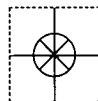
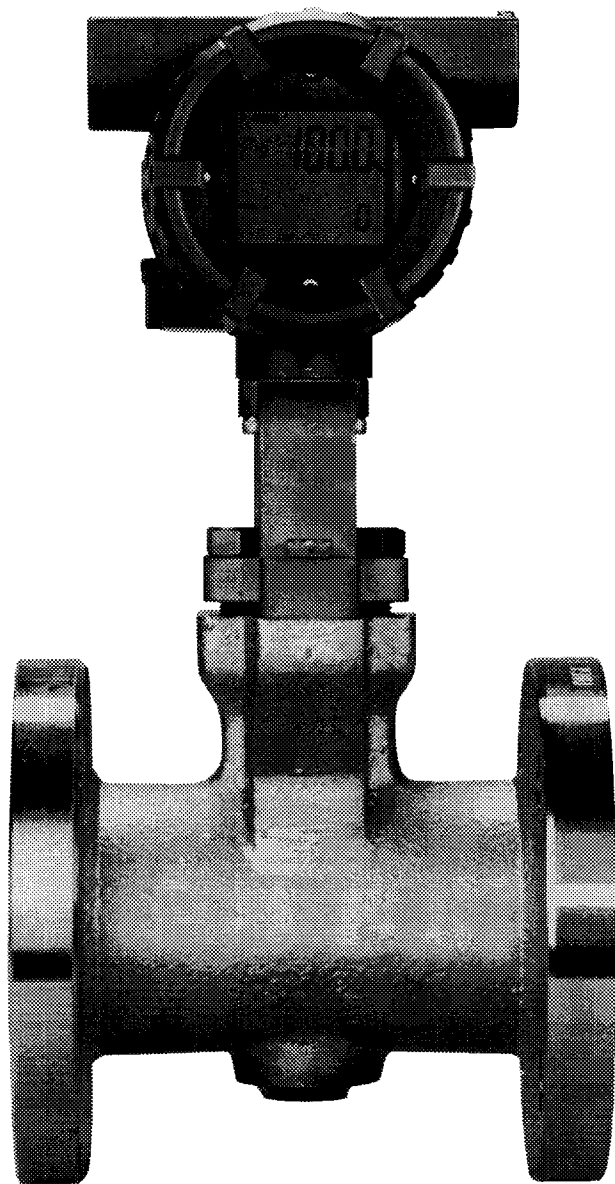


.1 YEAR
WARRANTY



User's Guide



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FV-500C SERIES **Vortex Flowmeter**



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It is the policy of OMEGA to comply with all worldwide safety and EMC/EMI regulations that apply. OMEGA is constantly pursuing certification of its products to the European New Approach Directives. OMEGA will add the CE mark to every appropriate device upon certification.

The information contained in this document is believed to be correct, but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, human applications.

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NOTES:

INTRODUCTION

The FV-500C series of vortex flowmeters have been fine-tuned to your order specifications prior to shipment. Before use, read this manual thoroughly and familiarize yourself fully with the features, operations and handling of digital YEWFLO to have the instrument deliver its full capabilities and to ensure its efficient and correct use.

Notices Regarding This Manual

- This manual should be passed to the end user.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. No part of this document may be reproduced or transmitted in any form or by any means without the written permission of OMEGA Engineering.
- This manual neither does warrant the marketability of this instrument nor it does warrant that the instrument will suit a particular purpose of the user.
- Every effort has been made to ensure accuracy in the contents of this manual. However, should any questions arise or errors come to your attention, please call our Customer Service Department at 1-800-622-2378 or 203-359-1660. We can also be reached on the Internet at www.omega.com
e-mail: info@omega.com
- This manual is not intended for models with custom specifications.
- Revisions may not always be made in this manual in conjunction with changes in specifications, constructions and/or components if such changes are not deemed to interfere with the instrument's functionality or performance.

Notices Regarding Safety and Modification

- For the protection and safety of personnel, the instrument and the system comprising the instrument, be sure to follow the instructions on safety described in this manual when handling the product. If you handle the instrument in a manner contrary to these instructions, OMEGA does not guarantee safety.
- If this instrument is used in a manner not specified in this manual, the protection provided by this instrument may be impaired.

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



WARNING

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



CAUTION

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



IMPORTANT

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



NOTE

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

== Direct current.

For Safe Use of digitalYEWFLO



WARNING

- If the process fluid is harmful to personnel, handle digitalYEWFLO carefully even after it has been removed from the process line for maintenance or other purposes. Exercise extreme care to prevent the fluid from coming into contact with human flesh and to avoid inhaling any residual gas.

INTRODUCTION

**CAUTION**

- When carrying digital YEW FLO around, exercise extreme care to avoid dropping it accidentally and causing bodily injury.

Warranty

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

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

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

**WARNING**

- The Vortex Flowmeter is a heavy instrument. Please give attention to prevent that persons are injured by carrying or installing. It is preferable for carrying the instrument to use a cart and be done by two or more persons.
- When removing the instrument from hazardous processes, avoid contact with the fluid and the interior of the meter.

Restriction on Use of Radio Transceiver**IMPORTANT**

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

NOTES:

1. HANDLING PRECAUTIONS

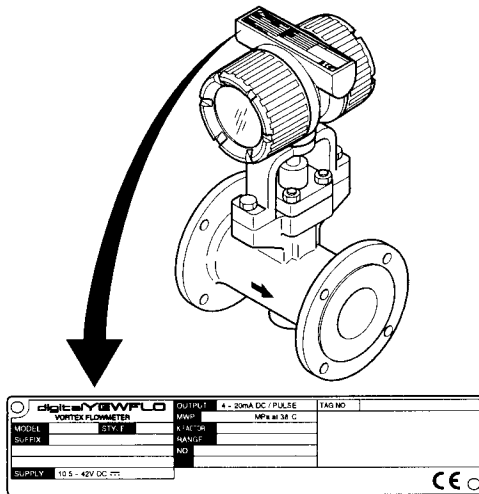
The FV-500C Vortex Flowmeter and Vortex Flow Converter are thoroughly tested at the factory before shipment. When these instruments are delivered, perform a visual check to ascertain that no damage occurred during shipment.

This section describes important cautions in handling these instruments. Read carefully before using them.

If you have any problems or questions, contact your nearest OMEGA Customer Service.

1.1 Model and Specifications

The model and important specifications are indicated on the data plate attached to the case. Verify that they are the same as those specified in the original order, referring to paragraph 2.2 to 2.5. In any correspondence, always give model (MODEL), serial number (NO) and calibrated range (RANGE) from the data plate.



NOTE: K Factor at 15°C :K

Figure 1.1(a) Example of Data Plate for Integral Type

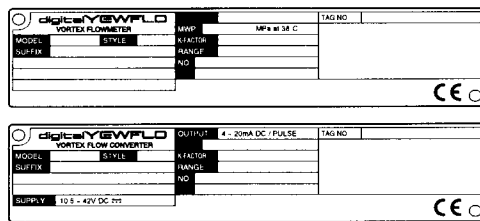


Figure 1.1(b) Example of Data Plate for Remote Type

1.2 Precautions Regarding Transportation and Storage Location

To protect against accidental damage to YEWFLO while transporting it to a new location, pack it in the original packing as when shipped from the OMEGA.



WARNING

The Vortex Flowmeter is a heavy instrument. Please be careful to prevent persons from injuring when it is handled.

Deterioration in insulation or corrosion can occur for unexpected reasons if YEWFLO is left uninstalled for a prolonged period after delivery. If YEWFLO is likely to be stored over a prolonged period, observe the following precautions.

Store the vortex flowmeter with forwarded statement. Choose a storage location that satisfies the following requirements:

- Not exposed to rain or splashwater.
- Less susceptible to mechanical vibration or shock.
- Kept within the temperature and humidity ranges shown in the following table, preferably at normal temperature and humidity (approximately 25 °C, 65%)

Temperature	-40 °C to +80 °C
Humidity	5 to 100% (no condensation)

T010201.EPS

1.3 Precautions Regarding Installation Locations

(1) Ambient Temperature

Avoid an area which has wide temperature variations. When the installation area is subjected to heat radiation from process plant, ensure adequate heat prevention or ventilation.

(2) Atmosphere Conditions

Avoid installing the vortex flowmeter in a corrosive atmosphere. When the vortex flowmeter must be installed in a corrosive atmosphere, adequate ventilation must be provided.

1. HANDLING PRECAUTIONS

(3) Mechanical Shock or Vibration

The vortex flowmeter is of sturdy construction, but select an area subject to minimize mechanical vibrations or impact shock. If the flowmeter is subject to vibrations, it is recommended that pipeline supports to be provided as shown in Figure 1.2.

(4) Other Considerations

- Choose a location where is sufficient clearance around YEWFO to allow such work as routine inspections.
- Choose a location that ensures easy wiring and piping.

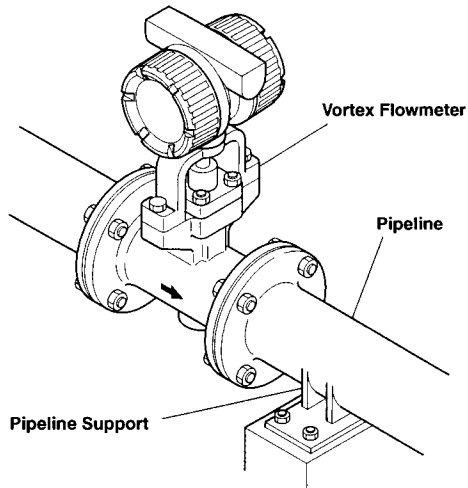


Figure 1.2

2. GENERAL DESCRIPTION

2.1 Outline

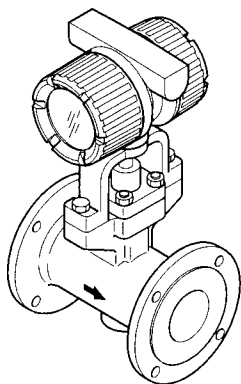
This vortex flowmeter measures liquid, gas and steam flow rates and converts them to a 4 to 20mA DC output or pulse, alarm, status output signal.

Since the converter is mounted independently from the flowmeter, it permits remote flow measurements of high temperature liquid, steam, etc.

Integral Type

The Integral Type Vortex Flowmeter has the converter with the flowmeter, and measures liquid, gas and steam flow rates and converts them to a 4 to 20mA DC output or pulse, alarm, status output signal.

Flange Type (built-in indicator)



Wafer Type

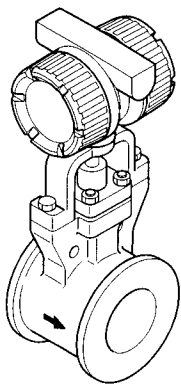


Figure 2.1.1 External Views (Integral Type)

Remote Type

The Remote Converter Type Vortex Flowmeter is used with the Vortex Flow Converter. A special cable is used between these instruments.

Vortex flow converter (built-in indicator)

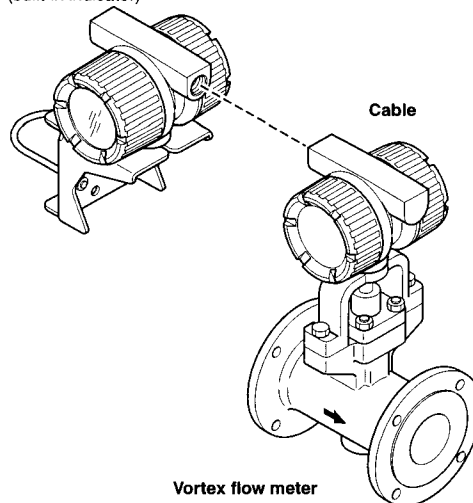


Figure 2.1.2 External Views (Remote Type)

- Name of a portion of the flowmeter (Example of the Wafer Type)

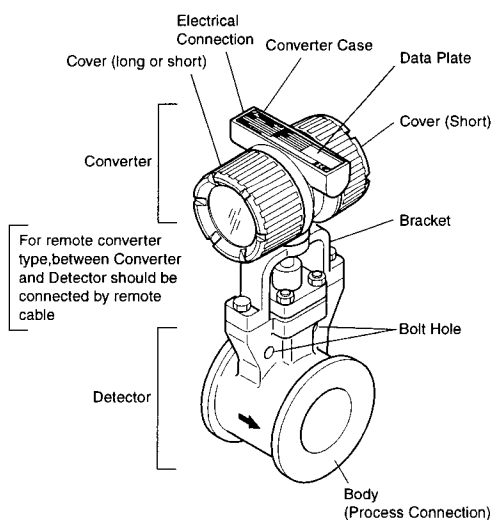


Figure 2.1.3 Example of Name of portion

2.2 Standard Specifications

Performance Specifications

Fluid to be Measured:

Liquid, Gas, Steam (Avoid Multiphase
Flow and Sticky Fluids)

Measuring Flow Rates:

Refer to Table 6

Accuracy:

0.75% of Reading (Liquid)

1% of Reading (Gas, Steam)

Refer to Table 8

Repeatability:

0.2% of Reading

Calibration:

factory-calibrated using water flow.

Normal Operating Condition

Process Temperature Range:

General: -40 to 500 F [-40 to 260 C]

High Process Temperature Version option

-40 to 842 F [-40 to 450 C]

Refer to Figure 1 for integral converter type.

Process Pressure Limit:

-14.2 PSIA (-1 kg/cm²) to flange rating.

Ambient Temperature Range:

Remote type detector, Remote type

converter: -40 to 185 F [-40 to 85 C]

Integral type, refer to Figure 1:

-40 to 185 F [-40 to 85 C]

Integral type with Indicator, refer to

Figure 1: -22 to 176 F [-30 C to 80 C]

Ambient Humidity:

5 to 100% RH (at 40 C)

(Non Condensing)

Power Supply Voltage:

10.5 to 42 V DC

(Refer to Figure 2; Relationship Between

Power Supply Voltage and Load Resistance)

Mechanical Specifications

Material (General Type):

Refer to Table.1

Body;

CF8M casting stainless steel (SUS316)

Shedder bar;

Duplex stainless steel (ASTM CD4MCu

equivalent to JIS SUS329J1.)

Gasket; JIS SUS316 stainless steel with

polytetrafluoroethylene (Teflon) coating.

Converter housing and case, cover;

Aluminum alloy

Coating Color:

Converter case, cover: Deep sea moss green

(Munsell 0.6GY 3.1/2.0) (Polyurethane corrosion-

resistant coating)

Protection:

IP67 immersion proof and dust proof. (NEMA 4X).

Electrical Connection:

ANSI 1/2 NPT female,

Signal Cable:

Used for remote detector and converter.

Max. length: 98 ft. (30 m.)

2. GENERAL DESCRIPTION

Outer Sheath Material: Heat resistant polyethylene

Temperature Rating: -40 to 302 F [-40 to 150 C]

Weight:

Refer to Dimensional Drawings.

Mounting:

Integral type and Remote type detector :

Flange mounting or wafer mounting

Remote type converter: 2 inch pipe mounting.

Electrical Specifications

Note*: Pulse output, alarm output and status output use
common terminals, therefore these functions are
not used simultaneously.

Output Signal: Simultaneous Output (both analog
and transistor contact output available).

Refer to "Installation" for power supply and
pulse output wiring.

Analog: 4 to 20 mA DC, 2-wire system.

Transistor Contact Output*:

Open collector, 3-wire system.

Pulse, alarm, status output are selected by
parameter setting.

Contact rating: 30 V DC, 120 mA DC

Low level: 0 to 2 V DC. (refer to Figure 3)

Communication Requirement:

Conditions of Communication Line:

Load Resistance:

250 to 600 (including cable resistance).

Refer to Figure 2.

Supply Voltage:

Refer to Figure 2.

Spacing from Power Lines: 6 in. (15cm)

or more (Parallel wiring should be avoided.)

2. GENERAL DESCRIPTION

Cable Length for Specific Applications:

Use the following formula to determine cable length for specific applications.

$$L = \frac{65 \times 10^6}{(R \times C)} - \frac{(C + 10,000)}{C}$$

where:

L=length in meters.

R=resistance in Ω (including barrier resistance)

C=cable capacitance in pF/m.

Cf= maximum shunt capacitance of receiving devices in pF/m.

Functions:

Damping Time Constant :

0 to 99 Sec (63% response time)

Note: Delay time is 0.5 Sec.

Analog output circuit time constant is 0.3 Sec.

Pulse Output Function*:

Pulse output is selected from scaled pulse, unscaled pulse, frequency (number of pulses output per second at 100% of output).

Pulse frequency : Max 10 kHz

Duty cycles : Approx. 50% (1:2 to 2:1)

Self -diagnostics and Alarm Output *:

In an alarm condition (over range output signal, EEPROM error, vibration noise, abnormal flow such as clogging, bubble) an alarm signal is output and indicated. The alarm signal output goes from close(ON) to open(OFF) during alarm.

Status Output Function *:

Flow Switch:

In case flow rate falls below the flow set value, a status signal is output.

The status signal output mode can be reversed (ON/ OFF) .

Data Security During Power Failure:

Data (parameter, totalizer value, etc.) storage by EEPROM. No back-up battery required.

Correction:

Instrument Error Correction:

Vortex flowmeter errors can be corrected by line segment approximations.

Reynolds Number Correction:

Output error at Reynolds number 20000 or less is corrected by using five-break-point line-segment approximation.

Gas Expansion Correction:

When measuring a compressible gas and steam, this expansion factor is useful to correct the error at velocities above 115 f/s (35m/s or more).

Down-scale or Up-scale burn out.

In case a CPU or EEPROM failure occurs, the output can be driven up-scale (21.6Ma) or down-scale (3.6Ma). Selection can be made by the end user via a jumper setting.

Indicator:

Flow rate (% or engineering units) and totalizer can be indicated simultaneously.

Short message for self diagnostics is displayed.

Local parameter setting can be accomplished by push buttons.

Rotatable 90° right and left

EMC Conformity Standards:

EN61326

AS/NZS 2064

Note: For remote converter type, the signal cable should be used with metal conduit.

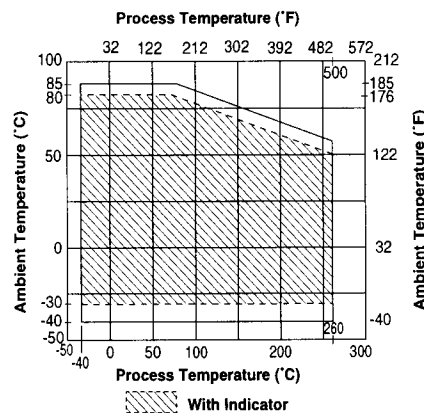


Figure 1 Ambient Temperature limit (Integral Type)

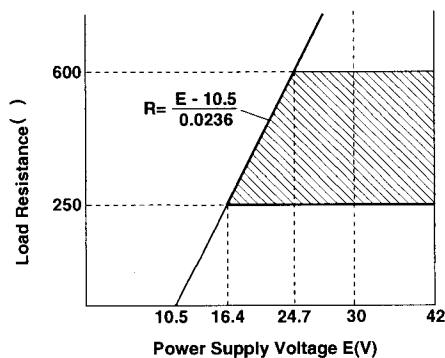


Figure 2 Relationship Between Power Supply and Load Resistance

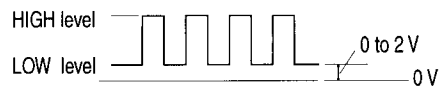


Figure 3 High and low level (Pulse output)

2. GENERAL DESCRIPTION

2.3 Sizing

The following tables show typical operating ranges. For specific operating conditions please have OMEGA® run the flow meter sizing program.

Table 4 Pressure Test Values for Stainless Steel

Flange Rating	Pressure
ANSI Class 150	412 psi (29 kgf/cm ²)
ANSI Class 300	1081 psi (76 kgf/cm ²)
ANSI Class 600	2161 psi (152 kgf/cm ²)
ANSI Class 900	3242 psi (228 kgf/cm ²)

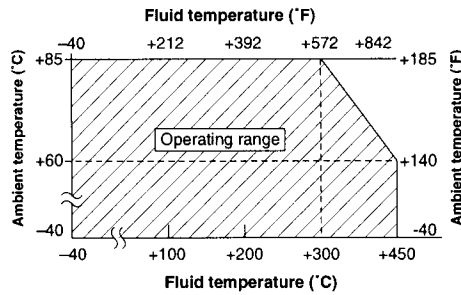


Figure 4 Fluid temperature range of high process temperature version

Minimum measurable flow velocity

Table 5 Relationship between Minimum Velocity and Density (Use the Larger of the Two Values)

Nominal size in in.	Liquid		GAS, Steam	
	General Type (unit: fps)	High Process Temperature Version (unit: fps)	General Type (unit: fps)	High Process Temperature version (unit: fps)
.5	$\sqrt{168.125/\rho}$	—	$\sqrt{53.8/\rho}$ or 9.95	—
1	$\sqrt{82.3/\rho}$	$\sqrt{329.5/\rho}$	$\sqrt{30.3/\rho}$ or 6.5	$\sqrt{84/\rho}$ or 6.5
1.5	$\sqrt{60.5/\rho}$	$\sqrt{329.5/\rho}$	$\sqrt{21.0/\rho}$ or 6.5	$\sqrt{84/\rho}$ or 6.5
2	$\sqrt{60.5/\rho}$	$\sqrt{107.6/\rho}$	$\sqrt{21.0/\rho}$ or 6.5	$\sqrt{41.2/\rho}$ or 6.5
3	$\sqrt{60.5/\rho}$	$\sqrt{107.6/\rho}$	$\sqrt{21.0/\rho}$ or 6.5	$\sqrt{41.2/\rho}$ or 6.5
4	$\sqrt{60.5/\rho}$	$\sqrt{107.6/\rho}$	$\sqrt{21.0/\rho}$ or 6.5	$\sqrt{41.2/\rho}$ or 6.5
6	$\sqrt{60.5/\rho}$	$\sqrt{107.6/\rho}$	$\sqrt{21.0/\rho}$ or 9.9	$\sqrt{41.2/\rho}$ or 6.5
8	$\sqrt{82.5/\rho}$	$\sqrt{136.2/\rho}$	$\sqrt{30.3/\rho}$ or 9.9	$\sqrt{55.8/\rho}$ or 9.9
10	$\sqrt{107.6/\rho}$	—	$\sqrt{41.22/\rho}$ or 9.9	—
12	$\sqrt{107.6/\rho}$	—	$\sqrt{41.22/\rho}$ or 9.9	—

ρ Density at operating conditions (lb/cubic ft)

Liquid density is 25-125 lb/cubic ft

Gas and steam density is 3.1214 lb/cubic ft or more.

Nominal size in mm	Liquid		GAS, Steam	
	General Type (unit: m/s)	High Process Temperature Version (unit: m/s)	General Type (unit: m/s)	High Process Temperature version (unit: m/s)
15	$\sqrt{250/\rho}$	—	$\sqrt{80/\rho}$ or 3	—
25	$\sqrt{122.5/\rho}$	$\sqrt{490/\rho}$	$\sqrt{45/\rho}$ or 2	$\sqrt{125/\rho}$ or 2
40	$\sqrt{90/\rho}$	$\sqrt{490/\rho}$	$\sqrt{31.3/\rho}$ or 2	$\sqrt{125/\rho}$ or 2
50	$\sqrt{90/\rho}$	$\sqrt{160/\rho}$	$\sqrt{31.3/\rho}$ or 2	$\sqrt{61.3/\rho}$ or 2
80	$\sqrt{90/\rho}$	$\sqrt{160/\rho}$	$\sqrt{31.3/\rho}$ or 2	$\sqrt{61.3/\rho}$ or 2
100	$\sqrt{90/\rho}$	$\sqrt{160/\rho}$	$\sqrt{31.3/\rho}$ or 2	$\sqrt{61.3/\rho}$ or 2
150	$\sqrt{90/\rho}$	$\sqrt{160/\rho}$	$\sqrt{31.3/\rho}$ or 3	$\sqrt{61.3/\rho}$ or 3
200	$\sqrt{122.5/\rho}$	$\sqrt{202.5/\rho}$	$\sqrt{45/\rho}$ or 3	$\sqrt{80/\rho}$ or 3
250	$\sqrt{160/\rho}$	—	$\sqrt{61.3/\rho}$ or 3	—
300	$\sqrt{160/\rho}$	—	$\sqrt{61.3/\rho}$ or 3	—

ρ Density at operating conditions (kg/m³)

Liquid density is 400-2000 kg/m³

Gas and steam density is 0.5 kg/m³ or more.

Table 6 Range of Measurable flow velocity

Fluid	Nominal Size	Minimum flow velocity	Maximum flow velocity
Liquid	15 to 300 mm	"flow velocity obtained from Table.5" or "flow velocity at Reynolds number of 5000", whichever is greater.	33 fps
	.5 to 12 in.	For liquid Reynolds number of 5000 : Use Figure.6	(10 m/s)
Gas, Steam	15 to 300 mm	"flow velocity obtained from Table.5" or "flow velocity at Reynolds number of 5000", whichever is greater.	262 fps
	.5 to 12 in.	For Gas and steam Reynolds number of 5000 : Use of a calculation formula on the following page.	(80 m/s)

When the flow velocity is lower than minimum, both the analog output and the pulse output is displayed as zero "0".

2. GENERAL DESCRIPTION

Guaranteed accuracy at minimum flow velocity

Table 7 Range of Guaranteed Accuracy Flow Velocity

Fluid	Nominal Size	Minimum flow velocity	Maximum flow velocity
Liquid	.5 to 4 in (15 to 100mm)	"flow velocity obtained from Table.5" or "flow velocity at Reynolds number of 20000", whichever is greater. For liquid Reynolds number of 20000 : The value is four times velocity value in Figure.6	33fps
	6 to 12 in (150 to 300 mm)	"flow velocity obtained from Table.5" or "flow velocity at Reynolds number of 40000", whichever is greater. For liquid Reynolds number of 40000 : The value is eight times velocity value in Figure.6	(10 m/s)
Gas, Steam	.5 to 4 in (15 to 100mm)	"flow velocity obtained from Table.5" or "flow velocity at Reynolds number of 20000", whichever is greater. For gas and steam Reynolds number of 20000 : Use of a calculation formula	262fps
	6 to 12 in (150 to 300mm)	"flow velocity obtained from Table.5" or "flow velocity at Reynolds number of 40000", whichever is greater. For gas and steam Reynolds number of 40000 : Use of a calculation formula	(80 m/s)

Table 8 Detailed Accuracy
(for Range of Guaranteed Accuracy)

Fluid	Nominal Size	Accuracy
Liquid	.5 in (15mm)	1.0% of Reading (20000 Re)
	1 to 4 in (25 to 100 mm)	1.0% of Reading (20000 Re < D 10 ³) 0.75% of Reading (D 10 ³ Re)
	6 to 12 in (150 to 300 mm)	1.0% of Reading (40000 Re)
Gas, Steam	.5 to 12 in (15 to 300 mm)	1.0% of Reading (Velocity 115fps (35m/s) or less) 1.5% of Reading (Velocity 115fps (35m/s) up to 262fps (80m/s))

D : Inner diameter of YEWFO (mm)

Re: Reynolds number

Note: This table shows the accuracy of pulse output. In case of analog output, add 0.1% of full scale to the values mentioned above.

Flow velocity at Reynolds Number of 5000(Liquid)

Kinematic Viscosity : Use of equation (2). When the nominal size is 50mm and the Kinematic viscosity is 10cSt, the flow velocity at Reynolds number of 5000 is 1m/s using Figure 6.

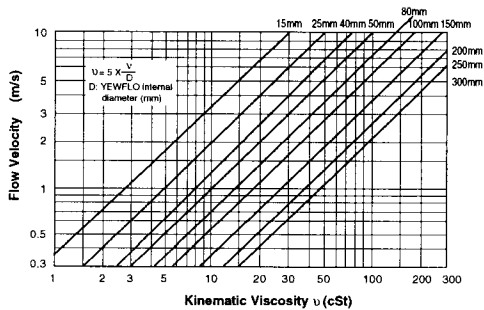


Figure 6 Flow velocity at Reynolds number of 5000(Liquid)

Calculation formula

- How to calculate volume flow rate at operating conditions.

$$Q_f = \frac{v \times D^2}{354} \quad \text{or} \quad Q_f = 3600 \times v \times S$$

- How to calculate the velocity of a Reynolds number.

$$v = 5 \times v / D \quad (\text{Reynolds number of 5000})$$

$$v = 20 \times v / D \quad (\text{Reynolds number of 20000})$$

$$v = 40 \times v / D \quad (\text{Reynolds number of 40000})$$

however

$$Re = \frac{354 \times 10^3 \times Q_f}{v \times D} \quad (1)$$

$$v = \frac{\mu}{\rho f} \times 10^3 \quad (2)$$

Q_f : Volume flow rate at operating conditions (m³/h)

D : Inner diameter of YEWFO (mm)

S : Sectional area of YEWFO(m²)

v : Flow velocity (m/s)

Re : Reynolds number (none unit)

ρf : Density at operating conditions (kg/m³)

μ : Viscosity at operating conditions (cP)

ν : Kinematic viscosity at operating conditions (cSt)

Table 9 Inner Diameter and Nominal value

Nominal Size	mm	inch	Inner Diameter in. (mm)	Nominal K-Factor Pulse / G (L)	Nominal Pulse Rate	
					Hz/1/s (Hz/m/s)	Hz/1/m (Hz/m ³ /h)
15	.5	.57 (14.6)	1423.3 (376)	19.11 (62.7)	23.6 (104)	
25	1	1.0 (25.7)	247.9 (65.6)	10.82 (35.5)	4.3 (19.1)	
40	1.5	1.56 (39.7)	70.7 (18.7)	7.04 (23.1)	1.2 (5.19)	
50	2	2.01 (51.1)	33.9 (8.95)	5.57 (18.3)	.57 (2.49)	
80	3	2.79 (71.0)	12.6 (3.33)	4.02 (13.2)	.21 (0.925)	
100	4	3.69 (93.8)	5.41 (1.43)	3.01 (9.88)	.09 (0.397)	
150	6	5.43 (138.8)	1.66 (0.441)	2.03 (6.67)	.03 (0.123)	
200	8	7.30 (185.6)	.700 (0.185)	1.52 (5.00)	.01 (0.0514)	
250	10	9.08 (230.8)	.365 (0.0966)	1.23 (4.04)	.006 (0.0268)	
300	12	10.87 (276.2)	.213 (0.0563)	1.03 (3.37)	.004 (0.0156)	

Typical fluid example

Table 10 Range of Measurable Water Flow Rate
(At standard condition of 59 F, $\rho = 62.428$ lb/cubic ft)

Nominal Size	mm	inch	Measurable Flow Rate in GPM (m ³ /h)	Range of Guaranteed Accuracy Flow Rate in GPM (m ³ /h)
15	.5		1.3 to 26 (0.30 to 6)	4.13 to 26 (0.94 to 6)
25	1		2.9 to 79.3 (0.65 to 18)	7.5 to 79.3 (1.7 to 18)
40	1.5		5.7 to 193 (1.3 to 44)	11.4 to 193 (2.6 to 44)
50	2		9.6 to 321 (2.2 to 73)	14.5 to 321 (3.3 to 73)
80	3		18.9 to 625 (4.3 to 142)	20.2 to 625 (4.6 to 142)
100	4		33.0 to 1091 (7.5 to 248)	33 to 1091 (7.5 to 248)
150	6		74.8 to 239.5 (17 to 544)	79.2 to 2395 (18 to 544)
200	8		149 to 4284 (34 to 973)	150 to 4284 (34 to 973)
250	10		264 to 6630 (60 to 1506)	265 to 6630 (60 to 1506)
300	12		379 to 9492 (86 to 2156)	379 to 9492 (86 to 215)

2. GENERAL DESCRIPTION

Table 11 Range of Measurable Air Flow Rate at Selected Process Pressures

Nominal Size	Flow Rate Limits	Minimum and Maximum Measurable Flow Rate in SCFM (Nm ³ /h at MPa in parenthesis)									
		0 PSI(0)	15 PSI(0.1)	25 PSI(0.2)	50 PSI(0.4)	75 PSI(0.6)	100 PSI(0.8)	150 PSI(1.0)	250 PSI(1.5)	300 PSI(2.0)	350 PSI(2.5)
0.5 in. (15mm)	min.	4.05(4.3)	5.76(6.7)	6.66(8.2)	8.51(10.5)	10.0(12.5)	11.34(16.1)	13.6(19.7)	19.3(28.6)	23(37.5)	26.7(46.4)
	max.	28.35(48.2)	57.32(95.8)	76.64(143)	125(239)	173.4(334)	221.9(429)	319.1(524)	514.3(762)	612.2(1000)	710.2(1238)
1.0 in. (25mm)	min.	9.38(11.0)	13.34(15.5)	15.43(19.0)	19.7(24.5)	23.2(29.0)	26.3(33.3)	31.5(40.6)	40(59.0)	47.3(77.5)	54.9(95.9)
	max.	87.48(149)	176.9(297)	236.5(444)	385.7(739)	535.1(1034)	684.8(1329)	984.7(1624)	1586(2361)	1889(3098)	2191(3836)
1.5 in. (40mm)	min.	18.67(30.0)	26.54(30.8)	30.69(37.8)	39.2(48.7)	46.17(61.6)	52.2(79.2)	62.6(97)	94.8(149)	112.9(184)	130.9(229)
	max.	208.7(356)	421.9(708)	564.2(1060)	920.0(1764)	1276(2468)	1633(3171)	2349(3875)	3785(5634)	4506(7394)	5228(9153)
2.0 in. (50mm)	min.	30.99(36.2)	44.0(51)	50.9(62.4)	65.1(80.5)	76.7(102)	86.7(131)	104(161)	157.4(233)	187.4(306)	217.4(379)
	max.	346.5(591)	700.4(1174)	936.6(1757)	1527(2922)	2119(4088)	2712(5254)	3899(6420)	6285(9335)	7481(12249)	8679(15164)
3.0 in. (80mm)	min.	60.14(70.1)	85.5(98.4)	98.9(120)	126.3(155)	148.7(197)	168.3(254)	201.8(310)	305.3(451)	363.6(591)	421.8(732)
	max.	672.4(1140)	1359(2266)	1817(3391)	2964(5642)	4113(7892)	5263(10143)	7568(12394)	12198(18021)	14518(23648)	16842(29274)
4.0 in. (100mm)	min.	104.4(122)	148.5(172)	171.7(211)	219.3(272)	258.3(334)	292.2(442)	350.4(540)	530.5(786)	631.5(1031)	732.6(1277)
	max.	1167(1990)	2360(3954)	3156(5919)	5148(9647)	7143(13775)	9140(17703)	13143(21632)	21182(31453)	25214(41274)	29251(51095)
6.0 in. (150mm)	min.	228.7(268)	325.1(377)	376.0(485)	480.2(808)	587.5(1131)	751.8(1453)	1081(1776)	1742(2583)	2073(3389)	2405(4196)
	max.	2556(4358)	5168(8659)	6911(12960)	11272(21559)	15639(30163)	20012(38765)	28777(47365)	46377(68867)	55205(90373)	64044(111875)
8.0 in. (200mm)	min.	496(575)	706.5(809)	817.0(990)	1043(1445)	1229(2202)	1390(2596)	1937(3175)	3122(4617)	3717(6059)	4312(7501)
	max.	4582(7792)	9264(15482)	12387(23172)	20204(38549)	28033(53933)	35872(69313)	51582(84693)	83129(123138)	99952(161591)	114796(200046)
10 in. (250mm)	min.	885(1037)	1259(1461)	1456(1788)	1859(2306)	2190(3127)	2478(4019)	2992(4911)	6911(7140)	5739(9370)	6658(11600)
	max.	7075(12049)	14304(23939)	19127(35833)	31196(59611)	43283(83400)	55387(107181)	79644(130968)	128353(190418)	152784(249881)	177246(309334)
12 in. (300mm)	min.	1269(1485)	1805(2093)	2087(2561)	2665(3303)	3139(4479)	3551(5756)	4288(7033)	6911(10225)	8226(13419)	9543(16612)
	max.	10142(17256)	20503(34286)	27415(51317)	44715(85370)	62039(119441)	79388(153499)	114157(187556)	183972(272699)	218890(357856)	254053(443017)

(1) At standard conditions STP 59°F, 14.7 PSIA (0 C, 1 atm).

(2) Pressure listed is at process temperature of 59°F (0°C).

(3) Maximum flow rate is at 262 f/s (80m/s).

(4) Minimum values are determined from Table 5.

Table 12 Range of Measurable Saturated Steam Flow Rate at Selected Process Pressures

Nominal Size	Flow Rate Limits	Minimum and Maximum Measurable Flow Rate in lb/h (kg/h at MPa) in parenthesis									
		15 PSI (0.1)	25 PSI (0.2)	50 PSI (0.4)	75 PSI (0.6)	100 PSI (0.8)	150 PSI (1)	250 PSI (1.5)	300 PSI (2)	350 PSI (2.5)	425 PSI (3)
0.5 in. (15mm)	min.	18.1(5.8)	20.7(7.0)	26.0(8.8)	30.4(10.4)	34.1(11.6)	40.8(12.8)	51(15.3)	55.5(19.1)	63.6(23.6)	70.9(28.1)
	max.	122.6(55.8)	160.8(80)	254.4(129)	346.2(177)	437(225)	616.9(272)	975.1(390)	1155(508)	1518(628)	1888(748)
1.0 in. (25mm)	min.	41.8(13.4)	47.9(16.2)	60.3(20.5)	70.3(24.1)	79(27.1)	93.8(30)	117.9(36)	128.4(41)	147.2(49)	164.1(58)
	max.	378.1(169.7)	496.3(247.7)	785.1(400)	1068(548)	1348(696)	1903(843)	3008(1209)	3563(1575)	4684(1945)	5825(2318)
1.5 in. (40mm)	min.	83.2(26.5)	119.9(32)	119.9(40.6)	139.8(47.7)	157.1(53.8)	186.6(59)	234.7(72)	255.4(93)	292.8(116)	348(138)
	max.	902.1(405)	1184(591)	1873(954)	2548(1310)	3216(1662)	4540(2012)	7177(2884)	8501(3759)	11175(4640)	13896(5532)
2.0 in. (50mm)	min.	138.1(44.0)	158.2(53)	199(67.3)	232.1(79)	260.8(89)	309.9(98)	389.6(119)	424(156)	486.1(192)	577.8(229)
	max.	1497(671)	1965(979)	3109(1580)	4231(2170)	5340(2753)	7538(3333)	11916(4778)	14113(6228)	18552(7688)	23070(9166)
3.0 in. (80mm)	min.	268(84.9)	307(103)	386.2(130)	450.5(152)	506.1(171)	601.3(189)	756(231)	822.8(300)	943.3(371)	1121(442)
	max.	2906(1295)	3814(1891)	6034(3050)	8210(4188)	10363(5314)	14628(6435)	23124(9224)	27389(12024)	36003(14842)	44771(17694)
4.0 in. (100mm)	min.	465(148)	533(179)	670.7(227)	782.4(267)	878.9(300)	1044(330)	1313(402)	1428(524)	1638(647)	1947(772)
	max.	5047(2261)	6624(3300)	10479(5326)	14259(7310)	17997(9276)	25406(11232)	40160(16102)	47567(20986)	62527(25907)	77754(30883)
6.0 in. (150mm)	min.	1019(324)	1167(392)	1468(498)	1712(600)	1924(761)	2286(922)	3303(1322)	3912(1723)	5142(2127)	6395(2536)
	max.	11051(4950)	14504(7226)	22944(11661)	31221(16010)	39404(20315)	55625(24595)	87929(35258)	104146(45953)	136900(56729)	170239(67624)
8.0 in. (200mm)	min.	2214(697)	2537(841)	3190(1068)	3722(1252)	4181(1410)	4968(1649)	6246(2364)	7012(3081)	9218(3803)	11463(4534)
	max.	19808(8851)	25997(12918)	41126(20850)	55962(28627)	70631(36325)	99706(43976)	157608(63043)	186678(82165)	245387(101433)	305147(120913)
10.0 in. (250mm)	min.	3947(1256)	4521(1518)	5687(1929)	6634(2260)	7453(2546)	11133(2801)	11133(3655)	12117(4764)	14233(5882)	17694(7011)
	max.	30585(13687)	40140(19977)	63500(32243)	86407(44268)	109055(56172)	153947(68005)	243350(97489)	288234(127058)	378881(156854)	471152(186978)
12.0 in. (300mm)	min.	5657(1799)	6481(2174)	8152(2762)	9509(3236)	10683(3646)	12692(4012)	15958(5235)	17367(6823)	20400(8423)	25369(10041)
	max.	46838(19602)	57535(28609)	91017(46175)	123850(63397)	156313(80445)	220658(97390)	348802(139614)	413135(181960)	543063(224633)	675317(267772)

(1) Maximum flow rate is at 262 f/s (80m/s).

(3) Minimum values are determined from Table 5.

2. GENERAL DESCRIPTION

Pressure Loss

At velocity of 10 m/s by water, $\Delta P = 108 \text{ kPa}$

At velocity of 80 m/s by atmospheric air,

$$\Delta P = 9 \text{ kPa}$$

obtained from the following equations.

$$\Delta P = 108 \times 10^{-5} \cdot \rho_f \cdot v^2 \dots \dots (1)$$

or

$$\Delta P = 135 \times \rho_f \cdot \frac{Q_f^2}{D^4} \dots \dots (2)$$

where,

ΔP : Pressure loss (kPa)

ρ_f : Density at operating condition (kg/m^3)

v : Flow velocity (m/s)

Q_f : Actual flow rate (m^3/h)

D : Internal Diameter (mm)

Figure 7 shows pressure loss versus actual flow rate. When nominal size 15 to 50mm and adjacent pipeline is Sch 40, and nominal size 80 to 300 mm and adjacent pipeline is Sch 80, the pressure loss will be approximately 10% smaller than calculated value.

(Example) Calculation of pressure loss

Calculate the pressure loss when the nominal size is 50 mm and the flow rate of water at operating temperature 80 °C is 30 m^3/h .

1. Since the density of water at 80 °C is 972 kg/m^3 , substitute this value in equation (2):

$$P = 135 \cdot 972 \cdot \frac{30^2}{51.1^4} = 17.3 \text{ kPa}$$

2. Obtain the pressure loss using equation (1). The flow velocity when the flow rate is 30 m^3/h is given by:

$$v = \frac{354 \times Q_f}{D^2} = \frac{354 \cdot 30}{51.1^2} = 4.07 \text{ m/s}$$

Therefore, substitute this value in equation (1):

$$P = 108 \cdot 10^{-5} \cdot 972 \cdot 4.07^2 = 17.3 \text{ kPa}$$

3. Obtain the pressure loss using Figure 7. Since the liquid pressure loss factor can be read as 18.5, then:

$$P = 98.1 \cdot 18.5 \cdot 972 \cdot 10^{-5} = 17.6 \text{ kPa}$$

Cavitation**(Minimum Back Pressure, Liquid service only):**

Cavitation occurs when the flow line pressure is low and flow velocity is high during fluid measurement, preventing correct measurement of flow rate. The optimum line pressure can be obtained from the following equation.

$$P = 2.7 \cdot \Delta P + 1.3 \times P_o \dots \dots (3)$$

Where,

P : Line pressure, 2 to 7 times as large as internal diameter on downstream of flowmeter body surface. (kPa absolute).

ΔP : Pressure loss (kPa).

Refer to the item above.

P_o : Saturation liquid vapor pressure at operating temperature (kPa absolute).

(Example) Confirmation of presence of cavitation

Suppose that the line pressure is 120 kPa abs and the flow rate scale is 0 to 30 m^3/h . It is only necessary to confirm the pressure at the maximum flow rate; therefore, the saturated steam pressure of water at 80 °C is as follows from the table of saturated steam pressures:

$$P_o = 47.4 \text{ kPa abs}$$

Therefore, substitute this value in equation (3):

$$P = 2.7 \times 17.3 + 1.3 \times 47.4 = 108.3 \text{ kPa abs}$$

Since the operating pressure of 120 kPa abs is higher than 108.3 kPa abs, no cavitation occurs.

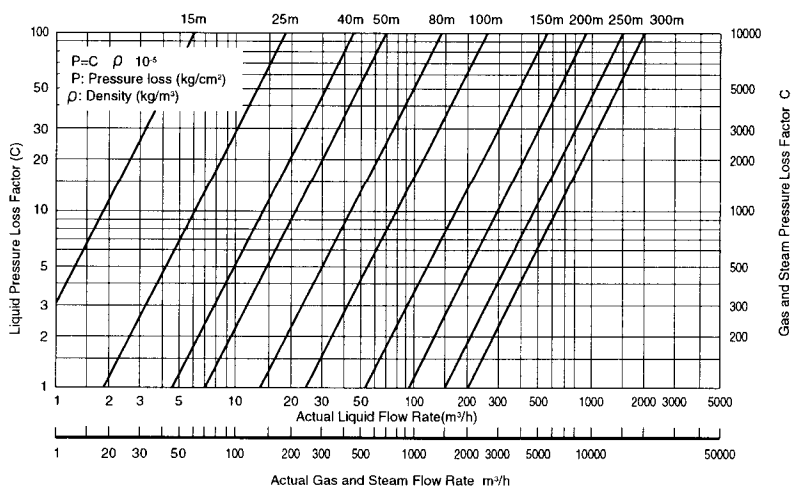


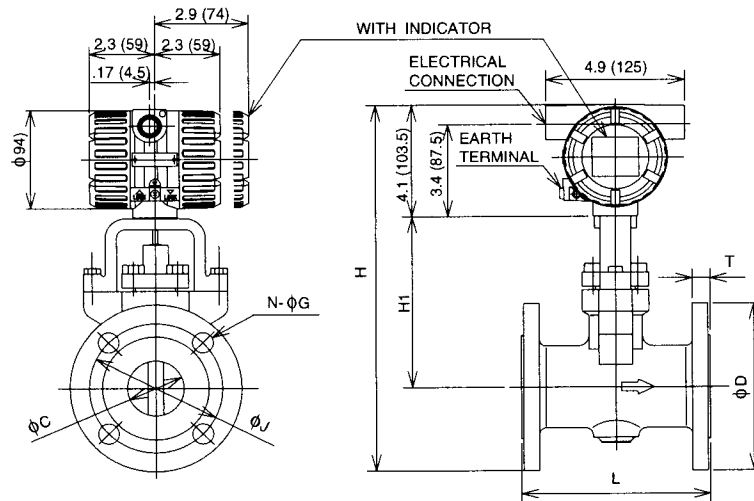
Figure 7 Pressure Loss

2. GENERAL DESCRIPTION

Flange type .5 to 4 in (15mm up to 100mm)

Note: All dimensions are nominal and for reference only. Dimensions are guaranteed through certified prints.

Unit: in (mm)



TYPE CODE	INTEGRAL/REMOTE															
	FV-505C-F [1.5 in (15mm)]								FV-510C-F [1 in (25mm)]							
	inches				millimeters				inches				millimeters			
PROCESS CONNECTION	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5
L	5.1 in		6.3		130 mm		160		5.9 in		7.5		150 mm		190	
C	.57 in				14.6 mm				1.0 in				25.7 mm			
D	3.5	3.8	3.8	4.8	88.9	95.3	95.3	120.7	4.3	4.8	4.8	5.9	108	124	124	149.4
H	10.8	10.8	10.8	11.5	275	278	278	291	11.3	11.6	11.6	12.1	286.5	294.5	294.5	307
H1	5 in				127 mm				5.1 in				129 mm			
T	.4	.6	.8	1.1	11.2	14.2	21	28.8	.6	.7	.9	1.4	14.2	17.5	24	34.9
J	2.4	2.6	2.6	3.3	60.5	66.5	66.5	82.6	3.1	3.5	3.5	4.0	79.2	89	89	101.6
N	4				4				4				4			
G	.6	.6	.6	.9	15.7	15.7	15.7	22.4	.6	.75	.75	1.0	15.7	19	19	25.4
WEIGHT	9 lb	10 lb	10 lb	15 lb	4.1 kg	4.3 kg	4.6 kg	6.7 kg	15 lb	16 lb	17 lb	24 lb	6.6 kg	7.2 kg	7.7 kg	11.1 kg

TYPE CODE	INTEGRAL/REMOTE															
	FV-515C-F [1.5 in (40mm)]								FV-520-C-F [2 in (50mm)]							
	inches				millimeters				inches				millimeters			
PROCESS CONNECTION	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5
L	5.9 in		7.9		150 mm		200		6.7 in		9.1		170 mm		230	
C	1.6 in		1.6		39.7 mm				2.0 in				51.1 mm			
D	5.0	6.1	6.1	7.0	127	155.4	155.4	177.8	6.0	6.5	6.5	8.5	152.4	165.1	165.1	215.9
H	11.9	12.5	12.5	12.9	303	317	317	328.5	13.3	13.3	13.5	14.6	337.5	344	344	369.5
H1	5.4 in				136 mm				6.2 in				158 mm			
T	.7	.8	1.1	1.5	17.5	20.6	28.8	38.2	.8	.9	1.3	1.8	19.1	22.4	31.8	44.5
J	3.8	4.5	4.5	4.9	98.6	114.3	114.3	124	4.7	4.7	5.1	6.5	120.7	127	127	165.1
N	4				4				4	.8	.8	4.8	8	8	8	8
G	.6	.9	.9	1.1	15.7	22.4	22.4	28.4	.8	.8	.8	1	19	19	19	25.4
WEIGHT	18 lb	21 lb	25 lb	36 lb	8.1 kg	9.3 kg	11.3 kg	16.2 kg	26 lb	29 lb	33 lb	59 lb	11.7 kg	13.2 kg	14.8 kg	26.5 kg

TYPE CODE	INTEGRAL/REMOTE															
	FV-530C-F [3 in (80mm)]								FV-540C-F [4 in (100mm)]							
	inches				millimeters				inches				millimeters			
PROCESS CONNECTION	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5
L	7.9 in		9.7		200 mm		245		8.7 in	9.5	11		220 mm		240	280
C	2.8 in				71 mm				3.7 in				93.8 mm			
D	7.5	8.3	8.3	9.5	190.5	209.6	209.6	241.3	9.0	10	10.7	11.5	228.6	254	273	292.1
H	14.7	15.1	15.1	15.7	374	383.5	383.5	399	16.1	16.6	16.9	17.3	409	420.5	430	439.5
H1	6.9 in				175 mm				7.5 in				190 mm			
T	.9	1.1	1.1	1.8	23.9	28.4	38.2	44.5	.9	1.3	1.8	2.0	23.9	31.8	44.5	50.9
J	6	6.6	6.6	7.5	152.4	168.2	168	190.5	7.5	7.9	8.5	9.3	190.5	200.2	216	235
N	4	8	8	8	4	8	8	8	8	8	8	8	8	8	8	8
G	.8	.9	.9	1.0	19	22.4	22.4	25.4	.8	.9	1.0	1.3	19	22.4	25.4	31.8
WEIGHT	44 lb	53 lb	56 lb	79 lb	20 kg	23.8 kg	25.4 kg	35.7 kg	61 lb	79 lb	112 lb	124 lb	27.4 kg	35.9 kg	50.8 kg	55.9 kg

(Note 1) Integral weight is the same as Remote

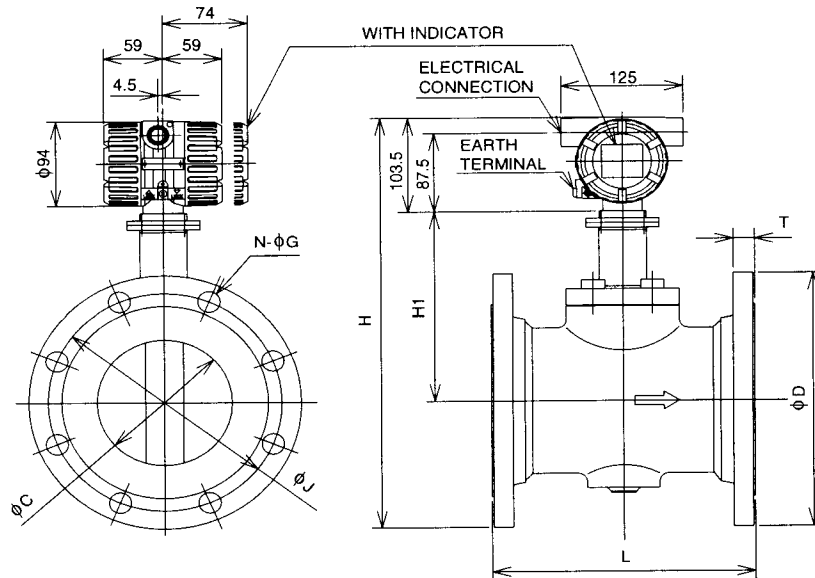
(Note 2) Add .5lb for display.

2. GENERAL DESCRIPTION

Flange type 6 to 12 in (150mm up to 300mm)

Note: All dimensions are nominal and for reference only. Dimensions are guaranteed through certified prints.

Unit: mm



TYPE	INTEGRAL/REMOTE															
CODE	FV-560C-F [6 in (150mm)]								FV-580C-F [8 in (200mm)]							
PROCESS CONNECTION	inches				millimeters				inches				millimeters			
	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5
L	10.6 in	12.2	13.2		270 mm	310	336		12.2 in	14.5	15.2		310 mm	370	386	
C	5.5 in				138.8 mm				7.3 in				185.6 mm			
D	11	12.5	14	15	279.4	317.5	356	381	13.5	15	16.5	18.5	342.9	381	419.1	469.9
H	17.8	18.5	19.3	19.8	452	471	491	503	20.3	21.1	21.8	22.8	516	535	554	579
H1	8.2 in				209 mm				9.5 in				241 mm			
T	1	1.4	2.1	2.4	25.4	36.6	54.4	62	1.1	1.6	2.4	2.8	28.4	41.1	62	69.9
J	9.5	10.6	11.5	12.5	241.3	269.7	292	317.5	11.8	13	13.7	15.5	298.5	330.2	349.3	393.7
N	8	12	12	12.8		12	12	12	8	12	12	12	8	12	12	12
G	.9	.9	1.1	1.3	22.4	22.4	28.4	31.8	.9	1	1.25	1.5	22.4	25.4	31.8	38.1
WEIGHT	80 lb	120 lb	186 lb	234 lb	36.4 kg	54.4 kg	84.4 kg	106 kg	122 lb	177 lb	300 lb	401 lb	55.4 kg	80.4 kg	136 kg	182 kg

TYPE	INTEGRAL/REMOTE							
CODE	FV-591C-F [10 in (250mm)]				FV-592C-F [12 in (300mm)]			
PROCESS CONNECTION	inches		millimeters		inches		millimeters	
	BA1	BA2	BA1	BA2	BA1	BA2	BA1	BA2
L	14.6 in		370 mm		15.7 in		400 mm	
C	9.1 in		230.8 mm		10.9 in		276.2 mm	
D	16	17.5	406.4	444.5	19	20.5	482.6	520.7
H	23	23.7	584	603	25.7	26.4	652	671
H1	10.9 in		277 mm		12.1 in		307 mm	
T	1.2	1.9	31.2	48.8	1.3	2.0	32.8	51.8
J	14.3	15.2	362	387.4	17	17.8	431.8	450.9
N	12	16	12	16	12	16	12	16
G	1.0	1.1	25.4	28.5	1.0	1.3	25.4	31.8
WEIGHT	199 lb	75 lb	90 kg	125 kg	308 lb	392 lb	140 kg	178 kg

(Note 1) Integral weight is the same as Remote

(Note 2) In case of with indicator, add 0.2kg

2. GENERAL DESCRIPTION

===== OPERATING INSTRUCTIONS =====

Specify the following when ordering :

1. Model and suffix codes.
2. Flow conditions (Please fill out the order sheet)
 - a. Fluid name (in case of a mixed gas, fill out the gas composition).
 - b. Maximum scale reading, normal flow and minimum flow rates.
 - c. Maximum and normal operating temperatures.
 - d. Maximum and normal operating pressures.
 - e. Density at normal conditions.
 - f. Viscosity at normal conditions.
 - g. Relative humidity at flowing conditions (wet gas only).
 - h. Deviation factor (if required for gas).
 - i. Output type (analog output, pulse output or simultaneous output)
 - j. Pulse rate
 - k. Totalized value rate
 - l. Nominal size

3. INSTALLATION

3.1 Precautions Regarding Installation Locations

(1) Ambient Temperature

Avoid an area which has wide temperature variations. When the installation area is subjected to heat radiation from process plant, ensure adequate heat prevention or ventilation.

(2) Atmospheric Conditions

Avoid installing the vortex flowmeter in a corrosive atmosphere. When the vortex flowmeter must be installed in a corrosive atmosphere, adequate ventilation must be provided.

(3) Mechanical Shock or Vibration

The vortex flowmeter is of sturdy construction, but select an area subject to minimize mechanical vibration or impact shock. If the flowmeter is subject to vibrations, it is recommended that pipeline supports to be provided as shown in Figure 3.1.

- (e) Handle the vortex flowmeter carefully when measuring dangerous liquids, so that the liquids do not splash into eyes or on face. When using dangerous gases, be careful not to inhale them.

3.2 Piping

See Table 3.1 about Valve Position and Straight Pipe Length and so on.

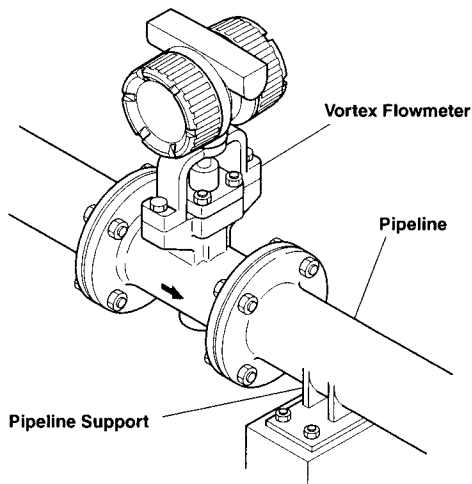


Figure 3.1

(4) Precautions Regarding Piping

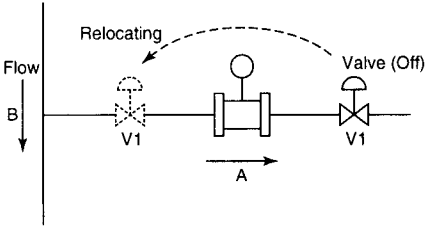
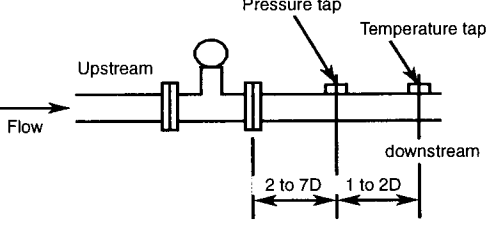
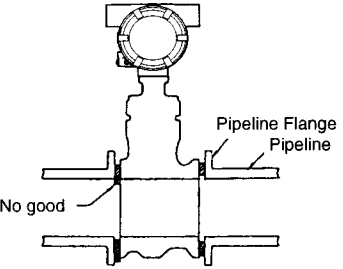
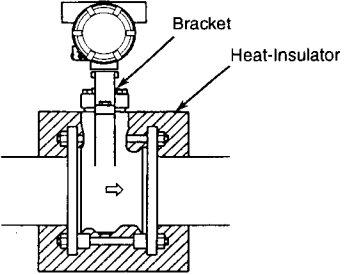
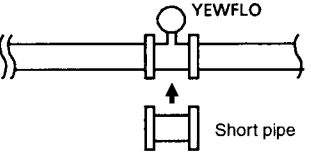
- (a) Ensure that the process connector bolts are tightened firmly.
- (b) Ensure that no leak exists in the process connection pipeline.
- (c) Do not apply a pressure higher than the specified maximum working pressure.
- (d) Do not loosen or tighten the flange mounting bolts when the assembly is pressurized.

3. INSTALLATION

Table 3.1 Installation

Description	Figure
Piping support: Typical vibration immunity level is 1G for normal piping condition. Piping support should be fixed in case of over 1G vibration level.	
Installation direction: If a pipe is always filled with liquids, the pipe can be installed vertically or at inclined angle.	
Adjacent pipes: The process pipeline inner diameter should be larger than the YEWFLO inner diameter. Use the following adjacent pipe. Nominal size 15mm up to 50mm : Sch 40 or less. Nominal size 80mm up to 300mm : Sch 80 or less.	
Reducer pipe: Ensure the upstream straight pipe length to be 10D or more, and the downstream straight pipe length to be 5D or more for per reducer pipe. (D: nominal YEWFLO diameter)	
Expander pipe: Ensure the upstream straight pipe length to be 10D or more, and the downstream straight pipe length to be 5D or more for per expander pipe.	
Bent pipe and straight pipe length: Ensure the upstream straight pipe length to be 10D or more, and the downstream straight pipe length to be 5D or more for per bent pipe.	
Valve position and straight pipe length: Install the valve on the downstream side of the flowmeter. The upstream straight pipe length dependent on the element located on the upstream such as reducer/expander, bent and etc., refer to description as above. Keep 5D or more for downstream straight pipe length. In case the valve has to be installed on the upstream of the flowmeter, ensure the upstream straight pipe length to be 20D or more, and the downstream straight pipe length be 5D or more.	
Fluid vibration: For a gas line which uses a position-type or roots-type blower compressor or a high-pressure liquid line (about 1MPa or more) which uses piston-type or plunger-type pump, fluid vibrations may be produced. In this case, install valve on the upstream side of YEWFLO. For inevitable fluid vibration, put a vibration damping device such as throttling plate or expansion section in the upstream side of YEWFLO.	
Piston-type or plunger pump: Install the accumulator on the upstream side of YEWFLO to reduce fluid vibrations.	

3. INSTALLATION

Description	Figure
<p>Valve position (T-type piping exist): When pulsation causes by a T-type piping exist, install the valve on the upstream of the flowmeter.</p> <p>Example: As shown in the figure, when the valve V1 is turned off, the fluid flow through B as to meter A the flow is zero. But due to the pulsating pressure is detected, the meter is zero point become fluctuating. To avoid this, change the valve V1 location to V1'.</p>	
<p>Pressure and Temperature Taps: Pressure tap outlet: install this tap between 2D and 7D on the downstream side of a flowmeter. Temperature tap outlet: install this on the downstream side 1D to 2D away from a pressure tap.</p>	
<p>Mounting Gasket: Avoid mounting gaskets which protrude into the pipe line. This may cause inaccurate readings. Use the gaskets with bolt holes, even if YEWFLOW is the wafer type. 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>	
<p>Heat-Insulation: When an integral-type flowmeter or a remote type detector is installed and the pipe carrying high-temperature fluids is heat-insulated, do not wrap adiabatic materials around the installation bracket of the converter.</p>	
<p>Flushing of the pipe line: Flush and clean scale, incrustation and sludge on the inside of pipe for newly installed pipe line and repaired pipe line before the operation. For flushing, the flow should flow through bypass-piping to avoid damaging the flowmeter. If there is no bypass-piping, install short pipe instead of the flowmeter.</p>	

3. INSTALLATION

3.3 Precautions Regarding Installation

(1) Gas or Steam Measuring Precautions

• Piping to Prevent Standing Liquid

Mount YEWFLO in a vertical pipeline to avoid liquid traps. When YEWFLO is installed horizontally, raise that part of the pipeline in which the YEWFLO is installed.

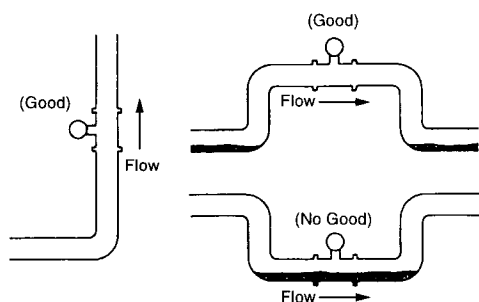


Figure 3.2

(2) Liquid Measurement Precautions

To insure accurate measurement, the YEWFLO must always have a full pipe.

• Piping Requirements for Proper Operation

Allow the flow to flow against gravity. When the flow is moving with gravity, lift the down-stream pipe length above the YEWFLO installation level to maintain full pipeline.

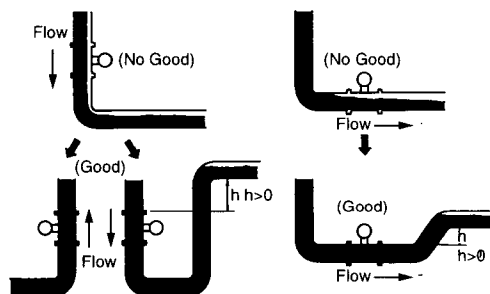


Figure 3.3

• Piping for Avoiding Bubbles

Flows containing both gas and liquid cause problems. Avoid gas bubbles in a liquid flow. Piping should be carried out to avoid bubble generation.

Install the valve on the downstream side of the flowmeter because pressure drop across the control valve may cause gas to come out of the solution.

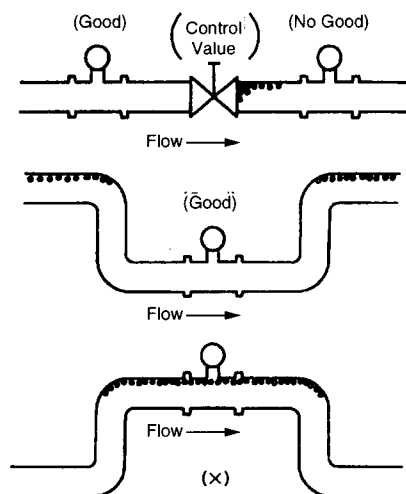


Figure 3.4

(3) Multi-Phase Flow

YEWFLO can measure gas, liquid and steam when there is no change in state. However, accurate measurement of mixed flows (e.g. gas and liquid) is not possible.

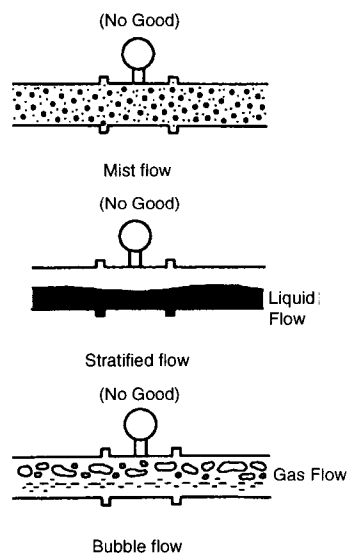


Figure 3.5

3. INSTALLATION

(4) Pipeline Diameter and digital YEWFO

The process pipeline inner diameter should be slightly larger than the vortex flowmeter inner diameter, schedule 40 or lower pipe should be used for 1/2 to 2 inch flowmeters and schedule 80 or lower pipes for 3 to 8 inch flowmeters.

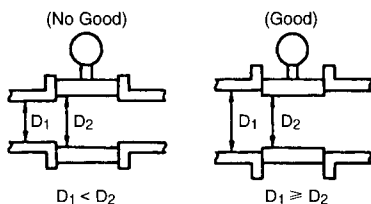


Figure 3.6

(5) Waterproof Construction

The vortex flowmeter is of NEMA4X waterproof construction. However, it cannot be used under water.

3.4 Piping to Improve Durability**(1) Pipe cleaning****¥ Flushing of pipe line (Cleaning)**

Flush and clean scale, incrustation and sludge on the inside of pipe wall for newly installed pipe line and repaired pipe line before the operation.

¥ Fluid Carrying Solids

Do not measure fluids that carry solids (e.g. sand and pebbles). Make sure users periodically remove solids adhering to the vortex shedder.

¥ Obstruction of flow fluids may cause to make a chemical reaction and the fluid will be crystalized and hardened, and be deposited on the pipe wall and shedder bar.

In those cases, clean shedder bar.

(2) Bypass piping

Installing a bypass, as illustrated in the figure below, permits the YEWFO to be checked or cleaned conveniently (vortex shedder, etc.).

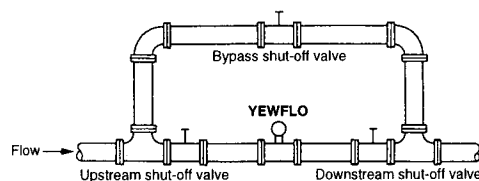


Figure 3.7

3. INSTALLATION

3.5 Installing the Vortex Flowmeter

Before installing the instrument verify the following. The direction of flow should match to the arrow mark on the instrument body. When changing the orientation of the terminal box, refer to "3.7."

Installation of Vortex flowmeter of the wafer and flange type is shown in Table 3.3.

When installing the wafer type vortex flowmeter, it is important to align the instrument bore with the inner diameter of the adjacent piping.

To establish alignment, use the four collars supplied with the instrument.

- Four collars are supplied for 1/2 inch (15mm) to 1- 1/2 inch (40mm), 2 inch of JIS 10K or ANSI class 150 or JPI class 150, and 3 inch of ANSI class 150 or JPI class 150. Install the instrument as illustrated in Figure 3.2.

- If the adjacent flanges have eight bolt holes, insert the stud bolts in the holes on the instrument shoulder.

Stainless steel stud bolts and nuts are available on order.

When they are to be supplied by the user, refer to Table 3.1 for stud bolt length. Gaskets must be supplied by the user.

- Gasket:

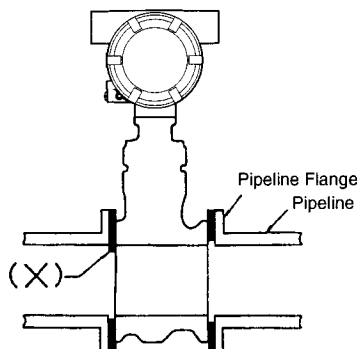
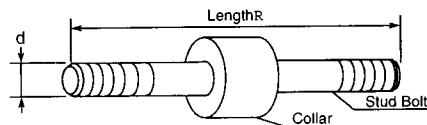
Avoid mounting gaskets which protrude into the pipeline. This may cause inaccurate readings.

Use gaskets with bolt holes, even if YEWFLOW is of the wafer type.

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.

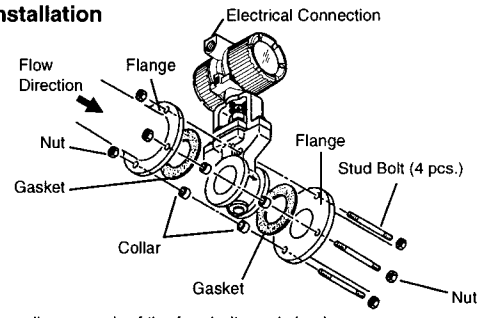
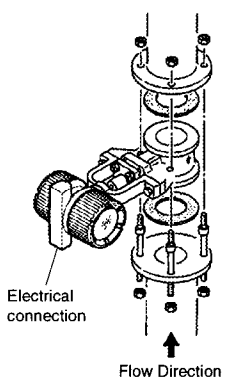
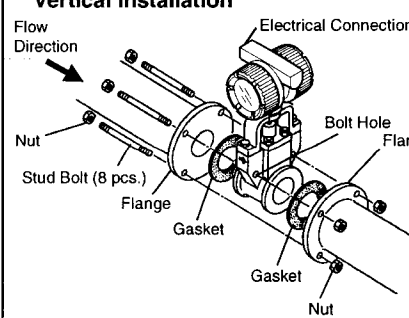
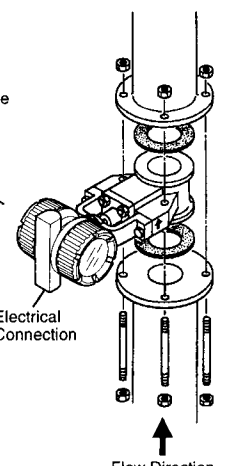
Table 3.2

Size mm (inch)	Flange Rating	Major Diameter of External Thread of Stud Bolt d (mm)	Length R (mm)
15A (1/2)	JIS 10K, 20K	12	160
	JIS 40K	16	160
	ANSI 150, 300, 600	12.7	155
25A (1)	JIS 10K, 20K, 40K	16	160
	ANSI 150	12.7	155
	ANSI 300, 600	15.9	160
40A (1-1/2)	JIS 10K, 20K	16	160
	JIS 40K	20	170
	ANSI 150	12.7	155
	ANSI 300, 600	19.1	170
50A (2)	JIS 10K, 20K, 40K	16	200
	ANSI 150, 300, 600	15.9	
80A (3)	JIS 10K	16	220
	JIS 20K, 40K	20	
	ANSI 150	15.9	
	ANSI 300, 600	19.1	
100A (4)	JIS 10K	16	220
	JIS 20K	20	240
	JIS 40K	22	270
	ANSI 150	15.9	240
	ANSI 300	19.1	240
	ANSI 600	22.2	270



3. INSTALLATION

Table 3.3(a) Installation of Wafer Type Vortex Flowmeter

Wafer type	Description								
<p>When Installation Collar are required, the installation vortex flowmeters applied to the following line sizes and flange ratings.</p> <table border="1"> <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, ANSI class 150</td></tr> <tr> <td>80(3)</td><td>ANSI class 150</td></tr> </tbody> </table> <p>WARNING</p> <p>The inside diameter of the gasket must be larger than the pipe inner diameter so that it will not disturb the flow in the pipeline.</p> <p>WARNING</p> <p>When installing the Flowmeter vertically in the open air, change the electrical connection port direction to the ground. If the electrical connection port is installed upwards, rain water might leak in.</p>	Size mm(inch)	Flange Rating	15 to 40 (1/2 to 1-1/2)	All ratings	50(2)	JIS 10K, ANSI class 150	80(3)	ANSI class 150	<p>Vertical Installation</p>  <ol style="list-style-type: none"> (1) Insert four collar on each of the four bolts and check that all four collars contact the outside diameter of the flowmeter body. (2) Tighten the four bolts uniformly. Check for leakage from the flange connections. <p>Horizontal Installation</p>  <ol style="list-style-type: none"> (1) Insert two each collars on each of the lower two bolts. (2) Place the flowmeter body on the lower two bolts. (3) Tighten the four bolts (including upper two bolts) and nuts uniformly. (4) Check for leakage from the flange connections.
Size mm(inch)	Flange Rating								
15 to 40 (1/2 to 1-1/2)	All ratings								
50(2)	JIS 10K, ANSI class 150								
80(3)	ANSI class 150								
<p>When Installation Collars are not required, the installation vortex flowmeters applied to the following line sizes and flanges.</p> <table border="1"> <thead> <tr> <th>Size mm(inch)</th><th>Flange Rating</th></tr> </thead> <tbody> <tr> <td>50(2)</td><td>JIS 20K, 40K ANSI class 300,600 JPI class 300,600</td></tr> <tr> <td>80(3)</td><td>JIS 10K, 20K, 40K ANSI class 300, 600 JPI class 300,600</td></tr> <tr> <td>100(4)</td><td>JIS 10K, 20, 40K ANSI class 150, 300, 600 JPI class 150,300,600</td></tr> </tbody> </table>	Size mm(inch)	Flange Rating	50(2)	JIS 20K, 40K ANSI class 300,600 JPI class 300,600	80(3)	JIS 10K, 20K, 40K ANSI class 300, 600 JPI class 300,600	100(4)	JIS 10K, 20, 40K ANSI class 150, 300, 600 JPI class 150,300,600	<p>Vertical Installation</p>  <p>Horizontal Installation</p>  <ol style="list-style-type: none"> (1) Insert two stud bolts in the bolt holes on the flowmeter shoulder to align the instrument body with the inner diameter of the adjacent piping. (2) Tighten all bolts uniformly and check that there is no leakage between the instrument and the flanges.
Size mm(inch)	Flange Rating								
50(2)	JIS 20K, 40K ANSI class 300,600 JPI class 300,600								
80(3)	JIS 10K, 20K, 40K ANSI class 300, 600 JPI class 300,600								
100(4)	JIS 10K, 20, 40K ANSI class 150, 300, 600 JPI class 150,300,600								

3. INSTALLATION

Table 3.3(b) Installation of Flange Type Vortex Flowmeter

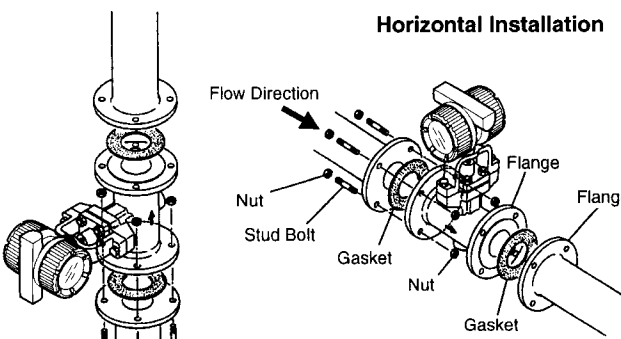
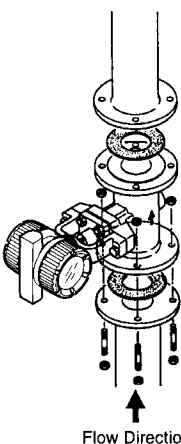
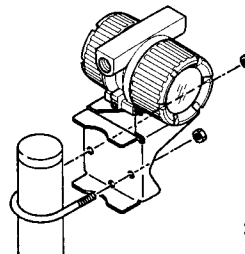
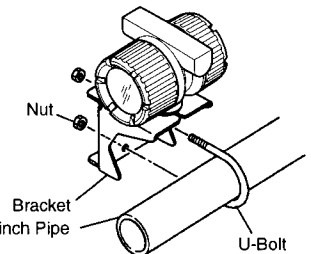
Flange type	Description
<p>Use the stud bolts and nuts supplied with the flowmeter of the user. The gaskets should be supplied by the user.</p> <p>CAUTION</p> <p>The inside diameter of the gasket must be larger than the pipe inner diameter so that it will not disturb the flow in the pipeline.</p>	<p>Horizontal Installation</p>  <p>Vertical Installation</p> 

Table 3.3(c) Installation of remote Type Converter

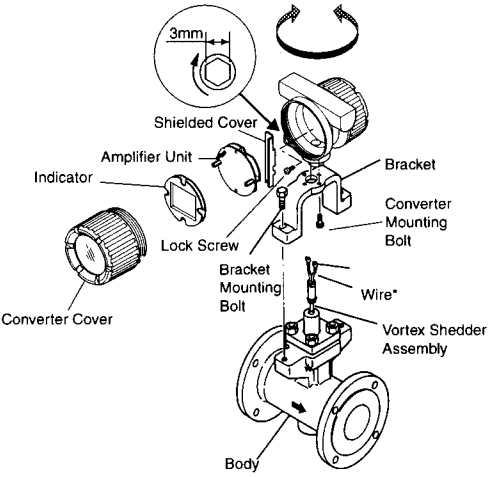
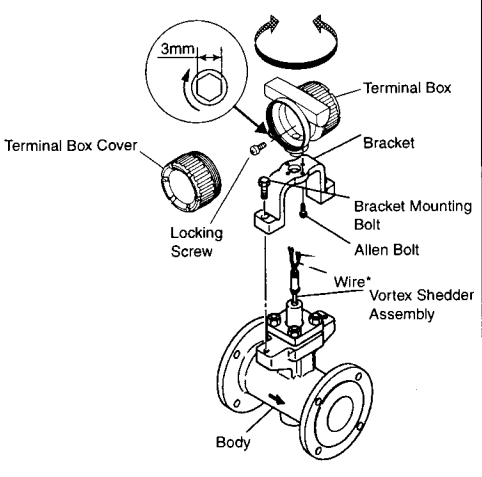
Remote type converter	Description
<p>CAUTION</p> <p>A signal cable is used between the remote type flowmeter and the converter. The maximum signal cable length is 97.5ft (30m).</p>	<p>The converter is mounted on a 2-inch (60.5mm outer dia.) stanchion or horizontal pipe. Do not mount the converter on a vertical pipe. It makes wiring and maintenance difficult. The converter mounting orientation can be changed as illustrated below.</p> <p>Stanchion Mounting</p>  <p>Horizontal Pipe Mounting</p> 

3. INSTALLATION

3.6 Changing the Terminal Box and the Indicator Orientation

3.6.1 Terminal Box

The terminal box can be changed in four directions with respect to the flow direction.

Integral Type Vortex Flowmeter	Remote Converter Type Vortex Flowmeter
<p><1> Remove the converter cover.</p> <p><2> For amplifier unit removal, refer to paragraph 3.7.2.</p> <p><3> Disconnect the vortex shedder assembly lead-wires from the converter.</p> <p><4> Remove the bracket mounting bolts and remove the converter and bracket from the flowmeter body. The bracket applies to the 1 (25mm) to 4 (100mm) inch flowmeters.</p> <p><5> Remove the four allen bolts securing the converter to the bracket.</p> <p><6> Turn the converter to the desired orientation. When reassembling the converter, reverse the above procedure.</p>  <p>The diagram shows the integral type vortex flowmeter assembly. It includes a converter with a shielded cover, an indicator, an amplifier unit, a bracket, a converter mounting bolt, a bracket mounting bolt, a wire, a vortex shedder assembly, and a body. A 3mm dimension is indicated for the converter cover removal.</p>	<p><1> Remove the terminal box cover.</p> <p><2> Loosen two screws to disconnect leadwires from shedder bar.</p> <p><3> Remove the bracket mounting bolts and remove the terminal box and bracket from the flowmeter body. The bracket applies to the 1 (25mm) to 4 (100mm) inch flowmeters.</p> <p><4> Remove the four allen bolts securing the terminal box to the bracket.</p> <p><5> Turn the terminal box to the desired orientation. When reassembling the terminal box, reverse the above procedure.</p>  <p>The diagram shows the remote converter type vortex flowmeter assembly. It includes a terminal box, a terminal box cover, a bracket, a bracket mounting bolt, a locking screw, an allen bolt, a wire, a vortex shedder assembly, and a body. A 3mm dimension is indicated for the terminal box cover removal.</p>

3. INSTALLATION

3.6.2 Indicator Removal and Rotation

If necessary for servicing of amplifier, remove the indicator as follows.

- (1) Turn the power OFF.
- (2) Remove the cover.
- (3) For the indicator, disconnect the cable connector from the amplifier unit.
- (4) Loosen the two indicator mounting screws using a Phillips screwdriver.
- (5) Pull out the indicator.
- (6) Reinstall the indicator in the reverse order to its removal (above) and secure the mounting screws.

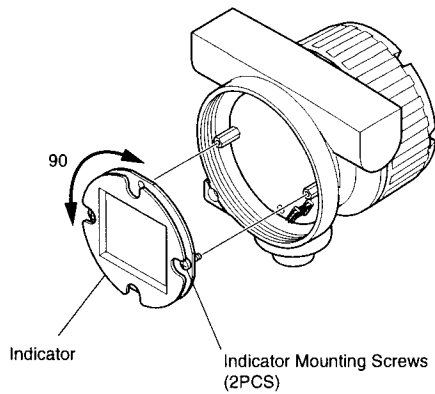


Figure 3.1 Removing and Reinstalling the Indicator

3.6.3 Amplifier Unit Removal and Mounting

The amplifier unit can be removed as follows.

- (1) Turn the power OFF.
- (2) Remove the converter cover.
- (3) Remove the indicator totalizer according to the procedures described in paragraph 3.2.
- (4) Loosen the terminal screws and remove the amplifier unit.

The amplifier unit can be mounted as follows.

- (1) Put two-mounting pins① into mounting hole②.
- (2) Push the head of two-mounting① head lightly.
- (3) Push head of IC⑤ and mount the amplifier unit③.
- (4) Tighten a mounting screw④.



IMPORTANT

Do not turn the amplifier unit. The connector pins may be damaged.

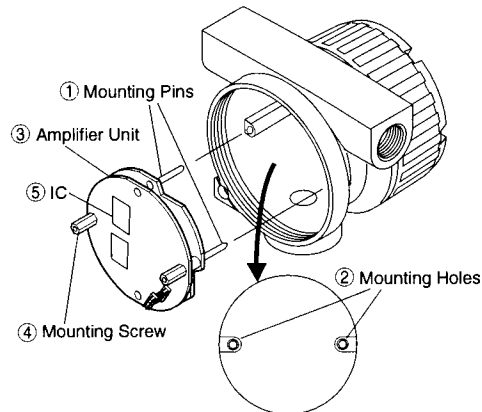


Figure 3.2 Removing Amplifier Unit

4. WIRING

4.1 Power Supply and Load Resistance

The remote converter type (FV-500C-RMK) vortex flowmeter is used with the converter. To connect these instruments, use a special cable. 30m (97.5 feet) is the maximum length.

The integral type vortex flowmeter measures fluid flow rates and converts them directly to a 4 to 20 mA DC output and pulse output signals.

Table 4.1 shows the connection method of several output conditions.

(1) Analog Output (4 to 20 mA DC)

This converter uses the same two wires for both, the signal and power supply. A DC power supply is required in a transmission loop. The total leadwire resistance including the instrument load and power distributor (supplied by the user) must conform to a value in the permissible load resistance range. Table 4.1 shows typical wiring connections.

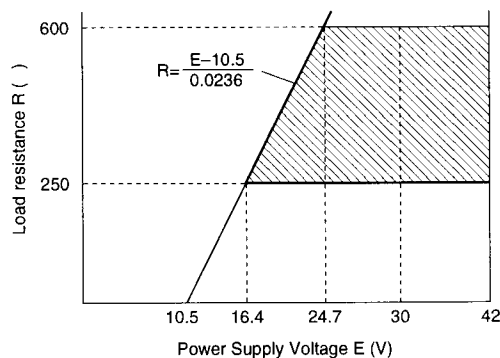


Figure 4.1 Relationship between Power Supply Voltage and Load Resistance (4 to 20 mA DC Output)

(2) Pulse output and Alarm, Status Output

This version uses three wires between the converter and the power supply. A DC power and load resistance are required, and pulse output is connected to a totalizer or an electric counter. Low level of the pulse output is 0 to 2V. No communication is possible over a transmission line. Communication via the amplifier board is always possible irrespective of the wiring condition.

(3) Simultaneous Analog-Pulse Output

When using YEWFO in the simultaneous analog -pulse output mode, the communicable distance of the transmission line is restricted on the wiring method. Table 4.1 shows the examples of flowmeter installation for this output mode. Communication via the amplifier board is always possible irrespective of the wiring condition.



IMPORTANT

For pulse output and the simultaneous analog-pulse output, use the load resistance. Refer to Table 4.1.

4.2 Connection

Table 4.1 shows the connection sample of connection for power supply and load resistance. The terminal position of each connection is shown in Figure 4.2.

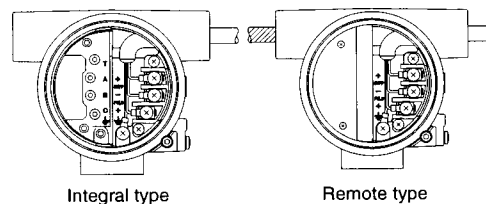
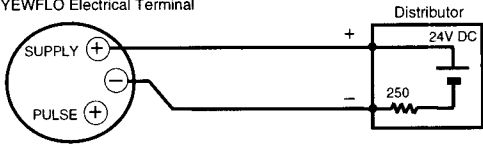
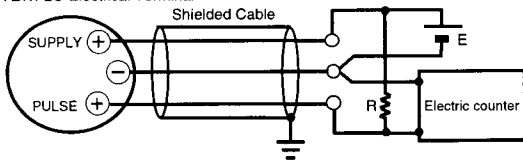
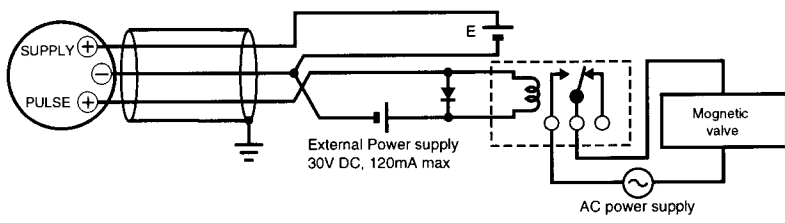
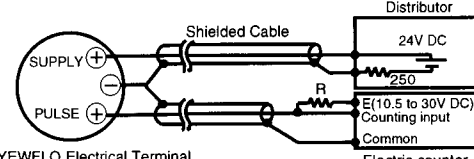
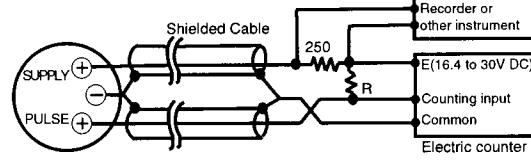
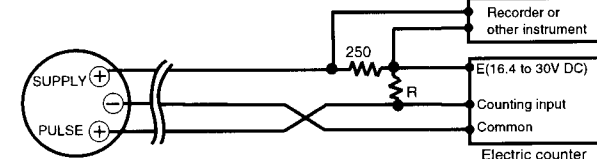


Figure 4.2

4. WIRING

Table 4.1 The connection example for simultaneous analog and pulse and alarm, status output.

Connection	Description
Analog Output	<p>YEWFO Electrical Terminal</p> 
Pulse Output	<p>YEWFO Electrical Terminal</p> <p>Use the Three-wire shielded cable.</p> 
Status Output Alarm Output	<p>YEWFO Electrical Terminal</p>  <p>External Power supply 30V DC, 120mA max</p> <p>AC power supply</p>
<p>Simultaneous Analog-Pulse Output</p> <p>Example 1 In this case, Communication is possible (up to a distance of 2km when a CEV cable is used).</p> <p>Example 2 In this case, Communication is possible (up to a distance of 200m when a CEV cable is used and R = 1k).</p> <p>Example 3 In this case, No communication is possible (when shielded cable is not used).</p>	<p>When analog and pulse output are used, the length of communication line is subjected to wiring conditions. Refer to examples 1 to 3. If the communication carries out from amplifier, no need to consider wiring conditions.</p> <p>Example 1: For the shielded cables in this example of flowmeter installation, use two-wire separately shielded cables. This supply voltage requires a power source with a maximum output current of no less than E/R.</p>  <p>Example 2: For the shielded cables in this example of flowmeter installation, use two-wire separately shielded cables. This supply voltage requires a power source with a maximum output current of no less than E/R+25mA. The supply voltage requires output impedance no more than 1/1000 of R (load resistance).</p>  <p>Example 3: This supply voltage requires a power source with a maximum output current of no less than E/R+25mA.</p> 
The range of load resistance R for the pulse output.	<p>The load resistance of pulse output should be used to 1kΩ, 2W.</p> <p>If no translation of the pulse output possible by the cable length or the frequency of the pulse output, the load resistance should be selected by calculation as shown below.</p> $\frac{E(V)}{120} \leq R(k\Omega) \leq \frac{0.1}{C(\mu F) \times f(kHz)}$ <p>Example of CEV cable capacitance 0.1 μF/km</p> $P(mW) = \frac{E^2(V^2)}{R(k\Omega)}$ <p>Where E = Supply voltage (V) f = Frequency of pulse output (kHz) R = Value of load resistance (kΩ) C = Cable capacitance (μF) P = Power ratio of the load resistance (mW)</p>

4.3 Wiring Cables and Wires

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

- (1) Use 600V PVC insulated wire or equivalent standard wire or cable.
- (2) Use shielded wire in areas susceptible to electrical noise (both analog and pulse output versions).
- (3) In areas with high or low ambient temperatures, use wires or cables suitable for such temperatures.
- (4) In atmospheres where oils or solvents, corrosive gases or liquids may be present, use suitable wires or cables.
- (5) Use cable which is withstood temperature of up to 60 C and more, when ambient temperature is more than 60 C.



IMPORTANT

For the remote type, use FV-500CABLE signal cable to connect the converter and remote type flowmeter.

4.4 Connection of the Remote Type Signal Cable

The remote type signal cable is shown in Figure 4.3 and 4.4, and the terminal is in Figure 4.5.

The maximum cable length is 30 m (97.5 feet).

Remove terminal box cover and wiring connection dust-cap before wiring.

For remote type the converter has two electrical connections (cable inlets). Use the left connection as viewed from the terminal box for the FV-500CABLE signal cable and the right connection for the transmission cable.

4. WIRING

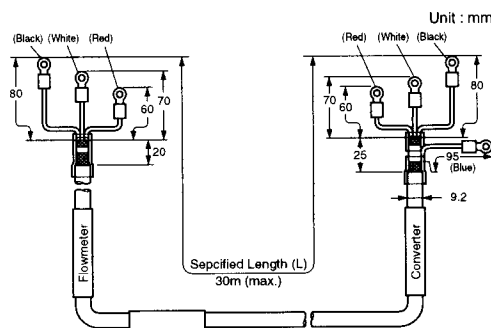


Figure 4.3 FV-500CABLE Signal Cable

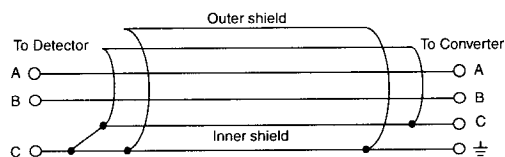


Figure 4.4 Construction of Remote Type Signal Cable

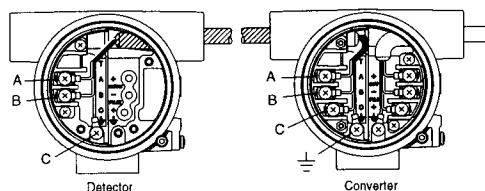


Figure 4.5 Terminal of Detector and Converter

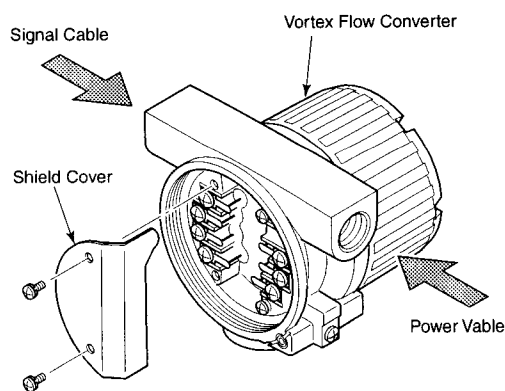


Figure 4.6 Shielded Cover

4. WIRING

4.5 Wiring Cautions

- (1) Lay wiring as far as possible from electrical noise sources such as large transformers, motors and power supplies.
- (2) It is recommended that crimp-on type solderless lugs be used for large wire ends.
- (3) For general use, it is recommended that conduits and ducts or racks be used to protect wiring from water or mechanical damage. A rigid steel conduit or flexible metal conduit is recommended. See Figure 4.9.

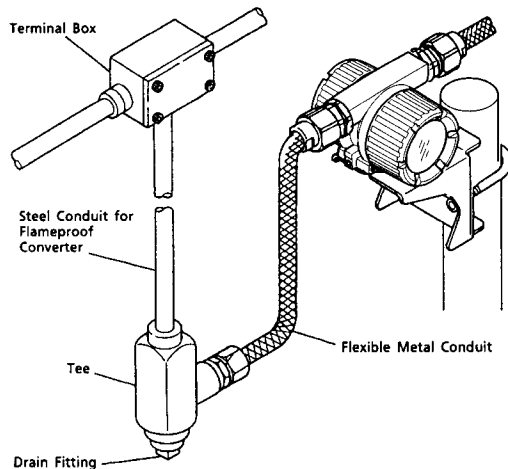


Figure 4.9

4.6 Grounding

- (1) For analog output version, ground the primary circuit in the power supply and the ground terminal of the flowmeter terminal box.
- (2) For pulse output version, ground the flowmeter. Also ground the shielded cable between the converter and the pulse receiver.
- (3) Grounding should satisfy Class D requirements (ground resistance 100 Ω or less).
- (4) Use 600V PVC insulated wire for grounding.

5. BASIC OPERATING PROCEDURES

Data setting can be performed with the three keys on the front panel (SET, SHIFT and INC).

Description of unit indications and its votes.

Table 5.1 shows the description of unit indications and its votes.

5.1 Construction of the Display

Figure 5.1 shows the configuration of the digital YEW FLO display panel (if equipped).

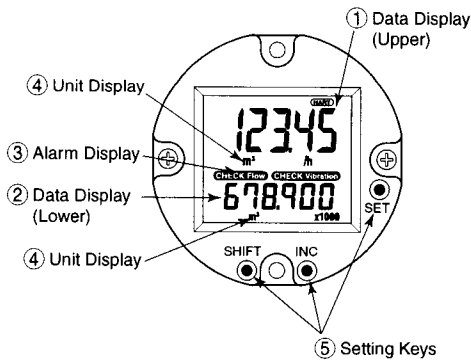


Table 5.1 Unit Indicator

Unit	Upper Indication	Lower Indication
%	○	×
m³	○	○
Nm³	○	○
N	○	○
Sm³	○	○
S	○	○
kg	○	○
t	○	○
/h	○	×
/m	○	×
/s	○	×
/d	○	×

Figure 5.1 Construction of the Display

- ① Data Display(Upper) : Displays flowrate data, setting data, total data.
- ② Data Display(Lower) : Displays total data, alarm data.
- ③ Alarm Display : Displays alarm of a flow error and a vibration error.
- ④ Unit Display : Displays Flowrate unit.
- ⑤ Setting Keys : These keys are used to change flow rate data displays and type of setting data.

5.2 Display Contents in Display Section

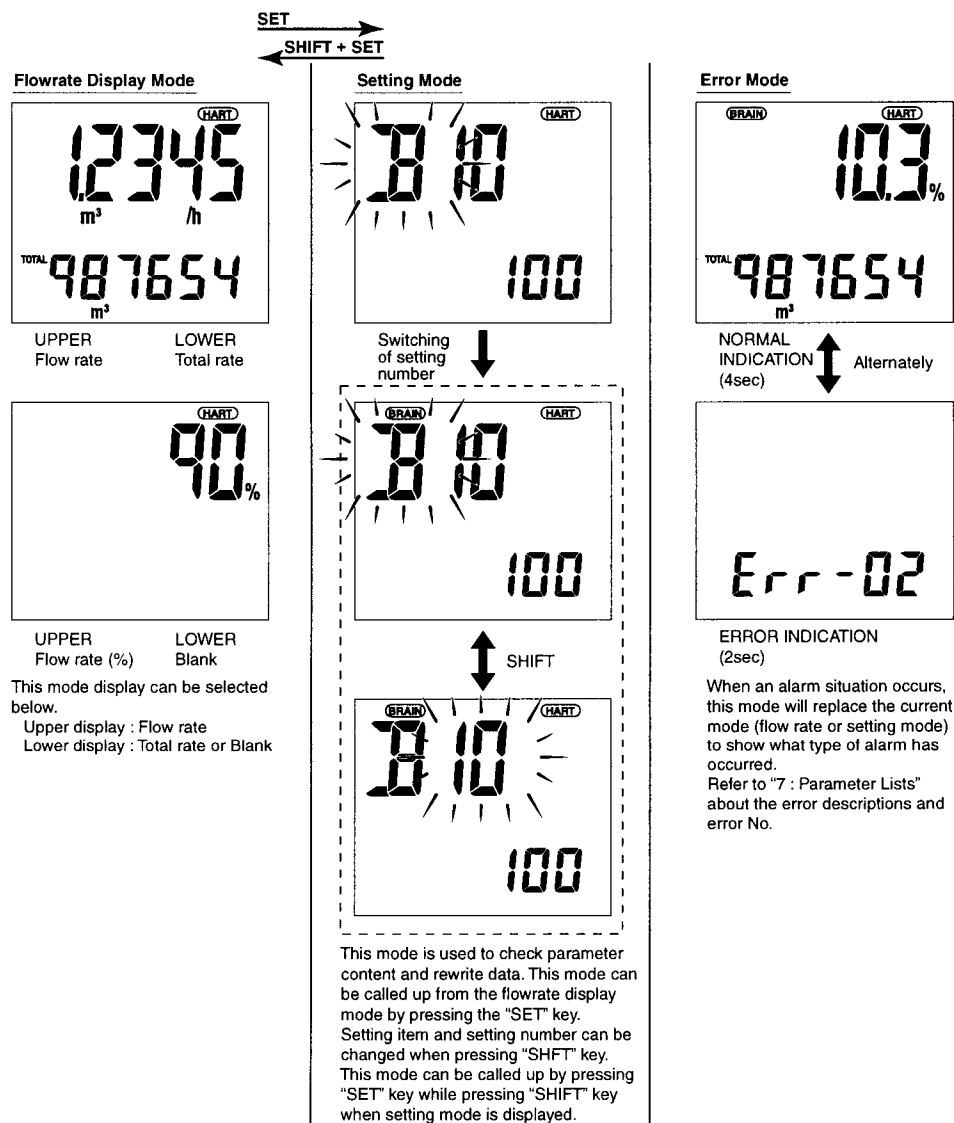
The display content items are classified in the following three items.

Table 5.2 Mode Name List

Mode (status) Name	Display Contents
Flowrate display mode	A mode in which instantaneous flow rates or totaled values are displayed. Display content is usually selected either in display content selection mode or by setting parameters via Brain communication.
Setting mode	In this mode, parameter contents are confirmed or data is updated using the setting section. The mode is changed to this mode when [SET] key is pressed in normal mode.
Alarm number display mode	This mode is overlapped when an alarm is occurring in display mode. The alarm number presentation to indicate alarm contents (about 2 sec) and the normal data display (about 4 sec) are repeated alternatively.

Mode represents that the system is in a state where the relevant setting or display is possible.

Display Example



5. BASIC OPERATING PROCEDURES

5.3 Display Contents in Display Section

The display mode is a mode in which instantaneous flow rates or totalized flow are displayed. In display mode, there are 3 display modes as shown in Table 5.3.

Table 5.3 Display Mode

Name	Contents	Upper Display	Lower Display
% Display	Instantaneous flow rate is displayed.	○	×
Engineering Display Unit	Instantaneous flow rate in an engineering unit is displayed.	○	×
Totalized Display	Totalized flow displayed without indicating the decimal point.	×	○
Blank	—	×	○

Display mode can be changed using the indicator setting section.

- For operation using indicator, change B30 and B31 parameter item number to display an appropriate display.



IMPORTANT

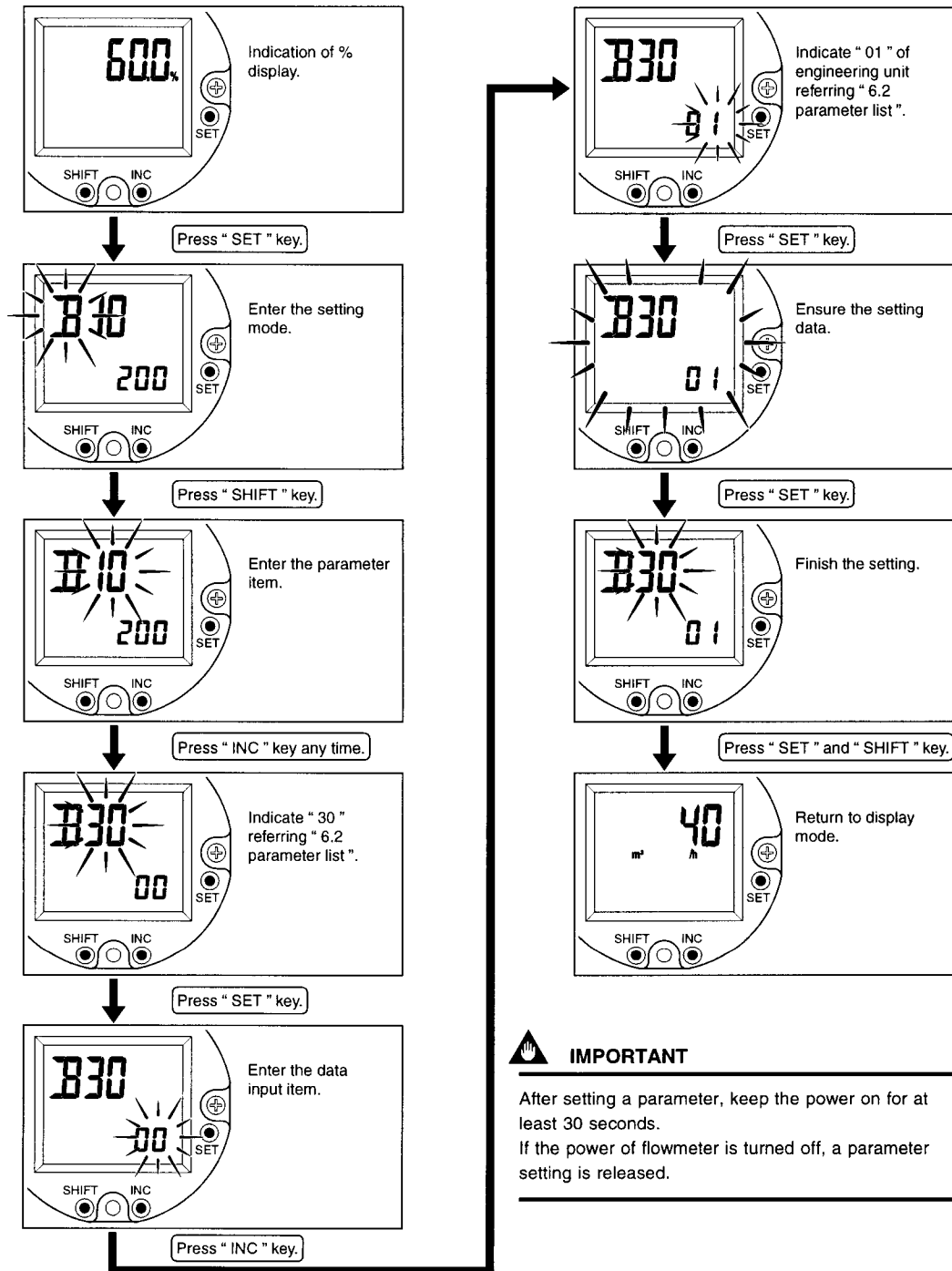
After setting a parameter, keep the power on for at least 30 seconds.

If the power of flowmeter is turned off, a parameter setting is released.

5. BASIC OPERATING PROCEDURES

5.3.1 Change the Display Mode from % Display to Engineering Unit

The display mode can be changed referring 6.1 parameter list .

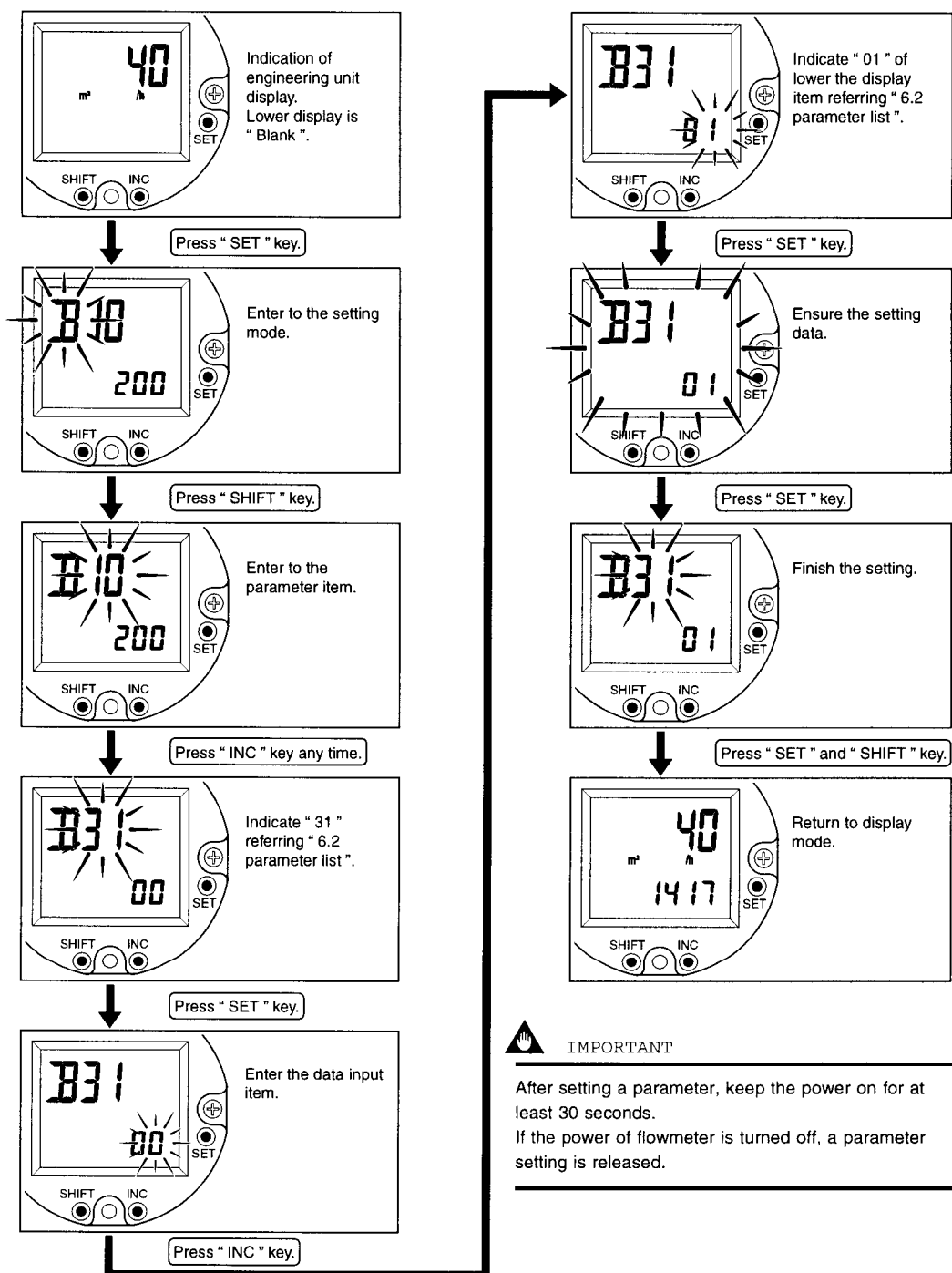
**IMPORTANT**

After setting a parameter, keep the power on for at least 30 seconds.

If the power of flowmeter is turned off, a parameter setting is released.

5.3.2 Indicate the Total Rate in the Lower Display

The display mode can be changed referring "6.1 parameter list".



IMPORTANT

After setting a parameter, keep the power on for at least 30 seconds.

If the power of flowmeter is turned off, a parameter setting is released.

5. BASIC OPERATING PROCEDURES

5.4 Setting Mode

The setting mode is used for checking parameters and rewriting data. The following is an overview of the setting mode.

**NOTE**

- Refer to "6.2 Parameter List" and "6.3 Parameter description" for information on how to change setting.

When completing setting, press **SHIFT** key and **SET** key simultaneously. The mode move to the display mode.

**IMPORTANT**

After setting a parameter, keep the power on for at least 30 seconds.

If the power of flowmeter is turned off, a parameter setting is released.

5.4.1 Structure of Setting Mode Display

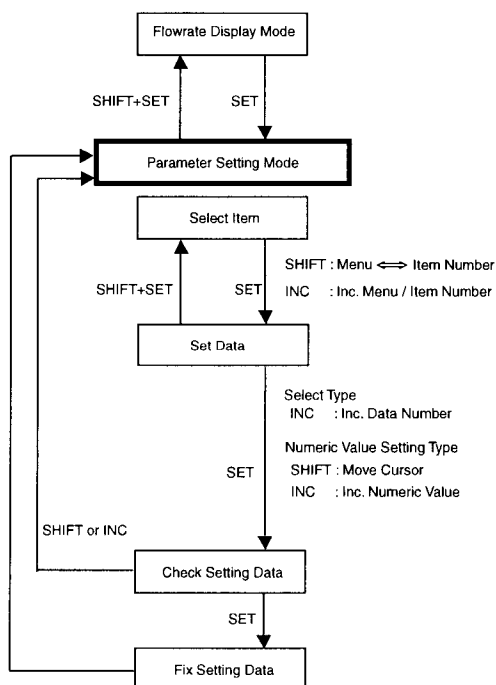
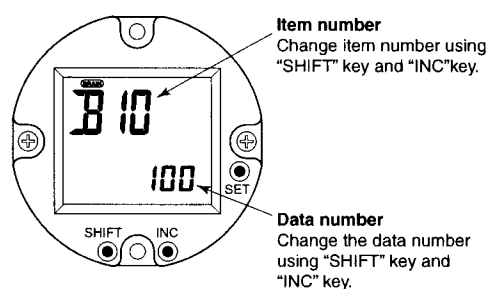
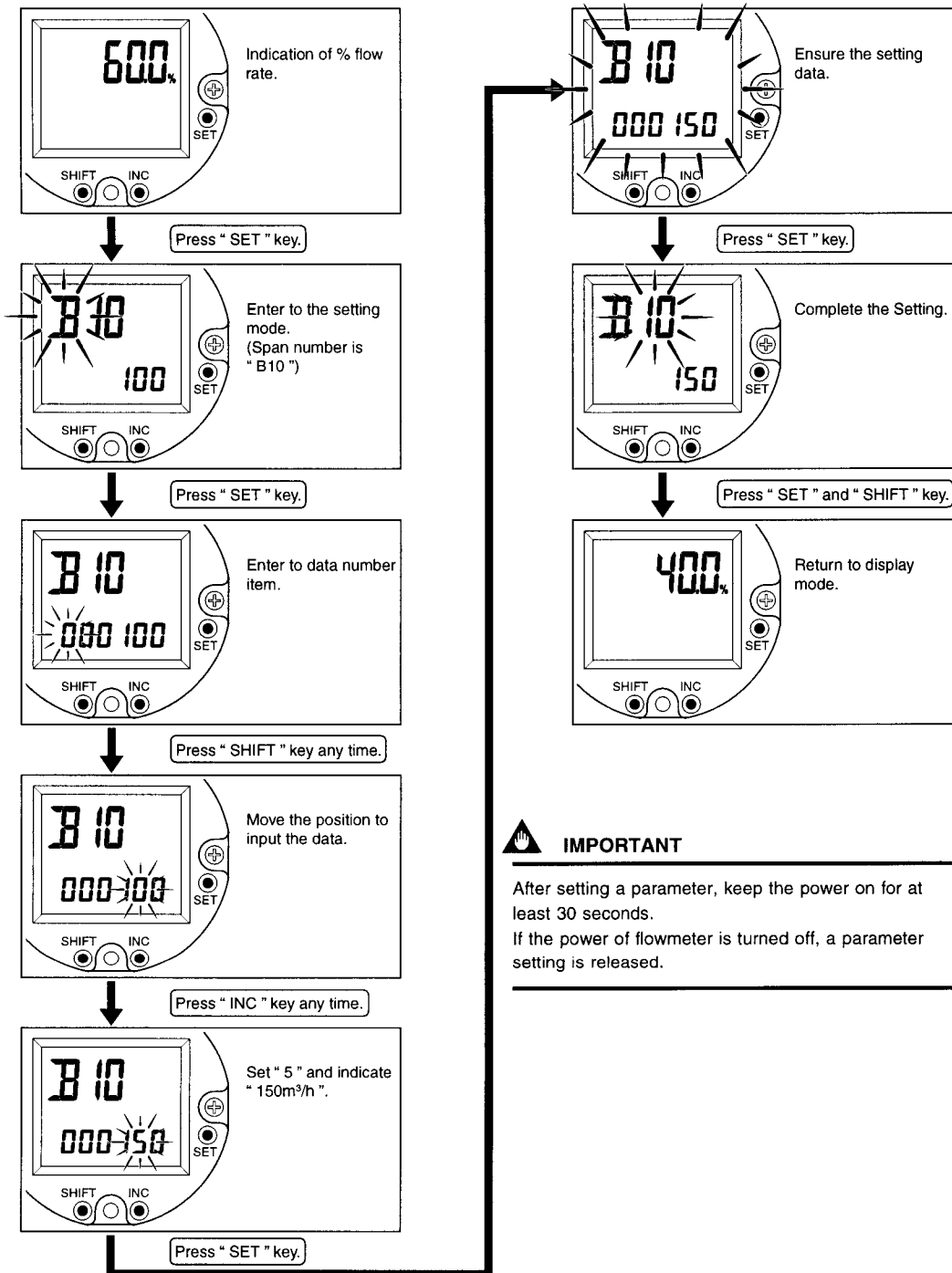


Figure 5.2 Indicator Construction and Parameter Setting Procedure

5. BASIC OPERATING PROCEDURES

5.4.2 Method of Parameter Setting

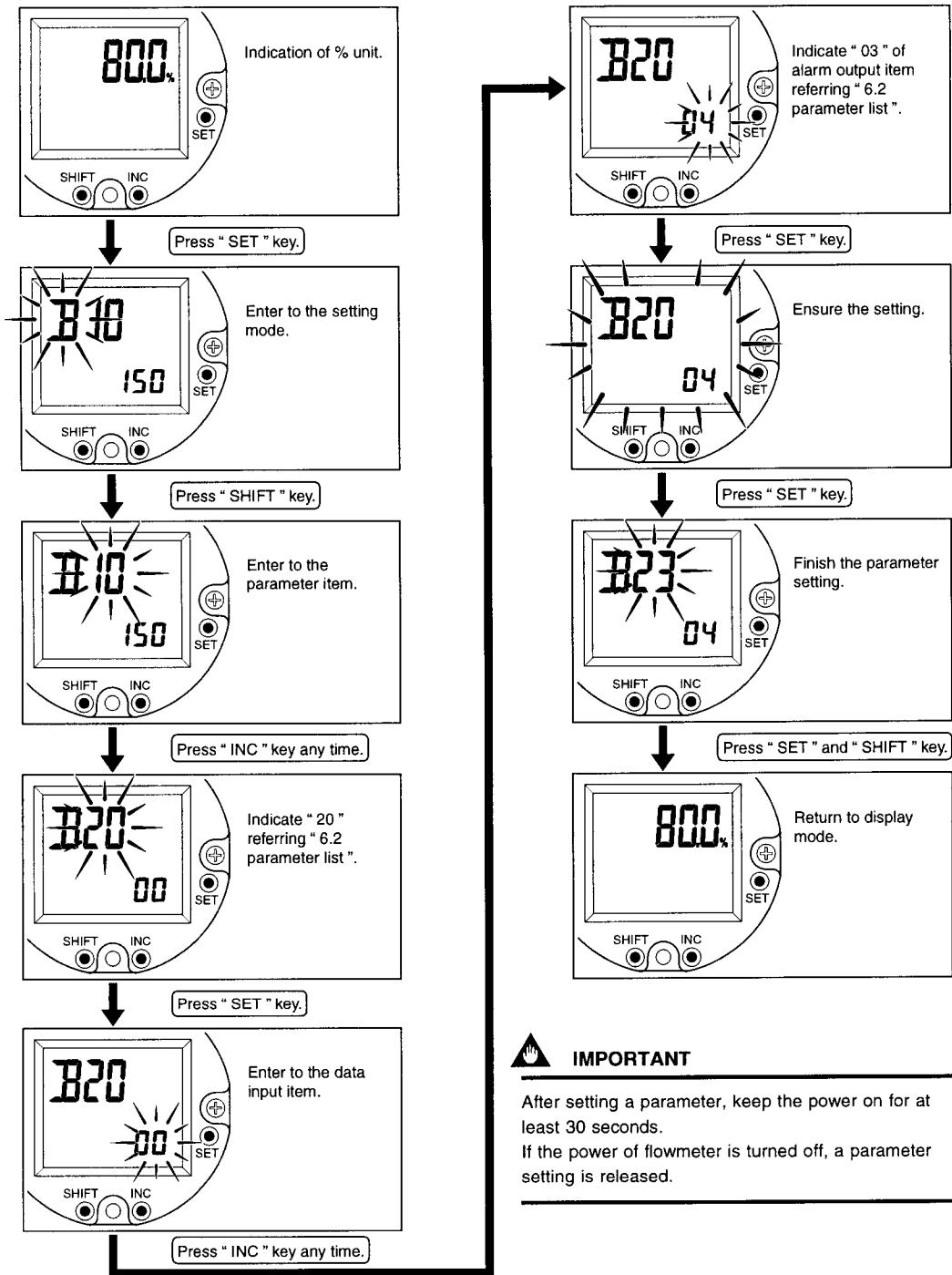
Example 1: Change the span from 100m³/h to 150m³/h**IMPORTANT**

After setting a parameter, keep the power on for at least 30 seconds.

If the power of flowmeter is turned off, a parameter setting is released.

5. BASIC OPERATING PROCEDURES

Example 2: Change the pulse output to alarm output.

**IMPORTANT**

After setting a parameter, keep the power on for at least 30 seconds.
If the power of flowmeter is turned off, a parameter setting is released.

6. PARAMETERS

6.1 Items Necessary for Parameter Setup

The parameters are set before factory shipment. Set the required parameter of changing contact out and indication of display.

6.2 Parameters List

This section describes the parameter of YEWFO.

- Contents of parameter lists.

Item	Description
Parameter number	Parameter item number.
Name	Parameter name.
R / W (Read and write)	Indicates parameter attributes. R : Display only (writing is not permitted). W : Writing is permitted.
Data range	Shows data setting ranges for numerical value entry. Shows data to be selected for data selection. () in parentheses, data code is shown for the display.
Unit	Engineering unit.
Remarks	Remarks such as a description of the contents are given.
Disp.	D : Display can set parameter.
U / D	L : Parameter can be set by UP LOAD and DOWN LOAD.
Initial value	Indicates the initial set values.

(1) Item A : Indication

These items are for the indication of flowrate and total.

Item	Name	R /W	DataRange	Unit	Remark	Initial value	Disp	U /D
A00	DISPLAY				Menu A (Display)			
A10	FLOW RATE(%)	R	0.0 to 110.0	%	Flow rate			
A20	FLOW RATE	R	0.0 to 65535	FU+C40	Flow rate (in engineering unit)			
A30	TOTAL	R	0 to 999999	FU	Totalized value			
A60	SELF CHECK	R	GOOD ERROR		Self-diagnostic message			

FU : Flow unit

(2) Item B : Easy Setting

These items are for the principal items to operate digital YEWFLOW.

A value in "()" is the data corresponding to the indicator.

Item	Name	R /W	DataRange	Unit	Remark	Initial value	Disp	U /D
B00	EASY SETUP				Menu B			
B10	FLOW SPAN	W	0.00001 to 32000	FU+C40	Flow Span	10	D	L
B15	DAMPING	W	0 to 99	sec	Damping Time	4	D	L
B20	CONTACT OUT	W	OFF (0) SCALED PULSE (1) UNSCALED PULSE (2) FREQUENCY (3) ALARM (4) FLOW SW(LOW:ON) (5) FLOW SW(LOW:OFF) (6)		Contact Output Type	(0)	D	L
(Indicate and Set only for B20 : SCALED PULSE, UNSCALED PULSE)								
B21	PULSE RATE	W	0.00001 to 32000	FU / P	Pulse Output Rate	1.0	D	L
(Indicate and Set only for B20 : FREQUENCY)								
B22	FREQ AT 100%	W	0 to 10000	PPS	Pulse Output Rate at sec / 100%	1000	D	L
(Indicate and Set only for B20 : FLOW SW (ON), FLOW SW (OFF))								
B23	SET LEVEL	W	0.00001 to 32000	FU+C40	Flow Switch (Actual Flow rate)	0.0	D	L
B30	UPPER DISP	W	FLOW RATE (%) (0) FLOW RATE (1)		Selection of Upper Display	(0)	D	L
B31	LOWER DISP	W	BLANK (0) TOTAL (1)		Selection of Lower Display	(0)	D	L
B40	TOTAL START	W	STOP (0) START (1)		Start / Stop of Totalizer	(0)	D	L
B45	TOTAL RATE	W	0.00001 to 32000	(0) FU / P	Total Rate	1.0	D	L
B47	TOTAL RESET	W	NOT EXECUTE (0) EXECUTE (1)		Totalizer Reset	(0)	D	L
B60	SELF CHECK	R	GOOD ERROR		Self-diagnostic message			

FU : Flow unit

6. PARAMETERS

(3) Item C : BASIC SETUP

These items are for the basic parameters with setting before shipment.

A value in "()" is the data corresponding to the indicator.

Item	Name	R/W	Data Range	Unit	Remark	Initial value	Disp.	U/D
C00	BASIC SETUP				Menu C (Meter characterize)			
C10	TAG NO.	W	16 characters		Tag Number			
C20	FLUID	W	LIQUID:Volume (0) GAS/STEAM:Volume (1) LIQUID:Mass (2) GAS/STEAM:Mass (3) GAS:STD/Normal (4)		Selection of FLUID type	(0)	D	L
(Indicate and Set only for C20 : LIQUID : Volume, GAS / STEAM : Volume)								
C22	VOLUME UNIT	W	m ³ (0) k m ³ (1) l (2) cf (3) m cf (4) k cf (5) USgal (6) k USgal (7) UKgal (8) k UKgal (9) bbl (10) m bbl (11) k bbl (12)		Selection of Flow Units for Flow Rate	(0)	D	L
(Indicate and Set only for C20 : LIQUID : MASS, GAS / STEAM : MASS)								
C25	DENSITY UNIT	W	kg/m ³ (0) lb/c f (1) lb/USgal (2) lb/UKgal (3)		Selection of Density Unit		D	L
C26	DENSITY f	W	0.00001 to 32000	C25	Operating Density (Manual Setting Value)	1024	D	L
C27	MASS UNIT	W	kg (0) t (1) lb (2) k lb (3)		Selection of Mass Flow Unit	(0)	D	L
(Indicate and Set only for C20 : GAS : STD / Normal)								
C30	TEMP UNIT	W	deg C (0) deg F (1)		Selection of Temperature Unit	(0)	D	L
C31	TEMP f	W	-999.9 to 999.9	C30	Operating Temperature (Manual Setting Value)	15.0	D	L
C32	TEMP b	W	-999.9 to 999.9	C30	Standard / Normal Temperature	15.0	D	L
C33	PRESS UNIT	W	MPa abs (0) kPa abs (1) bar abs (2) kg/cm ² a (3) psia (4)		Selection of Pressure Unit	(0)	D	L
C34	PRESS f	W	0.00001 to 32000	C33	Absolute Pressure at Operating Condition (Manual Setting Value)	0.1013	D	L
C35	PRESS b	W	0.00001 to 32000	C33	Absolute Pressure at Standard Condition	0.1013	D	L
C36	DEVIATION	W	0.001 to 10.0		Deviation Factor	1.0	D	L
C37	STD/NOR UNIT	W	Nm ³ (0) k Nm ³ (1) M Nm ³ (2) NI (3) Sm ³ (4) K Sm ³ (5) M Sm ³ (6) SI (7) scf (8) k scf (9) M scf (10)		Selection of Volumetric Unit at Normal Condition	(0)	D	L
C40	TIME UNIT	W	/s (0) /m (1) /h (2) /d (3)		Selection of Time Unit	(2)	D	L
C45	FLOW SPAN	W	0.00001 to 32000	FU+C40	Flow Span	10	D	L
C50	DAMPING	W	0 to 99	sec	Damping Time	4	D	L
C60	SELF CHECK	R	GOOD ERROR		Self-diagnostic message			

FU : Flow unit

6. PARAMETERS

(4) Item D : Additional Setup

These items are for Auxiliary Setup.

A value in "()" is the data corresponding to the indicator.

Item	Name	R/W	Data Range	Unit	Remark	Initial value	Disp.	U/D
D00	AUX. SETUP				Menu D (Additional Setup)			
D10	LOW CUT	W	to SPAN	FU+C40	Low Cut Flow rate Minimum Flow rate / 2		D	L
D20	TEMP UNIT	W	deg C (0) deg F (1)		Selection of Temperature Unit	(0)	D	L
D21	TEMP f	W	-999.9 to 999.9	D20	Operating Temperature (Manual Setting Value)	15.0	D	L
D25	DENSITY UNIT	W	kg/m ³ (0) lb/cf (1) lb/USgal (2) lb/UKgal (3)		Selection of Density Unit	(0)	D	L
D26	DENSITY f	W	0.00001 to 32000	D25	Operating Density (Manual Setting Value)	1024	D	L
D30	OUT LIMIT (H)	W	100.0 to 110.0	%	Upper Limit Value	110.0	D	L
D35	BURN OUT	R	High (0) Low (1)		Output Direction at Burn Out	(0)	D	L
D40	SPECIAL UNIT		No (0) Yes (1)		Selection of change for Special Flow Unit	(0)	D	L
(Indication and set only for D40 : Yes)								
D41	BASE UNIT	R	m ³ (0) k m ³ (1) l (2) cf (3) m cf (4) k cf (5) USgal (6) kUSgal (7) UKgal (8) kUKgal (9) bbl (10) m bbl (11) k bbl (12) kg (13) t (14) lb (15) k lb (16) Nm ³ (17) k Nm ³ (18) M Nm ³ (19) NI (20) Sm ³ (21) k Sm ³ (22) M Sm ³ (23) SI (24) scf (25) k scf (26) M scf (27)		Basic unit for conversion to special unit		D	
D42	USER'S UNIT	W	8 characters		User's unit			L
D43	CONV FACTOR	W	0.00001 to 32000		Coefficient for conversion to special unit	1.0	D	
D60	SELF CHECK	R	GOOD ERROR		Self-diagnostic message			L

FU : Flow unit

6. PARAMETERS

(5) Item E : Detector Setup

These items are for detector that has been already set before.

A value in "()" is the data corresponding to the indicator.

Item	Name	R/W	Data Range	Unit	Remark	Initial value	Disp.	U/D
E00	METER SETUP				Menu E (Detector setup)			
E10	NOMINAL SIZE	W	15mm (0) 25mm (1) 40mm (2) 50mm (3) 80mm (4) 100mm (5) 150mm (6) 200mm (7) 250mm (8) 300mm (9) — (10)		Selection of Nominal Size	(1)	D	L
E20	BODY TYPE	W	Standard (0) — (1)		Selection of Body Type	(0)	D	L
E30	SENSOR TYPE	W	Standard (0) High Temperature (1) Low Temperature (2)		Selection of Sensor Type	(0)	D	L
E40	K-FACT UNIT	W	P/l (0) P/Usgal (1) P/Ukgal (2)		Selection of K-factor Unit	(0)	D	L
E41	K-FACTOR	W	0.00001 to 32000	E40	K-factor value of 15 deg C	68.6	D	
E50	DETECTOR No.	W	16 characters		Detector number			
E60	SELF CHECK	R	GOOD ERROR		Self-diagnostic message			

FU : Flow unit

6. PARAMETERS

(6) Item H : Adjust.

These items are for setting of adjustment.

A value in "()" is the data corresponding to the indicator.

Item	Name	R/W	Data Range	Unit	Remark	Initial value	Disp.	U/D
H00	ADJUST				Menu H (Adjust)			
H10	TRIM 4mA	W	-1.00 to 1.00	%	Trimming 4mA	0.0	D	
H11	TRIM 20mA	W	-1.00 to 1.00	%	Trimming 20mA	0.0	D	
H20	USER ADJUST	W	0.00001 to 32000		User Adjust	1.0	D	
H25	REYNOLDS ADJ	W	NOT ACTIVE (0) ACTIVE (1)		Reynolds Coefficient	(0)	D	
(Indicator and Set only H25 : Active)								
H26	DENSITY f	W	0.00001 to 32000	D25	Density at operating condition	1024	D	
H27	VISCOSITY	W	0.00001 to 32000	mPa·s	Viscosity factor	1.0	D	
H30	EXPANSION FA	W	NOT ACTIVE (0) ACTIVE (1)		Expansion correction for compressible Gas	(0)	D	
H40	FLOW ADJUST	W	NOT ACTIVE (0) ACTIVE (1)		Instrumental Error Adjust	(0)	D	
(Indicator and Set only H40 : Active)								
H41	FREQUENCY 1	W	0 to 32000	Hz	First break-point frequency (f1)	0.0	D	
H42	DATA 1	W	-50.00 to 50.00	%	First correcting value (d1)	0.0	D	
H43	FREQUENCY 2	W	0 to 32000	Hz	Second break-point frequency (f2)	0.0	D	
H44	DATA 2	W	-50.00 to 50.00	%	Second correcting value (d2)	0.0	D	
H45	FREQUENCY 3	W	0 to 32000	Hz	Third break-point frequency (f3)	0.0	D	
H46	DATA 3	W	-50.00 to 50.00	%	Third correcting value (d3)	0.0	D	
H47	FREQUENCY 4	W	0 to 32000	Hz	Fourth break-point frequency (f4)	0.0	D	
H48	DATA 4	W	-50.00 to 50.00	%	Fourth correcting value (d4)	0.0	D	
H49	FREQUENCY 5	W	0 to 32000	Hz	Fifth break-point frequency (f5)	0.0	D	
H50	DATA 5	W	-50.00 to 50.00	%	Fifth correcting value (d5)	0.0	D	
H60	SELF CHECK	R	GOOD ERROR		Self-diagnostic message			

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(7) Item J : Test

These items are for test of output.

A value in "()" is the data corresponding to the indicator.

Item	Name	R/W	Data Range	Unit	Remark	Initial value	Disp.	U/D
J00	TEST				Menu J (Test)			
J10	OUT ANALOG	W	0.0 to 110.0	%	Current Output	0.0	D	
J20	OUT PULSE	W	0 to 10000	Hz	Pulse Output	0	D	
J30	OUT STATUS	W	OFF (0) ON (1)		Status Output	(0)	D	
J60	SELF CHECK	R	GOOD ERROR		Self-diagnostic message			

6. PARAMETERS

(8) Item K : Maintenance

These items are for maintenance.

Item	Name	R/W	Data Range	Unit	Remark	Initial value	Disp.	U/D
K00	MAINTENANCE				Menu K (Maintenance)			
K10	TLA	W	0.1 to 20.0		Trigger Level Adjust	1.0	D	
K20	SIGNAL LEVEL	W	0.1 to 20.0		Signal Level	1.0	D	
K25	N.B. MODE	W	AUTO (0) MANUAL (1) TUNING AT ZERO (2)		Selection of Noise balance Mode	(0)	D	
K26	NOISE RATIO	R/W	0.00 to 2.00				D	
K30	VELOCITY	R		m/s	Velocity		D	
K32	SPAN V	R		m/s	Span velocity		D	
K34	VORTEX FREQ.	R		Hz	Vortex frequency		D	
K36	SPAN F	R		Hz	Span frequency		D	
K40	ERROR RECORD	R			Error Records			
K50	SOFTWARE REV	R	0.01 to 99.99		Software Revision Number			
K60	SELF CHECK	R	GOOD ERROR		Self-diagnostic message			

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(9) Item M : Memo

These items are for Memorandum.

Item	Name	R/W	Data Range	Unit	Remark	Initial value	Disp.	U/D
M00	MEMO				Menu M (Memo)			
M10	MEMO 1	W	16 characters		Memorandum 1 (16 characters)			
M20	MEMO 2	W	16 characters		Memorandum 2 (16 characters)			
M30	MEMO 3	W	16 characters		Memorandum 3 (16 characters)			
M60	SELF CHECK	R	GOOD ERROR		Self-diagnostic message			

6. PARAMETERS

6.3 Parameter Description

(1) Item B : Easy Setting

These items are for the Principal items to operate YEWFLOW.

A value in () is the data corresponding to indicator.

[B10:FLOW SPAN] Flowrate span

Set the required span with a numerical.

[B15:DAMPING] Damping time constant

Set damping time constant values from 0s to 99sec.

[B20:CONTACT OUT] Contact output

Select contact output.

Item	Description
OFF (0)	_____
SCALED PULSE (1)	Refer to "B21"
UNSCALED PULSE (2)	Refer to "B21"
FREQUENCY (3)	Refer to "B22"
ALARM (4)	The status goes from close to open (OFF) during alarming
FLOW SW (LOW:ON) (5)	Refer to "B23"
FLOW SW (LOW:OFF) (6)	Refer to "B23"

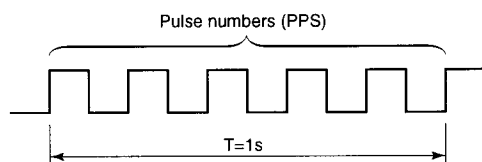
[B21:PULSE RATE] Pulse output rate

Set the rate of pulse output.

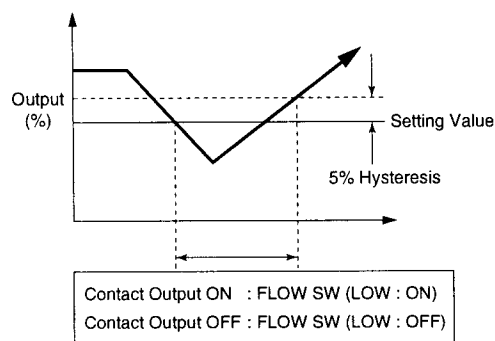
Scaled pulse output can be done by flowrate units at 1 pulse when SCALED PULSE in B20 is selected. The numbers of pulses are output by using vortex number which cause by shedder bar when UNSCALED PULSE in B20 is selected.

[B22:100% FREQ] Pulse numbers of 100% at one second

Set pulse number at 100% for one second when FREQUENCY in B20 is selected.

**[B23:SET LEVEL] Level of flow switch**

Set level of flow switch when FLOW SW in B20 is selected. The contact output is sent out when the flowrate is less than the set comparison level.

**[B30:UPPER DISP] Upper indicator display**

Select upper display, Flow rate (%) (0), Flowrate (1).

[B31:LOWER DISP] Lower indicator display

Select lower indicator display, BLANK (0), TOTAL (1).

When BLANK in B31 is selected, indicator is blank.

[B40:TOTAL START]

Select the START/STOP of totalizer from STOP (0), START (1).

[B45:TOTAL RATE] Total rate of the totalizer

Set the total rate of the totalizer.

[B47:TOTAL RESET] Reset the totalizer

When totalizer reset function is executed, the total display and communication parameter are reset.

6. PARAMETERS

(2) Item C : BASIC SETUP

These items are for the basic parameters with setting before shipment.

The parameters of item C are the same as item B.

A value in () is the data corresponding to indicator.

[C20:FLUID] Flowrate unit

Set the flowrate unit below.

Item	Description
LIQUID : Volume (0)	Volumetric flow of liquid measuring
GAS/STEAM : Volume (1)	Volumetric flow of gas or steam measuring
LIQUID : Mass (2)	Mass flow of liquid measuring
GAS/STEAM : Mass (3)	Mass flow of gas or steam measuring
GAS : STD/Normal (4)	Volumetric flow at Standard condition

The following items should be done in case of which "C20" is "LIQUID : Volume" or "GAS/STEAM : Volume".

[C22:VOLUME UNIT] Volumetric unit

Select the unit of volumetric flow from m³(0), km³(1), l(2), cf(3), mcf(4), def(5), USgal(6), kUKgal(9), bbl(10), mbbl(11), kbbbl(12).

The following items should be done in case of which "C20" is "LIQUID: Mass" or "GAS/STEAM : Mass"

[C25:DENSITY UNIT] Density Unit of Flow measurement

Select the unit of density from kg/m³(0), lb(1), lb/USgal(2), lb/UKgal(3).

[C26:DENSITY f] Density at normal operation conditions

Set the density value of the fluid at operating condition for mass flow unit.

[C27:MASS UNIT] Mass flowrate unit

Select the mass flowrate unit from kg(0), t(1), lb(2), klb(3).

The following item should be done in case of which "C20" is "GAS/STEAM : Volume".

[C30:TEMP UNIT] Fluid temperature unit at operating conditions

Select temperature unit at operating condition from degC (0), degF (1) .

[C31:TEMP f] Fluid temperature at operating conditions

Set fluid temperature at operating condition.

Range is -200 to 450 C

The following items should be done in case of which "C20" is "GAS/STD : Normal".

[C32:TEMP b] Fluid temperature at standard/normal conditions

Set the values of Fluid temperature at standard condition.

[C33:PRESS UNIT] Pressure unit

Select the unit of pressure from MPa abs(0), kPa abs(1), kg/cm² abs(2), bar abs(3) .

[C34:PRESS f] Absolute pressure at operating conditions

Set the absolute pressure at operating condition.

[C35:PRESS b] Absolute pressure at standard/normal condition

Set the absolute pressure at normal condition.

[C36:DEVIATION] Deviation factor

Set deviation factor.

[C37:STD/NOR UNIT] Volumetric unit at normal conditions

Select volumetric unit at normal condition from Nm³(0), kNm³(1), MNm³(2), NI(3), Sm³(4), Km³(5), Mm³(6), SI(7), scf(8), kscf(9), Mscf(10).

[C40:TIME UNIT] TIME UNIT

Select time unit from /s(0), /m(1), /h(2), d(3)

[C45:FLOW SPAN] Flowrate span

Set the required span with a numerical value.

[C50:DAMPING] Damping time constant

Set damping time constant values from 0 to 99sec.

6. PARAMETERS

(3) Item D (AUX SETUP)

These items are for Auxiliary setup.

A value in () is the data corresponding to indicator.

[D10:LOW CUT] Low-cut flowrate

Set to noise elimination or zero flow in the low flowrate (or low frequency) range. The settable range for low cut flowrate is more than half-minimum flowrate.

**NOTE**

The low cut can be set after the compensate items (H25, H30, H40) are set to "NOT ACTIVE". It is possible that indication value changes by the compensated items are set to "ACTIVE", however, it does not affect an actual calculation.

[D20:TEMP UNIT] Fluid temperature unit at operating conditions

Select temperature unit at operating condition from degC (0), degF (1).

[D21:TEMP f] Fluid temperature at operating conditions

Set fluid temperature at operating condition.

Range is -200 to 450 C

[D25:DENSITY UNIT] Density Unit of Flow measurement

Select the unit of density from kg/m³(0), lb(1), lb/USgal(2), lb/UKgal(3).

[D26:DENSITY f] Density at normal operation conditions

Set the density value of the fluid at operating condition for mass flow unit

[D30:OUT LIMIT] Limit value of output and indication

Set limit value of output from 100.0% to 110.0%

[D35:BURN OUT] Indication of the output direction at burn out

This is indication of the output direction at burn out. Refer to 7.1.6 Burn out when the output direction can be changed.

[D40:SPECIAL UNIT] Change to special flowrate unit

Select the availability of changing to special flowrate Unit from No(0) or Yes(1)

[D41:BASE UNIT] Indication of the special flowrate unit

Indication of the basic flowrate unit when item D40 is Yes(1)

[D42:USER'S UNIT] Free unit for users

Set in up to 8 alphanumeric characters when item D40 is Yes(1)

[D43:CONV FACTOR] Convert factor

Set the conversion factor for special units when item D40 is Yes(1)

(4) Item E (METER SETUP)

These items are for detector set up that has already been set before shipment.

A value in () is the data corresponding to indicator.

[E10:NOMINAL SIZE] Nominal size of the detector

Select the nominal size of the flowmeter, from 15mm(0), 25mm(1), 40mm(2), 50mm(3), 80mm(4), 100mm(5), 150mm(6), 200mm(7), 250mm(8), 300mm(9)

[E40:K-FACTOR UNIT],

Select this unit from p/l, p/USgal, p/UKgal.

[E41:K-FACTOR]

The flowmeter data plate includes a K-factor (KM) at 15 C for the combined detector.

[E50:DETECTOR NO.] Detector number of flowmeter

Set the serial number using 16 alphanumeric characters of the detector combined converter.

6. PARAMETERS

(5) Item H (ADJUST)

This item for setting of adjustment.

[H10, H11:TRIM 4mA, TRIM 20mA] Trimming of 4mA and 20mA

Fine tuning adjustment of 4mA and 20mA output.

Fine tuning range is from -1.00% to 1.00%.

[H20:USER ADJUST] Conversion factor for user setting.

Set conversion factor by user.

This conversion factor is converted into measurement flowrate.

[H25:REYNOLDS ADJ] Reynolds adjustment

Select the Reynolds adjustment.

This adjustment should be done in case of their error compensation, because error of vortex flowmeter should be increased when it come to low reynolds numbers.

The following item should be done in case of which "H25" is "ACTIVE".

[H26:DENSITY f]

Set the density at operating condition.

[H27:VISCOSITY]

Set the value of density and viscosity at standard conditions.

These values should be used for Reynolds adjustment.

Reynolds number(Re) is calculated as shown in the formula below.

$$Re = 354 \frac{Q \cdot \rho f}{D \cdot \mu}$$

Q : Volumetric flow (m³/h)

D : Internal diameter (m)

ρf : Density at operating condition

μ : Viscosity (mPa · s (cp))

Reynolds number which is not more than 40000 decrease, the error gradually increase so.

In Reynolds adjustment, the curve or error.

[H30:EXPANSION FA] Gas expansion correction.

When measuring a compressibility gas by mass flow (Steam M, Gas M) and standard condition (Gas Qn), this expansion factor is useful to correct the deviation from the ideal gas law.

[H40:FLOW ADJUST] Select a break point correction

Select a break point correction for the instrumental error from "NOT ACTIVE(0) OR ACTIVE(1)".

[H41, H45:FLOW ADJUST] Instrumental Error Correction

Correct the instrumental error in flowmeter characteristics using 1 line-segment approximation (with five correction factors).

(1) Flow frequency input at line segments needs to be

$$f_1 \leq f_2 \leq f_3 \leq f_4 \leq f_5.$$

When four correction factors are available, line segments need to be $f_4=f_5$ and $d_4=d_5$.

When three correction factors are available, line segments need to be $f_3=f_4=f_5$ and $d_3=d_4=d_5$.

(2) When a flow input of f_1 or less is present, correct the instrumental error as the corrected value= d_1 .

(3) When a flow input of f_5 or more is present, correct the instrumental error as the corrected value= d_5 .

(4) Abscissa (f_1 to f_5) : Set the break-point frequencies as parameters.

(5) Ordinate (d_1 to d_5) : Set the corrected value (%) at each break-point as parameters.

$$\text{Set value} = -\frac{Q_s - I}{I} \times 100$$

Where

Q_s : Correct flowrate determined by a reference apparatus

I : Indication of vortex flowmeter

- Definition of error varies with the type of flowmeter. Be careful of the difference in signs in the error and corrected value.

$$Q_f = \frac{f(\text{Hz})}{K\text{-factor}} \times 100$$

holds and the error is included in the K-factor.

Therefore, for the region where the K-factor shift on the positive side, the corrected value is negative.

The corrected value when the calibration fluid of the flowmeter and the fluid to be measured are different must be set as a corrected value obtained by making both abscissas agree with respect to the Reynolds number.

**NOTE**

If Low cut flowrate D10 is used together with those parameters (H30, H35, H40), D10 must be set in advance while those parameters are "NOT ACTIVE".

6. PARAMETERS

(6) Item J (TEST)

These items are for test of output.

A value in () is the data corresponding to indicator.

[J10:OUT ANALOG] 4 to 20mA Current output.

This function allows you to select 4 to 20mA output for loop test.

When this test is executed, transistor contact output (Pulse, Alarm, Status) is fixed at ON or OFF (not determined).

Exiting this parameter item or stopping access after ten minutes, this function will be reset automatically.

[J20:OUT PULSE] Pulse output

Output pulse output for loop test from 0Hz to 10000Hz.

Exiting this parameter item or stopping access after ten minutes, this function will be reset automatically.

When this test is executed, current output is fixed at 0% (4mA).

[J30:OUT STATUS] Status output test

Status output test can be executed (OFF(0) or ON(1)).

When this test is executed, current output is fixed at 0% (4mA).

Exiting this parameter item or stopping access after ten minutes, this function will be reset automatically.

(7) Item K (Maintenance)

These items are for maintenance.

A value in () is the data corresponding to indicator.

[K10:TLA] TLA Adjustment

Trigger level (TLA) is adjusted upon shipment. Therefore, TLA adjustment is nonnecessity. But set TLA adjustment below as

¥ The measurement of Low flow rate area is required.

¥ Mechanical vibration and impact are applied to YEWFLOW and Zero point and low flow rate area is output.

Note: Refer to 7.2 Adjustment for Manual Mode.

[K20:SIGNAL LEVEL]

Set the signal level.

[K25:N. B. MODE]

Set the Noise Balance Mode from AUTO(0) or MANUAL(1) or TUNING AT ZERO(2)

[K26:N. B. RATIO] The ratio of Noise Balance.

When NOISE BALANCE MODE (N. B. MODE) is AUTO, noise balance value is the indication only.

When N.B. mode is MANUAL, the noise balance can be adjusted entering the setting values.

Note: Refer to 7.2 Adjustment for Manual Mode.

[K30:VELOCITY] Flow velocity

Indication of flow velocity at the operating conditions.

[K32:SPAN V] Flow span velocity

Indication of flow span velocity.

[K34:VORTEX FREQ.] Vortex frequency.

Indication of vortex frequency at operating conditions.

[K36:SPAN F] Span vortex frequency.

Indication of span vortex frequency.

[K40:ERROR RECORD] Error record

The error record can be indicated.

¥ The error is recorded as history.

¥ The error history is not time-series data.

¥ The error history can be holded for 30 days.

[K50:SOFTWARE REV] Software revision

The software revision can be indicated.

6. PARAMETERS

6.4 Error Code Lists

When an ERROR is displayed by SELF CHECK in item A60, B60, C60, D60, E60, or H60, J60, K60, M60, press function key F2 [DIAG] and the error contents are displayed.

The error contents are listed below:

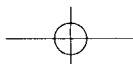
Table 6.2 ERROR Code List

Indication	Diagnostic Message	Error Name	Problem Cause	Current Output	Pulse Output	% Output	Engineering Unit Output	Totalizing Output	How to recover
Err-01	OVER OUTPUT	Over range output signal	Output signal is 110% or more	Fixed at 110%	Normal Operation	Fixed at 110%	Normal Operation	Normal Operation	Change parameters or over ranged flow input
Err-02	SPAN SET ERROR	Span Setting Error	Span setting parameter is more than 1.5 times of max flow velocity	Normal Operation	Normal Operation	Normal Operation	Normal Operation	Normal Operation	Change parameters span factor is outside the acceptable limits
Err-06	PULSE OUT ERROR	Pulse output error	Pulse output frequency is more than 10kHz	Normal Operation	Fixed at 10KHz	Normal Operation	Normal Operation	Normal Operation	Change parameters (ItemC, ItemE)
Err-07	PULSE SET ERROR	Pulse setting error	Pulse output frequency setting is more than 10kHz	Normal Operation	Normal Operation	Normal Operation	Normal Operation	Normal Operation	Change parameters (ItemC, ItemE)
CHECK Vibration	Transient noise	Error of Vibration	Transitional disturbance	Hold	Normal Operation	Hold	Hold	Normal Operation	CHECK the vibration
CHECK Vibration	CHECK Vibration	Error of Vibration	High vibration	Fixed at 0%	Stop Output	Fixed at 0%	Fixed at 0	Stop the total	CHECK the vibration
CHECK Flow	CHECK Flow	Error of Flow	Fluctuating	Normal Operation	Normal Operation	Normal Operation	Normal Operation	Normal Operation	CHECK the clogging
CHECK Flow	CHECK Flow	Error of Flow	Clogging	Normal Operation	Normal Operation	Normal Operation	Normal Operation	Normal Operation	CHECK the clogging
Err-20	PRE-AMP ERROR	PRE-AMP is failed		Normal Operation	Normal Operation	Normal Operation	Normal Operation	Normal Operation	Replace the AMP. unit
Err-30	EE PROM ERROR	EEPROM is not functioning correctly		Over 110% or -2.6% below	Halt	Fixed at 0%	Fixed at 0	Halt	Replace the AMP. unit
	CPU FAULT	CPU is failed	All operations are Dead. Display and self diagnostic function is also dead.g	Over 110% or -2.6%	Halt	Halt	Halt	Halt	Replace the AMP. unit

Note. Normal Operation : Operation continues without relation to error occurrence.
 Retain Operation : Calculation continues with relation to error occurrence.



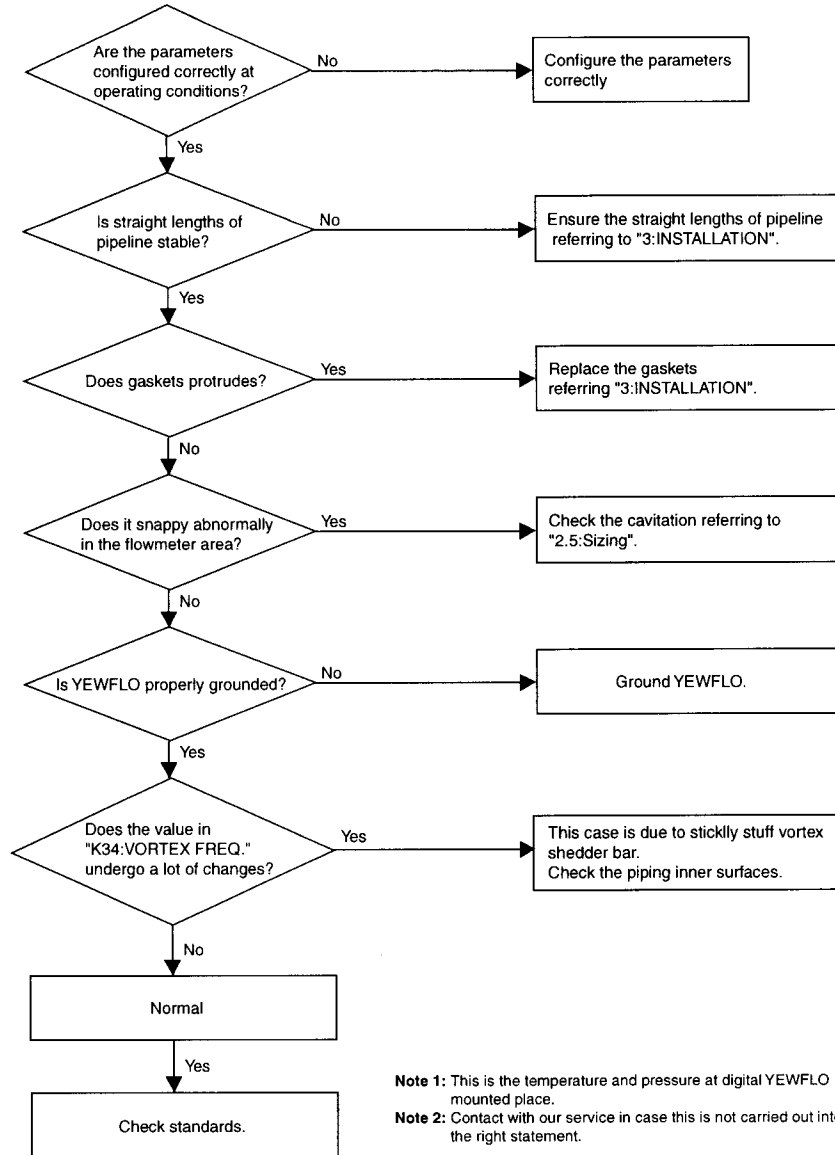
NOTES:



7. TROUBLESHOOTING

7.1 Flow

Large flowmeter errors and flowrate reading fluctuates.



After the output showed correctly, the indication goes down to zero at certain time.

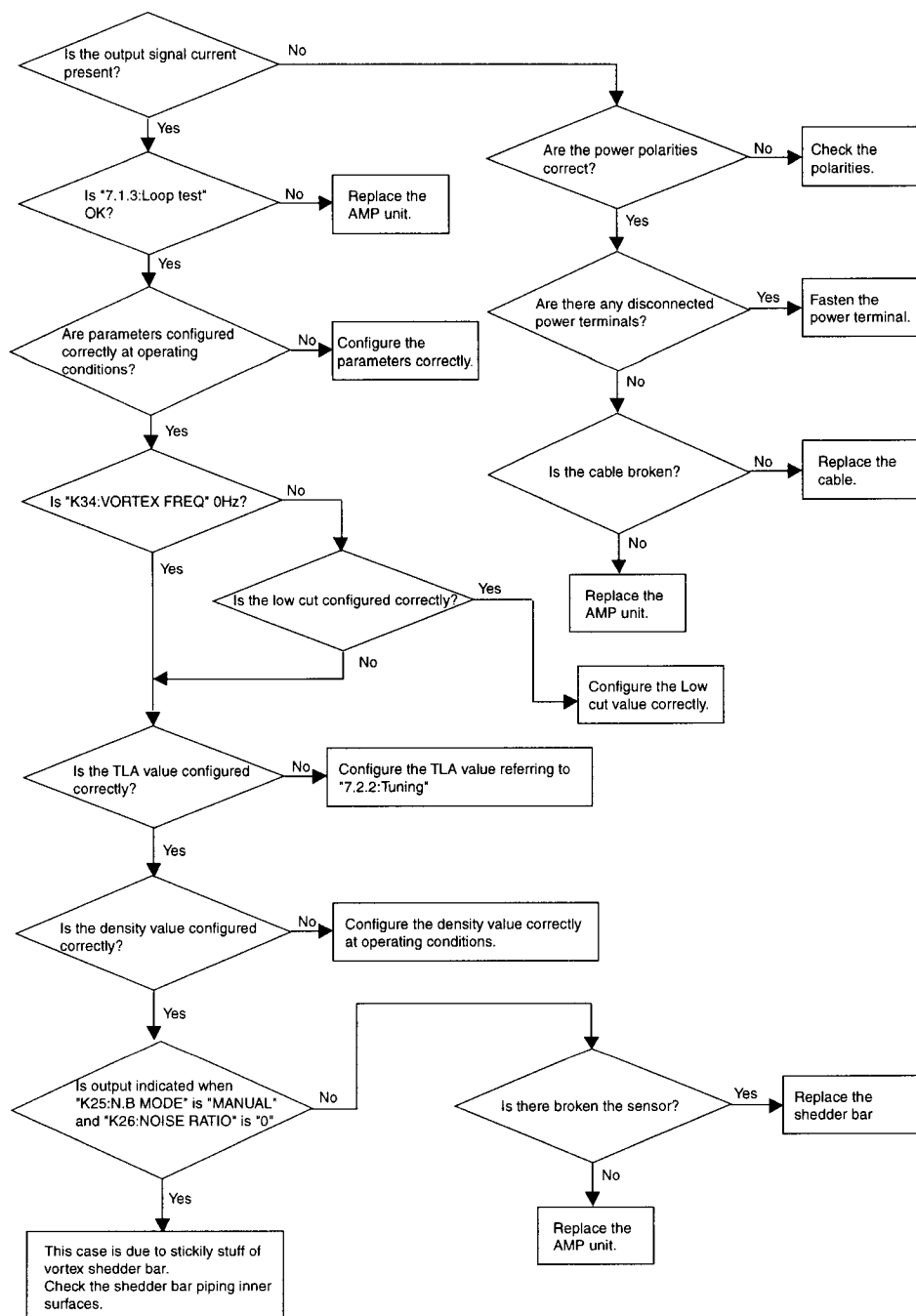
When this problem occurred, the cause is suspected of deterioration of sensor sensitivity and turbulent of fluid flow due to sticky stuff on the shedder bar and flowmeter inner tube.

How to cope with this problem

- 1) Referring item 7.2 Vortex Shedder Assembly Removal, take out the Vortex Shedder bar and clean it.
- 2) If there is the sticky stuff on inner tube of the flowmeter, remove the flowmeter body from adjacent pipes and clean it.

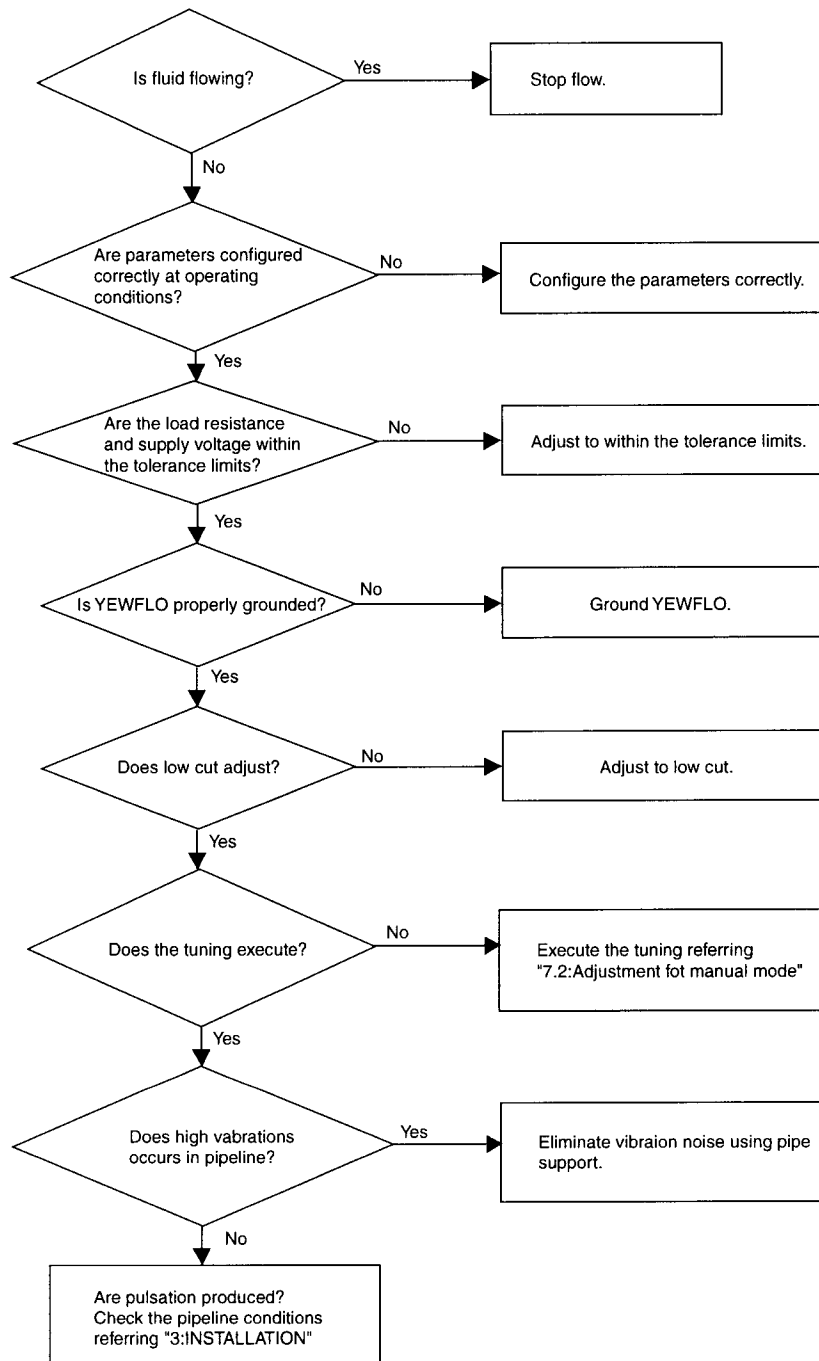
7. TROUBLESHOOTING

No output is indicated when the fluid is flowing.



7. TROUBLESHOOTING

Output is indicated at zero flow.



7.2 Vortex Shedder Removal

7. TROUBLESHOOTING

- (1) Remove the converter cover.
- (2) For Integral Type, loosen the terminal screws and disconnect leadwires on the amplifier and loosen 4 screws to disassemble the Amplifier. And for Remote Type, remove the terminal box cover in the same way.
- (3) Loosen the bracket mounting bolts and remove the terminal box together with the bracket. Be careful not to damage the leadwires connected to the vortex shedder assembly when removing the terminal box.
- (4) Loosen the vortex shedder assembly mounting bolts or nuts and remove the vortex shedder assembly.
- (5) When reassembling the vortex shedder assembly, reverse above procedure. Confirm the following.
 - a. The gasket should be changed to new one.
 - b. The guide pin on the vortex shedder mounting block meets the guide pin hole. See Figure 7.1. The guide pin applies to the 1 to 4 inch flowmeters.
 - c. The vortex shedder assembly is installed as illustrated in Figure 7.1.
 - d. Tighten the sensor mounting bolts or nuts with a torque wrench, applying the torque specified below.
Refer to figure 7 for bolt torque sequence.
 - e. Insert the leadwires (vortex shedder) through the terminal box bottom hole and lower the terminal box slowly until the bracket touches the flowmeter shoulder. Be sure to keep the leadwires vertical while lowering the terminal box.
 - f. After assembling, confirm that there is no leakage from the vortex flowmeter.

Table 7.1

Torque Value

Meter Size inch (mm)	1st Torque		2nd Torque		3rd Torque		4th Torque	
1/2 (15)	40 in lb	(0.45 kg m)	70 in lb	(0.8 kg m)	100 in lb	(1.15 kg m)	140 in lb	(1.6 kg m)
1 & 1.5 (25 & 40)	25 in lb	(0.29 kg m)	60 in lb	(0.67 kg m)	90 in lb	(1.03 kg m)	105 in lb	(1.2 kg m)
2 (50)	20 in lb	(0.23 kg m)	100 in lb	(1.15 kg m)	120 in lb	(1.37 kg m)	174 in lb	(1.99 kg m)
3 (80)	20 in lb	(0.23 kg m)	90 in lb	(1.03 kg m)	190 in lb	(2.2 kg m)	260 in lb	(2.98 kg m)
4 (100)	10 ft lb	(13.7 kg m)	15 ft lb	(2.1 kg m)	22 ft lb	(3.0 kg m)	29 ft lb	(3.97 kg m)
6 (150)	10 ft lb	(13.7 kg m)	15 ft lb	(2.1 kg m)	29 ft lb	(3.97 kg m)	37 ft lb	(5.1 kg m)
8 (200)	10 ft lb	(13.7 kg m)	22 ft lb	(3 kg m)	37 ft lb	(5.1 kg m)	51 ft lb	(6.99 kg m)
10 (250)	10 ft lb	(13.7 kg m)	22 ft lb	(3 kg m)	70 ft lb	(9.6 kg m)	116 ft lb	(15.89 kg m)
12 (300)	10 ft lb	(13.7 kg m)	22 ft lb	(3 kg m)	70 ft lb	(9.6 kg m)	116 ft lb	(15.89 kg m)



CAUTION

When the vortex shedder is removed, the gasket must be replaced with a new one.

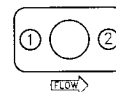
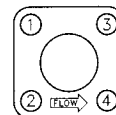
Figure 7.0 Yewflo Sensor Bolt Torque

Four-Bolt Pattern Torque Sequence: All bolts must be finger tight before beginning torque sequence. Torque the bolts/nuts in the following steps and sequences:

Step #1: 1,2,3,4 Step #3: 1,4,3,2
Step #2: 2,1,4,3 Step #4: 2,3,4,1

Two-Bolt Pattern Torque Sequence: All bolts must be finger tight before beginning torque sequence. Torque the bolts/nuts in the following steps and sequences:

Step #1: 1,2 Step #3: 1,2
Step #2: 2,1 Step #4: 2,1



7. TROUBLESHOOTING

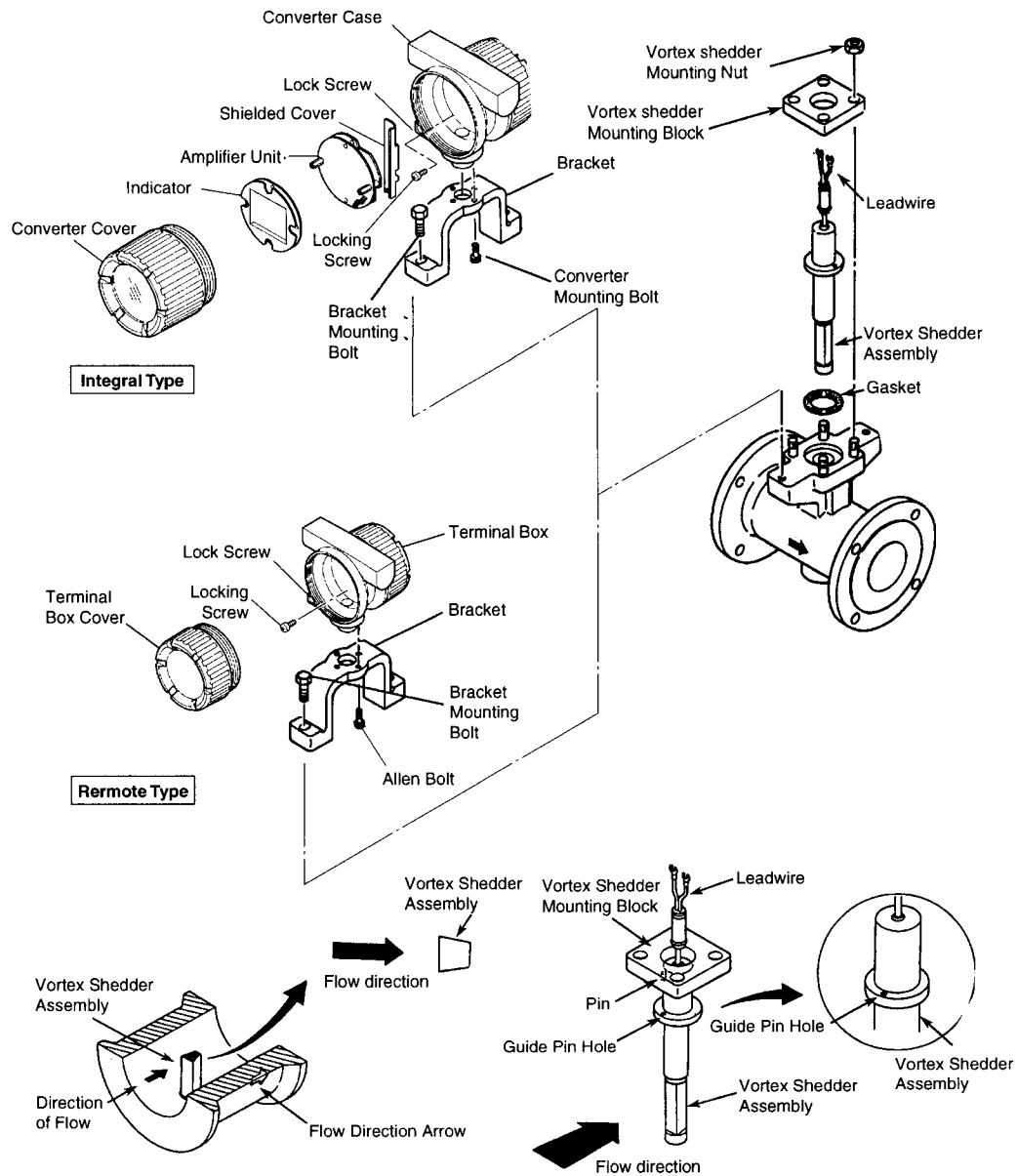


Figure 7.1 Disassembling and Reassembling the Vortex Shedder Assembly

7. TROUBLESHOOTING

7.3 Software Configuration

(1) Flow Calculation

The flowrate is calculated with the following equations based on the N number of generated vortices:

(a) Flowrate (in engineering units)

$$\text{RATE} = N \cdot \frac{1}{\Delta t} \cdot \epsilon_i \cdot \epsilon_e \cdot \epsilon_r \cdot \epsilon_p \cdot \frac{1}{KT} \cdot U_{KT} \cdot U_k \cdot U_{TM} \cdot \frac{1}{S_E} \quad \dots (7.1.1)$$

$$KT = KM \cdot \{1 - 4.81 \times (T_f - 15) 10^{-5}\} \quad \dots (\text{Metric Units}) \quad \dots (7.1.2)$$

$$KT = KM \cdot \{1 - 2.627 \times (T_f - 59) 10^{-5}\} \quad \dots (\text{English Units}) \quad \dots (7.1.3)$$

(b) Flowrate (%)

$$\text{RATE}(\%) = \text{RATE} \cdot \frac{1}{F_S} \quad \dots (7.2)$$

(c) Totalized value

$$\text{TOTAL} = N \cdot \epsilon_i \cdot \epsilon_e \cdot \epsilon_r \cdot \epsilon_p \cdot \frac{1}{KT} \cdot U_{KT} \cdot U_k \cdot \frac{1}{T_E} \quad \dots (7.3.1)$$

$$\text{TOTAL} = E_f \cdot \epsilon_e \cdot \epsilon_r \cdot \epsilon_p \cdot N \quad \dots (\text{Unscaled pulses}) \quad \dots (7.3.2)$$

(d) Velocity

$$V = N \cdot \frac{1}{\Delta t} \cdot \frac{1}{KT} \cdot U_{KT} \cdot \frac{4}{\pi D^2} \quad \dots (7.4.1)$$

(e) Reynolds number

$$\text{Red} = V \cdot D \cdot \rho_f \cdot \frac{1}{\mu} \times 1000 \quad \dots (\text{Metric Units}) \quad \dots (7.5.1)$$

$$\text{Red} = V \cdot D \cdot \rho_f \cdot \frac{1}{\mu} \times 124 \quad \dots (\text{English Units}) \quad \dots (7.5.2)$$

where N: Number of input pulses (pulse)
 Δt : Time corresponding to N (seconds)
 ϵ_i : Instrumental error correction factor
 ϵ_e : Expansion correction factor for compressive fluid
 ϵ_r : Reynolds number correction factor
 ϵ_p : Adjacent pipe error correction factor
 KT: K-factor at operating conditions (pulses/litre) (pulse/gal)
 KM: K-factor at temperature 15°C (59°F)
 U_{KT} : Unit conversion factor for K-factor
 U_k : Flow unit conversion factor (Refer to item (2))
 $U_k(\text{user})$: Flow unit conversion factor for user's unit
 U_{TM} : Factor corresponding to flow unit time (ex./m (minute) is 60.)
 S_E : Span factor (ex. E+ 3 is 10^3).
 P_E : Pulse rate (ex. E+ 3 is 10^3).
 T_f : Temperature at operating conditions (°C) (°F)

F_S : Flowrate span
 T_E : Total factor
 D: Internal diameter (m) (inch)
 μ : Viscosity (cP)
 ρ_f : Density at operating conditions (kg/m³) (lb/ft³)

(2) Flow Conversion Factor (Uk)

Flow conversion factor U_k is obtained by carrying out the following computation depending on the selection of the fluid to be measured and the flow unit.

(a) Steam

$$M (\text{Mass flowrate}): U_k = U_{p_f} \cdot U_k (\text{kg}) \quad \dots (7.6.1)$$

$$U_k = \rho_f \cdot U_k (\text{lb}) \quad \dots (7.6.2)$$

$$Q_f (\text{Flowrate at operation}): U_k = U_k (\text{m}^3) \quad \dots (7.7.1)$$

$$U_k = U_k (\text{acf}) \quad \dots (7.7.2)$$

(b) Gas

Q_n : (Flowrate at STP):

$$U_k (\text{Nm}^3) = \frac{P_f}{P_n} \cdot \frac{P_f 273.15}{P_n 273.15} \cdot \frac{1}{K} \quad \dots (7.8.1)$$

$$U_k (\text{scf}) = \frac{P_f}{P_n} \cdot \frac{\frac{5}{9} (T_n - 32) 273.15}{\frac{5}{9} (T_n - 32) 273.15} \cdot \frac{1}{K}$$

$$M: (\text{Mass flowrate}): U_k = \rho_f \cdot U_{p_f} \cdot U_k (\text{kg}) \quad \dots (7.9.1)$$

$$U_k = \rho_f \cdot U_{p_f} \cdot U_k (\text{lb}) \quad \dots (7.9.2)$$

$$Q_f: (\text{Flowrate}): U_k = U_k (\text{m}^3) \quad \dots (7.10.1)$$

$$U_k = U_k (\text{acf}) \quad \dots (7.10.2)$$

(c) Liquid

$$Q_f: (\text{Flowrate}): U_k = U_k (\text{m}^3) \quad \dots (7.11.1)$$

$$U_k = U_k (\text{acf}) \quad \dots (7.11.2)$$

$$M (\text{Mass flowrate}): U_k = \rho_f \cdot U (\text{kg}) \quad \dots (7.12.1)$$

$$U_k = 7.481 \cdot \rho_f \cdot U (\text{lb}) \quad \dots (7.12.2)$$

7.481 is a conversion factor of U.S. gal into acf

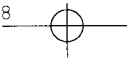
(d) User's unit

$$U_k = U_k (\text{user}) \quad \dots (7.13)$$

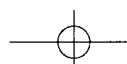
where

M: Mass flow
 H: Calorimetric flow
 Q_n : Volumetric flow in a Normal condition
 M: Mass flow
 Q_f : Volumetric flow in an operating condition
 ρ_f : Specific weight (kg/m³), (lb/acf)
 h_f : Specific enthalpy (kcal/kg), (Btu/lb)
 T_f : Temperature in an operating condition (°C), (°F)
 T_n : Temperature in a Normal condition (°C), (°F)
 P_f : Pressure in an operating condition (kg/cm² abs), (psia)
 P_n : Pressure in a Normal condition (kg/cm² abs), (psia)
 K: Deviation factor
 ρ_n : Density in a Normal condition (kg/Nm³), (lb/scf)
 ρ_f : Density in an operating condition (kg/m³), (lb/acf)
 $U_{k(\text{kg})}$, $U_{k(\text{cal})}$, $U_{k(\text{Nm}^3)}$, $U_{k(\text{m}^3)}$
 $U_{k(\text{lb})}$, $U_{k(\text{Btu})}$, $U_{k(\text{scf})}$, $U_{k(\text{acf})}$: Unit conversion factors

NOTES:



NOTES:





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