output Warning Output Total Switch H/L Alarm Fwd/Rev Rngs Auto 2 Rngs			Pulse Output	Selects function for the DO terminal
F11	DO Active Mode (DO ACT MODE)	W	Closed(On) Act Open(Off) Act			Closed(On) Act	Selects whether DO terminal will be set to “On Active” or “Off Active”.
F20	Forward Span2 (FWD SPAN2)	W	0.00001 to 32000	C40 /C41	0 to 4	1 m/s	Sets flow rate span for forward No. 2 range
F21	Reverse Span (REV SPAN)	W	0.00001 to 32000	C40 /C41	0 to 4	1 m/s	Sets flow rate span for reverse range
F30	Auto Range Hys (AUTO RNG HYS)	W	0 to 15	%	0	10 %	Sets hysteresis width for automatic range switching
F31	Bi Direction Hys (BI DIREC HYS)	W	0 to 8	%	0	2 %	Sets hysteresis width for forward/reverse switching
F60	— (SELF CHECK)	R	Good Error				Read Section 6.5 “Alarm Functions”.

(7) Item G (Menu G): Alarm Setting items

Menu G contains setting items relevant to alarm output, burnout, alarm record, etc.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
G00	Alarm (ALARM)						
G10	Low Alarm (LOW ALARM)	W	-105 to 105	%	0	-105%	Sets level setting value for low flow rate limit (L)
G11	High Alarm (HIGH ALARM)	W	-105 to 105	%	0	105%	Sets level setting value for high flow rate limit (H)
G12	H/L Alarm Hys (H/L ALM HYS)	W	0 to 10	%	0	5 %	Sets hysteresis width for high-low flow rate limit alarm
G20	4-20 System Alm (4-20 SYS ALM)	R	21.6mA (Read IM) 3.2mA (Read IM)			21.6mA (Read IM) (*)	Displays the current output during a system alarm occurrence
G25	4-20 Process Alm (4-20 PRO ALM)	W	21.6mA or More 20.5mA Hold 4.0mA 3.8mA 3.2mA or Less			21.6mA or More (*)	Selects the current output during a process alarm occurrence
G26	Alm-Sig Over (ALM-SIG OVER)	W	No Yes			Yes	Selects whether a signal overflow alarm is to be specified as an alarm.
G27	Alm-Emp Pipe (ALM-EMP PIPE)	W	No Yes			No	Selects whether an empty pipe alarm is to be specified as an alarm.
G28	Alm-H/L (ALM-H/L)	W	No Yes			No	Selects whether a flow rate high or low alarm is to be specified as an alarm.
G29	Alm-Adhesion (ALM-ADHESION)	W	No Yes			No	Selects whether an electrode adhesion alarm is to be specified as an alarm.
G30	4-20 Setting Alm (4-20 SET ALM)	W	21.6mA or More 20.5mA Hold 4.0mA 3.8mA 3.2mA or Less			21.6mA or More (*)	Selects the current output during a setting alarm occurrence
G31	Alm-Setting (ALM-SETTING)	W	No Yes			Yes	Selects whether a setting alarm is to be specified as an alarm.
G35	Alarm Display (ALM DISPLAY)	W	Normal NE107			Normal	Selects alarm display form on the display unit and configuration tools.
G40	Operation Time (OPERATE TIME)	R	0D 00:00 to 9999D 23:59				Operation time
G41	Alm Record1 (ALM RECORD1)	R	10:uP Fault 11:EEPROM Fault 12:Sub uP Fault 13:EX Pwr Fault 14:A/D(S) Fault 15:A/D(I) Fault 16:Analog Fault 17:Coil Open 18:Coil Short 19:Excite Error 20:Pulse Error 21:EEPROM Dflt 22:Power Off 23:Inst Pwr Fail 28:WDT 30:Sig Overflow 31:Empty Pipe 33:Adhesion Alm 91:Disp Cur Wng				Displays the content of the most recent alarm.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
G42	Alm Record Time1 (ALM TIME 1)	R	0D 00:00 to 9999D 23:59				Displays the operation time at the occurrence of the most recent alarm.
G43	Alm Record2 (ALM RECORD2)	R	Same as G41 (Alm Record 1)				Displays the content of the second most recent alarm.
G44	Alm Record Time2 (ALM TIME 2)	R	0D 00:00 to 9999D 23:59				Displays the operation time at occurrence of the second most recent alarm.
G45	Alm Record3 (ALM RECORD3)	R	Same as G41 (Alm Record 1)				Displays the content of the third most recent alarm.
G46	Alm Record Time3 (ALM TIME 3)	R	0D 00:00 to 9999D 23:59				Displays the operation time at the occurrence of the third most recent alarm.
G47	Alm Record4 (ALM RECORD4)	R	Same as G41 (Alm Record 1)				Displays the content of the fourth most recent alarm.
G48	Alm Record Time4 (ALM TIME 4)	R	0D 00:00 to 9999D 23:59				Displays the operation time at the occurrence of the fourth most recent alarm.
G60	— (SELF CHECK)	R	Good Error				Read Section 6.5 “Alarm Functions”.

(8) Item H (Menu H): Display Setting items

Menu H contains setting items that are relevant to display on the display unit.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
H00	Display Set (DISP SET)						
H10	Display Select1 (DISP SELECT1)	W	Flow Rate(%) Flow Rate Flow Rate(mA) Forward Total Reverse Total Dif Total			Flow Rate(%)	Selects content of the first line for Display Mode. Linked with B40.
H11	Display Select2 (DISP SELECT2)	W	Off Flow Rate(%) Flow Rate Flow Rate(mA) Flow Rate(Bar) Forward Total Reverse Total Dif Total Adhesion Check Communication (*1) Tag No Long Tag No(Hi) (*2) Long Tag No(Lo) (*2)			Off	Selects content of the second line for Display Mode. Linked with B41. (*1) Displays communication type according to Output Signal and Communication code: ●-D: BRAIN ●-E: HART5 ●-J: HART5 or HART7 (*2) Long tag No(Hi) and Long Tag No (Lo) are only for HART 7.
H12	Display Select3 (DISP SELECT3)	W	Same as H11 (Display Select2)			Off	Selects content of the third line for Display Mode. Linked with B42.
H20	Display Cycle (DISP CYCLE)	W	400ms 1s 2s 4s 8s			400ms	Selects the display cycle.
H30	Language (LANGUAGE)	W	English Japanese French German Italian Spanish			English	Selects the language used by the display unit. Linked with B10.
H40	LCD Contrast (LCD CONTRAST)	W	0 to 20		0	Factory setting value	Selects the display contrast
H60	— (SELF CHECK)	R	Good Error				Read Section 6.5 “Alarm Functions”.

(9) Item J (Menu J): Auxiliary Function Setting items

Menu J contains setting items such as the flow direction, rate limits, and low cut.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
J00	Aux (AUX)						
J10	4-20mA Low Cut (4-20 LOW CUT)	W	0 to 20	%	0	3%	Sets the range in vicinity of 0% within which the current output will be 4 mA.
J11	4-20mA Low Lmt (4-20 LOW LMT)	W	-1.25 to 100.00	%	2	-1.25%	Sets the low limit for current output
J12	4-20mA High Lmt (4-20 HI LMT)	W	0.0 to 103.13	%	2	103.13%	Sets the high limit for current output
J15	Pls Special Mode (PLS SPECIAL)	W	Normal Pulse Only			Normal	Selects the pulse special mode
J20	Flow Direction (FLOW DIRECT)	W	Forward Reverse			Forward	Selects the flow direction.
J21	Rate Limit (RATE LIMIT)	W	0 to10	%	0	5%	Sets the level to reduce output fluctuation.
J22	Dead Time (DEAD TIME)	W	0 to 15	s	0	0s	Sets the dead time to reduce output fluctuation. When “0” is set, rate limit function is not available.
J23	Pulsing Flow (PULSING FLOW)	W	No Yes			No	Selects whether pulsing flow is to be supported.
J25	T/P Damp Select (T/P DAMP SEL)	W	Damping No Damping			Damping	Selects whether the flow rate value obtained through damping calculation for total/ pulse or the instantaneous flow rate value (no damping) for total/pulse is to be used.
J30	Basic Frequency (BASIC FREQ)	W	Freq(1) Freq(2)			Freq(1)	Selects the basic frequency
J35	Memo 1 (MEMO 1)	W	ASCII 16 characters				Memo field
J36	Memo 2 (MEMO 2)	W	ASCII 16 characters				Memo field
J37	Memo 3 (MEMO 3)	W	ASCII 16 characters				Memo field
J40	MS Code 1 (MS CODE 1)	W	ASC II 16 characters				Sets MS code 1
J41	MS Code 2 (MS CODE 2)	W	ASCII 16 characters				Sets MS code 2
J42	MS Code 3 (MS CODE 3)	W	ASCII 16 characters				Sets MS code 3
J43	MS Code 4 (MS CODE 4)	W	ASCII 16 characters				Sets MS code 4
J44	MS Code 5 (MS CODE 5)	W	ASCII 16 characters				Sets MS code 5
J45	MS Code 6 (MS CODE 6)	W	ASCII 16 characters				Sets MS code 6
J50	Software Rev No (SOFTWARE REV)	R	—				Software revision number
J60	— (SELF CHECK)	R	Good Error				Read Section 6.5 “Alarm Functions”.

(10) Item K (Menu K): Diagnostic Function Setting items

Menu K contains items that are relevant to the diagnosis of insulation adhesion to the electrode.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
K00	Diagnosis (DIAGNOSIS)						
K10	Adhesion Check (ADHESION CHK)	W	No Execution Execution			No Execution	Selects whether or not to perform diagnosis of adhesion to the electrode.
K11	Adh Status (ADH STATUS)	R	Level0 Level1 Level2 Level3 Level4			Level0	Displays the status of adhesion level
K12	Adh Measure Value (ADH MEAS VAL)	R	—	M ohm	2	0.00M ohm	Displays the resistance value for adhesion to the electrode.
K13	Adhesion Level1 (ADH LEVEL1)	W	0.00 to 100.00	M ohm	2	0.35	Sets the resistance value for adhesion Level 1 to the electorode.
K14	Adhesion Level2 (ADH LEVEL2)	W	0.00 to 100.00	M ohm	2	0.40	Sets the resistance value for adhesion Level 2 to the electorode.
K15	Adhesion Level3 (ADH LEVEL3)	W	0.00 to 100.00	M ohm	2	0.45	Sets the resistance value for adhesion Level 3 to the electorode.
K16	Adhesion Level4 (ADH LEVEL4)	W	0.00 to 100.00	M ohm	2	0.60	Sets the resistance value for adhesion Level 4 to the electorode.
K17	Adh Chk Cyc (ADH CHK CYC)	W	0.5 min 1 min 5 min 10 min	min		5 min	Selects execution time of adhesion check
K19	Empty Check (EMPTY CHECK)	W	No Low Middle High			No	Selects whether or not to perform diagnosis of empty pipe check.
K20	Empty Status (EMPTY STATUS)	R	Normal Empty			Normal	Displays status of empty pipe
K21	DC Voltage A (DC VOLTAGE A)	R	—	V	2		Displays the voltage level at electrode A
K22	DC Voltage B (DC VOLTAGE B)	R	—	V	2		Displays the voltage level at electrode B
K23	Empty Level (EMPTY LEVEL)	W	-1.5 to 1.5	V	1	-1.2V	Sets the volatage level for empty pipe detection at the electrodes
K60	— (SELF CHECK)	R	Good Error				Read Section 6.5 “Alarm Functions”.

(11) Item M (Menu M): Automatic Zero-Adjustment Function Setting items

Menu M contains items that are relevant to automatic zero adjustment.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
M00	Adjustment (ADJUSTMENT)						
M10	Auto Zero Exe (AUTOZERO EXE)	W	No Execution Execution			No Execution	Selects whether or not automatic zero adjustment is carried out. Linked with B50.
M11	Autozero Time (AUTOZ TIME)	W	1 to 900	s	0	450 s	Sets execution time for automatic zero adjustment
M12	Flow Zero(IEL) (FL ZERO(IEL))	W	-99.999 to 99.999		3	0.000	Displays the result of automatic zero adjustment (excitation current (Low))
M13	Flow Zero(IEM) (FL ZERO(IEM))	W	-99.999 to 99.999		3	0.000	Displays the result of automatic zero adjustment (excitation current (Middle))
M14	Flow Zero(IEH) (FL ZERO(IEH))	W	-99.999 to 99.999		3	0.000	Displays the result of automatic zero adjustment (excitation current (High))
M15	Flow Span Adjust (FL SPAN ADJ)	W	0.4000 to 2.0000		4	1.0000	Sets adjustment factor of flow span
M20	Adjustment 4mA (ADJUST 4mA)	W	-10.00 to 10.00	%	2	0.00 %	Sets adjustment for 4mA output
M21	Adjustment 20mA (ADJUST 20mA)	W	-10.00 to 10.00	%	2	0.00 %	Sets adjustment for 20mA output
M60	— (SELF CHECK)	R	Good Error				Read Section 6.5 “Alarm Functions”.

(12) Item N (Menu N): Loop Test Setting items

Menu N contains items that are relevant to the execution of loop testing.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
N00	Test (TEST)						
N10	Test Mode (TEST MODE)	W	Normal Test			Normal	Selects whether mode will be set to “Normal” or “Test”.
N11	Test Output Value (TEST OUT VAL)	W	-1 to 103	%	0	0%	Sets the test output value.
N12	Test DO (TEST DO)	W	Open(Off) Closed(On) Pulse			Open(Off)	Selects the test condition for DO terminal.
N15	Test Time (TEST TIME)	W	10min 30min 60min 3h 6h 12h			30min	Select the holding time of the test mode
N20	Test Iex (TEST IEX)	W	Normal Test (Iex OFF)			Normal	Selects the test of excitation current
N30	Flow Tube (FLOW TUBE)	W	Detector Calibrator			Detector	Selects type of operating flowtube
N40	Average Execution (AVG EXEC)	W	Stop Start			Stop	Selects whether the execution for measurement of averaged flowrate is occurrence
N41	Average Timer (AVG TIMER)	W	1 to 600	s	0	30 s	Sets totalization time for measurement of averaged flowrate
N42	Average Flow (AVG FLOW)	R	-999999 to 999999	C40/C41	0 to 5	0.00000 m/s	Displays the averaged flowrate
N60	— (SELF CHECK)	R	Good Error				Read Section 6.5 “Alarm Functions”.

(13) Item P (Menu P): Parameter Protection items

Menu P contains items that are relevant to write protection and passwords.

Item	Name Display unit (BRAIN)	R/W	Data range Display unit /BRAIN	Units	Position of decimal point	Default value (*): Indicated item	Description
P00	Protect (PROTECT)						
P10	Key Code (KEY CODE)	W	0 to 9999			0	Parameter of the display restriction
P20	Write Protect (W PROTECT)	R	No Yes			No	Displays whether or not overwriting of parameter data is prohibited.
P21	Enable Wrt Passwd (ENABLE WRITE)	W	ASCII 8 characters				Sets the correct password so that write protection function will be released.
P22	New Password (NEW PASSWORD)	W	ASCII 8 characters				Sets the password for write protection funcion
P23	Software Seal (SOFT SEAL)	R	Break Keep			Keep	Displays whether or not a Joker password was used (Break).
P60	— (SELF CHECK)	R	Good Error				Read Section 6.5 “Alarm Functions”.

6.4 Parameter Description

IMPORTANT

One output can be selected from pulse, alarm, or status through the parameter setting.

(1) Menu B: Easy Setup items

Those parameters with a high frequency of use have been grouped together in Easy Setup. All basic functions can be controlled using only the parameters from this block. Parameters from Menu B share identical names with those from other menus; however, modification of one such parameter will result in the other being automatically modified.

[B10: Language] Selection of language used for the display unit
→ This setting is linked with that of parameter **H30**. One of the following languages can be selected for the display unit.

Data Range

Setting item	Description
English	All parameters, alarm messages, etc. displayed in English.
Japanese	All parameters, alarm messages, etc. displayed in Japanese katakana.
French	All parameters, alarm messages, etc. displayed in French.
German	All parameters, alarm messages, etc. displayed in German.
Italian	All parameters, alarm messages, etc. displayed in Italian.
Spanish	All parameters, alarm messages, etc. displayed in Spanish.

[B20: Flow Damping] Setting of the damping time constant
→ This setting is linked with that of parameter **C11**. The damping time constant should be modified to suppress an output fluctuation or to change the response time. This time constant has an effect on analog output and on the flow rate display (i.e., actual instantaneous flow rate, %, current value), and in addition, it also affects pulse output and totalization. However, when “No Damping” has been set for **J25: T/P Damp Select**, there will be no effect on pulse output or totalization.

*: Time constant: The time required for the output to reach 63.2% from 0%.

NOTE

When the damping time is short, the output fluctuates. Set the time to 5 seconds or more for control loop.

[B21: Base Flow Unit] Selection of flow units for the flow rate span
→ This setting is linked with that of parameter **C40**. This parameter selects the flow units for the flow rate span. (In case of mass flow, the setting of density is also required. Read **C46: Mass Flow Density** for more details.)

[B22: Base Time Unit] Selection of time units for the flow rate span
→ This setting is linked with that of parameter **C41**. This parameter selects the time units for the flow rate span; however, if “m” has been selected for the flow rate units, “/s” is automatically set for this parameter.

[B23: Flow Span] Setting of the flow rate span
→ This setting is linked with that of parameter **C42**. The span can be set for the forward flow rate in the range 0 to 32,000 (although this does not include 0). The units set using **B21/C40: Base Flow Unit** and **B22/C41: Base Time Unit** will be displayed at this time.

NOTE

If the flow rate units, time units, and flow rate span are specified upon ordering, these parameters will be setup before shipment; however, if this is not the case, it will be necessary for the appropriate values to be set up by the user.

NOTE

Flow rate span is the value for instantaneous flow rate that corresponds to a current output of 20 mA. The following factors should be taken into consideration when deciding on the flow rate span.

- In the case of applications with large variations in flow rate, the maximum flow rate should be set. If a flow rate in excess of the flow rate span was to occur, output would be possible up to an upper limit of 103.13%, and beyond this, error would occur. Note that the same applies to pulse output and totalization.
- In the case of applications that have a relatively stable flow rate, a flow rate span of 1.5 to 2.0 times larger than the normal flow rate may be considered suitable.
- The flow rate to be adopted should - upon conversion to flow velocity - correspond to a value within the range of 0.3 to 10 m/s. The flow velocity can be confirmed using sizing data or with parameter **C44: Velocity Check,** and in the latter case, the value obtained when span is converted to flow velocity will be displayed.
- Regardless of the position of the decimal point, the largest value that can be set on the display unit is 32,000. Furthermore, it is not possible to set a number of 4 or greater for the highest-order digit. Similarly, if 3 is set for this highest-order digit, it will not be possible to set a number of 2 or greater for the next digit to the right, regardless of the position of the decimal point.

  Example: A value of 333.33 is represented by the character string 33333, and since this exceeds 32000, it cannot be set. In such a case, the value 333.3 should be set instead.

[B24: Flow Decimal Pnt] Setting of the decimal point position for the instantaneous flow rate
→ This setting is linked with that of parameter **C43**.
This parameter sets the position of the decimal point for instantaneous flow rate values in terms of the number of digits. When set using “Auto”, the decimal point position will be automatically determined in accordance with the setting value for **B23/C42: Flow Span** as shown below.

Flow Span ≤ 9	Decimal point position: 3 digits
9 < Flow Span ≤ 90	Decimal point position: 2 digits
90 < Flow Span ≤ 900	Decimal point position: 1 digit
900 < Flow Span	Decimal point position: no digits (i.e., no decimal point)

When an item other than “Auto” is set, the selected number of digits for the decimal point position is used.
With the decimal point removed, 6 digits are available for the instantaneous flow rate value, and display is possible up to 999,999. If an overflow occurs as a result of the setting adopted for decimal point position, the warning **84: Disp Over Wng** will be displayed to provide notification of this condition.

Example: When 1000 m^3/h is set for B23/ C42: Flow Span

Item	Display content for instantaneous flow rate value
Auto	1000 m^3/h
0	1000 m^3/h
1	1000.0 m^3/h
2	1000.00 m^3/h
3	With the decimal point removed, 7 digits are not available for the instantaneous flow rate value; therefore, a warning is displayed.

[B30: Total Unit] Setting of units for totalization scale
→ This setting is linked with that of parameter **D10**. This parameter selects the flow rate units for use in totalization.

Item	Description
n Unit/P	$10^{-9} \times$ FU
u Unit/P	$10^{-6} \times$ FU
m Unit/P	$10^{-3} \times$ FU
Unit/P	FU
k Unit/P	$10^{3} \times$ FU
M Unit/P	$10^{6} \times$ FU
Pulse/s	Number of pulses to be counted for one second at 100% output.

FU: Flow rate unit selected in B21/C40: Base Flow Unit.

[B31: Total Scale] Setting of the totalization scale
→ This setting is linked with that of parameter **D11**. The flow rate is totalized in individual counts in accordance with this parameter's setting. If 0 is selected, it indicates that the totalization function is not to be used.

NOTE

If a totalization scale is specified upon ordering, this parameter is set up before shipment; however, if this is not the case, it will be necessary for the appropriate value to be set up by the user.

NOTE

- By setting the totalization scale, the totalized value is displayed on the display unit. The totalization scale is determined in accordance with the settings of **B30/D10: Total Unit** and **B31/D11: Total Scale**.
- The maximum value that can be displayed is 99999999, and if this is exceeded, the value 0 is counted once again. However, counting stops at 99999999 when the totalization switch function is used.
- If multiple ranges are being used, the flow rate span for the smallest range becomes the standard for the **D13: Total Low Cut** setting value.
- Totalization for the reverse flow rate and for the differential flow rate is carried out only when "Fwd/Rev Ranges" is selected for **F10: DO Function**.
- The totalized units are indicated on the display unit when **B31/D11** is 0.00001, 0.0001, 0.001, 0.01, 0.1, 1, 10, 100, 1000, or 10000. In the case of other setting values, the totalized units are not indicated.

Example 1: To count in 1 Ml (mega-liter) steps with flow rate span = 1000 m^3/h
Since 1 Ml = 10^3 x m^3, k Unit/P is set for **B30/D10**, and 1 is set for **B31/D11**. "x10^3 m^3" is indicated for the totalized units in the Display Mode.

Example 2: To count in 10 l (liter) steps with flow rate span = 100 m^3/h
Since 1 l = 10^{-3} x m^3, m Unit/P is set for **B30/D10**, and 10 is set for **B31/D11**. "x10^{-2} m^3" is indicated for the totalized units in the Display Mode.

Example 3: To count in 5 l (liter) steps with flow rate span = 100 m^3/h
Since 1 l = 10^{-3} x m^3, m Unit/P is set for **B30/D10**, and 5 is set for **B31/D11**. Since **B31/D11** is not 0.00001, 0.0001, 0.001, 0.01, 0.1, 1, 10, 100, 1000, or 10000, there is no indication of totalized units in the Display Mode.

- Setting of totalization scale is not possible when specific selections have been made for **B30/D10: Total Unit, B31/D11: Total Scale**, and **B23/C42: Flow Span**. In such a case, a setting alarm will be displayed, and parameters should be changed in accordance with the instructions given.

[B32: Pulse Unit] Setting of the pulse units
→ This setting is linked with that of parameter **E10**. This parameter selects the flow rate units to be used for pulse output.

Item	Description
n Unit/P	$10^{-9} \times$ FU
u Unit/P	$10^{-6} \times$ FU
m Unit/P	$10^{-3} \times$ FU
Unit/P	FU
k Unit/P	$10^{3} \times$ FU
M Unit/P	$10^{6} \times$ FU
Pulse/s	Number of pulses to be output for one second at 100% output.

FU: Flow rate unit selected in B21/C40: Base Flow Unit.

[B33: Pulse Scale] Setting of pulse scale
→ This setting is linked with that of parameter **E11**. Pulse output is performed in individual counts in accordance with this parameter's setting. If 0 is set, it indicates that the pulse output function is not to be used.

NOTE

If a pulse scale is specified upon ordering, this parameter is setup before shipment; however, if this is not the case, it will be necessary for the appropriate value to be setup by the user.

NOTE

- By setting the pulse scale, pulse output performs. The pulse scale is determined in accordance with the settings of **B32/E10: Pulse Unit** and **B33/E11: Pulse Scale**.
- Setting of pulse scale is not possible when specific selections have been made for **B32/E10: Pulse Unit, B33/E11: Pulse Scale, E12: Pulse Width** and **B23/C42: Flow Span**. In such a case, a setting alarm will be displayed, and parameters should be changed in accordance with the instructions given.

Example 1: To perform pulse output in 1 Ml (mega-liter) steps with flow rate span = 1000 m^3/h
Since 1 Ml = 10^3 x m^3, k Unit/P is set for **B32/E10**, and 1 is set for **B33/E11**.

Example 2: To perform pulse output in 10 l (liter) steps with flow rate span = 100 m^3/h
Since 1 l = 10^{-3} x m^3, m Unit/P is set for **B32/E10,** and 10 is set for **B33/E11**.

Example 3: To perform pulse output in 5 l (liter) steps with flow rate span = 100 m^3/h
Since 1 l = 10^{-3} x m^3, m Unit/P is set for **B32/E10**, and 5 is set for **B33/E11**.

[B40: Display Select1] Setting of the first line for display unit
→ This setting is linked with that of parameter **H10**. This parameter selects the display content of the first line for display unit. The size of the characters which are displayed will depend on the selections made for **B41/H11: Display Select2** and **B42/H12: Display Select3** as described below. (For more details, read Chapter 5.)

CAUTION

It is not possible to set Display Select1 to "Off."

[B41: Display Select2] Setting of the second line for display unit
→ This setting is linked with that of parameter **H11**. This parameter selects the display content of the second line for display unit. When "Off" is selected, one-line display will be adopted regardless of the setting made for **B42/H12: Display Select 3**.

[B42: Display Select3] Setting of the third line for display unit
→ This setting is linked with that of parameter **H12**. This parameter selects the display content of the third line for display unit. When "Off" is selected for this parameter, two-line display is adopted.

[B50: Auto Zero Exe] Execution of the automatic zero adjustment function
→ This setting is linked with that of parameter **M10**. This parameter executes the automatic zero adjustment function: If "Execution" is selected, this function will be started. "Now Auto Zero Executing..." is indicated while the Auto Zero function is being carried out. The result of the automatic zero adjustment is confirmed using **M12**, **M13**, and **M14**. If the result exceeds the rated value, the warning **82: Auto Zero Wng** will be displayed. (Read Chapter 9.)

Setting	Function
No Execution	No execution
Execution	Automatic zero adjustment is started. The current output becomes 10.4mA during this execution (450 seconds).

(2) Menu C: Basic Setting items

Menu C principally contains the basic setting items for the flowtube.

NOTE

In order to ensure that correct flow rate data can be acquired, it is crucial that the nominal size, flow rate span, and meter factor of the combined remote flowtube are set. In cases where the AXR integral flowmeter is ordered, the nominal size and meter factor will be set upon shipment from the manufacturing plant, and these will not require additional setting.
If a flow rate span was specified upon ordering, this will be set before shipment. If this is not the case, however, it will be necessary for the appropriate value to be set by the user.

[C10: Tag No] Setting of the tag number
→ The setting for this parameter corresponds to one of the ordered items.
Up to a maximum of 16 characters can be entered for the display unit. In case of using the HART configuration Tool, up to a maximum of 8 characters can be entered. For more details regarding the actual characters that can be used, read Subsection 5.2.2.

NOTE

If a tag number is specified upon ordering, this parameter is set up before shipment; however, if this is not the case, it will be necessary for the appropriate value to be set up by the user.

[C11: Flow Damping] Setting of the damping time
→ Read the description of parameter **B20**.

[C20: Low MF (IEL)] Setting of the low-frequency meter factor (Excitation current (Low))
This parameter sets the low-frequency meter factor for excitation current (Low).

[C21: High MF (IEL)] Setting of the high-frequency meter factor (Excitation current (Low))
This parameter sets the high-frequency meter factor for excitation current (Low).

[C22: Low MF (IEM)] Setting of the low-frequency meter factor (Excitation current (Middle))
This parameter sets the low-frequency meter factor as required for excitation current (Middle).

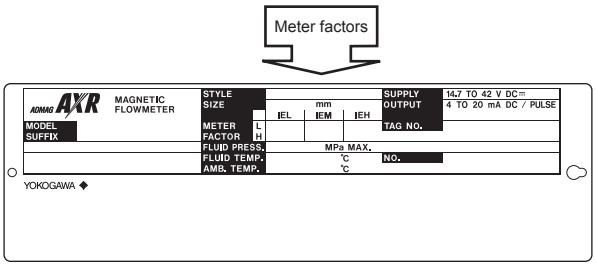
[C23: High MF (IEM)] Setting of the high-frequency meter factor (Excitation current (Middle))
This parameter sets the high-frequency meter factor for excitation current (Middle).

[C24: Low MF(IEH)] Setting of the low-frequency meter factor (Excitation current (High))
This parameter sets the low-frequency meter factor for excitation current (High).

[C25: High MF(IEH)] Setting of the high-frequency meter factor (Excitation current High))
This parameter sets the high-frequency meter factor for excitation current (High).

NOTE

Meter Factor Settings



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(1) The values of the meter factors which are marked at METER FACTOR fields on the name plate of the AXR are set in the AXR at the manufacturing plant.
(2) The meter factors are crucial in ensuring that the electromotive force is correctly in proportion to the flow velocity and are determined at the manufacturing plant by actual-flow calibration.

[C30: Nominal Size Unit] Setting of the nominal size units
This parameter selects the units used for setting of the nominal size.

[C31: Nominal Size] Setting of the nominal size
This parameter sets the nominal size of flowtube.

[C40: Base Flow Unit] Selection of flow units for the flow rate span
→ Read the description of parameter **B21**.

[C41: Base Time Unit] Selection of time units for the flow rate span
→ Read the description of parameter **B22**.

[C42: Flow Span] Setting of the flow rate span
→ Read the description of parameter **B23**.

[C43: Flow Decimal Pnt] Setting of the decimal point position for the instantaneous flow rate
→ Read the description of parameter **B24**.

[C44: Velocity Check] Display of the flow rate span velocity
This parameter displays the flow rate span for the maximum range in m/s units.

[C45: Density Unit] Setting of the density units for mass flow rate
This parameter selects the units for density as required when making settings using **C46: Mass Flow Density**.

[C46: Mass Flow Density] Setting of the density for mass flow rate
This parameter is necessary in situations where t, kg, g, klb or lb has been selected as the mass unit in **B21/C40: Base Flow Unit**. If a mass unit is selected in **B21/C40: Base Flow Unit** and a value of 0 is set for this parameter, the setting alarm "**57: Dens Set Err**" will be displayed. In such a case, ensure that the density is set correctly.

NOTE

Example : Since the water density is about 1000kg/m^3, set the parameter below.
"kg/m^3" is set for **C45: Density Unit**,
"1000" is set for **C46: Mass Flow Density**.
Set the suitable value under the actual use because the density changes by temperature.

[C50: User Span Select] Selection of the use of special flow rate units
This parameter selects whether or not special units are used for instantaneous flow rate. Actual setting of these units is carried out using **C51: Flow User Unit** and **C52: Flow User Span**.

[C51: Flow User Unit] Setting of the special flow rate units
This parameter is used to select the special units (up to maximum 8 characters in length). These units are displayed when instantaneous flow rate is selected in the Display Mode, and they are displayed for **A20: FLOW RATE** when BRAIN communication is being carried out.

[C52: Flow User Span] Setting of the special flow rate span
This parameter sets the special span to be displayed for 100% output in the maximum range.

NOTE

Example : To set the special flow rate span to 100 dl/s
Since 100 dl (deci-liter)=10 l (liter),
"l (Liter)" is set for **B21/C40: Base Flow Unit**,
"/s" is set for **B22/C41: Base Time Unit**,
"10" is set for **B23/C42: Flow Span**,
"Yes" is set for **C50: User Span Select**,
"dl/s" is set for **C51: Flow User Unit**,
"100" is set for **C52: Flow User Span**.
"100 dl/s" is indicated for 100% output in the Display Mode.

(3) Menu D: Total Setting items

Menu D contains parameters that are relevant to totalization function settings.

[D10: Total Unit] Setting of units for totalization scale
→ Read the description of parameter **B30**.

[D11: Total Scale] Setting of the totalization scale
→ Read the description of parameter **B31**.

[D12: Total Decimal Pnt] Setting of the decimal point position for the totalization display
This parameter sets the position of the decimal point for totalization display in terms of the number of digits. Except in cases where 0 is selected, the totalized units are not displayed.

Example: When totalized value is 12345678 m^3

Item	Totalization display
0	12345678 m^3
1	1234567.8
2	123456.78
3	12345.678
4	1234.5678
5	123.45678
6	12.345678
7	1.2345678

[D13: Total Low Cut] Setting of the totalization stop range
This parameter allows the settings to be made that prevent totalization when the flow rate is at or below the low-cut setting value. The low cut setting value depends on flow rate span.
● Flow rate span < 1 m/s:
Input value or 3 cm/s, whichever is bigger
● Flow rate span ≥ 1 m/s:
Input value
To confirm the flow rate span velocity in ”m/s” unit, read **[C44: Velocity Check].**
If the multiple ranges or forward/reverse ranges is used, low cut is carried out at the setting value for the smallest span.
Example: Situation where “the first range” is set to “0.8 m/s” and “the second range” is set to “1.5 m/s”
- When “5 %” is input in this parameter:
No totalization is carried out at flow rates of 4 cm/s or lower.
- When “3 % (i.e. 2.4cm/s)” is input in this parameter:
No totalization is carried out at flow rates of 3 cm/s or lower.

However, the low cut function will be terminated if this parameter is set to “0 %”.

NOTE

When the low cut is small, an incorrect output may occur at the flow rate of zero and the totalization may be carried out. Use the instrument with the default setting 3%. If the span is small, the damping time is short, or the fluid is low conductivity, the totalization may be carried out easily at the flow rate of zero. In this case, set the span to be large, set the damping time to be long, or set the low cut to be large.

[D14: Total Rate Check] Display of the totalization rate in “Pulse/s”
This parameter displays the totalization rate, which is converted to “Pulse/s” while 100% of the range flows.
When the multiple ranges or forward/reverse ranges are used, the AXR displays the totalization rate which 100% of their maximum range flows.

[D20: Total Execution] Operation setting for the totalization function
This parameter sets “Start” and “Stop” of the totalization function, in addition to performing the preset function for the forward totalized value and the reverse totalized value.

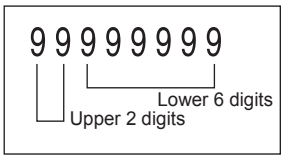
*: The preset function is to set a preset value to totalization and is used to start the count for totalization from the set value.

The preset value is determined using **D21: Ttl Set Val Lower** and **D22: Ttl Set Val Upper**. Setting of zero as the preset value allows the zero-reset function to be implemented. After presetting, this parameter goes back to its previous status (“Start” or “Stop”). In case that “Start” has been selected, the count for totalization starts from the preset value.

Item	Description
Start (initial value)	Starts totalization
Stop	Stops totalization
Preset Total	Sets the preset value for totalization display that has been specified as the forward totalized value.
Preset Rev Total	Sets the preset value for totalization display that has been specified as the reverse totalized value.

[D21: Ttl Set Val Lower] Setting of the totalization preset value (lower 6 digits)
This parameter sets a totalization preset value in the lower 6 digits of the 8-digit totalized value.
If zero is to be set as the preset value, “000000” should be set here.

[D22: Ttl Set Val Upper] Setting of the totalization preset value (upper 2 digits)
This parameter sets a totalization preset value in the upper 2 digits of the 8-digit totalized value. If zero is to be set as the preset value, “00” should be set here.



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[D23: Ttl Switch Lower] Setting of the totalization switch value (lower 6 digits)
The totalization switch function operates to set the digital output terminal (DO) to the condition which was set at **F11** (i.e., the DO becomes “Closed(On)” when the parameter is set as “Closed(On)” at **F11**) when the forward internal totalized value reaches or exceeds the totalization switch value. (For details regarding the setting method for the status output, read the descriptions of parameters **F10**.)

If this function is set up, the totalization count will stop at 99999999.
D23 sets the lower 6 digits of the 8-digit totalization switch value.

[D24: Ttl Switch Upper] Setting of the totalization switch value (upper 2 digits)
This parameter sets the upper 2 digits of the 8-digit totalization switch value.

[D30: Ttl User Select] Selection of the use of special totalization unit
This parameter specifies whether or not special units are used for totalization unit. Actual setting of these units is carried out using **D31: Ttl User Unit**.

[D31: Ttl User Unit] Setting of special totalization units
Units of up to maximum 8 characters in length can be specified using this parameter. The units set with this parameter are displayed whenever totalization (i.e., FTL, RTL, DTL) is selected in the Display Mode, and they are displayed for **A30: TOTAL, A31: REV TOTAL**, and **A32: DIF TOTAL** when BRAIN communication is being carried out.

NOTE

Example: To count in 1 dl (deci-liter) steps with flow rate span=10 l/s.
Since 1 dl (deci-liter) = 0.1 l (liter), “l (Liter)” is set for **B21/C40: Base Flow Unit**,
“/s” is set for **B22/C41: Base Time Unit**,
“10” is set for **B23/C42: Flow Span**,
“Unit/P” is set for **B30/D10: Total Unit**,
“0.1” is set for **B31/D11: Total Scale**,
“Yes” is set for **D30: Ttl User Select**,
“dl” is set for **D31: Ttl User Unit.**
“dl” is indicated for the totalized units in the Display Mode and is counted in 1 dl steps.

(4) Menu E: Pulse Setting items

Menu E contains items relevant to pulse output.

NOTE

For pulse output from the DO terminal, set **F10: DO Function** to “Pulse Output.”

[E10: Pulse Unit] Setting of the pulse units
→ Read the description of parameter **B32: Pulse Unit**

[E11: Pulse Scale] Setting of the pulse scale
→ Read the description of parameter **B33: Pulse Scale**

[E12: Pulse Width] Setting of the pulse width
This parameter selects the pulse width (i.e., m/s : millisecond) that is output.

Data Range

Setting	Pulse Rate (pps)	
	Maximum Value	Minimum Value
(0) 50% Duty	11000	0.0001 (pps: pulses per second)
(1) 0.05ms	10000	
(2) 0.1ms	5000	
(3) 0.5ms	1000	
(4) 1ms	500	
(5) 20ms	25	
(6) 33ms	15	
(7) 50ms	10	
(8) 100ms	5	
(9) 200ms	2.5	
(10) 330ms	1.5	
(11) 500ms	1.0	
(12) 1000ms	0.5	
(13) 2000ms	0.25	

NOTE

*: The pulse width with the exception of “50% Duty” is the “Closed (On)” time for each pulse in case that “Closed (On) Act”. Read the example 1 of **F11: DO Active Mode**.
A limit applies to the maximum pulse scale that can be set with respect to the pulse width. If a value in excess of this limit is set, a setting alarm will be displayed.

[E13: Pulse Low Cut] Setting of the pulse output stop range
This parameter allows the setting to be made which prevent pulse output when the flow rate is at or below the low-cut setting value.
The low cut setting value depends on flow rate span.
● Flow rate span < 1 m/s:
Input value or 3 cm/s, whichever is bigger
● Flow rate span ≥ 1 m/s:
Input value
To confirm the flow rate span velocity in ”m/s” unit, read **[C44: Velocity Check].**
If the multiple ranges or forward/reverse ranges is used, low cut is carried out at the setting value for the smallest span.
However, the low cut function will be terminated if this parameter is set to “0 %”.

NOTE

When the low cut is small, an incorrect output may occur at the flow rate of zero and a pulse may be output. Use the instrument with the default setting 3%. If the span is small, the damping time is short, or the fluid is low conductivity, a pulse may be output easily at the flow rate of zero. In this case, set the span to be large, set the damping time to be long, or set the low cut to be large.

[E14: Pulse Rate Check] Display of the pulse output rate in “Pulse/s”
This parameter displays the pulse output rate, which is converted to “Pulse/s” while 100% of the range flows.
When the multiple ranges or forward/reverse ranges are used, the AXR displays the pulse output rate which 100% of their maximum range flows.

(5) Menu F: Status Function Setting items

Menu F contains setting items relevant to status Output functions.

[F10: DO Function] Setting of the function for the DO output terminal
This parameter sets the function for the DO (digital output) terminal.

Setting	Function	Description
No Function	Stops output (i.e., inactive condition)	As no function is set, there is no output.
Pulse Output	Pulse output	Pulse output is carried out.
Alarm Output	Output upon alarm	Read Alarms (Section 6.5).
Warning Output	Output upon warning	
Total Switch	Totalization switch output	Status output is carried out when the forward internal totalized value reaches or exceeds the totalization switch value. The totalization switch value is determined using **D23: Ttl Switch Lower** and **D24: Ttl Switch Upper**.
H/L Alarm	H/L alarm output	Status output is carried out when the instantaneous flow rate equals or falls below the low flow rate limit (L), or when it equals or exceeds the high flow rate limit (H). These limit values are determined using **G10: Low Alarm** and **G11: High Alarm**.
Fwd/Rev Rngs	Forward/reverse flow rate measurement	When flow is in the reverse direction, switching to the reverse range is carried out automatically, measurement is performed, and status output is carried out.
Auto 2 Rngs	Automatic 2 ranges switching	This function ensures that when the instantaneous flow rate exceeds 100% of the range, transition to the next range is carried out automatically. Status output is carried out upon range switching.

[F11: DO Active Mode] Setting of the active mode for DO terminal
Operations are performed in accordance with the following table when the active mode has been set to “Closed (On) Act” using this parameter. Operating patterns are reversed when the active mode has been set to “Open (Off) Act.”

Selected function	Condition of DO terminal	
	Open (Off)	Closed (On)
Pulse Output (Read Example 1)	Open (Off) when pulses are output.	Closed (On) when pulses are output.
Alarm Output (Read Example 2)	Good (normal)	Alarm status
Warning Output	Good (normal)	Warning status
Total Switch (Read Example 3)	Below setting value	Equal or above setting value
H/L Alarm	Normal	H/L alarm status
Fwd/Rev Rngs	Forward direction	Reverse direction

Note: For “Auto 2 Rngs” read the **Multiple ranges setting** section.

Example 1: When the “Pulse Output” function is selected for the DO terminal and the **E12: Pulse Width** is “1 ms”, the following signals are output from the terminal.

[F11] setting	Function	DO status output
Closed (On) Active	Pulse output condition (1 ms)	Closed
	Pulse disable condition	Open
Open (Off) Active	Pulse output condition (1 ms)	Open
	Pulse disable condition	Closed

Example 2: When the “Alarm Output” function is selected for the DO terminal, the following signals are output from the terminal.

[F11] setting	Function	DO status output
Closed (On) Active	Alarm (Alarm status)	Closed
	Good (Normal)	Open
Open (Off) Active	Alarm (Alarm status)	Open
	Good (Normal)	Closed

Example 3: When the “Total Switch” function is selected for the DO terminal, the following signals are output from the terminal.

[F11] setting	Function	DO status output
Closed (On) Active	Equal or above setting value	Closed
	Below setting value	Open
Open (Off) Active	Equal or above setting value	Open
	Below setting value	Closed

NOTE

Multiple ranges setting

Parameters from **F20** to **F31** are used with the automatic multiple ranges. The followings will describe the setting method for the range.

The multiple ranges use the following parameters:
[B23: Flow Span] Setting of the flow rate span (Setting of the forward No.1 range)
[F20: Forward Span 2] Setting of the forward No.2 range
[F21: Reverse Span] Setting of the reverse range
[F30: Auto Range Hys] Setting of the automatic multiple ranges hysteresis width.
[F31: Bi Direction Hys] Setting of the forward/reverse flow measurement hysteresis width

Automatic multiple ranges switching

- When the instantaneous flow rate exceeds 100% of the range, transition to the next range (up to two ranges) is carried out automatically. Furthermore, when the flow is in reverse, the reverse range is automatically selected.
- Range switching can be confirmed according to the DO status output terminals. Read Table 6.4.1 for details of status output conditions for each range.

Status Output for Automatic Multiple Ranges Switching

Operations are performed in accordance with the following table when the active mode has been set to “Closed (On) Act” using **F11: DO Active Mode**. Operating patterns are reversed when the active mode has been set to “Open (Off) Act” using **F11: DO Active Mode**.

Table 6.4.1 Status Output for Automatic Multiple Ranges Switching

[F10] setting	Function		DO status output
No Function	Forward single range	—	—
Fwd/Rev Rngs	Auto forward/ reverse range	Forward Reverse	Open Closed
Auto 2 Rngs	Auto forward 2 ranges	Forward 1 range Forward 2 range	Open Closed

*: “No Function” is the default value. Only DO is used for single or dual ranges.

Parameter setting sequence (for automatic multiple ranges switching)

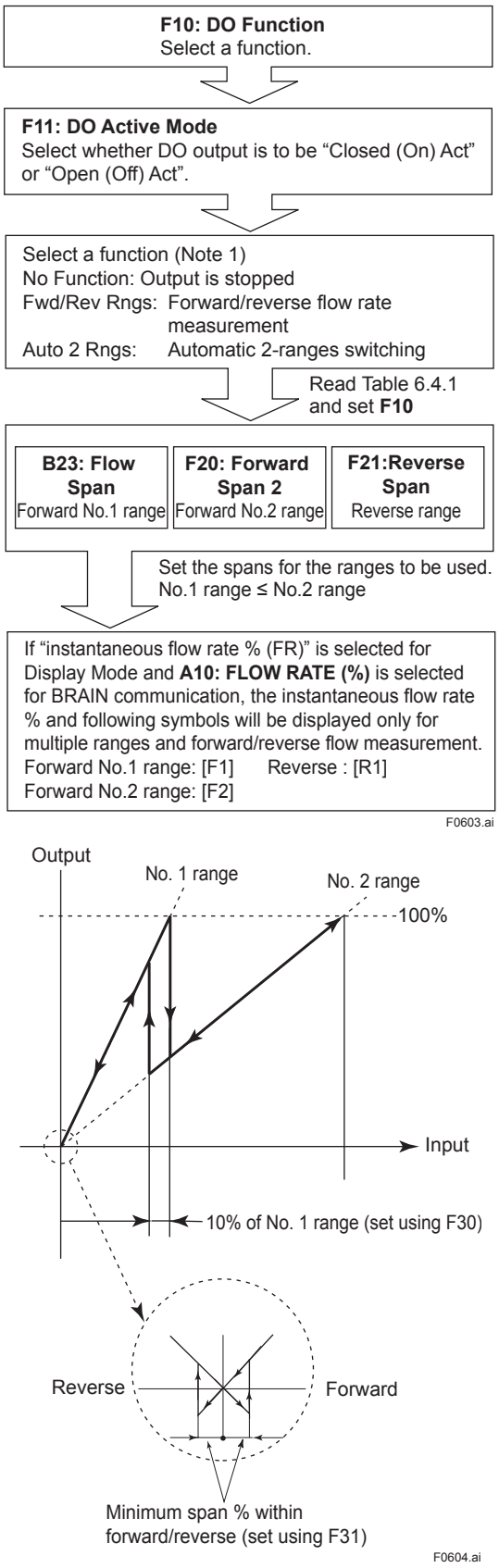


Figure 6.4.1 Multiple Ranges and Hysteresis Widths

NOTE

For more details regarding the setting of hysteresis width, read the description of setting parameter for **F30: Auto Range Hys** and **F31: Bi Direction Hys**.

[F30: Auto Range Hys] Setting of automatic range-switching hysteresis width
Automatic switching takes place for multiple range switching when 100% of the range is exceeded, and this parameter allows a hysteresis width to be set for this switching.
Read Figure 6.4.1.

[F31: Bi Direction Hys] Setting of forward/reverse flow measurement hysteresis width
This parameter sets the hysteresis for forward/reverse flow rate measurement as a % value of the minimum flow span.
Read Figure 6.4.1.

(6) Menu G: Alarm Setting items

Menu G principally contains setting items relevant to alarms. (Read Section 6.5.)

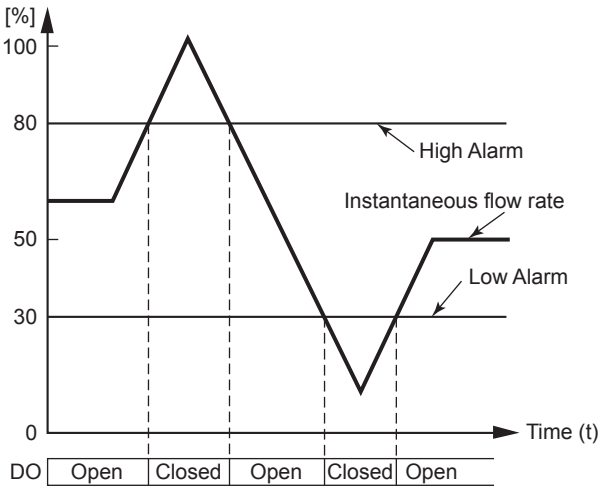
[G10: Low Alarm] Low alarm setting
This parameter sets the low limit (L) alarm value, and this is done using a % value of the maximum span.

- A setting value of -105% indicates that the alarm is disabled.

[G11: High Alarm] High alarm setting
This parameter sets the high limit (H) alarm value, and this is done using a % value of the maximum span.

- A setting value of 105% indicates that the alarm is disabled.

Output Example 1
The high alarm (H) is set to 80% or more; the low alarm (L) is set to 30% or less; and the H/L alarm hysteresis width is set to 0%.
Settings are:
G10: Low Alarm = 30%
G11: High Alarm = 80%
G12: H/L Alarm Hys = 0%



Select “H/L Alarm(O)” for **F10: DO Function**
Select “Closed (On) Act” for **F11: DO Active Mode**
Select “Yes” for **G28: Alm-H/L**

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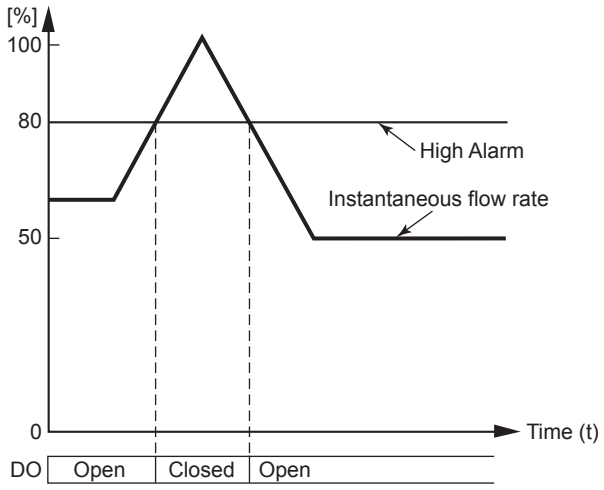
Output Example 2
The high alarm (H) is set to 80% or more of the flow rate span only without low alarm (L) setting; and the H/L alarm hysteresis width is set to 0%.
Settings are:
G10: Low Alarm = -105%
- A setting value of -105% indicates that the alarm is disabled.

G11: High Alarm = 80%
G12: H/L Alarm Hys = 0%



Select "H/L Alarm" for **F10: DO Function**
Select "Closed (On) Act" for **F11: DO Active Mode**
Select "Yes" for **G28: Alm-H/L**

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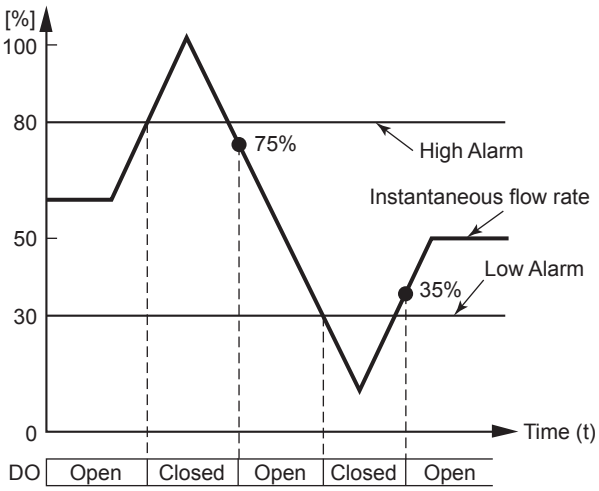
[G12: H/L Alarm Hys] Setting of upper/lower alarm value hysteresis width
This parameter sets the hysteresis width for upper and lower alarm value, using a % value of the maximum span.

Output Example
The hysteresis width is set to 5%.
Settings are:
G10: Low Alarm = 30%
G11: High Alarm = 80%
G12: H/L Alarm Hys = 5%



Select "H/L Alarm(O)" for **F10: DO Function**
Select "Closed (On) Act" for **F11: DO Active Mode**
Select "Yes" for **G28: Alm-H/L**

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[G20: 4-20mA System Alarm] Display of the current output during a system alarm occurrence
This parameter displays the current output during a system alarm occurrence.

Display	Function
3.2 mA(Read IM)	Fixed at 3.2 mA or less
21.6 mA(Read IM)	Fixed at 21.6 mA or more

The default parameter is set to the following table at the factory.

Standard	Optional code C1
21.6 mA(Read IM)	3.2 mA(Read IM)

NOTE

The direction of current output can be modified when a system alarm occurs. Read Subsection 11.3.1.

[G25: 4-20mA Process Alarm] Selection of the current output during a process alarm occurrence
This parameter sets the current output during a process alarm occurrence.

Setting	Function
21.6 mA or More	Fixed at 21.6 mA or more
20.5 mA	Fixed at 20.5 mA
Hold	Fixed current value when an alarm occurred.
4.0 mA	Fixed at 4.0 mA
3.8 mA	Fixed at 3.8 mA
3.2 mA or Less	Fixed at 3.2 mA or less

The default parameter is set to the following table at the factory.

Standard	Optional code C1
21.6 mA or More	3.2 mA or Less

[G26: Alm-Sig Over] Alarm recognition of “Signal Overflow Alarm”
This parameter specifies whether the signal overflow in process alarms will be recognized as an alarm. A signal overflow occurs when there is an error in the input signal.

Setting	Function
No	Not recognized as an alarm
Yes	Recognized as an alarm

[G27: Alm-Emp Pipe] Alarm recognition of “Empty Pipe Alarm”
This parameter specifies whether the empty pipe (flowtube is not filled with fluid) in process alarms will be recognized as an alarm.

Setting	Function
No	Not recognized as an alarm
Yes	Recognized as an alarm

[G28: Alm-H/L] Alarm recognition of “H/L Alarm”
This parameter specifies whether H/L alarm in process alarms will be recognized as an alarm.

Setting	Function
No	Not recognized as an alarm
Yes	Recognized as an alarm

NOTE

To set “H/L Alarm” as an alarm, it is necessary to set “H/L Alarm” according to **F10: DO Function**, and set **G10: Low Alarm** or **G11: High Alarm** as well.

[G29: Alm-Adhesion] Alarm recognition of “Adhesion Alarm”
This parameter specifies whether the electrode adhesion alarm in process alarms will be recognized as an alarm.

Setting	Function
No	Not recognized as an alarm
Yes	Recognized as an alarm

[G30: 4-20mA Setting Alarm] Selection of the current output during a setting alarm occurrence
This parameter sets the current output during a setting alarm occurrence.

Setting	Function
21.6 mA or more	Fixed at 21.6 mA or more
20.5 mA	Fixed at 20.5 mA
Hold	Fixed current value when an alarm occurred.
4.0 mA	Fixed at 4.0 mA
3.8 mA	Fixed at 3.8 mA
3.2 mA or Less	Fixed at 3.2 mA or less

The default parameter is set to the following table at the factory.

Standard	Optional code C1
21.6 mA or More	3.2 mA or Less

[G31: Alarm setting] Selection of the alarm output during a setting error occurrence
This parameter specifies whether the alarm will be recognized as an alarm during a setting error occurrence.

Setting	Function
No	Not recognized as an alarm
Yes	Recognized as an alarm

[G35: Alm Display] Selection of the alarm display form.
This parameter specifies the alarm display form of the display unit and configuration tools.

Setting	Function
Normal	The alarm display form does not follow NE-107.
NE107	The alarm display form follows NE-107.

NOTE

The AXR has three different type of alarm (i.e., system alarms, process alarms, and setting alarms). For setting alarms and process alarms, settings are made with **G26, G27, G28, G29** and **G31** to specify whether these will be recognized as an alarm.
Read Section 6.5 for more details regarding the content of each alarm and the effect of alarm recognition on output.

[G40: Operation Time] Display of operation time
This parameter is used to display the operation time. The operation time is the total time that is counted while the device works actually.
When the power supply is off, the operation time is not counted.
For example, “1D23:45” indicates an operation time of 1 day, 23 hours, and 45 minutes.

IMPORTANT

Use this value as a rough guideline because the operation time has an error.

[G41: Alm Record1] Alarm record1
This parameter is used to display the most-recent alarm, and the alarms that can be displayed are as follows.

Alarm Items

Item	Description
: 16 space characters (i.e., no display)	NO issuing of alarms
10:uP Fault	Microprocessor (CPU) failure
11:EEPROM Fault	EEPROM failure
12:Sub uP Fault	Sub-Microprocessor (Sub-CPU) failure
13:EX Pwr Fault	Excitation power failure
14:A/D(S) Fault	A/D converter (flow velocity signal) failure
15:A/D(I) Fault	A/D converter (excitation current) failure
16:Analog Fault	Analog signal board failure
17:Coil Open	Flowtube coil is open-circuit
18:Coil Short	Flowtube coil is short-circuit (This judge is acted when the AXR turns ON)
19:Excite Error	Excitation current failure
20:Pulse Error	Pulse output circuit failure
21:EEPROM Dflt	EEPROM returns to default values
22:Power Off	Power supply is off.
23:Inst Pwr Fail	Instantaneous power fail. After this fail is released, outputs reach the previous value immediately.
28:WDT	The return from excessive instantaneous noise. After the noise is released, output return the normal condition.
30:Sig Overflow	Input signal error
31:Empty Pipe	Flowtube is not filled with fluid.
33:Adhesion Alm	Insulation adhered to electrode.
91:Disp Cur Wng	Excessive current is used on the display unit.

NOTE

Records for “30: Sig Overflow” are kept only when **G26** specifies that this condition is to be recognized as an alarm (i.e., “Yes” is selected).
Records for “31: Empty Pipe” are kept only when **G27** specifies that this condition is to be recognized as an alarm (i.e., “Yes” is selected).
Records for “33: Adhesion Alm” are kept only when **G29** specifies that this condition is to be recognized as an alarm (i.e., “Yes” is selected).

[G42: Alm Record Time1] Display the operation time of alarm record1
This parameter is used to display the operation time at which the alarm indicated by **G41: Alm Record1** was occurred. For example, “1D23:45” indicates that an alarm was occured at the operation time of 1 day, 23 hours, and 45 minutes.

IMPORTANT

Use these values as a reference because the time of alarm records (1 to 4) have an error.

[G43: Alm Record2] Alarm record2
This parameter is used to display the second most-recent alarm, and the alarms that can be displayed are the same as those for **G41: Alm Record1**.

[G44: Alm Record Time2] Display the operation time of alarm record2
This parameter is used to display the operation time at which the alarm indicated by **G43: Alm Record2** was occurred. For example, “1D23:45” indicates that an alarm was occured at the operation time of 1 day, 23 hours, and 45 minutes.

[G45: Alm Record3] Alarm record3
This parameter is used to display the third most-recent alarm, and the alarms that can be displayed are the same as those for **G41: Alm Record1**.

[G46: Alm Record Time3] Display the operation time of alarm record3
This parameter is used to display the operation time at which the alarm indicated by **G45: Alm Record3** was occurred. For example, “1D23:45” indicates that an alarm was occured at the operation time of 1 day, 23 hours, and 45 minutes.

[G47: Alm Record4] Alarm record4
This parameter is used to display the fourth most-recent alarm, and the alarms that can be displayed are the same as those for **G41: Alm Record1**.

[G48: Alm Record Time4] Display the operation time of alarm record4
This parameter is used to display the operation time at which the alarm indicated by **G47: Alm Record4** was occurred. For example, “1D23:45” indicates that an alarm was occured at the operation time of 1 day, 23 hours, and 45 minutes.

(7) Menu H: Display Setting items

Menu H contains setting items relevant to the display unit.

[H10: Display Select1] Setting of the first line for display unit
→ Read the description for parameter **B40**
This parameter selects the display content of the first line for display unit.

[H11: Display Select2] Setting of the second line for display unit
→ Read the description for parameter **B41**
This parameter selects the display content of the second line for display unit.

[H12: Display Select3] Setting of the third line for display unit
→ Read the description for parameter **B42**
This parameter selects the display content of the third line for display unit.

[H20: Display Cycle] Setting of the display cycle
This parameter sets the cycle for the display-response speed of display unit. Settings should be made in accordance with the measurement environment by, for example, setting a longer display cycle when using the equipment in low temperatures.

[H30: Language] Selection of language used for the display unit
→ Read the description for parameter **B10**
This parameter can be used to select the language for the display unit.

[H40: LCD Contrast] Selection of display contrast
This parameter is used to set the contrast of the display (21 scales). Its contrast scale becomes small (bright) when its parameter sets smaller. Adjust the contrast as needed.

(8) Menu J: Auxiliary Function Setting items

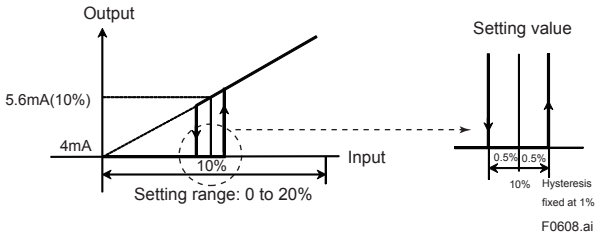
Menu J contains setting items such as the flow direction, rate limits, and current output limits.

[J10: 4-20mA Low Cut] Setting of the low-cut range for current output
This parameter is used to force current output to 0 % (i.e., 4 mA) in the vicinity of 0% output, and setting for the current (4 to 20 mA) output low cut is made using a percentage of the smallest flow rate span.
The low cut setting value depends on flow rate span.

- Flow rate span < 1 m/s:
  Input value or 3 cm/s, whichever is bigger
- Flow rate span ≥ 1 m/s:
  Input value

To confirm the flow rate span velocity in “m/s” unit, read **[C44: Velocity Check].**

Example 1: Situation where the flow rate span is set to 2 m/s:
When “10 %” is input in this parameter, low cut setting value is to be “10 %”.



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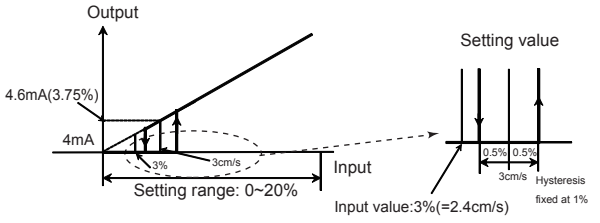
Example 2: Situation where the flow rate span is set to 0.8 m/s:
When “3 %” is input in this parameter, low cut setting value is to be “3 cm/s”.



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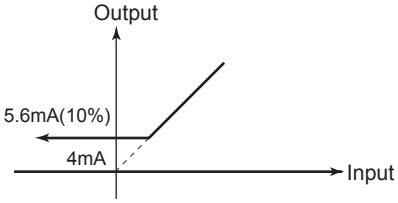
If the multiple ranges or forward/reverse ranges is used, low cut is carried out at the setting value for the smallest span.
However, the low cut function will be terminated if this parameter is set to 0 %.
The indications of the instantaneous flow rate (%, Actual instantaneous flow rate, mA, Bar graph) on the display unit are the same action.

NOTE

The default setting is 3%.
When the low cut is small, an incorrect output may occur at the flow rate of zero. Use the instrument with the default setting 3%. If the span is small, the damping time is short or the fluid is low conductivity, an incorrect output may occur easily at the flow rate of zero.

[J11: 4-20mA Low Lmt] Setting of the low limit for current output
This parameter is used to restrict low current portions of current (4 to 20mA) output, and it is initially set to -1.25%. Setting should be performed when a higher value is required for the lower limit.
The indications of the instantaneous flow rates (%, Actual instantaneous flow rate, mA, Bar graph) on the display unit are the same action.

Example: Situation where low limit is set to 10%



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NOTE

When the low limit works, the display indicates **83:Fix Cur Wng** as the warning.

NOTE

The set current output at each alarm function becomes higher priority than set value at **J11** when the alarm occurs.
The priority of this output is described below.
The process alarms and setting alarms are available when “Yes” were selected at **G26, G27, G28, G29** and/or **G31**.

System alarm (**G20**) >
Process alarm (**G25**) >
Setting alarm (**G30**) >
Low limit (**J11**)

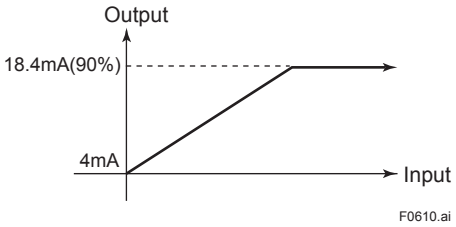
Example: “3.8mA” is set for **G25**
The current output is 3.8mA in spite of setting any value at **J11**.

NOTE

- If the setting value for the low limit is not less than the high limit value (as set using **J12: 4-20mA High Lmt**), the setting alarm "54: 4-20 Lmt Err" will be displayed.
- This parameter has no effect on pulse output or the totalization function.

[J12: 4-20mA High Lmt] Setting of the high limit for current output
This parameter is used to restrict high current portions of current (4 to 20mA) output, and it is initially set to 103.13%. Setting should be performed when a lower value is required for the higher limit. The indications of the instantaneous flow rates (%, Actual instantaneous flow rate, mA, Bar graph) on the display unit are the same action.

Example: Situation where high limit is set to 90%



NOTE

When the high limit works, the display indicates **83:Fix Cur Wng** as the warning.

NOTE

The set current output at each alarm function becomes higher priority than set value at **J12** when the alarm occurs.
The priority of this output is described below.
The process alarms and setting alarms are available when "Yes" were selected at **G26**, **G27, G28, G29** and/or **G31**.

System alarm (**G20**) >
Process alarm (**G25**) >
Setting alarm (**G30**) >
High limit (**J12**)

Example: "21.6mA or more" is set for **G25**
The current output is 21.6mA or more in spite of setting any value at **J12**.

[J15: Pulse Special Mode] Selection of the pulse special mode
This parameter is used to set the pulse mode only instead of using current output.

Setting	Function
Normal	Select this parameter when the current output or Simultaneous Current-Pulse output is used.
Pulse Only	Select this parameter when the pulse output as pulse special mode is used only. The current output is fixed at 12 mA.

NOTE

The pulse output function does not work unless setting the "Pulse Output" at **F10:DO Function** when the "Pulse only" is selected at **J15:Pulse Special Mode**.

[J20: Flow Direction] Setting of the flow direction
Upon shipment from the manufacturing plant, the system is setup such that flow in the same direction, as shown by the direction of the arrow mark on the flowtube, will be measured as forward flow; however, this parameter can be used to set "Reverse" so that flow in the opposite direction to the arrow mark will be treated as forward.

Note: This function does not apply to measurement in both the forward and reverse directions, although this can be setup using by selecting "Fwd/Rev Rngs" from either **F10: DO Function**.

Setting	Function
Forward	Forward direction corresponds with arrow mark.
Reverse	Forward direction is opposite to arrow mark.

[J21: Rate Limit] Setting of the rate limit value

- This parameter is used in situations where sudden noise cannot be eliminated by increasing the damping time constant.
- In situations where step signals or sudden noise signals caused by slurries or the like are entered, this parameter is used to set the standard for determining whether an input corresponds to a flow measurement or noise. Specifically, this determination is made using upper and lower rate limits and using the dead time.
- Rate limit values are set using a percentage of the smallest range. The range of deviation per one calculation cycle should be input.

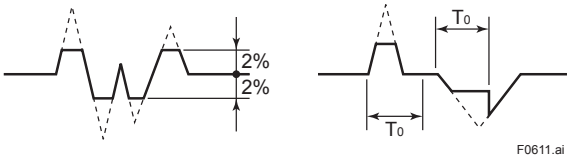
[J22: Dead Time] Setting of dead time
This parameter sets the time for application of the rate limit, and if a value of 0 is set, the rate limit function will be terminated.

NOTE

Determining rate limit value and dead time

Rate limit value:
Determines the level for output fluctuation cutoff. For example, if this is set to 2%, noise above 2% will be eliminated as shown in the diagram.

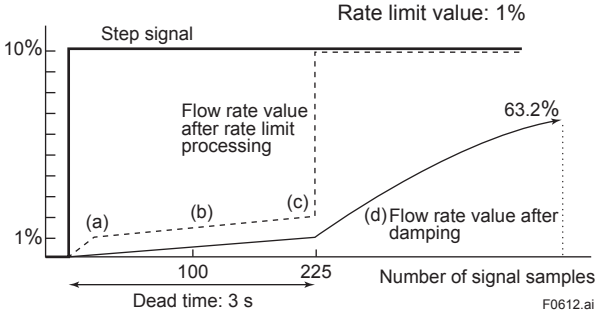
Dead time (T_0):
This is to be determined using the output fluctuation width. If noise exceeds the dead time as shown in the diagram below, the dead time should be made longer.



- Signal processing method:
  A fixed upper and lower limit value is setup with respect to the primary delay response value for the flow rate value obtained during the previous sampling, and if the currently sampled flow rate is outside these limits, then the corresponding limit is adopted as the current flow rate value. In addition, if signals which breach the limits in the same direction occur over multiple samples (i.e., within the dead time), it is concluded that the corresponding signal is a flow rate signal.

Example 1: Step input

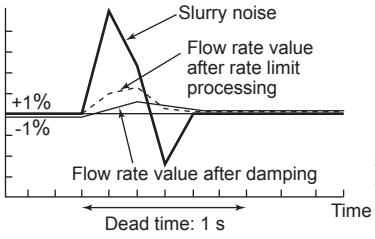
Input: 0 to 10%
Damping time constant: 5 s
Dead time: 3 s
Rate limit value: 1%



(1) In comparison with the previous value at (a), it is determined that the signal is in excess of the rate limit value and the response becomes 1%. However, the actual output applies damping, and therefore the output turns out to be as indicated by the solid line.
(2) Subsequent flow values within the dead time zone correspond to signals of post-damping flow value + rate limit value (1%).
(3) Since input signals do not return to within the rate limit value during the dead time, it is determined at (c) that this signal is a flow rate signal.
(4) The output signal becomes a damped curve and compliance with the step signal begins. Five seconds after determination of a flow rate signal in the above figure, a level of 63.2% is reached.

Example 2: Slurry noise

Input: 0 to 10%
Damping time constant: 1 s
Dead time: 1 s
Rate limit value: 1%



In the figure on the left, it is determined that the slurries noise signal is not a flow rate signal.

[J23: Pulsing Flow] Selection of pulsing flow support
In a situation where pulsating flow causes error in the average flow value, due to the application of a plunger pump, this parameter provides functionality whereby calculation is controlled and variations in flow rate are followed.

Setting	Function
No	Normal
Yes	Support for pulsing flow

[J25: T/P Damp Select] Setting of damping operation
This parameter is used to select that the flow rate value obtained through damping calculation for totalization and pulse output or the instantaneous flow rate value (no damping) for totalization and pulse output.

Setting	Function
Damp	Damping
No Damp	No damping

[J30: Basic Frequency] Selection of the basic frequency
This parameter is changed from default setting as “Freq (1)” to “Freq (2)” if the magnetic flowmeter occurred the error caused by installation of a next magnetic flowmeter closely.

[J35: Memo 1] Setting of memo 1

[J36: Memo 2] Setting of memo 2

[J37: Memo 3] Setting of memo 3

These parameters are used with the memo function, and up to 16 characters can be set for each.

[J40: MS CODE 1] Setting of MS code 1

[J41: MS CODE 2] Setting of MS code 2

[J42: MS CODE 3] Setting of MS code 3

[J43: MS CODE 4] Setting of MS code 4

[J44: MS CODE 5] Setting of MS code 5

[J45: MS CODE 6] Setting of MS code 6

The MS codes are set.

[J50: Software Rev No] Display of software revision
This parameter is used to display the software’s revision number.

(9) Menu K: Diagnostic Function Setting items

Menu K contains items that are relevant to the diagnosis of insulation adhesion to the electrode and so on.

[K10: Adhesion Check] Execution of adhesion diagnostic function
This parameter is used to execute the adhesion diagnostic function. If “Execution” is selected, this function will be started. “Now Adhesion Check Executing” is displayed while the adhesion diagnostic function is being carried out. The result of adhesion diagnosis can be confirmed by using **K12**. (Read Chapter 11.)

Setting	Function
No Execution	Adhesion diagnosis is not executed.
Execution	Adhesion diagnosis is started. The current output becomes 4 mA during this execution (approximately 5 minutes).

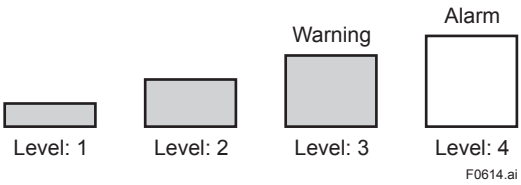
NOTE

Adhesion Diagnostic Function

- This function diagnose adhesion using electrode resistance values.
- The result of adhesion diagnosis is displayed at **K12:Adh Measure Value**.
- When “Adhesion check” has been set for **B41/H11: Display Select 2** or **B42/H12: Display Select 3**, the diagnose adhesion is indicated on the display unit using four different levels.
- If the judgment value for Level 3 is exceeded, a warning is displayed; and if the value for Level 4 is exceeded, an alarm or warning is displayed depending on the setting condition at **G29**.
- Available conductivity for this function is limited to 10 µS/cm.
  Make sure to use the adhesion diagnostic function with the greater conductivity than the above mentioned value.

IMPORTANT

- Parameters cannot be set during execution (approximately 5 minutes).
- Adhesion diagnosis should only be carried out when the fluid velocity is completely zero by closing the valve.
- Flow measurement is not performed during execution. While adhesion diagnosis is being carried out, normally a current of 4 mA is output. When adhesion diagnosis is carried out, change the control loop to the manual mode first.
- Adhesion diagnosis cannot be carried out while an alarm is occurring.



[K11:Adhesion Status] Display of the adhesion diagnosis level
This parameter is used to display the level of adhesion diagnosis.

[K12: Adh Measure Value] Displays the resistance value for adhesion diagnose
This parameter displays the value measured using the adhesion diagnostic function (in M ohm).

[K13: Adhesion Level1] Setting the resistance value for adhesion diagnostic level1
This parameter sets the resistance value (in M ohm) for judgment of Level 1.

[K14: Adhesion Level2] Setting the resistance value for adhesion diagnostic level2
This parameter sets the resistance value (in M ohm) for judgment of Level 2.

[K15: Adhesion Level3] Setting the resistance value for adhesion diagnostic level3
This parameter sets the resistance value (in M ohm) for judgment of Level 3.

*: The warning **80: Adhesion Wng** is displayed when the adhension level reaches Level 3.
*: If "Warning Output" has been selected for **F10: DO Function** status output will be performed when the adhesion level reaches Level 3.

[K16: Adhesion Level4] Setting the resistance value for adhesion diagnosis level4
This parameter sets the resistance value (in M ohm) for judgment of Level 4.

*: The process alarm as **33:Adhesion Alm** is displayed if "Yes" is selected at **G29:Alm-Adhesion**, and the value is beyond the judgment at Level:4.
*: Alarm output will be performed if "Alarm Output" has been selected for **F10: DO Function,** and "Yes" for **G29:Alm-Adhesion.**
*: The warning as **80:Adhesion Wng** is displayed if "No" is selected at **G29:Alm-Adhesion**, and the value is beyond the judgment at Level:4.

[K17: Adhesion Check Cycle] Setting of execution time for adhesion diagnosis
This parameter is used to set the execution time for adhesion diagnosis.
The parameter would be selected as "5 min" (default) without change for typical adhesion diagnosis purpose use.

Setting	Function
0.5 min	The resistance value of adhesion diagnosis is measured over a period of 30 seconds
1 min	The resistance value of adhesion diagnosis is measured over a period of 1 minute
5 min	The resistance value of adhesion diagnosis is measured over a period of 5 minutes
10 min	The resistance value of adhesion diagnosis is measured over a period of 10 minutes

[K19: Empty Check] Setting of empty check diagnosis
This parameter is used to set whether or not to perform diagnosis of empty check and the setting.

Setting	Function
No	Empty check: OFF Empty check is not carried out.
Low	Level of empty check diagnosis: Low An alarm is difficult to occur in the empty status, and the output may fluctuate. The return from the empty status is carried out in a short time. (The return time is approximately 3 seconds in our test data when using water having a conductivity of 10 µS/cm*1.)
Middle	Level of empty check diagnosis: Middle
High	Level of empty check diagnosis: High An alarm occurs easily in the empty status, but the return time from the empty status is carried out after a long time. (The return time is approximately 20 seconds in our test data when using water having a conductivity of 10 µS/cm*1.)

*1: The data is based on our test method, which is not guaranteed.

IMPORTANT

- If the pipe is empty, the output fluctuates or the Process Alarm (Signal Overflow) occurs. The pipe must be fully filled with liquid.
- The instrument checks whether the pipe is empty or not by measuring the resistance between the electrode and the ground. Therefore, it cannot check the status depending on the conditions in the pipe, electrode, and noise at the installation sites. In this case, set this parameter to “No.” Make sure that the check of the empty status may fail in the case of a high viscosity fluid or adhesive fluid.
- It takes 10 to 15 minutes to occur the Empty Pipe Alarm. The Process Alarm (Signal Overflow) may occur during the period from the empty status to the Empty Pipe Alarm.

NOTE

- When using the empty check function, set the appropriate parameters based on the above table. The default setting is “No.”
- Each of the setting values has the following features. Before using the instrument, confirm what happens in the empty and full status by checking the setting values in the order: High → Middle → Low.

Example: In the case of High

1) Set the parameter to “High,” empty the pipe, and confirm that the alarm occurs. Due to the Empty Pipe Alarm taking 10 to 15 minutes, the Process Alarm (Signal Overflow) occurs in this period. If the Empty Pipe Alarm does not occur in the empty status, the empty check cannot be carried out. Set the parameter to “No” in this case.
2) If the alarm is not released after the pipe is fully filled with liquid, the setting value is incorrect. Set the parameter to “Middle” or “Low” accordingly.

[K20: Empty Status] Display of empty pipe status
This parameter specifies the status of empty pipe inside the flowtube.

Setting	Status
Normal	Filled situation
Empty	Unfilled situation

[K21: DC Voltage A] Display of the voltage level at electrode A
This parameter is used to display the DC voltage level at electrode A. The possibility of adhesion at the electrode A is higher when this value becomes high.

[K22: DC Voltage B] Display of the voltage level at electrode B
This parameter is used to display the DC voltage level at electrode B. The possibility of adhesion at the electrode B is higher when this value becomes high.

[K23: Empty Level] Setting of the voltage level for empty pipe detection at the electrodes
This parameter is used to set the voltage level for empty pipe detection. The parameter would be set as default value without change for typical use.
This parameter is changed to smaller value when the Empty Pipe Alarm occurs frequently even if the filled situation.

(10) Menu M: Various Adjustment Function Setting items

Menu M contains items that are relevant to automatic adjustments.

[M10: Auto Zero Exe] Execution of automatic zero adjustment function
→ Read the description of parameter **B50**.

[M11: Autozero Time] Setting of execution time for automatic zero adjustment
This parameter is used to set the execution time of automatic zero adjustment.
Use the instrument with the default setting “450 seconds”. When the execution time is short, an error may occur.

[M12: FL Zero(IEL)] Display of the result of automatic zero adjustment (excitation current (Low))
This parameter is used to display the result of automatic zero adjustment (excitation current (Low) at **B50(M10): Auto Zero Exe**. It is possible to set parameters as coefficient value directly.

[M13: Flow Zero(IEM)] Display of the result of automatic zero adjustment (excitation current (Middle))
This parameter is used to display the result of automatic zero adjustment (excitation current (Middle) at **B50(M10): Auto Zero Exe**. It is possible to set parameters as coefficient value directly.

[M14: Flow Zero(IEH)] Display of the result of automatic zero adjustment (excitation current (High))
This parameter is used to display the result of automatic zero adjustment (excitation current (Low) at **B50(M10): Auto Zero Exe**. It is possible to set parameters as coefficient value directly.

[M15: Flow Span Adjust] Setting of adjustment factor of flow span
This parameter is used to set the adjustment of flow span. The adjustment is not acted when the value is set to "1" as its default. Use this default value for typical use.

[M20: Adjustment 4mA] Setting of adjustment for 4 mA output
This parameter is used to set the adjustment of 4 mA output. Use this default value for typical use.

[M21: Adjustment 20mA] Setting of adjustment for 20 mA output
This parameter is used to set the adjustment of 20 mA output. Use this default value for typical use.

CAUTION

The output adjustment function can match the 4mA and 20mA output to the reference meter such as a voltmeter. In the output adjustment, it is necessary to use the calibrated voltmeter and resistance.

(11) Menu N: Loop Test Setting items

Menu N contains items that are relevant to loop testing.

[N10: Test Mode] Setting for loop test execution

Setting	Function
Normal	No execution of loop testing.
Test	Loop testing is started

IMPORTANT

(1) Test output has priority over flow rate measurement signals. When carrying out flow rate measurements, be sure to always return to "Normal."
(2) Upon entry to the Test Mode, current output, totalization and DO terminal will simultaneously adopt test condition.
(3) "Normal" will be restored when the power is turned off or when the time set at **N15: Test Time** have elapsed since the last operation in Test Mode.
(4) In Test Mode, the warning **83: Fix Cur Wng** will be displayed as a warning message. (Read Section 6.5.)

[N11: Test Output Value] Setting for test output values
During loop testing, current output (4 to 20mA), totalization, and pulse will be output in accordance with this parameter's setting, and values can be set when "Test" has been selected for **N10: Test Mode**. With multiple ranges or when performing forward/reverse flow measurements, setting should be done using a percentage of the maximum range.

[N12: Test DO] Setting for DO terminal condition during testing
This parameter sets the condition of the DO terminal during loop testing. Setting is possible when "Test" has been selected for **N10: Test Mode**.

Setting	Function
Open (Off)	DO terminal in Open (Off) condition
Closed (On)	DO terminal in Closed (On) condition
Pulse	Outputs pulses as were specified with Menu E.*

*: If the pulse scale is 0 pps or there is a pulse setting error, the DO terminal is "Open (Off)."

[N15: Test Time] Selection of the holding time of test mode
This parameter is used to select the holding time of test mode from the last operation in test mode.

Setting	Function
10min	The holding time is 10min
30min	The holding time is 30min
60min	The holding time is 60min
3h	The holding time is 3h
6h	The holding time is 6h
12h	The holding time is 12h

[N20: Test Iex] Selection of the test for excitation current
This parameter is used to select a test for excitation current. The excitation current value is forcibly fixed at zero during this test. Setting is possible when "Test" has been selected for **N10: Test Mode**.

Setting	Function
Normal	Normal operation
Test (Iex OFF)	Testing is started. The excitation current value is forcibly fixed at zero.

IMPORTANT

1) The default setting is "Normal." Use the instrument with this default setting.
2) When the setting is "Test (Iex OFF)," the output is fixed to 0%. In the case of setting "Test (Iex OFF)," first change the control loop to the manual mode, and then set this parameter.
3) "Normal" will be restored when the power is turned off or when the time set at **N15: Test Time** have elapsed since entry to "Test (Iex OFF)."

[N30: Flow Tube] Selection of operating flowtube type
This parameter is used to select the type of operating flowtube which is connected to the converter. The parameter would be selected as "Detector" for typical use. This parameter is selected as "Calibrator" when the converter is connected to the calibrator.

[N40: Average Execution] Selection of execution for measurement of averaged flowrate
This parameter is used to select whether the execution for measurement of averaged flowrate is occurrence in a constant time.

Setting	Function
Stop	Stopping the execution of measurement for averaged flowrate.
Start	Starting the execution of measurement for averaged flowrate.The totalization is started in a time, which was set at **N41: Average Timer** using the value being set at **B20(C11): Flow Damping** when this function is started. This totalization is calculated at the result of instant flowrate for a time where was set at **N41**.

[N41: Average Timer] Setting of totalization time for measurement of averaged flowrate
This parameter is used to set the totalization time for averaged flowrate measurement.

[N42: Average Flow] Display of the averaged flowrate
This parameter is used to display the averaged flowrate for a time when is set at **N41** as totalizatoin time after selecting the "Start" at **N40**.

(12) Menu P: Parameter Protection items

Menu P contains items that are relevant to write protection and passwords.

[P10: Key Code] Parameter of the display restriction
This parameter restricts access to the Service Mode.

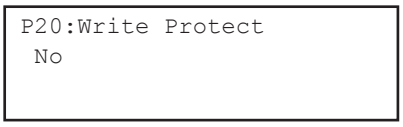
NOTE

Write Protect function

- The parameters **P20** through **P23** are set when using the write protect function. Specifically, this function responds to a hardware switch or the setting of a software password, and it protects parameters from being overwritten.
- If the hardware switch is set to "Protect", it will not be possible to overwrite parameters; furthermore, this condition will be maintained until the switch is set to "Enable."
- For more details regarding hardware switch settings, read Subsection 11.3.2.

[P20: Write Protect] Setting of password to release the write protection function
This parameter is used to indicate whether or not write protection is currently on.

Default setting (Enable)



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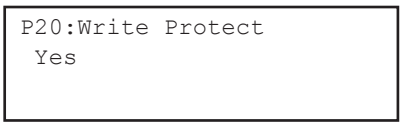
Write protection (Protect)

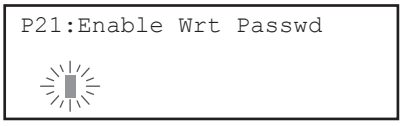


F0616.ai

NOTE

The mark of " " is displayed at the right periphery of the first line in the "Major item parameter search mode" and "Sub-item parameter search mode" during acting the write protection.

[P21: Enable Wrt Passwd] Setting of password to release the write protection function
When the correct password is input, write protection will be released for a period of 10 minutes; furthermore, this period will be extended by a further 10 minutes each time a parameter is overwritten.



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The cursor will flash when entering Parameter Replacement Mode, and the password set with **P22: New Password** should be input at this time.

[P22: New Password] Setting of a new password
This parameter sets the password required for the release of write protection. When set, it will be possible to make write protect settings on the software side.

Default setting

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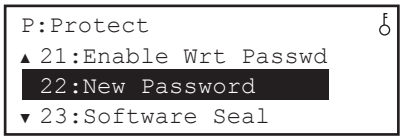
The default setting for this parameter is a string of 8 spaces (i.e., Enable), and thus, the password field will be empty. When the cursor is flashing, the password should be input. Press the SET key twice to confirm the password. The display will go back to "Sub-item parameter search mode."

After password setting



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To change a password, first of all use the password originally set with **P21: Enable Wrt Passwd** to release the write protect function, and then set the new password. Alternatively, if it is desired to return to the condition where no password is set, enter a string of 8 spaces.

[P23: Software Seal] Display the software seal
When the joker password has been used to release write protection, this parameter displays "Break," and when protection is cancelled using the password set using **P22: New Password**, it returns to "Keep."

NOTE

If you should forget your password, the joker password can be used to temporarily release write protection function. To obtain the joker password, please contact your nearest YOKOGAWA sales office.

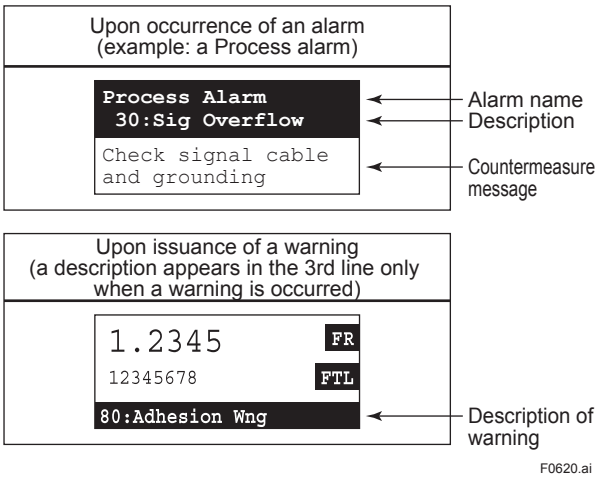
6.5 Alarm Functions

6.5.1 Alarm Levels

Alarms are classified into the following four different types based on level.

Alarm	Level	Description
System alarm	Major breakdown	Device breakdown or inability to obtain correct measurements. Replacement will be required.
Process alarm	Intermediate level break down	Device is normal but process-related errors make correct measurement impossible. Maintenance or the like will be required.
Setting alarm	Minor breakdown	Device is normal but errors have been made in the setting of parameters. Functions notrelated to the incorrect settings are operating normally. The incorrect settings must be corrected.
Warning	Warning	Device and measurements are normal but a warning is occurred.

When an alarm has been occurred, the corresponding alarm name, description, and suitable countermeasure will be displayed on the display unit. The normal Display Mode and Alarm Mode may be displayed alternatively. When a warning has been issued, the corresponding content will be shown in the third line in the Display Mode.



6.5.2 Alarm Selection

The display and output differs depending on the alarm levels. Certain types of alarm may or may not be recognized as alarms, according to the settings of certain parameters. The parameters that are relevant to this function as follows.

[F10: DO Function] Setting of the function for the DO status output terminal

[F11: DO Active Mode] Setting of the active mode for DO terminal

[G20: 4-20mA System Alm] Display of the current output during a system alarm occurrence

[G25: 4-20mA Process Alm] Selection of the current output during a process alarm occurrence

[G26: Alm-Sig Over] Alarm recognition of “Signal Overflow Alarm”

[G27: Alm-Emp Pipe] Alarm recognition of “Empty Pipe Alarm”

[G28: Alm-H/L] Alarm recognition of “H/L Alarm” (Read the descriptions of **G10** and **G11** for more details regarding H and L alarms.)

[G29: Alm-Adhesion] Alarm recognition of “Adhesion Alarm”

[G30: 4-20mA Setting Alarm] Selection of the current output during a setting alarm occurrence

[G31: Alm-Setting] Selection of the alarm output during a setting alarm occurrence

[G41: Alm Record1] Alarm record1

[G43: Alm Record2] Alarm record2

[G45: Alm Record3] Alarm record3

[G47: Alm Record4] Alarm record4

(1) Display and output condition for system alarms

		Alarm description	Alarm output	4-20mA output	Totalization	Pulse	Display unit	Alarm record
	Normal		Closed (ON)	Normal	Normal	Normal	Display Mode	No
10	µP Fault	Microprocessor (CPU) failure	Open (Off)	Fixed at 3.2mA or less otherwise 21.6mA or more (*)	Indetermination	Indetermination	Indetermination	Indetermination
11	EEPROM Fault	EEPROM failure	Open (Off)	Fixed at 3.2mA or less otherwise 21.6mA or more (*)	Stopped	Stopped	Alarm Mode (display of system Alarm message)	Recorded
12	Sub uP Fault	Substitute mcroprocessor (CPU) failure						
13	EX Pwr Fault	Extitation power circuit failure						
14	A/D(S) Fault	A/D converter failure (Signal)						
15	A/D(I) Fault	A/D converter failure (Excitation current)						
16	Analog Fault	Analog circuit failure						
17	Coil Open	Flowtube coil is open-circuit						
18	Coil Short	Flowtube coil is short-circuit						
19	Excite Error	Excitation circuit failure						
20	Pulse Error	Discrepancy of pulse count						
21	EEPROM Dflt	EEPROM default values						

Note: • Alarm is output only when **[F10:DO Function]** is set to “Alarm Output.”
• The operation when “Open (Off) Act” is set for **[F11:DO Active Mode]** is shown in above table.
*: The output value is performed in accordance with the setting of the burnout switch. For information about this switch, read Subsection 11.3.1.

(2) Display and output condition for process alarms

		Alarm description	Selection (parameter number)	Alarm output	4-20 mA output	Totalization	Pulse output	Displayunit	Alarm record
30	Sig Overflow	Input signal error	YES (G26)	Open (Off)	Fixed	Stopped	Stopped	Alarm Mode (Message)	Recorded
			NO (G26)	Closed (On)	Continuous (*)	Continuous (*)	Continuous (*)	Display Mode	No
31	Empty Pipe	Flowtube is not filled with fluid	YES (G27)	Open (Off)	Fixed	Stopped	Stopped	Alarm Mode (Message)	Recorded
			NO (G27)	Closed (On)	Continuous (*)	Continuous (*)	Continuous (*)	Display Mode	No
32	H/L Alm	H/L Alarm	YES (G28)	Open (Off)	Normal operation	Normal operation	Normal operation	Alarm Mode (Message)	No
			NO (G28)	Closed (On)				Display Mode	
33	Adhesion Alm	Electrode adhesion alarm	YES (G29)	Open (Off)	Fixed	Stopped	Stopped	Alarm Mode (Message)	Recorded
			NO (G29)	Closed (On)	Continuous (*)	Continuous (*)	Continuous (*)	Display Mode	No

Note: • larm is output only when **F10: DO Function** is set to “Alarm Output.”
• The operation when “Open (Off) Act” is set for **F11: DO Active Mode** is shown in above table.
• 4-20mA output upon the occurrence of an alarm will be fixed at the value selected with **G25: 4-20mA Process Alarm**.
*: Although outputs are continuous, output values are not guaranteed.

(3) Display and output condition for setting alarm occurrences

		Alarm description	Selection (parameter number)	Alarm output	4-20 mA output	Totalization	Pulse output	Displayunit	Alarm record
50	Span > 10m/s	Span flow velocity setting is 11 m/s or more	NO (G30)	Closed (On)	Fixed	Stopped	Stopped	Alarm Mode (message)	No
51	Span < 0.3m/s	Span flow velocity setting is 0.25 m/s or less							
52	TTL>10000p/s	Totalization rate is 11000 pps or more		Closed (On)	Normal operation	Stopped	Normal operation	Alarm Mode (message)	No
53	TTL<0.0001p/s	Totalization rate is 0.00005 pps or less							
54	4-20 Lmt Err	The condition [4-20 low limit (J11) < 4-20 high limit (J12)] is not satisfied.		Closed (On)	Fixed	Normal operation	Normal operation	Alarm Mode (message)	No
55	Multi Rng Err	The condition [No. 1 range < No. 2 range < No. 3 range < No. 4 range] is not satisfied for multiple ranges.		Closed (On)	Fixed	Stopped	Stopped	Alarm Mode (message)	No
56	H/L Set Err	The condition [High Alarm (G11) – Low Alarm (G10) > H/L Alarm Hys (G12)] is not satisfied.		Closed (On)	Normal operation	Normal operation	Normal operation	Alarm Mode (message)	No
57	Dens Set Err	Mass units have been selected for Base Flow Unit (C40) but density is set to 0.		Closed (On)	Fixed	Stopped	Stopped	Alarm Mode (message)	No
60	PLS >10000p/s	Pulse rate is 11000 pps or more with 50% duty selection.		Closed (On)	Normal operation	Normal operation	Stopped	Alarm Mode (message)	No
		Pulse rate is 10000 pps or more with 0.05 ms selection.							
61	PLS > 5000p/s	Pulse rate is 5000 pps or more with 0.1 ms selection.							
62	PLS > 1000p/s	Pulse rate is 1000 pps or more with 0.5 ms selection.							
63	PLS > 500p/s	Pulse rate is 500 pps or more with 1 ms selection.							
64	PLS > 25p/s	Pulse rate is 25 pps or more with 20 ms selection.							
65	PLS > 15p/s	Pulse rate is 15 pps or more with 33 ms selection.							
66	PLS > 10p/s	Pulse rate is 10 pps or more with 50 ms selection.							
67	PLS > 5p/s	Pulse rate is 5 pps or more with 100 ms selection.							
68	PLS > 2.5p/s	Pulse rate is 2.5 pps or more with 200 ms selection.							
69	PLS > 1.5p/s	Pulse rate is 1.5 pps or more with 333 ms selection.							
70	PLS > 1.0p/s	Pulse rate is 1.0 pps or more with 500 ms selection.							
71	PLS > 0.5p/s	Pulse rate is 0.5 pps or more with 1000 ms selection.							
72	PLS > 0.25p/s	Pulse rate is 0.25 pps or more with 2000 ms selection.							
73	PLS<0.0001p/s	Pulse rate is 0.00005 pps or less.							
74	Size Set Err	A value of 3000.1 mm or more is set for Nominal Size (C32).		Closed (On)	Fixed	Stopped	Stopped	Alarm Mode (message)	No
75	Adh Set Err	The condition [Level:1 < Level:2 < Level:3 < Level:4]is not satisfied for adhesion diagnostic level.		Closed (On)	Normal operation	Normal operation	Normal operation	Alarm Mode (message)	No
	Occurring of any alarm from 50 through 75	–	YES (G30)	Open (Off)	Fixed	Stopped	Stopped	Alarm Mode (message)	No

Note: • Alarm is output only when **F10: DO Function** is set to “Alarm Output.”
• The operation when “Open (Off) Act” is set for **F11: DO Active Mode** is shown in above table.
• 4-20mA output upon the occurrence of an alarm will be fixed at the value selected with **G30: 4-20 mA Setting Alarm**.

6.5.3 Alarms & Warning Messages

System Alarms (Device breakdown or inability to obtain correct measurements.)				
Display unit/BRAIN (☐60) content	**Alarm countermeasure message on display unit**	**NE-107 status**	**Alarm description**	**Countermeasure**
10:µP Fault	Contact near office or service center	F	Microprocessor (CPU) failure	Contact your nearest Yokogawa office or service center
11:EEPROM Fault		F	EEPROM failure	
12:Sub uP Fault		F	Substitute mcroprocessor (CPU) failure	
13:EX Pwr Fault		F	Extitation power circuit failure	
14:A/D(S) Fault		F	A/D converter failure	
15:A/D(I) Fault				
16:Analog Fault		F	Analog circuit failure	
17:Coil Open		F	Flowtube coil is open-circuit	
18:Coil Short		F	Flowtube coil is short-circuit	
19:Excite Error		F	Excitation circuit failure	
20:Pulse Error		F	Discrepancy of pulse count	
21:EEPROM Dflt		F	EEPROM default values	

Process Alarms (Device is normal but process-related errors make correct measurement impossible.)				
Display unit/BRAIN (☐60) content	**Alarm countermeasure message on display unit**	**NE-107 status**	**Alarm description**	**Countermeasure**
30:Sig Overflow	Check signal cableand grounding	S	Input signal error	Carry out an investigation as follows: • Check the signal cable for breakage. • Check for stray currents in the fluid. • Check the grounding. • Check whether flowtube is filling with fluid. • Check the electrode adhesion.
31:Empty Pipe	Fill flow tube with fluid	S	Flowtube is not filled with fluid	Fill the flowtube with fluid.
32:H/L Alm	Check the flow rate and setting value	−	Flow rate alarm for greater than High limit value or less than Low limit value.	Check the flow rate and setting value of High limit and Low limit.
33:Adhesion Alm	Clean electrodes	S	Electrode adhesion alarm	Clean the electrodes.

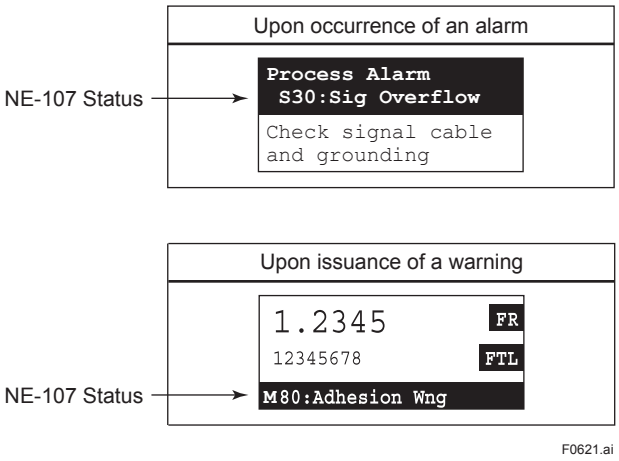
Setting Alarm (Device is normal but errors have been made in the setting of parameters.)				
Display unit/BRAIN (□60) alarm content	**Alarm countermeasure message on display unit**	**NE-107 status**	**Alarm description**	**Countermeasure**
50:Span > 10m/s	Check parameter C40,C41,C42,F20, and F21	S	Span flow velocity settings is 11 m/s or more	Check whether parameters C40, C41 and C42 are correct. In case that multiple range or forward and reverse flow measurement functions is used, check whether parameters F20 and F21 are correct.
51:Span < 0.3m/s	Check parameter C40,C41,C42,F20, and F21	S	Span flow velocity setting is 0.25 m/s or less	
52:TTL>10000p/s	Check parameter D10 and D11	S	Totalization rate is 11000 pps or more	Check whether parameters D10 and D11 are correct.
53:TTL<0.0001p/s	Check parameter D10 and D11	S	Totalization rate is 0.00005 pps or less	
54:4-20 Lmt Err	Check parameter J11 and J12	S	The condition [4-20 low limit (J11) < 4-20 high limit (J12)] is not satisfied.	Check whether parameters J11 and J12 are correct.
55:Multi Rng Err	Check parameter C42 and F20	S	The condition [No. 1 range < No. 2 range] is not satisfied for multiple ranges.	Check whether parameters C42 and F20 are correct.
56:H/L Set Err	Check parameter G10, G11, and G12	S	The condition [High Alarm (G11) -Low Alarm (G10) >H/L Alarm Hys (G12)] is not satisfied.	Check whether parameters G10, G11 and G12 are correct.
57:Dens Set Err	Check parameter C40, C45, and C46	S	Mass units have been selected for Base Flow Unit (C40) but density is set to 0.	Check whether parameters C40, C45 and C46 are correct.
60:PLS>10000p/s	Check parameter E10, E11, and E12	S	Pulse rate is 11000 pps or more with 50% duty selection. Pulse rate is 10000 pps or more with 0.05 ms selection"	Check whether parameters E10, E11 and E12 are correct.
61:PLS > 5000p/s	Check parameter E10, E11, and E12	S	Pulse rate is 5000 pps or more with 0.1 ms selection.	
62:PLS > 1000p/s	Check parameter E10, E11, and E12	S	Pulse rate is 1000 pps or more with 0.5 ms selection.	
63:PLS > 500p/s	Check parameter E10, E11, and E12	S	Pulse rate is 500 pps or more with 1 ms selection.	
64:PLS > 25p/s	Check parameter E10, E11, and E12	S	Pulse rate is 25 pps or more with 20 ms selection.	
65:PLS > 15p/s	Check parameter E10, E11, and E12	S	Pulse rate is 15 pps or more with 33 ms selection.	
66:PLS > 10p/s	Check parameter E10, E11, and E12	S	Pulse rate is 10 pps or more with 50 ms selection.	
67:PLS > 5p/s	Check parameter E10, E11, and E12	S	Pulse rate is 5 pps or more with 100 ms selection.	
68:PLS > 2.5p/s	Check parameter E10, E11, and E12	S	Pulse rate is 2.5 pps or more with 200 ms selection.	
69:PLS > 1.5p/s	Check parameter E10, E11, and E12	S	Pulse rate is 1.5 pps or more with 333 ms selection.	
70:PLS > 1.0p/s	Check parameter E10, E11, and E12	S	Pulse rate is 1.0 pps or more with 500 ms selection.	
71:PLS > 0.5p/s	Check parameter E10, E11, and E12	S	Pulse rate is 0.5 pps or more with 1000 ms selection.	
72:PLS > 0.25p/s	Check parameter E10, E11, and E12	S	Pulse rate is 0.25 pps or more with 2000 ms selection.	
73:PLS<0.0001p/s	Check parameter E10, E11, and E12	S	Pulse rate is 0.00005 pps or less.	
74: Size Set Err	Check parameter C30 and C31	C	A value of 3000.1 mm or more is set for Nominal Size (C31).	Check whether parameters C30 and C31 are correct.
75: Adh Set Err	Check parameter K13 to K16	C	The condition in Adhesion detection level, Level:1<Level:2<Level:3< Level:4 is not satisfied.	Check whether parameters K13, K14, K15 and K16 are correct.

Setting Alarms (Device and measurements are normal but a warning is issued.)				
Display unit/ BRAIN(□60) content	**Alarm countermeasure message on display unit**	**NE-107 status**	**Alarm description**	**Countermeasure**
80:Adhesion Wng	–	M	Slight adhesion to electrodes.	Clean and check the electrodes. Read parameter K15.
82:Auto Zero Wng	–	C	Results of automatic zero adjustment are higher than the rated values.	Carry out adjustment as follows: · Check if the flowtube is filled with fluid. · Check if the flow velocity is completely zero. · Check the condition of grounding.
83:Fix Cur Wng	–	S	The current value is fixed.	Confirm whether the flow rate is in excess of the upper limit (a set value at **J11**) or below the lower limit (a set value at **J12**), or whether upon entry to the Test Mode or not.
84:Disp Over Wng (only for display unit)	–	C	Overflow in the display digits during instantaneous flow rate display.	Check whether parameter C43 is correct.
90:Disp SW Wng (only for display unit)	–	–	Display unit switches are not operating.	Replace the display unit.
91:Disp Cur Wng	–	F	Excessive current is used on the display unit.	Replace the display unit.
93:Dev Sim Wng	–	C	In HART simulation	Check whether the device is in HART Simulation.

6.5.4 NE-107 status

When **[G35: Alarm Display]** is set in “NE107”, AXR alarms are classified into 4 status categories. The NE-107 status is shown in the display unit and configuration tools.

NE-107 status		Status of the device
F	Failure	Device malfunction, Parts malfunction
C	Function Check	The output signal is temporarily invaild for the local operation or manual operation.
S	Out of specification	The device works in out of specification. The output signal is uncertain for the process or the ambience.
M	Maintenance required	The maintenance is required in the near future.



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7. OPERATION VIA BRAIN TERMINAL (BT200)

NOTE

This chapter describes the AXR as an example.

7.1 BT200 Basic Operations

7.1.1 Key Layout and Display

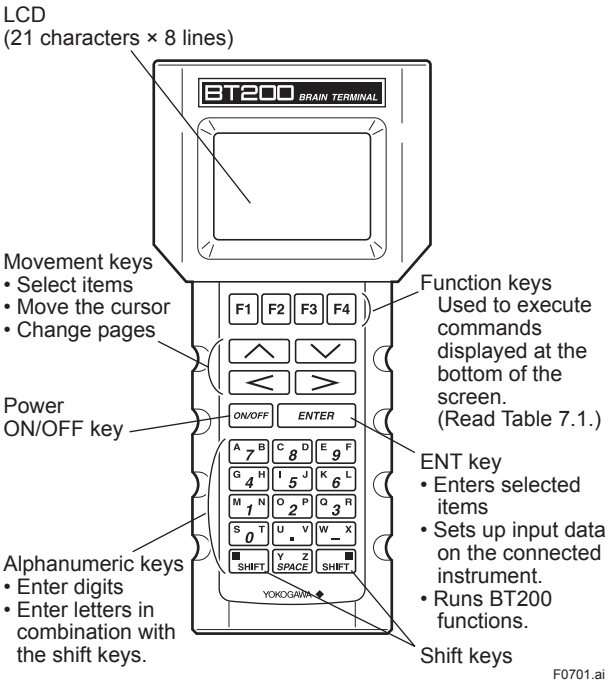
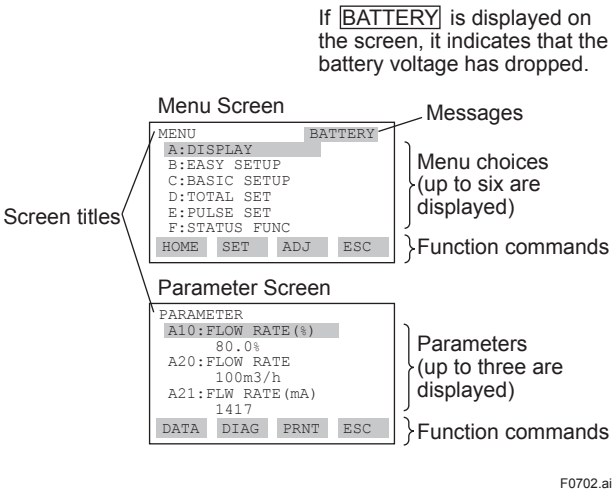


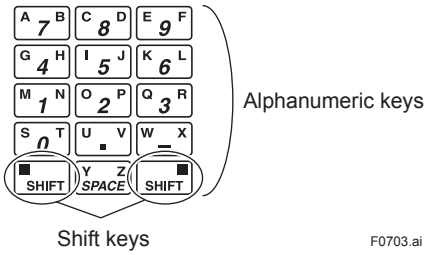
Figure 7.1 Key Layout



7.1.2 Key Descriptions

(1) Alphanumeric keys and shift keys

You can use the alphanumeric keys in conjunction with the shift keys to enter letters, digits, and symbols.



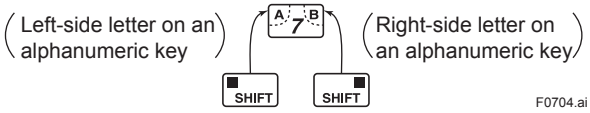
a) Entering digits, symbols, and spaces [i.e., 0-9, period (.), hyphen (-), underscore (_)]

Simply press the required alphanumeric key.

Entry	Key-in sequence
–4	W _ X, G 4 H
0.3	S 0 T, U . V, Q 3 R
1␣–9	M 1 N, Y Z SPACE, W _ X, E 9 F

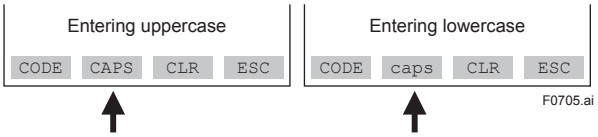
b) Entering letters (i.e., A through Z)

Press an alphanumeric key following a shift key to enter the letter shown on the same side as the shift key. The shift key must be pressed for each letter being input.



Entry	Key-in sequence
W	SHIFT, W _ X
IC	SHIFT, I 5 J, SHIFT, C 8 D
J. B	SHIFT, I 5 J, U . V, SHIFT, A 7 B

Use the function key [F2] CAPS to select between uppercase and lowercase (for letters only). The case toggles between uppercase and lowercase each time you press [F2] CAPS.



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Entry	Key-in sequence
Boy	to lower case SHIFT A 7 B F2 SHIFT O 2 P SHIFT Y Z SPACE (B) (o) (y)

Use the function key [F1] CODE to enter symbols. The following symbols will appear in sequence, one at a time, at the cursor each time you press [F1] CODE:

/ . – , + *) (’ & % $ # ” !

To enter characters next to these symbols, press [>] to move the cursor.

Entry	Key-in sequence
I/m	symbol command F2 SHIFT K 6 L F1 > SHIFT M 1 N (I) (/) (m)

(2) Function Keys

The functions of the function keys depend on the function commands on display.

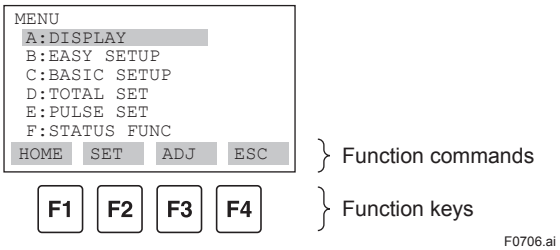

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Table 7.1 Function Command List

Command	Function
ADJ	Displays the ADJ menu
CAPS/caps	Selects uppercase or lowercase
CODE	Selects symbols
CLR	Erases input data or deletes all data
DATA	Updates parameter data
DEL	Deletes one character
DIAG	Calls the self-check panel
ESC	Returns to the most recent display
HOME	Displays the menu panel
NO	Quits setup and returns to the previous display
OK	Proceeds to the next panel
PRAM	Enters the parameter number setup mode
SET	Displays the SET menu
SLOT	Returns to the slot selection panel
UTIL	Calls the utility panel
*COPY	Prints out parameters on display
*FEED	Paper feed
*LIST	Lists all parameters in the menu
*PON/POFF	Automatic printout mode on or off
*PRNT	Changes to the print mode
*GO	Starts printing
*STOP	Cancels printing

* Available on BT200-P00 (with printer).

7.2 AXR Operation Using a BT200

This section describes procedures for setting parameters using a BRAIN Terminal (BT200). For more details regarding AXR functions, read Chapter 6 and for more details regarding BT200 operation methods, read the BT200 User's Manual (IM 01C00A11-01E).

7.2.1 BT200 Connection

Connection to a 4 to 20 mA DC signal line

The communication signal is superimposed onto the 4 to 20 mA DC analog signals to be transmitted.

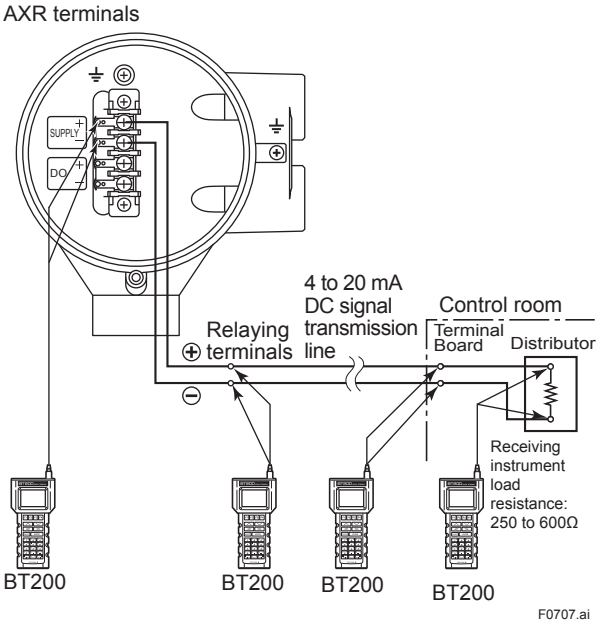


Figure 7.2 Connecting the BT200

IMPORTANT

Communication signal is superimposed on analog output signal. It is recommended to set a low-pass filter (approximately 0.1s) to the receiver in order to reduce the output effect from communication signal. Before online-communication, confirm that communication signal does not give effect on the upper system.

IMPORTANT

Restrictions exist with regard to the distance over which communication is possible. When simultaneous output of current and pulse output or pulse output are used, no communication is possible depending on the wiring. Read Section 4.6 and Chapter 12 in detail.

IMPORTANT

If the power of flowmeter is turned off within 30 seconds after parameters have been set, these settings will be canceled. Accordingly, please keep the power on for at least 30 seconds after setting parameters.

IMPORTANT

After approximately 5 minutes of inactivity, the Auto Power-Off function will operate to turn your BT200 off.

WARNING

Be sure to set parameters as "Protect" on the write protect function after finish of parameter setting work.
Read Chapter 6 Menu P and Subsection 11.3.2, how to use the write protect function in detail.

NOTE

In case of BT200, the parameters are displayed in English only.
Even if the language with the exception of English is selected at **B10/H30: Language**, the parameters are displayed in English upon BT200.

7.2.2 The data update and upload/ download function of BT200

(1) The data update of BT200

When the following parameters are displayed, the measured data is updated automatically every seven seconds.

Item	Name (BRAIN)	Item	Name (BRAIN)
A10	FLOW RATE (%)	G43	ALM RECORD2
A20	FLOW RATE	G44	ALM TIME 2
A21	FLW RATE (mA)	G45	ALM RECORD3
A30	TOTAL	G46	ALM TIME 3
A31	REV TOTAL	G47	ALM RECORD4
A32	DIF TOTAL	G48	ALM TIME 4
C44	VELOCITY CHK	K11	ADH STATUS
D14	TL RATE CHK	K12	ADH MEAS VAL
E14	PLS RATE CHK	K20	EMPTY STATUS
G20	4-20 SYS ALM	K21	DC VOLTAGE A
G40	OPERATE TIME	K22	DC VOLTAGE B
G41	ALM RECORD1	P20	W PROTECT
G42	ALM TIME 1	P23	SOFT SEAL

(2) Upload/download function of BT200

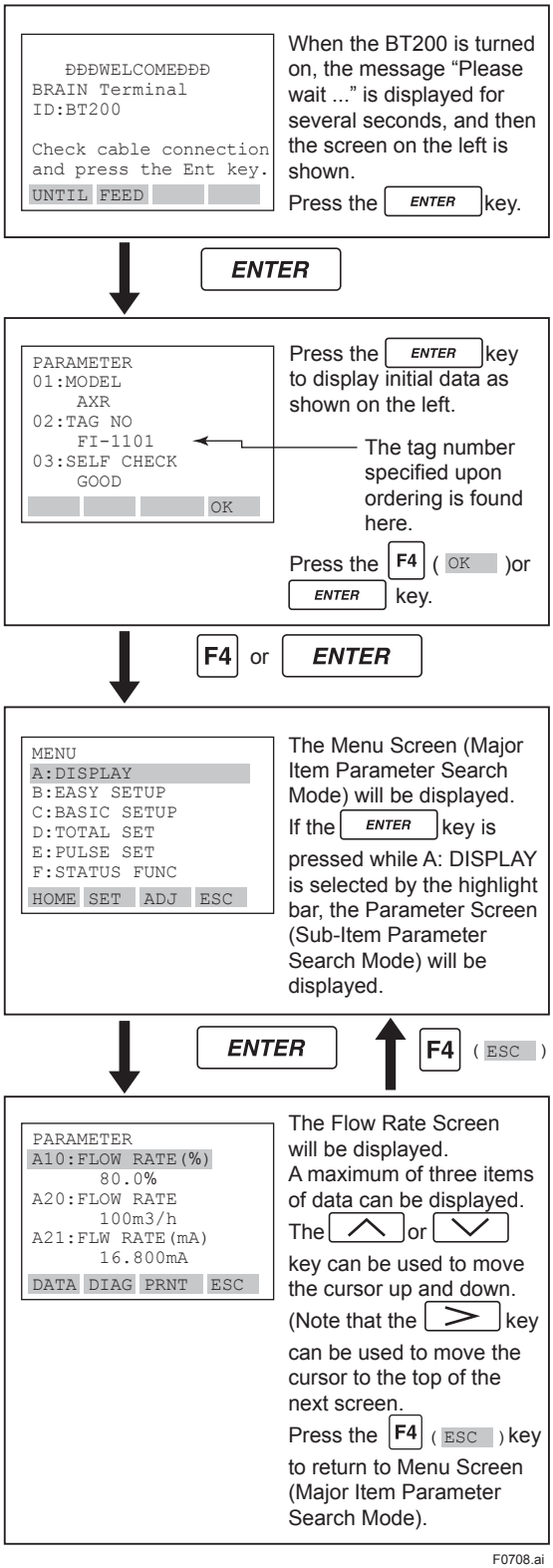
Upload function is used when the parameters of one AXR are copied to the BT200. And download function is used when the parameters copied to the BT200 are set to another AXR.
The targeted parameters for upload and download are following.

Item	Name (BRAIN)	Item	Name (BRAIN)
C11/B20	FLOW DAMPING	D10/B30	TOTAL UNIT
C30	SIZE UNIT	D11/B31	TOTAL SCALE
C31	NOMINAL SIZE	E10/B32	PULSE UNIT
C40/B21	FLOW UNIT	E11/B33	PULSE SCALE
C41/B22	TIME UNIT	H10/B40	DISP SELECT1
C42/B23	FLOW SPAN	H11/B41	DISP SELECT2
C43/B24	FLOW DECIMAL	H12/B42	DISP SELECT3

7.2.3 BT200 Screens & Flow Rate Data Display

Use the following procedure to display flow rate data on the BT200.

- The display of flow rate data is updated every 5 seconds.



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7.3 Parameter Setting Using a BT200

This section describes the procedure for setting of parametes using a BT200.

IMPORTANT

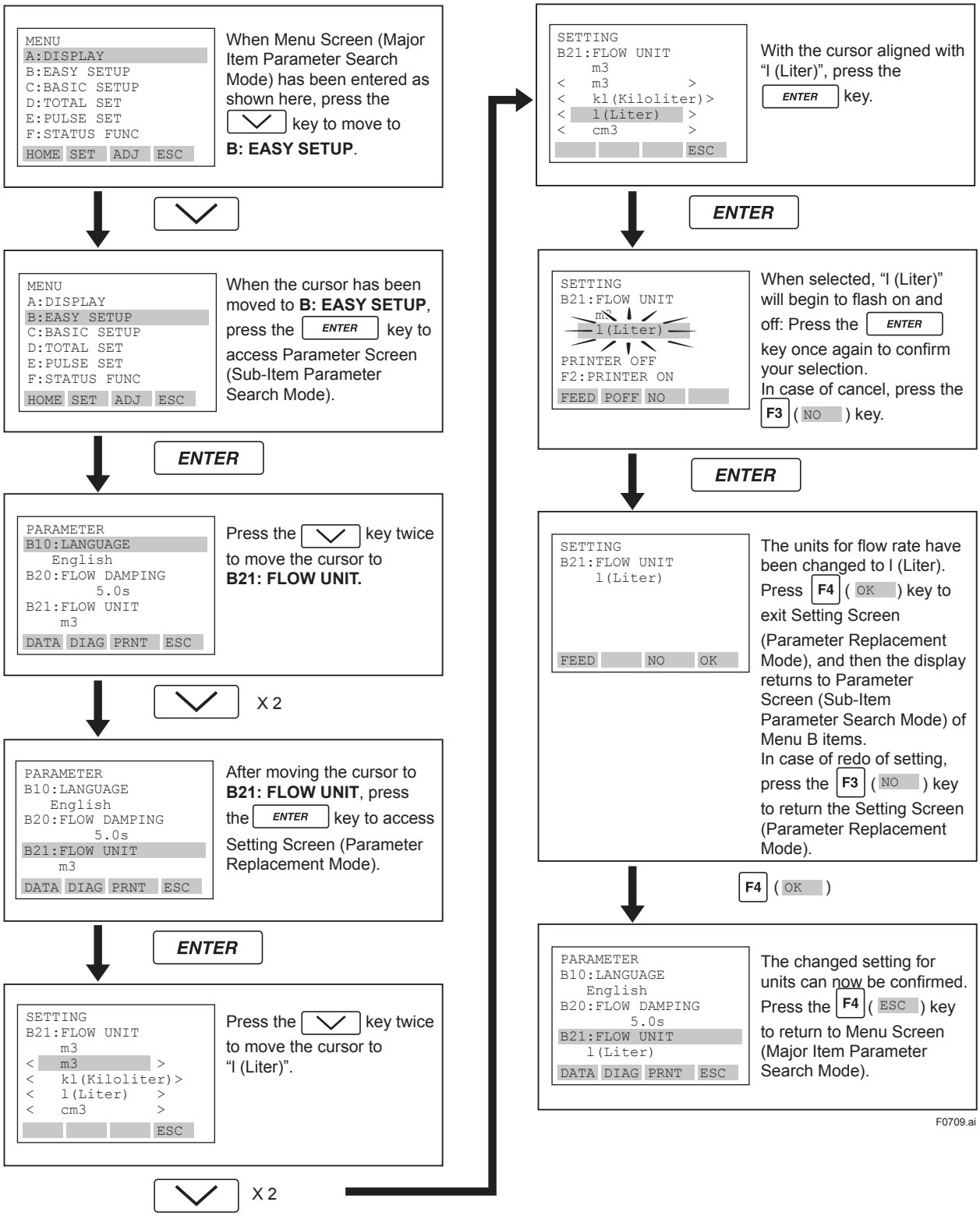
If the power of flowmeter is turned off within 30 seconds after parameters have been set, these settings will be canceled. Accordingly, please keep the power on for at least 30 seconds after setting parameters.

NOTE

Before updating any setting, remember to always check the data content you want to change as described in Chapter 6.

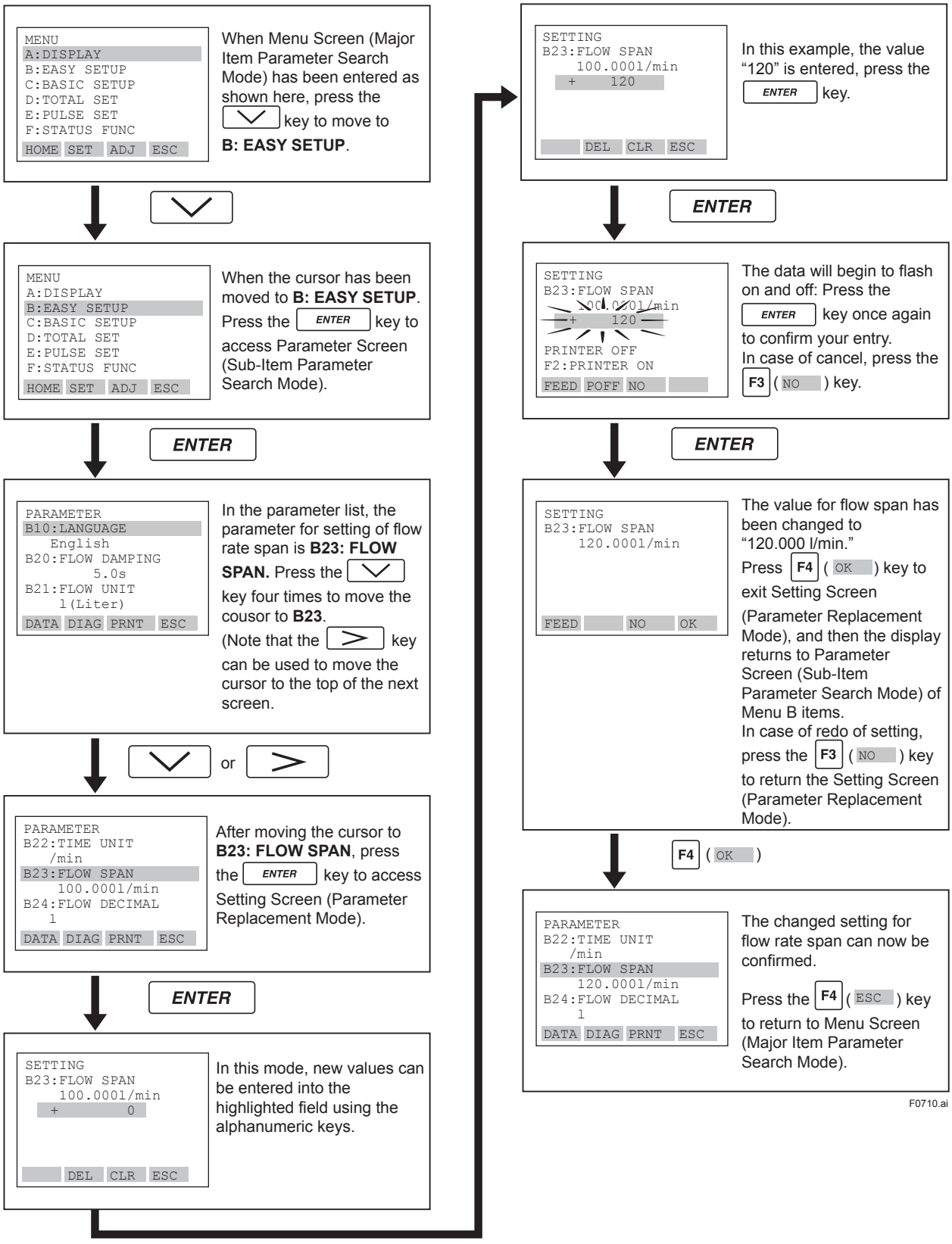
7.3.1 BT200 Setting of Selection-Type Data: Flow rate units

In this example, the flow rate units specified by the selection-type parameter **B21: Flow Unit** are changed from m3 to l (Liter).



7.3.2 BT200 Setting of Numeric-Type Data: Flow rate span

In this example, the flow rate span specified by the numeric-type parameter **B23: Flow Span** is changed from 100.000 l/min. to 120.000 l/m.



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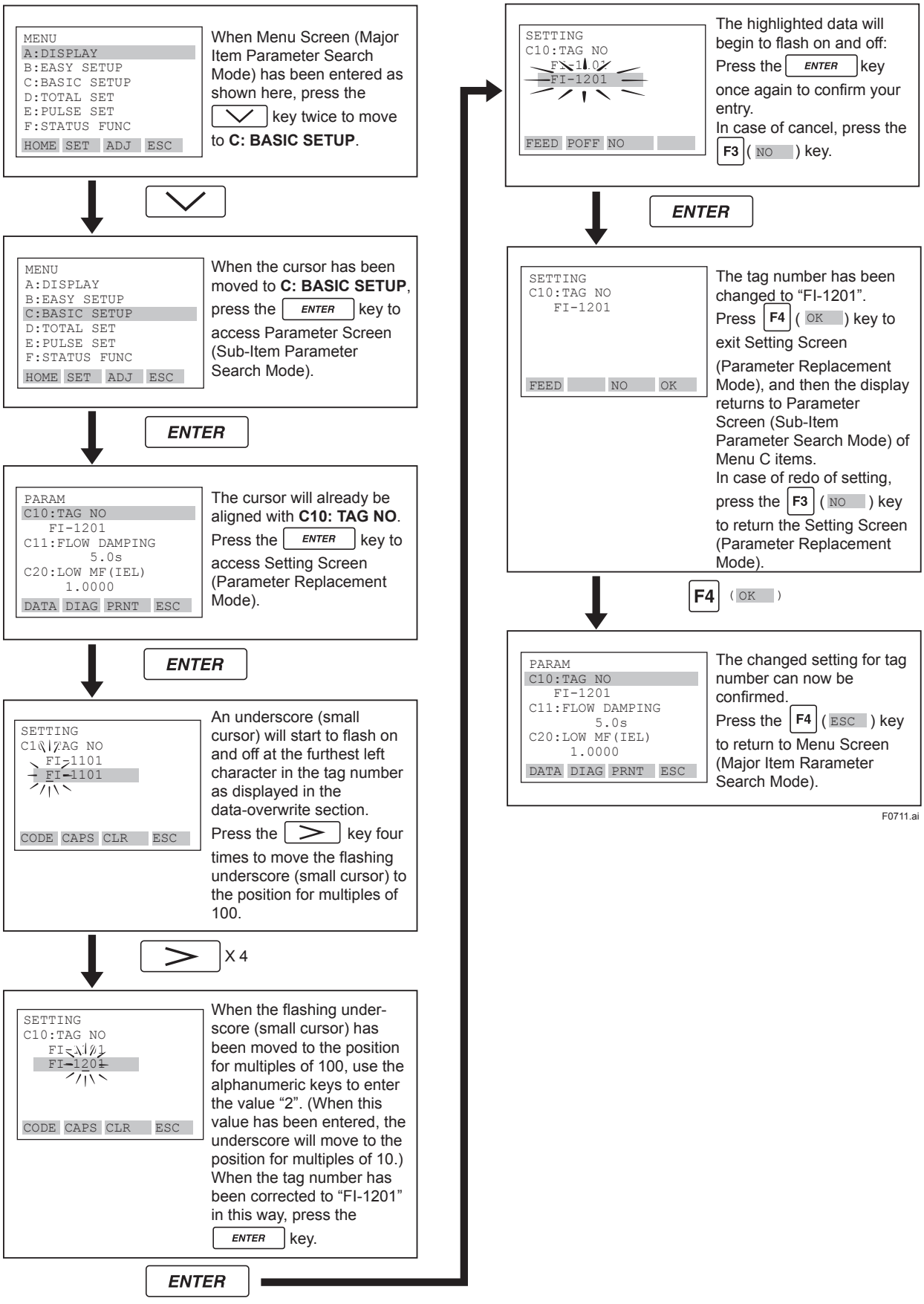
7.3.3 BT200 Setting of Alphanumeric-Type Data: Tag number

In this example, the tag number specified by the alphanumeric-type parameter **C10: TAG NO** is changed from "FI-1101" to "FI-1201."



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8. OPERATION VIA HART CONFIGURATION TOOL (HART 5)

This Chapter describes the device (AXR) operation procedures using a HART configuration Tool (such as FieldMate).

NOTE

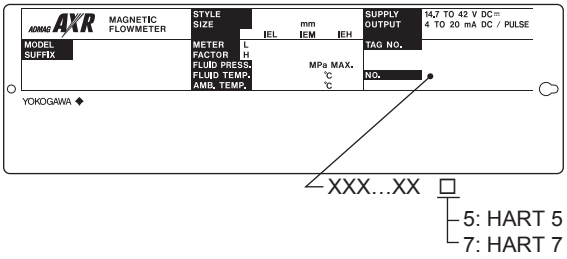
For more details regarding the operations for the HART configuration tool, read the HART configuration tool operations manual.

Note: HART is a registered trademark of the FieldComm Group.

8.1 HART Protocol Revision

For the models with the output signal code "-J", HART protocol revision 5 or 7 is selectable. The protocol revision is set as specified in the order. How to confirm protocol revision is shown below. There are two ways to confirm the protocol revision set to the transmitter.

(1) Confirmation by the name plate
The HART protocol revision at the time of shipment is shown by the last number at the serial number column of the name plate.



(2) Confirmation by using HART configuration tool
Read Subsection 8.8.5.

IMPORTANT

Protocol revision supported by HART configuration tool must be the same or higher than that of the device.

		Protcol revision supported by HART configuration tool	
		5	7
Protocol revision of the device	5	○	○
	7	×	○

○ : Communication OK
× : Communication NG

NOTE

In this User's Manual, HART protocol revision 5 and 7 are described as HART 5 and HART 7 respectively.

NOTE

When the output signal code of the device is "-J", HART protocol revision can be changed. Read Subsection 8.8.5 about the procedure of the revision change of HART 5 and HART 7.

8.2 Device Description (DD) on a HART Configuration Tool and AXR Device Revision

8.2.1 DD Revision and Device Revision

Before using the HART Configuration Tool (such as FieldMate), confirm that the DD (Device Description) of the AXR is installed in the Configuration Tool.

- AXR: HART 5
- Device type: 0x57
- Device Revision: 2
- DD Revision: 2

The DD revisions for AXR and Configuration Tool's can confirm in accordance with the following steps. If the correct DD is not installed in the HART Configuration Tool, download them from the HART official site, otherwise, contact the respective vendors of the Configuration Tool for its upgrade information.

1. Confirmation of the device revision for AXR
   (1) Connect the Configuration Tool to the AXR. The device revision can be checked as follows.

DD	Device Setup → Review → Review4 → Fld dev rev

2. Confirmation of the device revision for the HART Configuration Tool
   (1) Turn on the power of the Configuration Tool under the standalone condition.

(2) Confirm the installed DD revision in accordance with the procedure of the Configuration Tool. Read its manual how to confirm it in detail.

8.2.2 Device Type Manager (DTM) and Device Revision

When configure the parameters using FieldMate, use the DTM (Device Type Manager) reading the following table.

MODEL	DTM Name	Device Type	Device Revision
AXR	AXR V2.1	AXR (0x57)	2

The device revision can be checked as follows.

DTM	Configuration → HART → Fld dev rev

8.3 Interconnection between AXR and HART Configuration Tool

The HART Configuration Tool can interface with the AXR from the control room, the AXR site, or any other wiring termination point in the loop, provided there is a minimum load resistance of 250 Ω between the connection and the receiving instrument. To communicate, it must be connected in parallel with the AXR, and the connections must be non-polarized. Figure 8.3 illustrates the wiring connections for a direct interface at the AXR site. The HART Configuration Tool can be used for remote access from any terminal strip as well.

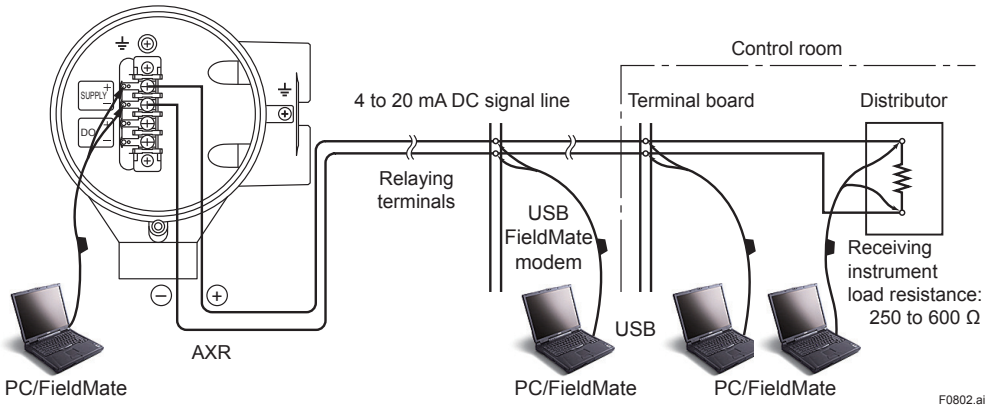


Figure 8.3 Connecting the HART Communicator

WARNING

Be sure to set parameters as “Protect” on the write protect function after finish of parameter setting work.
Read Chapter 6 Menu P and Subsection 11.3.2, how to use the write protect function in detail.

IMPORTANT

If the power of flowmeter is turned off within 30 seconds after parameters have been set, these settings will be canceled. Accordingly, please keep the power on for at least 30 seconds after setting parameters.

NOTE

Before updating any setting, remember to always check the parameter content you want to change as described in Chapter 6.

NOTE

In case of HART Configuration, the parameters are displayed in English only.
Even if the language with the exception of English is selected at “Language” setting display, the parameters are displayed in English upon HART Configuration Tool.

8.4 Basic Setup

■ Confirmation and Change of Tag and Device Information

The tag number and device information can be checked as follows:

- The location for the tag number and device information

(DD)

Tag	Device Setup → Detailed Setup → Basic setup → **Tag**
Descriptor	Device Setup → Detailed Setup → Device information → Field device information → **Descriptor**
Message	Device Setup → Detailed Setup → Device information → Field device information → **Message**
Date	Device Setup → Detailed Setup → Device information → Field device information → **Date**

(DTM)

Tag	Easy Setup → Tag or Configuration → HART → **Tag**
Descriptor	Configuration → Device infomation 1 → **Descriptor**
Message	Configuration → Device infomation 1 → **Message**
Date	Configuration → Device infomation 1 → **Date**

When changing the tag number or device information, enter the information directly within the following limitations.

Item	Number and characters
Tag	8
Descriptor	16
Message	32
Date	2/2/2 (mm/dd/yy) • mm : month • dd : day • yy : year

8.5 Parameters Configuration

The parameter structure of the HART configuration tool is hierarchical.
Read Section 8.9 or Section 8.10, Menu Tree Example for the corresponding parameters.
The menu tree shows a cross-reference of the parameters for HART and BRAIN.
Read Chapter 6 for the functions of parameters.
Note that some display parameters of AXR are different from those of HART configuration tools.

8.6 Data Renewing

There are two methods to load the AXR data from/to HART Configuration Tool --- periodic data renewing and discretionary data renewing. Read Section 8.9 or Section 8.10 menu tree for each corresponding parameter.

(1) Periodic Data Renewing
The data is updated 0.5 to 2 second cycles. The parameter of this type is marked as “D” in “Data Renewing” of Section 8.9 or Section 8.10 menu tree.

(2) Discretionary Data Renewing
The data can be loaded from/to the AXR when the data save is finished to the Configuration Tool. The parameter of this type is marked as “S” in “Data Renewing” of Section 8.9 or Section 8.10 menu tree.

NOTE

The AXR is not able to set parameters via its display unit during a communication of the HART Configuration Tool.

8.7 Self-diagnostic Functions

The self-diagnostic function of the AXR is explained in Section 6.5.
The HART configuration tool can be used to run self-diagnostics on a device and check for incorrect data settings.

(1) Using DD

The **Self test** and **Status** commands are available for self-diagnostics. When **Self test** is run, the display unit shows an error code and alarm message if the device detects any illegal parameter settings or functional faults.

- Procedure to call up the **Self test** display

Device Setup → Diagnosis/Service → Test/Status → Self test

If no error is detected, “Self test OK” is displayed on the configuration tool.
If the specific diagnostic item is known for the check, you can directly call up the item by using the **Status** command.
The status is categorized from 1 to 7. For details, read the table at the end of Section 8.9.
Show an example below to confirm the status of Status group 1.

- Procedure to call up the **Status** display

Device Setup → Diagnosis/Service → Test/Status → Status → Status group 1

If no error is detected, “Off” is displayed on the configuration tool.
If there is an error, “On” is displayed on the configuration tool, and a countermeasure for that error is necessary.

Example of display:	Span > 10 m/s	On
	Span < 0.3 m/s	Off
	TTL > 10000 p/s	Off
	TTL < 0.0001 p/s	Off
	4-20 Lmt Err	Off

(2) Using DTM

The **Device Status** commands are used for self-diagnostics. When **Device Status** is run, the display unit shows an error code and alarm message if the device detects any illegal parameter settings or functional faults.

- Procedure to call up the **Device Status** display

Device Status

If no error is detected, “Status: Normal” is displayed on the configuration tool.
If the specific diagnostic item is known for the check, you can directly call up the item by using the Diagnostic List in the Device Status display.
The Diagnostic List is categorized to Device Status, Hardware Failure, Transducer Status, Diag Status, and Configuration.
If no error is detected, color symbol which shows Normal State is displayed on top of the error message.
If color symbol which shows Error State is displayed, there is an error and a countermeasure for that error is necessary.

8.8 HART Specific Functions

8.8.1 Trim Analog Output

This function is used to adjust the analog output at 4 mA and 20 mA with the D/A trim or Scaled D/A trim.

(1) D/A trim
Connect a calibration digital ammeter, and then enter the read value of the ammeter for each output of AXR.

- Procedure to call up the **D/A trim** display

DD	Device Setup → Diagnosis/Service → Adjustment → D/A trim
DTM	Calibration → D/A trim

(2) Scaled D/A trim
The output is adjusted by using a voltmeter or other types of meters with 0 to 100% scale.
Example using a voltmeter:
4 mA DC → 1 V
20 mA DC → 5 V
Connect this meter, and enter the read value of the meter for each output of AXR.

- Procedure to call up the **Scaled D/A trim** display

DD	Device Setup → Diagnosis/Service → Calibration → Analog output trim →Scaled D/A trim
DTM	Calibration → Scaled D/A trim

(3) Clear D/A trim
When output is reset to the original value, clear the D/A trim.

- Procedure to call up the **Clear D/A trim** display

DD	Device Setup → Diagnosis/Service → Adjustment → Clear D/A trim
DTM	Calibration → Clear D/A trim

CAUTION

The output adjustment function can match the 4mA and 20mA output to the reference meter such as a voltmeter. In the output adjustment, it is necessary to use the calibrated voltmeter and resistance.

8.8.2 Fixed Current Output

This feature can be used to output a fixed current for loop checks.

● **In the case of using DD**

Call up the test output parameter (Loop test) and select the output signal.

• Procedure to call up the display

DD	Device Setup → Diagnosis/Service → Test → Loop test →
Display Item	Contents
4mA	Output a 4mA DC signal
20mA	Output a 20mA DC signal
Other	Set a desired output signal value
End	Exit

● **In the case of using DTM**

Call up the test output parameter (Loop test) and select either manual test or auto test, and set the current value.

• Procedure to call up the display

DTM	Diag and Service → Test → Loop test →
Display Item	Contents
Manual Test	Set the current value or % value at **Test output value**, then click the Start button.
Auto Test	Set the interval and rate of change of current output at **Auto Test Setting**, then click the Start button.

8.8.3 Burst Mode

AXR continuously sends the data via HART communication when the burst mode is set on (any one of PV, % range/current, or process vars/crnt). The data is sent intermittently as a digital signal at 3 times a second.
The burst mode is set as follows.

(1) Setting the data to be sent

• Procedure to call up the display

DD	Device Setup → Detailed setup → HART output → Burst option
DTM	Configuration → HART → Burst option

Select the type of data to be sent from the following options:

- Instantaneous flow rate (PV)
- Output in % and current output (% range/current)
- Instantaneous flow rate, totalization value* and current output (Process vars/crnt)

* "Totl," "Reverse Totl" or "Dif Totl"

(2) Setting the burst mode

• Procedure to call up the display

DD	Device Setup → Detailed setup → HART output → Burst mode
DTM	Configuration → HART → Burst mode

Then, select "**On**" at the menu to start the burst mode.
To release from the burst mode, call up the burst mode display, and set to "**Off**."
The default setting is "**Off**."

8.8.4 Multidrop Mode

When set in the multidrop mode, up to 15 field devices in a single communications line can be connected. To activate multidrop communication, the address of the field devices must be set to a number from 1 to 15. This deactivates the 4 to 20 mA analog output, fixing it to 4 mA. Burn out is also disabled.
Note that the accuracy for multidrop mode is different from that for other modes. Read Chapter 12.
The multidrop mode is set as follows.

(1) Setting the polling address

• Procedure to call up the display

DD (HART 5)	Device Setup → Detailed setup → HART output →
DTM (HART 5)	Configuration → HART → Poll addr
→ Poll addr	Enter the number from 1 to 15

(2) Activating the multidrop mode
About the procedure to call up the **Polling** display, read the User's Manual of each configuration tool.

NOTE

When the same polling address is assigned for two or more field devices in multidrop mode, communication with these field devices is disabled.

(3) Communication when set in the multidrop mode
1. The HART configuration tool searches a field device that is set in the multidrop mode when the HART configuration tool is turned on. When the HART configuration tool is connected to the field device, the polling address and the tag will be displayed.
2. Select the field device, and then communication with it is possible. The communication speed is slow in this case.
3. To communicate with another field device, turn off the power once and then turn it back on, or call up "**Online**" menu, and select "**Online**."
The polling address and the tag will appear. Select the field device.

(4) Release of the multidrop mode
Call up the "**Poll addr**" display, and set the address to "**0**."

8.8.5 Switching HART Protocol Revision

When the output signal code is "-J", HART protocol revision of the device can be selectable from 5 or 7. The HART protocol revision is set and shipped as specified in the order.
To change the HART protocol revision after shipment, follow the procedure shown below.

IMPORTANT

When changing the protocol revision, confirm the items below.
- Protocol revision supported by HART configuration tool must be the same or higher than new protocol revision of the device
- Confirm that the DD or DTM which is suitable to new protocol revision of the device is installed in the configuration tool. (Read Section 8.2 or Section 9.2)

1) Call up the parameter for protocol revision change
- Procedure to call up the **Chg universal rev** display.

DD	Device Setup → Detailed setup → Device information → Field device information → Revision #'s → Chg universal rev
DTM	Configuration → HART → Chg universal rev

2) Activate the "Chg universal rev" method

IMPORTANT

The message is displayed to separate the device from the automatic control loop.
Confirm that the device is separated.

3) Input the new revision number
An input column for new protocol revision number is displayed.
Input the new HART protocol revision number of "5" for HART 5 or "7" for HART 7.
4) Applying the new protocol revision
a. Close the configuration tool
After completion of Chg universal rev method, close the HART configuration tool.

NOTE

When using a FieldMate, close the main display of FieldMate.

b. Restart the device
Turn off the power to the device, and turn it on.

IMPORTANT

New protocol revision is applied only after having performed restart of the transmitter.

5) Confirming the new protocol revision
a. Restart the HART configuration tool

NOTE

When execute the other parameter confirmation or setting change, execute after restart the configuration tool.

b. Confirm the new HART protocol revision number

Call up the **Universal rev** parameter, and confirm that the new HART revision number is displayed.

- Procedure to call up the **Universal rev**. parameter.

DD	Device Setup → Detailed setup → Device information → Field device information → Revision #'s → Universal rev →
DTM	Configuration → HART → Universal rev. →
5	HART protocol revision: 5
7	HART protocol revision: 7

HART protocol revision can also be confirmed on the second line and third line of the device display.

- Procedure to call up the **Display Select**

Second line	DD	Device setup → Detailed setup → Function Set → Display → Display Select2
	DTM	Configuration → Display Set → Display Select2
Third line	DD	Device setup → Detailed setup → Function Set → Display → Display Select3
	DTM	Configuration → Display Set → Display Select3

Protocol Revision	Displayed on AXR screen
HART Protocol Revision 5	HART5
HART Protocol Revision 7	HART7

8.8.6 Other operations for the HART configuration tool

Regarding other operations for the HART configuration tool, read the HART configuration tool operations manual.

8.9 Menu Tree for DD (HART 5)

Root Menu
Device setup
PV % rng
PV AO
PV Span

1 Device Setup	1 Process Variables	PV % rnge	R	A10	D
		PV	R	A20	D
		PV AO	R	A21	D
		Totl	R	A30	D
		Reverse Totl	R	A31	D
		Dif Totl	R	A32	D
	2 Diagnosis/Service	1 Test/Status	1 Status	Status group 1(System alarms)	R		D
				Status group 2(Process alarms)	R	Read	D
				Status group 3(Process alarms)	R	Section 6.5	D
				Status group 4(Setting alarms)	R	“Alarm	D
				Status group 5(Setting alarms)	R	Functions”	D
				Status group 6(Setting alarms)	R		D
				Status group 7(Warnings)	R		D
			2 Self test		R	–	–
			3 Device reset		W	–	–
		2 Adjustment	1 Auto Zero Execute		W	–	–
			2 Auto Zero Exec		R	B50/M10	D
			3 Auto Zero Time		W	M11	S
			4 Flow Zero(IEL)		W	M12	S
			5 Flow Zero(IEM)		W	M13	S
			6 Flow Zero(IEH)		W	M14	S
			7 Flow Span Adjust		W	M15	S
			8 Adjust 4mA		R	M20	D
			9 Adjust 20mA		R	M21	D
			D/A trim		W	–	–
			Scaled D/A trim		W	–	–
			Clear D/A trim		W	–	–
		3 Test	1 Loop test		W	–	–
			2 Test Mode		W	N10	S
			3 Test Output Value		W	N11	S
			4 Test DO		W	N12	S
			5 Test Time		W	N15	S
			6 Test Iex		W	N20	S
			7 Select Flow Tube		W	N30	S
			8 Flow Average Exec		W	–	–
			9 Average Exec		W	N40	D
			Average Time		W	N41	S
			Average Flow		R	N42	D
		4 Diagnosis	1 Adh Check Execute		W	–	–
			2 Adhesion Check		R	K10	D
			3 Adhesion Status		R	K11	D
			4 Adh Measure Value		R	K12	D
			5 Adhesion Level1		W	K13	S
			6 Adhesion Level2		W	K14	S
			7 Adhesion Level3		W	K15	S
			8 Adhesion Level4		W	K16	S
			9 Adh Check Cycle		W	K17	S
			Empty Check		W	K19	S
			Empty Status		R	K20	D
			DC Voltage A		R	K21	D
			DC Voltage B		R	K22	D
			Empty Level		W	K23	S
	3 Easy Setup	1 Language			W	B10/H30	S
		2 PV Damping			W	B20/C11	S
		3 Base Flow Unit			W	B21/C40	S
		4 Base Time Unit			W	B22/C41	S
		5 PV Span			W	B23/C42	S
		6 Flow Decimal Pnt			W	B24/C43	S
		7 Total Unit			W	B30/D10	S
		8 Total Scale			W	B31/D11	S
		9 Pulse Unit			W	B32/E10	S
		Pulse Scale			W	B33/E11	S
		Display Select1			W	B40/H10	S
		Display Select2			W	B41/H11	S
		Display Select3			W	B42/H12	S
		Auto Zero Execute			W	–	–

(continued on next page)

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				Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
4 Detailed Setup	1 Basic Setup	1 Tag		W	C10	S
		2 PV Damping		W	B20/C11	S
		3 Low MF(IEL)		W	C20	S
		4 High MF(IEL)		W	C21	S
		5 Low MF(IEM)		W	C22	S
		6 High MF(IEM)		W	C23	S
		7 Low MF(IEH)		W	C24	S
		8 High MF(IEH)		W	C25	S
		9 Nominal Size Unit		W	C30	S
		Nominal Size		W	C31	S
		Base Flow Unit		W	B21/C40	S
		Base Time Unit		W	B22/C41	S
		PV Span		W	B23/C42	S
		Flow Decimal Pnt		W	B24/C43	S
		Velocity Check		R	C44	D
		Density Unit		W	C45	S
		Mass Flow Density		W	C46	S
		User Span Select		W	C50	S
		Flow User Unit		W	C51	S
		Flow User Span		W	C52	S
	2 Total Set	1 Total Unit		W	B30/D10	S
		2 Total Scale		W	B31/D11	S
		3 Total Decimal Pnt		W	D12	S
		4 Total Low Cut		W	D13	S
		5 Total Rate Check		R	D14	D
		6 Total Execution		W	D20	S
		7 Ttl Set Val Lower		W	D21	S
		8 Ttl Set Val Upper		W	D22	S
		9 Ttl Switch Lower		W	D23	S
		Ttl Switch Upper		W	D24	S
		Ttl User Select		W	D30	S
		Ttl User Unit		W	D31	S
	3 Pulse Set	1 Pulse Unit		W	B32/E10	S
		2 Pulse Scale		W	B33/E11	S
		3 Pulse Width		W	E12	S
		4 Pulse Low Cut		W	E13	S
		5 Pulse Rate Check		R	E14	D
	4 Function Set	1 DO Function Set	1 DO Function	W	F10	S
			2 DO Active Mode	W	F11	S
			3 Forward Span2	W	F20	S
			4 Reverse Span	W	F21	S
			5 Auto Range Hys	W	F30	S
			6 Bi Direction Hys	W	F31	S
		2 Alarm Set	1 Low Alarm	W	G10	S
			2 High Alarm	W	G11	S
			3 Hi/Lo Alarm Hys	W	G12	S
			4 4-20 System Alm	R	G20	D
			5 4-20 Process Alm	W	G25	S
			6 Alarm-Signal Over	W	G26	S
			7 Alarm-Empty Pipe	W	G27	S
			8 Alarm-High/Low	W	G28	S
			9 Alarm-Adhesion	W	G29	S
			4-20 Setting Alm	W	G30	S
			Alarm-Setting	W	G31	S
			Alarm Display	W	G35	S

(continued on next page)

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					Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
4 Detailed setup	4 Function Set	3 Alarm Record	1 Operation Time		R	G40	D
			2 Alm Record1		R	G41	D
			3 Alm Record Time1		R	G42	D
			4 Alm Record2		R	G43	D
			5 Alm Record Time2		R	G44	D
			6 Alm Record3		R	G45	D
			7 Alm Record Time3		R	G46	D
			8 Alm Record4		R	G47	D
			9 Alm Record Time4		R	G48	D
		4 Display Set	1 Display Select1		W	B40/H10	S
			2 Display Select2		W	B41/H11	S
			3 Display Select3		W	B42/H12	S
			4 Display Cycle		W	H20	S
			5 Language		W	B10/H30	S
			6 LCD Contrast		W	H40	S
		5 Aux	1 4-20mA Low Cut		W	J10	S
			2 4-20mA Low Limit		W	J11	S
			3 4-20mA High Limit		W	J12	S
			4 Pls Special Mode		W	J15	S
			5 Flow Direction		W	J20	S
			6 Rate Limit		W	J21	S
			7 Dead Time		W	J22	S
			8 Pulsing Flow		W	J23	S
			9 T/P Damping Select		W	J25	S
			Basic Frequency		W	J30	S
			Memo1		W	J35	S
			Memo2		W	J36	S
			Memo3		W	J37	S
			Software Rev No		R	J50	S
	5 HART Output	1 Poll addr			W	–	S
		2 Num req preams			R	–	S
		3 Burst mode			W	–	S
		4 Burst option			W	–	S
	6 Device Information	1 Field Device Information	1 Manufacturer		R	–	S
			2 Tag		W	C10	S
			3 Descriptor		W	–	S
			4 Message		W	–	S
			5 Date		W	–	S
			6 Dev id		R	–	S
			7 MS Code1		W	J40	S
			8 MS Code2		W	J41	S
			9 MS Code3		W	J42	S
			MS Code4		W	J43	S
			MS Code5		W	J44	S
			MS Code6		W	J45	S
			Write Protect Menu	Write protect	R	P20	D
				Enable Wrt 10min	W	–	–
				New Password	W	–	–
				Software Seal	R	P23	D
			Revision #'s	Universal rev	R	–	S
				Fld dev rev	R	–	S
				Software rev	R	–	S
				Next universal rev	R	–	S
				Chg universal rev	W	–	–
		2 Model Specification	1 Use		W	–	S
			2 Lining		W	–	S
			3 Electrode Material		W	–	S
			4 Electrode Struct		W	–	S
			5 Grounding Ring		W	–	S
			6 Process Connect		W	–	S
			7 Lay Length		W	–	S
			8 Electrical Conn		W	–	S
			9 Sensor Serial No		W	–	S

(continued on next page)

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			Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
5 Review	1 Review1	(*3)			–
	2 Review2				–
	3 Review3				–
	4 Review4				–
Hot Key Configration	1 PV Span		W	B23/C42	S
	2 Write Protect Menu	1 Write protect	R	P20	D
		2 Enable Wrt 10min	W	–	–
		3 New Password	W	–	–
		4 Software Seal	R	P23	D

*1: Data Renewing
D: Periodic Data Renewing
S: Discretionary Data Renewing
–: Others (Method, etc...)
*2: Parameter of BRAIN protocol
–: HART only
*3: Review1 to 4
Read the table at the end of Section 8.9.

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Review1
Tag
PV Damping
Low MF(IEL)
High MF(IEL)
Low MF(IEM)
High MF(IEM)
Low MF(IEH)
High MF(IEH)
Nominal Size Unit
Nominal Size
Base Flow Unit
Base Time Unit
PV Span
Flow Decimal Pnt
Velocity Check
Density Unit
Mass Flow Density
User Span Select
Flow User Unit
Flow User Span
Total Unit
Total Scale
Total Decimal Pnt
Total Low Cut
Total Rate Check
Total Execution
Ttl Set Val Lower
Ttl Set Val Upper
Ttl Switch Lower
Ttl Switch Upper
Ttl User Select
Ttl User Unit
Pulse Unit
Pulse Scale
Pulse Width
Pulse Low Cut
Pulse Rate Check

Review2
DO Function
DO Active Mode
Forward Span2
Reverse Span
Auto Range Hys
Bi Direction Hys
Low Alarm
High Alarm
Hi/Lo Alarm Hys
4-20 System Alm
4-20 Process Alm
Alarm-Signal Over
Alarm-Empty Pipe
Alarm-High/Low
Alarm-Adhesion
4-20 Setting Alm
Alarm-Setting
Alarm Display
Operation Time
Alarm Record1
Alarm Record Time1
Alarm Record2
Alarm Record Time2
Alarm Record3
Alarm Record Time3
Alarm Record4
Alarm Record Time4

Review3
Display Select1
Display Select2
Display Select3
Display Cycle
Language
LCD Contrast
4-20mA Low Cut
4-20mA Low Limit
4-20mA High Limit
Pls Special Mode
Flow Direction
Rate Limit
Dead Time
Pulsing Flow
T/P Damping Select
Basic Frequency
Memo1
Memo2
Memo3
MS Code1
MS Code2
MS Code3
MS Code4
MS Code5
MS Code6
Software Rev No
Use
Lining
Electrode Material
Electrode Struct
Grounding Ring
Process Conn
Lay Length
Electrical Connect
Sensor Serial No
Adhesion Check
Adhesion Status
Adh Measure Value
Adhesion Level1
Adhesion Level2
Adhesion Level3
Adhesion Level4
Adh Check Cycle
Empty Check
Empty Status
DC Voltage A
DC Voltage B
Empty Level

Review4
Poll addr
Num req preams
Burst mode
Burst option
Manufacturer
Tag
Descriptor
Message
Date
Dev id
Write protect
Universal rev
Fld dev rev
Software rev

Status group 1 (*1)
10: uP Fault
11: EEPROM Fault
12: Sub uP Fault
13: EX Pwr Fault
14: A/D(S) Fault
15: A/D(I) Fault
16: Analog Fault
17: Coil Open

Status group 2 (*1)
18: Coil Short
19: Excite Error
20: Pulse Error
21: EEPROM Dflt

Status group 3 (*1)
30: Sig Overflow
31: Empty Pipe
32: H/L Alm
33: Adhesion Alm

Status group 4 (*1)
50: Span > 10m/s
51: Span < 0.3m/s
52: TTL>10000p/s
53: TTL<0.0001p/s
54: 4-20 Lmt Err
55: Multi Rng Err
56: H/L Set Err
57: Dens Set Err

Status group 5 (*1)
60: PLS>10000p/s
61: PLS > 5000p/s
62: PLS > 1000p/s
63: PLS > 500p/s
64: PLS > 25p/s
65: PLS > 15p/s
66: PLS > 10p/s
67: PLS > 5p/s

Status group 6 (*1)
68: PLS > 2.5p/s
69: PLS > 1.5p/s
70: PLS > 1.0p/s
71: PLS > 0.5p/s
72: PLS > 0.25p/s
73: PLS<0.0001p/s
74: Size Set Err
75: Adh Set Err

Status group 7 (*1)
80: Adhesion Wng
82: Auto Zero Wng
83: Fix Cur Wng
84: Disp Over Wng
91: Disp Cur Wng

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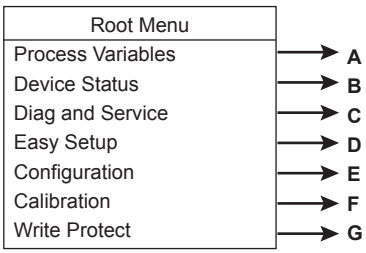
*1: For the detail of alarms in Status group 1 to 7, read Section 6.5.

8.10 Menu Tree for DTM (HART 5)



A

Process Variables	PV	Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
	PV	R	A20	D
	PV % rnge	R	A10	D
	PV AO	R	A21	D
	PV Span	W	B23/C42	D
	PV Damping	W	B20/C11	D
	Totl	R	A30	D
	Reverse Totl	R	A31	D
	Dif Totl	R	A32	D

B

Device Status	Process Variables	
		PV
		PV % rnge
		Totl
		Reverse Totl
		Dif Totl
	Diagnostic List	
		Device Status
		Hardware Failure
		Transducer Status
		Configuration

C

			Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
Diag and Service	Test	Loop test	W	–	–
		Test Mode	W	N10	S
		Test Output Value	W	N11	S
		Test DO	W	N12	S
		Test auto release time	W	N15	S
		Test Iex	W	N20	S
		Select Flow Tube	W	N30	S
		Flow Average Exec	W	N40/N41	–
		Average Flow	R	N42	D
		Device reset	W	–	–
	Alarm Set	Low Alarm	W	G10	S
		High Alarm	W	G11	S
		Hi/Lo Alarm Hys	W	G12	S
		4-20 System Alm	R	G20	D
		4-20 Process Alm	W	G25	S
		Alm-Signal Over	W	G26	S
		Alm-Empty Pipe	W	G27	S
		Alm-High/Low	W	G28	S
		Alm-Adhesion	W	G29	S
		4-20 Setting Alm	W	G30	S
		Alarm-Setting	W	G31	S
		Alarm Display	W	G35	S
	Alarm Record	Operation Time	R	G40	D
		Alm Record1	R	G41	D
		Alm Record Time1	R	G42	D
		Alm Record2	R	G43	D
		Alm Record Time2	R	G44	D
		Alm Record3	R	G45	D
		Alm Record Time3	R	G46	D
		Alm Record4	R	G47	D
		Alm Record Time4	R	G48	D
	Diagnosis	Adh Check Execute	W	–	–
		Adhesion Check	R	K10	D
		Adhesion Status	R	K11	D
		Adh Measure Value	R	K12	D
		Adhesion Level1	W	K13	S
		Adhesion Level2	W	K14	S
		Adhesion Level3	W	K15	S
		Adhesion Level4	W	K16	S
		Adh Check Cycle	W	K17	S
		Empty Check	W	K19	S
		Empty Status	R	K20	D
		DC Voltage A	R	K21	D
		DC Voltage B	R	K22	D
		Empty Level	W	K23	S

D

		Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
Easy Setup	Tag	W	C10	S
	Language	W	B10/H30	S
	PV Damping	W	B20/C11	S
	Base Flow Unit	W	B21/C40	S
	Base Time Unit	W	B22/C41	S
	PV Span	W	B23/C42	S
	Flow Decimal Pnt	W	B24/C43	S
	Total Unit	W	B30/D10	S
	Total Scale	W	B31/D11	S
	Pulse Unit	W	B32/E10	S
	Pulse Scale	W	B33/E11	S
	Display Select1	W	B40/H10	S
	Display Select2	W	B41/H11	S
	Display Select3	W	B42/H12	S
	Auto Zero Exec	W	–	–

E

			Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
Configuration	Characterize Meter	Low MF(IEL)	W	C20	S
		High MF(IEL)	W	C21	S
		Low MF(IEM)	W	C22	S
		High MF(IEM)	W	C23	S
		Low MF(IEH)	W	C24	S
		High MF(IEH)	W	C25	S
		Nominal Size Unit	W	C30	S
		Nominal Size	W	C31	S
	Flow Condition	PV Damping	W	B20/C11	S
		Base Flow Unit	W	B21/C40	S
		Base Time Unit	W	B22/C41	S
		PV Span	W	B23/C42	S
		Flow Decimal Pnt	W	B24/C43	S
		User Span Select	W	C50	S
		Flow User Unit	W	C51	S
		Flow User Span	W	C52	S
		Velocity Check	R	C44	D
		Density Unit	W	C45	S
		Mass Flow Density	W	C46	S
	Total Set	Total Unit	W	B30/D10	S
		Total Scale	W	B31/D11	S
		Total Decimal Pnt	W	D12	S
		Total Low Cut	W	D13	S
		Total Rate Check	R	D14	D
		Total Execution	W	D20	S
		Ttl Set Val Lower	W	D21	S
		Ttl Set Val Upper	W	D22	S
		Ttl Switch Lower	W	D23	S
		Ttl Switch Upper	W	D24	S
		Ttl User Select	W	D30	S
		Ttl User Unit	W	D31	S
	Pulse Set	Pulse Unit	W	B32/E10	S
		Pulse Scale	W	B33/E11	S
		Pulse Width	W	E12	S
		Pulse Low Cut	W	E13	S
		Pulse Rate Check	R	E14	D
	DO Function Set	DO Function	W	F10	S
		DO Active Mode	W	F11	S
		Forward Span2	W	F20	S
		Reverse Span	W	F21	S
		Auto Range Hys	W	F30	S
		Bi Direction Hys	W	F31	S

(continued on next page)

			Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
Configuration	Display Set	Display Select1	W	B40/H10	S
		Display Select2	W	B41/H11	S
		Display Select3	W	B42/H12	S
		Display Cycle	W	H20	S
		Language	W	B10/H30	S
		LCD Contrast	W	H40	S
	Aux	4-20mA Low Cut	W	J10	S
		4-20mA Low Limit	W	J11	S
		4-20mA High Limit	W	J12	S
		Pls Special Mode	W	J15	S
		Flow Direction	W	J20	S
		Rate Limit	W	J21	S
		Dead Time	W	J22	S
		Pulsing Flow	W	J23	S
		T/P Damp Select	W	J25	S
		Basic Frequency	W	J30	S
		Memo 1	W	J35	S
		Memo 2	W	J36	S
		Memo 3	W	J37	S
		Software Rev No	R	J50	S
	Model Specification	Use	W	–	S
		Lining	W	–	S
		Electrode Material	W	–	S
		Electrode Struct	W	–	S
		Grounding Ring	W	–	S
		Process Connect	W	–	S
		Lay Length	W	–	S
		Electrical Conn	W	–	S
		Sensor Serial No	W	–	S
	Device Information	Model	R	–	S
		Manufacturer	R	–	S
		Descriptor	W	–	S
		Message	W	–	S
		Date	W	–	S
		MS Code1	W	J40	S
		MS Code2	W	J41	S
		MS Code3	W	J42	S
		MS Code4	W	J43	S
		MS Code5	W	J44	S
		MS Code6	W	J45	S
		Write protect	R	P20	S
		Software rev	R	J50	S
	HART	Tag	W	C10	S
		Poll addr	W	–	S
		Dev id	R	–	S
		Universal rev	R	–	S
		Fld dev rev	R	–	S
		Next universal rev	R	–	S
		Chg universal rev	W	–	S
		Num req preams	R	–	S
		Physical signl code	R	–	S
		Burst mode	W	–	S
		Burst option	W	–	S

F

		Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
Calibration	Auto Zero Exec	W	–	–
	Auto Zero Exec	R	B50/M10	D
	Auto Zero Time	W	M11	S
	Flow Zero(IEL)	W	M12	S
	Flow Zero(IEM)	W	M13	S
	Flow Zero(IEH)	W	M14	S
	Flow Span Adjust	W	M15	S
	Adjust 4mA	R	–	S
	Adjust 20mA	R	–	S
	D/A trim	W	–	–
	Scaled D/A trim	W	–	–
	Clear D/A trim	W	–	–

G

		Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
Write Protect	Write protect	R	P20	D
	Enable Wrt 10min	W	P21	–
	New Password	W	P22	–

*1: Data Renewing
D: Periodic Data Renewing
S: Discretionary Data Renewing
–: Others (Method, etc...)
*2: Parameter of BRAIN protocol
–: HART only

9. OPERATION VIA HART CONFIGURATION TOOL (HART 7)

This Chapter describes the device (AXR) operation procedures using a HART configuration Tool (such as FieldMate).

NOTE

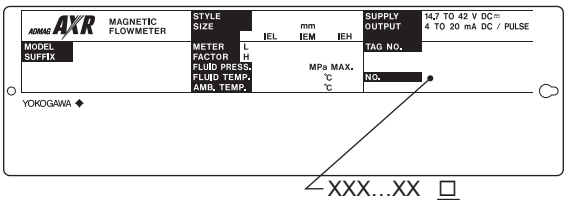
For more details regarding the operations for the HART configuration tool, read the HART configuration tool operations manual.

Note: HART is a registered trademark of the FieldComm Group.

9.1 HART Protocol Revision

For the models with the output signal code "-J", HART protocol revision 5 or 7 is selectable. The protocol revision is set as specified in the order. How to confirm protocol revision is shown below. There are two ways to confirm the protocol revision set to the transmitter.

(1) Confirmation by the name plate
The HART protocol revision at the time of shipment is shown by the last number at the serial number column of the name plate.



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(2) Confirmation by using HART configuration tool
Follow the procedure below.
1) Connect the configuration tool to the device.
2) Call up "Review4" display.
[Root Menu] → Review → Review4
3) HART protocol revision is displayed on the "Universal rev" column.

IMPORTANT

Protocol revision supported by HART configuration tool must be the same or higher than that of the device.

		Protcol revision supported by HART configuration tool	
		5	7
Protocol revision of the device	5	○	○
	7	×	○

○ : Communication OK
× : Communication NG

NOTE

- In this User's Manual, HART protocol revision 5 and 7 are described as HART 5 and HART 7 respectively.
- HART 7 communication is supported by FieldMate R2.04 or later.

NOTE

When the output signal code of the device is "-J", HART protocol revision can be changed. Read Subsection 9.8.5 about the procedure of the revision change of HART 5 and HART 7.

9.2 Device Description (DD) on a HART Configuration Tool and AXR Device Revision

9.2.1 DD Revision and Device Revision

Before using the HART Configuration Tool (such as FieldMate), confirm that the DD (Device Description) of the AXR is installed in the Configuration Tool before using.

- AXR: HART 7
- Device type: 0x3757
- Device Revision: 10
- DD Revision: 1

The DD revisions for AXR and Configuration Tool's can confirm in accordance with the following steps. If the correct DD is not installed in the HART

Configuration Tool, download them from the HART official site, otherwise, contact the respective vendors of the Configuration Tool for its upgrade information.

1. Confirmation of the device revision for AXR
   Connect the Configuration Tool to the AXR.
   The device revision can be checked as follows.

[Root Menu] → Review → Review4 → Fld dev rev

2. Confirmation of the device revision for the HART Configuration Tool
   (1) Turn on the power of the Configuration Tool under the standalone condition.
   (2) Confirm the installed DD revision in accordance with the procedure of the Configuration Tool. Read its manual how to confirm it in detail.

9.2.2 Device Type Manager (DTM) and Device Revision

When configure the parameters using FieldMate, use the DTM (Device Type Manager) reading the following table.

MODEL	DTM Name	Device Type	Device Revision
AXR	AXR HART 7 DTM	AXR (0x3757)	10

The device revision can be checked as follows.

[Root Menu] → Review → Review4 → Fld dev rev

9.3 Interconnection between AXR and HART Configuration Tool

The HART Configuration Tool can interface with the AXR from the control room, the AXR site, or any other wiring termination point in the loop, provided there is a minimum load resistance of 250 Ω between the connection and the receiving instrument. To communicate, it must be connected in parallel with the AXR, and the connections must be non-polarized. Figure 9.3 illustrates the wiring connections for a direct interface at the AXR site. The HART Configuration Tool can be used for remote access from any terminal strip as well.

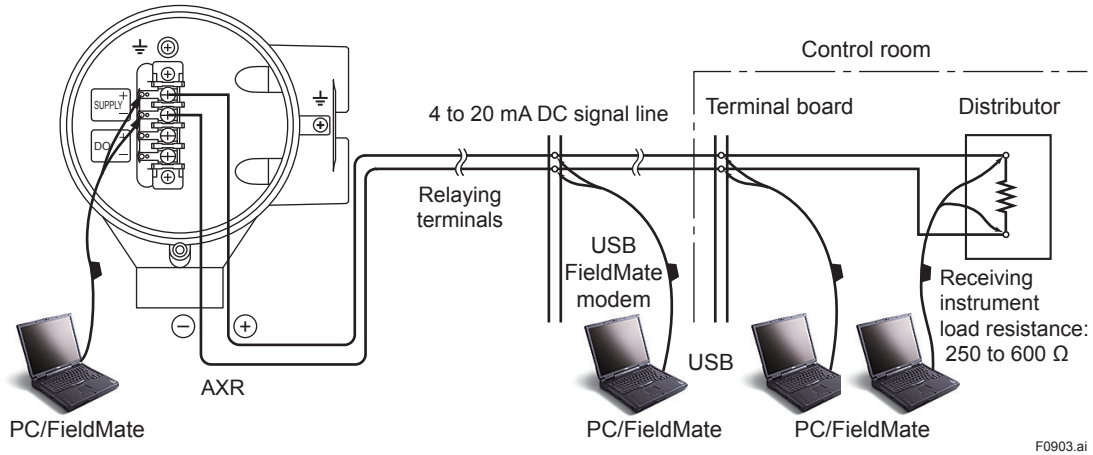


Figure 9.3 Connecting the HART Communicator

WARNING

Be sure to set parameters as “Protect” on the write protect function after finish of parameter setting work.
Read Chapter 6 Menu P and Subsection 11.3.2, how to use the write protect function in detail.

IMPORTANT

If the power of flowmeter is turned off within 30 seconds after parameters have been set, these settings will be canceled. Accordingly, please keep the power on for at least 30 seconds after setting parameters.

NOTE

Before updating any setting, remember to always check the parameter content you want to change as described in Chapter 6.

NOTE

In case of HART Configuration, the parameters are displayed in English only.
Even if the language with the exception of English is selected at “Language” setting display, the parameters are displayed in English upon HART Configuration Tool.

9.4 Basic Setup

■ Confirmation and Chage of Tag and Device Information

The tag number and device information can be checked as follows:

- The location for the tag number and device information

Tag	**[Root Menu]** → Detailed Setup → Basic setup → **Tag**
Long tag	**[Root Menu]** → Detailed Setup → Basic setup → **Long tag**
Descriptor	**[Root Menu]** → Detailed Setup → Device info → Field device information → **Descriptor**
Message	**[Root Menu]** → Detailed Setup → Device information → Field device information → **Message**
Date	**[Root Menu]** → Detailed Setup → Device info → Field device information → **Date**

When changing the tag number or device information, enter the information directly within the following limitations.

Item	Limitations
Tag	Up to 8 characters or numbers*1
Long tag	Up to 32 characters or numbers*2
Descriptor	Up to 16 characters or numbers*1
Message	Up to 32 characters or numbers*1
Date	mm/dd/yyyy (DD) yyyy/mm/dd (DTM) - mm: month (2 digits) - dd: days (2 digits) - yyyy: years (4 digits)

9.5 Parameters Configuration

The parameter structure of the HART configuration tool is hierarchical.
Read Section 9.9, Menu Tree Example for the corresponding parameters. The menu tree shows a cross-reference of the parameters for HART and BRAIN.
Read Chapter 6 for the functions of parameters.
Note that some display parameters of AXR are different from those of HART configuration tools.

9.6 Data Renewing

There are two methods to load the AXR data from/to HART Configuration Tool --- periodic data renewing and discretionary data renewing. Read Section 9.9 menu tree for each corresponding parameter.

(1) Periodic Data Renewing
The data is updated 0.5 to 2 second cycles. The parameter of this type is marked as “D” in “Data Renewing” of Section 9.9 menu tree.

(2) Discretionary Data Renewing
The data can be loaded from/to the AXR when the data save is finished to the Configuration Tool. The parameter of this type is marked as “S” in “Data Renewing” of Section 9.9 menu tree.

NOTE

The AXR is not able to set parameters via its display unit during a communication of the HART Configuration Tool.

9.7 Self-diagnostic Functions

The HART configuration tool can be used to run self-diagnostics on a device and check for incorrect data settings.

(1) Using DD and DTM

The **Self test** and **Status** commands are available for self-diagnostics. When **Self test** is run, the display unit shows an error code and alarm message if the device detects any illegal parameter settings or functional faults.

- Procedure to call up the **Self test** display

[Root Menu] → Diagnosis/Service → Test/Status → Self test

If no error is detected, “Self test OK” is displayed on the configuration tool.
If the specific diagnostic item is known for the check, you can directly call up the item by using the **Status** command.
The status is categorized from 1 to 7. Read the table at the end of Section 9.9.
Show an example below to confirm the status of Status group 1.

- Procedure to call up the **Status** display

[Root Menu] → Diagnosis/Service → Test/Status → Status → Status group 1

If no error is detected, “Off” is displayed on the configuration tool.
If there is an error, “On” is displayed on the configuration tool, and a countermeasure for that error is necessary.

Example of display:	Span > 10 m/s	On
	Span < 0.3 m/s	Off
	TTL > 10000 p/s	Off
	TTL < 0.0001 p/s	Off
	4-20 Lmt Err	Off

9.8 HART Specific Functions

9.8.1 Test Output, Simulation, and Squawk

NOTE

Fixed current output, Flow Simulation Mode, and Device Variable Simulation Function continue for a given holding time, then is released automatically. Even if the HART configuration tool power supply is turned off or the communication cable is disconnected, the test output will continue for that time.
The holding time can be selected from 10 min, 30 min*, 60 min, 3 hour, 6 hour or 12 hour.
*: Default value.

- Procedure to call up the display

DD DTM	**[Root Menu]** → Diagnosis/Service → Test → Test Time

(1) Fixed current output

This feature can be used to output a fixed current for loop checks.
Call up the test output parameter (Loop test) and select the output signal.

- Procedure to call up the display

DD DTM	**[Root Menu]** → Diagnosis/Service → Test → Loop test →
Display Item	Contents
4mA	Output a 4mA DC signal
20mA	Output a 20mA DC signal
Other	Set a desired output signal value
End	Exit

(2) Device Variable Simulation Function

Using the simulation function, the output signal can be confirmed by setting any value and status to the selected device variable.
Call up the parameter and follow the message shown.
After completing the step 5, the simulation starts.
The indicator shows output and warning (93: Dev Sim Wng).

- Procedure of device variable simulation

Step 1	Call up the parameter	**[Root Menu]** → Diagnosis/ Service → Test → Simulate
2	Selection of Device Variable	Select one parameter from the list below Off PV (Instantanous flow rate) SV (Forward totalization value) TV (Reverse totalization value) QV (Differential totalization value) % Range (% in output) Loop Current (current output)
3	Setting of Value	Input the simulate value
4	Setting of Data quality	Select one parameter from the list below Bad Poor accuracy Manual / Fixed Good
5	Setting of Limit status	Select one parameter from the list below Not limited Low limited High limited Constant

NOTE

- The total is accumulated from the instantanous flow rate. Therefore, the total depends on the instantanous flow rate.
- The total simulation is only applied for LCD display and communication output and does not affect the totalization value.
- The simulations for flow rate are reflected to the output. Accordingly, the loop current, LCD display, and communication output are directly corresponded to the simulate value. The alarm output is also available according to the simulate value.

(3) Squawk

This feature can be used to identify the communicating device by remotely causing LCD to display the particular pattern as shown in the Figure.
"SQUAWK" continues for approximately 60 seconds, then is released automatically.

- Procedure to call up the **Squawk** display

[Root Menu] → Diagnosis/Service → Test → Squawk → Squawk

9.8.2 Trim Analog Output

This function is used to adjust the analog output at 4 mA and 20 mA with the D/A trim.

(1) D/A trim
Connect a calibration digital ammeter, and then enter the read value of the ammeter for each output of AXR.

- Procedure to call up the **D/A trim** display

[Root Menu] Diagnosis/Service → Adjustment → D/A trim

(2) Clear D/A trim
When output is reset to the original value, clear the D/A trim.

- Procedure to call up the **Clear D/A trim** display

[Root Menu] Diagnosis/Service → Adjustment → Clear D/A trim

CAUTION

The output adjustment function can match the 4mA and 20mA output to the reference meter such as a voltmeter. In the output adjustment, it is necessary to use the calibrated voltmeter and resistance.

9.8.3 Burst Mode

When the **Burst mode** is enabled, the transmitter continuously sends up to three data listed in Table 9.8.
Read (1) for details.

When the **Burst mode** is set to "Wired HART Enabled", transmitter continuously sends alarm signal also.
Read (3) for detail.

When changing the setting of **Burst mode**, set "Off" to the **Burst mode**.
Default setting is "Off".

(1) Burst message

The device can transmit three burst messages at the maximum.
The parameters for **Burst Message** are as follows.

- Burst Command
- Update Period and Max Update Period
- Burst Msg Trigger Mode

Table 9.8 Burst parameters

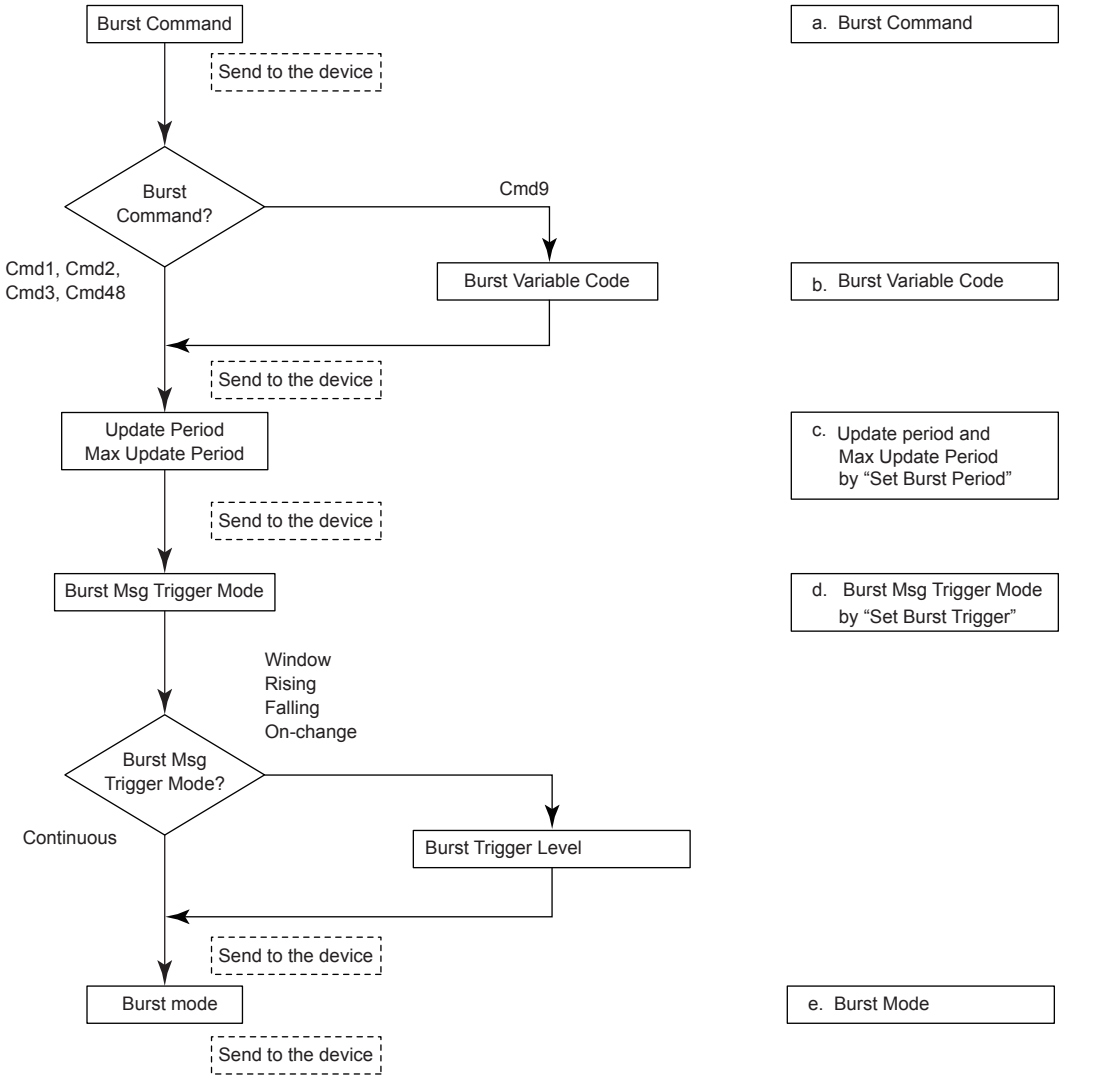
Command parameter	Burst Command	Burst Msg Trigger Mode	Burst Trigger Source	Burst Trigger Units
PV (Instantanous flow rate)	Cmd1:PV	Continuous	---	---
		Window	PV	L/min Cum/h m/s spcl*2
		Rising		
		Falling		
		On-change		
% range/current (Output in % and current output)	Cmd2:% range/current	Continuous	---	---
		Window	% range	%
		Rising		
		Falling		
		On-change		
Process vars/current (Loop current, PV, SV, TV, QV)	Cmd3:Dyn vars/current	Continuous	---	---
		Window	PV	L/min Cum/h m/s spcl*2
		Rising		
		Falling		
		On-change		
Process vars/% range/ current with status*1 Mapping by user.	Cmd9:Device vars w/Status	Continuous	---	---
		Window	Top of Burst Device Variables	Depends on mapping
		Rising		
		Falling		
		On-change		
Self diagnosis information	Cmd48:Read Additional Device Status	Continuous	---	---
		On-change	All status	---

*1 : Output the data with time and status.
*2 : Unit used in PV

(2) Burst mode setting procedure

- Procedure to call up the display

DD DTM	**[Root Menu]** → Detailed setup → HART output → Burst Condition → Burst Message 1,2 or 3 → Burst Command



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a) Burst Command

Select the transmission data at **Burst Command** parameter.

Burst Command	Command parameter
Cmd1: PV	Variable assigned to PV
Cmd2: % range/current	% range/current (Output in % and Loop current)
Cmd3: Dyn vars/current	Process vars/current (Loop current, PV, SV, TV, QV)
Cmd9: Device vars w/Status	Process vars/% range/current Mapping by user
Cmd48: Read Additional Device Status	Self diagnosis information

b) Burst Variable Code

This parameter need to be set when **Burst Command** is Cmd9:Device vars w/Status (up to eight items).

- Procedure to call up the display

DD DTM	**[Root Menu]** → Detailed setup → Output condition →HART output → Burst condition → Burst Message 1,2 or 3 → Burst Device Variables → Burst Variable Code →
Display Item	Contents
PV	Instantanous flow rate
SV	Forward totalization value
TV	Reverse totalization value
QV	Differential totalization value
% rnge	% in output
Loop current	Current output
Not Used	–

c) Update Period and Max Update Period

Set to **Update Period** and **Max Update Period**.
When the period that is earlier than the operation period of each process value was set, it is set automatically to become bigger than an operation period of the device.
For **Update Period**, set the value that is smaller than **Max Update Period**.

- Procedure to call up the display

DD DTM	**[Root Menu]** → Detailed setup → HART output → Burst condition → Burst Message 1,2 or 3 → Set Burst Period
→ Update Period / Max Update Period	0.5 s
	1 s
	2 s
	4 s
	8 s
	16 s
	32 s
	1 min
	5 min
	10 min
	15 min
	30 min
	45 min
	60 min

d) Burst Msg Trigger Mode

Set the **Burst Msg Trigger Mode** from the parameters shown below.
When **Burst Msg Trigger Mode** is Window, Rising or Falling, set the **Burst Trigger Level**.

- Procedure to call up the display

DD DTM	**[Root Menu]** → Detailed setup → HART output → Burst condition → Burst Message 1,2 or 3 → Set Burst Trigger →
Display Item	Contents
Continuous	Burst Message is transmitted continuously.
Window	In “Window” mode, the Trigger Value must be a positive number and is the symmetric window around the last communicated value.
Rising	In “Rising” mode, the Burst Message must be published when the source value exceeds the threshold established by the trigger value.
Falling	In “Falling” mode, the Burst Message must be published when the source value fall below the threshold established by the trigger value.
On-change	In “On-change” mode, the Burst Message must be published when the source value on change established by the trigger value.

e) Burst Mode

When the **Burst mode** is set to "Wired HART Enabled", the transmitter starts to send the data.

- Procedure to call up the display

DD DTM	**[Root Menu]** → Detailed setup → HART output → Burst condition → Burst Message 1,2 or 3 → Burst mode → Wired HART Enabled

IMPORTANT

In case of using HART7 Burst communication, use Burst Message 1 in following settings:

Contents	Menu	Value
c) Update Period	Set Burst Period	0.5 s (Default)
d) Burst Msg Trigger Mode	Burst Msg Trigger Mode	Continuous (Default)
e) Burst mode	Burst mode	Wired HART Enabled

(3) Event Notification

When a setting change and a change of the Self-diagnostics occur, device detect it as an event and can transmit an alarm signal continuously.
Up to four events that occurred can be stored.
When using this function, set to **Burst mode** as "Wired HART Enabled".

(3-1) Set Event Notification

- Procedure to call up the display

DD DTM	**[Root Menu]** → Detailed setup →HART output → Burst condition → Event Notification →
→ Event Mask	Set the status to detect
→ Event Notification Retry Time	Set the retry time when the event occur.
→ Max Update Time	Set the retry time when the event does not occur.
→ Event Debounce Interval	The setting of the minimum event duration
→ Event Notification Control	Stop the event monitor: Off Shift to the monitor state: Enable event notification on token-passing data link layer

a) Event Mask

Set the status to detect in the **Event Mask** parameter.

Status group 1 Mask to 7 Mask
Device Status Mask
Ext dev status Mask
Device Diagnostic Status 0 Mask

b) Event Notification Retry Time/ Max Update Time/ Event Debounce Interval

Set to Event Notification Retry Time, Max Update Time and Event Debounce Interval.
For **Event Notification Retry Time**, set the value that is smaller than **Max Update Time**.

Event Notification Retry Time /Max Update Time	Event Debounce Interval
---	Off
0.5 s	0.5 s
1 s	1 s
2 s	2 s
4 s	4 s
8 s	8 s
16 s	16 s
32 s	32 s
1 min	1 min
5 min	5 min
10 min	10 min
15 min	15 min
30 min	30 min
45 min	45 min
60 min	60 min

c) Event Notification Control

Select "Enable event notification on token-passing data link layer" in the **Event Notification Control** parameter to shift to the monitor state:

(3-2) Acknowledge Event Notification (DTM only)

The transmission of the event message stops when event is approved.

- Procedure to call up the display

DTM	**[Root Menu]** → Detailed setup →HART output → Burst condition → Event Notification → Event Knowledge →
→ Acknowledge Event Notification	Acquisition of the event number and approval.

a) Get Event Number

Confirm the latest event number.
Execute **Acknowledge Event Notification** method.

1) Set "Enter Event Number" to "0".
2) OK.
3) Set "Select Transaction" to "Trans 0: Read Event Notification".
4) OK.
5) Confirm "Event Number".

b) Acknowledge Event Notification

Execute **Acknowledge Event Notification** method.

1) Enter “the event number which is confirmed in a) 5” into “Enter Event Number”.
2) OK.
3) Set “Select Transaction” to “Trans 1 : Send Acknowledge”.
4) OK.
5) Confirm “Even Status” is 0x00.

(3-3) Event Notification Record (DTM only)

- Procedure to call up the display

DTM	**[Root Menu]** → Detailed setup → Output condition →HART output → Burst condition → Event Notification → Event knowledge →
→ Acknowledge Event Notification	Acquisition of the event number and approval.

a) Get Event Number

Confirm the latest event number.
Execute **Acknowledge Event Notification** method.

1) Set “Enter Event Number” to “0”.
2) OK.
3) Set “Select Transaction” to “Trans 0: Read Event Notification”.
4) OK.
5) Confirm “Event Number”.

b) Confirmation record of Event Notification

Confirm four events checked in a).
Execute **Acknowledge Event Notification** method.

1) Enter “the event number which is confirmed in a) 5” into “Enter Event Number”.
2) OK.
3) Set “Select Transaction” to “Trans 0:Read Event Notification”.
4) OK.
5) Knowledge menu displays events record.

Ex.) When the confirmed event number is 123.

Event Number	Explanation
123	The latest event
122	An event before the once.
121	An event before the twice.
120	An event before three times.

9.8.4 Multidrop Mode

“Multidropping” transmitters refer to the connection of several transmitters to a single communication transmission line. Up to 63 transmitters can be connected when set in the multidrop mode. To activate multidrop communication, the transmitter address must be changed to a number from 1 to 63. This change deactivates the 4 to 20 mA analog output, sending it to 4 mA. The alarm current is also disabled.

Setting of Multidrop Mode

(1) Polling address

- Procedure to call up the display

DD DTM	**[Root Menu]** → Detailed setup →Output condition →HART output →
→ Poll addr	Enter the number from 1 to 63

(2) Enabling the Multidrop Mode

About the procedure to call up the **Polling** display, Read the User’s Manual of each configuration tool.

When **Loop current mode** is set to “Enabled”, an analog signal output is available for one device in a loop.

- Procedure to call up the display

DD DTM	**[Root Menu]** → Detailed setup → Output condition →Analog output → Loop current mode →
Enabled	Loop current mode is enabled.
Disabled	Loop current mode is disabled.

NOTE

When the same polling address is set for two or more transmitters in multidrop mode, communication with these devices is disabled.

(3) Communication when set in multidrop mode.

- The HART configuration tool searches for a device that is set in multidrop mode when it is turned on. When the HART configuration tool is connected to the device, the polling address and the tag will be displayed.
- Select the desired device. After that, normal communication to the selected device is possible. However, the communication speed will be slow.

To release multidrop mode, call up the **Poll addr** display and set the address to "0" and set the Loop current mode to "Enabled".

9.8.5 Switching HART Protocol Revision

When the output signal code is "-J", HART protocol revision of the device can be selectable from 5 or 7. The HART protocol revision is set and shipped as specified in the order.
To change the HART protocol revision after shipment, follow the procedure shown below.

IMPORTANT

When changing the protocol revision, confirm the items below.

- Protocol revision supported by HART configuration tool must be the same or higher than new protocol revision of the device.
- Confirm that the DD or DTM which is suitable to new protocol revision of the device is installed in the configuration tool. (Read Section 8.2 or Section 9.2)

1) Call up the parameter for protocol revision change

- Procedure to call up the **Chg universal rev** display.

DD DTM	**[Root Menu]** → Detailed setup → Device information → Field device information → Revision #'s → Chg universal rev

2) Activate the "Chg universal rev" method

IMPORTANT

The message is displayed to separate the device from the automatic control loop.
Confirm that the device is separated.

3) Input the new revision number

An input column for new protocol revision number is displayed.
Input the new HART protocol revision number of "5" for HART 5 or "7" for HART 7.

4) Applying the new protocol revision
   a. Close the configuration tool
      After completion of Chg universal rev method, close the HART configuration tool.

NOTE

When using a FieldMate, close the main display of FieldMate.

   b. Restart the device
      Turn off the power to the device, and turn it on.

IMPORTANT

New protocol revision is applied only after having performed restart of the transmitter.

5) Confirming the new protocol revision
   a. Restart the HART configuration tool

NOTE

When execute the other parameter confirmation or setting change, execute after restart the configuration tool.

   b. Confirm the new HART protocol revision number

Call up the **Universal rev** parameter, and confirm that the new HART revision number is displayed.

- Procedure to call up the **Universal rev**. parameter.

DD DTM	**[Root Menu]** → Detailed setup → Device information → Field device information → Revision #'s → Universal rev →
5	HART protocol revision: 5
7	HART protocol revision: 7

HART protocol revision can also be confirmed on the second line and third line of the device display.

- Procedure to call up the **Display Select**

DD DTM	**[Root Menu]** → Detailed Setup → Function Set → Display Set →
→ Display Select2 or Display Select3	Select "Communication"

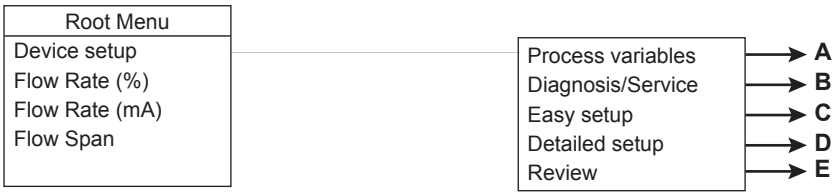
Protocol Revision	Displayed on AXR screen
HART Protocol Revision 5	HART5
HART Protocol Revision 7	HART7

9.8.6 Other operations for the HART configuration tool

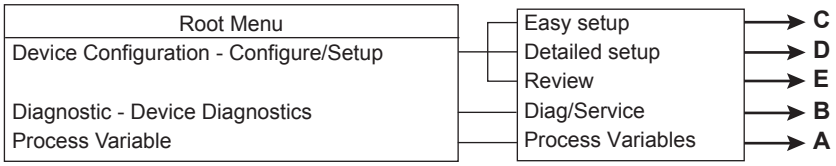
Regarding other operations for the HART configuration tool, read the HART configuration tool operations manual.

9.9 Menu Tree for DD and DTM (HART 7)

■ DD



■ DTM



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A

Process Variables	Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
TAB (*3)			
Flow Rate(%)	R	A10	D
Flow Rate	R	A20	D
Flow Rate(mA)	R	A21	D
Fwd Total	R	A30	D
Rev Total	R	A31	D
Dif Total	R	A32	D
Process Vars/Status	R	-	D
TAB (*3)	R	-	D
PV	R	-	D
PV Data quality	R	-	D
PV Limit status	R	-	D
SV	R	-	D
SV Data quality	R	-	D
SV Limit status	R	-	D
TV	R	-	D
TV Data quality	R	-	D
TV Limit status	R	-	D
QV	R	-	D
QV Data quality	R	-	D
QV Limit status	R	-	D
Percent Range	R	-	D
PR Data quality	R	-	D
PR Limit status	R	-	D
Loop Current	R	-	D
LC Data quality	R	-	D
LC Limit status	R	-	D

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B

Diagnosis/Service	Test/Status	Status		Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
			Time Stamp	R	–	D
			Status group 1	R	–	D
			Status group 2	R	–	D
			Status group 3	R	–	D
			Status group 4 (4*)	R	–	D
			Status group 5	R	–	D
			Status group 6	R	–	D
			Status group 7	R	–	D
			Device status	R	–	D
			Ext dev status	R	–	D
			Device Diagnostic Status 0	R	–	D
			Cfg chng count	R	–	D
			Reset cfg chng flag	W	–	–
		Self test		W	–	–
		Device reset		W	–	–
	Adjustment			W	–	–
		Auto Zero Execute		R	B50/M10	D
		Auto Zero Exec		W	M11	S
		Auto Zero Time		W	M12	S
		Flow Zero(IEL)		W	M13	S
		Flow Zero(IEM)		W	M14	S
		Flow Zero(IEH)		W	M15	S
		Flow Span Adjust		R	M20	D
		Adjust 4mA		R	M21	D
		Adjust 20mA		W	–	–
		D/A trim		W	–	–
		Clear D/A trim				
	Test			W	–	–
		Loop test		W	–	–
		Squawk		W	–	–
		Simulate		W	N10	S
		Test Mode		W	N11	S
		Test Output Value		W	N12	S
		Test DO		W	N15	S
		Test Time		W	N20	S
		Test Iex		W	N30	S
		Select Flow Tube		W	–	–
		Flow Average Exec		W	N40	D
		Average Exec		W	N41	S
		Average Time		R	N42	D
		Average Flow				
	Diagnosis			W	–	–
		Adh Check Execute		R	K10	D
		Adhesion Check		R	K11	D
		Adhesion Status		R	K12	D
		Adh Measure Value		W	K13	S
		Adhesion Level1		W	K14	S
		Adhesion Level2		W	K15	S
		Adhesion Level3		W	K16	S
		Adhesion Level4		W	K17	S
		Adh Check Cycle		W	K19	S
		Empty Check		R	K20	D
		Empty Status		R	K21	D
		DC Voltage A		R	K22	D
		DC Voltage B		W	K23	S
		Empty Level				

C

Easy Setup		Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
	Language	W	B10/H30	S
	Flow Damping	W	B20/C11	S
	Base Flow Unit	W	B21/C40	S
	Base Time Unit	W	B22/C41	S
	Flow Span	W	B23/C42	S
	Flow Decimal Pnt	W	B24/C43	S
	Total Unit	W	B30/D10	S
	Total Scale	W	B31/D11	S
	Pulse Unit	W	B32/E10	S
	Pulse Scale	W	B33/E11	S
	Display Select1	W	B40/H10	S
	Display Select2	W	B41/H11	S
	Display Select3	W	B42/H12	S
	Auto Zero Execute	W	–	–

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D

			Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
Detailed Setup	Basic Setup	Tag	W	C10	S
		Long tag	W	–	S
		Flow Damping	W	B20/C11	S
		Low MF(IEL)	W	C20	S
		High MF(IEL)	W	C21	S
		Low MF(IEM)	W	C22	S
		High MF(IEM)	W	C23	S
		Low MF(IEH)	W	C24	S
		High MF(IEH)	W	C25	S
		Nominal Size Unit	W	C30	S
		Nominal Size	W	C31	S
		Base Flow Unit	W	B21/C40	S
		Base Time Unit	W	B22/C41	S
		Flow Span	W	B23/C42	S
		Flow Decimal Pnt	W	B24/C43	S
		Velocity Check	R	C44	D
		Density Unit	W	C45	S
		Mass Flow Density	W	C46	S
		User Span Select	W	C50	S
		Flow User Unit	W	C51	S
		Flow User Span	W	C52	S
	Total Set	Total Unit	W	B30/D10	S
		Total Scale	W	B31/D11	S
		Total Decimal Pnt	W	D12	S
		Total Low Cut	W	D13	S
		Total Rate Check	R	D14	D
		Total Execution	W	D20	S
		Ttl Set Val Lower	W	D21	S
		Ttl Set Val Upper	W	D22	S
		Ttl Switch Lower	W	D23	S
		Ttl Switch Upper	W	D24	S
		Ttl User Select	W	D30	S
		Ttl User Unit	W	D31	S
	Pulse Set	Pulse Unit	W	B32/E10	S
		Pulse Scale	W	B33/E11	S
		Pulse Width	W	E12	S
		Pulse Low Cut	W	E13	S
		Pulse Rate Check	R	E14	D

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Detailed Setup	Function Set			Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
		DO Function Set	DO Function	W	F10	S
		TAB (*3)	DO Active Mode	W	F11	S
			Forward Span2	W	F20	S
			Reverse Span	W	F21	S
			Auto Range Hys	W	F30	S
			Bi Direction Hys	W	F31	S
		Alarm Set	Low Alarm	W	G10	S
		TAB (*3)	High Alarm	W	G11	S
			Hi/Lo Alarm Hys	W	G12	S
			4-20 System Alm	R	G20	D
			4-20 Process Alm	W	G25	S
			Alarm-Signal Over	W	G26	S
			Alarm-Empty Pipe	W	G27	S
			Alarm-High/Low	W	G28	S
			Alarm-Adhesion	W	G29	S
			4-20 Setting Alm	W	G30	S
			Alarm-Setting	W	G31	S
			Alarm Display	W	G35	S
		Alarm Record	Operation Time	R	G40	D
		TAB (*3)	Alm Record1	R	G41	D
			Alm Record Time1	R	G42	D
			Alm Record2	R	G43	D
			Alm Record Time2	R	G44	D
			Alm Record3	R	G45	D
			Alm Record Time3	R	G46	D
			Alm Record4	R	G47	D
			Alm Record Time4	R	G48	D
		Display Set	Display Select1	W	B40/H10	S
		TAB (*3)	Display Select2	W	B41/H11	S
			Display Select3	W	B42/H12	S
			Display Cycle	W	H20	S
			Language	W	B10/H30	S
			LCD Contrast	W	H40	S
		Aux	4-20mA Low Cut	W	J10	S
		TAB (*3)	4-20mA Low Limit	W	J11	S
			4-20mA High Limit	W	J12	S
			Pls Special Mode	W	J15	S
			Flow Direction	W	J20	S
			Rate Limit	W	J21	S
			Dead Time	W	J22	S
			Pulsing Flow	W	J23	S
			T/P Damping Select	W	J25	S
			Basic Frequency	W	J30	S
			Memo1	W	J35	S
			Memo2	W	J36	S
			Memo3	W	J37	S
			Software Rev No	R	J50	S

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						Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
Detailed Setup	HART Output	Poll addr				W	-	S
		Loop current mode				W	-	S
		Num req preams				R	-	S
		Num resp preams				W	-	S
		Burst Condition	Burst Message1	Burst mode		W	-	S
		TAB (*3)	TAB (*3)	Burst Command		W	-	S
				Burst Variables	Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
				Set Burst Trigger		-	-	-
				Set Burst Period		-	-	-
				Burst Msg Trigger Mode		R	-	D
				Burst Trigger Units		R	-	S
				Burst Trigger Level		R	-	S
				Update Period		R	-	S
				Max Update Period		R	-	S
			Burst Message2	Burst mode		W	-	S
			TAB (*3)	Burst Command		W	-	S
				Burst Variables	Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
				Set Burst Trigger		W	-	-
				Set Burst Period		W	-	-
				Burst Msg Trigger Mode		R	-	D
				Burst Trigger Units		R	-	S
				Burst Trigger Level		R	-	S
				Update Period		R	-	S
				Max Update Period		R	-	S
			Burst Message3	Burst mode		W	-	S
			TAB (*3)	Burst Command		W	-	S
				Burst Variables	Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
					Burst Variable Code	W	-	S
				Set Burst Trigger		W	-	-
				Set Burst Period		W	-	-
				Burst Msg Trigger Mode		R	-	D
				Burst Trigger Units		R	-	S
				Burst Trigger Level		R	-	S
				Update Period		R	-	S
				Max Update Period		R	-	S
			Event Notification	Event Notification Control		W	-	D
			TAB (*3)	Event Mask	Status group 1 Mask	W	-	S
					Status group 2 Mask	W	-	S
					Status group 3 Mask	W	-	S
					Status group 4 Mask	W	-	S
					Status group 5 Mask	W	-	S
					Status group 6 Mask	W	-	S
					Status group 7 Mask	W	-	S
					Device status Mask	W	-	S
					Ext dev status Mask	W	-	S
					Device Diagnostic Status 0 Mask	W	-	S
				Set Event Time		W	-	-
				Event Notification Retry Time		R	-	S
				Max Update Time		R	-	S
				Event Debounce Interval		R	-	S
				(*5) Event Knowledge	Ack Event Notification	W	-	-
					Event Number	R	-	S
					Event Status	R	-	D
					Time First Unack Event Trigger	R	-	S
					Latched Status group 1	R	-	S
					Latched Status group 2	R	-	S
					Latched Status group 3	R	-	S
					Latched Status group 4	R	-	S
					Latched Status group 5	R	-	S
					Latched Status group 6	R	-	S
					Latched Status group 7	R	-	S
					Latched Device status	R	-	S
					Latched Ext dev status	R	-	S
					Latched Device Diagnostic Status 0	R	-	S
					Latched Cfg chng count	R	-	S
			PV Update Period			R	-	D
			SV Update Period			R	-	D
			TV Update Period			R	-	D
			QV Update Period			R	-	D
			PR Update Period			R	-	D
			LC Update Period			R	-	D

(continued on next page)

F0910.ai

					Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
Detailed Setup	Device Information	Field Device Information	Manufacturer		R	-	S
		TAB (*3)	Model		R	-	S
			Tag		W	C10	S
			Long tag		W	-	S
			Descriptor		W	-	S
			Message		W	-	S
			Date		W	-	S
			Dev id		R	-	S
			Device Profile		R	-	S
			Max dev vars		R	-	S
			Country		W	-	S
			SI Unit Control		R	-	S
			MS Code1		W	J40	S
			MS Code2		W	J41	S
			MS Code3		W	J42	S
			MS Code4		W	J43	S
			MS Code5		W	J44	S
			MS Code6		W	J45	S
			Write Protect Menu	Write protect	R	P20	D
			TAB (*3)	Enable Wrt 10min	W	-	-
				New Password	W	-	-
				Software Seal	R	P23	D
			Revision #'s	Universal rev	R	-	S
			TAB (*3)	Fld dev rev	R	-	S
				Software rev	R	-	S
				Next universal rev	R	-	S
				Chg universal rev	W	-	-
		Model Specification	Use		W	-	S
			Lining		W	-	S
			Electrode Material		W	-	S
			Electrode Struct		W	-	S
			Grounding Ring		W	-	S
			Process Connect		W	-	S
			Lay Length		W	-	S
			Electrical Conn		W	-	S
			Sensor Serial No		W	-	S

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			Read/Write	Parameter of BRAIN protocol (*2)	Data Renewing (*1)
E					
Review	Review1	(*6)			–
	Review2				–
	Review3				–
	Review4				–
Hot Key Configuration (*7)	PV Span		W	B23/C42	S
	Simulate		W	–	–
	Write Protect Menu	Write protect	R	P20	D
		Enable Wrt 10min	W	P21	–
		New Password	W	P22	–
		Software Seal	R	P23	D

*1: Data Renewing
D: Periodic Data Renewing
S: Discretionary Data Renewing
–: Others (Method, etc...)
*2: Parameter of BRAIN protocol
–: HART only
*3: TAB
On DTM screen, displayed as Tab page
*4: Status Group 1 to 7
Read the table at the end of Section 9.9.
*5: Event Knowledge
DTM only
*6: Review 1 to 4
Read the table at the end of Section 9.9.
*7: Hot Key Configuration
On DTM screen, “Hot Key”

F0912.ai

Review1
Tag
Long tag
PV Damping
Low MF(IEL)
High MF(IEL)
Low MF(IEM)
High MF(IEM)
Low MF(IEH)
High MF(IEH)
Nominal Size Unit
Nominal Size
Base Flow Unit
Base Time Unit
PV Span
Flow Decimal Pnt
Velocity Check
Density Unit
Mass Flow Density
User Span Select
Flow User Unit
Flow User Span
Total Unit
Total Scale
Total Decimal Pnt
Total Low Cut
Total Rate Check
Total Execution
Total Set Val Lower
Total Set Val Upper
Ttl Switch Lower
Ttl Switch Upper
Ttl User Select
Ttl User Unit
Pulse Unit
Pulse Scale
Pulse Width
Pulse Low Cut
Pulse Rate Check

Review2
DO Function
DO Active Mode
Forward Span2
Reverse Span
Auto Range Hys
Bi Direction Hys
Low Alarm
High Alarm
Hi/Lo Alarm Hys
4-20 System Alm
4-20 Process Alm
Alarm-Signal Over
Alarm-Empty Pipe
Alarm-High/Low
Alarm-Adhesion
4-20 Setting Alm
Alarm-Setting
Alarm Display
Operation Time
Alarm Record1
Alarm Record Time1
Alarm Record2
Alarm Record Time2
Alarm Record3
Alarm Record Time3
Alarm Record4
Alarm Record Time4

Review3
Display Select1
Display Select2
Display Select3
Display Cycle
Language
LCD Contrast
4-20mA Low Cut
4-20mA Low Limit
4-20mA High Limit
Pls Special Mode
Flow Direction
Rate Limit
Dead Time
Pulsing Flow
T/P Damping Select
Basic Frequency
Memo1
Memo2
Memo3
MS Code1
MS Code2
MS Code3
MS Code4
MS Code5
MS Code6
Software Rev No
Use
Lining
Electrode Material
Electrode Struct
Grounding Ring
Process Connect
Lay Length
Electrical Conn
Sensor Serial No
Adhesion Check
Adhesion Status
Adh Measure Value
Adhesion Level1
Adhesion Level2
Adhesion Level3
Adhesion Level4
Adh Check Cycle
Empty Check
Empty Status
DC Voltage A
DC Voltage B
Empty Level

Review4
Poll addr
Loop current mode
Num req preams
Num resp preams
Manufacturer
Model
Tag
Long tag
Descriptor
Message
Date
Dev id
Device Profile
Max dev vars
Country
SI Unit Control
Write protect
Universal rev
Fld dev rev
Software rev

Status group 1 (*1)
10: uP Fault
11: EEPROM Fault
12: Sub uP Fault
13: EX Pwr Fault
14: A/D(S) Fault
15: A/D(I) Fault
16: Analog Fault
17: Coil Open

Status group 2 (*1)
18: Coil Short
19: Excite Error
20: Pulse Error
21: EEPROM Dflt

Status group 3 (*1)
30: Sig Overflow
31: Empty Pipe
32: H/L Alm
33: Adhesion Alm

Status group 4 (*1)
50: Span > 10m/s
51: Span < 0.3m/s
52: TTL>10000p/s
53: TTL<0.0001p/s
54: 4-20 Lmt Err
55: Multi Rng Err
56: H/L Set Err
57: Dens Set Err

Status group 5 (*1)
60: PLS>10000p/s
61: PLS > 5000p/s
62: PLS > 1000p/s
63: PLS > 500p/s
64: PLS > 25p/s
65: PLS > 15p/s
66: PLS > 10p/s
67: PLS > 5p/s

Status group 6 (*1)
68: PLS > 2.5p/s
69: PLS > 1.5p/s
70: PLS > 1.0p/s
71: PLS > 0.5p/s
72: PLS > 0.25p/s
73: PLS<0.0001p/s
74: Size Set Err
75: Adh Set Err

Status group 7 (*1)
80: Adhesion Wng
82: Auto Zero Wng
83: Fix Cur Wng
84: Disp Over Wng
91: Disp Cur Wng
93: Dev Sim Wng

F0913.ai

*1: For the detail of alarms in Status group 1 to 7, read Section 6.5.

10. ACTUAL OPERATION

After you have installed the flowtube into the process piping, wired the input/output terminals, set up the required parameters, and performed a pre-operation zero adjustment, the magnetic flowmeter should output an accurate flow signal from its terminals as soon as flow of the fluid to be measured begins.

IMPORTANT

Warm up the instruments for at least 30 minutes. Perform flow measurement 30 minutes after turning on the power.

This section describes zero adjustment and the corresponding procedures.

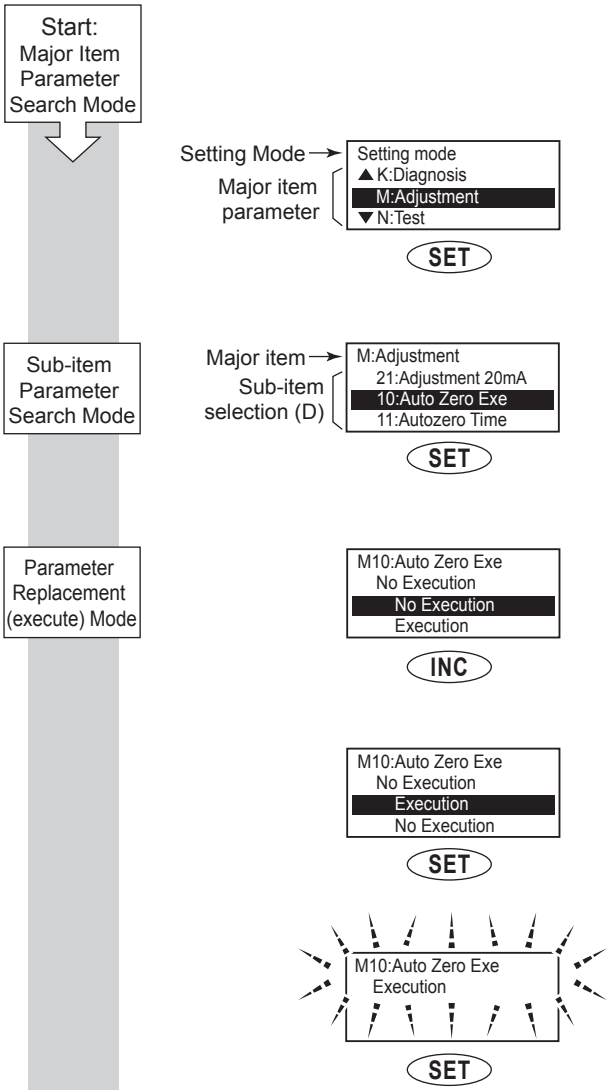
10.1 Pre-operation Zero Adjustment

Zero adjustment is carried out to ensure that the output for zero flow is 0%. Although adjustment to zero is performed at the manufacturing plant prior to shipment, this procedure must be carried out once again following the installation of piping in order to match the magnetic flowmeter to its operating conditions.
This section describes the zero adjustment procedure using display unit switches from the converter and using the external status input; accordingly, one of these methods should be selected and implemented.

IMPORTANT

- Zero adjustment should be carried out before actual operation. Note that parameter settings and update functions cannot be carried out during this procedure (i.e., for approximately 450 seconds).
- Zero adjustment should only be carried out when the flowtube has been filled with the measurement fluid, wait 10 minutes, and the fluid velocity is completely zero by closing the valve.
- Each time that the fluid being measured is changed, it will be necessary for zero adjustment to be carried out for the new fluid.
- While zero adjustment is being carried out, normally a current of 10.4 mA is output. Since the current of 10.4 mA is output, when zero adjustment is carried out, first change the control loop to the manual mode, and then set this parameter.
- Zero adjustment cannot be carried out during occurring various alarms.

This section describes the procedure for zero adjustment using the display unit switches. (For more details regarding setting methods using these switches, read Chapter 5.)
The parameters for zero adjustment are **B50/M10: Auto Zero Exe** (and either of these can be used to carry out this procedure). For more details regarding these parameters, read Chapter 6.
The parameter **M10: Auto Zero Exe** will be used in the following description.



Once in Setting Mode, use the INC switch to move the cursor to **M: Adjustment**.

Touch the SET switch to access Sub-item Parameter Search Mode.

Upon selection of **M: Adjustment**, the cursor will be positioned at **M10: Auto Zero Exe**. (Sub-item selection (D))
Touch the SET switch to access Parameter Replacement Mode.

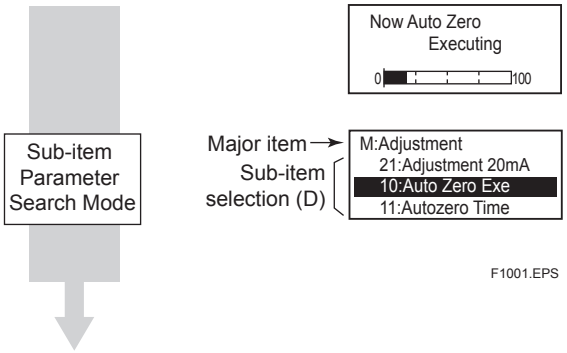
Touch the INC switch to move the cursor to "Execution".

Touch the SET switch to select the "Execution".

In order to request confirmation, the entire display flashes on and off. Touch the SET switch once again at this time to fix selection of the automatic zero adjustment function.

NOTE

When no operations are carried out for 20 seconds in the flashing state, the system will automatically return to the Sub-item Parameter Search Mode.
When the operations except SET are carried out, the parameter cannot be set.



F1001.EPS

Auto zero adjustment function is being executed (about 450 seconds).

When zero adjustment function has been completed, the system automatically returns to the sub-item selection screen (D).

NOTE

The results of **M10: Auto Zero Exe** can be displayed using **M12**, **M13** and **M14**. Alternatively, if the results of the automatic zero adjustment exceed the rated value, the warning **82: Auto Zero Wng** will be displayed.

11. MAINTENANCE

WARNING

- Maintenance work must be carried out by the trained personnel having knowledge of safety standard and not by operators.
- Do not open the cover in wet weather or high humidity.
- When opening the cover, wait for more than 5 minutes after turning off the power. Furthermore, opening of the cover must also be carried out by the trained personnel having knowledge of safety standard.

IMPORTANT

- The amplifier assembly contains sensitive parts that may be damaged by static electricity. Exercise care so as not to directly touch the electronic parts or circuit patterns on the board, for example, by preventing static electrification by using grounded wrist straps when handing the assembly. Also take precautions such as placing a removed amplifier assembly into a bag with an antistatic coating.

CAUTION

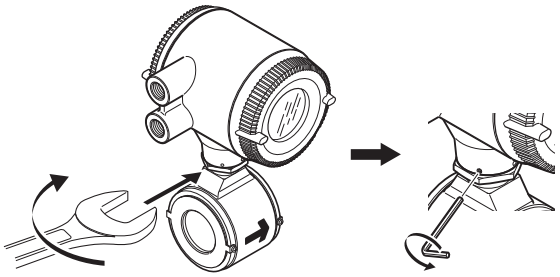
- Explosion proof type must be, as a rule, removed to a non-hazardous area for maintenance and be disassembled and reassembled to the original state. For details, “INSTALLATION AND OPERATING PRECAUTIONS FOR TIIS FLAMEPROOF EQUIPMENT” at the end of this manual.
- The cover is locked by the special screw. In case of opening the cover, use the hexagonal wrench (nominal size 3).
- Be sure to lock the cover by the special screw using this hexagonal wrench after installing the cover.

11.1 Changing Direction of Electrical Connection

(1) The following tools are required to change the direction of the electrical connection:
- Hexagonal wrench (nominal size 2.5)
- Wrench

(2) Turn off the power to the flowmeter.

(3) Using the wrench, loosen the hexagonal nut at the neck of the instrument.



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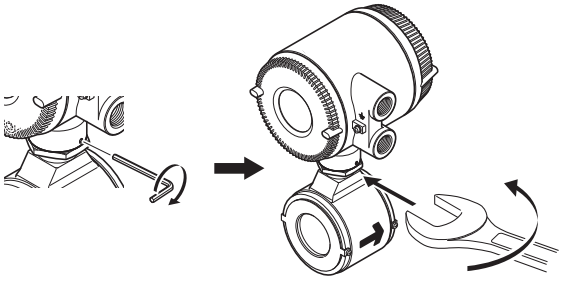
(4) Using the hexagonal wrench (nominal size 2.5), loosen the screw in the neck.

(5) Turn the converter in the desired direction.

NOTE

The converter can be turned –140 degree to +180 degree from the arrow mark indicating the flow direction. Do not exceed these angle.

(6) Using the hexagonal wrench (nominal size 2.5), retighten the neck screw.



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(7) Using the wrench, retighten the hexagonal nut at the neck. After that, check that the converter.

11.2 Components Replacement

IMPORTANT

In case of explosion proof type, component replacement by other than authorized representative of Yokogawa is prohibited and will void the certification. If necessary, contact Yokogawa.

WARNING

- Component replacement must be carried out by the trained personnel having knowledge of safety standard. No operator shall be permitted to perform any operations relating to component replacement.
- Component replacement and the associated operations must be carried out by expert engineer or skilled personnel and not by operators.
- Before opening the cover, it is important to ensure that at least 5 minutes have passed since the power was turned off. Furthermore, opening of the cover must also be carried out by expert engineer or skilled personnel.

IMPORTANT

- As a rule, maintenance of this flowmeter should be implemented in a maintenance service shop where the necessary tools are provided.
- The amplifier assembly contains sensitive parts that may be damaged by static electricity.
  Excercise care so as not to directly touch the electronic parts or circuit patterns on the board, for example, by preventing static electrification by using grounded wrist straps when handing the assembly. Also take precautions such as placing a removed amplifier assembly into a bag with an antistatic coating.

11.2.1 Display Unit Replacement

CAUTION

When using this instrument for a long time in conditions of high temperature and humidity, the visibility of the display unit may deteriorate. In this case, it is necessary to replace the display unit.

(1) Removing the Cover

(1) Turn off the power.
(2) The cover has the locking screws in front and behind it as shown in Figure 11.2.1 in case of explosion proof type. This is used for the cover-locking system. Loosen cover locking screws clockwise using a hexagonal wrench (nominal size 3) to unlock the cover. (Upon shipment from the manufacturing plant, the cover is locked.)
Hold the flowmeter with your hand and remove the cover by turning it in the direction of the arrow as shown below (both explosion proof and general purpose types).

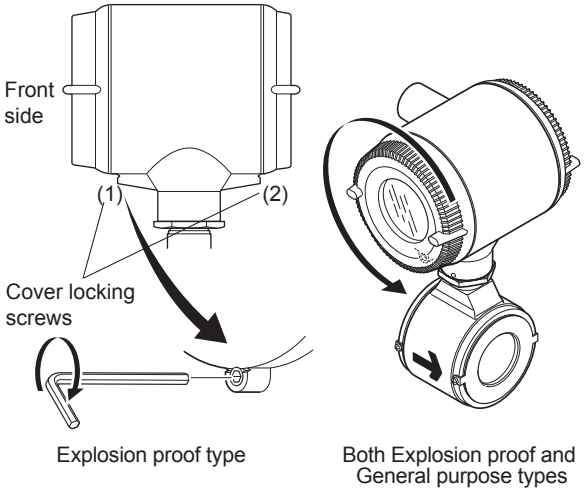


Figure 11.2.1 Removing the Display Cover

(2) Removing the Dispaly Unit

(1) Hold the display unit with your hand and loosen the four mounting screws. Remove the display unit by pulling it in a straight, taking care not to damage it (Read Figure 11.2.2).

(3) Assembling the Display Unit

(1) Align the display unit in a straight with its connector located its backside facing the connector of amplifier assembly and then make the required connection.
(2) Secure the display unit using its four mounting screws.

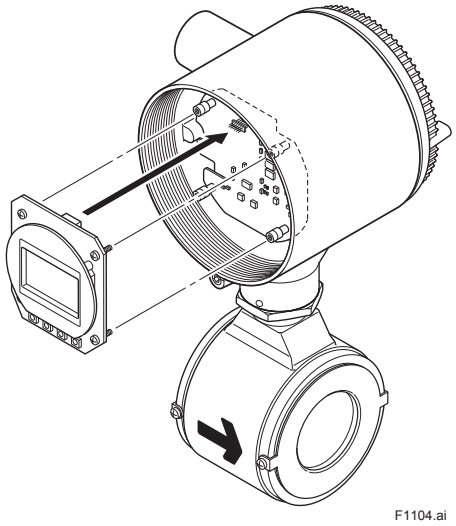


Figure 11.2.2 Removing and Assembling the Display Unit

NOTE

Secure to display unit steadily when attaching to the amplifier assembly.
The instrument may damage caused by vibration of piping, etc… under its operation if the screwing up work was not enough.

(4) Changing the Display Unit Orientation 90 Degrees

(1) Hold the display unit with your hand and remove the four mounting screws.
(2) Remove the display unit carefully in a straight without damaging the connector located its backside.
(3) Turn the display unit 90 degrees clockwise and confirm the assembling position.
(4) Align the display unit in a straight with its connector located its backside facing the connector of amplifier assembly and then make the required connection.
(5) Secure the display unit using its four mounting screws.

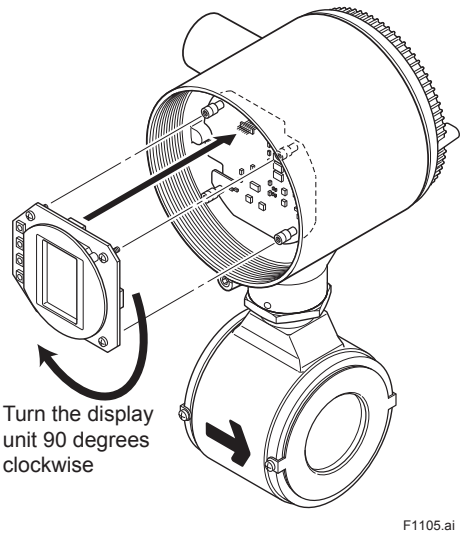


Figure 11.2.3 Assembling the Display Unit

NOTE

Secure to display unit steadily when attaching to the amplifier assembly.
The instrument may damage caused by vibration of piping, etc… under its operation if the screwing up work was not enough.

(5) Installing the Cover

(1) Install the cover to the flowmeter by turning it in the direction of the arrow as shown below. Tighten cover locking screws counterclockwise using a hexagonal wrench (nominal size 3) to lock the cover (in case of explosion proof type).

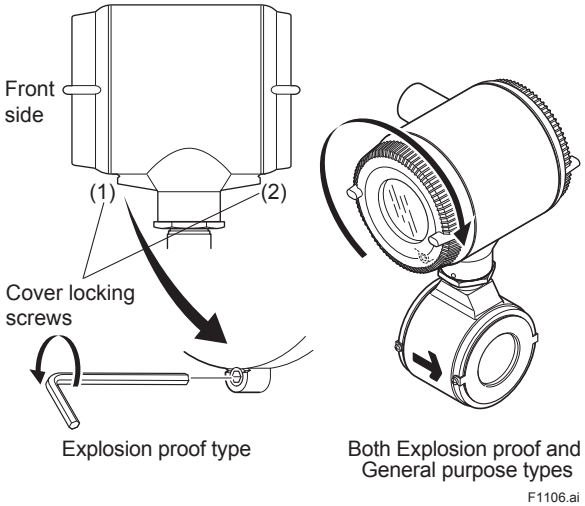


Figure 11.2.4 Installing the Display Cover

11.2.2 Amplifier Replacement

IMPORTANT

In case of amplifier replacement, it is necessary to perform the parameter resetting.
For parameters, Read Chapter 6.

(1) Removing the Amplifier Assembly

(1) Turn off the power.
(2) Remove the cover.
(3) Hold the display unit with your hand and loosen the four mounting screws. Remove the connector 1 by pulling it in a straight, taking care not to damage it (Read Figure 11.2.5).
(4) Loosen the four mounting hexagonal screws using a hexagonal socket driver (nominal size 5.5).
(5) Remove the amplifier assembly carefully at a crawl in a straight, taking care not to damage the connector 2 and 3.
(6) Hold the amplifier assembly with your hand and remove the connector 3 carefully by holding both sides of it with your fingers (claws).
Do not apply excessive force to the connector 4 during this work at this time.

(2) Assembling the Amplifier Assembly

(1) To replace the amplifier assembly, follow the procedures used to remove it in the reverse order.
(2) Carefully connect the cable 1 to the connector 4, making sure that the connectors' direction are correct.
(3) Replace the amplifier assembly by pushing it in the converter with folding back the cable 1 and 2, taking care not to entangle these tow cables during installing the hexagonal screws.
(4) Align the display unit in a straight with the connector 2 facing the connector of amplifier assembly and then make the required connection.
Take care not to entangle the connector 1 to the shield board and the front cover when they are installed.
(5) Install the four hexagonal screws on the amplifier assembly using a hexagonal socket driver (nominal size 5.5).
(6) Align the display unit in a straight with its connector located its backside facing the connector 1 and then make the required connection.
(7) Secure the display unit using its four mounting screws.

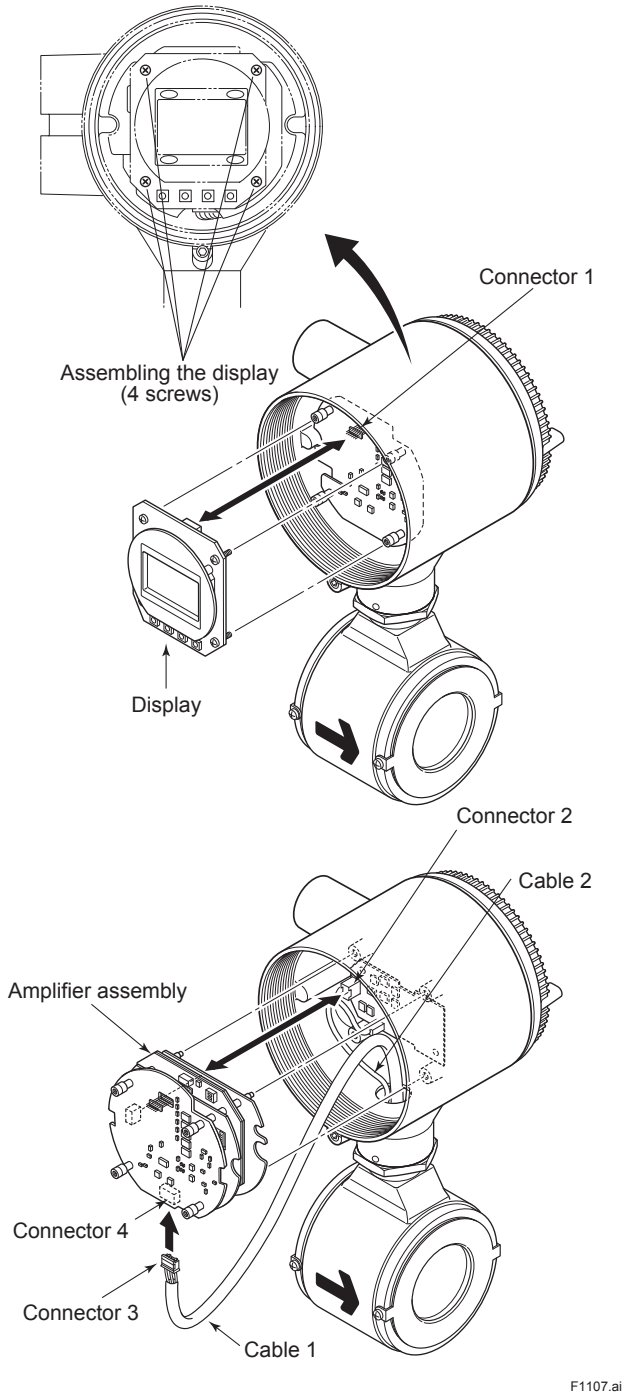


Figure 11.2.5 Assenbling the Amplifier

NOTE

Secure to display unit steadily when attaching to the amplifier assembly.
The instrument may damage caused by vibration of piping, etc… under its operation if the screwing up work was not enough.

11.3 Setting of Switches

11.3.1 Setting of Burnout Switch

The burnout function sets the direction of current output in situations during occurring the system alarm. Upon shipment from the manufacturing plant, the burnout direction is set to High (21.6 mA or more); however, in cases where the optional code C1 has been specified, the output direction will be set to Low (3.2 mA or less).

Modification of the burnout direction must be carried out using the setting switch from the amplifier's board (Switch 2) (Read Figure 11.3).

Table 11.3 Output Setting Pins for Burnout

Position of Pin	Burnout Direction	Burnout Output	Remarks
L H	High	21.6 mA or more	Set to High before shipment
L H	Low	3.2 mA or less	Set to Low for optional code C1

NOTE

On the amplifier's board, the burnout setting switch (Switch 2) and the write protect switch (Switch 1) are located adjacent to each other. Accordingly, special care should be taken when making switch settings.

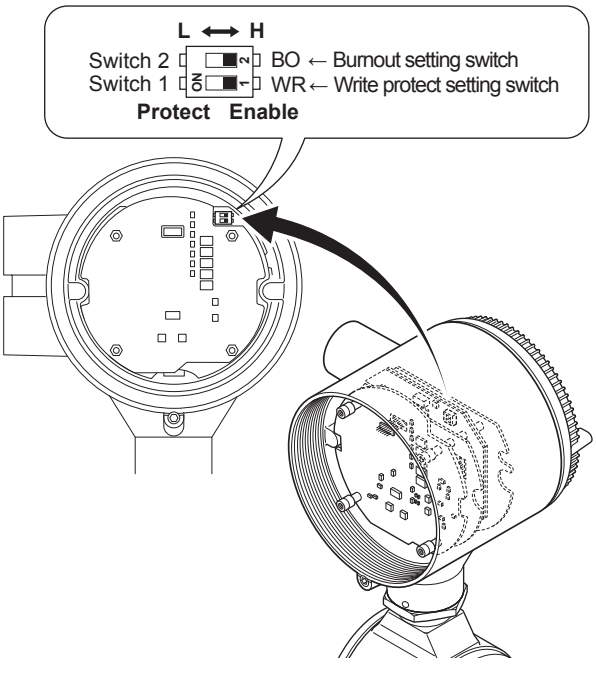


Figure 11.3 Switch Configuration

11.3.2 Setting of Write Protect Switch

By setting the write protect function to "Protect" it is possible to prevent the overwriting of parameters. Write protection can be carried out using either the hardware switch on the amplifier board (Switch 1) or software parameter settings. If either of these items is set to "Protect," the overwriting of parameters will be prohibited.

NOTE

If the hardware switch is set to "Protect," it will not be possible to overwrite parameters; furthermore, this condition will be maintained until the switch is set to "Enable."

For more details regarding usage of the write protect function and the software's parameter switches, read Chapter 6.

11.4 Adhesion diagnostic function

The long-term measurement of adhesive fluids may adversely affect the flow measurement due to insulating materials adhering to the electrode, which could cause the output vibration to increase or make it impossible to measure the flow rate. This function checks the level of adhesion by measuring the resistance value.

NOTE

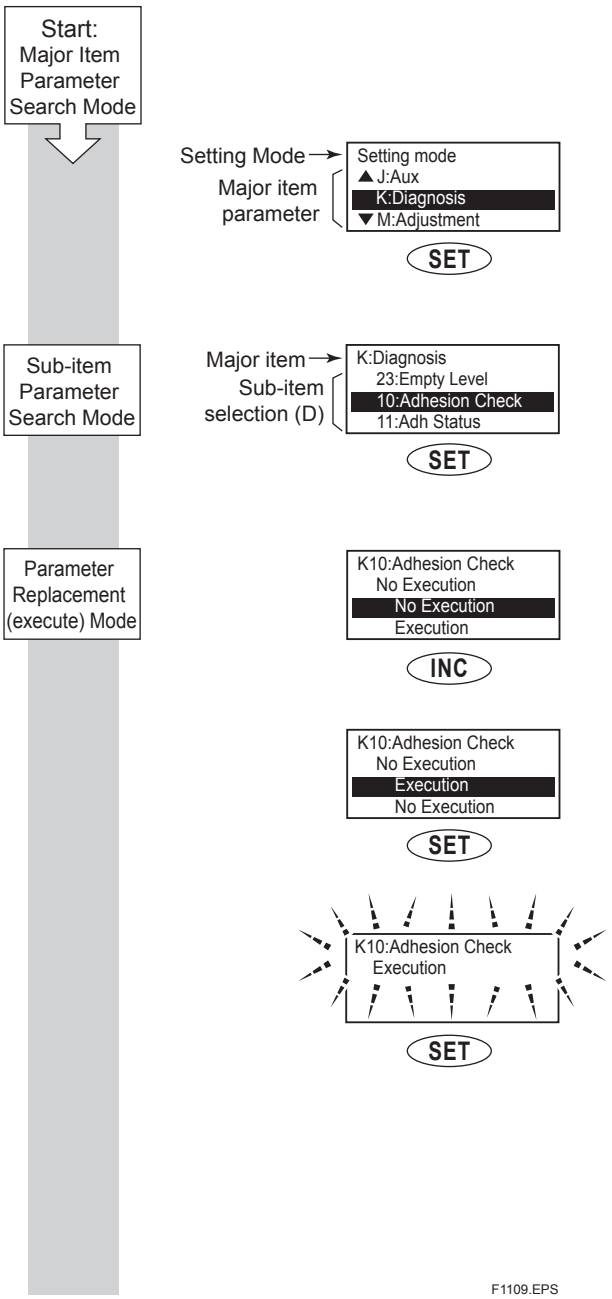
Adhesion Diagnostic Function

- This function diagnose adhesion using electrode resistance values.
- The result of adhesion diagnosis is displayed at **K12:Adh Measure Value**.
- When “Adhesion check” has been set for **B41/H11: Display Select 2** or **B42/H12: Display Select 3**, the diagnose adhesion is indicated on the display unit using four different levels.
- If the judgment value for Level 3 is exceeded, a warning is displayed; and if the value for Level 4 is exceeded, an alarm or warning is displayed depending on the setting condition at **G29**.
- Available conductivity for this function is limited to 10 µS/cm.
  Make sure to use the adhesion diagnostic function with the greater conductivity than the above mentioned value.

IMPORTANT

- Parameters cannot be set during execution (approximately 5 minutes).
- Adhesion diagnosis should only be carried out when the fluid velocity is completely zero by closing the valve.
- Flow measurement is not performed during execution. While adhesion diagnosis is being carried out, normally a current of 4 mA is output. When adhesion diagnosis is carried out, change the control loop to the manual mode first.
- Adhesion diagnosis cannot be carried out while an alarm is occurring.

This section describes the procedure for Adhesion Diagnostic using the display unit switches. (For more details regarding setting methods using these switches, read Chapter 5.)
The parameters that are relevant to the adhesion diagnostic function are as follows.
[K10:Adhesion Check] Execution of adhesion diagnostic function
[K11:Adhesion Status] Display of the adhesion diagnosis level
[K12:Adh Measure Value] Displays the resistance value for adhesion diagnose
[K13:Adhesion Level1] Setting the resistance value for adhesion diagnostic level1
[K14:Adhesion Level2] Setting the resistance value for adhesion diagnostic level2
[K15:Adhesion Level3] Setting the resistance value for adhesion diagnostic level3
[K16:Adhesion Level4] Setting the resistance value for adhesion diagnostic level4
[K17:Adhesion Check Cycle] Setting of execution time for adhesion diagnosis
For more details regarding these parameters, read Chapter 6.
The parameter for executing the adhesion diagnostic function is **K10:Adhesion Check**.
The parameter **K10:Adhesion Check** will be used in the following description.



Once in Setting Mode, use the INC switch to move the cursor to **K: Diagnosis**.

Touch the SET switch to access Sub-item Parameter Search Mode.

Upon selection of **K: Diagnosis**, the cursor will be positioned at **K10: Adhesion Check**. (Sub-item selection (D)).
Touch the SET switch to access Parameter Replacement Mode.

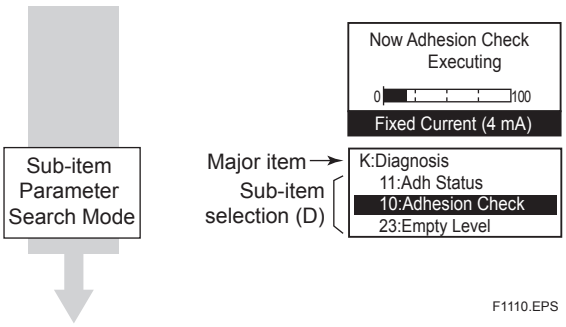
Touch the INC switch to move the cursor to “Execution”.

Touch the SET switch to select the “Execution”.

In order to request confirmation, the entire display flashes on and off. Touch the SET switch once again at this time to fix selection of the Adhesion Diagnosis function.

NOTE

When no operations are carried out for 20 seconds in the flashing state, the system will automatically return to the Sub-item Parameter Search Mode.
When the operations except SET are carried out, the parameter cannot be set.



Adhesion Diagnostic function is being executed (about 5 minutes).

When Adhesion Diagnostic function has been completed, the system automatically returns to the sub-item selection screen (D).

IMPORTANT

In the event of a warning or alarm when executing the adhesion diagnostic function, take one of the following actions:

- Clean the electrodes, and then execute the adhesion diagnostic function.
- Set the values of adhesion diagnostic level3 **K15: Adhesion Level3** and level4 **K16: Adhesion Level4** bigger than the result of the resistance value for adhesion diagnosis.
- Turn off the power to the flowmeter once, and then turn on the power again.

11.5 Regular Inspection Items

(1) Inspection of moisture-proofing inside the terminal box: Once/year
(2) Retightening of piping joint screws: About twice/year
(3) Inspection of electrodes and lining (in case of adhesive and/or abrasive fluids, etc.)
Determine the period of regular inspection as necessary.

11.6 Insulation Resistance Test, Dielectric Strength Test

NOTE

Note the following precautions when conducting the insulation resistance test and dielectric strength test.

(1) Conduct these tests as necessary minimum. Applying the test voltage may deteriorate the insulation and safety of the instrument, even if the overvoltage is far below the insulation breakdown level.
(2) The voltage for the insulation resistance test must be 500 V DC or less (100 V DC or less for the optional code A). The voltage for the dielectric strength test must be 500 V AC or less (100 V AC or less for the optional code A).
(3) The test procedures are as follows. Be sure to disconnect all the wiring before the tests.

11.6.1 Procedure of Insulation Resistance test

(1) Individually, short-circuit the power supply terminals (SUPPLY+ and SUPPLY-) and digital output terminals (DO+ and DO-), and connect the insulation resistance tester (Power OFF) to the functional grounding terminal..
The polarity between the power supply and the current output terminal or the digital output terminal must become a positive pole.
(2) Apply the DC voltage specified in Table 11.6.1 between above-mentioned terminal and the functional grounding terminal.
The voltage impression time should be a period while the test result could reach fulfilling the standard.
(3) After inspection, insert a resister (100 kΩ, 1/2W) between the terminals and discharge for approximately one second. Never touch the terminals with bare hands during discharge. Furthermore, never short-discharge without inserting a resister.

Table 11.6.1 Test terminal for insulation resistance test

Inspection location	Terminal	Test voltage	Standard
Power Supply/Digital Output - Functional Grounding	SUPPLY/DO -⏚	500 V DC	100 MΩ or more
When the optional code A is selected (with the lightning protector), values are as follows.			
Power Supply/Digital Output - Functional Grounding	SUPPLY/DO -⏚	100 V DC	20 MΩ or more

11.6.2 Procedure of Dielectric Strength Test

(1) Individually, short-circuit the power supply terminals (SUPPLY+ and SUPPLY-) and digital output terminals (DO+ and DO-), and connect the dielectric strength tester (Power OFF) to the functional grounding terminal. Set the current limitation value as 20 mA in the tester.
The polarity between the power supply and the current output terminal or the digital output terminal must become a positive pole.
(2) Apply the AC voltage specified in Table 11.6.2, which approximates a sinusoidal wave form (50 Hz or 60 Hz), between the above mentioned terminal and the functional grounding terminal.
The AC voltage should be given from 0V to the inspection voltage specified in Table 11.6.2 gradually.
(3) Keep one minute under the inspection voltage, and confirm fulfilling the standard or less of the tester.
(4) Decrease the voltage slowly so as not to generate the voltage serge after the test ends.
(5) After inspection, insert a resister (100 kΩ, 1/2W) between the terminals and discharge for approximately one second. Never touch the terminals with bare hands during discharge. Furthermore, never short-discharge without inserting a resister.

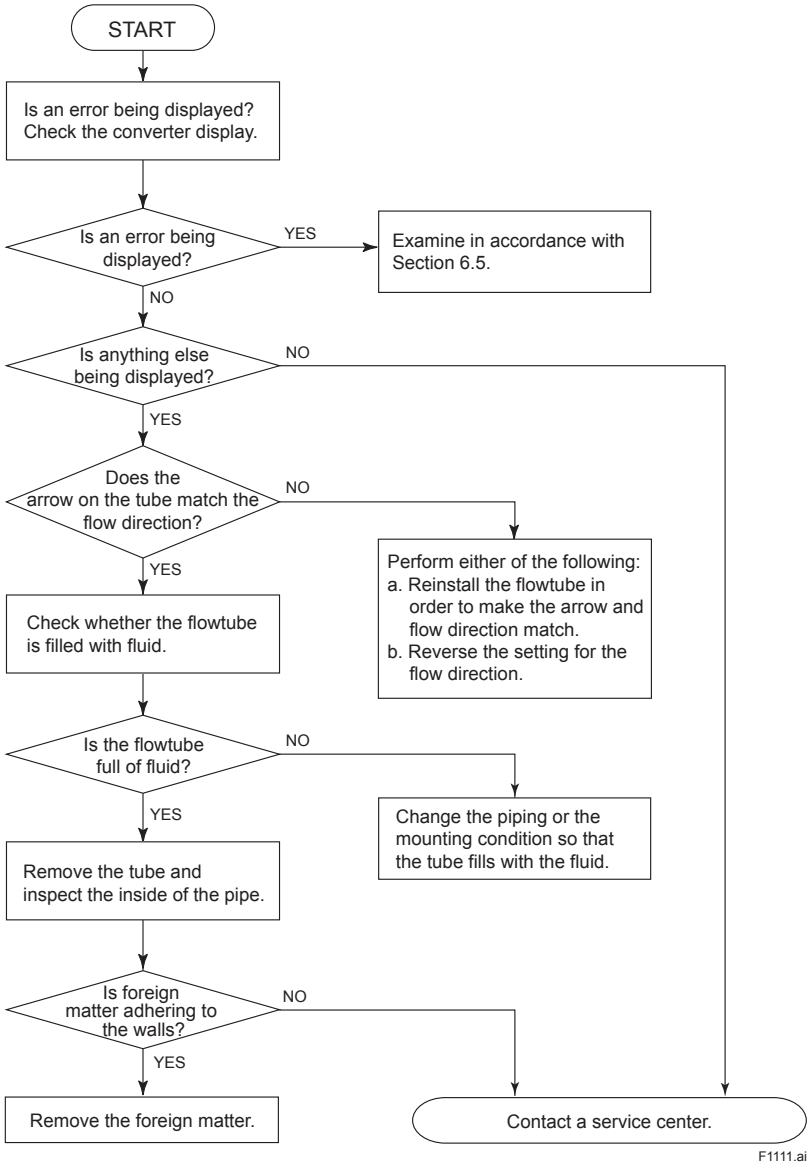
Table 11.6.2 Test terminal for dielectric strength test

Inspection location	Terminal	Test voltage	Test time	Standard
Power Supply/Digital Output - Functional Grounding	SUPPLY/DO -⏚	500 V AC	1 min.	25 mA or less
When the optional code A is selected (with the lightning protector), values are as follows.				
Power Supply/Digital Output - Functional Grounding	SUPPLY/DO -⏚	100 V AC	1 min.	6 mA or less

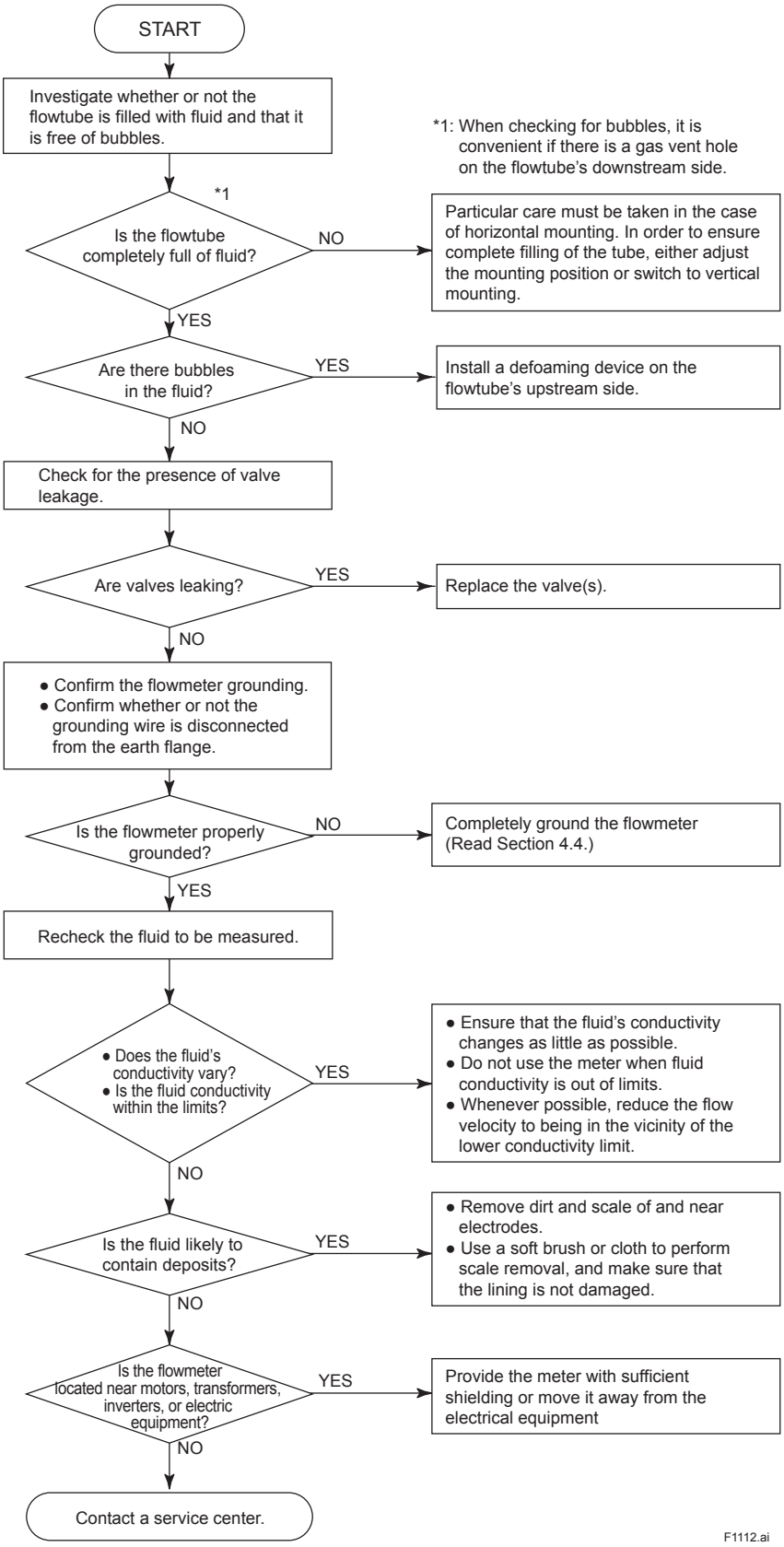
11.7 Troubleshooting

Although magnetic flowmeters rarely require maintenance, failures may occur when the instrument is not operated correctly. This section describes troubleshooting procedures where the cause of the breakdown is identified through receiver indication.

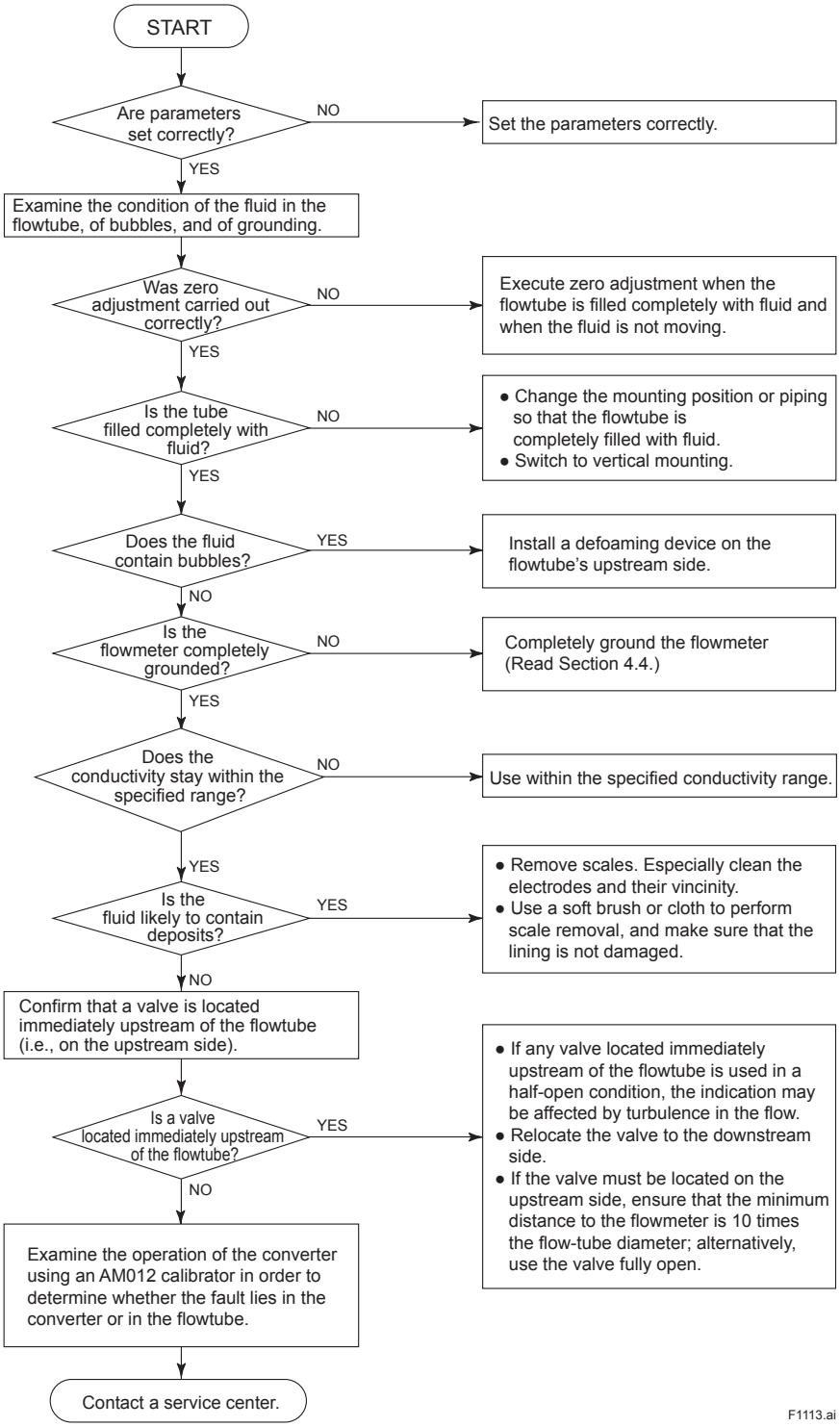
11.7.1 No Indication



11.7.2 Unstable Zero



11.7.3 Disagreement Between Indication and Actual Flow



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12. OUTLINE

12.1 STANDARD SPECIFICATIONS

● Converter

The contents of (*1) and (*2) described in the converter specifications are follows.

***1: One output can be selected from pulse, alarm, or status through the parameter setting.**

***2: For models without an indicator, the configuration tool (Such as handheld terminal or FieldMate, etc.) is necessary to set or change parameters.**

Excitation Method:

• Dual frequency excitation: Size 25 to 200 mm (1 to 8 in.)

Output Signals:

Current output and digital output can be carried out simultaneously.
Read Section 4.6.

• Current output: 4 to 20 mA DC, two-wire system
Output range: 3.8 to 20.5 mA (–1.25 to 103.13%)

• Digital output (*1):
Transistor contact output, open collector
Contact rating: 30 V DC, 120 mA DC
Low level: 0 to 2 V DC (Read Figure 12.1)

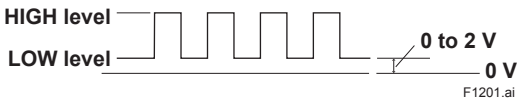


Figure 12.1 High and Low levels (transistor contact output)

Current Output Status at System Alarms (Burnout)

Up-scale: 110%, 21.6 mA DC or more (standard)
Down-scale: –5%, 3.2 mA DC or less

Supply Voltage:

14.7 to 42 V DC for general-purpose use and explosion proof type
14.7 to 32 V DC for lightning protector (optional code A)

Note 1: Supply voltage means the voltage necessary to provide between the power terminals of the magnetic flowmeter.

Note 2: Connecting with the commercial AC power supply will damage the flowmeter. Be sure to use the DC power supply in the predetermined range.

Note 3: The ADMAG AXR can be connected with almost all distributors, signal conditioner cards, and I/O modules except certain devices.
Read the following table for Yokogawa's devices, choose an appropriate connecting device and the corresponding length of cable.
For devices other than those in the table, decide on the connection by reading the supply voltage specifications and the description in Section 4.6.

Connecting device		Maximum length of cable (rough guideline)	
Name	Model	Cable with cross section of 2 mm^2	Cable with cross section of 1.25 mm^2
Signal Conditioner Card	EA1 EA2	2 km	2 km
I/O Module	AAM11 AAM11B	2 km	2 km
Analog I/O Module (for FIO)	AAI143	2 km	2 km
	AAI141 AAI841 AAI135 AAI835	Not applicable	Not applicable
Analog I/O Module (for Prosafe-RS)	SAI143	1.4 km	0.8 km
Distributor	SDBT SDBS	2 km	2 km
JUXTA	VJA1 VJA4 VJA7	2 km	2 km

Communication Requirement:

BRAIN

Communication Signal:
BRAIN communication signal (superimposed on 4 to 20 mA DC signals)
Conditions of Communication Line:
Supply Voltage: 20.6 to 42 V DC
Load Resistance: 250 to 600 Ω (including cable resistance)
Read Figure 12.2.
Communication Distance: Up to a distance of 2 km when a CEV cable is used
Read Section 4.6.
Load Capacitance: 0.22 μF or less
Load Inductance: 3.3 mH or less
Distance from other Power Line: 15 cm (6 in.) or more (Avoid parallel wiring.)
Input Impedance of Communicating Device:
10 kΩ or more at 2.4 kHz

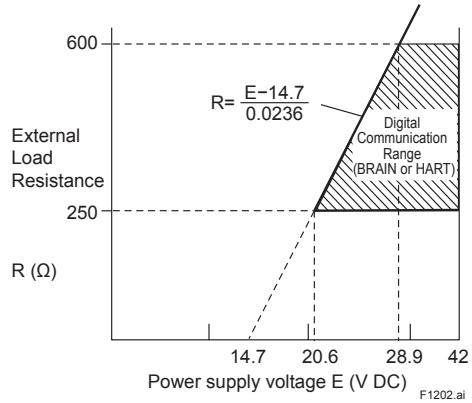


Figure 12.2 Relationship Between Power Supply Voltage And External Load Resistance

HART

Communication Signal:
HART communication signal (superimposed on 4 to 20 mA DC signals)
Note: HART is a registered trademark of the FieldComm Group.
Conditions of Communication Line:
Supply Voltage: 20.6 to 42 V DC
Load Resistance: 250 to 600 Ω (including cable resistance)
Read Figure 12.2.
HART Protocol Revision:
HART protocol revision can be selected from 5 or 7 when ordering. ("-J" only)
The protocol revision can be changed by user configuration.
The HART protocol revision at the time of shipment is shown by the last number at the serial number column of the name plate.
Note: Protocol revision supported by HART configuration tool must be the same or higher than that of AXR.

Selection of HART 5/ HART 7

Output Signal Code		-E	-J	
Ordering Information		–	Specify "5"	Specify "7"
HART Protocol Revision		HART 5		HART 7
Selection guide	Requirement for HART 7 functionality	NO		YES Be sure to confirm the protocol revision of the HART configuration tool shown in Note 2.
	Other conditions	Not available to switch to HART 7 protocol after delivery.	Available to switch to HART 7 protocol after delivery by user-configuration.	Available to switch to HART 5 protocol after delivery by user-configuration.
Remarks		Note 1	Note 2	Note 2

Note 1: "-E" is HART5 exclusive model and will be terminated. "-J" is recommended for HART communication.
Note 2: HART protocol revision for the device and HART configuration tool
HART 7 communication is supported by FieldMate R2.04 or later.

	Protocol revision supported by HART configuration tool	
	5	7
AXR, HART 5	Available	Available
AXR, HART 7	Not available	Available

Indicator (*2):

Full dot-matrix LCD (128 x 64 pixels)
Operational switch: 4 magnet switches (including push switches)

Lightning Protector:

When optional code A is selected, the lightning protector is built into the power supply and digital output terminals.

Protection:

General-purpose Use/TIIS Flameproof type:
IP66/IP67, Type 4X
Explosion proof type except for TIIS:
In the case of explosion proof type except TIIS, read description of "Enclosure" in "HAZARDOUS AREA CLASSIFICATION".

Converter Coating:

Case and Cover: Corrosion-resistant coating
Coating Color: Mint-green paint (Munsell 5.6 BG 3.3/2.9 or its equivalent)

Converter Material:

Case and Cover: Aluminum alloy

Mounting/Shapes:

- Electrical Connection: ANSI 1/2 NPT female
  ISO M20 x 1.5 female
  JIS G1/2 female
- Direction of Electrical Connection: The direction can be changed even after delivery.
- Terminal Connection: M4 size screw terminal

Grounding:

Grounding resistance of 100 Ω or less is necessary.
When the optional code A is selected, grounding resistance of 10 Ω or less shall be required.
* In case of TIIS explosion proof type, read description of HAZARDOUS AREA CLASSIFICATION.
* For an explosion proof type except for TIIS, follow the domestic electrical requirements in each country.

Functions

How to Set Parameters (*2):

Both of four push buttons and magnet switches can be used for setting. The magnet switches can be used to set parameters without opening the case cover.
The magnet switches need operational magnets (optional code BM). These are also available as part number F9840PA.
Users can choose a language on indicator from English, Japanese, German, French, Italian, and Spanish. Parameters can also be set with the configuration tool (Such as HHT (handheld terminal) or FieldMate, etc.). The language for the HHT is English only.

Instantaneous Flow Rate/Totalized Value Display Functions (for models with an indicator) (*2):

The full dot-matrix LCD enables user selections of displays from one line to three lines for:

- Instantaneous flow rate
- Instantaneous flow rate (%)
- Instantaneous flow rate (bar graph)
- Current output value (mA)
- Totalized forward-direction flow rate
- Totalized reverse-direction flow rate
- Totalized differential flow rate
- Tag No.
- Results of electrode adhesion diagnosis
- Communication type

Totalizer Display Function (*2):
The flow rate is counted one count at a time according to the setting of totalization pulse weights. For forward and reverse flow measurement functions, the totalized values of the flow direction (forward or reverse) and the flow direction are displayed on the indicator together with the units. The difference of totalized values between the forward and reverse flow rate can be displayed. Totalization for the reverse flow rate is carried out only when “Forward and reverse flow measurement functions” is selected.

Damping Time Constant (*2):
The time constant can be set from 1.0 second to 200.0 seconds (63% response). The default is 5 seconds.
When the damping time is short, the output fluctuates. Set the time to 5 seconds or more for control loop.

Span Setting Function (*2):
Span flows can be set in units such as volume flow rate, mass flow rate, time, or flow rate value. The velocity unit can also be set.
Volume Flow Rate Unit: kcf, cf, mcf, Mgal (US), kgal (US), gal (US), mgal (US), kbbl (US)*, bbl (US)*, mbbl (US)*, µbbl (US)*, Ml (megaliter), m^3, kl (kiloliter), l (liter), cm^3
Mass Flow Rate Unit (Density must be set): klb (US), lb (US), t (ton), kg, g
Velocity Unit: ft, m (meter)
Time Unit: s (sec), min, h (hour), d (day)
* “US Oil” or “US Beer” can be selected.

Pulse Output (*1)(*2):
Scaled pulse is output one by one according to the setting of pulse weight.
Pulse Width: Duty 50% or fixed pulse width (0.05, 0.1, 0.5, 1, 20, 33, 50, 100, 200, 330, 500, 1000, 2000 ms) can be selected.
Output Rate: 0.0001 to 10,000 pps (pulses per second)

Multi-range Functions (*1)(*2):
Automatic range switching
When the flow rate exceeds 100% of the range, transition to the next range (up to two ranges) is carried out automatically. Range switching can be confirmed by the status output and on the indicator.

Forward and Reverse Flow Measurement Functions (*1)(*2):
Flows in both forward and reverse directions can be measured. The reverse flow measurement can be confirmed by the status output and on the indicator.

Totalization Switch (*1)(*2):
The status output is carried out when a totalized value becomes equal to or greater than the set value.

Preset Totalization (*1)(*2):
The parameter setting enables a totalized value to be preset to a setting value or zero.

Alarm Selection Function (*2):
Alarms are classified into the System Alarms (hardware failure), Process Alarms (such as Signal Overflow and Adhesion Alarm), Setting Alarms, and Warnings. Process Alarms and Setting Alarms can be activated or deactivated for each item. The current output for an alarm can be selected from the following settings. If any System Alarm occurs, turn the power off and back on again to return to the normal condition.
System Alarm: 21.6 mA or more, 3.2 mA or less
Process Alarm, Setting Alarm:
21.6 mA or more, 20.5 mA, HOLD (fixed to the current value before the alarm), 4 mA, 3.8 mA, 3.2 mA or less.
The default settings of each alarm are as follows:

	Standard	Optional code C1
System Alarm	21.6 mA or more	3.2 mA or less
Process Alarm		
Setting Alarm		

Note: In the case of style: S1 with optional code C1, the current output is set up to 3.8 mA during Process Alarms and Setting Alarms.

NE-107 Alarm Message (*2):
Alarms are classified into 4 categories by NAMUR NE-107 and can be displayed.
-F: Failure
-C: Function check
-S: Out of specification
-M: Maintenance required

Alarm Output (*1)(*2):
Alarms are generated only for the items selected via the ‘Alarm Selection Function’ if relevant failures occur.

Self Diagnosis Functions (*2):
When an alarm is output, details of the System Alarms, Process Alarms, Setting Alarms, and Warnings are displayed together with the specific description of corresponding countermeasures.
Results of mean flow measurement during a given period, etc. can be checked by using parameters.

Flow Rate Upper/Lower Limit Alarms (*1)(*2):
If a flow rate becomes out of the predetermined range, the alarm output is generated.

Electrode Adhesion Diagnosis Function (*1) (*2):
This function enables checking of the adhesion level of insulating substances to the electrodes. Depending on the status of adhesion, users are notified by a warning or an alarm via status outputs.
While adhesion diagnosis is being carried out (approximately 5 minutes), a current of 4 mA is output because the flow measurement is not performed.
Adhesion diagnosis should only be carried out when the fluid velocity is completely zero by closing the valve.
When adhesion diagnosis is carried out, change the control loop to the manual mode first.

Data Security during Power Failure:
Data (parameters, totalization value, etc.) storage by EEPROM. No back-up battery required.

Low Cut (*2):
In this function, the values of the current output along with LCD indication, totalization, and pulse, which are corresponding to setting span of 0 to 20%, are fixed at 0% (including reverse flow). The default setting is 3%.
When the Low Cut point is small, the incorrect output may occur at the flow rate of zero. Set the Low Cut point to 3% or more. If the span is small, the damping time is short or the fluid is low conductivity, the incorrect output may easily occur at the flow rate of zero.

Zero Adjustment Function (*2):
By using the parameter setting, zero adjustment is carried out to ensure that the output for zero flow is 0%. Zero adjustment should be carried out only when the flowtube is filled with measurement fluid and the flow is completely stopped by closing the valves. During zero adjustment (450 seconds), the current output is 10.4 mA.

● Flowtubes

Size of AXR Flowtubes:

Lay length code 1 **Unit: mm (in.)**

Use	Process Connection	Integral Flowmeter
General-purpose Use/Explosion Proof Type	Wafer*1	80 (3.0), 100 (4.0), 150 (6.0), 200 (8.0)
	Flange*1	25 (1.0), 40 (1.5), 50 (2.0), 65 (2.5), 80 (3.0), 100 (4.0), 150 (6.0), 200 (8.0)

*1: The dimensions of lay length code 1 are the same as those of the PFA lining standard lay length (lay length code 1) in the AXF series. For details, read "EXTERNAL DIMENSIONS."

Lay length code 2 **Unit: mm (in.)**

Use	Process Connection	Integral Flowmeter
General-purpose Use/Explosion Proof Type	Wafer*2	25 (1.0), 40 (1.5), 50 (2.0), 65 (2.5), 80 (3.0), 100 (4.0), 150 (6.0), 200 (8.0)

*2: Excluding the size of 65 mm, dimensions of lay length code 2 are the same as those of PFA lining replacement models (lay length code 2) in AXF series. Lay lengths for special gaskets (optional codes GA, GB, GD) are different. For details, read "EXTERNAL DIMENSIONS."

Coating:

General-purpose Use/Explosion Proof Type:

Size 25 to 100 mm (1 to 4 in.) (Wafer type),
Size 25 to 100 mm (1 to 4 in.) (Flange type):
- Housing: No coating (Stainless steel surface)
- Flange (Flange type only):
  No coating (Stainless steel surface)

Size 150 to 200 mm (6.0 to 8 in.) (Wafer type),
Size 150 to 200 mm (6.0 to 8 in.) (Flange type):
- Housing, Flange (Flange type only)
  Corrosion-resistant coating
  Coating color; Mint green (Munsell 5.6 BG 3.3/2.9 or its equivalent)

Flowtube Material:

Size 25 to 100 mm (1 to 4 in.)

Part Name			Material
Housing			Stainless steel-JIS SUS304 (AISI 304 SS/EN 1.4301 equivalent)
Flange			Stainless steel-JIS SUS304 or SUSF304 (AISI 304 SS/EN 1.4301 equivalent)
Mini-Flange	Wafer type	Size 25 mm (1.0 in.)	Stainless steel-SCS13
		Size 40 to 100 mm (1.5 to 4.0 in.)	Stainless steel-JIS SUS430 ASTM 4300/DIN X6Cr17/ EN 1.4016 equivalent
Pipe	Wafer type	Size 25 mm (1.0 in.)	Stainless steel-SCS13
		Size 40 to 100 mm (1.5 to 4.0 in.)	Stainless steel-JIS SUS304 (AISI 304 SS/EN 1.4301 equivalent)
	Flange type	Size 25 mm (1.0 in.)	Stainless steel-SCS13
		Size 40 to 100 mm (1.5 to 4.0 in.)	Stainless steel-JIS SUS304 (AISI 304 SS/ EN 1.4301 equivalent)

Size 150 mm (6.0 in.) to 200 mm (8.0 in.)

Part Name		Material
Housing		Carbon steel-JIS SPCC equivalent
Flange	Process Connection code: B**	Stainless steel-JIS SUS304 or SUSF304 (AISI 304 SS/EN 1.4301 equivalent)
	Process Connection code: C**	Carbon steel-JIS SS400 or SFVC 2A
Mini-Flange	Wafer Type	Carbon steel-JIS SS400 or SFVC 2A
Pipe	Flange Type/Wafer Type	Stainless steel-JIS SUS 304 (AISI 304 SS/EN 1.4301 equivalent)

Wetted Part Material:

Lining;
Fluorocarbon PFA*1 lining
*1: PFA is FDA (U.S. Food and Drug Administration) approval material.
The inner surface of the PFA lining is mirror-finished to Ra of 0.05 to 0.15 µm. The value of Ra is the average of measurements at several points. Mirror finished PFA lining is standard for size 25 to 100 mm (1 to 4 in.) and optional for size 150 to 200 mm (6 to 8 in.) specified by optional code PM.

Electrode;
Stainless steel-JIS SUS316L (AISI 316L SS/EN 1.4404 equivalent), Hastelloy*1 C276 equivalent, Tantalum, Platinum-Iridium

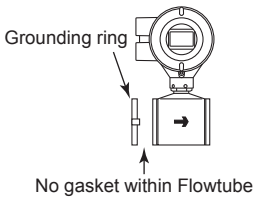
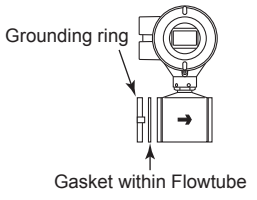
Grounding Ring/Grounding Electrode;

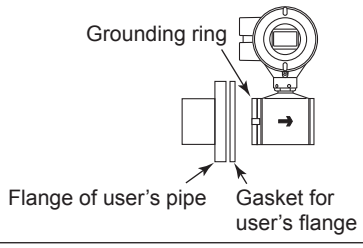
- Grounding Ring (plate type)
  Stainless steel-JIS SUS316 (AISI 316 SS/EN 1.4401 equivalent), Stainless steel-JIS SUS316L or ASTM 316L (AISI 316L SS/EN 1.4404 equivalent), Hastelloy*1 C276 equivalent
- Grounding Electrode (electrode type)*2
  Fluorocarbon PFA lining + grounding electrode (Tantalum, Platinum-Iridium)

*1: Hastelloy is a registered trademark of Haynes International Inc.

*2: The permeable fluids (such as nitric acid, hydrofluoric acid, or sodium hydroxide at high temperature) are unusable.

Gasket;

Use	General-purpose Use/ Explosion Proof Type
Standard	
Optional code (GA, GC, or GD)	
	Gasket Material (within Flowtube)
	GA: Fluororubber for PVC pipes (Viton®) GC: Acid-resistant fluororubber for PVC pipes (Viton®) GD: Alkali-resistant fluororubber for PVC pipes (Viton®)

Use	General-purpose Use/ Explosion Proof Type
Optional code (BSF or BSC)	
	Gasket Material (for user's flange)
	BSF: PTFE-sheathed non-asbestos BSC: Chloroprene rubber

Recommended Gaskets Between Flowtubes And User's Flanges:

Gaskets Type

Use compressed non-asbestos fiber gaskets, PTFE-sheathed non-asbestos gaskets or gaskets which have equivalent elasticity.
For optional codes GA, GC, and GD, use rubber gaskets or others which have equivalent elasticity.

Gaskets Size

Be sure to choose a gasket with an inner and outer diameter that does not protrude inside the piping (Read Subsection 3.3.4).
If the inner diameter of the gasket is too large, or outer diameter of the gasket is too small, fluid leakage may result.

Electrode Construction:

Internal insertion type

12.2 HAZARDOUS AREA CLASSIFICATION

Read Chapter 14.

12.3 STANDARD PERFORMANCE

Accuracy:

General-Purpose Use; Vs: Span setting value (m/s)

Size in mm (in.)	Span in m/s (ft/s)	Accuracy
25 to 100 (1 to 4)	0.3 ≤ Vs < 1 (1 ≤ Vs < 3.3)	±0.25 cm/s (at indications less than 50% of span)
		±(0.4+0.1/Vs)% of rate (at indications 50% or more of span)
	1 ≤ Vs < 2 (3.3 ≤ Vs < 6.7)	±0.2% of span (at indications less than 35% of span)
		±0.5% of rate (at indications 35% or more of span)
	2 ≤ Vs ≤ 10 (6.7 ≤ Vs ≤ 33)	±0.16% of span (at indications less than 30% of span)
		±0.5% of rate (at indications 30% or more of span)
150 to 200 (6 to 8)	0.3 ≤ Vs < 1 (1 ≤ Vs < 3.3)	±0.30 cm/s (at indications less than 50% of span)
		±(0.3+0.2/Vs)% of rate (at indications 50% or more of span)
	1 ≤ Vs < 2 (3.3 ≤ Vs < 6.7)	±0.3% of span (at indications less than 35% of span)
		±0.5% of rate (at indications 35% or more of span)
	2 ≤ Vs ≤ 10 (6.7 ≤ Vs ≤ 33)	±0.16% of span (at indications less than 30% of span)
		±0.5% of rate (at indications 30% or more of span)

Explosion proof Type; Vs: Span setting value (m/s)

Size in mm (in.)	Span in m/s (ft/s)	Accuracy
25 to 100 (1 to 4)	0.3 ≤ Vs < 1 (1 ≤ Vs < 3.3)	±0.30 cm/s (at indications less than 50% of span)
		±(0.3+0.2/Vs)% of rate (at indications 50% or more of span)
	1 ≤ Vs < 2 (3.3 ≤ Vs < 6.7)	±0.3% of span (at indications less than 35% of span)
		±0.5% of rate (at indications 35% or more of span)
	2 ≤ Vs ≤ 10 (6.7 ≤ Vs ≤ 33)	±0.16% of span (at indications less than 30% of span)
		±0.5% of rate (at indications 30% or more of span)
150 to 200 (6 to 8)	0.3 ≤ Vs < 1 (1 ≤ Vs < 3.3)	±0.50 cm/s (at indications less than 50% of span)
		±(0.5/Vs)% of rate (at indications 50% or more of span)
	1 ≤ Vs < 2 (3.3 ≤ Vs < 6.7)	±0.45% of span (at indications less than 30% of span)
		±0.25% of span (at indications from 30% or more to less than 45% of span)
		0.5% of rate (at indications 45% or more of span)
	2 ≤ Vs ≤ 10 (6.7 ≤ Vs ≤ 33)	±0.24% of span (at indications less than 35% of span)
		±0.5% of rate (at indications 35% or more of span)

The accuracy of a product before shipment is defined as totalized value at the result of calibration test in our water actual flow test facility.
Calibrated conditions in our water actual test facility are as follows:

Fluid temperature:	20 ± 10°C
Ambient temperature:	20 ± 5°C
Length of straight runs:	10 D or more on the up-stream side; 5 D or more on the downstream side
Reference conditions:	Similar to BS EN29104 (1993); ISO 9104 (1991)

Accuracy for Multi-drop of HART (generally accepted values)

Vs: Span setting value (m/s)

Size in mm (in.)	Span in m/s (ft/s)	Accuracy
25 to 200 (1 to 8)	0.3 ≤ Vs < 1 (1 ≤ Vs < 3.3)	±(0.4+0.3/Vs)% of span
	1 ≤ Vs < 2 (3.3 ≤ Vs < 6.7)	± 0.5% of span
	2 ≤ Vs ≤ 10 (6.7 ≤ Vs ≤ 33)	± 0.25% of span (at indications less than 50% of span)
		± 0.5% of rate (at indications 50% or more of span)

Repeatability (Reference):

±0.2% of rate
(When the flow velocity is 1.5 m/s toward 2 m/s of setting span)

Insulation Resistance:

Inspection location	Terminal	Test voltage	Standard
Power Supply/Digital Output - Functional Grounding	SUPPLY/DO -⏚	500 V DC	100 MΩ or more

When the optional code A is selected (with the lightning protector), values are as follows.

Power Supply/Digital Output - Functional Grounding	SUPPLY/DO -⏚	100 V DC	20 MΩ or more

Note: Conduct the test according to the instruction manual.

Dielectric Strength:

Inspection location	Terminal	Test voltage	Test time	Standard
Power Supply/Digital Output - Functional Grounding	SUPPLY/DO -⏚	500 V AC	1 min.	25 mA or less

When the optional code A is selected (with the lightning protector), values are as follows.

Power Supply/Digital Output - Functional Grounding	SUPPLY/DO -⏚	100 V AC	1 min.	6 mA or less

Note: Conduct the test according to the instruction manual.

CE Marking:

CE marking is affixed on the name plate except for models with any of the following specifications.

- Optional Code: FF1, CF1, SF2, JF3

Safety Requirement Standards:

CAN/CSA C22.2 No. 61010-1-04

- Altitude of installation site: Max. 2000 m above sea level
- Installation category: I
  "Overvoltage category (Installation category)" describes a number which defines a transient overvoltage condition. It implies the regulation for impulse withstand voltage. " I " applies to electrical equipment which is supplied from the circuit when appropriate transient overvoltage control means (interfaces) are provided.
- Pollution degree: 2
  "Pollution degree" describes the degree to which a solid, liquid, or gas which deteriorates dielectric strength or surface resistivity is adhering. " 2 " applies to normal indoor atmosphere. Normally, only non-conductive pollution occurs. Occasionally, however, temporary conductivity caused by condensation must be expected.
- Indoor/Outdoor use

EMC Conformity Standards:

EN61326-1 Class A, Table 2 (For use in industrial locations)
EN61326-2-3

- Performance Specification during immunity test
  Flowrate output: Output fluctuation within ±3% of default (1m/s) span

CAUTION

This instrument is a class A product, and it is designed for use in the industrial environment.

Please use this instrument in the industrial environment only.

SIL Certification:

AXR series are certified by exida in compliance with the following standards;
IEC 61508: 2000; Part1 to Part7
Functional Safety of Electrical/electronic/programmable electronic safety-related systems; SIL 2 capability for single flowmeter use, SIL 3 capability for dual flowmeter use.

12.4 NORMAL OPERATING CONDITIONS

Ambient Temperature:

General-purpose Use:

–40 to +55°C (–40 to +131°F)

Explosion proof type:

In the case of explosion proof type, read description of " Ambient Temperature" "Enclosure" in "HAZARDOUS AREA CLASSIFICATION"

*1: Minimum temperature should also be limited according to minimum fluid temperature of flow tube's specification.
Read description of "Fluid Temperature and Pressure".

*2: Indicator operating range: –20 to +55°C (–4 to +131°F)

Ambient Humidity: 0 to 100%

Lengthy continuous operation at 95% or more is not recommended.

Fluid Conductivity:

Size 25 to 200 mm (1 to 8 in.): 10 µS/cm or larger

Note: Fluids with large flow noise (pure water, fluids with low conductivity and low viscosity such as alcohol) cause the output fluctuation and therefore it is impossible to measure accurately.

Output Fluctuation:

The output fluctuates depending on the fluid conditions and damping settings.
The following table shows the output fluctuation as a rough guideline at flow velocity near 100% of flow span (damping: 5 s)

• Size 25 to 100 mm (1 to 4 in.)

Fluid Conductivity [µS/cm]	Fluctuation (% of rate) as a rough guideline	
	Flow Span 2.0 m/s	Flow Span 4.0 m/s
10	3.0% or less	7.0% or less
50	1.0% or less	1.0% or less
100	0.5% or less	0.5% or less
500	0.5% or less	0.5% or less

• Size 150 to 200 mm (6 to 8 in.)

Fluid Conductivity [µS/cm]	Fluctuation (% of rate) as a rough guideline	
	Flow Span 2.0 m/s	Flow Span 4.0 m/s
10	5.0% or less	Non-recommendation
50	2.0% or less	3.0% or less
100	1.0% or less	1.0% or less
500	0.6% or less	1.0% or less

Measurable Flow Rate Range:

SI Units (Size: mm, Flow rate: m^3/h)

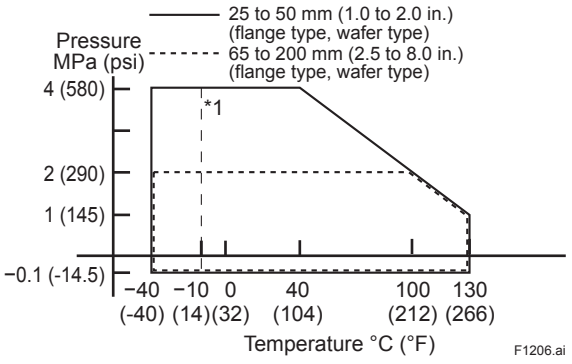
Size (mm)	0 to Min. Span Flow Rate (0.3 m/s)	0 to Max. Span Flow Rate (10 m/s)
25	0 to 0.5302 m^3/h	0 to 17.671 m^3/h
40	0 to 1.3572	0 to 45.23
50	0 to 2.1206	0 to 70.68
65	0 to 3.584	0 to 119.45
80	0 to 5.429	0 to 180.95
100	0 to 8.483	0 to 282.74
150	0 to 19.090	0 to 636.1
200	0 to 33.930	0 to 1,130.9

English Units (Size: in., Flow rate: GPM)

Size (in.)	0 to Min. Span Flow Rate (1 ft/s)	0 to Max. Span Flow Rate (33 ft/s)
1.0	0 to 2.335 GPM	0 to 77.80 GPM
1.5	0 to 5.253	0 to 175.0
2.0	0 to 9.337	0 to 311.2
2.5	0 to 14.59	0 to 486.2
3.0	0 to 21.01	0 to 700.2
4.0	0 to 37.35	0 to 1244
6.0	0 to 84.03	0 to 2800
8.0	0 to 149.4	0 to 4979

Fluid Temperature and Pressure:

The following figure shows maximum allowable fluid pressure for the flowtube. Further fluid pressure should also be limited according to flange rating.



*1: For wafer types of 40 to 200 mm (1.5 to 8.0 in.), and for carbon steel flange types (process connection code: C**) of 150 to 200 mm (6.0 to 8.0 in.), the minimum fluid temperature is –10°C (+14°F).

*2: For fluid temperature of the explosion proof type, read descriptions of "HAZARDOUS AREA CLASSIFICATION".

Vibration Conditions:

9.8 m/s^2 or less (frequency of 500 Hz or less)

Note: · Level of vibration is in conformity with IEC 60068-2-6 (SAMA 31.1-1980).
· Avoid locations with much vibration where the pipe vibration frequency is 500 Hz or more. Such a condition may cause damage to the instrument.

12.5 MODEL AND SUFFIX CODE

• Wafer Type

Model	Suffix Code	Description	Applicable Model
AXR025	----------	Size 25 mm (1 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR040	----------	Size 40 mm (1.5 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR050	----------	Size 50 mm (2 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR065	----------	Size 65 mm (2.5 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR080	----------	Size 80 mm (3 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR100	----------	Size 100 mm (4 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR150	----------	Size 150 mm (6 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR200	----------	Size 200 mm (8 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
Use	G ----------	General-Purpose Use	
	C ----------	Explosion proof Type (*1)	
Output Signal and Communication	-D ----------	Integral Flowmeter with 4 to 20 mA DC Output and digital communication (BRAIN protocol)	
	-E ----------	Integral Flowmeter with 4 to 20 mA DC Output and digital communication (HART protocol) (*12)	
	-J ----------	Integral Flowmeter with 4 to 20 mA DC Output with digital communication (HART5/HART7 protocol) (*13)	
Power Supply	1 ----------	Integral Flowmeter Operating voltage range 14.7 to 42 V DC Two-wire system	
Lining (*2)	A ----------	Fluorocarbon PFA	
Electrode Material (*2)	L ----------	JIS SUS316L (AISI 316L SS/EN 1.4404 Equivalent)	
	P ----------	Platinum-iridium	
	H ----------	Hastelloy C276 Equivalent	
	T ----------	Tantalum	
Electrode Structure	1 ----------	Non-replaceable	
Grounding Ring and Grounding Electrode Material (*2)	N ----------	None (*3)	
	S ----------	JIS SUS316 (AISI 316 SS/EN 1.4401 Equivalent)	
	L ----------	JIS SUS316L or ASTM 316L (AISI 316L SS/EN 1.4404 Equivalent)	
	P ----------	Platinum-iridium	
	H ----------	Hastelloy C276 Equivalent	
	T ----------	Tantalum	
Process Connection (*4) (*5)	-AA1 ----------	ANSI Class 150 Wafer	
	-AA2 ----------	ANSI Class 300 Wafer	
	-AD1 ----------	DIN PN 10 Wafer (*6)	Size 200 mm (8.0 in)
	-AD2 ----------	DIN PN 16 Wafer (*6)	Size 65 mm (2.5 in.) to 200 mm (8.0 in.)
	-AD4 ----------	DIN PN 40 Wafer (*6)	Size 25 mm (1.0 in.) to 50 mm (2.0 in.)
	-AJ1 ----------	JIS 10K Wafer	
	-AJ2 ----------	JIS 20K Wafer	
	-AG1 ----------	JIS F12 (JIS75M) Wafer	Size 80 mm (3.0 in.) to 200 mm (8.0 in.)
Lay Length	1 ----------	Lay length code 1 (*7)	Size 80 mm (3.0 in.) to 200 mm (8.0 in.)
	2 ----------	Lay length code 2 (*8)	
Electrical Connection (*9)	-0 ----------	JIS G1/2 female	
	-2 ----------	ANSI 1/2 NPT female	
	-4 ----------	ISO M20 × 1.5 female	
Indicator (*10)(*11)	1 ----------	Integral Flowmeter with indicator (Horizontal)	
	2 ----------	Integral Flowmeter with indicator (Vertical)	
	N ----------	Integral Flowmeter without indicator	
Calibration	B -----	Always B	
Options	/□	Optional code (Read the Table of Optional Specifications)	

Note: An exclusive User's Manual might be attached for products whose suffix code or optional codes contain code "Z". Please read it along with their standard manual.

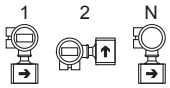
*1: For explosion proof types, specify types of explosion proof certification using the optional codes.
For the TIIS flameproof type, select optional code G11. Available only for JIS G1/2 female electrical connections.
Available only for wiring of using a flameproof packing adapter approved by Yokogawa.
The flameproof metal conduit wiring for TIIS flameproof type is not permitted.

*2: ⚠ Users must consider the characteristics of selected wetted parts material and influence of process fluids.
The use of inappropriate materials can result in the leakage of corrosive process fluids and cause injury to personnel and/or damage to plant facilities. It is also possible that the instrument itself can be damaged and that fragments from the instrument can contaminate the user's process fluids.
Be very careful with highly corrosive process fluids such as hydrochloric acid, sulfuric acid, hydrogen sulfide, sodium hypochlorite, and high-temperature steam (150°C [302°F] or above). Contact Yokogawa for detailed information of the wetted parts material.

*3: Available only for metal piping.

*4: Mating dimensions are based on standards as follow:
ANSI: ASME B 16.5, DIN: DIN 2501, JIS: JIS B 2220 and JIS G 3443-2

*5: Allowable fluid pressure should also be limited according to fluid temperature and pressure.
*6: Even when DIN PN10, 16, or 40 is required for a model of size 25 to 50 mm (1.0 to 2.0 in.), select PN40 (Process connection code: AD4) because there is no difference in the dimensions of the mating faces.
Even when DIN PN10 or 16 is required for a model of size 65 to 150 mm (2.5 to 6.0 in.), select PN16 (Process connection code: AD2) because there is no difference in the dimensions of the mating faces.
*7: The dimensions of lay length code 1 are the same as those of the PFA lining standard lay length (lay length code 1) in the AXF series. For details, read “EXTERNAL DIMENSIONS”.
*8: Excluding the size of 65 mm, dimensions of lay length code 2 are the same as those of PFA lining replacement models (lay length code 2) in AXF series. Lay lengths for special gaskets (optional codes GA, GC, GD) are different. For details, read “EXTERNAL DIMENSIONS”.
*9: For an explosion proof type except for TIIS, select “ANSI 1/2 NPT female” or “ISO M20 × 1.5 female”.
For the TIIS flameproof type, select “JIS G1/2 female” and optional code G11.
*10: Select from among the figures at the right.



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*11: In the case of the TIIS flameproof type, select “with indicator” (code 1 or 2).
*12: Output signal code “-E”: HART 5.(Output signal code “-J” is recommended for HART communication.)
*13: Output signal code “-J”: HART 5 or HART7 selectable. Specify HART 5 or HART 7 when ordering.

• Flange Type

Model	Suffix Code	Description	Applicable Model
AXR025	----------	Size 25 mm (1 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR040	----------	Size 40 mm (1.5 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR050	----------	Size 50 mm (2 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR065	----------	Size 65 mm (2.5 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR080	----------	Size 80 mm (3 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR100	----------	Size 100 mm (4 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR150	----------	Size 150 mm (6 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
AXR200	----------	Size 200 mm (8 in.) Two-wire Magnetic Flowmeter Integral Flowmeter	
Use	G ----------	General-Purpose Use	
	C ----------	Explosion proof Type (*1)	
Output Signal and Communication	-D ----------	Integral Flowmeter with 4 to 20 mA DC Output and digital communication (BRAIN protocol)	
	-E ----------	Integral Flowmeter with 4 to 20 mA DC Output and digital communication (HART protocol) (*11)	
	-J ----------	Integral Flowmeter with 4 to 20 mA DC Output with digital communication (HART5/HART7 protocol) (*12)	
Power Supply	1 ----------	Integral Flowmeter Operating voltage range 14.7 to 42 V DC Two-wire system	
Lining (*2)	A ----------	Fluorocarbon PFA	
Electrode Material (*2)	L ----------	JIS SUS316L (AISI 316L SS/EN 1.4404 Equivalent)	
	P ----------	Platinum-iridium	
	H ----------	Hastelloy C276 Equivalent	
	T ----------	Tantalum	
Electrode Structure	1 ----------	Non-replaceable	
Grounding Ring and Grounding Electrode Material (*2)	N ----------	None (*3)	
	S ----------	JIS SUS316 (AISI 316 SS/EN 1.4401 Equivalent)	
	L ----------	JIS SUS316L or ASTM 316L (AISI 316L SS/EN 1.4404 Equivalent)	
	P ----------	Platinum-iridium	
	H ----------	Hastelloy C276 Equivalent	
	T ----------	Tantalum	
Process Connection (*4) (*5)	-BA1 ----------	ANSI Class 150 Flange JIS SUS304 or SUSF304	
	-BA2 ----------	ANSI Class 300 Flange JIS SUS304 or SUSF304	
	-BD1 ----------	DIN PN 10 Flange(JIS SUS304 or SUSF304) (*6)	Size 200 mm (8.0 in.)
	-BD2 ----------	DIN PN 16 Flange JIS SUS304 or SUSF304 (*6)	Size 65 mm (2.5 in.) to 100 mm (4.0 in.)
	-BD4 ----------	DIN PN 40 Flange JIS SUS304 or SUSF304 (*6)	Size 25 mm (1.0 in.) to 50 mm (2.0 in.)
	-BJ1 ----------	JIS 10K Flange JIS SUS304 or SUSF304	
	-BJ2 ----------	JIS 20K Flange JIS SUS304 or SUSF304	
	-BG1 ----------	JIS F12 (JIS75M) Flange JIS SUS304 or SUSF304	Size 80 mm (3.0 in.) to 200 mm (8.0 in.)
	-CA1 ----------	ANSI Class 150 Flange (Carbon Steel)	Size 150 mm (6.0 in.) to 200 mm (8.0 in.), Not available for TIIS flameproof type.
	-CA2 ----------	ANSI Class 300 Flange (Carbon Steel)	Size 150 mm (6.0 in.) to 200 mm (8.0 in.), Not available for TIIS flameproof type.
	-CD1 ----------	DIN PN 10 Flange (Carbon Steel) (*6)	Size 200 mm (8.0 in.), Not available for TIIS flame-proof type.
	-CD2 ----------	DIN PN 16 Flange (Carbon Steel) (*6)	Size 150 mm (6.0 in.) to 200 mm (8.0 in.), Not available for TIIS flameproof type.
	-CJ1 ----------	JIS 10K Flange (Carbon Steel)	Size 150 mm (6.0 in.) to 200 mm (8.0 in.), Not available for TIIS flameproof type.
	-CJ2 ----------	JIS 20K Flange (Carbon Steel)	Size 150 mm (6.0 in.) to 200 mm (8.0 in.), Not available for TIIS flameproof type.
	-CG1 ----------	JIS F12 (JIS75M) Flange (Carbon Steel)	Size 150 mm (6.0 in.) to 200 mm (8.0 in.), Not available for TIIS flameproof type.
Lay Length	1 ----------	Lay length code 1 (*7)	
Electrical Connection (*8)	-0 ---------	JIS G1/2 female	
	-2 ---------	ANSI 1/2 NPT female	
	-4 ---------	ISO M20 × 1.5 female	
Indicator (*9)(*10)	1 -------	Integral Flowmeter with indicator (Horizontal)	
	2 -------	Integral Flowmeter with indicator (Vertical)	
	N -------	Integral Flowmeter without indicator	
Calibration	B ----	Always B	
Options	/□	Optional code (Read the Table of Optional Specifications)	

Note: An exclusive User's Manual might be attached for products whose suffix code or optional codes contain code "Z". Please read it along with their standard manual.

*1: For explosion proof types, specify types of explosion proof certification using the optional codes.
For the TIIS flameproof type, select optional code G11. Available only for JIS G1/2 female electrical connections.
Available only for wiring of using a flameproof packing adapter approved by Yokogawa.
The flameproof metal conduit wiring for TIIS flameproof type is not permitted.

*2: ⚠ Users must consider the characteristics of selected wetted parts material and influence of process fluids.
The use of inappropriate materials can result in the leakage of corrosive process fluids and cause injury to personnel and/or damage to plant facilities. It is also possible that the instrument itself can be damaged and that fragments from the instrument can contaminate the user's process fluids. Be very careful with highly corrosive process fluids such as hydrochloric acid, sulfuric acid, hydrogen sulfide, sodium hypochlorite, and high-temperature steam (150°C [302°F] or above). Contact Yokogawa for detailed information of the wetted parts material.

*3: Available only for metal piping.

*4: Mating dimensions are based on standards as follow:
ANSI:ASME B 16.5, DIN: DIN 2501, JIS:JIS B 2220 and JIS G 3443-2

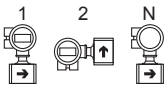
*5: Allowable fluid pressure should also be limited according to fluid temperature and pressure.

*6: Even when DIN PN10, 16, or 40 is required for a model of size 25 to 50 mm (1.0 to 2.0 in.), select PN40 (Process connection codes: BD4) because there is no difference in the dimensions of the mating faces.
Even when DIN PN10 or 16 is required for a model of size 65 to 150 mm (2.5 to 6.0 in.), select PN16 (Process connection codes: BD2) because there is no difference in the dimensions of the mating faces.

*7: The dimensions of lay length code 1 are the same as those of the PFA lining standard lay length (lay length code 1) in the AXF series.
For details, read "EXTERNAL DIMENSIONS".

*8: For an explosion proof type except for TIIS, select "ANSI 1/2 NPT female" or "ISO M20 × 1.5 female".
For the TIIS flameproof type, select "JIS G1/2 female" and optional code G11.

*9: Select from among the figures at the right.



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*10: In the case of the TIIS flameproof type, select "with indicator" (code 1 or 2).

*11: Output signal code "-E": HART 5.(Output signal code "-J" is recommended for HART communication.)

*12: Output signal code "-J": HART 5 or HART 7 selectable. Specify HART 5 or HART 7 when ordering.

12.6 OPTIONAL SPECIFICATIONS

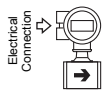
○Available –: Not available

Item	Specifications	Applicable Model		Code
		General	Explosion proof	
		AXR***G	AXR***C	
Lightning Protector	A lightning protector is built into the power supply and digital output terminals. Supply voltage: 14.7 to 32 V DC Allowable current: Max 600 A (8/20 µs)	○	○	A
Down-scale of output status at alarms (Burnout)	The current output is set to 3.2 mA (-5%) or less during System Alarms (hardware failure), Process Alarms and Setting Alarms. Standard products are delivered with a setting of 21.6 mA (110%) or more during System Alarms, Process Alarms and Setting Alarms. Note: In the case of style: S1 with optional code C1, the current output is set up to 3.2 mA or less during System Alarms, and 3.8 mA during Process Alarms and Setting Alarms.	○	○	C1
Mass Unit Setting	The flow rate span, transmission pulse weight, and totalizer display pulse weight can be set in terms of mass unit. Specify the density of the process fluid when ordering in addition to the mass flow rate span, transmission pulse weight (for mass unit), and totalizer display pulse weight (for mass unit). 1. Density a. Available density Numerics: Specify the numeric within the value of 500 to 2000 kg/m^3, 4.2 to 16.7 lb/gal, or 31.2 to 124.8 lb/cf. And it can be up to five digits, to a maximum of 32000 ignoring the decimal point. A fraction is limited to the fourth decimal place. b. Available density units: kg/m^3, lb/gal, lb/cf Example: A water density is about 1000kg/m^3. In this case specify "1000kg/m^3". However a density is changed by temperature. Specify the actual density. (The 1000kg/m^3 is equivalent to 8.345lb/gal and 62.43lb/cf.) 2. The mass flow rate span, transmission pulse weight, and totalizer display pulse weight a. Available density Numerics: Specify the numeric within the value of 0.0001 to 32000. And it can be up to five digits, to a maximum of 32000 ignoring the decimal point. A fraction is limited to the fourth decimal place. b. Mass Units Available mass units: t, kg, g, klb, lb Available time units: /d, /h, /min, /s Note1: In the case of specifying the mass flow span, calculate the volumetric flow span by the setting density, and specify the available value in the mass flow span. Note2: In the case of transmission pulse weight and totalizer display pulse weight, specify the mass unit which was specified as the flow unit.	○	○	MU
Waterproof Glands	Waterproof glands are attached to the electrical connections. Available only for JIS G1/2 female electric connections.	○	–	EG
Waterproof Glands with Union Joints	Waterproof glands with union joints are attached to the electrical connections. Available only for JIS G1/2 female electric connections.	○	–	EU
Plastic Glands	Plastic glands are attached to the electrical connections. Available only for JIS G1/2 female electric connections.	○	–	EP
Mirror Finished PFA Lining	Mirror finishing on the PFA lining inside of the tube to the smoothness lining. The Ra is average of measured values on several points. Size 150 to 200 mm (6 to 8 in): Ra 0.05 to 0.15 µm Mirror finished PFA lining is standard for size 25 to 100 mm (1 to 4 in.) and optional for size 150 to 200 mm (6 to 8 in.) specified by optional code PM.	○	○	PM
Stainless Steel Tag Plate	A pendant tag plate of JIS SUS304 (AISI 304 SS/EN 1.4301 equivalent) is provided. Choose this option when a pendant tag plate is required in addition to the standard nameplate with the tag number inscribed on it. Dimension (Height × Width): Approx. 12.5 (4.92) × 40 (15.7) mm (inch)	○	○	SCT
Direction change of the electrical connection (*1)	+90 degrees rotated converter to change the direction of the electrical connection.	○	○	RA
	+180 degrees rotated converter to change the direction of the electrical connection.	○	○	RB
	–90 degrees rotated converter to change the direction of the electrical connection.	○	○	RC

Item	Specifications		Applicable Model		Code
			General	Explosion proof	
			AXR***G	AXR***C	
Bolts, Nuts, and Gaskets (*2)	Bolts, nuts, and gaskets are provided for wafer connections. Available only for ANSI 150, JIS10K, or, JIS20K wafer connections.	Bolts: JIS SUS304 (AISI 304 SS stainless steel equivalent); Nuts: JIS SUS403 (AISI 403 SS stainless steel equivalent); Gaskets: Chloroprene rubber (*3)	○	○	BSC
		Bolts: JIS SUS304 (AISI 304 SS stainless steel equivalent); Nuts: JIS SUS403 (AISI 403 SS stainless steel equivalent); Gaskets: PTFE-sheathed non-asbestos (*4)	○	○	BSF
Special Gaskets (*5)	Viton® gaskets for use with PVC piping. Allowable temperature and pressure are equivalent to Valqua #4010, special fluororubber not mixed.		○	○	GA
	Acid-resistant Viton® gaskets for use with PVC piping. Allowable temperature and pressure are equivalent to Valqua #4010, special fluororubber mixed (mixing #D2470).		○	○	GC
	Alkali-resistant Viton® gaskets for use with PVC piping. Allowable temperature and pressure are equivalent to Valqua #4010, special fluororubber mixed (mixing #D0970).		○	○	GD
Oil-prohibited Use	Electrodes, linings, and grounding rings are assembled and packed with polyethylene after being cleaned with water and acetone and dried with air. The label 'OIL FREE' is affixed.		○	○	K1
Oil-prohibited Use with Dehydrating Treatment	Electrodes, linings, and grounding rings are assembled and packed with polyethylene including desiccants after being cleaned with water and acetone and dried with air. The label 'OIL & WATER FREE' is affixed.		○	○	K5
Epoxy Resin Coating	Epoxy resin coating which has alkali-resistance instead of standard polyurethane resin coating. The color is same as standard type.		○	○	X1
High Anti-corrosion Coating	Three-layer coating (polyurethane coating on two-layer epoxy resin coating) in the same range as that for the standard coating. The color is same as standard type. Salt/alkali/acid/weather-resistance.		○	○	X2
Material Certificate	Reproduced material certificates for pipe, electrodes, grounding rings/grounding electrodes, flanges or mini flanges.		○	○	M01
Hydrostatic Test	The test verifies the absence of leaks by applying the following water pressures (which are determined under process connection conditions) to linings for ten minutes. Test results are described in a test certificate (QIC). Process Connection: — Water Pressure: ANSI Class 150, DIN PN10, JIS 10K — 1.5 MPa ANSI Class 300, DIN PN16, JIS 20K — 3.0 MPa DIN PN40 — 6.0 MPa JIS F12 — 1.25 MPa		○	○	T01
Calibration Certificate	Level 2: The Declaration and the Calibration Equipment List are issued.		○	○	L2
	Level 3: The Declaration and the Primary Standard List are issued.		○	○	L3
	Level 4: The Declaration and the Yokogawa Measuring Instruments Control System are issued.		○	○	L4
Vent Hole	With a vent hole provided for permeable fluids (such as nitric acid, hydrofluoric acid, or sodium hydroxide at high temperature). Available only for a flange type tube.		○	○	H

Item	Specifications	Applicable Model: General AXR***G	Applicable Model: Explosion proof AXR***C	Code
Five-point Calibration in User-specified Span (*8)	A flow test near 0, 25, 50, 75, and 100% of the user-specified span is performed instead of the standard flow test and a test certificate (QIC) is submitted. Specify the span flow rate and unit when placing an order. Specify the span (100% flow span) whose corresponding flow velocity lies between 1.0 to 10 m/s and that is less than the maximum line capacity. Selectable range of flow rate span is showing below. Size: mm (in.) — Selectable range of flow rate span: m^3/h (Flow rate span velocity: m/s) 25 (1): 1.77 (1.0) to 11 (6.22) 40 (1.5): 4.53 (1.0) to 28 (6.30) 50 (2): 7.07 (1.0) to 56 (7.92) 65 (2.5): 12.0 (1.0) to 80 (6.70) 80 (3): 18.1 (1.0) to 126 (6.96) 100 (4): 28.3 (1.0) to 190 (6.72) 150 (6): 63.6 (1.0) to 380 (5.97) 200 (8): 113 (1.0) to 670 (5.92)	○	○	SC
Bar-magnet for operation of magnet switches (*6)	Bar-magnet for operation of magnet switches, with a case.	○	○	BM
ATEX Certification	ATEX Explosion proof Read “HAZARDOUS AREA CLASSIFICATION”	–	○	KF2
FM Approval	FM Explosion proof Read “HAZARDOUS AREA CLASSIFICATION”	–	○	FF1
CSA Certification	CSA Explosion proof Read “HAZARDOUS AREA CLASSIFICATION”	–	○	CF1
IECEx Certification	IECEx Explosion proof Read “HAZARDOUS AREA CLASSIFICATION”	–	○	SF2
TIIS Certification	TIIS flameproof Read “HAZARDOUS AREA CLASSIFICATION” (Need to select optional code G11.)	–	○	JF3
Flameproof packing adapter for TIIS Flame-proof Type (*7)	One flameproof packing adapter and one blind plug.	–	○	G11
	One flameproof packing adapter addition	–	○	G32

*1:

Standard	+90-degree rotation	+180-degree rotation	–90-degree rotation
	Optional Code RA	Optional Code RB	Optional Code RC
			

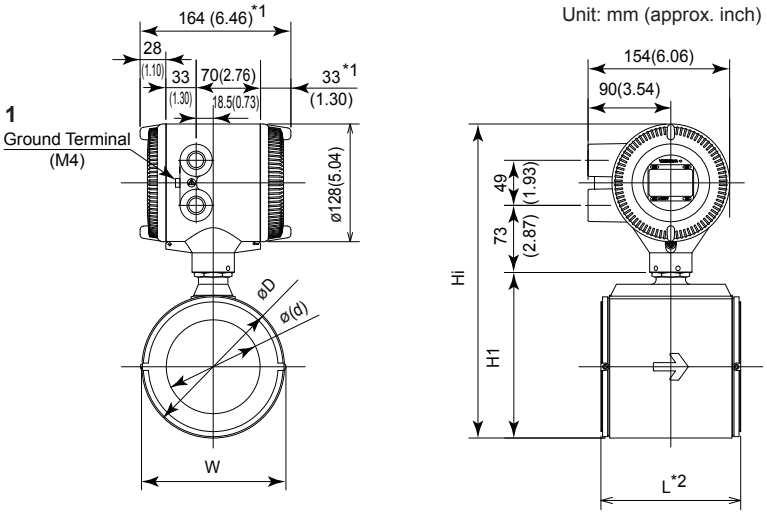
*2: When specifying the optional code BSC, it is advisable to specify the optional code GA, GC, or GD at the same time to prevent potential leakage caused by the difference in elasticity between the flowtube and chloroprene gaskets.
*3: Allowable temperature and pressure with the optional code BSC (only for Gaskets: Chloroprene rubber) are equivalent to Valqua #2010.
*4: Allowable temperature and pressure with the optional code BSF (only for Gaskets: PTFE-sheathed non-asbestos) are equivalent to Valqua #7030 (S).
*5: Read description of “Gasket” in the “Wetted Part Material”.
Special gaskets are inserted between the flowtube and the grounding ring or grounding electrode.
*6: Keep the bar-magnet in the case because of the powerful magnetic force.
*7: For the TIIS flameproof type, select optional code G11. In case of two flameproof packing adapters, select optional code G32 with G11.
Available only for JIS G1/2 female electric connection.
*8: Standard flow test condition is follows;
- General-purpose use (25 to 200 mm)/ Exprosion proof type (25 to 100 mm): span; 2 m/s, test point; 0, 30, 100%
- Exprosion proof type (150, 200 mm): span; 2 m/s, test point; 0, 35, 100%

12.7 EXTERNAL DIMENSIONS

● Lay Length Code 1, AXR080-AXR100, Wafer Type

Unit: mm (approx. inch)

AXR080 G
AXR100 C – □ 1 A □ 1 □ – A □□ 1



Size code		080	100
Size		80 (3)	100 (4)
Lining code		A	A
Face-to-face length	L*2	120 (4.72)	150 (5.91)
Outside dia.	øD	129 (5.08)	155 (6.10)
Inter diameter of Grounding ring	ød	77 (3.03)	102 (4.02)
Width	W	129 (5.08)	155 (6.10)
Height	H1	157 (6.18)	183 (7.20)
Max. Height	Hi	319 (12.54)	345 (13.56)
Weight kg (lb)		5.8 (12.8)	8.1 (17.9)

*1: When indicator code N is selected, subtract 5 mm (0.2 inch) from the value in the figure.
*2: Depending on the selection of grounding ring code and optional code, add the following value to "L" (face-to-face length).

Grounding Ring Code		S, L, H	P, T	N
Optional Code	None	+0	+26 (1.02)	-2 (0.08)
	GA, GC, GD (Special Gaskets)	+8 (0.31)	+30 (1.18)	–

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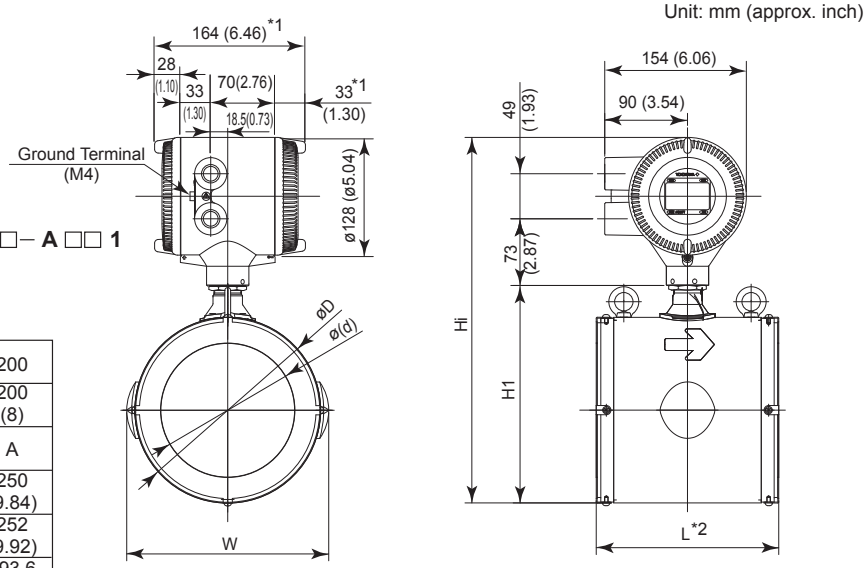
● Lay Length Code 1, AXR150-AXR200, Wafer Type

Unit: mm (approx. inch)

AXR150 G
AXR200 C – □ 1 A □ 1 □ – A □□ 1



Size code		150	200
Size		150 (6)	200 (8)
Lining code		A	A
Face-to-face length	L*2	200 (7.87)	250 (9.84)
Outside dia.	øD	202 (7.95)	252 (9.92)
Inter diameter of Grounding ring	ød	146.1 (5.75)	193.6 (7.62)
Width	W	220 (8.66)	272 (10.71)
Height	H1	243 (9.57)	293 (11.54)
Max. Height	Hi	405 (15.93)	455 (17.89)
Weight kg (lb)		15.9 (35.1)	23.5 (51.8)

*1: When indicator code N is selected, subtract 5 mm (0.2 inch) from the value in the figure.
*2: Depending on the selection of grounding ring code and optional code, add the following value to "L" (face-to-face length).

Grounding Ring Code		S, L, H	P, T	N
Optional Code	None	+0	+32 (1.26)	-2 (0.08)
	GA, GC, GD (Special Gaskets)	+10 (0.39)	+38 (1.5)	–

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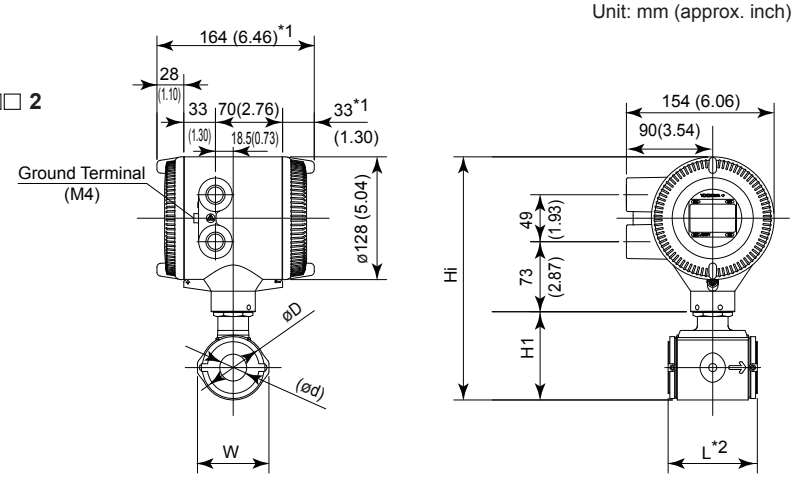
● Lay Length Code 2, AXR025, Wafer Type

Unit: mm (approx. inch)

AXR025 G/C –□ 1 A□ 1 □– A□□ 2



Size code		025
Size		25 (1)
Lining code		A
Face-to-face length	L*2	93 (3.66)
Outside dia.	øD	67.5 (2.66)
Inter diameter of Grounding ring	ød	28 (1.10)
Width	W	74.5 (2.93)
Height	H1	92 (3.62)
Max. Height	Hi	253.5 (9.98)
Weight kg (lb)		3.6 (7.8)

*1: When indicator code N is selected, subtract 5 mm (0.2 inch) from the value in the figure.
*2: Depending on the selection of grounding ring code and optional code, add the following value to “L” (face-to-face length).

Grounding Ring Code		S, L, H	P, T	N
Optional Code	None	+0	+22 (0.87)	-2 (0.08)
	GA, GC, GD (Special Gaskets)	+8 (0.31)	+26 (1.02)	–

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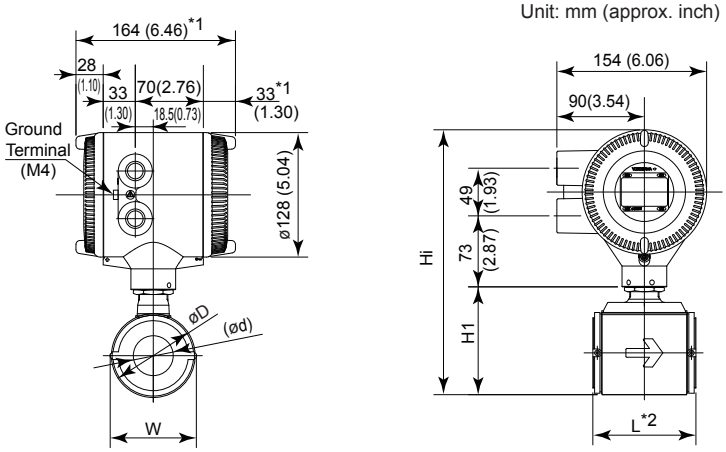
● Lay Length Code 2, AXR040-AXR065, Wafer Type

Unit: mm (approx. inch)

AXR040 / AXR050 / AXR065 G/C –□ 1 A□ 1 □– A□□ 2



Size code		040	050	065
Size		40 (1.5)	50 (2)	65 (2.5)
Lining code		A	A	A
Face-to-face length	L*2	106 (4.17)	120 (4.72)	120 (4.72)
Outside dia.	øD	86 (3.39)	99 (3.90)	117 (4.61)
Inter diameter of Grounding ring	ød	41 (1.61)	53 (2.09)	66 (2.60)
Width	W	86 (3.39)	99 (3.90)	117 (4.61)
Height	H1	111 (4.37)	129 (5.08)	147 (5.79)
Max. Height	Hi	273 (10.73)	291 (11.44)	309 (12.17)
Weight kg (lb)		4.1 (9.1)	4.8 (10.7)	5.4 (11.9)

*1: When indicator code N is selected, subtract 5 mm (0.2 inch) from the value in the figure.
*2: Depending on the selection of grounding ring code and optional code, add the following value to “L” (face-to-face length).

Grounding Ring Code		S, L, H	P, T	N
Optional Code	None	+0	+22 (0.87)	-2 (0.08)
	GA, GC, GD (Special Gaskets)	+8 (0.31)	+26 (1.02)	–

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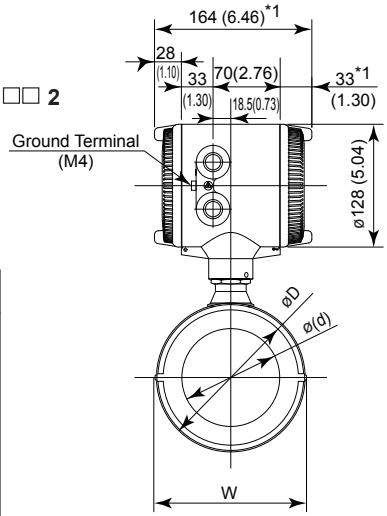
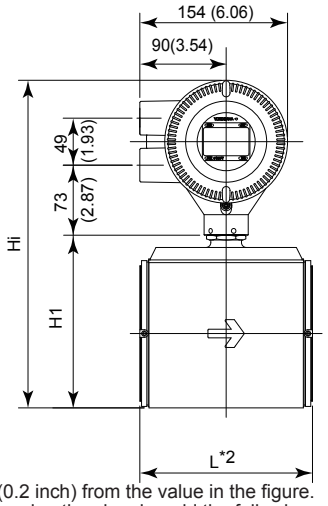
● Lay Length Code 2, AXR080-AXR100, Wafer Type

Unit: mm (approx. inch)

AXR080 G
AXR100 C –□ 1 A□ 1 □– A□□ 2





Size code		080	100
Size		80 (3)	100 (4)
Lining code		A	A
Face-to-face length	L *2	160 (6.30)	180 (7.09)
Outside dia.	øD	129 (5.08)	155 (6.10)
Inter diameter of Grounding ring	ød	77 (3.03)	102 (4.02)
Width	W	129 (5.08)	155 (6.10)
Height	H1	157 (6.18)	183 (7.02)
Max. Height	Hi	319 (12.54)	345 (13.56)
Weight kg (lb)		6.5 (14.4)	8.9 (19.6)

*1: When indicator code N is selected, subtract 5 mm (0.2 inch) from the value in the figure.
*2: Depending on the selection of grounding ring code and optional code, add the following value to "L" (face-to-face length).

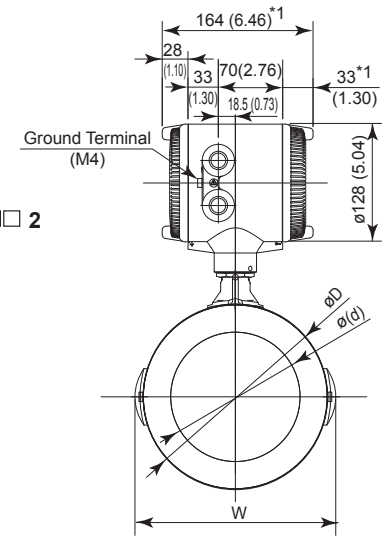
Grounding Ring Code		S, L, H	P, T	N
Optional Code	None	+0	+22 (0.87)	-2 (0.08)
	GA, GC, GD (Special Gaskets)	+8 (0.31)	+26 (1.02)	–

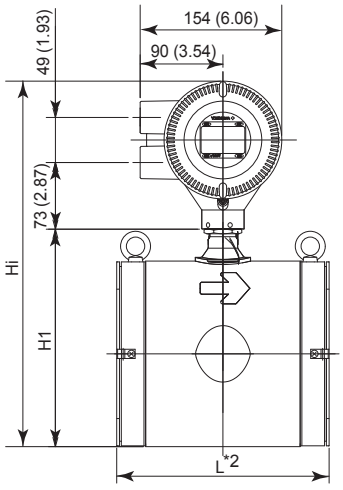
F1216.ai

● Lay Length Code 2, AXR150-AXR200, Wafer Type

Unit: mm (approx. inch)

AXR150 G
AXR200 C –□ 1 A□ 1 □– A□□ 2





Size code		150	200
Size		150 (6)	200 (8)
Lining code		A	A
Face-to-face length	L *2	230 (9.06)	300 (11.81)
Outside dia.	øD	202 (7.95)	252 (9.92)
Inter diameter of Grounding ring	ød	140.7 (5.54)	188.9 (7.44)
Width	W	220 (8.66)	272 (10.71)
Height	H1	243 (9.57)	293 (11.54)
Max. Height	Hi	405 (15.93)	455 (17.89)
Weight kg (lb)		19.3 (42.5)	28.2 (62.2)

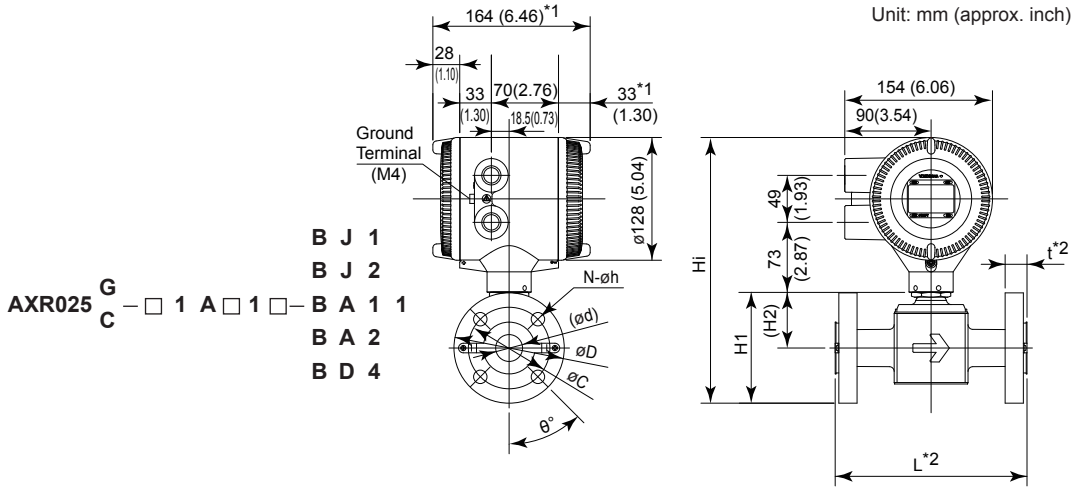
*1: When indicator code N is selected, subtract 5 mm (0.2 inch) from the value in the figure.
*2: Depending on the selection of grounding ring code and optional code, add the following value to "L" (face-to-face length).

Grounding Ring Code		S, L, H	P, T	N
Optional Code	None	+0	+28 (1.1)	-6 (0.24)
	GA, GC, GD (Special Gaskets)	+2 (0.08)	+30 (1.18)	–

F1217.ai

● Lay Length Code 1, AXR025, JIS/ANSI/DIN Flange Type

Unit: mm (approx. inch)



AXR025 G/C – □ 1 A □ 1 □ – B J 1 / B J 2 / B A 1 1 / B A 2 / B D 4

Process Connection		BJ1 (JIS10K)	BJ2 (JIS20K)	BA1 (ANSI Class 150)	BA2 (ANSI Class 300)	BD4 (DIN PN40)
Size code		025	025	025	025	025
Size		25 (1)	25 (1)	25 (1)	25 (1)	25 (1)
Lining code		A	A	A	A	A
Face-to-face length	L^{0}_{-3} *2	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)
Outside dia.	øD	125 (4.92)	125 (4.92)	108.0 (4.25)	124.0 (4.88)	115 (4.53)
Thickness	t *2	18 (0.71)	20 (0.79)	18.2 (0.72)	21.5 (0.85)	22 (0.87)
Inter diameter of Grounding ring	ød	28 (1.10)	28 (1.10)	28 (1.10)	28 (1.10)	28 (1.10)
Pitch circle dia.	øC	90 (3.54)	90 (3.54)	79.2 (3.12)	88.9 (3.50)	85 (3.35)
Bolt hole interval	θ°	45	45	45	45	45
Hole dia.	øh	19 (0.75)	19 (0.75)	15.7 (0.62)	19.1 (0.75)	14 (0.55)
Number of holes	N	4	4	4	4	4
Height	H1	120 (4.74)	120 (4.74)	112 (4.40)	120 (4.74)	115 (4.54)
Height	H2	58 (2.28)	58 (2.28)	58 (2.28)	58 (2.28)	58 (2.28)
Max. Height	Hi	282 (11.09)	282 (11.09)	273 (10.76)	281 (11.07)	277 (10.90)
Weight kg (lb)		6.1 (13.4)	6.5 (14.3)	5.6 (12.3)	6.7 (14.7)	6.4 (14.1)

*1: When indicator code N is selected, subtract 5 mm (0.2 inch) from the value in the figure.
*2: Depending on the selection of grounding ring code and optional code, add the following value to “L” (face-to-face length) and “t” (thickness of flange).

		L	t	L	t	L	t
Grounding Ring Code		S, L, H		P, T		N	
Optional Code	None	+0	+0	+26 (1.02)	+13 (0.51)	-2 (0.08)	-1 (0.04)
	GA, GC, GD (Special Gaskets)	+8 (0.31)	+4 (0.16)	+30 (1.18)	+15 (0.59)	—	—

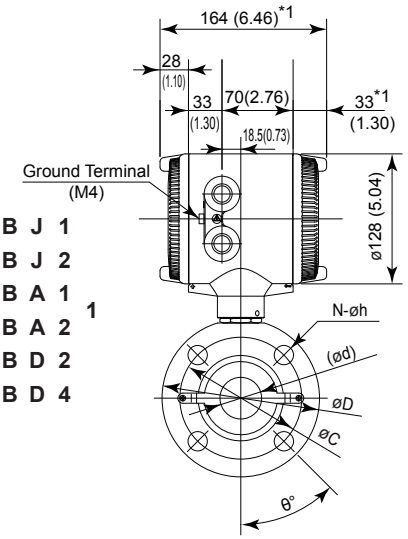
F1218.ai

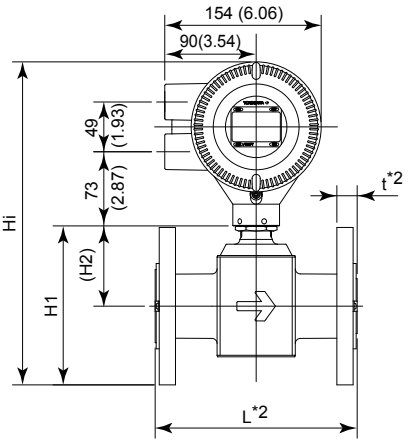
● Lay Length Code 1, AXR040-AXR065, JIS/ANSI/DIN Flange Type

Unit: mm (approx. inch)

AXR040
AXR050 G/C – □ 1 A □ 1 □ – 1

B	J 1
B	J 2
B	A 1
B	A 2
B	D 2
B	D 4





Process Connection		BJ1 (JIS10K)			BJ2 (JIS20K)			BA1 (ANSI Class 150)			BA2 (ANSI Class 300)			BD4 (DIN PN40)		BD2 (DIN PN16)
Size code		040	050	065	040	050	065	040	050	065	040	050	065	040	050	065
Size		40 (1.5)	50 (2)	65 (2.5)	40 (1.5)	50 (2)	65 (2.5)	40 (1.5)	50 (2)	65 (2.5)	40 (1.5)	50 (2)	65 (2.5)	40 (1.5)	50 (2)	65 (2.5)
Lining code		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Face-to-face length	L $^{0}_{-3}$ *2	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)	200 (7.87)
Outside dia.	øD	140 (5.51)	155 (6.10)	175 (6.89)	140 (5.51)	155 (6.10)	175 (6.89)	127.0 (5.00)	152.4 (6.00)	177.8 (7.00)	155.4 (6.12)	165.1 (6.50)	190.5 (7.50)	150 (5.91)	165 (6.50)	185 (7.28)
Thickness	t *2	20 (0.79)	20 (0.79)	22 (0.87)	22 (0.87)	22 (0.87)	24 (0.94)	21.5 (0.85)	23.1 (0.91)	26.4 (1.04)	24.6 (0.97)	26.4 (1.04)	29.4 (1.16)	22 (0.87)	24 (0.94)	22 (0.87)
Inter diameter of Grounding ring	ød	41 (1.61)	53 (2.09)	66 (2.60)	41 (1.61)	53 (2.09)	66 (2.60)	41 (1.61)	53 (2.09)	66 (2.60)	41 (1.61)	53 (2.09)	66 (2.60)	41 (1.61)	53 (2.09)	66 (2.60)
Pitch circle dia.	øC	105 (4.13)	120 (4.72)	140 (5.51)	105 (4.13)	120 (4.72)	140 (5.51)	98.6 (3.88)	120.7 (4.75)	139.7 (5.50)	114.3 (4.50)	127.0 (5.00)	149.4 (5.88)	110 (4.33)	125 (4.92)	145 (5.71)
Bolt hole interval	θ°	45	45	45	45	22.5	22.5	45	45	45	45	22.5	22.5	45	45	45
Hole dia.	øh	19 (0.75)	19 (0.75)	19 (0.75)	19 (0.75)	19 (0.75)	19 (0.75)	15.7 (0.62)	19.1 (0.75)	19.1 (0.75)	22.4 (0.88)	19.1 (0.75)	22.4 (0.88)	18 (0.71)	18 (0.71)	18 (0.71)
Number of holes	N	4	4	4	4	8	8	4	4	4	4	8	8	4	4	4
Height	H1	138 (5.43)	157 (6.16)	176 (6.93)	138 (5.43)	157 (6.16)	176 (6.93)	131 (5.17)	155 (6.11)	177 (6.97)	146 (5.73)	162 (6.36)	184 (7.24)	143 (5.63)	162 (6.36)	181 (7.13)
Height	H2	68 (2.67)	79 (3.11)	89 (3.50)	68 (2.67)	79 (3.11)	89 (3.50)	68 (2.67)	79 (3.11)	89 (3.50)	68 (2.67)	79 (3.11)	89 (3.50)	68 (2.67)	79 (3.11)	89 (3.50)
Max. Height	Hi	299 (11.79)	318 (12.52)	338 (13.31)	299 (11.79)	318 (12.52)	338 (13.31)	293 (11.53)	317 (12.47)	339 (13.35)	307 (12.09)	323 (12.72)	346 (13.62)	304 (11.98)	323 (12.72)	343 (13.50)
Weight kg (lb)		7.5 (16.5)	8.7 (19.2)	11.0 (24.2)	8.0 (17.6)	8.9 (19.6)	11.3 (24.9)	7.2 (15.8)	9.3 (20.5)	12.8 (28.2)	9.6 (21.1)	10.9 (24.0)	14.6 (32.2)	8.7 (19.1)	10.6 (23.4)	11.8 (26.0)

*1: When indicator code N is selected, subtract 5 mm (0.2 inch) from the value in the figure.
*2: Depending on the selection of grounding ring code and optional code, add the following value to “L” (face-to-face length) and “t” (thickness of flange).

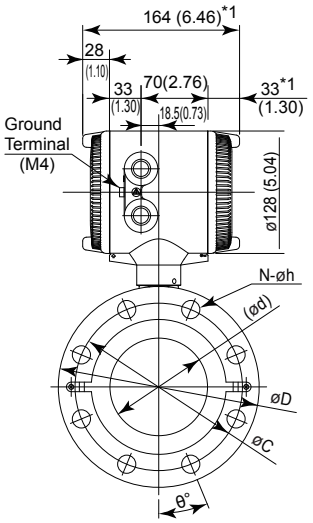
		L	t	L	t	L	t
Grounding Ring Code		S, L, H		P, T		N	
Optional Code	None	+0	+0	+26 (1.02)	+13 (0.51)	-2 (0.08)	-1 (0.04)
	GA, GC, GD (Special Gaskets)	+8 (0.31)	+4 (0.16)	+30 (1.18)	+15 (0.59)	—	—

F1219.ai

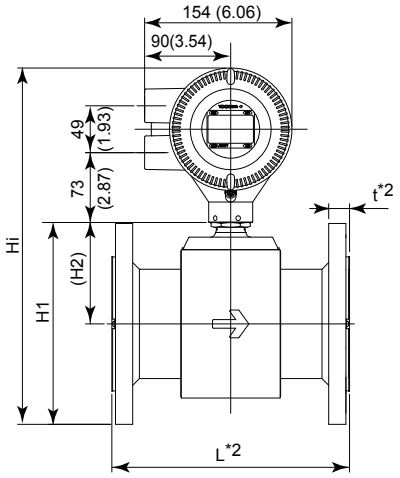
● Lay Length Code 1, AXR080-AXR100, JIS/ANSI/DIN Flange Type

AXR080 G
AXR100 C
– □ 1 A □ 1 □ – 1

B J 1	
B J 2	
B G 1	
B A 1	
B A 2	
B D 2	



Unit: mm (approx. inch)



Process Connection		BJ1 (JIS10K)		BJ2 (JIS20K)		BG1 (JIS F12)		BA1 (ANSI Class 150)		BA2 (ANSI Class 300)		BD2(DIN PN16)	
Size code		080	100	080	100	080	100	080	100	080	100	080	100
Size		80 (3)	100 (4)	80 (3)	100 (4)	80 (3)	100 (4)	80 (3)	100 (4)	80 (3)	100 (4)	80 (3)	100 (4)
Lining code		A	A	A	A	A	A	A	A	A	A	A	A
Face-to-face length	L $^{0}_{-3}$ *2	200 (7.87)	250 (9.84)	200 (7.87)	250 (9.84)	200 (7.87)	250 (9.84)	200 (7.87)	250 (9.84)	200 (7.87)	250 (9.84)	200 (7.87)	250 (9.84)
Outside dia.	øD	185 (7.28)	210 (8.27)	200 (7.87)	225 (8.86)	211 (8.31)	238 (9.37)	190.5 (7.50)	228.6 (9.00)	209.6 (8.25)	254.0 (10.00)	200 (7.87)	220 (8.66)
Thickness	t *2	22 (0.87)	22 (0.87)	26 (1.02)	28 (1.10)	22 (0.87)	22 (0.87)	27.9 (1.10)	27.9 (1.10)	32.4 (1.28)	35.8 (1.41)	24 (0.94)	24 (0.94)
Inter diameter of Grounding ring	ød	77 (3.03)	102 (4.02)	77 (3.03)	102 (4.02)	77 (3.03)	102 (4.02)	77 (3.03)	102 (4.02)	77 (3.03)	102 (4.02)	77 (3.03)	102 (4.02)
Pitch circle dia.	øC	150 (5.91)	175 (6.89)	160 (6.30)	185 (7.28)	168 (6.61)	195 (7.68)	152.4 (6.00)	190.5 (7.50)	168.1 (6.62)	200.2 (7.88)	160 (6.30)	180 (7.09)
Bolt hole interval	θ°	22.5	22.5	22.5	22.5	45	45	45	22.5	22.5	22.5	22.5	22.5
Hole dia.	øh	19 (0.75)	19 (0.75)	23 (0.91)	23 (0.91)	19 (0.75)	19 (0.75)	19.1 (0.75)	19.1 (0.75)	22.4 (0.88)	22.4 (0.88)	18 (0.71)	18 (0.71)
Number of holes	N	8	8	8	8	4	4	4	8	8	8	8	8
Height	H1	187 (7.36)	211 (8.30)	195 (7.68)	218 (8.59)	200 (7.87)	225 (8.85)	190 (7.48)	220 (8.66)	200 (7.87)	233 (9.16)	195 (7.68)	216 (8.49)
Height	H2	95 (3.74)	106 (4.16)	95 (3.74)	106 (4.16)	95 (3.74)	106 (4.16)	95 (3.74)	106 (4.16)	95 (3.74)	106 (4.16)	95 (3.74)	106 (4.16)
Max. Height	Hi	349 (13.74)	372 (14.65)	357 (14.06)	380 (14.95)	362 (14.25)	386 (15.21)	352 (13.86)	382 (15.02)	362 (14.25)	394 (15.52)	357 (14.06)	377 (14.85)
Weight kg (lb)		11.3 (24.9)	15.2 (33.5)	14.1 (31.0)	19.7 (43.4)	13.9 (30.6)	18.3 (40.3)	14.6 (32.2)	20.5 (45.2)	18.3 (40.3)	29.6 (65.2)	13.6 (29.9)	17.3 (38.1)

*1: When indicator code N is selected, subtract 5 mm (0.2 inch) from the value in the figure.
*2: Depending on the selection of grounding ring code and optional code, add the following value to “L” (face-to-face length) and “t” (thickness of flange).

		L	t	L	t	L	t
Grounding Ring Code		S, L, H		P, T		N	
Optional Code	None	+0	+0	+26 (1.02)	+13 (0.51)	-2 (0.08)	-1 (0.04)
	GA, GC, GD (Special Gaskets)	+8 (0.31)	+4 (0.16)	+30 (1.18)	+15 (0.59)	—	—

F1220.ai

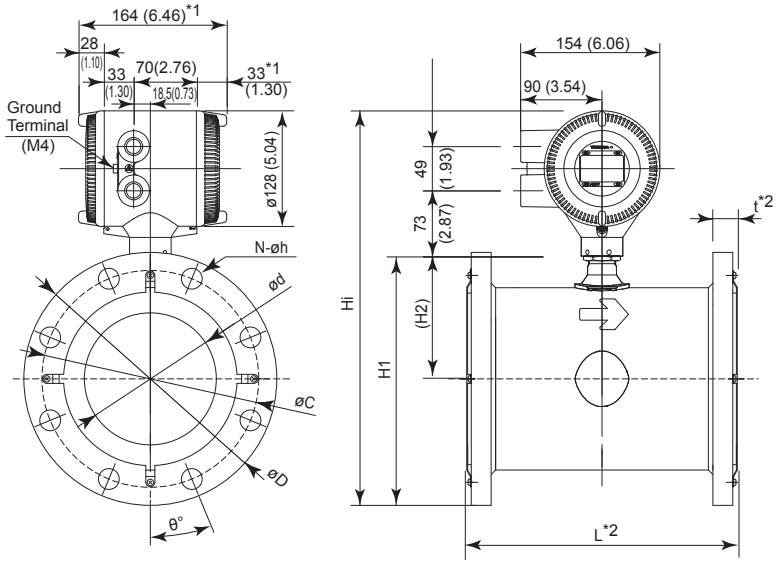
● Lay Length Code 1, AXR150-AXR200, JIS/ANSI/DIN Flange Type

Unit: mm (approx. inch)

AXR150 G
AXR200 C
– □ 1 A □ 1 □ –

B	A □
B	D □
B	J □
B	G 1
C	A □
C	D □
C	J □
C	G 1

1



Process Connection		BJ1/CJ1 (JIS 10K)		BJ2/CJ2 (JIS 20K)		BG1/CG1 (JIS F12)		BA1/CA1 (ANSI Class 150)		BA2/CA2 (ANSI Class 300)		BD1/CD1 (DIN PN10)	BD2/CD2(DIN PN16)	
Size code		150	200	150	200	150	200	150	200	150	200	200	150	200
Size		150 (6)	200 (8)	150 (6)	200 (8)	150 (6)	200 (8)	150 (6)	200 (8)	150 (6)	200 (8)	200 (8)	150 (6)	200 (8)
Lining code		A	A	A	A	A	A	A	A	A	A	A	A	A
Face-to-face length	L $^{0}_{-3}$ *2	300 (11.81)	350 (13.78)	300 (11.81)	350 (13.78)	300 (11.81)	350 (13.78)	300 (11.81)	350 (13.78)	300 (11.81)	350 (13.78)	350 (13.78)	300 (11.81)	350 (13.78)
Outside dia.	øD	280 (11.02)	330 (12.99)	305 (12.01)	350 (13.78)	290 (11.42)	342 (13.46)	279.4 (11.00)	342.9 (13.50)	317.5 (12.50)	381.0 (15.00)	340 (13.39)	285 (11.22)	340 (13.39)
Thickness	t *2	27 (1.06)	27 (1.06)	33 (1.30)	35 (1.38)	27 (1.06)	29 (1.14)	30.4 (1.20)	33.4 (1.31)	41.5 (1.63)	46.1 (1.81)	29 (1.14)	27 (1.06)	29 (1.14)
Inter diameter of Grounding ring	ød	146.1 (5.75)	193.6 (7.62)	146.1 (5.75)	193.6 (7.62)	146.1 (5.75)	193.6 (7.62)	146.1 (5.75)	193.6 (7.62)	146.1 (5.75)	193.6 (7.62)	193.6 (7.62)	146.1 (5.75)	193.6 (7.62)
Pitch circle dia.	øC	240 (9.45)	290 (11.42)	260 (10.24)	305 (12.01)	247 (9.72)	299 (11.77)	241.3 (9.50)	298.5 (11.75)	269.7 (10.62)	330.2 (13.00)	295 (11.61)	240 (9.45)	295 (11.61)
Bolt hole interval	θ°	22.5	15	15	15	30	22.5	22.5	22.5	15	15	22.5	22.5	15
Hole dia.	øh	23 (0.91)	23 (0.91)	25 (0.98)	25 (0.98)	19 (0.75)	19 (0.75)	22.4 (0.88)	22.4 (0.88)	22.4 (0.88)	25.4 (1.00)	22 (0.87)	22 (0.87)	22 (0.87)
Number of holes	N	8	12	12	12	6	8	8	8	12	12	8	8	12
Height	H1	281 (11.06)	331 (13.03)	294 (11.56)	341 (13.43)	286 (11.26)	337 (13.27)	281 (11.05)	337 (13.29)	300 (11.80)	357 (14.04)	336 (13.23)	284 (11.16)	336 (13.23)
Height	H2	141 (5.55)	166 (6.54)	141 (5.55)	166 (6.54)	141 (5.55)	166 (6.54)	141 (5.55)	166 (6.54)	141 (5.55)	166 (6.54)	166 (6.54)	141 (5.55)	166 (6.54)
Max. Height	Hi	443 (17.42)	493 (19.39)	456 (17.95)	503 (19.80)	448 (17.64)	499 (19.65)	443 (17.43)	499 (19.66)	462 (18.18)	519 (20.41)	498 (19.61)	446 (17.54)	498 (19.61)
Weight kg (lb)		29.2 (64.4)	38.7 (85.3)	38.5 (84.9)	53.3 (117.5)	31.3 (69.0)	44.6 (98.3)	32.3 (71.2)	50.6 (71.2)	53.9 (118.8)	80.2 (176.8)	43.9 (96.8)	30.1 (66.4)	43.3 (95.5)

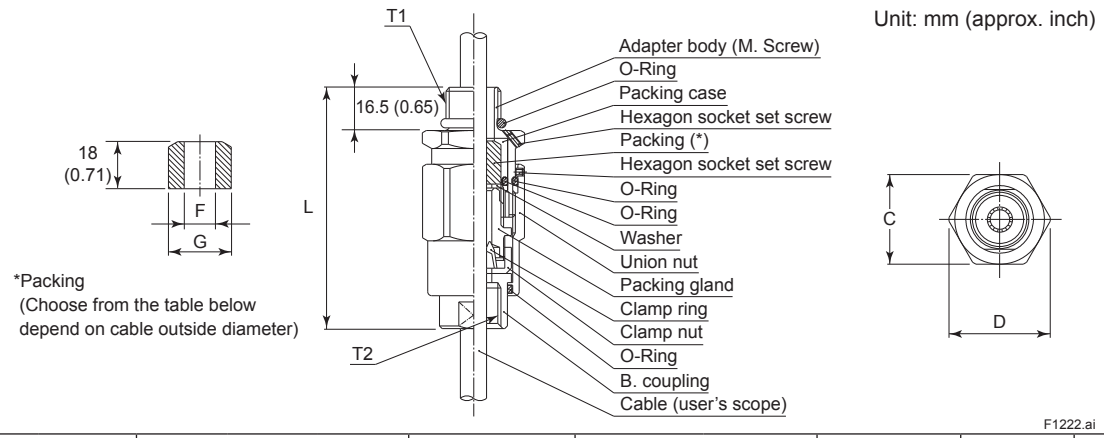
*1: When indicator code N is selected, subtract 5 mm (0.2 inch) from the value in the figure.
*2: Depending on the selection of grounding ring code and optional code, add the following value to “L” (face-to-face length) and “t” (thickness of flange).

		L	t	L	t	L	t
Grounding Ring Code		S, L, H		P, T		N	
Optional Code	None	+0	+0	+32 (1.26)	+16 (0.63)	-2 (0.08)	-1 (0.04)
	GA, GC, GD (Special Gaskets)	+10 (0.39)	+5 (0.20)	+38 (1.5)	+19 (0.75)	—	—

F1221.ai

● Flameproof Packing Adapter for TIIS Flameproof Type (Optional code G11 or G32)

Unit: mm (approx. inch)



F1222.ai

Nominal diameter		Dimension			Cable outer diameter	Packing diameter		Identification mark	Weight kg (lb)	Parts No.
T1	T2	C	D	L		F	G			
G 1/2	G 1/2	35 (1.38)	39 (1.54)	94.5 (3.72)	ø8.0 to ø10.0 (0.31 to 0.39)	ø10.0(0.39)	ø20.0 (0.79)	16 8-10	0.26 (0.57)	G9601AM*
					ø10.0 to ø12.0 (0.39 to 0.47)	ø12.0(0.47)		16 10-12		

*: G 11: 1 unit
G 11 with G 32: 2 units

● Unless otherwise specified, difference in the dimensions are the following table.

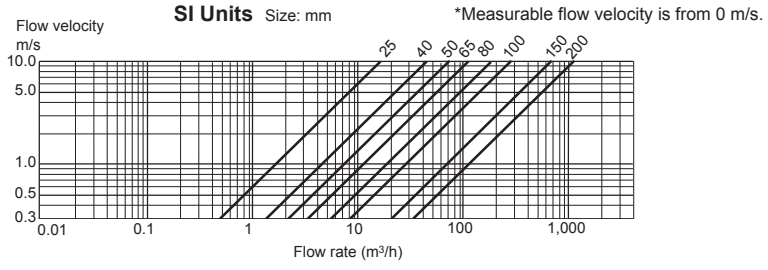
General tolerance in the dimensional outline drawing.

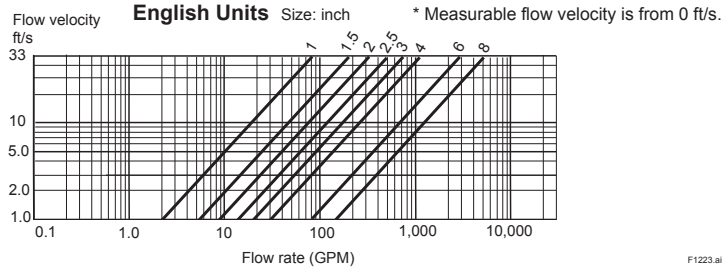
Unit : mm (approx.inch)

Category of basic dimension		Tolerance	Category of basic dimension		Tolerance
Above	Equal or below		Above	Equal or below	
	3 (0.12)	±0.7 (±0.03)	500 (19.69)	630 (24.80)	±5.5 (±0.22)
3 (0.12)	6 (0.24)	±0.9 (±0.04)	630 (24.80)	800 (31.50)	±6.25 (±0.25)
6 (0.24)	10 (0.39)	±1.1 (±0.04)	800 (31.50)	1000 (39.37)	±7.0 (±0.28)
10 (0.39)	18 (0.71)	±1.35 (±0.05)	1000 (39.37)	1250 (49.21)	±8.25 (±0.32)
18 (0.71)	30 (1.18)	±1.65 (±0.06)	1250 (49.21)	1600 (62.99)	±9.75 (±0.38)
30 (1.18)	50 (1.97)	±1.95 (±0.08)	1600 (62.99)	2000 (78.74)	±11.5 (±0.45)
50 (1.97)	80 (3.15)	±2.3 (±0.09)	2000 (78.74)	2500 (98.43)	±14.0 (±0.55)
80 (3.15)	120 (4.72)	±2.7 (±0.11)	2500 (98.43)	3150 (124.02)	±16.5 (±0.65)
120 (4.72)	180 (7.09)	±3.15 (±0.12)			
180 (7.09)	250 (9.84)	±3.6 (±0.14)			
250 (9.84)	315 (12.40)	±4.05 (±0.16)			
315 (12.40)	400 (15.75)	±4.45 (±0.18)			
400 (15.75)	500 (19.69)	±4.85 (±0.19)			

Remarks: The numeric is based on criteria of tolerance class IT18 in JIS B 0401.

12.8 SIZING DATA (Measurable flow velocity is from 0 m/s.)





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13. PED (PRESSURE EQUIPMENT DIRECTIVE)

This chapter describes further requirements and notices concerning the PED (Pressure Equipment Directive). The description in this chapter is prior to other description in this User's Manual.

(1) Technical Data

Module: H
Type of Equipment: Piping
Type of Fluid: Liquids and gas
Group of Fluid: 1 and 2 (*4)

General-purpose Use/Explosion Proof Type:

MODEL	DN (mm) (*1)	PS (MPa) (*1)	PS · DN (MPa · mm)	CATEGORY (*2) (*4)
AXR025G	25	4	100	Sound Engineering Practice (SEP) (*3)
AXR025C				
AXR040G	40	4	160	II
AXR040C				
AXR050G	50	4	200	II
AXR050C				
AXR065G	65	2	130	II
AXR065C				
AXR080G	80	2	160	II
AXR080C				
AXR100G	100	2	200	II
AXR100C				
AXR150G	150	2	300	II
AXR150C				
AXR200G	200	2	400	III
AXR200C				

*1: PS: Maximum allowable pressure for Flowtube
DN: Nominal size
*2: For details, refer to the following.
Table 6 covered by ANNEX II of Directive 97/23/EC (until July 18th, 2016)
Table 6 covered by ANNEX II of Directive 2014/68/EU (from July 19th, 2016)
*3: Article 3, paragraph 3 of Directive 97/23/EC (until July 18th, 2016)
Article 4, paragraph 3 of Directive 2014/68/EU (from July 19th, 2016)
*4: Models classified in CATEGORY II shall not be used for unstable gases of Group 1.

(2) Installation

WARNING

- Tighten the bolts of the piping joints according to the prescribed torque values.
- Take measures to protect the flowmeters from forces caused by vibration channeled through the piping.

(3) Operation

WARNING

- The instrument should be operated with the temperature and pressure of the fluid under normal operating conditions.
- The ambient temperature should be that of normal operating conditions.
- Take measures to prevent excessive pressure such as water hammer, etc. To avoid water hammer prevent the pressure from exceeding the PS (maximum allowable pressure) by setting the system's safety valves, etc. appropriately.
- Should external fire occur, take safety measures at the device itself or system-wide prevent it having an effect on the flowmeters.
- Avoid using fluids exceeding the corrosion proof limitations of the lining and electrodes.
- Take measures not to abrade the metal pipe, and avoid abrading the lining by using fluids such as slurry and sand are contained.

14. EXPLOSION PROOF TYPE INSTRUMENT

In this section, further requirements and differences for explosion proof type instrument are described.

NOTE

When describing the model name like AXR□□□C in this manual, "□□□" means any of following.
025, 040, 050, 065, 080, 100, 150, 200

WARNING

Magnetic flowmeters with the model name AXR□□□C are products which have been certified as explosion proof type instruments. Strict limitations are applied to the structures, installation locations, external wiring work, maintenance and repairs, etc. of these instruments. Sufficient care must be taken, as any violation of the limitations may cause dangerous situations.
Be sure to read this chapter before handling the instruments.
For explosion proof type instrument, the description in this chapter is prior to other description in this user's manual.
For TIIS flameproof type instruments, be sure to read "INSTALLATION AND OPERATING PRECAUTIONS FOR TIIS FLAMEPROOF EQUIPMENT" at the end of this manual.

WARNING

The terminal box cover and display cover is locked by special screw. In case of opening the cover, please use the hexagonal wrench (nominal size 3).
The covers of explosion proof type products are locked. Use this hexagonal wrench to open and close the cover. Before opening the cover, be sure to check that the power of flowmeter has been turned off. Once the cover is closed, be sure to re-lock the product.
Be sure to lock the cover with the special screw using the hexagonal wrench after tightening the cover.

14.1 ATEX

WARNING

Only trained persons use this instrument in industrial locations.

(1) Technical Data

Applicable Standard:
EN 60079-0: 2009, EN 60079-1: 2007,
EN 60079-7: 2007, EN 60079-11: 2007,
EN 60079-31: 2009
Certificate: DEKRA 11ATEX0144

Type of Gas Atmosphere Protection
Type of Protection:
Group: II
Category: 2G
Ex d e ia IIC T6…T4 Gb
Specification of Protection:
Electrode Circuit: Um=250V
Power Supply/Current Output: 42Vdc max., 4 to 20mA, Um=250V
Digital Output: ON; 2Vdc, 120mA max., OFF; 30Vdc max., 4mA, Um=250V
Excitation Circuit: 29 V max.
Enclosure: IP66/IP67
Process Temperature:

Temperature Class	Maximum Process Temperature	Minimum Process Temperature
T6	+70°C (+158°F)	–30°C (–22°F)
T5	+85°C (+185°F)	–30°C (–22°F)
T4	+130°C (+266°F)	–30°C (–22°F)

Ambient Temp.: –30°C to +55°C
(–22°F to +131°F)

Type of Dust Atmosphere Protection
Type of Protection:
Group: II
Category: 2D
Ex tb IIIC T90°C, T110°C, T130°C Db
Specification of Protection:
Electrode Circuit: Um=250V
Power Supply/Current Output: 42Vdc max., 4 to 20mA, Um=250V

Digital Output: ON; 2Vdc, 120mA max., OFF; 30Vdc max., 4mA, Um=250V
Excitation Circuit: 29 V max.
Enclosure: IP66/IP67
Process Temperature:

Maximum Surface Temperature	Maximum Process Temperature	Minimum Process Temperature
T90°C (+194°F)	+70°C (+158°F)	–30°C (–22°F)
T110°C (+230°F)	+85°C (+185°F)	–30°C (–22°F)
T130°C (+266°F)	+130°C (+266°F)	–30°C (–22°F)

Ambient Temp.: –30°C to +55°C
(–22°F to +131°F)

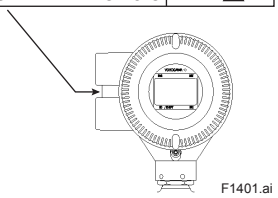
WARNING

If the AXR is mounted in an area where the use of EPL Db equipment 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.

(2) Electrical Connection

The type of electrical connection is stamped near the electrical connection port according to the following codes.

Screw Size	Marking
ISO M20x1.5 female	M ⚠
ANSI 1/2NPT female	N ⚠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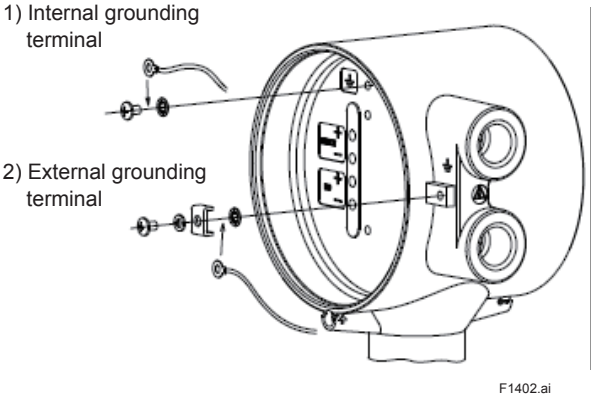
(3) Installation

WARNING

- Grounding resistance of 100 Ω or less is necessary.
  When optional code A is selected, grounding resistance of 10 Ω or less shall be required.
- All wiring shall comply with local installation requirements and local electrical code.
- In hazardous locations, the cable entry devices shall be of a certified ATEX flameproof type, suitable for the conditions of use and correctly installed.
- Unused apertures shall be closed with suitable flameproof certified blanking elements. (The plug attached is flameproof certified.)

The grounding terminals are located on the inside and outside of the terminal area.
Connect the cable to grounding terminal in accordance with wiring procedure 1) or 2).



F1402.ai

Figure 14.1 Wiring Procedure for Grounding Terminals

(4) Operation

WARNING

- After de-energizing, delay 5 minutes before opening.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

(5) Maintenance and Repair

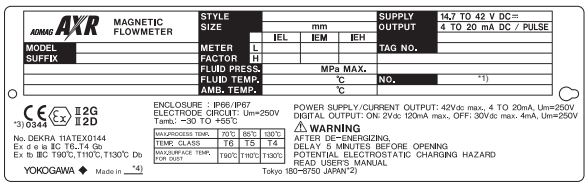
WARNING

The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void the certification.

WARNING

Electrostatic charge may cause an explosion hazard.
Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of product.

(6) Name Plate



MODEL: Specified model code
SUFFIX: Suffix codes of the model code
STYLE: Specified style code
SIZE: Nominal size of apparatus
METER FACTOR: Sensor constant number of apparatus
SUPPLY: Supply voltage of apparatus
OUTPUT: Output signal of apparatus
FLUID TEMP.: Fluid temperature of apparatus
FLUID PRESS.: Fluid pressure of apparatus
AMB. TEMP., Tamb: Ambient temperature
POWER SUPPLY/CURRENT OUTPUT: Power supply with output sigunal of apparatus
DIGITAL OUTPUT: Output signal of apparatus
NO.: Manufacturing serial number *1)
CE: CE marking
II 2G: Group II Category 2 Gas atmosphere
II 2D: Group II Category 2 Dust atmosphere
No.: DEKRA 11ATEX0144
EC Type Examination certificate number
Ex d e ia IIC T6…T4 Gb
Protection type and temp. class for gas
Ex tb IIIC T90°C, T110°C, T130°C, Db
Protection type and maximum surface temp. for dust
ENCLOSURE: Enclosure protection code
ELECTRODE CIRCUIT Um: Voltage of electrode circuit
⚠WARNING: Warning to apparatus
YOKOGAWA ◆ TOKYO 180-8750 JAPAN :
Name and address of manufacturer. *2)

*1: The first number in the second block of "NO." column is the last one number of the production year. For example, the year of production of the product engraved as follows is year 2008.
No. S5EA05158 8̲45 7
↑
Produced in 2008

*2: "180-8750" is a zip code which represents the following address.
2-9-32 Nakacho, Musashino-shi, Tokyo Japan

*3: The identification number of the notified body :
0344 DEKRA Netherland

*4: The product-producing country

14.2 FM

(1) Technical Data

Applicable Standard:
FM3600, FM3610, FM3615,
FM3810, ANSI/NEMA 250

Type of Protection:
Explosionproof for Class I, Division 1, Groups A, B, C & D.
Dust-ignitionproof for Class II/III, Division1, Groups E, F & G.
With intrinsically safe electrodes for Class I, Division 1, Groups A, B, C & D.
"SEAL ALL CONDUITS WITHIN 18 INCHES" WHEN INSTALLED IN DIV. 2, "SEALS NOT REQUIRED"

Specification of Protection:
Electrode Circuit Um: 250 V
Supply voltage/Current Output:
42 Vdc max/4 to 20 mA
Digital Output : ON; 2 Vdc, 120 mA max.
OFF; 30 Vdc max, 4 mA
Excitation Circuit: 29V max.
Enclosure: NEMA Type 4X
Process Temperature:

Temperature Code	Maximum Process Temperature	Minimum Process Temperature
T6	+70°C (+158°F)	–40°C (–40°F)
T5	+85°C (+185°F)	–40°C (–40°F)
T4	+130°C (+266°F)	–40°C (–40°F)

Ambient Temp.: –40°C to +55°C
(–40°F to +131°F)

(2) Installation

WARNING

- The grounding resistance of 100 Ω or less is necessary.
  When the optional code A is selected, grounding resistance of 10 Ω or less shall be required.
- All wiring shall comply with National Electrical Code ANSI/NFPA 70 and Local Electrical Code.
- In hazardous locations, wiring to be in conduit as shown in Figure 14.2.
- When installed in Division 2, "SEALS NOT REQUIRED"

(3) Operation

WARNING

- "OPEN CIRCUIT BEFORE REMOVING COVERS."
- "SEALS ALL CONDUITS WITHIN 18 INCHES" in hazardous locations.
- When installed in Division 2, "SEALS NOT REQUIRED"
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

(4) Maintenance and Repair

WARNING

The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void the approval of Factory Mutual Research Corporation.

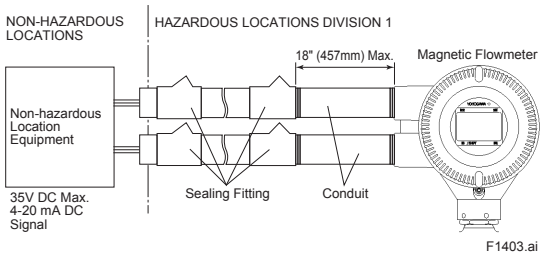


Figure 14.2 Conduit Wiring

14.3 CSA

(1) Technical Data

Certificate: 2136807

For Division system of area classification

Applicable Standard:

CAN/CSA-C22.2 No.0-M91,
CAN/CSA-C22.2 No.0.4-04,
C22.2 No.0.5-1982, C22.2 No.25-1966,
C22.2 No.30-M1986,
CAN/CSA-C22.2 No.94-M91,
CAN/CSA-C22.2 No.157-92,
CAN/CSA-C22.2 No.61010-1-04

Type of Protection:

Class I, Groups A, B, C and D;
Class II, Groups E, F and G; Class III
With Intrinsically Safe Electrodes for Class I, Groups A, B, C and D

Specification of Protection :

Electrode Circuit Um: 250 V
Power Supply/Current Output: 42Vdc max./ 4 to 20mA
Digital Output:
On: 2Vdc, 120mA max.
Off: 30Vdc max., 4mA
Excitation Circuit: 29V max.
Enclosure: Type 4X
Process Temperature:

Temperature Code	Maximum Process Temperature	Minimum Process Temperature
T6	+70°C (+158°F)	-40°C (-40°F)
T5	+85°C (+185°F)	-40°C (-40°F)
T4	+130°C (+266°F)	-40°C (-40°F)

Ambient Temperature: -40 to +55°C (-40°F to +131°F)

For Zone system of area classification

Applicable Standard:

CAN/CSA-C22.2 No.60079-0:07,
CAN/CSA-E60079-1:02,
CAN/CSA-E60079-7:03,
CAN/CSA-E60079-11:02,
CAN/CSA-E61241-1-1:02,
CAN/CSA-C22.2 No.61010-1-04

Type of Gas Atmosphere Protection

Type of Protection:

Ex d e [ia] IIC T6…T4
with Intrinsically Safe Electrodes for Zone 0, Ex ia IIC T6…T4

Specification of Protection:
Electrode Circuit Um: 250 V
Power Supply/Current Output: 42Vdc max./ 4 to 20mA
Digital Output:
On: 2Vdc, 120mA max.
Off: 30Vdc max., 4mA
Excitation Circuit: 29V max.
Enclosure: IP66/IP67
Process Temperature:

Temperature Code	Maximum Process Temperature	Minimum Process Temperature
T6	+70°C (+158°F)	-40°C (-40°F)
T5	+85°C (+185°F)	-40°C (-40°F)
T4	+130°C (+266°F)	-40°C (-40°F)

Ambient Temperature: -40 to +55°C (-40°F to +131°F)

Type of Dust Atmosphere Protection

Type of Protection:
DIP A21 T_A 90°C, 110°C, 130°C
Specification of Protection:
Electrode Circuit Um: 250 V
Power Supply/Current Output: 42Vdc max./ 4 to 20mA
Digital Output:
On: 2Vdc, 120mA max.
Off: 30Vdc max., 4mA
Excitation Circuit: 29V max.
Enclosure: IP66/IP67
Process Temperature:

Maximum Surface Temperature T_A	Maximum Process Temperature	Minimum Process Temperature
90°C	+70°C (+158°F)	-40°C (-40°F)
110°C	+85°C (+185°F)	-40°C (-40°F)
130°C	+130°C (+266°F)	-40°C (-40°F)

Ambient Temperature: -40 to +55°C (-40°F to +131°F)

Process Sealing Certification:

Dual Seal certified by CSA to the requirements of ANSI/ISA 12.27.01-2003.
No additional sealing required.
Primary seal failure annunciation;
Deterioration of the flowrate output at nonzero flow point.
Unstable flowrate output at zero flow point.

(2) Installation

For Division

WARNING

- All wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.
- In hazardous location, wiring shall be in conduit as shown in Figure 14.3.

WARNING : A SEAL SHALL BE INSTALLED WITHIN 50cm OF THE ENCLOSURE.
UN SCELLEMENT DOIT ÊTRE INSTALLÉ Á MOINS DE 50cm DU BOÎTIER.

- When installed in Division 2, “SEALS NOT REQUIRED”

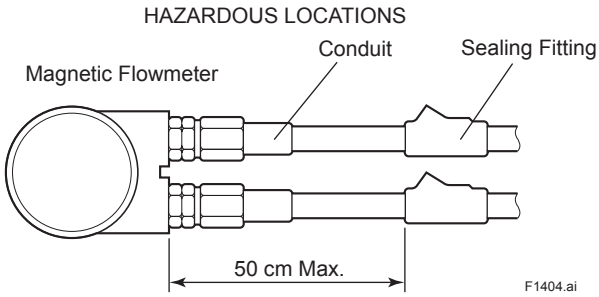


Figure 14.3 Conduit Wiring

For Zone

WARNING

- All wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.
- In hazardous locations, the cable entry devices shall be of a certified flameproof type, suitable for the conditions of use and correctly installed.
- Unused apertures shall be closed with suitable flameproof certified blanking elements. (The plug attached is certified as the flameproof and IP66 or IP67 as a part of this apparatus.)

(3) Operation

For Division

WARNING

WARNING : OPEN CIRCUIT BEFORE REMOVING COVER.
OUVRIR LE CIRCUIT AVANT D'ENLEVER LE COUVERCLE.

- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

For Zone

WARNING

WARNING : AFTER DE-ENERGIZING, DELAY 5 MINUTES BEFORE OPENING.
APRÉS POWER-OFF, ATTENDRE 5 MINUTES AVANT D'OUVRIR.

- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

(4) Maintenance and Repair

WARNING

The instrument modification or parts replacement by other than authorized representative of YOKOGAWA Electric Corporation or YOKOGAWA Corporation of AMERICA is prohibited and will void Canadian Standards Explosionproof Certification.

14.4 IECEx

WARNING

Only trained persons use this instrument in industrial locations.

(1) Technical Data

Applicable Standard:
IEC 60079-0: 2007, IEC 60079-1: 2007,
IEC 60079-7: 2006, IEC 60079-11: 2006,
IEC 60079-31: 2008
Certificate: IECEx DEK 11.0053

Type of Gas Atmosphere Protection

Type of Protection:
Ex d e ia IIC T6…T4 Gb
Specification of Protection:
Electrode Circuit: Um=250V
Power Supply/Current Output: 42Vdc max., 4 to 20mA, Um=250V
Digital Output: ON; 2Vdc, 120mA max., OFF; 30Vdc max., 4mA, Um=250V
Excitation Circuit: 29 V max.
Enclosure: IP66/IP67
Process Temperature:

Temperature Class	Maximum Process Temperature	Minimum Process Temperature
T6	+70°C (+158°F)	–30°C (–22°F)
T5	+85°C (+185°F)	–30°C (–22°F)
T4	+130°C (+266°F)	–30°C (–22°F)

Ambient Temp.: –30°C to +55°C
(–22°F to +131°F)

Type of Dust Atmosphere Protection

Type of Protection:
Ex tb IIIC T90°C, T110°C, T130°C, Db
Specification of Protection:
Electrode Circuit: Um=250V
Power Supply/Current Output: 42Vdc max., 4 to 20mA, Um=250V
Digital Output: ON; 2Vdc, 120mA max., OFF; 30Vdc max., 4mA, Um=250V
Excitation Circuit: 29 V max.
Enclosure: IP66/IP67
Process Temperature:

Maximum Surface Temperature	Maximum Process Temperature	Minimum Process Temperature
T90°C (+194°F)	+70°C (+158°F)	–30°C (–22°F)
T110°C (+230°F)	+85°C (+185°F)	–30°C (–22°F)
T130°C (+266°F)	+130°C (+266°F)	–30°C (–22°F)

Ambient Temp.: –30°C to +55°C
(–22°F to +131°F)

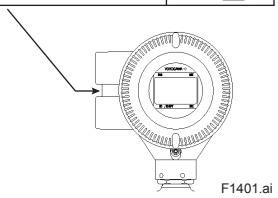
WARNING

If the AXR is mounted in an area where the use of EPL Db equipment 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.

(2) Electrical Connection

The type of electrical connection is stamped near the electrical connection port according to the following codes.

Screw Size	Marking
ISO M20x1.5 female	M ⚠
ANSI 1/2NPT female	N ⚠

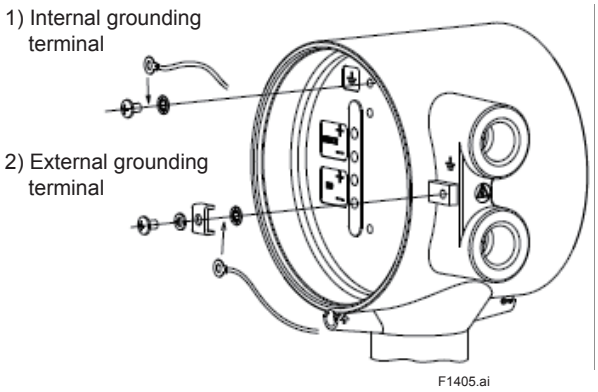

F1401.ai

(3) Installation

WARNING

- Grounding resistance of 100 Ω or less is necessary.
  When optional code A is selected, grounding resistance of 10 Ω or less shall be required.
- All wiring shall comply with local installation requirements and local electrical code.
- In hazardous locations, the cable entry devices shall be of a certified IECEx flameproof type, suitable for the conditions of use and correctly installed.
- Unused apertures shall be closed with suitable flameproof certified blanking elements. (The plug attached is certified as the flameproof and IP66 or IP67 as a part of this apparatus.)
- In case of ANSI 1/2 NPT plug, ANSI hexagonal wrench should be applied to screw in.

The grounding terminals are located on the inside and outside of the terminal area.
Connect the cable to grounding terminal in accordance with wiring procedure 1) or 2).



F1405.ai

Figure 14.4 Wiring Procedure for Grounding Terminals

(4) Operation

WARNING

- After de-energizing, delay 5 minutes before opening.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

(5) Maintenance and Repair

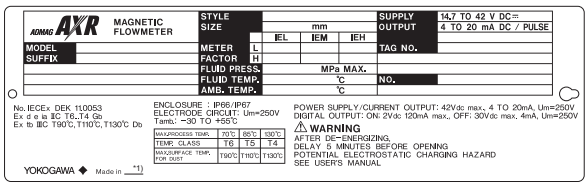
WARNING

Electrostatic charge may cause an explosion hazard.
Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of product.

WARNING

The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void the certification.

(6) Name Plate



MODEL: Specified model code
SUFFIX: Suffix codes of the model code
STYLE: Specified style code
SIZE: Nominal size of apparatus
METER FACTOR: Sensor constant number of apparatus
SUPPLY: Supply voltage of apparatus
OUTPUT: Output signal of apparatus
FLUID PRESS.: Fluid pressure of apparatus
FLUID TEMP.: Fluid temperature of apparatus
AMB. TEMP., Tamb: Ambient temperature
POWER SUPPLY/CURRENT OUTPUT: Power supply with output signal of apparatus
DIGITAL OUTPUT: Output signal of apparatus
NO.: Manufacturing serial number
No.: IECEx DEK 11.0053
IECEx Type Examination certificate number
Ex d e ia IIC T6…T4 Gb
Protection type and temp. class for gas
Ex tb IIIC T90°C, T110°C, T130°C, Db
Protection type and maximum surface temp. for dust
ENCLOSURE: Enclosure protection code
ELECTRODE CIRCUIT Um: Voltage of electrode circuit
⚠WARNING: Warning to apparatus
YOKOGAWA ◆ Name of manufacturer.

*1: The product-producing country

14.5 TIIS

CAUTION

The model AXR□□□C magnetic flowmeter with optional code JF3, which has obtained certification according to technical criteria for explosion proof construction of electric machinery and equipment (Standards Notification No. 556 from the Japanese Ministry of Labor) conforming to IEC standards, is designed for hazardous areas where inflammable gases or vapors may be present. (This allows installation in Zone 1 and 2 areas) To preserve the safety of flameproof equipment requires great care during mounting, wiring, and piping. Safety requirements also place restrictions on maintenance and repair activities. Users absolutely must read "INSTALLATION AND OPERATING PRECAUTIONS FOR TIIS FLAMEPROOF EQUIPMENT" at the end of this manual.

(1) Technical Data

Certificate:

Size: mm(inch)	Wafer Type -A**	Flange Type -B**
25 (1.0)	TC19746	TC19746
40 (1.5)	TC19747	TC19747
50 (2.0)	TC19748	TC19748
65 (2.5)	TC19749	TC19749
80 (3.0)	TC19750	TC19750
100 (4.0)	TC19751	TC19751
150 (6.0)	TC19753	TC19754
200 (8.0)	TC19756	TC19757

Construction: Ex d e [ia] IIC T4
Converter: Flameproof enclosure and intrinsically safety (ia)
Flowtube: Increased safety and intrinsically safety (ia)
Electrode: Intrinsically safety (ia)
Gas Group And Temperature Class: IIC T4

- Non-intrinsically safety circuit
  - Supply Voltage: 14.7 to 42 V dc
  - Output Signal: 4 to 20 mA dc
  - Digital Output: ON; 2 V dc, 120 mA
    OFF; 30 V dc, max., 4 mA
  - Allowable Voltage (Um): 250 V ac 50/60 Hz, 250 V dc
  - Excitation Circuit: 29 V

- Intrinsically safety circuit
  - Maximum Voltage (Uo): 14 V
  - Maximum Current (Io): 17 mA
  - Maximum Electrical Power (Po): 0.12 W
- Fluid Temperature: –20 to 130°C
- Ambient Temperature: –20 to 55°C
- Grounding:
  Grounding resistance of 10 Ω or less is necessary for class A grounding terminal.
  Grounding resistance of 100 Ω or less is necessary for Functional grounding terminal.
  When the optional code A is selected, grounding resistance of 10 Ω or less shall be required.

IMPORTANT

Class A grounding should be installed in non-hazardous area.

- Flameproot packing adapter:
  The specifying optional code G11 is necessary.
  In case of two flameproof packing adapters, select optional code G32 with G11.

(2) Wiring Installation

For the external wiring of flameproof types, use a flameproof packing adapter (optional code G11, G32) approved by Yokogawa (Read Figure 14.5.2) (Read “INSTALLATION AND OPERATING PRECAUTIONS FOR TIIS FLAMEPROOF EQUIPMENT” at the end of this manual).

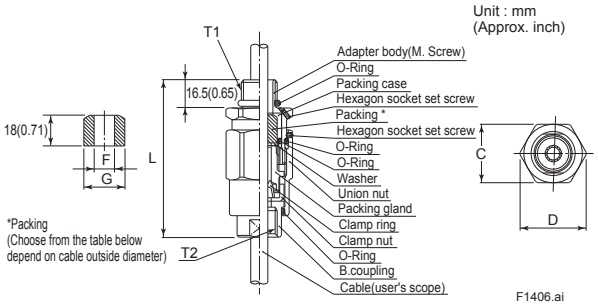
WARNING

Available only for wiring of using a flameproof packing adapter approved by Yokogawa.
The flameproof metal conduit wiring for TIIS flameproof type is not permitted.

(2-1) Wiring Cable through Flameproof Packing Adapter

WARNING

For the TIIS flameproof type with wiring using a flameproof packing adapter, wire cables through the packing adapters approved by Yokogawa (optional code G11, G32).



Nominal diameter		Dimension			Cable outer diameter	Packing diameter		Identification mark	Weight kg (lb)	Parts No.
T1	T2	C	D	L		F	G			
G 1/2	G 1/2	35 (1.38)	39 (1.54)	94.5 (3.72)	ø8.0 to ø10.0 (0.31 to 0.39)	ø10.0(0.39)	ø20.0 (0.79)	16 8-10	0.26 (0.57)	G9601AM*
					ø10.0 to ø12.0 (0.39 to 0.47)	ø12.0(0.47)		16 10-12		

*: G 11: 1 unit
G 11 with G 32: 2 units

Figure 14.5.1 Flameproof Packing Adapter

- Apply a nonhardening sealant to the terminal box connection port and to the threads on the flameproof packing adapter for waterproofing.

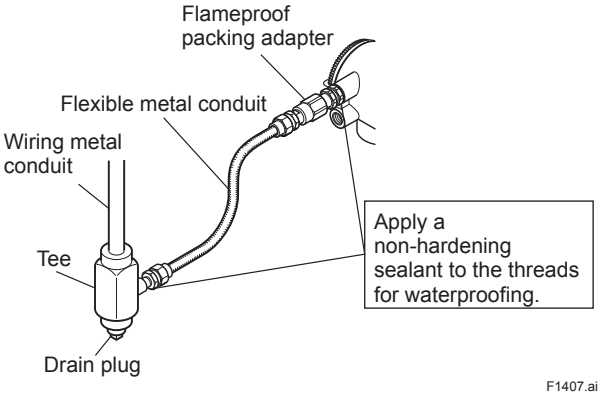


Figure 14.5.2 Typical Wiring Using Flexible Metal Conduit

Follow the procedure for flameproof packing adapter setting. (Read Figure 14.5.3)

CAUTION

Before fighting, confirm cable length from terminal to flameproof packing adapter when setting. Once it is tightened, loosening and re-tightening may damage its sealing performance.

(a) Loosen the locking screw and remove the terminal box cover.
(b) Measure the cable outer diameter in two directions to within 0.1 mm.
(c) Calculate the average of the two diameters, and use packing with an internal diameter nearest to this value (Read Table of the Figure 14.5.1).
(d) Screw the flameproof packing adapter into the terminal box until the O-ring touches the wiring port (at least 6 full turns), and firmly tighten the lock nut.
(e) Insert the cable through the union cover, the union coupling, the clamp nut, the clamp ring, the gland, the washer, the rubber packing, and the packing box, in that order.
(f) Insert the end of the cable into the terminal box.
(g) Tighten the union cover to grip the cable.
When tightening the union cover, tighten approximately one turn past the point where the cable will no longer move up and down.
Proper tightening is important. If it is too tight, a circuit break in the cable may occur; if not tight enough, the flameproof effectiveness will be compromised.
(h) Fasten the cable by tightening the clamp nut.
(i) Tighten the lock nut on the union cover.
(j) Connect the cable wires to each terminal.

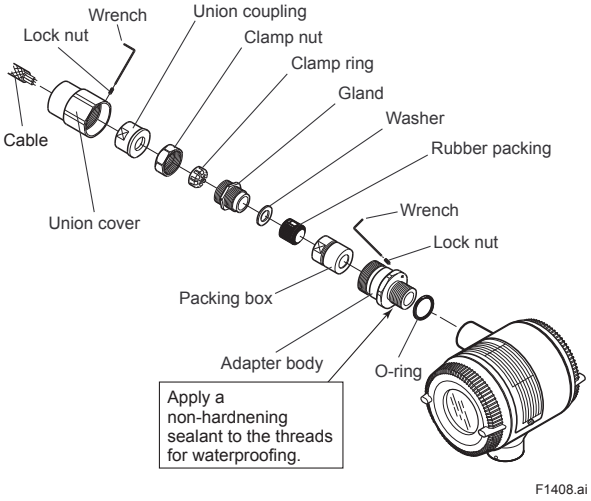


Figure 14.5.3 Installing Flameproof Packing Adapter

(3) Installation

The model AXR□□□C magnetic flowmeter with optional code JF3 should be used according to 1) to 4).

1) Follow Figure 14.5.4 regarding the system configuration.

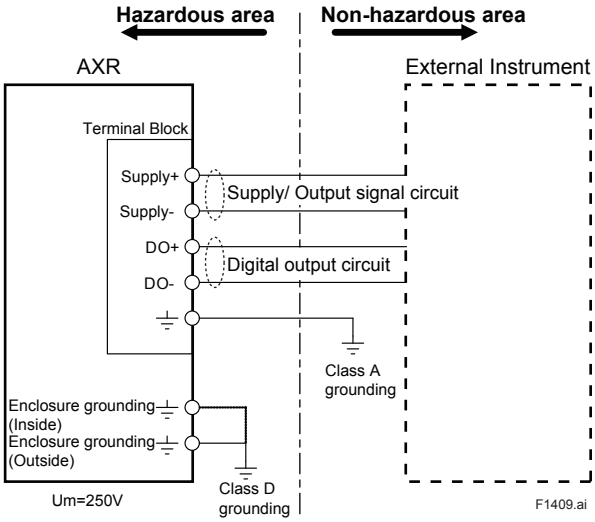


Figure 14.5.4 Configuration (TIIS)

2) AXR should be used at ambient temperature -20°C to 55°C and fluid temperature 130°C or less.
3) Grounding A should be installed in Non-hazardous area.
4) Power supply and internal voltage of the external instrument used with AXR should not exceed AC 250V 50/60Hz, DC 250V.

(4) Operation

WARNING

After de-energizing, delay 5 minutes before opening.

Appendix 1. Safety Instrumented Systems Installation

WARNING

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

A1.1 Scope and Purpose

This section provides an overview of the user responsibilities for installation and operation of the AXR in order to maintain the designed safety level for Safety Instrumented Systems (SIS) applications. Items that will be addressed are proof testing, repair and replacement of the transmitter, reliability data, lifetime, environmental and application limits, and parameter settings.

A1.2 Using the AXR for an SIS Application

A1.2.1 Safety Accuracy

The AXR has a specified safety accuracy of 2%. This means that the internal component failures are listed in the device failure rate if they will cause an error of 2% or greater.

A1.2.2 Diagnostic Response Time

The AXR will report an internal failure within 8 seconds of the fault occurrence.

A1.2.3 Setup

During installation the flowmeter must be setup with engineering units parameters. This is typically done with a handheld terminal. These parameters must be verified during the installation to insure that the correct parameters are in the flowmeter. Engineering range parameters can be verified by reading these parameters from the optional local display or by checking actual calibration of the flowmeter.

The calibration of the flowmeter must be performed after parameters are set.

A1.2.4 Required Parameter Settings

The following parameters need to be set in order to maintain the designed safety integrity.

Table A1.2.1 Required Parameter Settings

Item	Description
Burnout direction switch	To specify if the output should go 21.6 mA or higher or 3.2 mA or lower upon detection of an internal failure.
Write protection switch	The write function should be disabled.

A1.2.5 Proof Testing

The objective of proof testing is to detect failures within the flowmeter that are not detected by the diagnostics of the flowmeter. Of main concern are undetected failures that prevent the safety instrumented function from performing its intended function. Read Table A1.2.2 for proof testing method.

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

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

The personnel performing the proof test of the flowmeter should be trained in SIS operations including bypass procedures, AXR flowmeter maintenance, and company management of change procedures.

Table A1.2.2 Proof Testing

Testing method	Tool required	Expected outcome	Remarks
Analog Output Loop Test: 1. Bypass the safety PLC or take other appropriate action to avoid a false trip. 2. Send a HART or BRAIN command to the Magnetic Flowmeter to go to the high alarm current output and verify that the analog current reaches that value and verify that discrete contact has de-energized (if used). 3. Send a HART or BRAIN command to the Magnetic Flowmeter to go to the low alarm current output and verify that the analog current reaches that value. 4. Use the HART or BRAIN communicator to view detailed device status to ensure no alarms or warnings are present in the Magnetic Flowmeter. 5. Perform reasonability check on the sensor value(s) versus an independent estimate (i.e. from direct monitoring of BPCS value) to show current reading is good. 6. Restore the loop to full operation. 7. Remove the bypass from the safety PLC or otherwise restore normal operation.	• Handheld • Calibrated Flow Source	Proof Test Coverage = 78%	The output needs to be monitored to assure that the Magnetic Flowmeter communicates the correct signal.
Analog Output Loop Test and Calibration 1. Bypass the safety PLC or take other appropriate action to avoid a false trip. 2. Perform Analog Output Loop Test. 3. Verify the measurement for two flow points. 4. Restore the loop to full operation. 5. Remove the bypass from the safety PLC or otherwise restore normal operation.	• Handheld • Calibrated Flow Source	Proof Test Coverage = 96%	The output needs to be monitored to assure that the Magnetic Flowmeter communicates the correct signal.

* For details of the proof test coverage, refer to the FMEDA No. YOK 10/06-91 R001.

A1.2.6 Repair and Replacement

If repair is to be performed with the process online the AXR will need to be bypassed during the repair. The user should setup appropriate bypass procedures.

In the unlikely event that the AXR has a failure, the failures that are detected should be reported to Yokogawa.

When replacing the AXR, the procedure in the installation manual should be followed.

The personnel performing the repair or replacement of the AXR should have a sufficient skill level.

A1.2.7 Startup Time

The AXR generates a valid signal within 10 second of power-on startup.

A1.2.8 Firmware Update

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

A1.2.9 Reliability Data

A detailed Failure Mode, Effects, and Diagnostics Analysis (FMEDA) report is available from Yokogawa with all failure rates and failure modes.

The AXR is certified up to SIL2 for use in a simplex (1oo1) configuration, depending on the PFDavg respectively PFH calculation of the entire Safety Instrumented Function.

The development process of the AXR is certified up to SIL3, allowing redundant use of the transmitter up to this Safety Integrity Level, depending the PFDavg respectively PFH calculation of the entire Safety Instrumented Function.

When using the transmitter in a redundant configuration, the use of a common cause factor (β-factor) of 5% is suggested. If the owner-operator of the plant would institute common cause failure training and more detailed maintenance procedures for avoiding common cause failure, a beta factor of 2% would be applicable.

A1.2.10 Lifetime Limits

The expected lifetime of the AXR is 10 years. The reliability data listed the FMEDA report is only valid for this period. The failure rates of the AXR may increase sometime after this period. Reliability calculations based on the data listed in the FMEDA report for AXR lifetimes beyond 10 years may yield results that are too optimistic, i.e. the calculated Safety Integrity Level will not be achieved.

A1.2.11 Environmental Limits

The environmental limits of the AXR are specified in this manual.

A1.2.12 Application Limits

The application limits of the AXR are specified in this manual. If the flowmeter is used outside of the application limits, the reliability data listed in Subsection A1.2.9 becomes invalid.

A1.3 Definitions and Abbreviations

A1.3.1 Definitions

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

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

A1.3.2 Abbreviations

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

INSTALLATION AND OPERATING PRECAUTIONS FOR TIIS FLAMEPROOF EQUIPMENT

Apparatus Certified Under Technical Criteria (IEC-compatible Standards)

1. General

The following describes precautions on electrical apparatus of flameproof construction (hereinafter referred to as flameproof apparatus) in explosion-protected apparatus.
Following the Labour Safety and Health Laws of Japan, flameproof apparatus is subjected to type tests to meet either the technical criteria for explosionproof electrical machinery and equipment (standards notification no. 556 from the Japanese Ministry of Labour) (hereinafter referred to as technical criteria), in conformity with the IEC Standards, or the “Recommended Practice for Explosion-Protected Electrical Installations in General Industries,” published in 1979. These certified apparatus can be used in hazardous locations where explosive or inflammable gases or vapours may be present.
Certified apparatus includes a certification label and an equipment nameplate with the specifications necessary for explosion requirements as well as precautions on explosion protection. Please confirm these precautionary items and use them to meet specification requirements.
For electrical wiring and maintenance servicing, please refer to “Internal Wiring Rules” in the Electrical Installation Technical Standards as well as “USER’S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry,” published in 1994.
To meet flameproof requirements, equipment that can be termed “flameproof” must:

(1) Be certified by a Japanese public authority in accordance with the Labour Safety and Health Laws of Japan and have a certification label in an appropriate location on its case, and
(2) Be used in compliance with the specifications marked on its certification label, equipment nameplate and precautionary information furnished.

2. Electrical Apparatus of Flameproof Type of Explosion-Protected Construction

Electrical apparatus which is of flameproof construction is subjected to a type test and certified by the Japanese Ministry of Labour aiming at preventing explosion caused by electrical apparatus in a factory or any location where inflammable gases or vapours may be present. The flameproof construction is of completely enclosed type and its enclosure shall endure explosive pressures in cases where explosive gases or vapours entering the enclosure cause explosion. In addition, the enclosure construction shall be such that flame caused by explosion does not ignite gases or vapours outside the enclosure.
In this manual, the word "flameproof" is applied to the flameproof equipment combined with the types of protection "e", "o", "i", and "d" as well as flameproof equipment.

3. Terminology

(1) Enclosure

An outer shell of an electrical apparatus, which encloses live parts and thus is needed to configure explosion-protected construction.

(2) Shroud

A component part which is so designed that the fastening of joint surfaces cannot be loosened unless a special tool is used.

(3) Enclosure internal volume

This is indicated by:— the total internal volume of the flameproof enclosure minus the volume of the internal components essential to equipment functions.

(4) Path length of joint surface

On a joint surface, the length of the shortest path through which flame flows from the inside to outside of the flameproof enclosure. This definition cannot be applied to threaded joints.

(5) Gaps between joint surfaces

The physical distance between two mating surfaces, or differences in diameters if the mating surfaces are cylindrical.

Note: The permissible sizes of gaps between joint surfaces, the path length of a joint surface and the number of joint threads are determined by such factors as the enclosure' s internal volume, joint and mating surface construction, and the explosion classification of the specified gases and vapours.

4. Installation of Flameproof Apparatus

(1) Installation Area

Flameproof apparatus may be installed, in accordance with applicable gases, in a hazardous area in Zone 1 or 2, where the specified gases are present. Those apparatus shall not be installed in a hazardous area in Zone 0.

Note: Hazardous areas are classified in zones based upon the frequency of the appearance and the duration of an explosive gas atmosphere as follows:
Zone 0: An area in which an explosive gas atmosphere is present continuously or is present for long periods.
Zone 1: An area in which an explosive gas atmosphere is likely to occur in normal operation.
Zone 2: An area in which an explosive gas atmosphere is not likely to occur in normal operation and if it does occur it will exist for a short period only.

(2) Environmental Conditions

The standard environmental condition for the installation of flameproof apparatus is limited to an ambient temperature range from –20°C to +40°C (for products certified under Technical Criteria). However, some field-mounted instruments may be certified at an ambient temperature up to +60 °C as indicated on the instrument nameplates. If the flameproof apparatus are exposed to direct sunshine or radiant heat from plant facilities, appropriate thermal protection measures shall be taken.

5. External Wiring for Flameproof Apparatus

Flameproof apparatus require cable wiring or flameproof metal conduits for their electrical connections. For cable wiring, cable glands (cable entry devices for flameproof type) to wiring connections shall be attached. For metal conduits, attach sealing fittings as close to wiring connections as possible and completely seal the apparatus. All non-live metal parts such as the enclosure shall be securely grounded. For details, see the “USER’S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry,” published in 1994.

(1) Cable Wiring

- For cable wiring, cable glands (cable entry devices for flameproof type) specified or supplied with the apparatus shall be directly attached to the wiring connections to complete sealing of the apparatus.
- Screws that connect cable glands to the apparatus are those for G-type parallel pipe threads (JIS B 0202) with no sealing property. To protect the apparatus from corrosive gases or moisture, apply nonhardening sealant such as liquid gaskets to those threads for waterproofing.
- Specific cables shall be used as recommended by the “USER’S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry,” published in 1994.
- In necessary, appropriate protective pipes (conduit or flexible pipes), ducts or trays shall be used for preventing the cable run (outside the cable glands) from damage.
- To prevent explosive atmosphere from being propagated form Zone 1 or 2 hazardous location to any different location or non-hazardous location through the protective pipe or duct, apply sealing of the protective pipes in the vicinity of individual boundaries, or fill the ducts with sand appropriately.
- When branch connections of cables, or cable connections with insulated cables inside the conduit pipes are made, a flameproof or increased-safety connection box shall be used. In this case, flameproof or increased-safety cable glands meeting the type of connection box must be used for cable connections to the box.

(2) Flameproof Metal Conduit Wiring

- For the flameproof metal conduit wiring or insulated wires shall be used as recommended by the USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry, published in 1994.
- For conduit pipes, heavy-gauge steel conduits conforming to JIS C 8305 Standard shall be used.
- Flameproof sealing fittings shall be used in the vicinity of the wiring connections, and those fittings shall be filled with sealing compounds to complete sealing of the apparatus. In addition, to prevent explosive gases, moisture, or flame caused by explosion form being propagated through the conduit, always provide sealing fittings to complete sealing of the conduit in the following locations:
  (a) In the boundaries between the hazardous and non-hazardous locations.
  (b) In the boundaries where there is a different classification of hazardous location.
- For the connections of the apparatus with a conduit pipe or its associated accessories, G-type parallel pipe threads (JIS B 0202) shall be used to provide a minimum of five-thread engagement to complete tightness. In addition, since these parallel threads do not have sealing property, nonhardening sealant such as liquid gaskets shall thus be applied to those threads for ensuring waterproofness.
- If metal conduits need flexibility, use flameproof flexible fittings.

6. Maintenance of Flameproof Apparatus

To maintain the flameproof apparatus, do the following. (For details, see Chapter 10 "MAINTENANCE OF EXPLOSION-PROTECTED ELECTRICAL INSTALLATION" in the USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry.)

(1) Maintenance servicing with the power on.

Flameproof apparatus shall not be maintenance-serviced with its power turned on. However, in cases where maintenance servicing is to be conducted with the power turned on, with the equipment cover removed, always use a gas detector to check that there is no explosive gas in that location. If it cannot be checked whether an explosive gas is present or not, maintenance servicing shall be limited to the following two items:

(a) Visual inspection
Visually inspect the flameproof apparatus, metal conduits, and cables for damage or corrosion, and other mechanical and structural defects.

(b) Zero and span adjustments
These adjustments should be made only to the extent that they can be conducted from the outside without opening the equipment cover. In doing this, great care must be taken not to cause mechanical sparks with tools.

(2) Repair

If the flameproof apparatus requires repair, turn off the power and transport it to a safety (non-hazardous) location. Observe the following points before attempting to repair the apparatus.

(a) Make only such electrical and mechanical repairs as will restore the apparatus to its original condition. For the flameproof apparatus, the gaps and path lengths of joints and mating surfaces, and mechanical strength of enclosures are critical factors in explosion protection. Exercise great care not to damage the joints or shock the enclosure.

(b) If any damage occurs in threads, joints or mating surfaces, inspection windows, connections between the transmitter and terminal box, shrouds or clamps, or external wiring connections which are essential in flameproofness, contact Yokogawa Electric Corporation.

CAUTION

Do not attempt to re-process threaded connections or refinish joints or mating surfaces.

(c) Unless otherwise specified, the electrical circuitry and internal mechanisms may be repaired by component replacement, as this will not directly affect the requirements for flameproof apparatus (however, bear in mind that the apparatus must always be restored to its original condition). If you attempt to repair the flameproof apparatus, company-specified components shall be used.

(d) Before starting to service the apparatus, be sure to check all parts necessary for retaining the requirements for flameproof apparatus. For this, check that all screws, bolts, nuts, and threaded connections have properly been tightened.

(3) Prohibition of specification changes and modifications

Do not attempt to change specifications or make modifications involving addition of or changes in external wiring connections.

7. Selection of Cable Entry Devices for Flameproof Type

CAUTION

The cable glands (cable entry devices for flameproof type) conforming to IEC Standards are certified in combination with the flameproof apparatus. So, Yokogawa-specified cable entry devices for flameproof type shall be used to meet this demand.

References:

(1) Type Certificate Guide for Explosion-Protected Construction Electrical Machinery and Equipment (relating to Technical Standards Conforming to International Standards), issued by the Technical Institution of Industrial Safety, Japan

(2) USER'S GUIDELINES for Electrical Installations for Explosive Gas Atmospheres in General Industry (1994), issued by the Japanese Ministry of Labour, the Research Institute of Industrial Safet

■Notes for the Identification Tag

An exclusive User's Manual might be attached for products whose suffix code or optional codes contain code "Z". Please read it along with their standard manual.

The Identification Tag which is enclosed with a product.
Please keep the Identification Tag with this document.

Identification Tag <Sample>

Identification Tag

Serial No.	S5T303057
Material	AXR025G Two-wire Magnetic Flowmeter (25mm/1in)
MS Code	AXR025G-J1AH1H-AJ12-01A/EP/BSF
Comp. No.	0001
Qty	1 ST

Order Instruction

FLUID NAME
WATER
TAG NO.

FLOWRATE SPAN
0 6 m3/h
TOTALIZER DISPLAY PULSE WEIGHT

TRANSMISSION PULSE WEIGHT

FINAL DESTINATION
JAPAN
SOFTWARE TAG

etc.

Customer PO	
Linkage No.	2003902869-000010

■RoHS (2011/65/EU) Directive

Read GS 01E20S00-01EN [ADMAG Series Magnetic Flowmeter List of RoHS (2011/65/EU) Directive Compliant Products]

Revision Information

- Title : AXR Two-wire Magnetic Flowmeter Integral Flowmeter
- Manual No. : IM 01E30D01-01EN

Edition	Date	Page		Revised Item
1st	Sep. 2009	–		New publication
2nd	Nov. 2010	1-2	(3), (4)	Added the sentence.
		3-1	(3)	Added the sentence.
		3-7 to 3-12	3.3.2 to 3.3.3	Added the Torque Value of size 150 to 200 mm. Added the Centering Device Idenfication of size 150 to 200 mm. Added the Inner Diameters of Grounding Ring and Outer Diameter for Effective Sealing of size 150 to 200 mm.
		4-2	4.3	Changed the sentence of Wiring Ports.
		4-6	4.6 (1)	Added the note of HART protocol.
		5-1	5.	Added the sentence
		8-5	8.4.6	Corrected the HART protocol parameter attribute.
		11-1 to 11-22	11.	Added the sentence of size 150 to 200 mm.
				Added the note of OPTIONAL SPECIFICATIONS
				Added the Flange material Added optional code PM Changed the Selectable range of flow rate span in the optional code SC.
		12-1	12. (1)	Added AXR150G and AXR200G.
		13-1 to 13-4	13.1 to 13.3	Changed the item name in Technical Data.
3rd	Aug. 2012	1-1	1.	Changed the style. Changed the Note.
		4-1 to 4-15	4.	Changed the Terminal Configuration.
				Added the Terminal Configuration.
		4-6 to 4-7	4.6 (1)	Changed the Supply Voltage.
				Added the Connection Device (JUXTA VJA7)
		6-3, 6-11	6.3 (2), (8)	Added "Long Tag No (Hi)" and "Long Tag No (Lo) to Data range for B41 and H11.
		6-6, 6-22	6.3 (4), 6.4 (3)	Changed the default value and the setting value for D13.
		6-7, 6-24	6.3 (5), 6.4 (4)	Changed the default value and the setting value for E13.
		6-12, 6-32	6.3 (9), 6.4 (8)	Changed the default value and the setting value for J10.
		6-46	6.5.3	Added "93:Dcv Sim Wng".
		6-46	6.5.4	Added "NE-107"
		8-1 to 8-17	8.	Changed HART 5 by the device revision up.
		9-1 to 9-18	9.	Added HART 7.
		12-1	12.	Changed the Supply Voltage.
				Added the Connection Device (JUXTA VJA7)
		12-2		Added HART 7.
		12-3		Added NE-107
		12-3, 12-12		Changed the current output value in case of Style 2 with optional code C1.
		12-3		Changed the default value and the setting value of Low out
		12-5 to 12-7		Changed the Accuracy.
		12-6		Added SIL Certification.
		12-1 to 12-21		Added AXR 150C and AXR200C.
		14-1 to 14-10	14.	Added AXR 150C and AXR200C.
		A1-1 to A1-3	Appendix 1.	Added "Safety instrumented System Installation"

Edition	Date	Page	Revised Item	
4th	Sep. 2015	1-1	1.	Added the NOTE for this manual.
		1-2	1.1 (1)	Added the WARNING for installation.
		2-1	2.1	Changed the name plate in Figure 2.1.1
		3-1	3.1 (3)	Changed the lengths of straight runs, when installed two or more magnetic flowmeters on a single pipe.
		3-13	3.3.4	Changed the table number. Added the recommended inner diameter of gasket in Table 3.3.12.
		4-3	4.3 (2)	Changed the number of washer in Figure 4.3.1.
		4-4	4.4	Changed the IMPORTANT for grounding.
				Changed the sentence in Figure 4.4.3.
		4-14 to 4-17	4.6	Added the sentence for grounding in Table 4.6.5 to Table 4.6.7.
		6-11	6.3 (8)	Added the default value for H40.
		6-20	6.4 (2)	Changed the name plate.
		6-22	6.4 (3)	Changed the sentence for D20.
		6-31	6.4 (7)	Added the sentence for H40.
		7-3	7.2.1	Added the load resistance in Figure 7.2.
				Added the IMPORTANT for communication.
		8-1	8.1	Changed the name plate.
		8-2	8.3	Added the load resistance in Figure 8.3.
		9-1	9.1	Changed the name plate.
		9-2	9.3	Added the load resistance in Figure 9.3.
		9-9	9.8.3 (2)	Added the IMPORTANT for HART7 Burst communication.
		11-2	11.2	Added the IMPORTANT for component replacement.
		12-5	12.1	Changed the sentence for gasket size.
		12-7	12.3	Deleted the marks.
				Added the performance specification in EMC Conformity Standards.
				Changed the table and note for PED.
		12-13	12.6	Changed the allowable current, when selected the optional code A.
		12-15		Deleted the note for IECEx certification.
		12-23	12.7	Changed the table for flameproof packing adapter and added the parts number.
		13-1	13 (1)	Changed the table and note for PED.
		14-1	14.	Added the NOTE for this manual.
		14-7	14.4	Changed the table for flameproof packing adapter and added the parts number.
		A1-2	A1.2.5	Added the Proof Test Coverage in Table A1.2.2.

Edition	Date	Page	Revised Item	
5th	Mar. 2016	1-3 to 1-4	1.1 (7) to (9)	Added the sentence for Modification, Product Disposal and Authorized Representative.
		4-8	4.6 (1)	Corrected the trademarks.
		8-1	8.	Corrected the trademarks.
		9-1	9.	Corrected the trademarks.
		12-2	12.1	Corrected HART and Protection.
		12-5		Added the material for Grounding Ring and Grounding Electrode.
		12-7	12.3	Added the sentence for CE marking.
				Deleted "EN61010-1" in Safety Requirement Standards.
				Deleted the sentence for PED.
		12-9	12.5	Added the material for Grounding Ring and Grounding Electrode.
		12-11		Added the material for Grounding Ring and Grounding Electrode.
		12-15	12.6	Added the optional code CF1 for CSA certification.
		12-22	12.7	Corrected the flange thickness for size 150mm, ANSI Class 300.
		13-1	13.	Added the sentence for PED.
		14-3	14.1 (6)	Corrected the figure for name plate.
		14-4 to 14-6	14.3	Added the sentence for CSA certification.
		14-8	14.4 (6)	Corrected the figure for name plate.
		Appendix		Added "EU DECLARATION OF CONFORMITY"
6th	Mar. 2017	1-1		Added a description at Regarding This User's Manual.
		3-6		Deleted the optional codes BCF and BCC.
		3-7		Deleted the optional code BCF.
		3-8		Deleted the optional code BCF.
		3-9		Deleted the optional codes BCF and BCC.
		12-5		Deleted the optional codes BCF and BCC.
		12-7		SIL 2: certified by exida.
		12-9		Added a note.
		12-12		Added a note.
		12-14		Deleted the optional codes BCF and BCC. Changed the model number of gasket.
		12-15		Deleted the optional codes BCF and BCC.
		13-1		Changed the table for PED (Pressure Equipment Directive).
		A1-2		Added a description of the proof test coverage.
7th	May. 2017	Appendix	Added "■Notes for the Identification Tag" and "■Addition of description for Special Specifications".	