

# Vortex Flowmeter VY Series Installation Manual

IM 01F07A01-01EN



Integral Type Flowmeter  
(VY□□□)



Remote Type Sensor  
(VY□□□-N)



Remote Type Converter  
(VY4A)

1. INTRODUCTION	1
2. HANDLING PRECAUTIONS	2
3. INSTALLATION	3
4. WIRING	4
5. BASIC OPERATING PROCEDURES (DISPLAY)	5
6. PARAMETERS	6
7. OPERATION	7
8. ERRORS AND COUNTERMEASURES WITH DISPLAY UNIT	8
9. APPLICABLE STANDARDS	9

This manual summarizes descriptions in the manuals below relating to installation and wiring. There are some differences, however they do not affect the safety of the product performance and use.

**Table 1.1 Related Documents**

Document title	Document No.	Shipped together /Web Download	Document title	Document No.	Shipped together /Web Download
Vortex Flowmeter VY Series	GS 01F07A00-01EN	Web Download	Vortex Flowmeter VY Series FM (USA) Explosion Protection Type	IM 01F07A03-01EN	Shipped together (for code F*1)
FSA130 Magnetic Flowmeter / Vortex Flowmeter Verification Tool	GS 01E21A04-01EN	Web Download	Vortex Flowmeter VY Series FM (Canada) Explosion Protection Type	IM 01F07A03-02EN	Shipped together (for code C*1)
Vortex Flowmeter VY Series Read Me First	IM 01F07A21-01Z1	Shipped together	Vortex Flowmeter VY Series ATEX Explosion Protection Type	IM 01F07A03-03EN	Shipped together (for code K*2)
Vortex Flowmeter VY Series Safety Manual	IM 01F07A21-02EN	Web Download (for option SL)	Vortex Flowmeter VY Series IECEx Explosion Protection Type	IM 01F07A03-04EN	Shipped together (for code S*2)
Vortex Flowmeter VY Series Installation Manual	IM 01F07A01-01EN	Shipped together on request	Vortex Flowmeter VY Series Japan Explosion Protection Type	IM 01F07A03-05JA	Shipped together (for code JF5)
Vortex Flowmeter VY Series Maintenance Manual	IM 01F07A01-02EN	Web Download /Sold separately	Vortex Flowmeter VY Series INMETRO Explosion Protection Type	IM 01F07A03-07PT	Shipped together (for code U*2)
Vortex Flowmeter VY Series HART Communication Type	IM 01F07A02-01EN	Web Download /Sold separately	Vortex Flowmeter VY Series NEPSI Explosion Protection Type	IM 01F07A03-08ZH	Shipped together (for code N*2)
Vortex Flowmeter VY Series Verification Tool	IM 01F07A04-01EN	Web Download /Sold separately	Vortex Flowmeter VY Series KOREAN Explosion Protection Type	IM 01F07A03-10KO	Shipped together (for code P*2)



# Vortex Flowmeter VY Series Installation Manual

IM 01F07A01-01EN 3rd Edition

## Contents

<b>1. INTRODUCTION.....</b>	<b>2</b>	<b>7. OPERATION .....</b>	<b>39</b>
1.1 Using This Instrument Safely.....	4	7.1 Adjustments.....	39
1.2 Warranty .....	7	7.1.1 Zero Adjustment .....	39
<b>2. HANDLING PRECAUTIONS .....</b>	<b>8</b>	7.1.2 Span Adjustment .....	39
2.1 Checking Model and Specifications .....	8	7.1.3 Loop Test .....	39
2.2 Transportation and Storage Precautions .....	8	7.1.4 Totalizer Start and Totalizer Reset Methods.....	40
<b>3. INSTALLATION .....</b>	<b>10</b>	7.1.5 Pulse Output (Scaling) .....	40
3.1 Installation Precautions.....	10	7.1.6 Setting of Burnout Setting Switch.....	40
3.2 Piping Precautions.....	11	7.1.7 Setting the Write Protect Setting Switch...	41
3.3 Maintenance of Piping .....	16	7.1.8 Operation at a Power Failure .....	41
3.4 Thermal Insulation of Cryogenic Type and High Temperature Type.....	16	7.2 Adjustment for Manual Mode.....	41
3.5 Mounting Procedures .....	17	7.2.1 Low Cut Adjustment .....	41
<b>4. WIRING .....</b>	<b>22</b>	7.2.2 Zero Tuning .....	41
4.1 Load Resistance and Wiring Conditions.....	22	<b>8. ERRORS AND COUNTERMEASURES WITH DISPLAY UNIT .....</b>	<b>43</b>
4.2 Selection of Cables .....	23	8.1 When Error Is Large or Unstable Is Output ....	43
4.3 Connection Between Integral Type and Remote Transmitter.....	24	8.2 Indication Drops to Zero at Certain Times.....	44
4.4 Connecting the Vortex Flowmeter Signal Cable (VY1C).....	28	8.3 The Indication Is Zero Even It is Flowing.....	45
4.5 Terminal Processing Method of Vortex Flowmeter Signal Cable (VY1C).....	29	8.4 Indication When No Fluid is Flowing .....	46
4.6 Wiring Procedures and Precautions .....	30	8.5 With Built-in Temperature Sensor .....	47
4.7 Grounding .....	31	<b>9. APPLICABLE STANDARDS .....</b>	<b>48</b>
4.8 Lightning Protector (option code: /A) .....	31	PED (Pressure Equipment Directive).....	48
<b>5. BASIC OPERATING PROCEDURES (DISPLAY).....</b>	<b>32</b>	<b>Revision Information .....</b>	<b>49</b>
5.1 Configuration of Display .....	32		
<b>6. PARAMETERS .....</b>	<b>33</b>		
6.1 Vortex Flowmeter VY Series Parameters.....	33		
6.2 Configuration of Parameters .....	33		
6.3 Self-Diagnostic (Error Code List) .....	34		
6.3.1 Errors and Countermeasures.....	34		
6.3.2 Operation when an error occurs.....	36		

# 1. INTRODUCTION

Thank you for purchasing the Vortex Flowmeter VY Series. This manual explains installation and wiring of the Vortex Flowmeter VY Series. Manuals explaining details regarding the functional specifications, explanation of functions, maintenance, and handling of each communication specifications unique to each product can be downloaded from the Yokogawa website. Be sure to read these manuals to ensure correct use of the products.

A printed version of the manual is also available for purchase. For details, contact your nearest sales office or Service Center.

Website address:

<https://www.yokogawa.com/library/>

## ■ Regarding This Manual

- This manual should be provided to the end user.
- 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.
- The specifications covered by this manual are limited to those for the standard type under the specified model number break-down and do not cover custom-made instruments.
- Please note that this manual may not be revised for any specification changes, construction changes or operating part changes that are not considered to affect function or performance.
- Yokogawa assumes no responsibilities for this product except as stated in the warranty.
- 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

- When handling this instrument, follow the safety precautions described in this document for protection and safety of personnel, this instrument and systems that incorporate this instrument. Yokogawa does not guarantee the safety of this instrument if the customer has failed to comply with these precautions.
- Modification of the product in question without the authorization of Yokogawa is strictly forbidden.
- When an explosion protected type instrument has been repaired or modified by the customer and cannot be restored to its original condition, the explosion protective structure of this instrument will be impaired and a hazardous condition will arise. Be sure to consult Yokogawa regarding repairs and modifications.

The following safety symbol marks are used on this product and in this manual.



### 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. This document presents precautions for avoiding such hazards should such a situation arise.



### 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 the product. This document presents precautions for avoiding such hazards should there be a physical risk to the user's well-being or damage to equipment.


## 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.

Various symbols are marked on the instrument itself. The meanings of these symbols are as follows.

 Functional ground terminal

 Direct current

 Handling precaution  
This is attached to locations where this manual must be referenced to protect personnel safety and devices.

- This product is not designed or manufactured to be used in critical applications that directly affect or threaten human lives. Such applications include nuclear power equipment, devices using radioactivity, railway facilities, aviation equipment, air navigation facilities, aviation facilities, and medical equipment. If so used, it is the user’s responsibility to include in the system additional equipment and devices that ensure personnel safety.
- Modification of this instrument is strictly forbidden.
- If this instrument is modified or replaced, each explosion protection accreditation is invalidated.
- This instrument should be disposed of in accordance with local and national legislation/regulations.
- When handling this instrument, follow the safety precautions described in this document and other precautions for the protection and safety of this instrument and systems that incorporate this product. When these precautions are not complied with, the protection functions of this instrument may be impaired or instrument functions may not be fully demonstrated. In this case, Yokogawa makes no guarantee whatsoever for the quality, performance, functions, and safety of the product.
- When performing the installation of protective and safety circuits for this instrument or control systems, such as lightning protection systems or devices on this instrument or on systems controlled by this instrument, or the foolproof or failsafe design of processes and lines that use this instrument or control systems, and the design and installation of other protective and safety circuits, the customer should implement this appropriately at their own judgment. Also, the customer should separately consider achieving the above by devices other than this instrument, and prepare devices accordingly.
- When replacing the parts of this instrument, be sure to use only parts specified by Yokogawa.

## 1.1 Using This Instrument Safely

When handling this product, follow the safety precautions described in this document for the protection and safety of this product and systems that incorporate this product. When these precautions are not complied with, the protection functions of this product may be impaired or product functions may not be fully demonstrated. In this case, Yokogawa will not be liable for indirect damages resulting from use of this product or the inability to use this product.

### (1) General

- This product complies with the requirements of installation category (overvoltage category) I, measurement category none (O (other)) and pollution degree 2.
- This product complies with EMC standards EN61326-1 and EN61326-2-3.
- This product complies with EMC standard EN61326-1, Class A (commercial and industrial use).
- This product complies with international protection codes IP66 and IP67 within the EN60529 standard.
- This product is for indoor and outdoor use.



### WARNING

- Installation, wiring and maintenance of this product should be performed by trained personnel having knowledge of product characteristics and safety. No operator shall be permitted to perform any operations relating to installation, wiring and maintenance.
- Tighten wiring at the appropriate torque values using appropriate wires and crimping terminals. Use crimping terminals with insulating covers for wiring the power supply and ground wires. To prevent electric shock resulting from damage, do not pull wiring cables with strong force.
- Do not open the cover in wet weather or humid environments. When the cover is opened, the stated enclosure protection is not applicable.
- During normal operation, use this product with the cover closed.
- When opening and closing the cover, pay sufficient care to handling of screws and O-rings to prevent damage and attachment of foreign objects.
- Some of the electronic components used on this product are susceptible to damage as a result of static electricity. Take sufficient care when handling electronic components by, for example, wearing wrist straps to prevent charging by static electricity and not directly touching electronic components, circuits and other components susceptible to static electricity.
- When connecting the wiring, check that the supply voltage is within the rated voltage range specified for this product before connecting the power cable. In addition, check that no voltage is applied to the power cable before connecting the wiring.
- To prevent electric shock, completely tighten covers after wiring.
- To prevent electric shock, do not apply a voltage exceeding the rating to the input and output terminals.
- Cover unused cable entries with the blanking plug provided or purchased from Yokogawa. When unused cable entries are not covered by a blanking plug, the stated enclosure protection is not applicable to cable entries.
- Wiring, switch settings, and maintenance should be performed in an environment where the ambient temperature is -40°C or higher (the ambient temperature is -30°C or higher for the display).

**(2) Installation**



- The vortex flowmeter must be installed within the specification conditions.
- The vortex 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 vortex flowmeter. When moving the vortex flowmeter, always use a trolley and have at least two people carry it.
- When the vortex flowmeter is processing hot fluids, the instrument itself may become extremely hot. Take sufficient care not to get burnt.
- When 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 loads, for example, a person stepping on the vortex flowmeter.
- Defects in protection functions  
If you feel that the protection functions of this product are defective, do not operate this product. Also, before operating this product, check to see if the protection functions are defective.
- Use in gaseous environments  
In an explosion protected environment, select an explosion protected type. When a general type is selected, do not operate this product at locations where flammable and explosive gases, steam and burnable dust are present. Use of this product in such environments is very dangerous. Use of this product for a long period of time in environments where high concentrations of corrosive gas (H<sub>2</sub>S, SO<sub>x</sub>, etc.) are present may cause failure.
- Damage to protective structure  
The protective structure of this product may be impaired if it is operated in a way not described in this manual and in the related documents indicated in Table 1.1.
- Take care not to site this product near motors, transformers, inverters, and other power sources nearby. Failure to do so might cause inductive interference
- All procedures relating to installation must comply with the electrical code of the country where it is used.

**(3) Wiring**



- When connecting the wiring, check that the supply voltage is within the rated voltage range 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.
- Use external wiring having an allowable temperature 15°C or higher than the ambient temperature.
- When wiring in conduits, use waterproof union covers to prevent water from flowing into the cable entries through the conduits. Also, install a drain valve and periodically drain the conduits.
- To prevent damage from condensation and to ensure insulation inside terminal boxes, do not connect cables outdoors in wet weather.
- Do not remove the transmitter case. This can be removed only by Yokogawa service personnel.

**(4) Operation**



After setting parameters, use the write protect function to disable overwriting of parameters. For details on the hardware write protect function and software write protect function, read the communication manual in the related documents indicated in Table 1.1.

**(5) Maintenance**



**WARNING**

- For details on maintenance, read the maintenance manual in the related documents indicated in Table 1.1. Perform only maintenance that is described in this manual. Do not perform other maintenance. If other maintenance is necessary, contact your nearest sales office or Service Center.
- When the vortex flowmeter is processing hot fluids, the device itself may become extremely hot. Take sufficient care not to get burnt.
- When the fluid being processed is a toxic substance, avoid contact with the fluid and avoid inhaling any residual gas, even after the product has been taken off the piping line for maintenance and so forth.
- Take care to prevent debris, dirt and other foreign matter from adhering to the display glass and nameplate. Wipe off any foreign matter with a soft, dry cloth.

**(6) Explosion protected type devices**



**WARNING**

- This instrument has been certified as an explosion protected type device. Strict limitations are applied to the structures, installation locations, external wiring work, maintenance and repairs, etc. of this instrument. Sufficient care must be taken, as any violation of the limitations may cause dangerous situations. Before handling this product, be sure to read the explosion proof Instruction Manual in the related documents indicated in Table 1.1.
- Take care not to generate sparks through mechanical contact when accessing the flameproof explosion protected type device and peripheral devices at hazardous locations.

**(7) European Pressure Equipment Directive (PED)**



**WARNING**

When using the instrument in compliance with PED, be sure to read Chapter 9 "PED (Pressure Equipment Directive)" before use.

**(8) Modification**

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

**(9) Product Disposal**

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

**(10) 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

**(11) CE Marking**

CE marking is displayed on the nameplate for non-explosion protected type devices and ATEX explosion protected type devices. Products with CE marking are in compliance with the statutory requirements of the applicable EU directives.

**(12) EU RoHS Directive**

EN IEC 63000:2018

**(13) Morocco Conformity Mark**



This conformity mark indicates that the product complies with Moroccan requirements.

**(14) CRN (Canadian Registration Number)**

This applies to non-explosion protected type devices for Canada and FMc explosion protected type devices.

Integral flowmeters and remote sensors (15 to 400 mm diameter) have obtained CRN approval in all provinces and territories of Canada.

## 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 flowmeter 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 inappropriate re-installation after delivery.
  - Problems or damage resulting from disasters such as fires, earthquakes, storms, floods, or lightning strikes and external causes.
  - Problems or damage resulting from repairs or modifications not performed by Yokogawa or someone authorized by Yokogawa.
- **Trademarks**
- "HART" is the registered trademark of FieldComm Group.
  - All the brands or names of Yokogawa Electric's products used in this manual are either trademarks or registered trademarks of Yokogawa Electric Corporation.
  - Product names and company names in this document are trademarks or registered trademarks of the respective companies.
  - In this document, trademarks or registered trademarks are not marked with "™" or "®".



# 2. HANDLING PRECAUTIONS

This section describes the precautions to follow when handling the product. Be sure to read this section before using the product.

For information other than that described in this section, refer to the related section.

If you have any problems or questions, contact your nearest YOKOGAWA service center or sales representative.

## 2.1 Checking Model and Specifications

This instrument is inspected thoroughly before it is shipped from the factory. When this instrument is delivered to the installation site, check its external appearance for damage, and make sure that all parts for installation are provided.

Be sure that you have your model number (MODEL) and serial number (No.) available when contacting Yokogawa. The model code and specifications given on the nameplate are those current when this product was shipped from the factory.

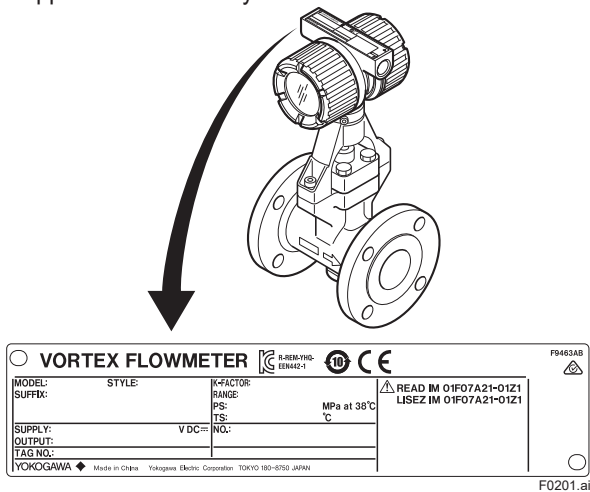
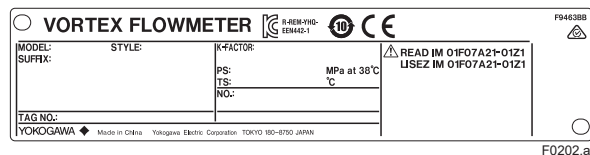


Figure 2.1(a) Example of Nameplate (Integral Type)

### Remote Sensor



### Remote Transmitter

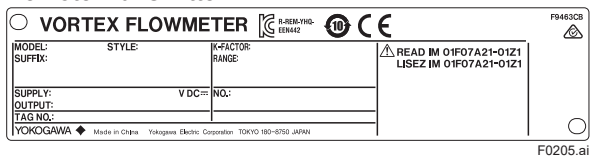


Figure 2.1(b) Example of Nameplate (Remote Type)

## 2.2 Transportation and Storage Precautions

To prevent damage to the vortex flowmeter due to accidents during transportation, it should be carried in its original packing condition.

Deterioration of insulation, corrosion or other abnormalities may occur due to unexpected situations if the vortex flowmeter is stored for a long period of time after it is delivered to the user site. When it is anticipated that the vortex flowmeter will be stored for a long time, pay attention to the following points.

- (1) The vortex flowmeter should be stored in its original packing condition in the storage location.
- (2) Select a storage location that fulfills 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: The preferred ambient temperature and humidity levels are +25°C and approximately 65% RH.  
Ambient temperature: -40 to +85°C, -50 to +85°C (/LAT)  
Humidity: 0 to 100% RH (no condensation)
- (3) When storing a vortex flowmeter after use, completely clean the flowmeter to ensure that there is no measured fluid remaining in its piping line and on the shedder bar.
- (4) If the vortex flowmeter is carried to the installation site and is stored without being installed, rain water might get inside and impair the instrument's performance. Install, wire and perform other installation work immediately after transporting the vortex flowmeter to the installation site.

- (5) The vortex flowmeter is a heavy instrument. When moving the vortex flowmeter, always use a trolley and have at least two people carry it. When winching instruments, winch by the method shown in Figure 2.2.

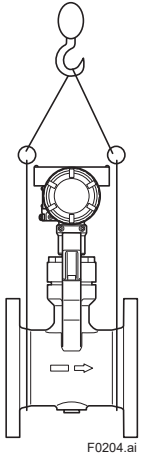


Figure 2.2 Winching Method

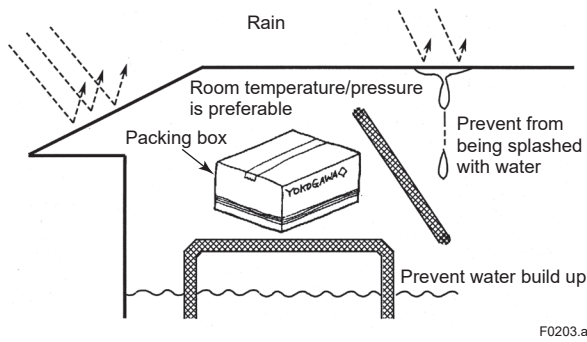


Figure 2.3 Storage Site Precautions

# 3. INSTALLATION

## 3.1 Installation Precautions

### (1) Ambient Temperature

Avoid locations that are subjected to considerable temperature variations and fluctuations. When the installation site is subjected to heat radiation from the plant, adopt insulation measures or ensure adequate ventilation.

### (2) Atmospheric Conditions

Avoid installing the vortex flowmeter in a corrosive atmosphere. When the vortex flowmeter must be installed in a corrosive atmosphere, take measures to ensure adequate ventilation, and prevent the entry or build-up of rain water in wiring ducts.

### (3) Mechanical Shock or Vibration

The vortex flowmeter has been designed to be a strong structure. However, install it at a location that is subjected to minimal mechanical shock or vibration.

If the flowmeter is subjected to vibrations, it is recommended that pipeline supports are provided as shown in Figure 3.1.

### (4) Piping Line

When passing fluids along the piping line of the vortex flowmeter, pay attention to the following points to ensure safe and accurate use.

- (a) Make sure that the connector bolts for installing the vortex flowmeter and piping line are tightened firmly.
- (b) Make sure that there are no leaks on the piping.
- (c) Do not apply a pressure higher than the specified maximum working pressure.
- (d) Do not loosen or tighten the flange mounting bolts when the assembly is pressurized. Be sure to depressurize the piping line before doing this.
- (e) Handle the vortex flowmeter carefully when measuring toxic liquids, so that the liquids do not splash into the eyes or face. When using toxic gases, be careful not to inhale them.

### (5) Other

- Choose a location where there is sufficient clearance around the vortex flowmeter to allow work such as routine inspection.
- Choose a location that allows easy wiring and piping.

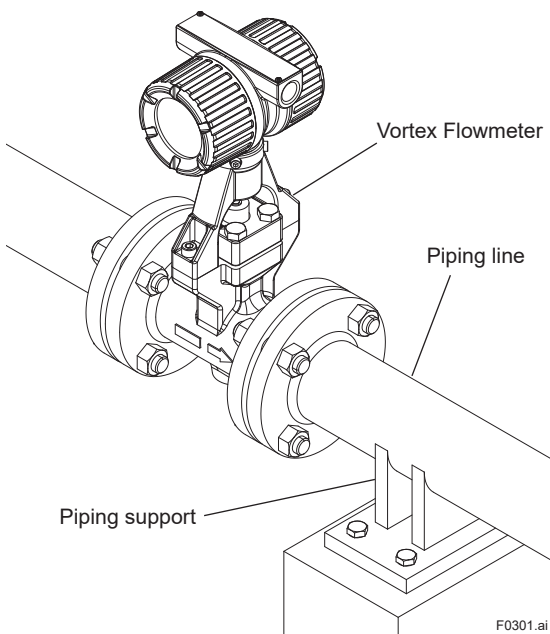


Figure 3.1 Example of Pipeline Support

## 3.2 Piping Precautions

### ■ Straight Pipe Length and Recommendations

For details on straight pipe lengths on the upstream and downstream of the vortex flowmeter, see Straight pipe length and recommendations (1) to (3).

#### ● Installation position

Design the piping so that the piping line is always filled with the fluid that flows through (constantly filled condition).

If the flowmeter is in a constantly filled condition, measurement can be performed even when the pipe is installed vertically or at inclined angle. However, it is recommended to avoid installing the instrument with the transmitter positioned below the piping. When the fluid temperature is  $-40^{\circ}\text{C}$  or less, do not install the instrument with the transmitter positioned below the piping.

#### ● Upstream conditions

Install the instrument in a section of straight pipe where the upstream side is sufficiently rectified.

#### ● Adjacent pipes

Use the adjacent pipes which have a larger inner diameter than that of the vortex flowmeter.

Ensure that the piping and pipe of the vortex flowmeter are concentric.

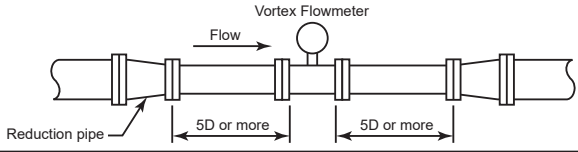
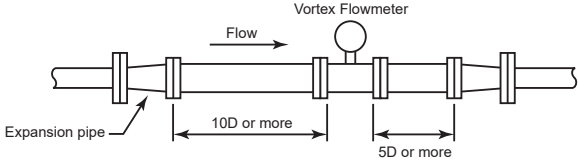
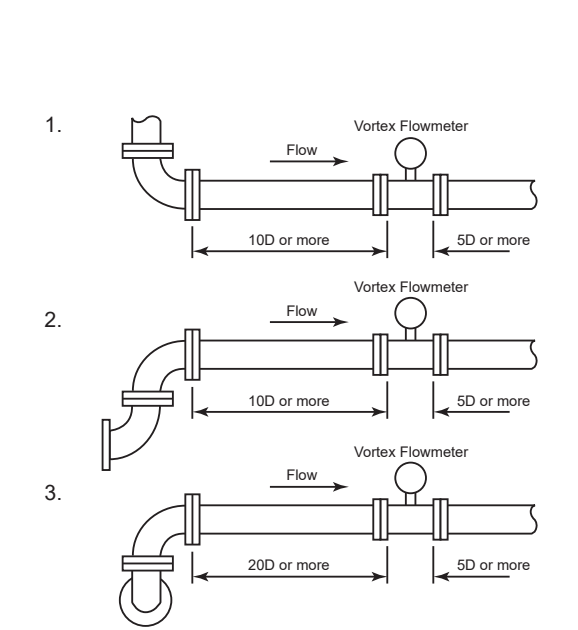
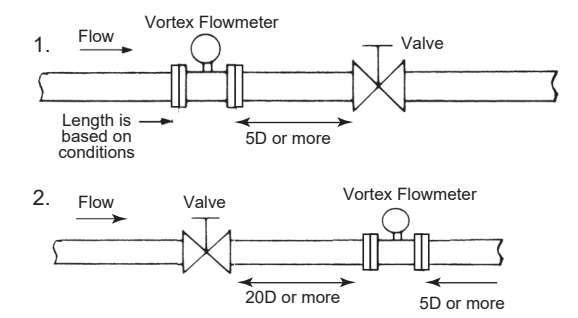
Ensure that the gaskets of adjacent pipes do not protrude into the piping line.

#### ● Straight pipe length

Check the conditions of the upstream and downstream piping, and provide the required straight pipe lengths. If the conditions cannot be satisfied, the flow inside the piping line may be disturbed and this may cause inaccurate readings. In this case, consider a flowmeter that does not require straight piping, such as a Coriolis mass flowmeter.

• Required straight pipe lengths and recommendations (1)

D: Nominal diameter of vortex flowmeter (mm)

Description	Figure
<p>• <b>Reduction pipe</b></p> <p>Ensure that the upstream straight pipe length is 5D or more, and the downstream straight pipe length is 5D or more.</p>	
<p>• <b>Expansion pipe</b></p> <p>Ensure that the upstream straight pipe length is 10D or more, and the downstream straight pipe length is 5D or more.</p>	
<p>• <b>Bent pipe</b></p> <p>Ensure that the upstream straight pipe length is 10D or more, and the downstream straight pipe length is 5D or more.</p> <ol style="list-style-type: none"> <li>1. Single bend pipe</li> <li>2. Double bend pipe, coplanar</li> <li>3. Double bend pipe, non coplanar</li> </ol>	
<p>• <b>Valve position and straight pipe length</b></p> <ol style="list-style-type: none"> <li>1. Install the valve on the downstream side of the vortex flowmeter. Read the information above for the upstream straight pipe length depending on the conditions, and ensure that the downstream straight pipe length is 5D or more.</li> <li>2. If the valve needs to be installed on the upstream of the vortex flowmeter, ensure that the upstream straight pipe length is 20D or more, and the downstream straight pipe length is 5D or more.</li> </ol>	

• Required straight pipe lengths and recommendations (2)

D: Nominal diameter of vortex flowmeter (mm)

Description	Figure
<p>• <b>Fluid vibration</b></p> <p>Fluid vibration may occur in a gas line or high-pressure liquid line (approximately 1 MPa or more) that uses a piston-type or roots-type blower or compressor. In these cases, install the vortex flowmeter on the downstream side of the valve at a distance of 20D or more, and ensure a length of 5D or more on the downstream side of the flowmeter. If the piping design requires that a valve be installed on the downstream side of the vortex flowmeter, install a vibration damping device such as throttling plate or expansion section on the upstream side of the vortex flowmeter.</p>	
<p>• <b>Installing near a pump</b></p> <p>If a piston-type or plunger-type pump is used, install an accumulator on the upstream side of the vortex flowmeter to reduce fluid vibration in the piping.</p>	
<p>• <b>Effect of pulsation pressure due to T-type piping</b></p> <p>If pulsation pressure occurs due to T-type piping, install a valve on the upstream side of the vortex flowmeter.</p> <p>Example: As shown in the figure, when the flow rate of A is zero because V1 is closed, pulsation pressure is detected when B is flowing, which causes the zero point of the meter to fluctuate. To prevent this from occurring, change the valve installation location to V1'.</p> <p>Note: In case of the Reduced Bore Type, moisture may be remained upstream of the flowmeter. Drain it appropriately.</p>	
<p>• <b>Pressure and temperature taps</b></p> <p>When temperature/pressure compensation is to be performed, install a pressure tap on the downstream side of the vortex flowmeter at a distance of 2D to 7D.</p> <p>Then install a temperature tap on the downstream side of the pressure tap at a distance of 1D to 2D.</p> <p>When using a temperature tap only, install it on the downstream side of the vortex flowmeter at a distance of 3D to 9D.</p>	
<p>• <b>Mounting gasket</b></p> <p>Avoid mounting gaskets that protrude into the pipe line, as this may cause inaccurate readings.</p> <p>Use gaskets with bolt holes to prevent protrusion into the piping line. When using a spiral gasket (without bolt holes), confirm the size with the gasket-manufacturer, as standard items may not be used for certain flange ratings.</p>	

• Required straight pipe lengths and recommendations (3)

Description	Figure
<p>• <b>Thermal insulation of integral flowmeter and remote sensor</b></p> <p>When applying thermal insulation to a pipe carrying high-temperature fluid, do not wrap the insulating material around the bracket (VY015 to VY100) or the nozzle (VY150 to VY400).</p>	
<p>• <b>Flushing (cleaning) the pipe</b></p> <p>If there is a possibility of scaling or sludge (boiling scale, mud) inside newly installed or repaired piping, flush the piping before operation. When performing flushing, use bypass piping to avoid damaging the flowmeter. If there is no bypass piping, install a short pipe in place of the flowmeter when performing flushing.</p>	

■ **Mounting Precautions**

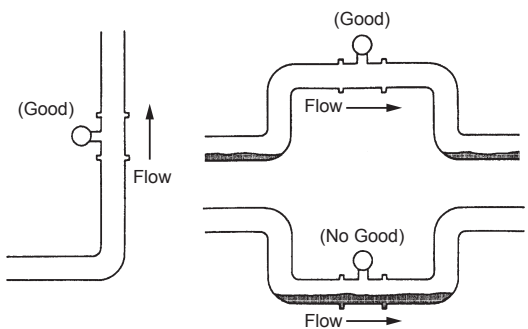
Be sure to observe the following items so that the performance of the vortex flowmeter is fully demonstrated.

(1) **Gas or Steam Measuring Precautions**

Ensure that accurate measurement can be performed with the piping line filled with the fluid that flows through.

• **Piping to Prevent Liquid Traps**

Mount the vortex flowmeter in a vertical pipeline to avoid liquid traps. When the vortex flowmeter is installed horizontally, raise the part of the piping line in which the vortex flowmeter is installed.

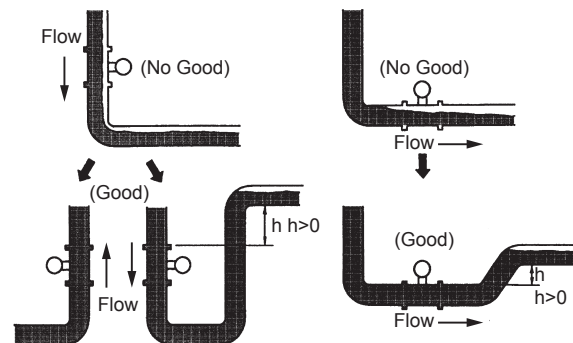


(2) **Liquid Measurement Precautions**

The flowrate cannot be measured accurately if the piping line is not filled with fluid. When piping, observe the following precautions.

• **Maintaining a Filled Pipe State**

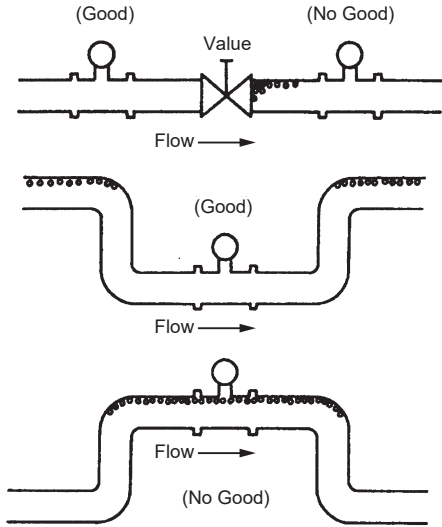
Make the fluid flow against gravity upwards from below. When the fluid is flowing with gravity, lift the down-stream pipe length above the vortex flowmeter installation level to maintain a filled pipe state at all times.



F0303.ai

• Piping for Avoiding Bubbles

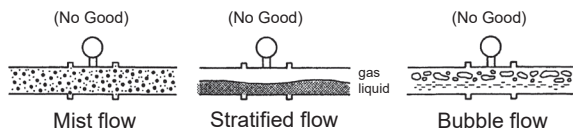
Flows containing both gas and liquid may not satisfy the accuracy specifications of the instrument. Prevent gas bubbles from forming in a liquid flow. Piping should be carried out to prevent the build-up of gas bubbles in the vortex flowmeter. Also, install the valve on the downstream side of the vortex flowmeter because pressure drop across the control valve may cause gas to liquefy.



F0304.ai

(3) Multi-Phase Flow

The vortex flowmeter can measure gas, liquid and steam within the same structure. However, accurate measurement of mixed flows (e.g. gas and liquid) is not possible.



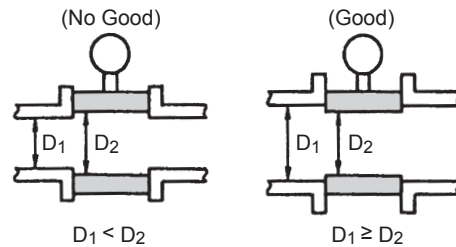
F0305.ai

(4) Diameter of Adjacent Pipes and Concentricity of Inner Diameters in Vortex Flowmeter

Use the adjacent pipes which have a larger inner diameter than that of the vortex flowmeter. Refer to the table below.

Model code	Type of body	Adjacent pipe
VY015 to VY050	-0: General type	Sch40 or pipe with larger inner diameter than Sch40
VY025 to VY080	-1: Reduced bore type (1 size reduction)	
VY040 to VY100	-2: Reduced bore type (2 size reduction)	
VY080 to VY400	-0: General type	Sch80 pipe with larger inner diameter than Sch80
VY100 to VY200	-1: Reduced bore type (1 size reduction)	
VY150 to VY200	-2: Reduced bore type (2 size reduction)	
VY025 to VY150	-4: High pressure reduced bore type (1 size reduction)	Sch160 pipe with larger inner diameter than Sch160

- Ensure that the piping and pipe of the vortex flowmeter are concentric.
- Ensure that the gaskets of adjacent pipes do not protrude into the piping line.



F0306.ai

(5) Other

The degree of protection of the vortex flowmeter is of IP66/IP67 (JIS C 0920, IEC60629) or Type 4X (NEMA250). Therefore, it cannot be used under water.



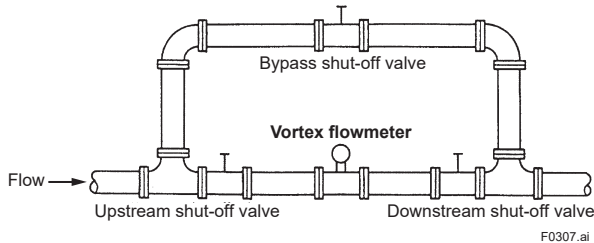
### 3.3 Maintenance of Piping

#### (1) Cleaning Inside Piping

- Periodically clean and remove any incrustation and sludge sticking to the inside surface of the body and shedder bar.
- Be sure to remove any welding scraps, scale and sludge after welding.
- A chemical reaction sometimes occurs and causes the measured fluid to harden when it accumulates in the piping. So, periodically clean the piping and remove any deposit.

#### (2) Bypass Piping for Improving Maintainability

Installation of bypass piping is recommended as shown in the figure below for inspection and cleaning of the shedder bar and other parts inside the vortex flowmeter.



### 3.4 Thermal Insulation of Cryogenic Type and High Temperature Type

When the high temperature type and cryogenic type are used (type of shedder bar: C, D, E), perform heat insulation by following the precautions below.

#### ■ Installing the Cryogenic Type

Installation of the flowmeter is the same as the standard type, except that stainless steel nuts and bolts (ordered separately from Yokogawa) should be used as a countermeasure for brittleness in low-temperature applications.

To maintain the vortex flowmeter at an ultra-low temperature, embed it in cold insulation material from the body up to the mounting bracket.

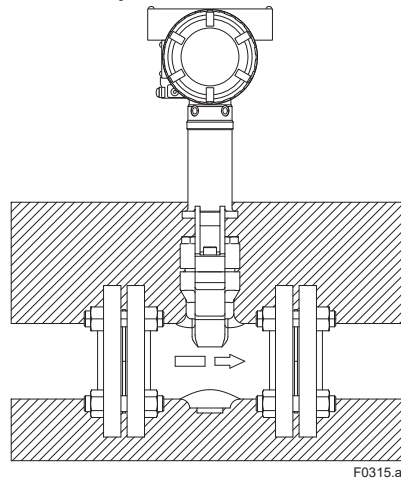
#### ■ Maintaining the Cryogenic Type

The cryogenic type uses a shedder bar made of materials different to those used on a standard type as a countermeasure for brittleness in low-temperature applications.

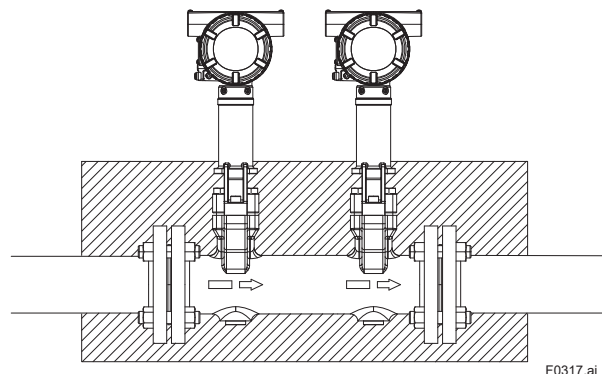
When replacing parts, specify the cryogenic type.

#### ■ Preventing Condensation on the Cryogenic type

To prevent condensation inside the terminal boxes, sufficiently seal cable entries.



General Type, Remote Sensor

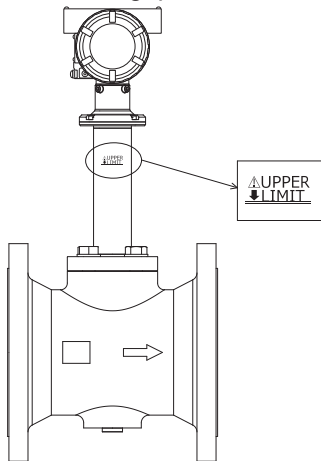


■ Installing the High Temperature Type

Installation of the flowmeter is the same as the standard type. Be sure to follow the instructions in the following CAUTION to thermally insulate the vortex flowmeter.



Strictly observe the upper limit of the heat insulating material to prevent overheating of the transmitter case and terminal boxes. Seal the heat insulating material to prevent hot air leaking from between gaps in the material.



F0316.ai

■ Maintaining the High Temperature Type

The high temperature type uses a shedder bar and gaskets made of materials different to those used on a standard type as a countermeasure for brittleness in high-temperature applications. When replacing parts, specify the high-temperature type.

3.5 Mounting Procedures

When installing the vortex flowmeter on piping, ensure that the arrow indicated on the body of the vortex flowmeter matches the direction of flow of the measured fluid.

- When changing the positional relationship between the transmitter case and the terminal box, and the direction of flow of the measured fluid, read the maintenance manual in the related documents indicated in Table 1.1.
1. Positioning the sensor
 

When installing the sensor, ensure that the measuring pipe and adjacent pipes are concentric. When installing a wafer type, pay attention to the following points to ensure concentricity.

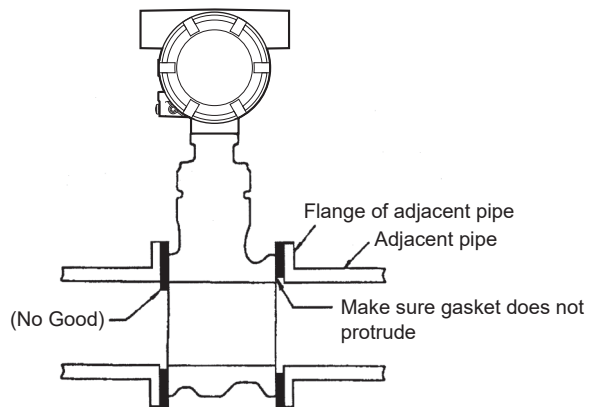
- Four collars (centering adjustment jigs for the flowmeter) are used in sets of four for the bolt holes of flanges on adjacent pipes such as pipes of nominal diameter 15 mm to 40 mm, nominal diameter 50 mm JIS 10K, ASME Class 150, JPI Class 150, EN PN10 to PN40, nominal diameter 80 mm ASME Class 150, and JPI Class 150. For this reason, use these collars to install the sensor as shown in Table 3.2.
- When the flanges of adjacent pipes have eight bolt holes, install by using the bolt thru holes on the vortex flowmeter body shown in Table 3.2.



Nuts and stud bolts for piping connection parts are not provided. These must be prepared by the customer. They are, however, provided when option code BL (material SUS304) is selected. The customer should refer to Table 3.1 for guidelines on outer diameter and length in accordance with flange standards when preparing stud bolts.

2. Mounting Gaskets

Gaskets for piping connection parts must be prepared by the customer. Avoid mounting gaskets in such a way that they protrude into the piping line between the flanges of adjacent pipes and the vortex flowmeter. Protruding gaskets may disturb the flow of fluid in the piping line and may cause error in readings.



F0310.ai

- Use gaskets with bolt holes to prevent protrusion into the piping line.
- The customer should tighten gaskets at the torque matched to the specification of the gaskets they have prepared.

Table 3.1

Size mm (inch)	Flange pressure rating	Stud bolt O.D (d) (mm)	Stud bolt length (l) (mm)
15 mm (1/2 inch)	JIS 10K, 20K/EN PN 10, 16, 25, 40	12	160
	JIS 40K	16	160
	ASME/JPI Class 150, 300, 600	12.7	155
25 mm (1 inch)	JIS 10K, 20K, 40K	16	160
	ASME/JPI Class 150	12.7	155
	ASME/JPI Class 300, 600 EN PN 10, 16, 25, 40	15.9 12	160 160
40 mm (1-1/2 inch)	JIS 10K, 20K/EN PN 10, 16, 25, 40	16	160
	JIS 40K	20	170
	ASME/JPI Class 150	12.7	155
	ASME/JPI Class 300, 600	19.1	170
50 mm (2 inch)	JIS 10K, 20K, 40K/EN PN 10, 16, 25, 40 ASME/JPI Class 150, 300, 600	16	200
		15.9	200
80 mm (3 inch)	JIS 10K/EN PN 10, 16, 25, 40	16	220
	JIS 20K, 40K	20	240
	ASME/JPI Class 150	15.9	240
	ASME/JPI Class 300, 600	19.1	240
100 mm (4 inch)	JIS 10K/EN PN 10, 16	16	220
	JIS 20K/EN PN 25, 40	20	240
	JIS 40K	22	270
	ASME/JPI Class 150	15.9	240
	ASME/JPI Class 300	19.1	240
	ASME/JPI Class 600	22.2	270

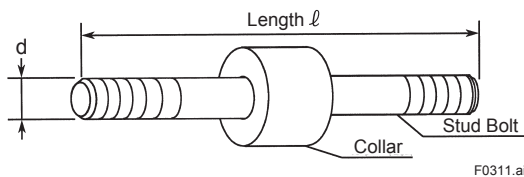
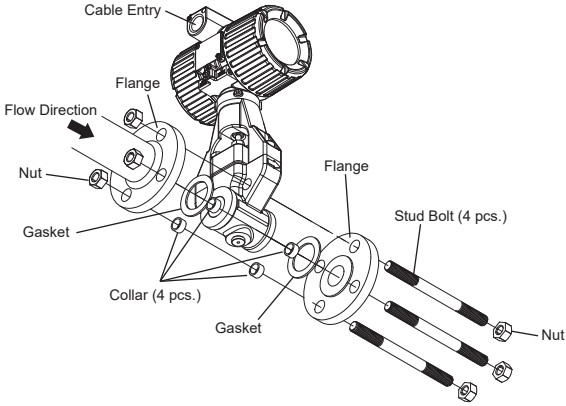
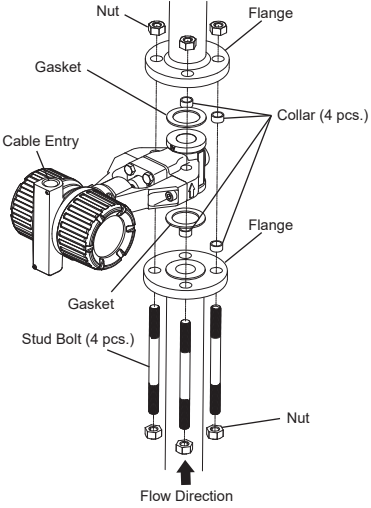


Table 3.2 (1) Installation of Wafer Type Vortex Flowmeter

Wafer type	Figure								
<p><b>■ When a collar is used</b></p> <p>A collar is suitable for when the flange used is as follows.</p> <table border="1" data-bbox="204 360 513 553"> <thead> <tr> <th>Size mm (inch)</th> <th>Flange Rating</th> </tr> </thead> <tbody> <tr> <td>15 to 40 (1/2 to 1-1/2)</td> <td>All ratings</td> </tr> <tr> <td>50(2)</td> <td>JIS 10K, ASME Class 150 JPI Class 150 EN PN 10, 16, 25, 40</td> </tr> <tr> <td>80(3)</td> <td>ASME Class 150 JPI Class 150</td> </tr> </tbody> </table> <p><b>IMPORTANT</b></p> <ul style="list-style-type: none"> <li>• Use gaskets having an inner diameter greater than the inner diameter of the vortex flowmeter and adjacent pipes, and ensure that they do not protrude into the piping line.</li> <li>• When mounting on vertical piping outdoors, ensure that the cable entries face the ground (downwards). On some types, when both ends are cable entries, mount so that both sides are horizontal to the ground.</li> <li>• In the case of vertical piping, the two collars at the top may move after mounting. However, there are no problems when using in this state.</li> </ul>	Size mm (inch)	Flange Rating	15 to 40 (1/2 to 1-1/2)	All ratings	50(2)	JIS 10K, ASME Class 150 JPI Class 150 EN PN 10, 16, 25, 40	80(3)	ASME Class 150 JPI Class 150	<p><b>Figure</b></p> <p>Horizontal piping installation</p>  <p>Vertical piping installation</p>  <ol style="list-style-type: none"> <li>(1) Pass two collars each along the two bolts on the under side of the body.</li> <li>(2) Evenly tighten the stud bolts and nuts with the outer diameter surface on both sides of the body in contact with the collars.</li> <li>(3) Make sure that there are no leaks.</li> </ol>
Size mm (inch)	Flange Rating								
15 to 40 (1/2 to 1-1/2)	All ratings								
50(2)	JIS 10K, ASME Class 150 JPI Class 150 EN PN 10, 16, 25, 40								
80(3)	ASME Class 150 JPI Class 150								

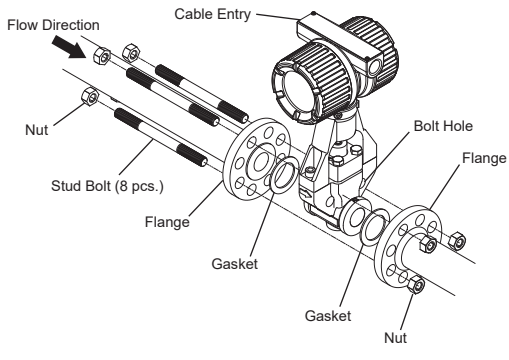
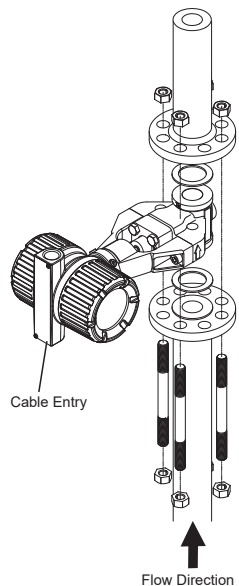
Wafer type	Figure									
<p>■ <b>When a collar is not used</b></p> <p>A collar is suitable for when the flange used is as follows.</p> <table border="1" data-bbox="204 309 515 611"> <thead> <tr> <th>Size mm (inch)</th> <th>Flange Rating</th> </tr> </thead> <tbody> <tr> <td>50(2)</td> <td>JIS 20K, 40K ASME Class 300, 600 ASME Class 300, 600</td> </tr> <tr> <td>80(3)</td> <td>JIS 10K, 20K, 40K ASME Class 300, 600 ASME Class 300, 600 EN PN10 to 40</td> </tr> <tr> <td>100(4)</td> <td>JIS 10K, 20K, 40K ASME Class 150, 300, 600 ASME Class 150, 300, 600 EN PN10 to 40</td> </tr> </tbody> </table>	Size mm (inch)	Flange Rating	50(2)	JIS 20K, 40K ASME Class 300, 600 ASME Class 300, 600	80(3)	JIS 10K, 20K, 40K ASME Class 300, 600 ASME Class 300, 600 EN PN10 to 40	100(4)	JIS 10K, 20K, 40K ASME Class 150, 300, 600 ASME Class 150, 300, 600 EN PN10 to 40	<p>Horizontal piping installation</p>  <ol style="list-style-type: none"> <li>(1) Pass the two stud bolts through the bolt thru holes, and ensure that the inner diameter of the vortex flowmeter piping is concentric with the process piping.</li> <li>(2) Install the other stud bolts, and evenly tighten all stud bolts.</li> <li>(3) Make sure that there are no leaks.</li> </ol>	<p>Vertical piping installation</p> 
Size mm (inch)	Flange Rating									
50(2)	JIS 20K, 40K ASME Class 300, 600 ASME Class 300, 600									
80(3)	JIS 10K, 20K, 40K ASME Class 300, 600 ASME Class 300, 600 EN PN10 to 40									
100(4)	JIS 10K, 20K, 40K ASME Class 150, 300, 600 ASME Class 150, 300, 600 EN PN10 to 40									

Table 3.2 (2) Installation of Flange Type Vortex Flowmeter

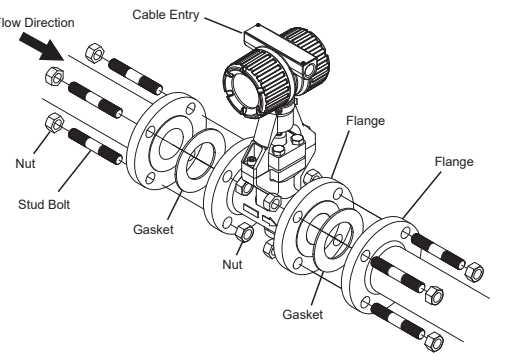
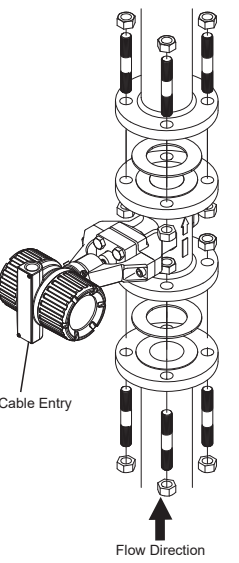
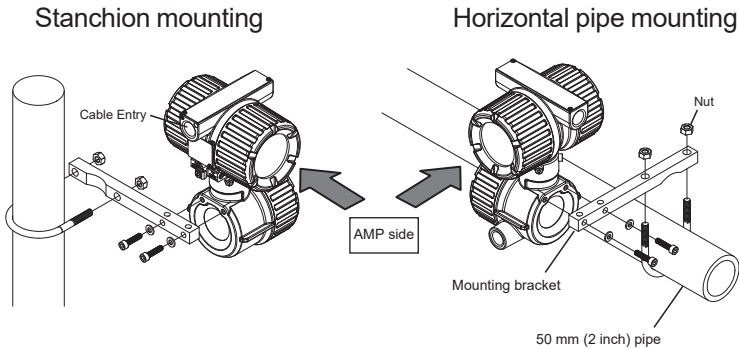
Flange type	Figure	
<p>Mounting bolts, nuts and gaskets for flanges must be prepared by the customer.</p> <p><b>IMPORTANT</b></p> <p>Use gaskets having an inner diameter greater than the inner diameter of the vortex flowmeter and adjacent pipes, and ensure that they do not protrude into the piping line.</p>	<p>Horizontal piping installation</p> 	<p>Vertical piping installation</p>  <p>Mount as shown in the figure by using the bolts (stud bolts), nuts and gaskets.</p>

Table 3.2 (3) Installation of Remote Transmitter (VY4A)

Remote transmitter (VY4A)	Figure
<p>The remote transmitter is connected to the remote sensor by the vortex flowmeter signal cable (VY1C).</p> <p>When installing the remote transmitter, install within the maximum length (50 m) of the vortex flowmeter signal cable (VY1C).</p>	 <p>The diagram illustrates two mounting configurations for the remote transmitter. On the left, 'Stanchion mounting' shows the transmitter attached to a vertical pipe with a 'Cable Entry' point. On the right, 'Horizontal pipe mounting' shows the transmitter mounted on a horizontal pipe. This configuration includes a 'Mounting bracket' attached to the pipe with a 'Nut'. A label 'AMP side' with an arrow points to the transmitter's connection point. Below the horizontal pipe, it is noted as '50 mm (2 inch) pipe'.</p>

# 4. WIRING



## CAUTION

- Lay wiring as far as possible from electrical noise sources such as large capacity transformers, motors, and power supplies.
- Remove the terminal cover and dustproof plug from electrical connections before wiring.
- Be sure to waterproof the threaded sections of cable entries.
- To prevent noise, use separate ducts for the vortex flowmeter signal cable (VY1C) and power cables.
- Use external wiring that has an allowable temperature 15°C or higher than the ambient temperature.
- When using an explosion protected type, wiring in conformance with laws and regulations is required to maintain the explosion proofing performance of the unit.
- If a lightning protector (option code /A) is installed, be sure to install an arrester module during wiring. For details on the arrester module, read 4.8 "Lightning Protector (option code: /A)".

## 4.1 Load Resistance and Wiring Conditions

Table 4.1 shows the wiring methods for individual output conditions.

### (1) Analog Output

This vortex flowmeter uses the same two wires for both the signal and power supply wiring. The power supply voltage range is 10.5 to 42 VDC (10.5 to 30 VDC, when a lightning protector is installed and for an intrinsically safe approval explosion protected type).

When configuring a loop, ensure that the total resistance of the lead wire and the load, for example, of the loop and distributor to be installed falls within the range shown in Figure 4.1. When a distributor is not used, connect the load resistance to the power supply side.

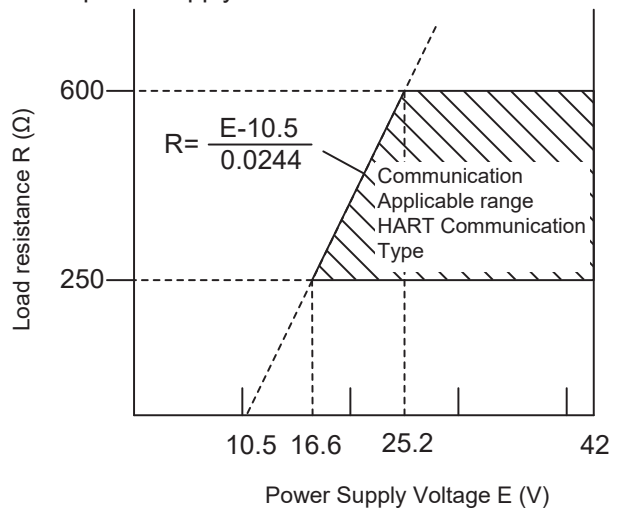


Figure 4.1 Relationship between Power Supply Voltage and Load Resistance

### (2) Pulse Output, Alarm Output and Status Contact Output

This vortex flowmeter of pulse output, alarm output and status contact output are connected by transistor contacts.

The rating of the contacts is 30 V, 80 mA DC. Also, resistances are required for pulse output, alarm output and status contact output. For details, refer to Table 4.1.

### (3) Simultaneous Current/pulse Output

When using simultaneous analog/pulse output, communication on the transmission line is restricted by the wiring method.

Select the load resistance values while referring to Table 4.1.

#### **IMPORTANT**

Absence of a load resistance for pulse output, alarm output and status contact output may result in equipment malfunction. Low resistance values also may result in equipment malfunction. So, be sure to provide resistance.

### (4) Analog Input

Analog input is used for connecting with external devices such as a 2-wire type transmitter that have analog output.

The rated input range is 4 to 20 mA. For details on wiring, see Table 4.1.

#### **IMPORTANT**

An input voltage exceeding 42 V may result in equipment malfunction. An input current exceeding 100 mA may result in equipment malfunction. Be sure to wire so that the maximum input voltage and current values are not exceeded.

## 4.2 Selection of Cables

The following should be taken into consideration when selecting cables for use between the transmitter and distributor.

- (1) For wiring of cables, use 600V PVC insulated wire or twisted wire or cable having equivalent or higher performance.
- (2) Use shielded cable at locations susceptible to electrical noise. Furthermore, when wiring cables for simultaneous analog/pulse output, individual 2-wire shielded cable is sometimes necessary.
- (3) At locations with high or low ambient temperatures, use wires or cables suitable for the location of use.
- (4) When using the vortex flowmeter in atmospheres where toxic gases and liquids, or oils and solvents are present, use wires or cables made of materials that can withstand use in these atmospheres.
- (5) The outer diameter of the screw for the cable terminal and the grounding terminal is 4mm.
- (6) For wire and cable terminals, a crimping terminal with an insulating sleeve (for 4mm screw) is recommended.

#### **IMPORTANT**

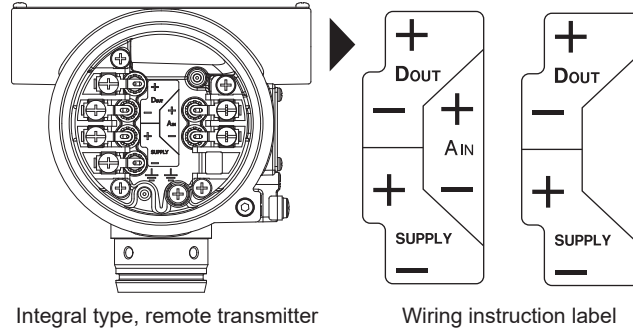
To connect the remote sensor to the remote transmitter, be sure to use the vortex flowmeter signal cable (VY1C).



### 4.3 Connection Between Integral Type and Remote Transmitter

Table 4.1 shows an example of wiring between the power supply and load resistance. Figure 4.2 shows the position of each connection terminal.

In the case of communication and input/output code JA and JJ, "SUPPLY +,-, D<sub>OUT</sub> +,-" is indicated on the wiring instruction label. In the case of communication and input/output code JB, "SUPPLY +,-, D<sub>OUT</sub> +,-, A<sub>IN</sub> +,-" is indicated on the wiring instruction label.



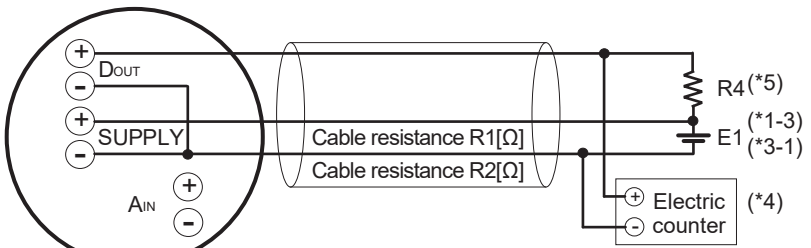
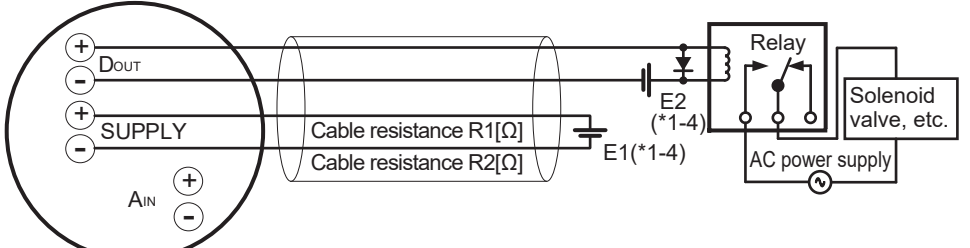
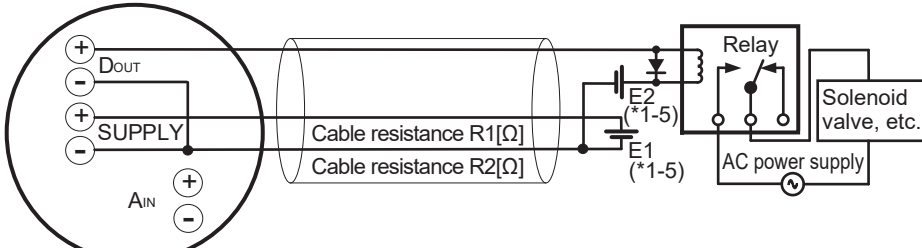
Terminal Symbol	Application
SUPPLY +, -	HART communication and analog output
D <sub>OUT</sub> +, -	Pulse/status output
A <sub>IN</sub> +, -	Analog input

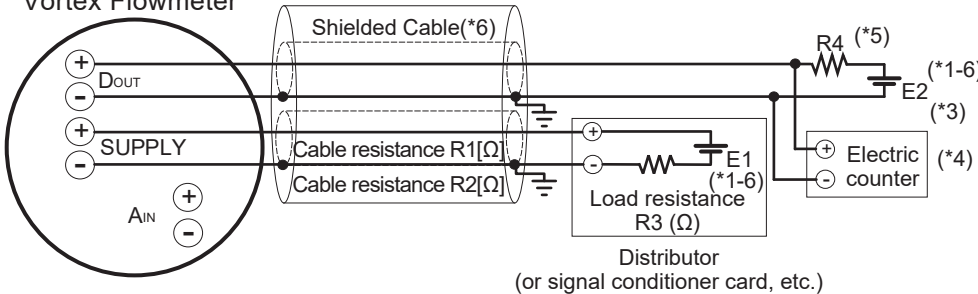
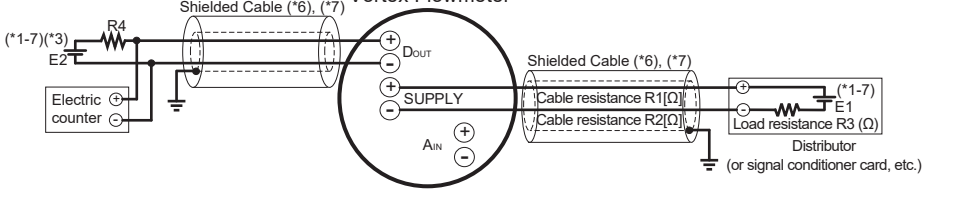
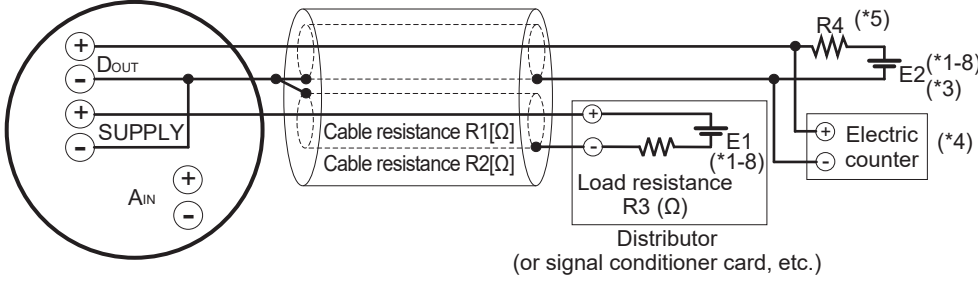
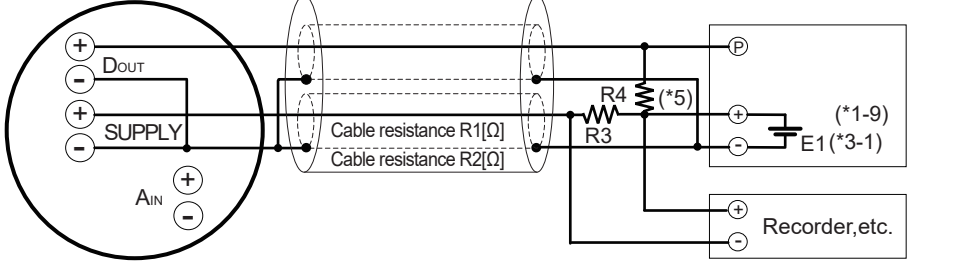
F0402.ai

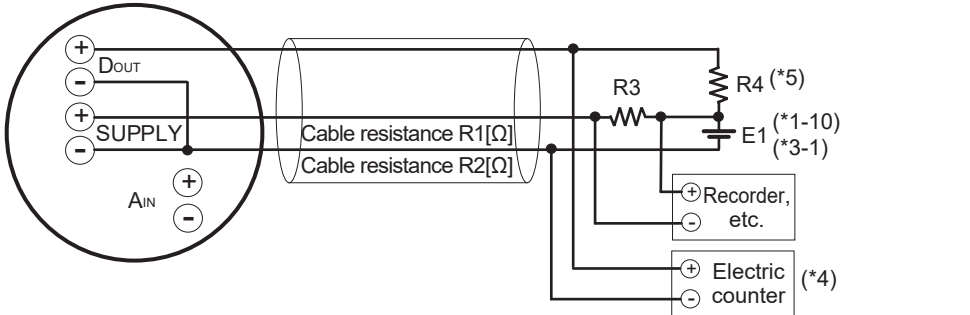
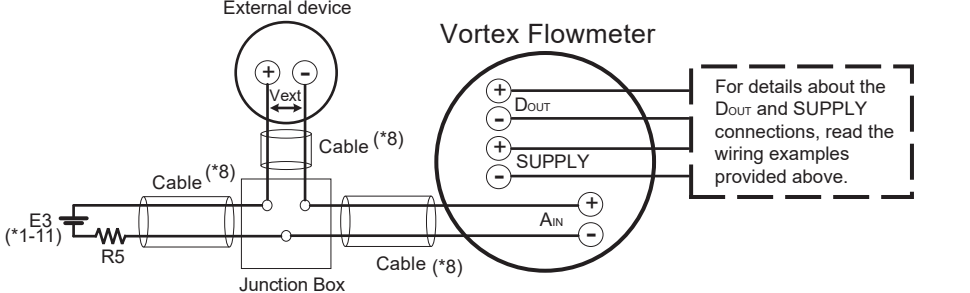
Figure 4.2 Terminal Positions

Table 4.1 Wiring Examples

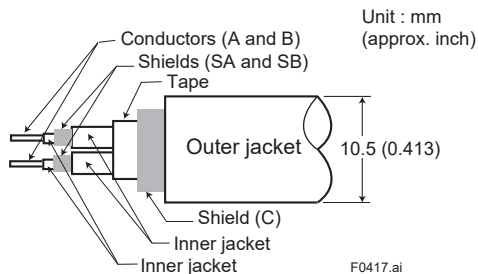
Connection	Description
<p>● <b>Analog output</b>                      Example:                      One cable entry                      2-wire cable                      HART communication possible                      Communication distance up to 2 km (with CEV cable)</p>	<p>Vortex Flowmeter</p> <p style="text-align: right;">Distributor (or signal conditioner card, etc.)</p> <p>*1-1: <math>0.0244 \times (R1 + R2 + R3) + 10.5 \leq E1[V] \leq 42</math> (*2)</p>
<p>● <b>Pulse output</b>                      Example 1:                      One cable entry                      4-wire cable                      HART communication not possible</p>	<p>Vortex Flowmeter</p> <p>*1-2: <math>0.0244 \times (R1 + R2) + 10.5 \leq E1[V] \leq 42</math> (*2)  <math>E2[V] \leq 30</math></p>

Connection	Description
<p>Example 2: (Replacement from DY) One cable entry 3-wire cable HART communication not possible</p>	<p><b>Vortex Flowmeter</b></p>  <p>*1-3: <math>0.0244 \times (R1 + R2) + 10.5 \leq E1[V] \leq 30</math></p>
<p>● <b>Status output and alarm output</b> Example 1: One cable entry 4-wire cable HART communication not possible</p>	<p><b>Vortex Flowmeter</b></p>  <p>*1-4: <math>0.0244 \times (R1 + R2) + 10.5 \leq E1[V] \leq 42</math> (*2) E2: 30Vdc max, 80mA max</p>
<p>Example 2: (Replacement from DY) One cable entry 3-wire cable HART communication not possible</p>	<p><b>Vortex Flowmeter</b></p>  <p>*1-5: <math>0.0244 \times (R1 + R2) + 10.5 \leq E1[V] \leq 42</math> (*2) E2: 30Vdc max, 80mA max</p>

Connection	Description
<p>● <b>Simultaneous analog/pulse output (*9)</b></p> <p>Example 1:                      One cable entry                      2-wire individually shielded cables                      HART communication possible                      Communication distance up to 2 km (with AX01C-A*11 cable)</p>	<p>Vortex Flowmeter</p>  <p>*1-6: <math>0.0244 \times (R1 + R2 + R3) + 10.5 \leq E1[V] \leq 42</math> (*2)  <math>E2[V] \leq 30</math></p>
<p>Example 2:                      Two cable entries                      2-wire individually shielded cables                      HART communication possible                      Communication distance up to 2 km (with CEV-S cable)</p>	<p>Vortex Flowmeter</p>  <p>*1-7: <math>0.0244 \times (R1 + R2 + R3) + 10.5 \leq E1[V] \leq 42</math> (*2)  <math>E2[V] \leq 30</math></p>
<p>Example 3 (Replacement from DY Example 1):                      One cable entry                      2-wire individually shielded cables (*10)                      HART communication possible                      Communication distance up to 2 km (with AX01C-A*11 cable)</p>	<p>Vortex Flowmeter</p>  <p>*1-8: <math>0.0244 \times (R1 + R2 + R3) + 10.5 \leq E1[V] \leq 42</math> (*2)  <math>E2[V] \leq 30</math></p>
<p>Example 4 (Replacement from DY Example 2):                      One cable entry                      2-wire individually shielded cables (*10)                      HART communication possible                      Communication distance up to 200 m (with AX01C-A*11 cable)</p>	<p>Vortex Flowmeter</p>  <p>*1-9: <math>0.0244 \times (R1 + R2 + R3) + 10.5 \leq E1[V] \leq 42</math> (*2)</p>

Connection	Description
<p>Example 5 (Replacement from DY Example 3): One cable entry 3-wire cable (*10) HART communication not possible</p>	<p><b>Vortex Flowmeter</b></p>  <p>*1-10: <math>0.0244 \times (R1 + R2 + R3) + 10.5 \leq E1[V] \leq 30</math></p>
<p>● <b>Analog input</b> Two cable entry 2-wire cable</p>	<p><b>Vortex Flowmeter</b></p>  <p>*1-11: <math>V_{ext} + (R5 + R6 + R7) \times I + 3.8 \leq E3[V] \leq 42</math> (*2)  <math>V_{ext}</math>: Minimum operating voltage of external device  <math>I</math>: Maximum current flowing in loop                      Voltage between <math>A_{IN}</math> terminals is 3.8 V typ with loop current of 20 mA.                      Calculate with 4.2 V if used at low temperature below 0°C.</p>

- \*2: If lightning protector (option code /A) is installed, calculate with maximum voltage of 30 V.
- \*3: The flowmeter requires a power supply with a maximum output current of  $E2/R4$  or more.
- \*3-1: The flowmeter requires a power supply with a maximum current of  $E1/R4 + 22.4$  mA or more.
- \*4: To avoid the influence of external noise, use an electric counter that suits the pulse output frequency.
- \*5: Resistor is not necessary in case of an electric counter that can receive the contact pulse signal directly. (R4 is in open state.)
- \*6: Separate shielded cables are required for SUPPLY and  $D_{OUT}$ .
- \*7: Communication cannot be performed if shielded cables are not used, but simultaneous analog and pulse output is possible.
- \*8: Add all cable resistance values on the positive side to obtain R6 ( $\Omega$ ).  
Add all cable resistance values on the negative side to obtain R7 ( $\Omega$ ).
- \*9: When using simultaneous analog/pulse output, communication may be more susceptible to noise than when using analog output only.
- \*10: This example describes the wiring method when reusing existing digital YEW FLO wiring cables. For a new installation, use 2-wire individually shielded cables.
- \*11: AX01C-A is the the dedicated signal cable (without cable end finish) for Yokogawa Magnetic Flowmeter ADMAG TI series. Other shield cable which is equivalent architecture to AX01C-A can be used for DY. However the material of insulator may decrease the communication distance.



- Load resistance R for pulse output

Use formulas (1) and (2) to calculate the load resistance and power, and select the resistance.

$$\frac{E(V)}{80 \text{ (mA)}} \leq R \text{ (k}\Omega) \leq \frac{0.1}{C \text{ (}\mu\text{F)} \times f \text{ (kHz)}} \quad \dots (1)$$

$$P \text{ (mW)} = \frac{E^2 \text{ (V)}}{R \text{ (k}\Omega)} \quad \dots (2)$$

E: Power supply voltage (V)

C: Cable capacitance ( $\mu\text{F}$ ) (for CEV cable,  $C \approx 0.1 \mu\text{F/km}$ )

f: Pulse output frequency (kHz)

P: Resistor power (mW)

R: Load resistance for pulse output ( $\text{k}\Omega$ )

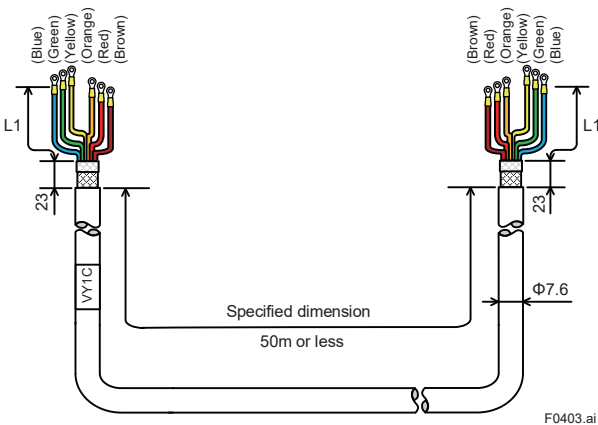
### 4.4 Connecting the Vortex Flowmeter Signal Cable (VY1C)

Figures 4.3 and 4.4 show the vortex flowmeter signal cable (VY1C) The maximum length of the vortex flowmeter signal cable is 50 m. Figure 4.5 shows the terminals on the sensor side and transmitter side. Pay attention when connecting these terminals.

Perform end processing while referring to "4.5 End Processing Method of Vortex Flowmeter Signal Cable (VY1C)".

#### CAUTION

To comply with EMC Directives, attach the clamp so that the shield braiding of the vortex flowmeter signal cable (VY1C) is butting against the sensor terminal box and transmitter terminal box. (Figure 4.6)



Cable color	Length L1 (mm)
Brown	75 +5/-0
Red	80 +5/-0
Orange	90 +5/-0
Yellow	105 +5/-0
Green	100 +5/-0
Blue	95 +5/-0

Figure 4.3 Vortex Flowmeter Signal Cable (VY1C)

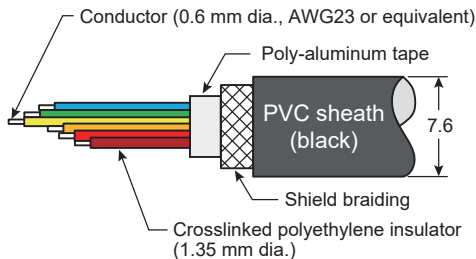
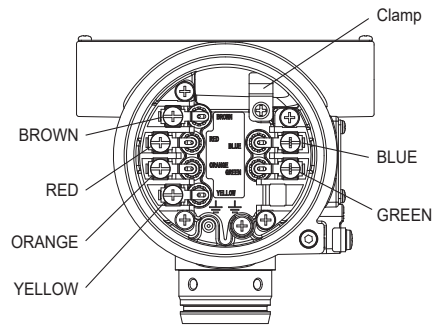
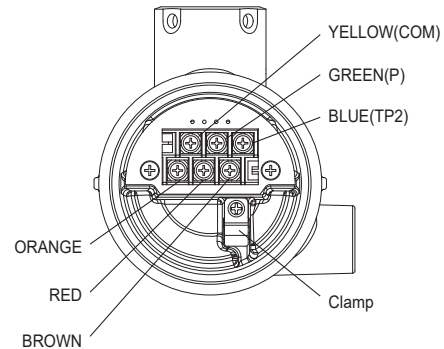


Figure 4.4 Vortex Flowmeter Signal Cable (VY1C)



Remote Sensor side



Remote Transmitter side

Terminal Symbol	Application
BROWN, RED, ORANGE, YELLOW, GREEN, BLUE (*1)	Connect the vortex flowmeter signal cable (VY1C)

F0405.ai

\*1: Match the colors of the vortex flowmeter signal cable (VY1C) with the corresponding terminals.

Figure 4.5 Terminal Positions

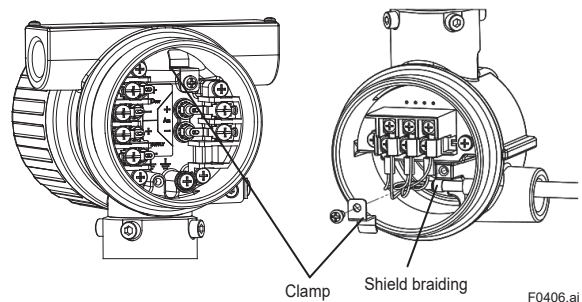
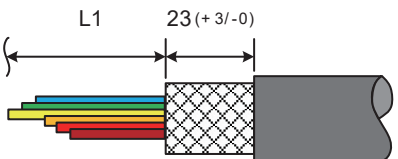
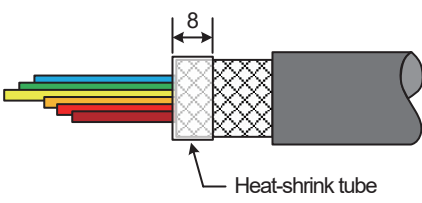
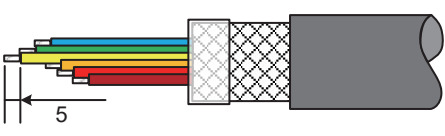
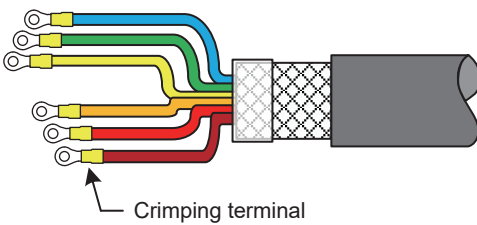

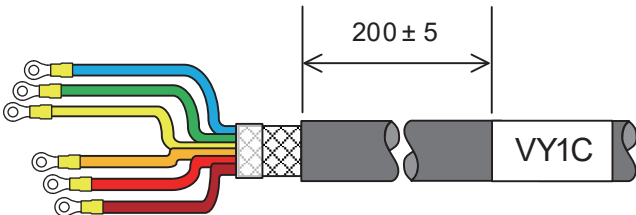


Figure 4.6 Clamp Mounting

### 4.5 Terminal Processing Method of Vortex Flowmeter Signal Cable (VY1C)

	Description	Figure
1	Peel back the PVC sheath (black) and the shield braiding underneath, poly-aluminum tape and non-woven fabric, and cut the crosslinked polyethylene insulator to the specified length (L1).	 <p>L1      23 (+3/-0)</p> <p>L1 length                      1. Blue 95 mm                      2. Green 100 mm                      3. Yellow 105 mm                      4. Orange 90 mm                      5. Red 80 mm                      6. Brown 75 mm                      Tolerance: +5/-0 mm</p>
2	Cover with heat-shrink tube, and warm with a hair dryer or similar to shrink the tube.	 <p>8</p> <p>Heat-shrink tube</p>
3	Peel back the end sheath of the crosslinked polyethylene insulator.	 <p>5</p>
4	Attach the crimping terminals. *Tool example) NH 5 / NH 32	 <p>Crimping terminal</p>
5	Attach the label to the cable.  <b>CAUTION</b> <hr/> Check the insulation resistance of the cable. 500 VDC and 100 MΩ or more between wires. Perform this check with both ends open.	 <p>200 ± 5</p> <p>VY1C</p>

 **CAUTION**

When a vortex flowmeter signal cable (VY1C) with ends processed is required after delivery to the customer site, consult with your dealer or sales representative.

### 4.6 Wiring Procedures and Precautions



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

Be sure to observe the following precautions to ensure correct wiring.

- (1) Lay wiring as far as possible from electrical noise sources such as large capacity transformers, motors, and power supplies.
- (2) Remove the terminal cover and dustproof plug from electrical connections before wiring. When opening the cover of an explosion protected type turn the locking screw to the right while referring to Figure 4.7 to unlock it. Also, when the cover is closed after wiring, be sure to turn the locking screw to the left to lock it.
- (3) Use of a flexible metal conduit and a duct for wiring for waterproofing or for protecting electrical wires from damage is recommended (see Figures 4.8 and 4.9).

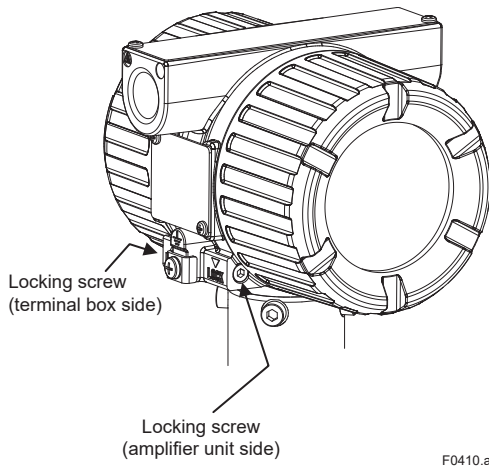


Figure 4.7 Locking Screw

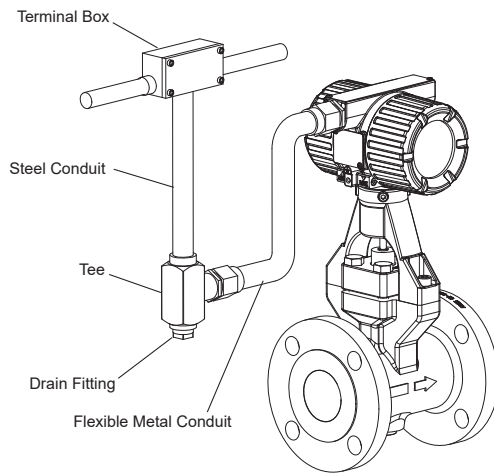


Figure 4.8 Wiring Example (Integral Flowmeter/Remote Sensor)

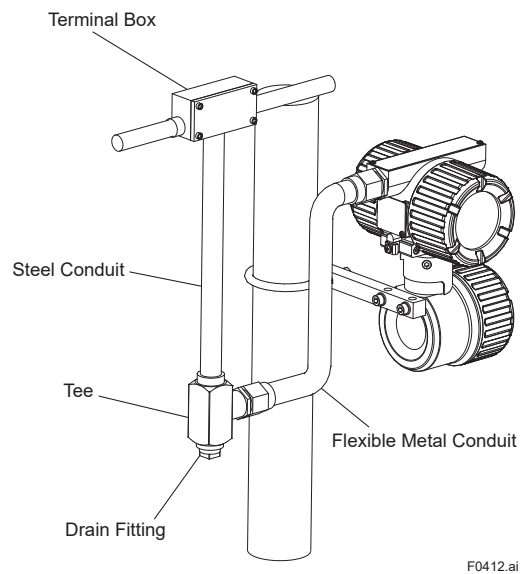


Figure 4.9 Wiring Example (Remote Transmitter (VY4A))



## 4.7 Grounding

- (1) Ground by D class grounding (grounding resistance of 100Ω or less).

### IMPORTANT

If a lightning protector (option code /A) is installed, ground by a C class grounding (grounding resistance 10Ω or less).

- (2) As shown in Figure 4.10, a grounding terminal is located on the inside and outside, respectively. Either of these terminals may be used.
- (3) In the case of a remote transmitter, ground the sensor side.
- (4) Use 600 V PVC insulated wire for grounding.

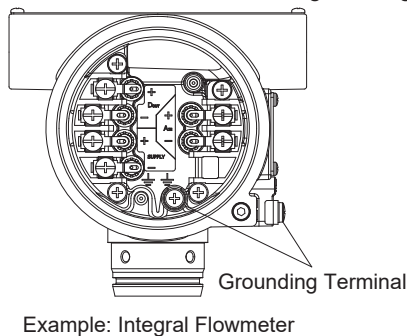


Figure 4.10 Grounding Terminal

## 4.8 Lightning Protector (option code: /A)

When screw-fastening the lightning protector (Figure 4.11), match the terminals on the lightning protector module with terminals of the same shape on the terminal block.

When replacing the lightning protector (Figure 4.11), remove the screws from the terminal block, then screw-fasten the terminals on the lightning protector module matched to terminals of the same shape on the terminal block. Wire according to the wiring instruction label at the top of the lightning protector module.

In the case of communication and input/output code JA and JJ, "SUPPLY +,-, D<sub>OUT</sub> +,-" is indicated on the wiring instruction label. In the case of communication and input/output code JB, "SUPPLY +,-, D<sub>OUT</sub> +,-, A<sub>IN</sub> +,-" is indicated on the wiring instruction label.

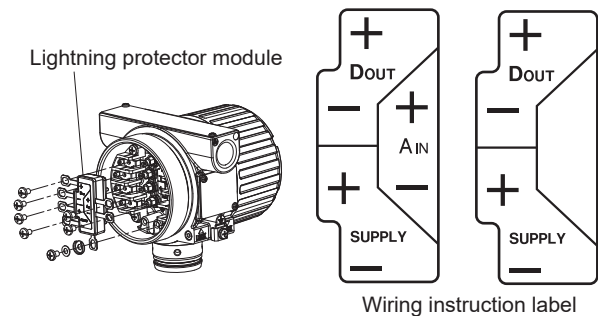
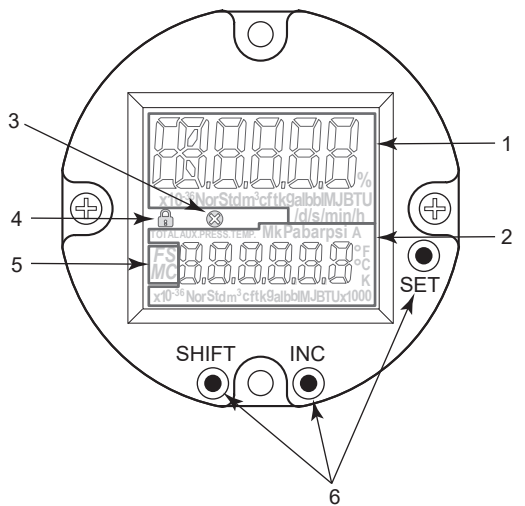


Figure 4.11 Lightning Protector Module

# 5. BASIC OPERATING PROCEDURES (DISPLAY)

Data is changed with the three keys on the indicator (SET, SHIFT and INC) or by using the HART Configuration Tool.

## 5.1 Configuration of Display



F0501.ai

Figure 5.1 Configuration of Display

- 1 Indicator upper display:  
This displays the flowrate data, temperature data and other setting item No.
- 2 Indicator lower display:  
This displays temperature/pressure/density data, alarm No. and data settings based on total data, temperature data and analog input.
- 3 Alarm icon:  
This displays if a serious alarm has occurred. Serious alarms are system alarms and process alarms.
- 4 Write protect icon:  
This displays the write protect status.
- 5 NE107 category icon  
This displays the NE107 category.
- 6 Setting switch:  
This switch is used to change the flowrate data indication and the content of setting data

For details on how to set from other indicators, refer to the Communications Manual listed in Table 1.1 Related Documents.

## 6. PARAMETERS

### 6.1 Vortex Flowmeter VY Series Parameters

The internal parameters of the Vortex Flowmeter VY Series are set to their defaults before shipment from the factory, except when specified otherwise when the order is placed.

Change and set the measured fluid, contact outputs and display indication, if necessary.

#### **IMPORTANT**

Settings will be canceled if the flowmeter is turned OFF within 30 seconds of changing settings. After changing settings, be sure to wait at least 30 seconds before turning the flowmeter OFF.

### 6.2 Configuration of Parameters

Item A (menu A): Process Variables

Item B (menu B): Easy Setup

Item C (menu C): Basic Setup

Item D (menu D): Additional Setup

Item E (menu E): Sensor Setup

Item F (menu F): Compensation Setup

Item G (menu G): Temperature/Pressure  
Measurement Setup

Item H (menu H): Adjustment Functions

Item J (menu J): Test/Simulation

Item K (menu K): Maintenance

In addition, for details on "Parameter List" and "Parameter Description", read the Communications Manual in the related documents indicated in Table 1.1.

Parameter information unique to the device is held as data on the pre-amplifier inside the sensor, and can be restored based on that data when the remote transmitter is replaced, for example. For details on how to back up and restore data, read the Communications Manual in the related documents indicated in Table 1.1.

## 6.3 Self-Diagnostic (Error Code List)

### 6.3.1 Errors and Countermeasures

#### ■ System Alarms

The device has malfunctioned and normal measurement is not possible. The product might need to be replaced.

NE107 Status	Error messages		Details of error	Countermeasures
	Indicator	HART		
F	AL-010	010:CPU failure	A failure in the program memory of the transmitter CPU is detected	Contact your nearest sales office or Service Center.
F	AL-011	011:CPU failure	A failure in the I/O calculation memory of the transmitter CPU is detected	Contact your nearest sales office or Service Center.
F	AL-012	012:Main storage failure	Physical/logical failure of the transmitter EEPROM is detected	Contact your nearest sales office or Service Center.
F	AL-013	013:Sub storage failure	Physical/logical failure of the sensor EEPROM is detected	Contact your nearest sales office or Service Center.
F	AL-014	014:Main ASIC failure	Operation stop of the main control IC is detected	Contact your nearest sales office or Service Center.
F	AL-015	015:Sub ASIC failure	Operation stop of the sub control IC is detected	Contact your nearest sales office or Service Center.
F	AL-016	016:ADC circuit failure	Failure of the sensor ADC circuit is detected	Contact your nearest sales office or Service Center.
F	AL-017	017:Signal circuit failure	Failure of the sensor signal circuit is detected	Contact your nearest sales office or Service Center.
F	AL-018	018:Power circuit failure	Failure of the sensor power circuit is detected	Contact your nearest sales office or Service Center.
F	AL-020	020:Flow sensor failure	Failure of the flow sensors (A or B) is detected	Contact your nearest sales office or Service Center.
F	AL-021	021:Temperature sensor failure	Failure of the temperature sensor is detected	Contact your nearest sales office or Service Center.
F	AL-023	023:Analog input failure	Failure of analog input device is detected	Check the connections to the analog input device

■ **Process Alarms**

The device is normal but normal measurement is not possible due to process-related problems. Consider maintenance.

NE107 Status	Error messages		Details of error	Countermeasures
	Indicator	HART		
S	AL-030	030:Fluctuation	Fluctuation of the flow rate signal is detected	Check the process and installation status.
S	AL-031	031:Transient noise	Excessive noise in the flow rate signal is detected	Check the process and installation status.
S	AL-032	032:High vibration	Abnormal vibration of the piping is detected	Check the process and installation status.
S	AL-033	033:Critical vibration	Abnormal resonance of the piping is detected	Check the process and installation status.
S	AL-040	040:Temperature out of range	The fluid temperature is out of the specification temperature range	Check the process.
S	AL-042	042:Analog output out of range	Analog output is out of the upper/lower limit value range	Check the parameter settings or the process values assigned to analog output.
S	AL-043	043:Pulse output out of range	Pulse output/frequency output are out of the specification range	Check the parameter settings or the process values assigned to pulse output.
S	AL-044	044:Analog input out of range	Analog input is out of the upper/lower limit value range	Check the device connected to analog input
S	AL-045	045:T/P compensation out of range	The fluid temperature and fluid pressure is out of the compensation range	Check the fluid temperature and fluid pressure values.

■ **Setting Alarms**

The device is operating normally, however, a parameter setting error has occurred. Check the parameter settings.

NE107 Status	Error messages		Details of error	Countermeasures
	Indicator	HART		
C	AL-050	050:Flow span set error	The flow rate span setting is out of the specification range	Correct the flow rate span value. Or, check the flow rate calculation setting parameter.
C	AL-051	051:Temperature span set error	The Temperature span setting is inconsistent or out of the specification range	Correct the temperature span value.
C	AL-053	053:Flow calculation set error	Setting inconsistency in flow rate calculation (including calculation tool)	Check the flow rate setting, flow rate selection and flow rate calculation setting parameter.
C	AL-054	054:Analog output set error	Analog output upper/lower limit value setting inconsistency	Check the analog output parameter setting.
C	AL-055	055:Pulse output set error	Pulse output setting inconsistency	Check the pulse output rate, frequency of processing values 0% and 100%, and flow rate span value.
C	AL-056	056:Analog input set error	Analog input upper/lower limit value setting inconsistency	Check the analog input parameter and flow rate calculation settings.
C	AL-060	060:Sensor backup error	Transmitter/sensor backup setting inconsistency	Check the data to be backed up.

■ **Warnings**

The device and measurement are operating normally, however, a warning has occurred.

NE107 Status	Error messages		Details of error	Countermeasures
	Indicator	HART		
M	AL-070	070:Sensor communication error	Control IC communication error is detected	In the case of a remote type, check the vortex flowmeter signal cable (VY1C). In the case of an integral flowmeter, contact your nearest sales office or Service Center.
M	AL-071	071:Flow sensor error	Abnormal sensor sensitivity is detected	Check the state of the flow sensors by using Built-in Verification.
M	AL-072	072:Clogging	Clogging of a flow sensor is detected	Remove foreign matter by following the instructions in the device manual.
M	AL-073	073:Degradation	Degradation of a flow sensor is detected	Consider the timing for cleaning the inside of the vortex flowmeter.
S	AL-074	074:Board temperature out of range	A device internal temperature out of the specification range is detected	Review the installation environment.
C	AL-080	080:Simulation running	Test/simulation is running	When restoring to normal operation, cancel simulation or the output test.
C	AL-081	081:Verification running	Verification is currently executing	Wait for diagnostic processing to complete.
-	AL-082	082:Incorrect PIN	Entry of wrong user rights PIN	Enter the correct PIN. If you have forgotten your password, contact your nearest sales office or Service Center.

### 6.3.2 Operation when an error occurs

#### ■ System Alarms

The device has malfunctioned and normal measurement is not possible. The product might need to be replaced.

NE107	Error messages		Analog output	Pulse output Frequency output	Status output	Vortex frequency	Built-in temperature	Analog input	Instantaneous flow rate	Fluid temperature	Fluid pressure	Fluid density Fluid density ratio Specific enthalpy	Flow rate total
	Indicator	HART											
-	-		Burn-out (HW)	Stop	Open (HW)	-	-	-	-	-	-	-	-
F	AL-010	010:CPU failure	Burn-out	Stop	Operation	Fixed at 0%	Fixed at 0%	Fixed at 0%	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Stop
F	AL-011	011:CPU failure	Burn-out	Stop	Operation	Fixed at 0%	Fixed at 0%	Fixed at 0%	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Stop
F	AL-012	012:Main storage failure	Burn-out	Stop	Operation	Fixed at 0%	Fixed at 0%	Fixed at 0%	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Stop
F	AL-013	013:Sub storage failure	Burn-out	Stop	Operation	Fixed at 0%	Fixed at 0%	Fixed at 0%	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Stop
F	AL-014	014:Main ASIC failure	Burn-out	Stop	Operation	Fixed at 0%	Fixed at 0%	Fixed at 0%	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Stop
F	AL-015	015:Sub ASIC failure	Burn-out	Stop	Operation	Fixed at 0%	Fixed at 0%	Fixed at 0%	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Stop
F	AL-016	016:ADC circuit failure	Burn-out	Stop	Operation	Fixed at 0%	Fixed at 0%	Fixed at 0%	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Stop
F	AL-017	017:Signal circuit failure	Burn-out	Stop	Operation	Fixed at 0%	Fixed at 0%	Fixed at 0%	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Stop
F	AL-018	018:Power circuit failure	Burn-out (L)	Stop	Operation	Fixed at 0%	Fixed at 0%	Fixed at 0%	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Stop
F	AL-020	020:Flow sensor failure	User setting Flow sensor alarm action	Stop	Operation	User setting Flow sensor alarm action	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Stop
F	AL-021	021:Temperature sensor failure	User setting Temp sensor alarm action	Stop	Operation	Operation	User setting Temp sensor alarm action	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Stop
F	AL-023	023:Analog input failure	User setting Aux input alarm action	Stop	Operation	Operation	Operation	User setting Aux input alarm action	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Stop

■ **Process Alarms**

The device is normal but has malfunctioned and normal measurement is not possible due to process-related problems. Maintenance, etc. is needed.

NE107	Error messages		Analog output	Pulse output Frequency output	Status output	Vortex frequency	Built-in temperature	Analog input	Instantaneous flow rate	Fluid temperature	Fluid pressure	Fluid density Fluid density ratio Specific enthalpy	Flow rate total
	Indicator	HART											
S	AL-030	030:Fluctuation	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
S	AL-031	031:Transient noise	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
S	AL-032	032:High vibration	User setting High vibration action	Operation	Operation	User setting High vibration action	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
S	AL-033	033:Critical vibration	User setting Critical vibration action	Operation	Operation	User setting Critical vibration action	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
S	AL-040	040:Temperature out of range	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
S	AL-042	042:Analog output out of range	Limit	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
S	AL-043	043:Pulse output out of range	Operation	Limit	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
S	AL-044	044:Analog input out of range	Operation	Operation	Operation	Operation	Operation	Limit	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
S	AL-045	045:T/P compensation out of range	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation

■ **Setting Alarms**

The device is operating normally, however, a parameter setting error has occurred. Parameter must be set.

NE107	Error messages		Analog output	Pulse output Frequency output	Status output	Vortex frequency	Built-in temperature	Analog input	Instantaneous flow rate	Fluid temperature	Fluid pressure	Fluid density Fluid density ratio Specific enthalpy	Flow rate total
	Indicator	HART											
C	AL-050	050:Flow span set error	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
C	AL-051	051:Temperature span set error	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
C	AL-053	053:Flow calculation set error	Operation	Operation	Operation	Operation	Operation	Operation	Hold	Interlocked to input	Interlocked to input	Hold	Hold
C	AL-054	054:Analog output set error	Hold	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
C	AL-055	055:Pulse output set error	Operation	Hold	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
C	AL-056	056:Analog input set error	Operation	Operation	Operation	Operation	Operation	Hold	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
C	AL-060	060:Sensor backup error	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation

■ Warnings

The device is operating normally and normal measurement is being executed, however, a warning has occurred.

NE107	Error messages		Analog output	Pulse output Frequency output	Status output	Vortex frequency	Built-in temperature	Analog input	Instantaneous flow rate	Fluid temperature	Fluid pressure	Fluid density Fluid density ratio Specific enthalpy	Flow rate total
	Indicator	HART											
M	AL-070	070:Sensor communication error	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
M	AL-071	071:Flow sensor error	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
M	AL-072	072:Clogging	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
M	AL-073	073:Degradation	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
S	AL-074	074:Board temperature out of range	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
C	AL-080	080:Simulation running	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
C	AL-081	081:Verification running	Operation	Operation	Operation	Hold	Hold	Hold	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation
-	AL-082	082:Incorrect PIN	Operation	Operation	Operation	Operation	Operation	Operation	Interlocked to input	Interlocked to input	Interlocked to input	Interlocked to input	Operation

Operation: Operation state in which output is being correctly output

Interlocked to input: Operation state in which the same processing as when there is no alarm is performed

Example 1) The volumetric flow rate also is held if the vortex frequency to be input is held when the volumetric flow rate is in use.

Example 2) When a Temperature sensor failure occurs

When the vortex flowmeter is used for the volumetric flow rate, the vortex frequency to be input becomes normal action and the volumetric flow rate also becomes normal action.

When the vortex flowmeter is used for the mass flow rate, temperature and pressure are to be input in addition to the vortex frequency. Accordingly, the combination becomes vortex frequency (normal), temperature (error) and pressure (normal). Output becomes the mass flow rate calculated according to the temperature error as a result of specifying handling of the temperature error by setting in Temp sensor alarm action.



# 7. OPERATION

The vortex flowmeter outputs signals from the specified terminals when the measured fluid begins to flow after the following:

- 1 The flowmeter has been installed on the piping
- 2 The input/output terminals have been wired
- 3 The required parameters have been set

This section describes test methods before operation and adjustment methods during trial operation.

## CAUTION

The parameter settings in "3" above have already been set before shipment from the factory according to the sizing data when ordering. Therefore, it is not necessary to set the initial parameters except when design (measurement) conditions are changed.

### 7.1 Adjustments

#### 7.1.1 Zero Adjustment

Zero adjustment is not necessary since the zero point does not shift.

The zero point of a vortex flowmeter is stable as it incorporates a frequency output sensor. However, because of the effect of electrical noise and vibration noise, the vortex flowmeter may output even when the flowrate is zero. In this case, read "7.2 Adjustment for Manual Mode".

#### 7.1.2 Span Adjustment

Span adjustment (adjustment of 4 to 20 mA DC output) is not necessary after the span has been set and changed.

To check the output of 4 to 20 mA DC, read "7.1.3 Loop Test".

#### 7.1.3 Loop Test

-2.5% to 110.0% (parameter J10: Test analog output) can be output at 4 to 20 mA DC output and 0 Hz to 10000 Hz (parameter J20: Test pulse output) can be output at pulse output to check loop or analog output. (In the case of an indicator, output is either current or pulse.) To check analog output, follow the "Check Procedure" below.

## IMPORTANT

- When using a measuring instrument, do not ground that instrument.
- Settings are canceled if the vortex flowmeter is turned OFF within 30 seconds of setting parameters. After setting, do not turn the power supply OFF for 30 seconds or more.

### Check Procedure

1. Connect the instruments as shown in Figure 7.1, and warm up for three minutes more.
2. Set parameter J05/Test mode to "Analog output". (Set "1" on the indicator.)
3. Set parameter J10/Test analog output to "100%".
4. When the load resistance is 250Ω, the digital multimeter indicates 5V. When a known load resistance (RΩ) is used, make sure that R(Ω) x 0.02 (A). Check that the output value is in the rated value (±0.016 mA).
5. Next, check that the output value is in the rated value (±0.016 mA) after setting parameter J10/Test analog output to 50%.
6. Then, check that the output value is in the rated value (±0.016 mA) after setting parameter J10/Test analog output to 0%.

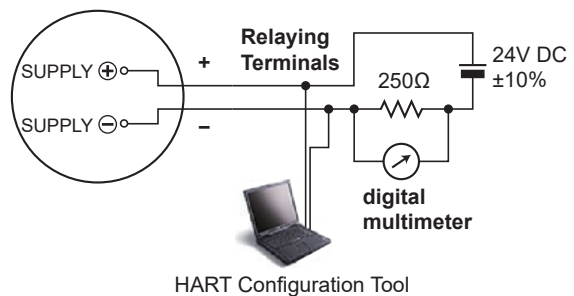


Figure 7.1 Connection Method

F0701.ai

### 7.1.4 Totalizer Start and Totalizer Reset Methods

#### (1) Totalizer start

To display totals, start the totalizer function.

(a) Operation using HART Configuration Tool  
Set Totalizer start/stop to "1:Start".

(b) Operation using indicator  
Enter the setting mode, and set parameter "B40:01". For details on how to set from an indicator, refer to the Communications Manual listed in Table 1.1 Related Documents.

(Note) When the total rate is specified before shipment from the factory, Totalizer Start/stop is set to "START".

#### (2) Totalizer reset

(a) Operation using HART Configuration Tool  
Set Totalizer start/stop to "1:Reset".

(b) Operation using indicator  
Enter the setting mode, and set parameter "B47:01". For details on how to set from an indicator, refer to the Communications Manual listed in Table 1.1 Related Documents.

### 7.1.5 Pulse Output (Scaling)

Two modes are provided for pulse output. Set the desired mode in parameter B20/Pulse/Status output mode.

#### (1) Scaled pulse

When "Scaled pulse" is selected at B20/Pulse/Status output mode, the flowrate per single pulse output (unit is set at item C) is set.

#### (2) Unscaled pulse

When "Unscaled pulse" is selected at B20/Pulse/Status output mode, the result obtained by calculation based on the number of vortices that occurred from the vortex shedder is output as the number of pulses.

The formula for the number of output pulses is as follows.

Number of output pulses per second = number of vortices per second / PULSE RATE setting value

For details on the calculation formula, refer to "Calculation Formula" in the Communications Manual listed in Table 1.1 Related Documents.

#### • Pulse Rate setting

Set the pulse rate at "B21/Pulse output rate".

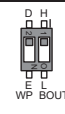
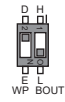
Example: If "10" is set when the flowrate unit is m<sup>3</sup>, the pulse rate is expressed as 10 m<sup>3</sup>.

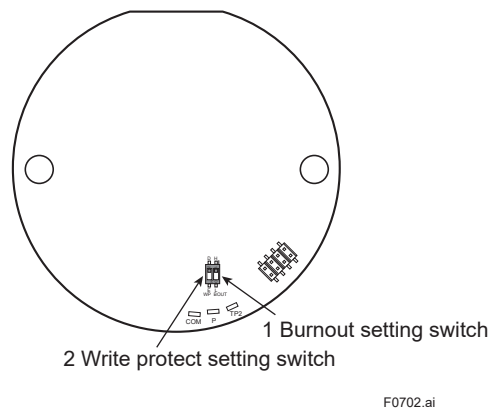
### 7.1.6 Setting of Burnout Setting Switch

The VY series of vortex flowmeters is equipped with a burnout function for for setting the output direction when a hardware malfunction errors. Read Section 6.3 "Self-Diagnostic (Error Code List)". Before shipment from the factory, the burnout output direction is set to HIGH. However, when option codes /C1 and /C2 are specified, the burnout output direction is set to LOW.

To change the burnout output direction, change the setting of the burnout setting switch on the CPU board in the amplifier.

**Table 7.1 Burnout Output Direction Setting Pin at a Hardware Error**

Position of setting pin	Burnout direction	Burnout output	Remark
	HIGH	110% or more (21.6 mA DC or more)	Set to HIGH before shipment.
	LOW	-2.5% or less (3.6 mA DC or less)	When option codes /C1 and /C2 are specified, the switch is set to LOW.



**Figure 7.2 Positions of Burnout and Write Protect Setting Pins**

### NOTE

- The burnout setting switch (1) and write protect setting switch (2) are located next to each other on the CPU board in the amplifier. When setting the burnout output direction or write protect, take care not to mistake these switches.
- To ensure safety, touch only the electrical circuits and cables of the setting switch. Do not touch other circuits and cables.

### 7.1.7 Setting the Write Protect Setting Switch

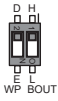
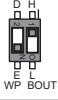
The write protect function, when set to "Protect", disables overwriting of parameters. Write protection is switched by either the write protect switch (2) on the CPU board in the amplifier or in software parameter settings. If either of these items is set to "Protect", parameters can no longer be overwritten.

#### NOTE

If the setting switch is set to "Protect" on the hardware, it is not possible to overwrite parameters. Furthermore, this state is maintained until the setting switch is set to "Disable".

For details on the write protect function set in software parameters, read "Software Write Protect" in the Communications Manual listed in Table 1.1 Related Documents.

Table 7.2 Setting Pin for Write Protect Function

Position of setting pin	Write protect function
	Disable
	Protect

### 7.1.8 Operation at a Power Failure

When a power failure occurs, the totalized value will be protected by EEPROM (Electrically Erasable Programmable ROM). However, during a power failure, the vortex flowmeter does not operate, so totalizing of totalized values is discontinued.

- The EEPROM does not need a battery for backup.
- After power is recovered, totalizing is resumed and continues, and the vortex flowmeter automatically returns to normal operation.

## 7.2 Adjustment for Manual Mode

Adjustment at startup is not required as the vortex flowmeter is automatically adjusted so that disturbance noise such as vibration through piping is canceled at all times. However, adjust in the manual mode when there is flowrate output even though fluid flow is stopped.

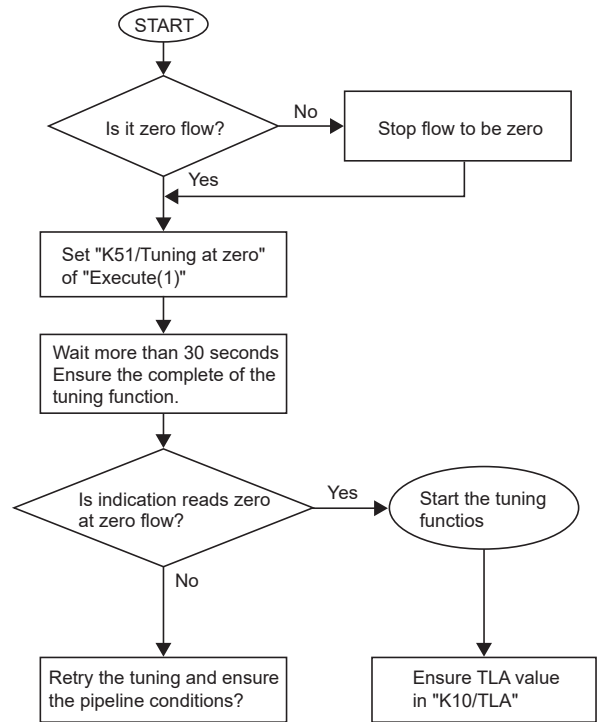
### 7.2.1 Low Cut Adjustment

Adjustment by this function intentionally sets the low-flowrate range to zero for the purpose of removing noise.

Set the flowrate value to set the flowrate to zero at "D10/Flow lowcut". For details on the setting method, read "Parameter Descriptions" in the Communications Manual listed in Table 1.1 Related Documents.

### 7.2.2 Zero Tuning

Perform this adjustment while referring to Figure 7.3 below.



F0703.ai

Figure 7.3 Tuning Flow

If tuning is executed, the following parameter setting values change.

K25/Noise balance mode = MANUAL(0)

K26/Noise ratio = fixed value

Note, however, that the measurable minimum flow velocity increases when the K10/TLA values are changed from their initial values.

1. Checking the flowrate

Be sure to check that fluid flow has stopped.

2. Executing tuning

Execute tuning with K51/Tuning at zero set to "1:

Execute". After executing, wait 30 seconds or more.

3. Completion of tuning

(1) Checking completion of tuning

- Checking on the HART Configuration Tool
  - (a) Move to Maintenance > Signal controls > Tuning status
  - (b) Tuning is completed if Tuning status is indicated as either of "Pass" or "Failure". If the Tuning status is "Unknown", repeat steps (1) and (2). (During tuning, "Running" is displayed.)
- Checking on the indicator
  - Press the INC key to move to K52. Tuning is completed if the parameter data (on lower indication) is "1" or "2". (During tuning, "3" is displayed.) If the indication is "2" or "0", repeat tuning.

(2) Checking the TLA

The K10/TLA values sometimes change which causes the measurable minimum flow velocity to increase after tuning is completed.

The measurable minimum flow velocity after TLA is changed is given by the following formula.

$$\text{Minimum Flowrate after changing TLA Value} = \text{Specified Minimum Flowrate} \times \sqrt{\frac{\text{TLA Value after Tuning}}{\text{TLA initial value or default value}}}$$

F0704.ai

Make sure that there are no problems in the measurable minimum flow velocity after TLA is changed.

(3) Check output

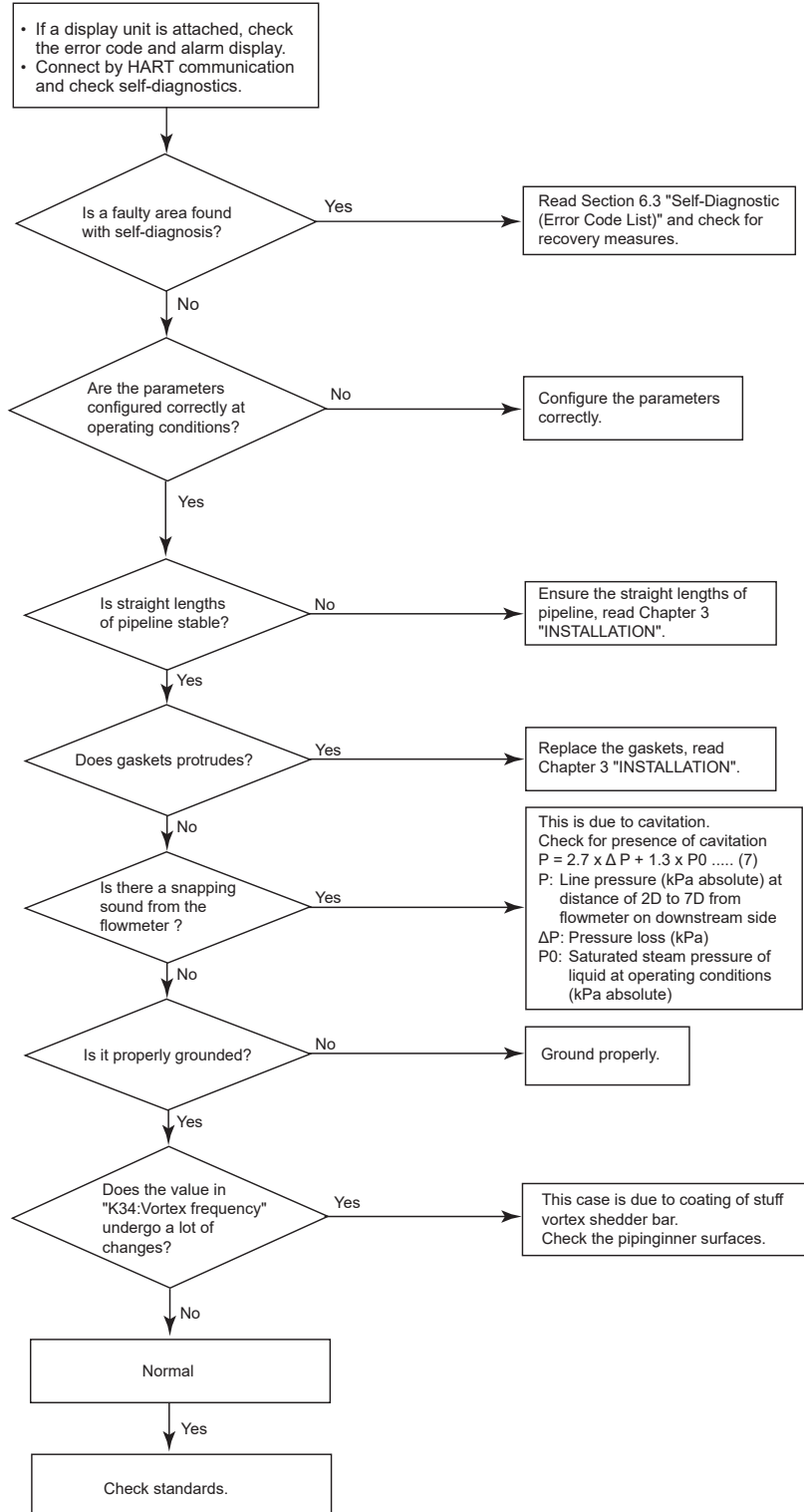
Make sure that there is no output when the flow rate reading is zero.

If there is continuous output when the flow rate reading is zero even after tuning, repeat tuning check the following item.

- Are vibrations abnormally high in the pipeline?
  - In this case, read Section 3.1 "Installation Precautions", and keep the pipeline supported.

# 8. ERRORS AND COUNTERMEASURES WITH DISPLAY UNIT

## 8.1 When Error Is Large or Unstable Is Output



F0801.ai

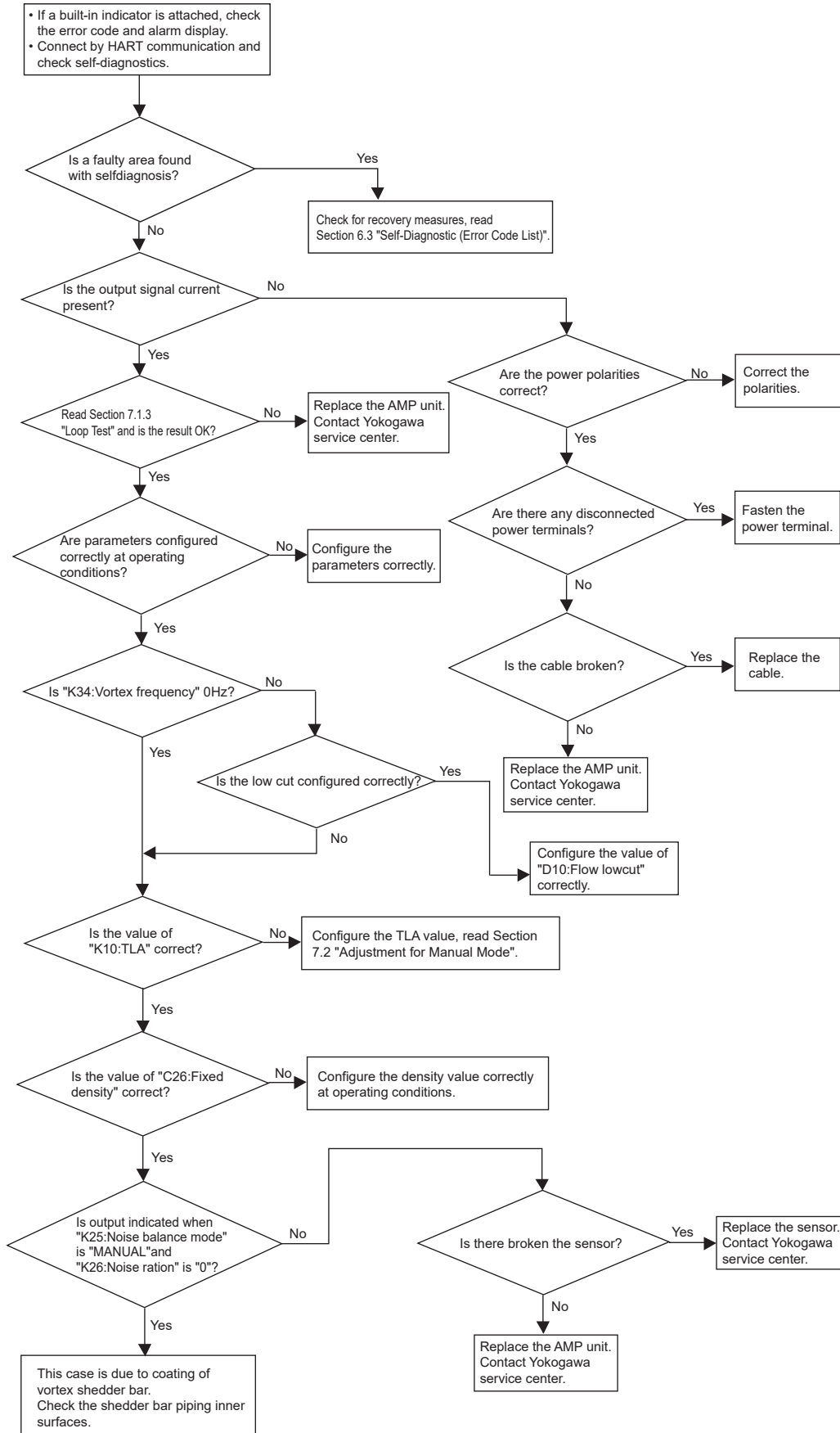
## 8.2 Indication Drops to Zero at Certain Times

When this problem occurs, deterioration of sensor sensitivity and turbulence of fluid flow due to coating on the vortex shedder bar and flowmeter inner tube are suspected as the cause.

### How to cope with this problem

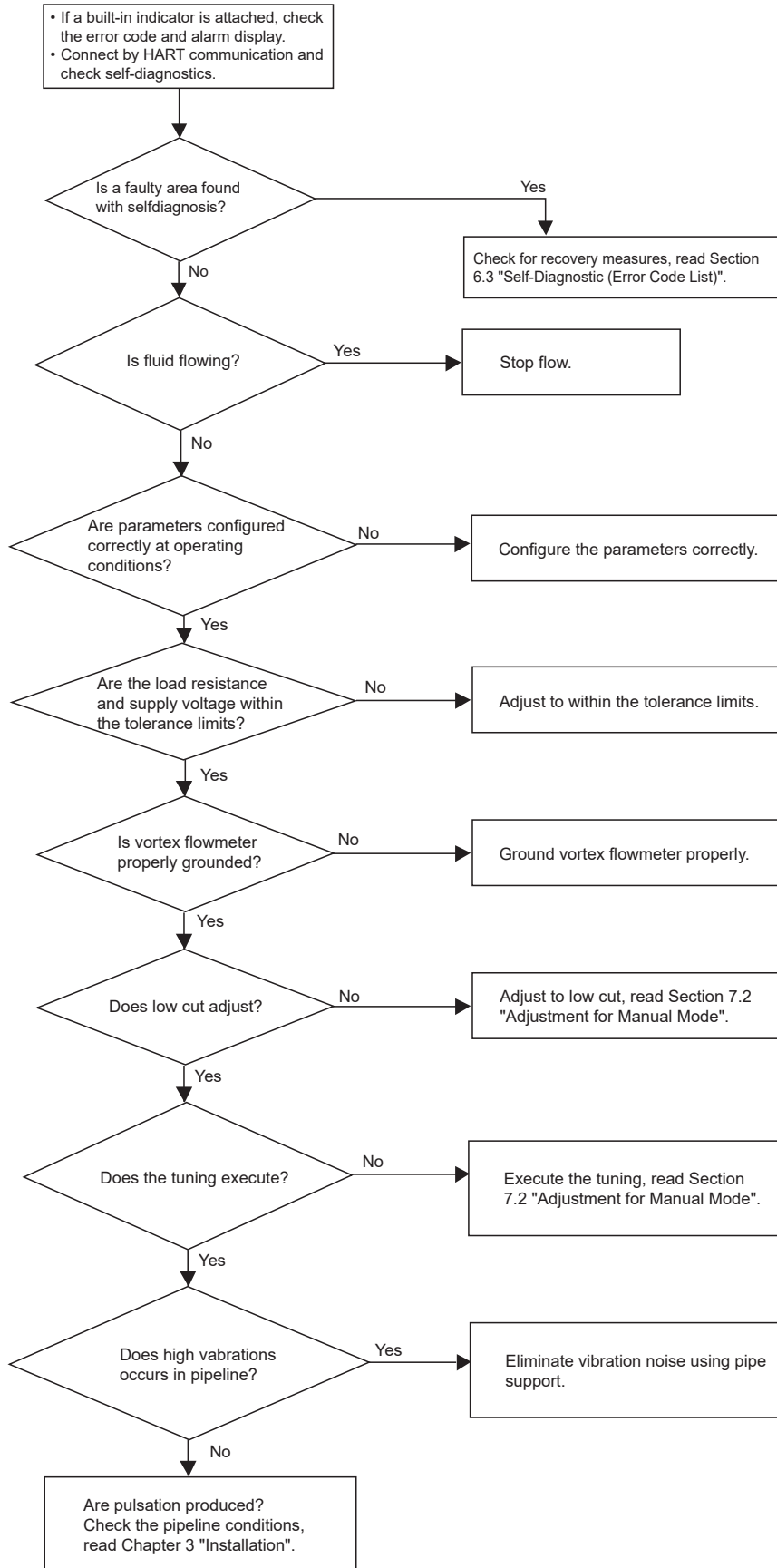
- 1) Remove the vortex shedder bar from the body according to "Vortex Shedder Removal" in the Maintenance Manual listed in Table 1.1 Related Documents.
- 2) If there is coating on the inner tube of the flowmeter, remove the flowmeter body from adjacent pipes and clean it.

### 8.3 The Indication Is Zero Even It is Flowing



F0802.ai

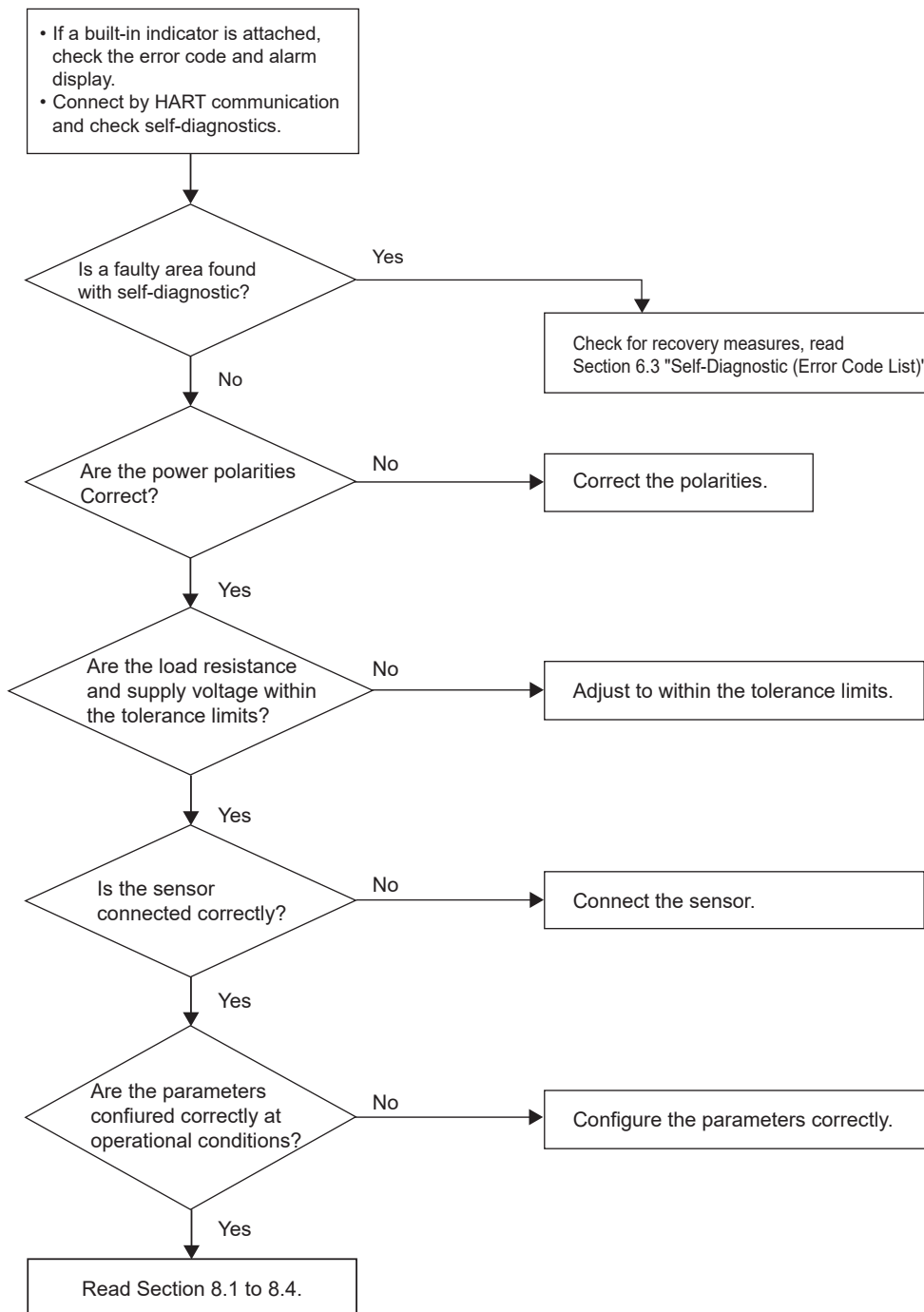
### 8.4 Indication When No Fluid is Flowing



F0803.ai



### 8.5 With Built-in Temperature Sensor



F0804.ai

# 9. APPLICABLE STANDARDS

## PED (Pressure Equipment Directive)

This chapter describes further requirements and cautions concerning the PED (Pressure Equipment Directive).

Be sure to read this chapter ahead of the User's Manual.

### (1) Specifications

#### PED (Pressure Equipment Directive):

Type of equipment: Pressure accessory – Piping

Type of fluid: liquid and gas

Group of fluid: 1 and 2

Module: H

MODEL	DN (*1) (mm)	PS (*1)		PS•DN (*1)		CATEGORY (*2)
		(bar)	(MPa)	(bar•mm)	(MPa•mm)	
VY015	15	414	41.4	6210	621	Sound Engineering Practice (SEP) (*3)
VY025	25	414	41.4	10350	1035	
VY040	40	414	41.4	16560	1656	II (*4)
VY050	50	414	41.4	20700	2070	II (*4)
VY080	80	414	41.4	33120	3312	II (*4)
VY100	100	414	41.4	41400	4140	II (*4)
VY150 (*5)	150	414	41.4	62100	6210	III
VY200	200	414	41.4	82800	8280	III
VY250	250	414	41.4	103500	10350	III
VY300	300	414	41.4	124200	12420	III
VY400	400	250	25	100000	10000	III

\*1: PS: Maximum allowable pressure for flow tube, DN: Nominal diameter

\*2: Table 6 covered by ANNEX II of Directive 2014/68/EU

\*3: Article 4, paragraph 3 of Directive 2014/68/EU

\*4: Models classified as Category II cannot be used for unstable gases in Group 1.

\*5: VY150 with nickel alloy CW-12MW body material is not compliant with PED.

### (2) Installation



#### WARNING

- When installing on piping, firmly tighten the bolts at the appropriate torque values.
- Take measures to protect the flowmeter from force caused by vibration through piping.

### (3) Operation



#### WARNING

- The temperature and pressure of the fluid should be applied under normal operating conditions.
- The ambient temperature should be applied under normal operating conditions.
- Pay attention to prevent excessive pressure such as water hammer. When water hammer occurs, take measures such as installing a safety valve on the system to prevent the pressure from exceeding PS (maximum allowable pressure).
- When an external fire occurs, take safety measures at the device or system to prevent the flowmeter from being affected.
- Pay attention to abrasion of metal pipes when using abrasive fluids that contain slurry or sand and the like.

---

# Revision Information

- Title : Vortex Flowmeter VY Series Installation Manual
- Manual No. : IM 01F07A01-01EN

<b>Edition</b>	<b>Date</b>	<b>Page</b>	<b>Revised Item</b>
1st	Feb. 2022	-	New publication
2nd	Aug. 2022	Front cover 8 16	Table 1.1, added Ex-proof IMs. Added temperature range of /LAT. Added Dual-Sensor (Welded)
3rd	Jan.2023	4	Added a notice for WANING to 1.1.