Instruction Manual

digitalYEWFLO

Model DY
Vortex Flowmeter
(Integral Type, Remote Type)
Model DYA
Vortex Flow Converter
(Remote Type)

IM 1F6A0-01E-A

YOKOGAWA
Yokogawa Corporation of America

IM 1F6A0-01E-A
1st Edition

CONTENTS

INTRODUCTION

The DY 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 digitalYEWFLO 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 Yokogawa Electric Corporation (hereinafter simply referred to as Yokogawa).
- This manual neither does warrant the marketability of this instrument nor it does warrant that the instrument will suit a particular purpose of the user.
- Every effort has been made to ensure accuracy in the contents of this manual. However, should any questions arise or errors come to your attention, please contact your nearest Yokogawa sales office that appears on the back of this manual or the sales representative from which you purchased the product.
- This manual is not intended for models with custom specifications.
- Revisions may not always be made in this manual in conjunction with changes in specifications, constructions and/or components if such changes are not deemed to interfere with the instrument's functionality or 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, Yokogawa does not guarantee safety.
- If this instrument is used in a manner not specified in this manual, the protection provided by this instrument may be impaired.
- As for explosionproof model, if you yourself repair or modify the instrument and then fail to return it to its original form, the explosion-protected construction of the instrument will be impaired, creating a hazardous condition. Be sure to consult Yokogawa for repairs and modifications.

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

WARNING

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

CAUTION

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

IMPORTANT

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

NOTE

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

⎓ 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.
- In case of Explosion proof type instrument, further requirements and differences are described in Chapter 10 "EXPLOSION PROOF INSTRUMENT". The description in Chapter 10 is prior to other descriptions in this instruction manual.

CAUTION

- When carrying digitalYEWFLO 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.
- In case of Explosion proof type instrument, further requirements and differences are described in chapter 9 "EXPLOSION PROOF TYPE INSTRUMENT". The description in chapter 9 is prior to other descriptions in this instruction manual.

■ Restriction on Use of Radio Transceiver

IMPORTANT

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

1. HANDLING PRECAUTIONS

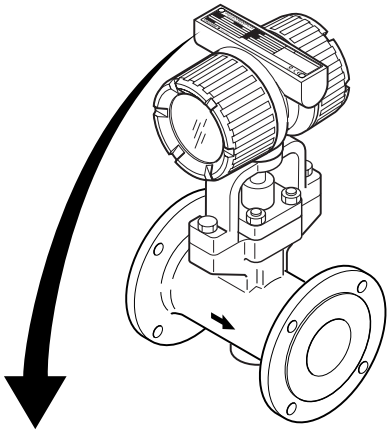
The Model DY Vortex Flowmeter and Model DYA Vortex Flow Converter are thoroughly tested at the factory before shipment. When these instruments are delivered, perform a visual check to ascertain that no damage occurred during shipment.

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

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

1.1 Model and Specifications

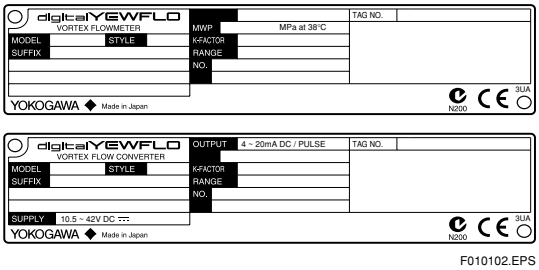
The model and important specifications are indicated on the data plate attached to the case. Verify that they are the same as those specified in the original order, referring to paragraph 2.2 to 2.5. In any correspondence, always give model (MODEL), serial number (NO) and calibrated range (RANGE) from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



NOTE: K Factor at 15°C :K

F010101.EPS

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



F010102.EPS

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 Yokogawa factory.

⚠ 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 expoted 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) 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 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 YEWFLO to allow such work as routine inspections.
- Choose a location that ensures easy wiring and piping.

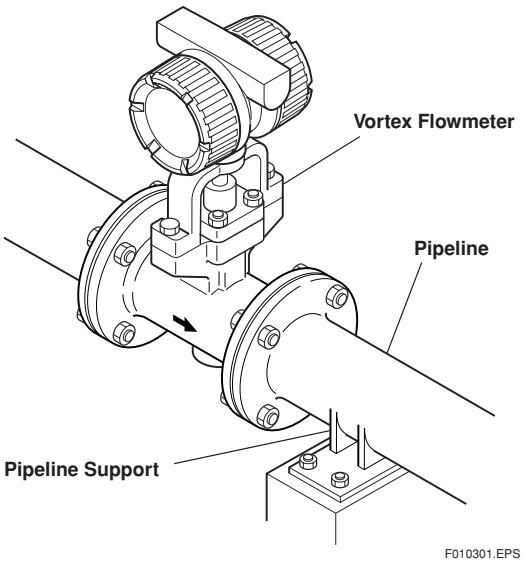


Figure 1.2

2. GENERAL DESCRIPTION

2.1 Outline

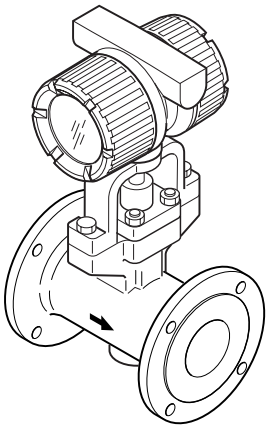
This vortex flowmeter measures liquid, gas and steam flow rates and converts them to a 4 to 20mA DC output or pulse, alarm, status output signal.

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

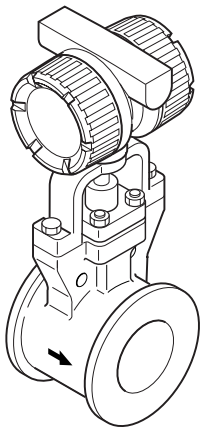
■ Integral Type

The Integral Type Vortex Flowmeter (DY-A) 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



F020101.EPS

Figure 2.1.1 External Views (Integral Type)

■ Remote Type

The Remote Converter Type Vortex Flowmeter (DY-N) is used with the Model DYA Vortex Flow Converter. A special cable (DYC) is used between these instruments.

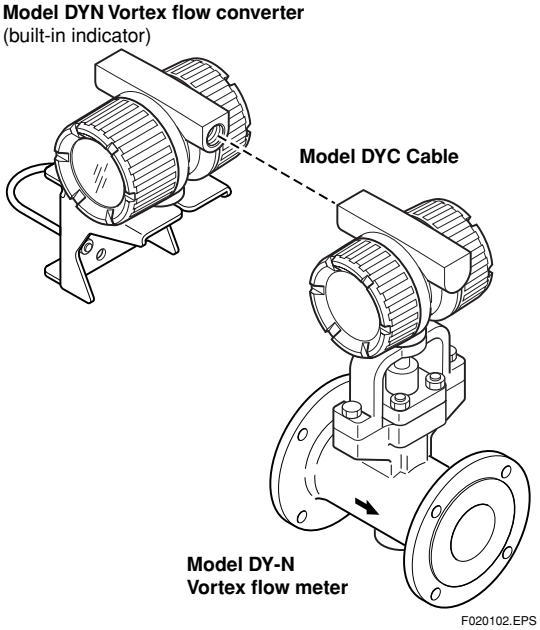


Figure 2.1.2 External Views (Remote Type)

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

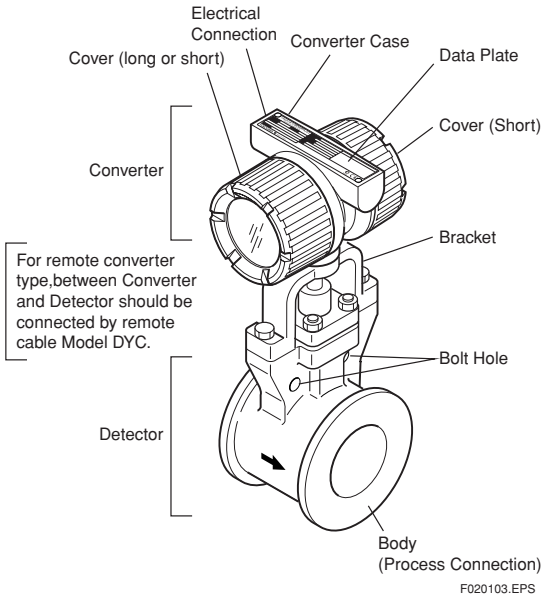


Figure 2.1.3 Example of Name of portion

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/cm^2) 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).
Hazardous Area Classifications:
Refer to item “Option Specifications”
Electrical Connection:
ANSI 1/2 NPT female,
Signal Cable:
Model DYC cable, used for remote detector and converter.
Max. length : 98 ft. (30 m.)
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 :
Communication Signal :
BRAIN or HART communication signal (superimposed on a 4 to 20 mA DC signal)
Conditions of Communication Line :
Load Resistance :
250 to 600 Ω(including cable resistance).
Refer to Figure 2.
Supply Voltage :
16.4 to 42 V DC for digital communications BRAIN and HART protocols .(16.4 to 30 V DC for intrinsically safe type).
Refer to Figure 2.
Spacing from Power Lines : 6 in. (15cm) or more (Parallel wiring should be avoided.)
BRAIN:
Communication Distance :
Up to 1.2 miles (2 km),when polyethylene insulated PVC-sheathed cables (CEV cables) are used. Communication distance varies depending on type of cable used.
Load Capacitance: 0.22 μF or less
Load Inductance: 3.3 mH or less
Input Impedance of Receiver Connected to the Receiving Resistance:
10 kΩ or more at 2.4 kHz.
HART:
Communication Distance:
Up to .9 miles (1.5km), when using multiple twisted pair cables. Communication distance varies depending on type of cable used.

Cable Length for Specific Applications:

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

$$L = \frac{65\times10^6}{(R\times C)} - \frac{(C_f+10.000)}{C}$$

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.

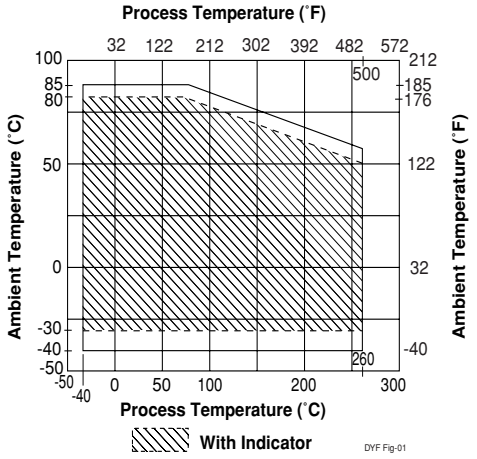


Figure 1 Ambient Temperature limit (Integral Type)

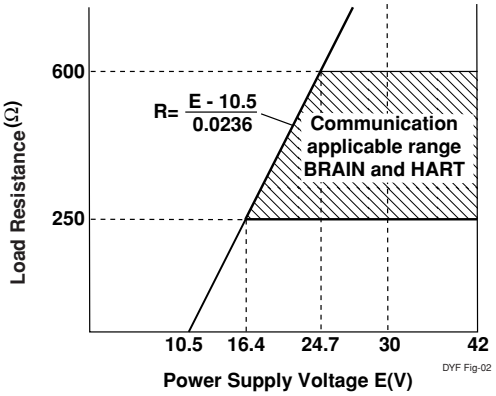


Figure 2 Relationship Between Power Supply and Load Resistance

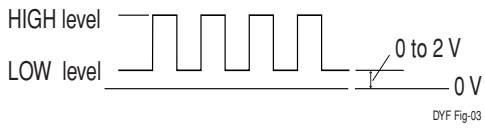


Figure 3 High and low level (Pulse output)

2.3 Model and Suffix Codes

DY Vortex Flowmeter (Integral Type, Remote type detector)

Model	Suffix Codes			Description
DY015	·····			Size 15 mm (1/2 inch)
DY025	·····			Size 25 mm (1 inch)
DY040	·····			Size 40 mm (1-1/2 inch)
DY050	·····			Size 50 mm (2 inch)
DY080	·····			Size 80 mm (3 inch)
DY100	·····			Size 100 mm (4 inch)
DY150	·····			Size 150 mm (6 inch)
DY200	·····			Size 200 mm (8 inch)
DY250	·····			Size 250 mm (10 inch)
DY300	·····			Size 300 mm (12 inch)
Output Signal /Communication *1	-D ·····			4 to 20 mA DC, Pulse, BRAIN Communication
	-E ·····			4 to 20 mA DC, Pulse, HART Communication
	-N ·····			Remote type detector
Body Material *2		B ·····		CF8M
		X ·····		Others
Shedder bar Material *3			M ·····	Duplex Stainless
			X ·····	Others
			L ·····	Duplex Stainless
Process Connection *4			AA1 ·····	ANSI Class 150 Wafer
			AA2 ·····	ANSI Class 300 Wafer
			AA4 ·····	ANSI Class 600 Wafer
			BA1 ·····	ANSI Class 150 Flange(Raised Face)
			BA2 ·····	ANSI Class 300 Flange(Raised Face)
			BA4 ·····	ANSI Class 600 Flange(Raised Face)
			BA5 ·····	ANSI Class 900 Flange(Raised Face)
			CA4 ·····	ANSI Class 600 Flange(Ring Joint)
			CA5 ·····	ANSI Class 900 Flange(Ring Joint)
Electrical Connection		-2·····		ANSI 1/2 NPT Female *5
Indicator *6			D ·····	With Indicator
			N ·····	No Indicator, Remote type detector
Options		/□		Refer to Option Specifications

DYF Tab-01

DYA Vortex Flowmeter Converter(Remote Type)

Model	Suffix Code		Description
DYA	·····		Vortex Flowmeter Converter (Remote Type)
Output Signal /Communication *1	-D·····		4 to 20 mA DC, Pulse BRAIN Communication
	-E·····		4 to 20 mA DC, Pulse HART Communication
Electrical Connection	2·····		ANSI 1/2 NPT Female *5
Indicator		D ·····	With Indicator
		N ·····	No Indicator
Options	/ □		Refer to Option Specifications

DYC Signal Cable

Model	Suffix Code	Description
DYC	·····	Signal Cable
Cable End	-1·····	With End finish
Cable Length	-0010F·····	10 ft.
	-0015F·····	15 ft.
	-0030F·····	30 ft.
	-0050F·····	50 ft.
	-0065F·····	65 ft.
	-0075F·····	75 ft.
	-0100F·····	100 ft.

* 1 : Nominal size, Fluid(Liquid, Gas, Steam), Density, Viscosity, Pressure, Temperature, Flow range, Parameters are set at the factory before shipment.
* 2 : Refer to Table 1.
When selecting option /NC or /HX or /HT, select X (others).
* 3 : Select M for .5-8in (15-200mm) sizes.
Select L for 10-12in (250-300mm) sizes.
When selecting option /NC, /HX, or /HT select X.
* 4 : Refer to Table 2.
* 5 : In case of /FF1 or /CF1, the screw length is deeper than ANSI standard for 0.5 to 3.5 threads.
* 6 : Indicator is not available for remote type detector.

DYF Tab-02

Table 1 Body, Shedder bar, Gasket Material

Option Item (Note 1)	Option Code (Note 1)	Material			Process Connection	
		Body (Note 2)	Shedder bar (Note 3)	Gasket	Wafer Nominal Size	Flange Nominal Size
General (REFERENCE)	—	CF8M	Duplex Stainless Steel	(Note 4)	.5 to 4 in. (15 to 100mm)	.5 to 12 in. (15 to 300mm)
Compliance with NACE	NC	CF8M	Hastelloy C	(Note 5)	.5 to 4 in. (15 to 100mm)	.5 to 8 in. (15 to 200mm)
Corrosion Resistant Version	HX	Hastelloy C	Hastelloy C	(Note 5)	.5 to 4 in. (15 to 100mm)	.5 to 6 in. (15 to 150mm)
High Process Temperature Version	HT	CF8M	Hastelloy C	316SS stainless steel plated with silver	1 to 4 in. (25 to 100mm)	1 to 8 in. (25 to 200mm)

(Note 1) Refers to options for Model and Suffix Codes (page 4).
(Note 2) When selecting /NC or /HX or /HT, select body material code [-X].
(Note 3) When selecting /NC or /HX or /HT, select shedder bar material code [-X].
(Note 4) 316SS stainless steel with polytetrafluoroethylene(Teflon) coating
(Note 5) Hastelloy C with polytetrafluoroethylene (Teflon) coating.

DYF Tab-03

Table 2 Flowmeter Selection Guide

Process Connection	Wafer		Flange(Raised Face)		Flange(Ring Joint)	
	Suffix Code	Nominal Size	Suffix Code	Nominal Size	Suffix Code	Nominal Size
ANSI Class 150	AA1	.5 in up to 4 in (15 mm up to 100 mm)	BA1	.5 in up to 12 in (15 mm up to 300 mm)	—	—
ANSI Class 300	AA2	.5 up to 4 in (15 mm up to 100 mm)	BA2	.5 in up to 12 in (15 mm up to 300 mm)	—	—
ANSI Class 600	AA4	.5 in up to 4 in (15 mm up to 100 mm)	BA4	.5 in up to 8 in (15 mm up to 200 mm)	CA4	.5 in up to 8 in (15 mm up to 200 mm)
ANSI Class 900	—	—	BA5	1 in up to 6 in (25 mm up to 150 mm)	CA5	1 in up to 6 in (25 mm up to 150 mm)

DYF Tab-04

2.4 Option Specifications

ITEM	Specifications	Code
Factory Mutual (FM)	FM Explosion proof Approval Explosion proof for Class I, Division 1, Groups A,B,C and D Dust-ignition proof for Class II/III, Division 1, Groups E, F and G Enclosure: NEMA TYPE4X Seal all conduit within 18 inches For Class I, Div. 2 locations "FACTORY SEALED, CONDUIT SEAL NOT REQUIRED." Temperature Code: T6 Amb. Temp: -40 to 140°F (-40 to 60°C) Electrical connection: ANSI 1/2NPT female	FF1
	FM Intrinsically safe Approval (Note 1) Intrinsically safe for Class I,II,III, Division 1, Groups A, B, C, D, E, F and G Nonincendive for Class I,II, Division 2, Groups A, B, C, D, E, F and G, Class III, Division 1 Hazardous locations Enclosure: NEMA 4X Temperature Code: T4 Amb. Temp.(Integral Type and Remote Type Converter) : -40 to 140°F (-40 to 60°C) Amb. Temp.(Remote Type Detector) : -40 to 185°F (-40 to 85°C) Vmax=30 V, Imax=165 mA, Pmax=0.9 W, Ci=6 nF, Li=0.15 mH Electrical connection: ANSI 1/2NPT female	FS1

(Note 1) : For intrinsically safe approval, use a certified barrier

DYF Tab-05

ITEM	Specifications	Code
Canadian Standards Association (CSA)	CSA Explosion proof Approval Explosion proof for Class I,Division 1, Groups B,C and D Dust-ignition proof for Class II/III, Division 1, Groups E, F and G For class I, Division 2 locations "FACTORY SEALED, CONDUIT SEAL NOT REQUIRED." Enclosure: "Type 4X" Temperature class : T6...T1 Amb.Temp.:-40 to 140°F (-40 to 60°C) Max. process temp. : T6; 185°F (85°C,) T5; 212°F (100°C), T4; 275°F (135°C), T3; 392°F (200°C), T2; 572°F (300°C), T1; 842°F (450°C) Electrical connection : ANSI 1/2 NPT female	CF1
	CSA Intrinsically safe Approval (Note 1) Intrinsically safe for Class I,II,III, Division 1, Groups A, B, C, D, E, F and G Nonincendive for Class I,II, Division 2, Groups A, B, C, D, E, F and G, Class III, Division 1 Enclosure: "Type 4X", Temperature class : T4...T1 Amb. Temp.(Integral Type and Remote Type Converter): -40 to 140°F (-40 to 60°C) Amb. Temp.(Remote Type Detector): -40 to 185°F (-40 to +85°C) Max. process temp. : T4; 275°F (135 °C), T3; 392°F (200°C), T2; 572°F (300°C), T1; 842°F (450°C) Vmax=30 V, Imax=165 mA, Pmax=0.9 W, Ci=6 nF, Li=0.15 mH	CS1

DYF Tab-06

(Note 1) : For intrinsically safe approval, use a certified barrier

Item	Specification	Applicable Model	Code
Stainless Steel Tag Plate (Note 1)	SUS304 tag plate, wire tied to converter case.	DY/DYA	SCT
Stainless Steel Bolt & Nut Assembly	SUS304 bolt/nut assembly. Used when a wafer type is installed.	DY Wafer Type	BL
Epoxy Coating	Epoxy coating for meter cover and case.	DY / DYA	X1
High Process Temperature Version	Process temperature range -40 to 842°F (-40 to +450°C) Refer to Table 1 , Figure 4. Refer to Table 5 for minimum velocity. For other sizes, please contact YOKOGAWA.	DY***-N	HT
Lightning Protector	Lightning arrester in power supply line. Maximum power supply voltage : 30VDC	DY***-D,E / DYA	A
Compliance with NACE	Compliance with NACE. Refer to Table 1.	DY	NC
Corrosion Resistant Version	Corrosion Resistant Verion. Refer to Table 1.	DY	HX
180° Rotation of Converter Housing	180° rotation of housing (flow right to left).	DY	CRC
Down-scale burn-out in event of CPU or EEPROM failure /NAMUR compliance(Note 2)	Set output to 3.6mA or less when burn-out occurs.	DY***-D,E / DYA	NM

DYF Tab-07

(Note 1) When /SCT is not chosen, the specified Tag Number is printed on a paper tag.
(Note 2) The output is set 3.6mA or less (General type is set 21.6mA or more at shipping).

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)

DYF Tab-09

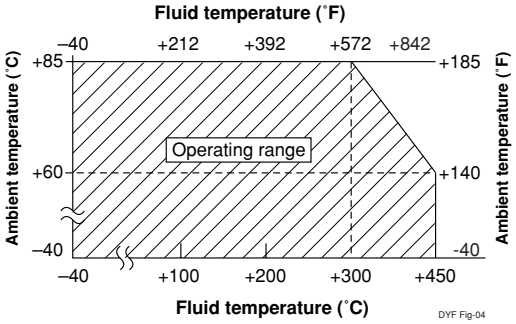


Figure 4 Fluid temperature range of high process temperature version

2.5 Sizing

The following tables show typical operating ranges. For specific operating conditions please run the flow meter sizing program. Available from Yokogawa.

■ 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.

DYF Tab-10-II

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/m^3)
Liquid density is 400-2000kg/m^3
Gas and steam density is 0.5kg/m^3 or more.

Table 6 Range of Measurable flow velocity

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

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

DYF Tab-11

■ 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 (10 m/s)
	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	
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 (80 m/s)
	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	

DYF Tab-12

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)}

DYF Tab-13

D : Inner diameter of YEWFLO (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.

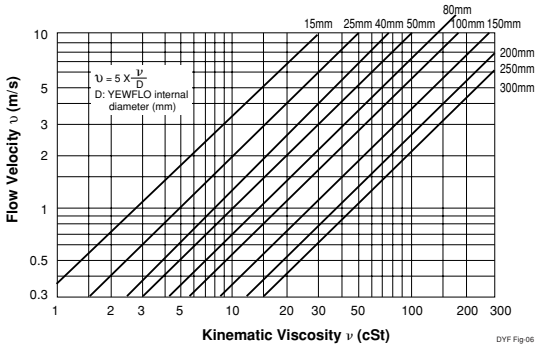


Figure 6 Flow velocity at Reynolds number of 5000(Liquid)

■ Calculation formula

■ How to calculate volume flow rate at operating conditions.

• $Qf = \frac{\upsilon \times D^2}{354}$ or $Qf = 3600 \times \upsilon \times S$

■ How to calculate the velocity of a Reynolds number.

• $\upsilon = 5 \times \nu / D$ (Reynolds number of 5000)
• $\upsilon = 20 \times \nu / D$ (Reynolds number of 20000)
• $\upsilon = 40 \times \nu / D$ (Reynolds number of 40000)

however

• $Re = \frac{354 \times 10^3 \times Qf}{\nu \times D}$ ..... (1)

• $\nu = \frac{\mu}{\rho f} \times 10^3$ ..... (2)

Qf : Volume flow rate at operating conditions (m^3/h)
D : Inner diameter of YEWFLO (mm)
S : Sectional area of YEWFLO(m^2)
υ : Flow velocity (m/s)
Re : Reynolds number (none unit)
pf : Density at operating conditions (kg/m^3)
μ : Viscosity at operating conditions (cP)
ν : Kinematic viscosity at operating conditions (cSt)

Table 9 Inner Diameter and Nominal value

Nominal Size		Inner Diameter in. (mm)	Nominal K-Factor Pulse /G (/L)	Nominal Pulse Rate	
mm	inch			Hz/ft/s (Hz/m/s)	Hz/ft/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, ρ = 62.428 lb/cubic ft)

Nominal Size		Measurable Flow Rate in GPM (m^3/h)	Range of Guarranted Accuracy Flow Rate in GPM (m^3/h)
mm	inch		
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)	20.2 625 (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)

DYF Tab-14-b

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	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)
(15mm)	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	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)
(25mm)	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	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)
(40mm)	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	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)
(50mm)	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	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)
(80mm)	max.	672.4(1140)	1359(2266)	1817(3391)	2964(5642)	4113(7892)	5263(10143)	7568(12394)	121986(18021)	14518(23648)	16842(29274)
4.0 in	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)
(100mm)	max.	1167(1990)	2360(3954)	3156(5919)	5148(9847)	7143(13775	9140(17703)	13143(21632)	21182(31453)	25214(41274)	29251(51095)
6.0 in	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)
(150mm)	max.	2556(4358)	5168(8659)	6911(12960)	11272(21559	15639(30163	20012(38765)	28777(47365)	46377(68867)	55205(90373)	64044(111875)
8.0 in	min.	496(575)	706.5(809)	817.0(990)	1043(1445)	1229(2202)	1390(2599)	1937(3175)	3122(4617)	3717(6059)	4312(7501)
(200mm)	max.	4582(7792)	9264(15482)	12387(23172	20204(38549	28033(53933	35872(69313)	51582(84693)	83129(123138)	98952(161591)	114796(200046)
10 in	min.	885(1037)	1259(1461)	1456(1788)	1859(2306)	2190(3127)	2478(4019)	2992(4911)	6911(7140)	5739(9370)	6658(11600)
(250mm)	max.	7075(12049)	14304(23939	19127(35833	31196(59611	43283(83400	55387(107181)	79644(130968)	128353(190418)	152784(249881)	177246(309334)
12 in	min.	1269(1485)	1805(2093)	2087(2561)	2665(3303)	3139(4479)	3551(5756)	4288(7033)	6911(10226)	8226(13419)	9543(16612)
(300mm)	max.	10142(17256)	20503(34286)	27415(51317)	44715(85370)	62039(119441)	79388(153499)	114157(187556)	183972(272699)	218890(357856)	254053(443017)

DYF Tab-15

(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/hr 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.	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)
(15mm)	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.	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)
(25mm)	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.	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)
(40mm)	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.	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)
(50mm)	max.	1497(671)	1965(979)	3109(1580)	4231(2170)	5340(2753)	7538(3333)	11916(4778)	14113(6228)	18552(7688)	23070(9166)
3.0 in.	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)
(80mm)	max.	2906(1295)	3814(1891)	6034(3050)	8210(4188)	10363(5314)	14628(6435)	23124(9224)	27389(12024)	36003(14842)	44771(17694)
4.0 in.	min.	465(148)	533(179)	670.7(227)	782.4(267)	878.9(300)	1044(330)	1313(402)	1428(524)	1638(647)	1947(772)
(100mm)	max.	5047(2261)	6624(3300)	10479(5326)	14259(7310)	17997(9276)	25406(11232)	40160(16102)	47567(20986)	62527(25907)	77754(30883)
6.0 in.	min.	1019(324)	1167(392)	1468(498)	1712(600)	1924(761)	2286(922)	3303(1322)	3912(1723)	5142(2127)	6395(2536)
(150mm)	max.	11051(4950)	14504(7226)	22944(11661)	31221(16010)	39404(20315)	55625(24595)	87929(35258)	104146(45953)	136900(56729)	170239(67624)
8.0 in.	min.	2214(697)	2537(841)	3190(1068)	3722(1252)	4181(1410)	4968(1649)	6246(2364)	7012(3081)	9218(3803)	11463(4534)
(200mm)	max.	19808(8851)	25997(12918)	41126(20850)	55962(28627)	70631(36325)	99706(43976)	157608(63043)	186678(82165)	245387(101433)	305147(120913)
10.0 in.	min.	3947(1256)	4521(1518)	5687(1929)	6634(2260)	7453(2546)	11133(2801)	11133(3655)	12117(4764)	14233(5882)	17694(7011)
(250mm)	max.	30585(13687)	40140(19977)	63500(32243)	86407(44268)	109055(56172)	153947(68005)	243350(97489)	288234(127058)	378881(156854)	471152(186978)
12.0 in.	min.	5657(1799)	6481(2174)	8152(2762)	9509(3236)	10683(3646)	12692(4012)	15958(5235)	17367(6823)	20400(8423)	25369(10041)
(30mm)	max.	46838(19602))	57535(28609))	91017(46175))	123850(63397)	156313(80445)	220658(97390)	348802(139614	413135(181960)	543063(224633)	675317(267772)

DYF Tab-16

(1) Maximum flow rate is at 262 f/s (80m/s).
(3) Minimum values are determined from Table 5.

■ Pressure Loss

At velocity of 10 m/s by water, ΔP = 108 kPa
At velocity of 80 m/s by atmospheric air,
ΔP = 9 kPa
obtained from the following equations.

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

or

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

where,

ΔP : Pressure loss (kPa)
ρ_f : Density at operating condition (kg/m^3)
υ : 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 30m^3/h.

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

$$\Delta P = 135 \times 972 \times \frac{30^2}{51.1^4}$$

$$= 17.3 \text{kPa}$$

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

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

Therefore, substitute this value in equation (1):

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

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

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

■ 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.

$$P = 2.7 \cdot \Delta P + 1.3 \cdot Po \cdots\cdots (3)$$

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.
Po : 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:

Po = 47.4 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.

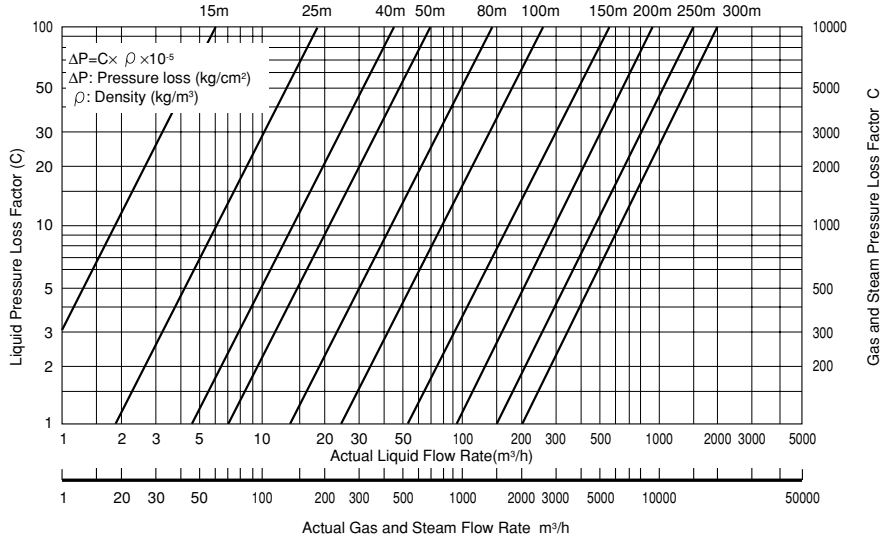


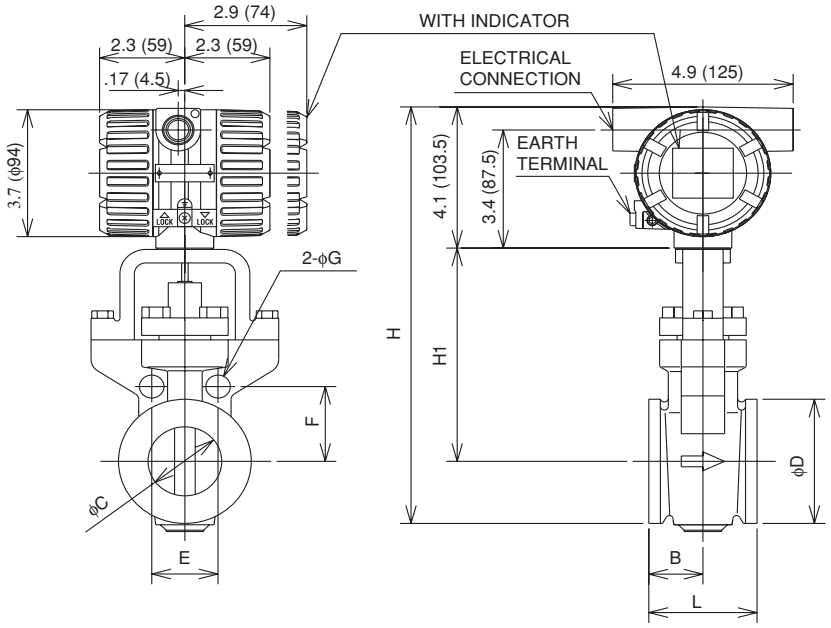
Figure 7 Pressure Loss

2.6 External Dimensions

■ **Wafer 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	INTEGRAL/REMOTE											
CODE	DY015 [.5 in (15mm)]						DY025 [1 in (25mm)]					
PROCESS CONNECTION	inches			millimeters			inches			millimeters		
	AA1	AA2	AA4	AA1	AA2	AA4	AA1	AA2	AA4	AA1	AA2	AA4
L	2.8 in			70 mm			2.8 in			70 mm		
B	1.4 in			35 mm			1.4 in			35 mm		
C	.6 in			14.6 mm			1.0 in			25.7 mm		
D	1.4 in			35.1 mm			2.0 in			50.8 mm		
H	9.8 in			248 mm			10.2 in			258 mm		
H1	5 in			127 mm			5.1 in			129 mm		
E	1.7	1.9	1.9	42.7	47.1	47.1	2.2	2.5	2.5	56	62.9	62.9
F	.8	.9	.9	21.4	23.5	23.5	1.1	1.2	1.2	28	31.4	31.4
G	.6	.6	.6	14	14	14	.6	.7	.7	14	17	17
WEIGHT	6 lb			2.8 kg			8 lb			3.7 kg		

TYPE	INTEGRAL/REMOTE											
CODE	DY040 [1.5 in (40mm)]						DY050 [2 in (50mm)]					
PROCESS CONNECTION	inches			millimeters			inches			millimeters		
	AA1	AA2	AA4	AA1	AA2	AA4	AA1	AA2	AA4	AA1	AA2	AA4
L	2.8 in			70 mm			3.0 in			75 mm		
B	1.4 in			35 mm			1.5 in			37.5 mm		
C	1.6 in			39.7 mm			2.0 in			51.1 mm		
D	2.9 in			73 mm			3.6 in			92 mm		
H	10.9 in			276 mm			12.2 in			307.5 mm		
H1	5.4 in			136 mm			6.2 in			158 mm		
E	2.8	3.2	3.2	69.7	80.8	80.8	(Note 3)	1.9	1.9	(Note 3)	48.6	48.6
F	1.4	1.6	1.6	34.8	40.4	40.4	(Note 3)	2.3	2.3	(Note 3)	58.7	58.7
G	.6	.8	.8	14	20	20	(Note 3)	.6	.6	(Note 3)	17	17
WEIGHT	9.5 lb			4.3 kg			14 lb			6.0 kg		

TYPE	INTEGRAL/REMOTE											
CODE	DY080 [3 in (80mm)]						DY100 [4 in (100mm)]					
PROCESS CONNECTION	inches			millimeters			inches			millimeters		
	AA1	AA2	AA4	AA1	AA2	AA4	AA1	AA2	AA4	AA1	AA2	AA4
L	3.9 in			100 mm			4.7 in			120 mm		
B	1.5 in			40 mm			1.9 in			50 mm		
C	2.8 in			71 mm			3.7 in			93.8 mm		
D	5.0 in			127 mm			6.2 in			157.2 mm		
H	13.5 in.			342 mm			14.6 in.			372 mm		
H1	6.9 in			175 mm			7.5 in			190 mm		
E	(Note 3)	2.5	2.5	(Note 3)	64.4	64.4	2.9	3.0	3.3	72.9	76.6	82.6
F	(Note 3)	3.1	3.1	(Note 3)	77.7	77.7	3.5	3.6	3.9	88	92.5	99.7
G	(Note 3)	.8	.8	(Note 3)	20	20	.7	.8	.9	17	20	23
WEIGHT	21 lb			9.4 kg			28 lb			12.8 kg		

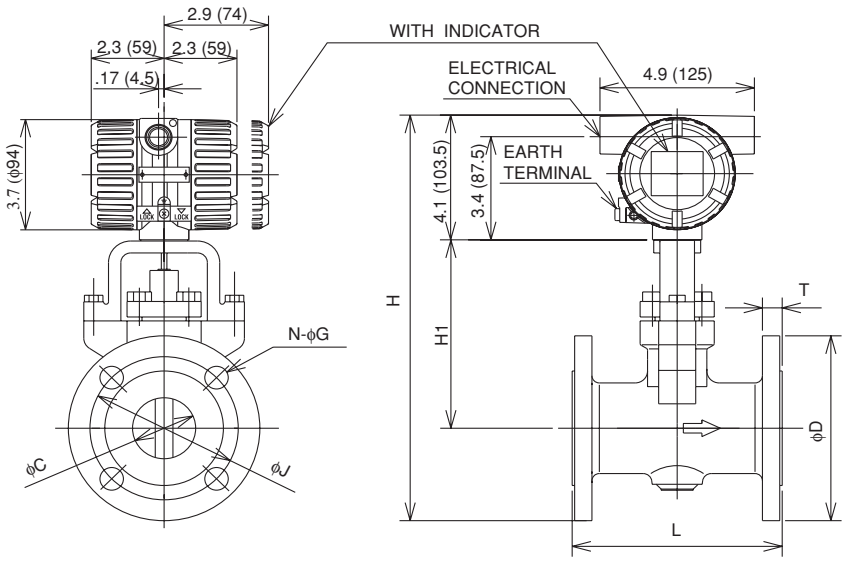
(Note 1) Integral weight is the same as Remote.
(Note 2) Add .5lb for display.
(Note 3) The hole is not provided.

F02.06-03.EPS

■ **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	INTEGRAL/REMOTE															
CODE	DY015 [.5 in (15mm)]								DY025 [1 in (25mm)]							
PROCESS CONNECTION	inches				millimeters				inches				millimeters			
	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	INTEGRAL/REMOTE															
CODE	DY040 [1.5 in (40mm)]								DY050 [2 in (50mm)]							
PROCESS CONNECTION	inches				millimeters				inches				millimeters			
	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	8	4	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	INTEGRAL/REMOTE															
CODE	DY080 [3 in (80mm)]								DY100 [4 in (100mm)]							
PROCESS CONNECTION	inches				millimeters				inches				millimeters			
	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	32	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	170	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			
G	.8	.9	23	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

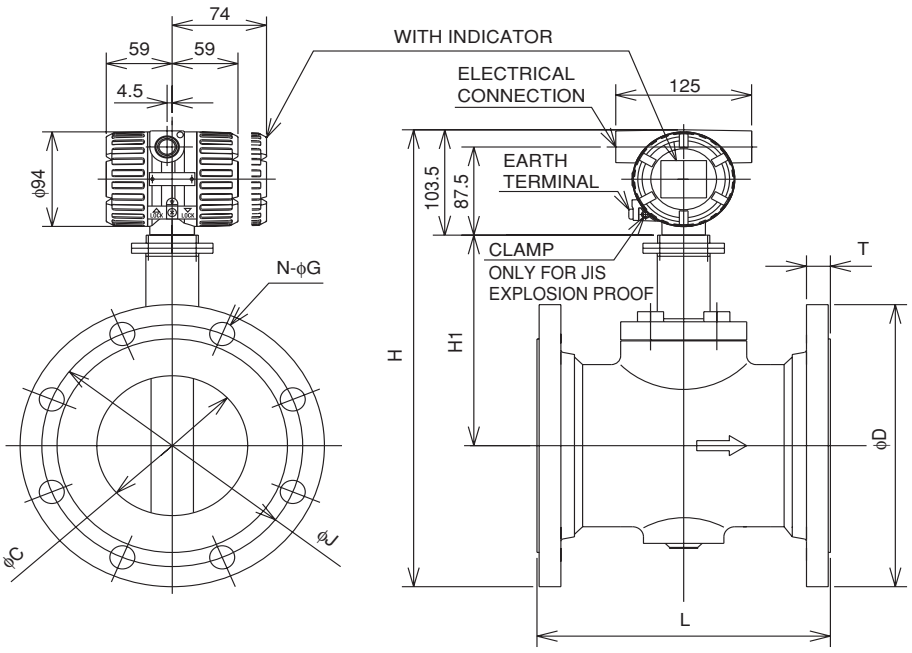
(Note 1) Integral weight is the same as Remote
(Note 2) Add .5lb for display.

F02.06-01.EPS

■ **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	DY150 [6 in (150mm)]								DY200 [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	DY250 [10 in (250mm)]				DY300 [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

F02.06-02A.EPS

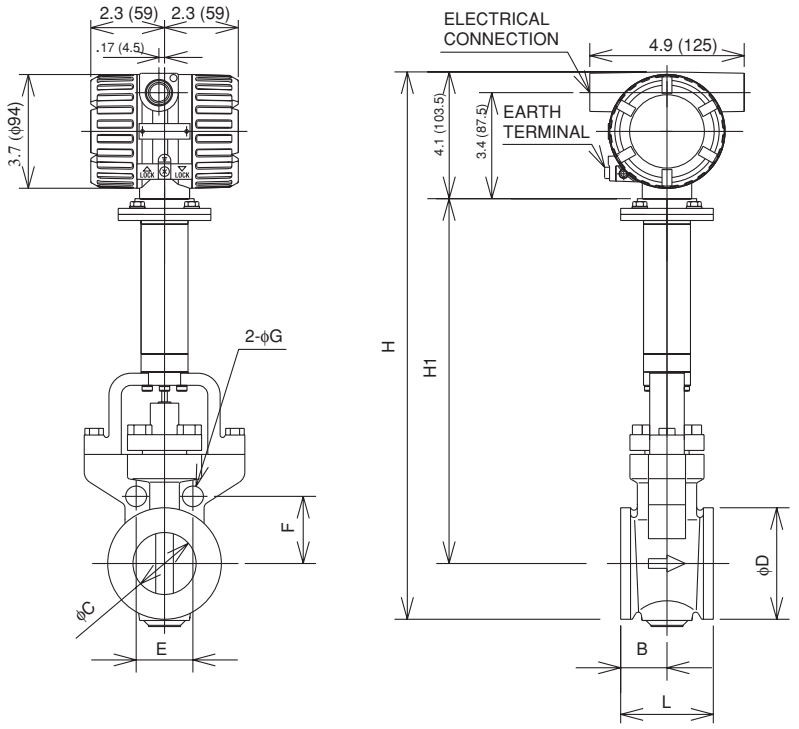
(Note 1) Integral weight is the same as Remote
(Note 2) In case of with indicator, add 0.2kg

■ **High Process Temperature Version (/HT): 1 to 4 in (25mm up to 100mm)**

■ **Wafer type**

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

Unit: in (mm)



TYPE	REMOTE Only																	
CODE	DY025 [1 in (25mm) /HT]						DY040 [1.5 in (40mm) /HT]						DY050 [2.0 in (50mm) /HT]					
PROCESS CONNECTION	inches			millimeters			inches			millimeters			inches			millimeters		
	AA1	AA2	AA4	AA1	AA2	AA4	AA1	AA2	AA4	AA1	AA2	AA4	AA1	AA2	AA4	AA1	AA2	AA4
L	2.8 in			70 mm			2.8 in			70 mm			3.0 in			75 mm		
B	1.4 in			35 mm			1.4 in			35 mm			1.5 in			37.5 mm		
C	1.0 in			25.7 mm			1.6 in			39.7 mm			2.0 in			51.1 mm		
D	2.0 in			50.8 mm			2.8 in			73 mm			3.6 in			92 mm		
H	15.8 in			401 mm			16.5 in			419 mm			17.7 in			450.5 mm		
H1	10.7 in			272 mm			10.9 in			279 mm			11.8 in			301 mm		
E	2.2	2.5	2.5	56	62.9	62.9	2.7	3.2	3.2	69.7	80.8	80.8	(Note 1)	1.9	1.9	(Note 1)	48.6	48.6
F	1.1	1.2	1.2	28	31.4	31.4	1.4	1.6	1.6	34.8	40.4	40.4	(Note 1)	2.3	2.3	(Note 1)	58.7	58.7
G	.6	.7	.7	14	17	17	.6	.8	.8	14	20	20	(Note 1)	.7	.7	(Note 1)	17	17
WEIGHT	9 lb			4.1 kg			10 lb			4.7 kg			14 lb			6.4 lb		

F02.06-06.EPS

TYPE	REMOTE Only											
CODE	DY080 [3 in (80mm) /HT]						DY100 [4 in (100mm) /HT]					
PROCESS CONNECTION	inches			millimeters			inches			millimeters		
	AA1	AA2	AA4	AA1	AA2	AA4	AA1	AA2	AA4	AA1	AA2	AA4
L	3.9 in			100 mm			4.7 in			120 mm		
B	1.6 in			40 mm			2.0 in			50 mm		
C	2.8 in			71 mm			3.7 in			93.8 mm		
D	5.0 in			127 mm			6.2 in			157.2 mm		
H	19.1 in			485 mm			20.3 in			515 mm		
H1	12.5 in			318 mm			13.1 in			333 mm		
E	(Note 1)	2.5	2.5	(Note 1)	64.4	64.4	2.9	3.0	3.3	72.9	76.6	82.6
F	(Note 1)	3.1	3.1	(Note 1)	77.7	77.7	3.5	3.6	3.9	88	92.5	99.7
G	(Note 1)	.8	.8	(Note 1)	20	20	.7	.8	.9	17	20	23
WEIGHT	22 lb			9.8 kg			29 lb			13.2 kg		

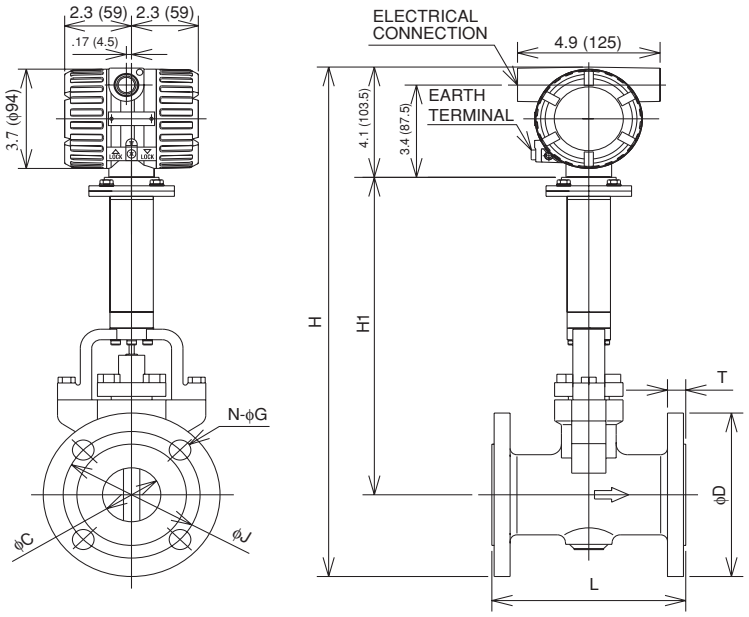
(Note 1) The hole is not provided.

■ **High Process Temperature Version (/HT): 1 to 4 in (25mm up to 100mm)**

■ **Flange type**

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

Unit: in (mm)



TYPE	REMOTE Only							
CODE	DY025 [1 in (25mm) /HT]							
PROCESS CONNECTION	inches				millimeters			
	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5
L	5.9 in			7.5 in	150 mm			190
C	1.0 in				25.7 mm			
D	4.3	4.9	4.9	5.9	108	124	124	149.4
H	16.9	17.2	17.2	17.7	430	438	438	450
H1	10.7 in				272 mm			
T	.6	.7	.9	1.4	14.2	17.5	24	34.9
J	3.1	3.5	3.5	4.0	79.2	89	89	101.6
N	4				4			
G	.6	.7	.7	1.0	15.7	19	19	25.4
WEIGHT	15 lb	17 lb	18 lb	26 lb	7.0 kg	7.6 kg	8.1 kg	11.5 kg

TYPE	REMOTE Only															
CODE	DY040 [1.5 in (40mm) /HT]								DY050 [2 in (50mm) /HT]							
PROCESS CONNECTION	inches				millimeters				inches				millimeters			
	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				39.7 mm				2 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	17.6	18.1	18.1	18.6	446	460	460	472	18.9	19.1	19.1	20.2	481	487	487	513
H1	11 in				279 mm				11.9 in				301 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	3.9	4.5	4.5	4.9	98.6	114.3	114.3	124	4.8	5.0	5.0	6.5	120.7	127	127	165.1
N	4				4				4	8	8	8	4	8	8	8
G	.6	.9	.9	1.1	15.7	22.4	22.4	28.4	.7	.7	.7	1.0	19	19	19	25.4
WEIGHT	18.8 lb	21.4 lb	25.8 lb	37 lb	8.5 kg	9.7 kg	11.7 kg	16.6 kg	27 lb	30 lb	34 lb	59 lb	12.1 kg	13.6 kg	15.2 kg	26.9 kg

TYPE	REMOTE Only															
CODE	DY080 [3 in (80mm) /HT]								DY100 [4 in (100mm) /HT]							
PROCESS CONNECTION	inches				millimeters				inches				millimeters			
	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5
L	7.8 in			9.7	200 mm			245	8.6 in		9.4	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	10	10.7	11.5	228.6	254	273	292.1
H	20.4	20.7	20.7	21.3	517	527	527	542	21.7	22.2	22.5	23	552	564	573	583
H1	12.5 in				318 mm				13.1 in				333 mm			
T	.9	1.5	1.5	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			
G	.7	.9	.9	1.0	19	22.4	22.4	25.4	.7	.9	1	1.3	19	22.4	25.4	31.8
WEIGHT	45 lb	54 lb	57 lb	80 lb	20.4 kg	24.2 kg	25.8 kg	36.1 kg	62 lb	80 lb	113 lb	125 lb	27.8 kg	36.3 kg	51.2 kg	56.3 kg

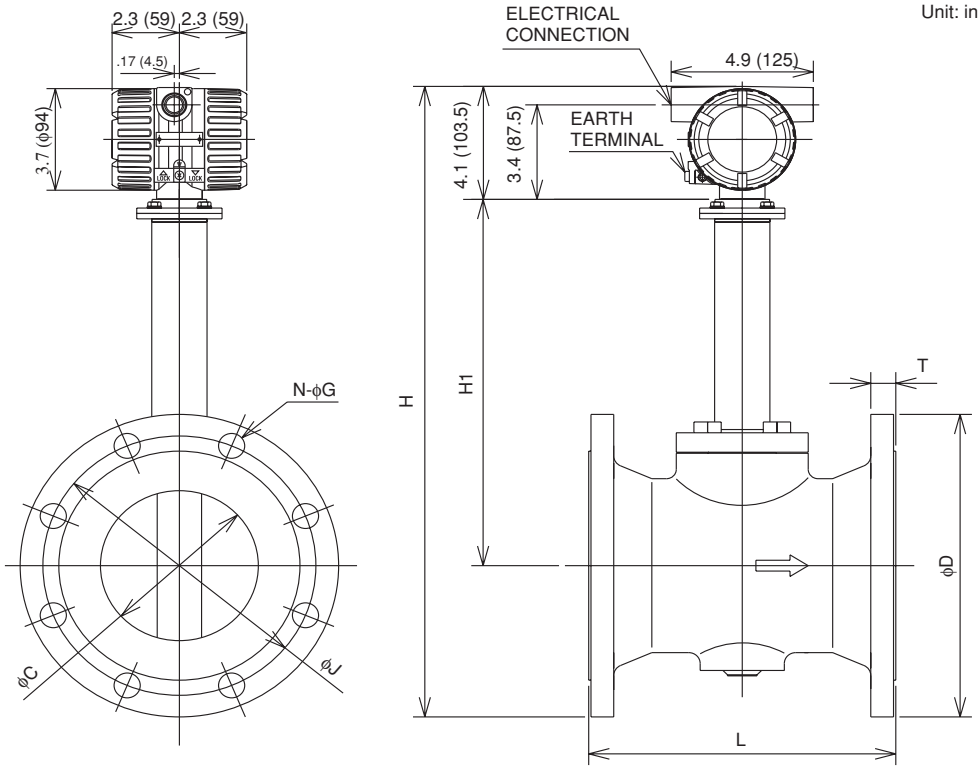
F02.06-04.EPS

■ **High Process Temperature Version (/HT): 6 to 8 in (150mm up to 200mm)**

■ **Flange type**

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

Unit: in (mm)

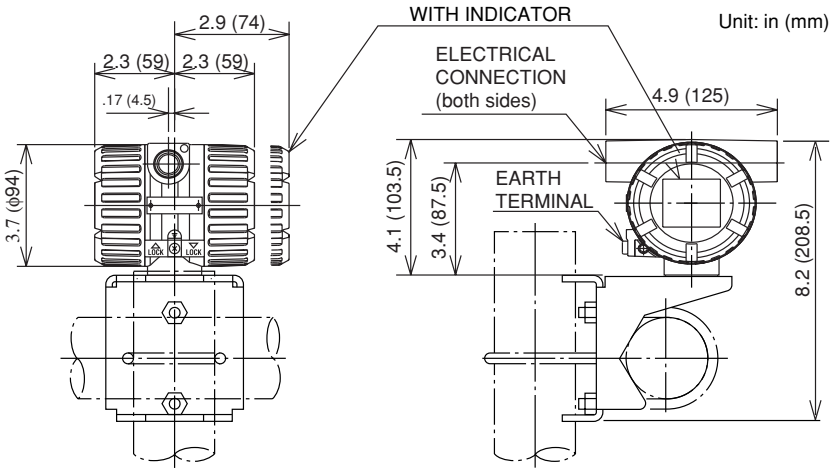


TYPE	REMOTE Only															
CODE	DY150 [6 in (150mm) /HT]								DY200 [8 in (200mm) /HT]							
PROCESS CONNECTION	inches				millimeters				inches				millimeters			
	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5	BA1	BA2	BA4	BA5
L	10.6 in		12.2	13.2	270 mm		310	336	12.2 in		14.6	15.2	310 mm		370	386
C	5.3 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	22.9	23.6	24.5	24.9	582	601	621	633	25.4	26.1	26.9	27.9	646	665	684	709
H1	13.4 in				339 mm				14.6 in				371 mm			
T	1	1.4	2.1	2.4	25.4	36.6	54.4	62	1.2	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	11.7	13	13.8	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	1.3	1.5	22.4	25.4	31.8	38.1
WEIGHT	80 lb	120 lb	233 lb	234 lb	36.4 kg	54.4 kg	84.4 kg	106 kg	122 lb	178 lb	300 lb	400 lb	55.4 kg	80.4 kg	136 kg	182 kg

F02.06-05.EPS

■ **Remote Type Converter**

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

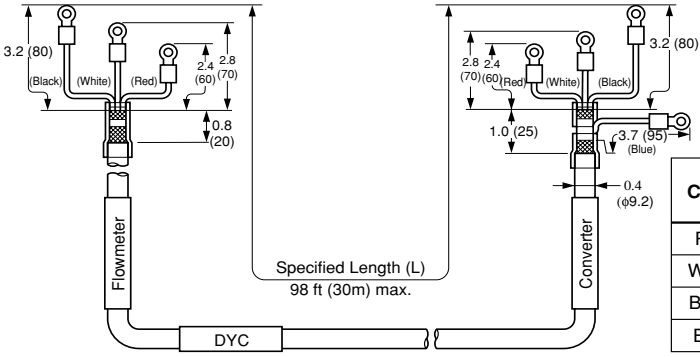


Weight: 4.2lbs (1.9 kg)
Note: For flowmeters with indicator, add .4lbs (0.2 kg).

F02.06-07.EPS

■ **Signal Cable for Remote Type**

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



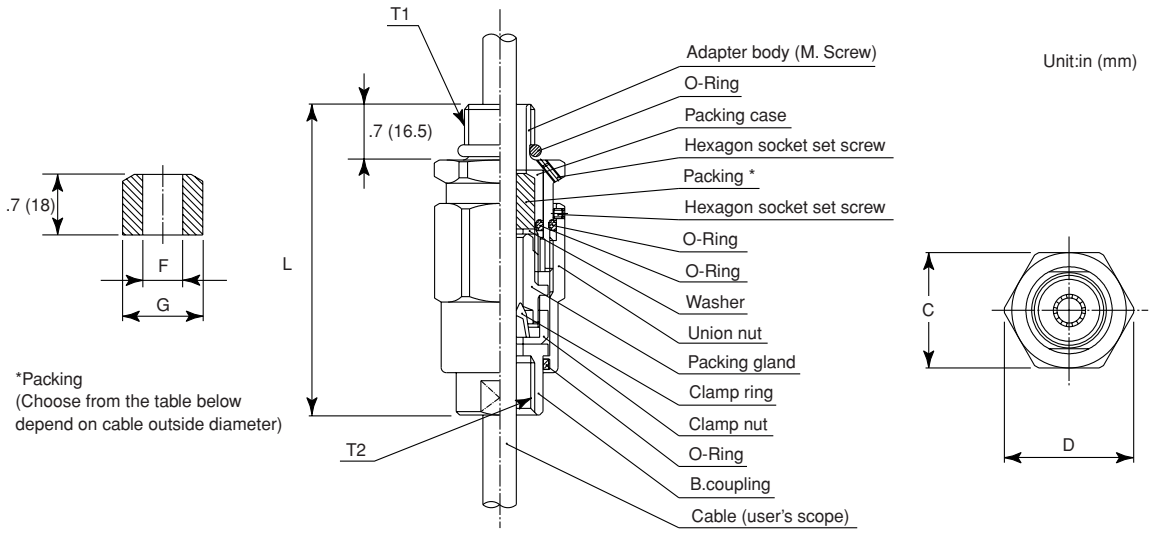
Cable Color and Terminal

Color	Terminal	
	Flow meter	Converter
Red	A	A
White	B	B
Black	⏚	C
Blue		⏚

F0204_27.EPS

■ **Flameproof Packing Adapter (Option code /G11,/G12)**

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



Size					Cable outer diameter	Packing dimensions		Identification mark	Weight lb (kg)
T1	T2	C	D	L		F	G		
G 1/2	G 1/2	1.4 (35)	1.5 (39)	3.7 (94.5)	.3 (ϕ8) to .4 (ϕ10)	.4 (ϕ10.0)	.8 (ϕ20.0)	16 8-10	.6 (0.26)
					.4 (ϕ10) to .5 (ϕ12)	.5 (ϕ12.0)		16 10-12	

Fig50

= = = = OPERATING INSTRUCTIONS = = = =

Specify the following when ordering :
1. Model and suffix codes.
2. Flow conditions (Please fill out the order sheet " WS 1F6A0-01E")
   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

= = = = = RELATED INSTRUMENTS = = = = =

YFCT Flow Computing Totalizer ..... See GS 1P1B1-E
SDBT Distributor ..... See GS 1B4T1-E
See GS 1B4T2-E

= = = = = = RELATED MATERIAL = = = = = =

How to fill in YEWFLO Vortex Flowmeter. TI 1F2B4-01E
YEWFLO Vortex Flowmeter Sizing TI 1F2B4-02E
YEWFLO Vortex Flowmeter Guide Book TI 1F2B4-03E
digitalYEWFLO Vortex Flowmeter TI 1F6A0-01E
YFCT Flow Computing Totalizer Operation and Parameter TI 1P1B1-03E
YFCT Flow Computing Totalizer Auxiliary Data Entry Guide TI 1P1B1-11E

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.

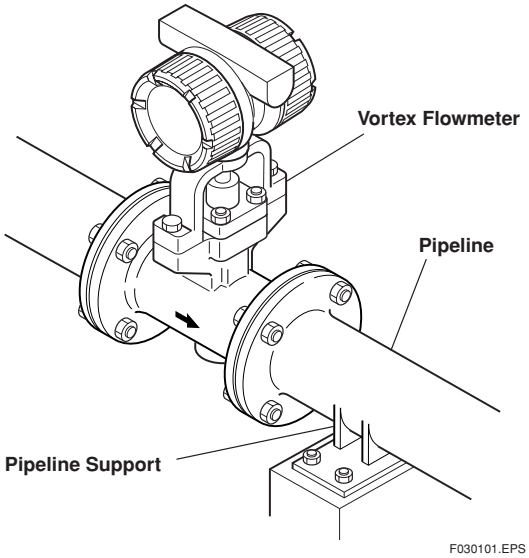


Figure 3.1

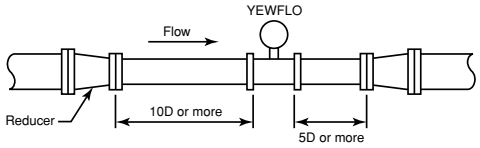
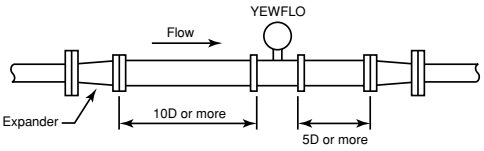
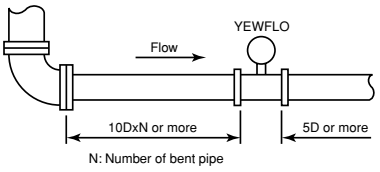
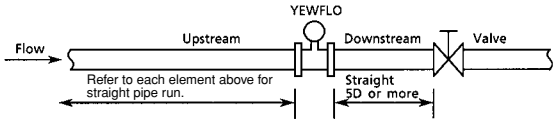
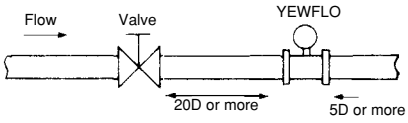
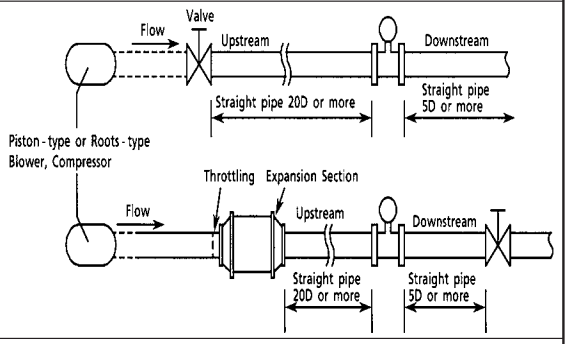
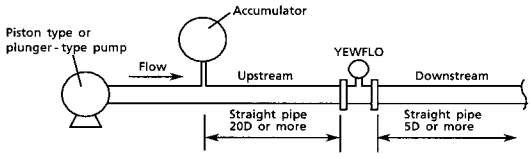
(4) Precautions Regarding Piping

(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.
(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.

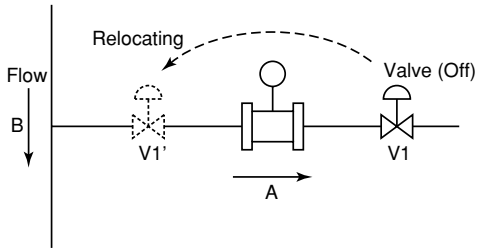
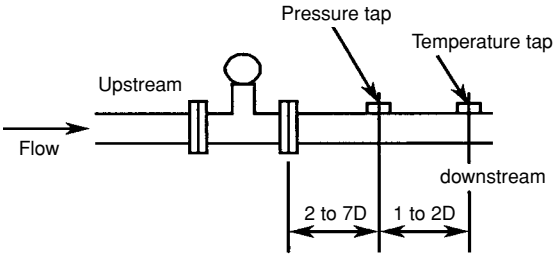
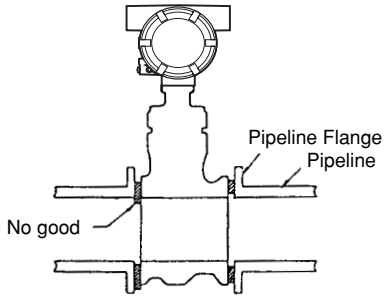
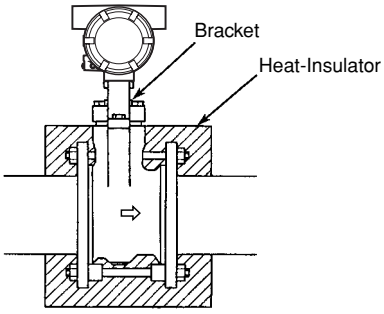
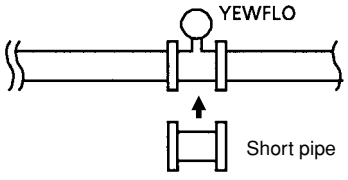
3.2 Piping

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

Table 3.1 Installation

Description	Figure
Piping support: Typical vibration immunity level is 1G for normal piping condition. Piping support shoud 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 pipline inner diameter should be larger than the YEWFLO inner diameter. Use the following adjacent pipe. Norminal size 15mm up to 50mm : Sch 40 or less. Norminal 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.	

F030102-1.EPS

Description	Figure
Valve positon (T-type piping exist): When pulsation causes by a T-type piping exist, install the valve on the upstream of the flowmeter. Example:As shown in the figure, when the valve V1 is turned off, the fluid flow throught 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'.	
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.	
Mounting Gasket: Avoid mounting gaskets which protrude into the pipe line. This may cause inaccurate readings. Use the gaskets with bolt holes, even if YEWFLO 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.	
Heat-Insulation: When an integral-type flowmeter or a remote type detector is installed and the pipe carrying higt-temperature fluids is heat-insulated, do not wrap adiabatic materials around the installation bracket of the converter.	
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.	

F030102-2.EPS

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.

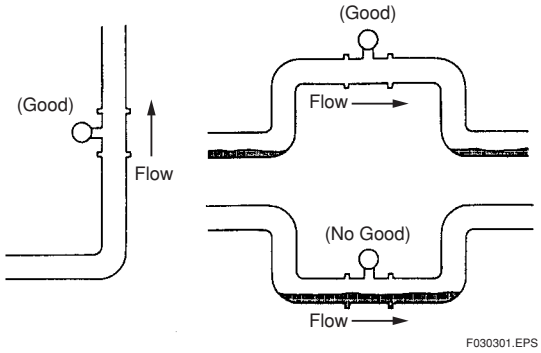


Figure 3.2

(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.

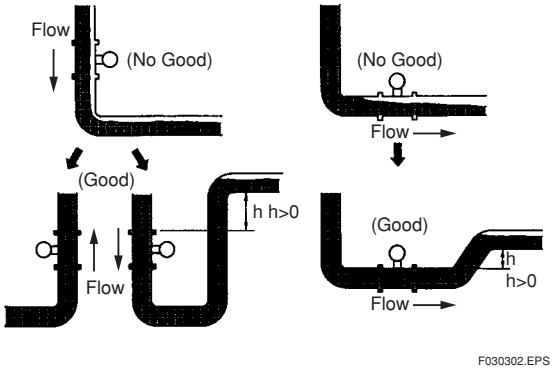


Figure 3.3

• **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.

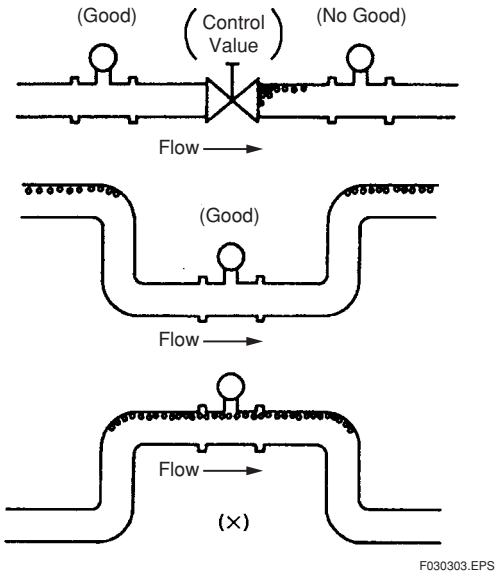


Figure 3.4

(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.

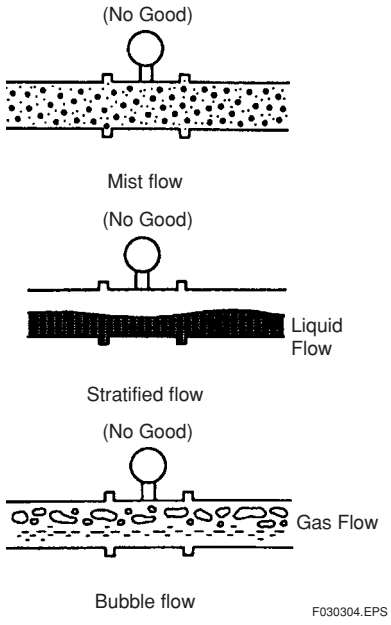


Figure 3.5

(4) Pipeline Diameter and digitalYEWFLO

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.

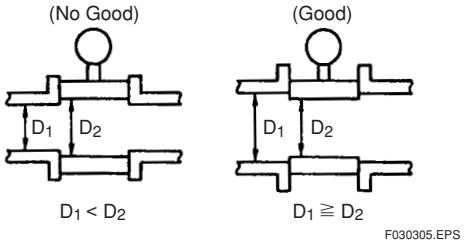


Figure 3.6

(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 YEWFLO to be checked or cleaned conveniently (vortex shedder, etc.).

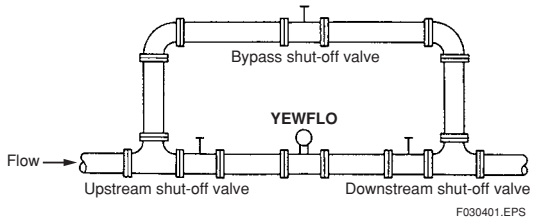


Figure 3.7

3.5 Cryogenic and High process Temperature Version Insulation

When you are using cryogenic type and high process temperature version of YEWFLO Vortex Flowmeter (Option code/HT /LT),refer to illustrated insulation method as shown in Figure 3.8

(1) Installing Cryogenic Vortex Flowmeter

For cryogenic applications, use stainless steel mounting bolts and nuts to install the flowmeter. These can be ordered separately from YOKOGAWA. Cover the flowmeter body with heat insulating material so that the flowmeter can be maintained at ultra-low temperatures (refer to the Figure 3.8).

(2) Maintenance for Cryogenic Applications

DY/LT uses special materials that produce vortex flowmeter for cryogenic applications. When you are replacing a shedder bar, specify cryogenic type shedder bar. To avoid condensing in the terminal box, ensure that the wire connecting port is well sealed.

(3) Installing High Process Temperature Vortex Flowmeter

Cover the flowmeter body with heat insulating material so that the flowmeter can be maintained at high temperatures(Refer to the figure 3.8)

(4) Maintenance for High Process Temperature Applications

DY/HT uses special materials that produce vortex flowmeter for High Process Temperature applications When you are replacing a shedder bar or a gasket, specify High Process Temperature type.

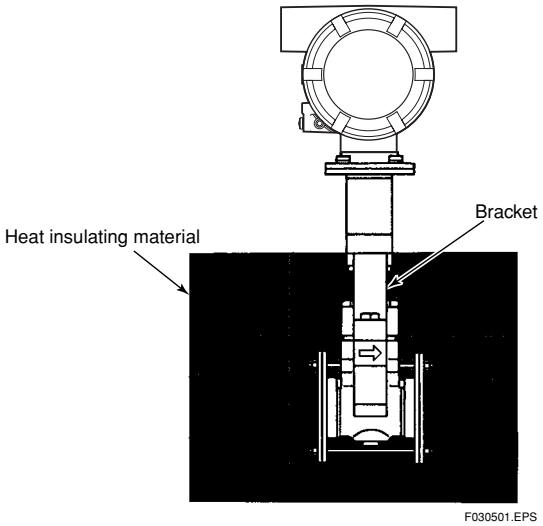


Figure 3.8

3.6 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.

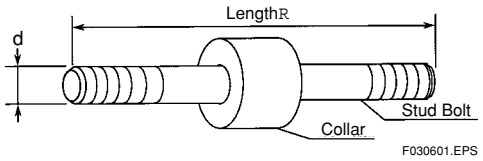
To establish alignment, use the four collars supplied with the instrument.

1. Four collars are supplied for 1/2 inch (15mm) to 1- 1/2inch (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.
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.
3. Gasket:
   Avoid mounting gaskets which protrude into the pipeline. This may cause inaccurate readings.
   Use gaskets with bolt holes, even if YEWFLO 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.

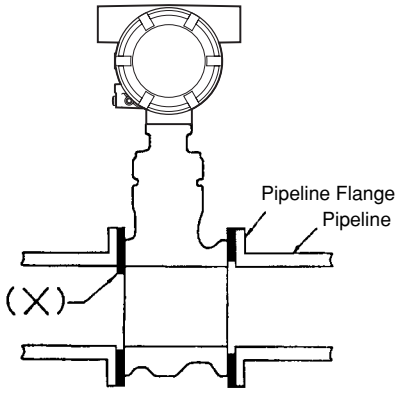
Table 3.2

Size mm (inch)	Flange Rating	Major Dimeter of External Threed 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	240
	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

T030601.EPS



F030601.EPS



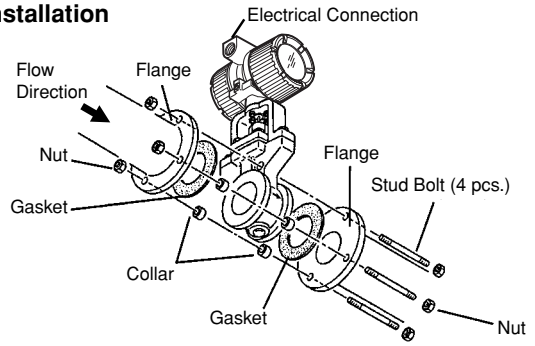
F030602.EPS

Table 3.3(a) Installation of Wafer Type Vortex Flowmeter

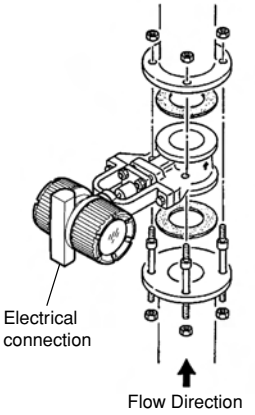
<table>
<tr><th>Wafer type</th><th>Description</th></tr>
<tr><td>When Installation Collar are required, the installation vortex flowmeters applied to the following line sizes and flange ratings.

<table>
<tr><th>Size mm(inch)</th><th>Flange Rating</th></tr>
<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>
</table>

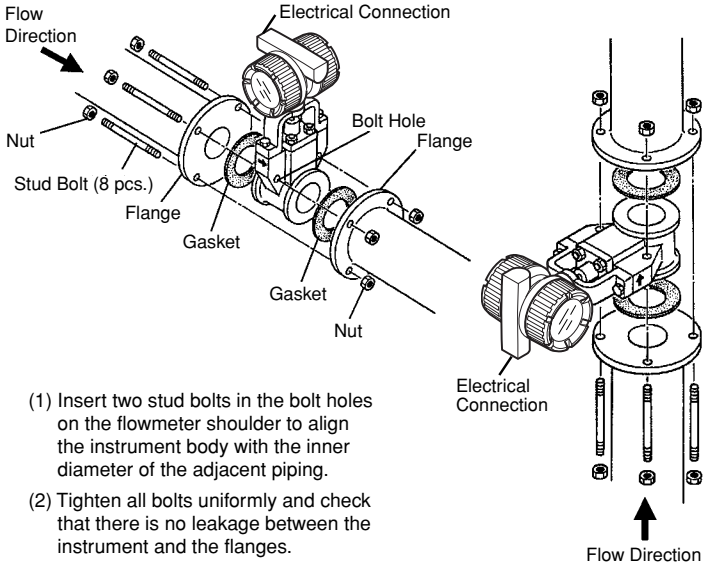
⚠ WARNING
The inside diameter of the gasket must be larger than the pipe inner diameter so that it will not disturb the flow in the pipeline.

⚠ WARNING
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.</td><td>
Vertical Installation


(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.

Horizontal Installation


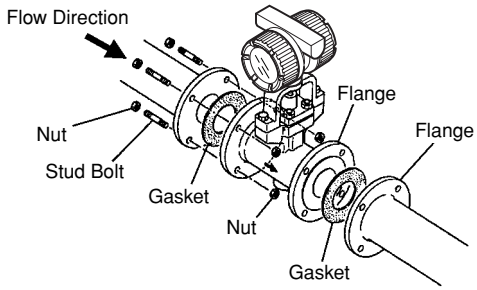
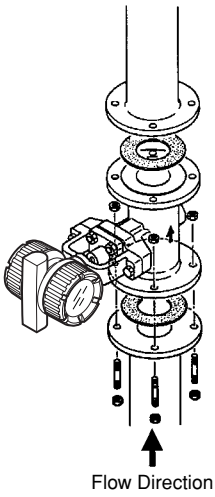
(1) Insert two each collars on each of the lower two bolts.
(2) Place the flowmeter body on the lower two bolts.
(3) Tighten the four bolts (including upper two bolts) and nuts uniformly.
(4) Check for leakage from the flange connections.</td></tr>
<tr><td>When Installation Collars are not required,the installation vortex flowmeters applied to the following line sizes and flanges.

<table>
<tr><th>Size mm(inch)</th><th>Flange Rating</th></tr>
<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>
</table>
</td><td>
Vertical Installation Horizontal Installation


(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.</td></tr>
</table>

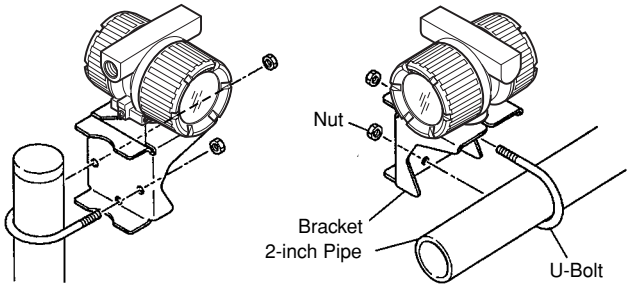
T030602.EPS

Table 3.3(b) Installation of Flange Type Vortex Flowmeter

Flange type	Description
Use the stud bolts and nuts supplied with the flowmeter of the user. The gaskets should be supplied by the user. ⚠ **CAUTION** 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.	**Horizontal Installation**   **Vertical Installation**

T030603.EPS

Table 3.3(c) Installation of remote Type Converter

Remote type converter	Description
⚠ **CAUTION** A signal cable (DYC) is used between the remote type flowmeter and the converter. The maximum signal cable length is 97.5ft (30m).	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. **Stanchion Mounting** **Horizontal Pipe Mounting** 

T030604.EPS

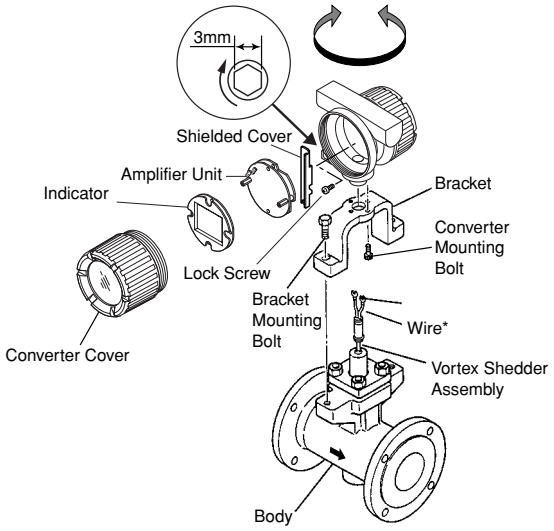
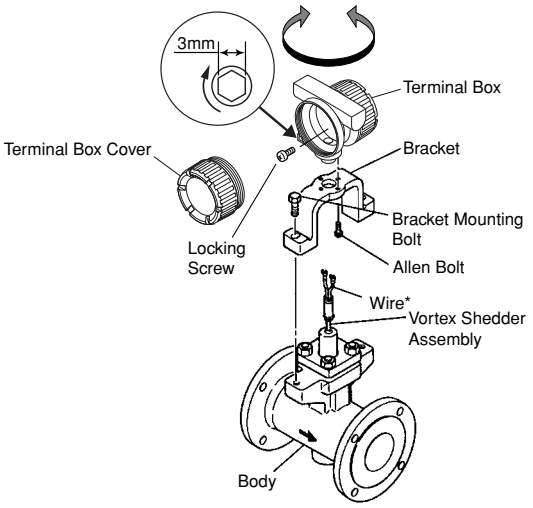
3.7 Changing the Terminal Box and the Indicator Orientation

CAUTION

It is prohibited by law for the user to modify flameproof instruments. It is not permitted to add or remove indicators. If modification is required, contact YOKOGAWA.

3.7.1 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
<1> Remove the converter cover. <2> For amplifier unit removal, refer to paragraph 3.7.2. <3> Disconnect the vortex shedder assembly lead-wires from the converter. <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. <5> Remove the four allen bolts securing the converter to the bracket. <6> Turn the converter to the desired orientation. When reassembling the converter, reverse the above procedure.	<1> Remove the terminal box cover. <2> Loosen two screws to disconnect leadwires from shedder bar. <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. <4> Remove the four allen bolts securing the terminal box to the bracket. <5> Turn the terminal box to the desired orientation. When reassembling the terminal box, reverse the above procedure.
	

F030701.EPS

3.7.2 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.

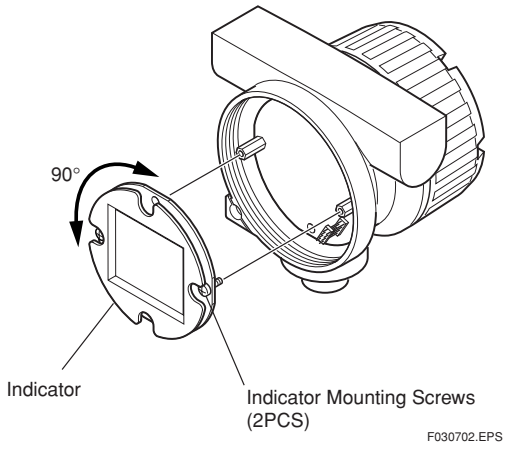


Figure 3.1 Removing and Reinstalling the Indicator

3.7.3 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.

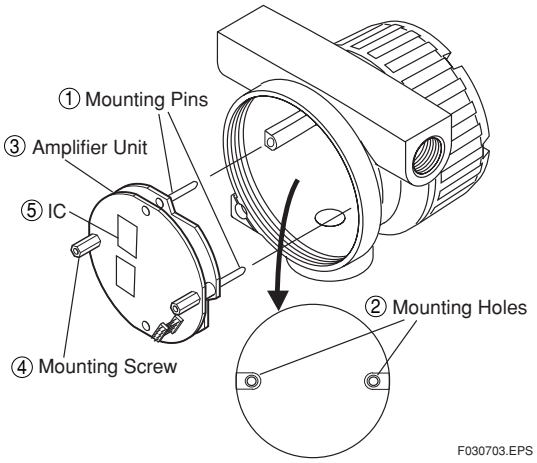


Figure 3.2 Removing Amplifier Unit

4. WIRING

4.1 Power Supply and Load Resistance

The remote converter type (DY-N) vortex flowmeter is used with the Model DYA converter. To connect these instruments, use a special cable (DYC). 30m (97.5 feet) is the maximum length.

The integral type (DY) 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 conditons.

(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.

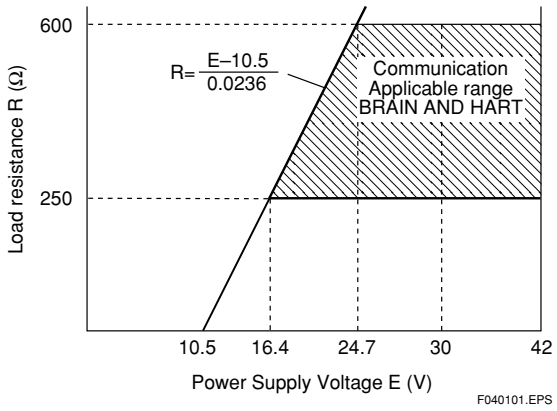


Figure 4.1 Relationship between Power Supply Voltage and Load Resistance (4 to 20 mA DC Output)

(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 YEWFLO 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.

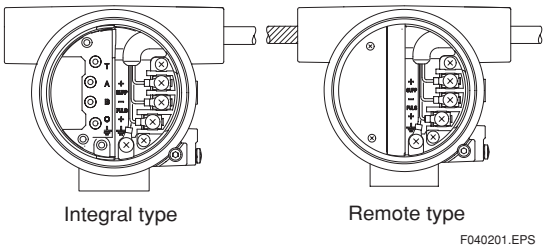
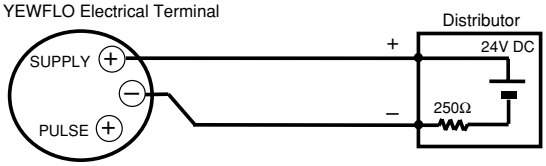
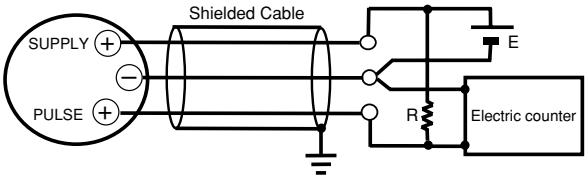
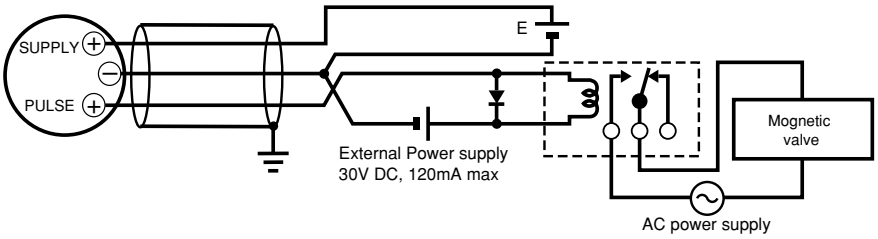
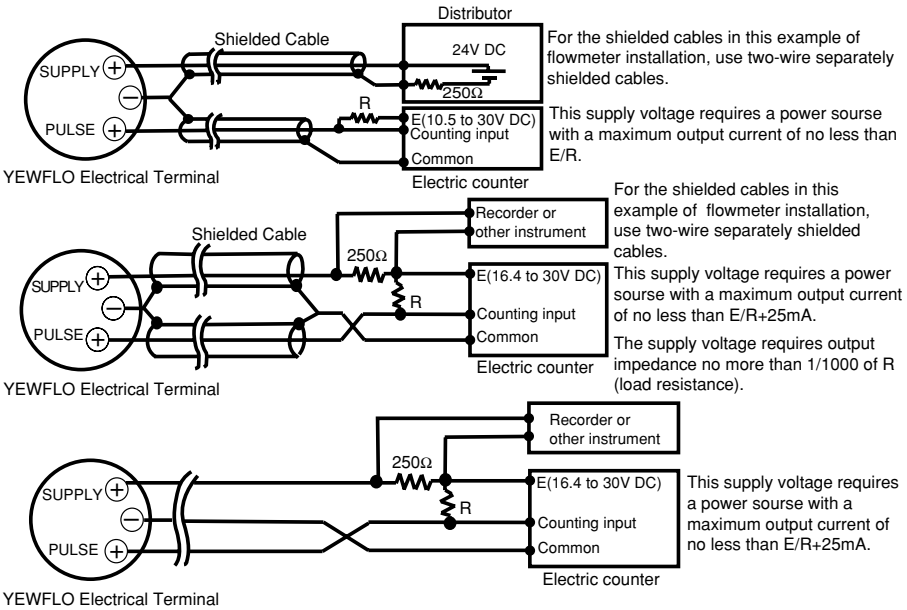


Figure 4.2

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

<table>
<tr><th>Connection</th><th>Description</th></tr>
<tr><td>Analog Output</td><td>YEWFLO Electrical Terminal
 
</td></tr>
<tr><td>Pulse Output</td><td>YEWFLO Electrical Terminal
Use the Three-wire shielded cable.
 
</td></tr>
<tr><td>Status Output
Alarm Output</td><td>YEWFLO Electrical Terminal
 
</td></tr>
<tr><td>Simultaneous
Analog
-Pulse Output
Example 1
In this case, Communica -tion is possible(up to a distance of 2km when a CEV cable is used).

Example 2
In this case, Communica -tion is possible (up to a distance of 200m when a CEV cable is used and R = 1kΩ).

Example 3
In this case, No communi -cation is possible (when shielded cable is not used).</td><td>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.
 
</td></tr>
<tr><td>The range of load resistance R for the pulse output.</td><td>The load resistance of pulse output should be used to 1kΩ, 2W.
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.
$\frac{E\ (V)}{120} \leqq R\ (k\Omega) \leqq \frac{0.1}{C\ (\mu F) \times f\ (kHz)}$
Example of CEV cable capacitance ≒ 0.1μF/km
$P\ (mW) = \frac{E^2\ (V^2)}{R\ (k\Omega)}$
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)</td></tr>
</table>

T040201.EPS

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 DYC signal cable to connect the converter and remote type flowmeter(DY-N).

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 DYC signal cable and the right connection for the transmission cable.

If a signal cable kit is supplied by YOKOGAWA, both ends of the cable must be finished in accordance with the following instructions as shown in Table 4.2 and 4.3.

CAUTION

After completing the signal cable connections, install the shielded cover to signal cable terminal as shown in Figure 4.6.

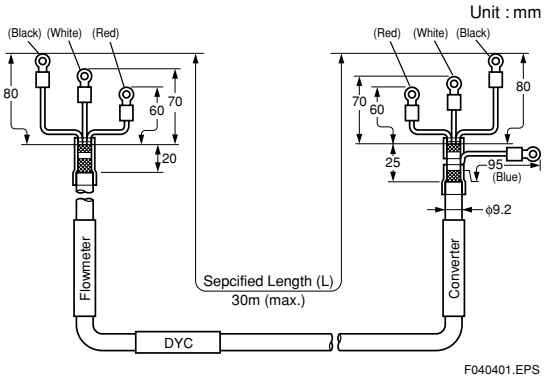


Figure 4.3 DYC Signal Cable

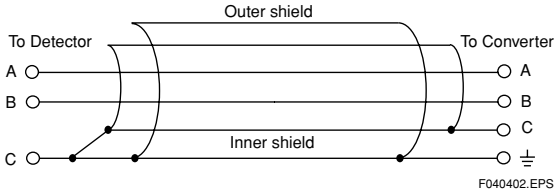


Figure 4.4 Construction of Remote Type Signal Cable

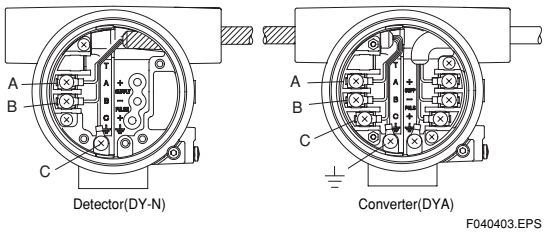


Figure 4.5 Terminal of Detector and Converter

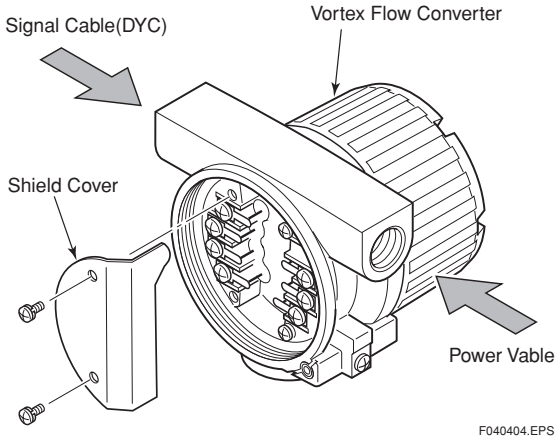
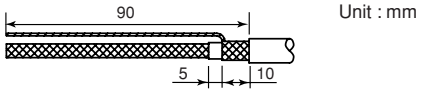
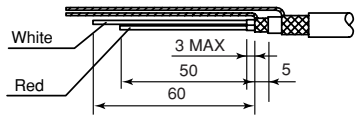
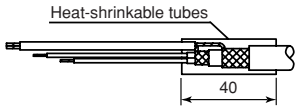
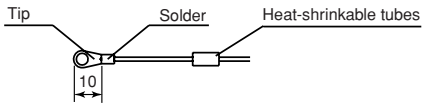
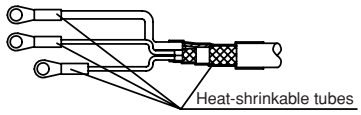
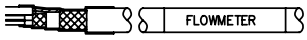
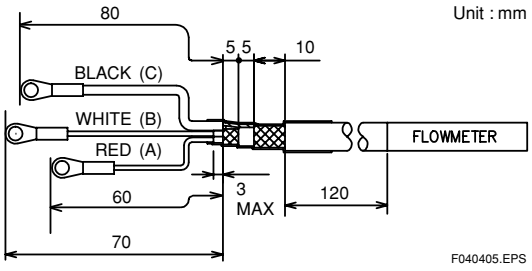


Figure 4.6 Shielded Cover

Table 4.2 Finishing the Signal Cable End(DYC) (For Vortex Flowmeter Detector DY-N)

	Description	Figure
1	Remove the outer polyethylene jacket, outer braided shield and inner jacket, inner braided shield as per the dimensions below.	
2	Cut of the black conductive layers(convering the two wires) completely, as per the dimensions below. Twist each of the conductor and drain wires so that there are no free strands.	
3	Do not short - circuit the conductive layer and the terminals.	
4	Remove the red and white insulation as per the dimensions below. Twist the outer drain wire and the inner drain wire each other.	
5	Insert black FEP insulation tubing over inner shield until it stops inside the braided shield. Cut the tubing off leaving only 5mm(0.2in) of the inner shield exposed. Remove 5mm(0.2in) of insulation from the tips of the two wires.	
6	Insert the heat-shrinkable tubes as shown.	
7	Put heat-shrinkable tubes on red, white, black. Crimp the chip to each wire end and then solder.	
8	Shrink the heat-shrinkable tubes by heating with a drier etc.	
9	Affix the label as shown. Confirm that the insulation resistance between each wire including the inner shield is 10Mohm or greater at 500VDC. Maintain both ends of the wires disconnected(open - circuited) during the insulation resistance test.	

T040401.EPS



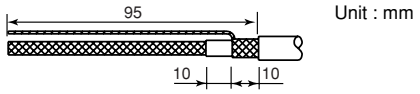
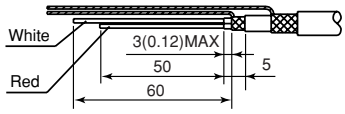
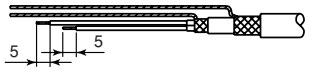
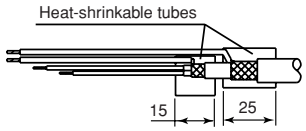
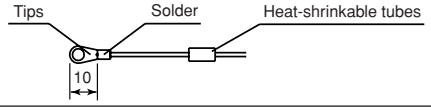
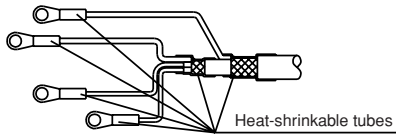
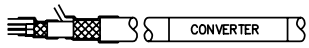
F040405.EPS

Figure 4.7

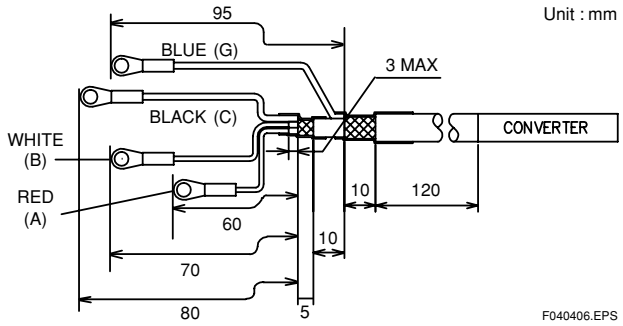
⚠ CAUTION

Do not touch the '' conductive layer" (black area convering the signal cables A and B) to the converter case, terminal, and other leadwires. If it is touched, operation of the converter may be incorrect. When the cable is terminated, remove the conductive layer properly.

Table 4.3 Finishing the Signal Cable End(DYC) (For Vortex Flowmeter Converter DYA)

	Description	Figure
1	Remove the outer polyethylene jacket, outer braided shield and inner jacket, inner braided shield as per the dimensions as shown.	
2	Cut of the black conductive layers(convering the two wires) completely, as per the dimensions below. Twist each of the conductor and drain wires so that there are no free strands.	
3	Do not short - circuit the conductive layer and the terminals.	
4	Remove the red and white insulation as per the dimensions as shown.	
5	Insert black FEP insulation tubing over inner shield until it stops inside the braided shield. Cut the tubing off leaving only 5mm of the inner shield exposed. Remove 5mm of insulation from the tips of the two wires.	
6	Insert the heat-shrinkable tubes as shown.	
7	Put heat-shrinkable tubes on red, white, black. Crimp the chip to each wire end and then solder.	
8	Shrink the heat-shrinkable tubes by heating with a drier etc.	
9	Affix the label as shown. Confirm that the insulation resistance between each wire including the inner shield is 10Mohm or greater at 500VDC. Maintain both ends of the wires disconnected(open - circuited) during the insulation resistance test.	

T040402.EPS



F040406.EPS

Figure 4.8

⚠ CAUTION

Do not touch the " conductive layer" (black area convering the signal cables A and B) to the converter case, terminal, and other leadwires. If it is touched, operation of the converter may be incorrect. When the cable is terminated, remove the conductive layer properly.

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.

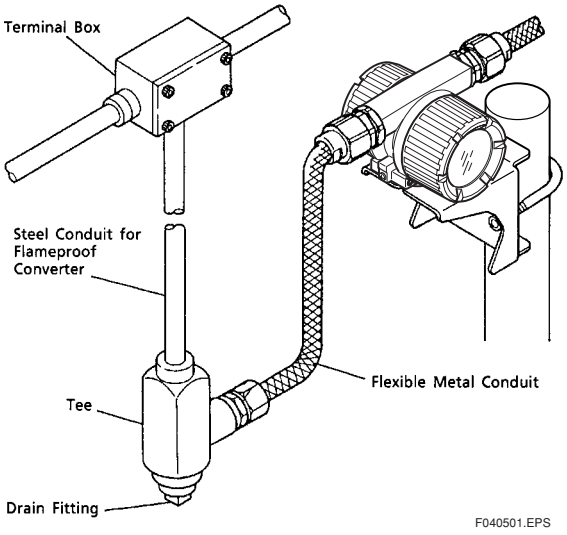


Figure 4.9

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 100Ω or less).
(4) Use 600V PVC insulated wire for grounding.

5. BASIC OPERATING PROCEDURES

Data setting can be perfirmed with the three keys on the front panel (SET,SHIFT and INC) or using a handheld BRAIN(BT) terminal and HART communicator.

5.1 Construction of the Display

Figure 5.1 shows the configuration of the digitalYEWFLO display panel (if equipped).

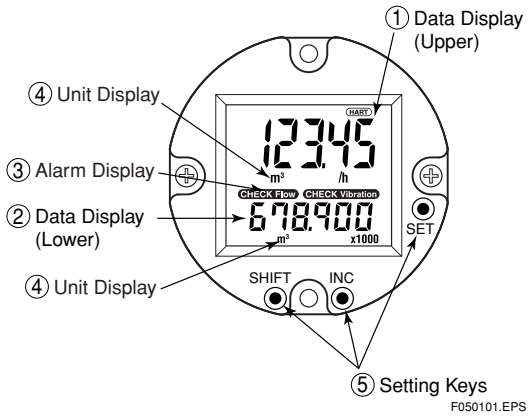


Figure 5.1 Construction of the Display

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.

■ Description of unit indications and its votes.

Table 5.1 shows the description of unit indications and it's votes.

Table 5.1 Unit Indicator

Unit	Upper Indication	Lower Indication
%	○	×
m^3	○	○
	○	○
Nm^3	○	○
N	○	○
Sm^3	○	○
S	○	○
kg	○	○
t	○	○
/h	○	×
/m	○	×
/s	○	×
/d	○	×

T050101.EPS

5.2 Display Contents in Display Section

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

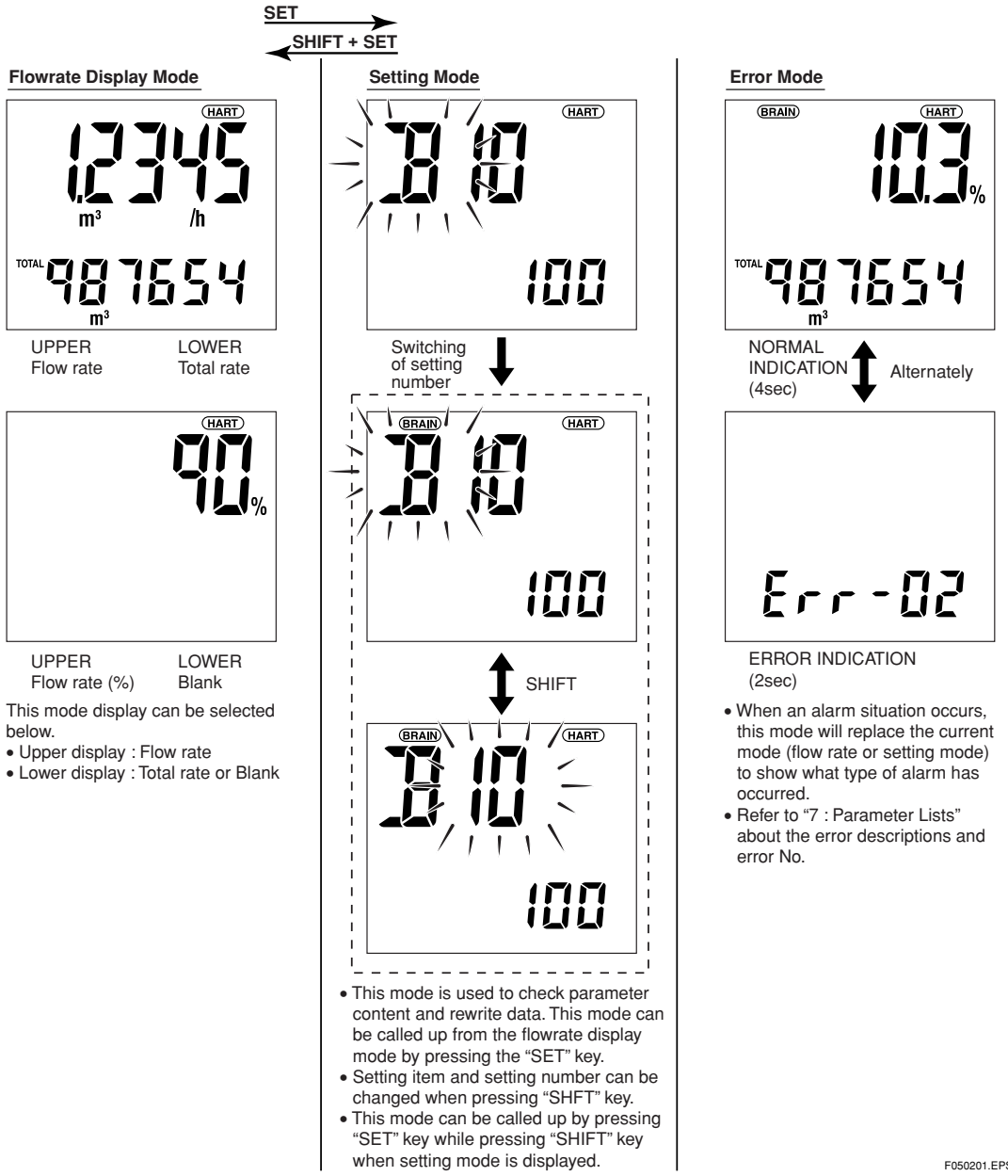
Table 5.2 Mode Name List

Mode (status) Name	Display Contents
Flowrate display mode	A mode in which instantaneous flow rates or totalized 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.

T050201.EPS

● Display Example



F050201.EPS

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	—	×	○

T050301.EPS

Display mode can be changed using the BT200 terminal or the indicator setting section.

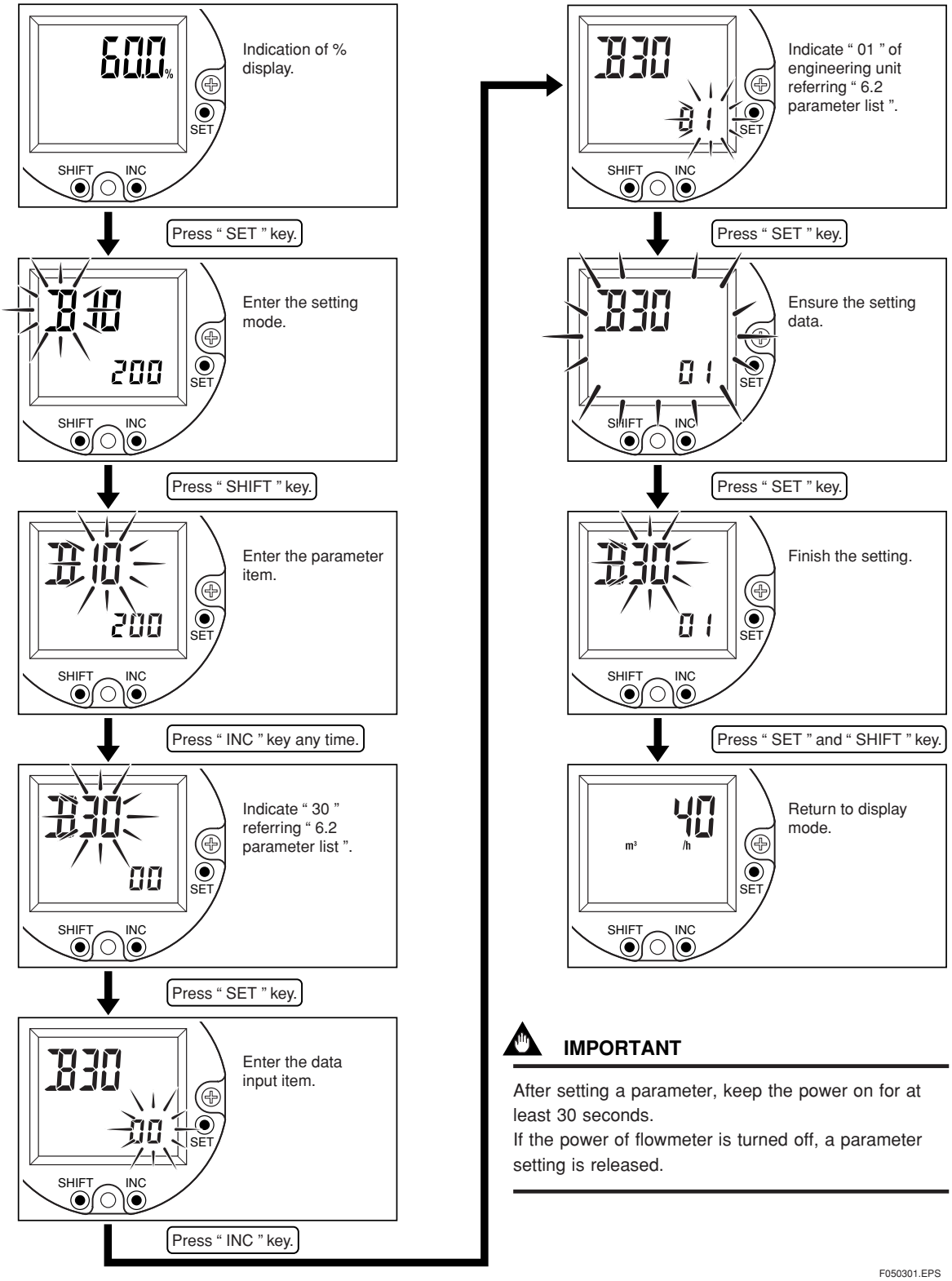
- For operation using BT200, perform changes using the parameter item " B30:UPPER DISP" and "B31:LOWER DISP" referring to section 6 "Parameters".
- For operation using indicator, change B30 and B31 parameter item number to display an appropriate display.

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.

5.3.1 Change the Display Mode from % Display to Engineering Unit

The display mode can be changed referring “6.1 parameter list”.



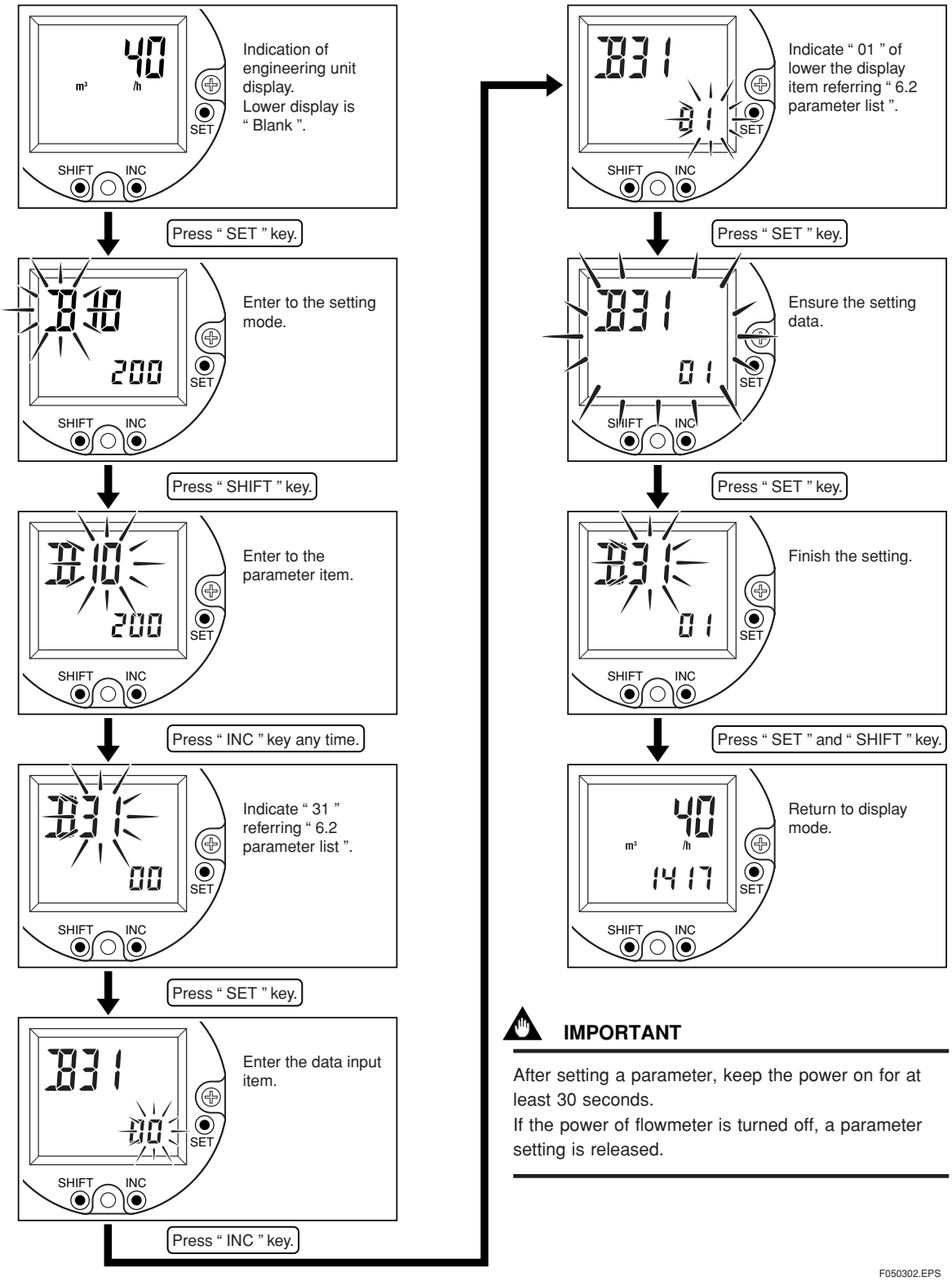
IMPORTANT

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.

F050301.EPS

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.

F050302.EPS

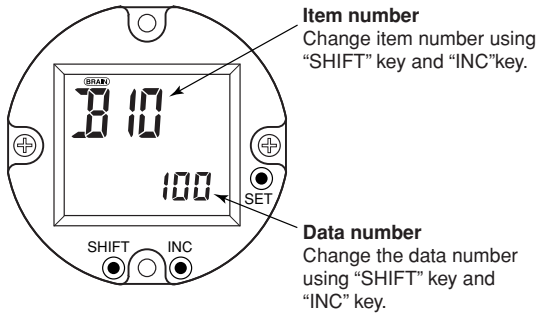
5.4 Setting Mode

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.

5.4.1 Structure of Setting Mode Display



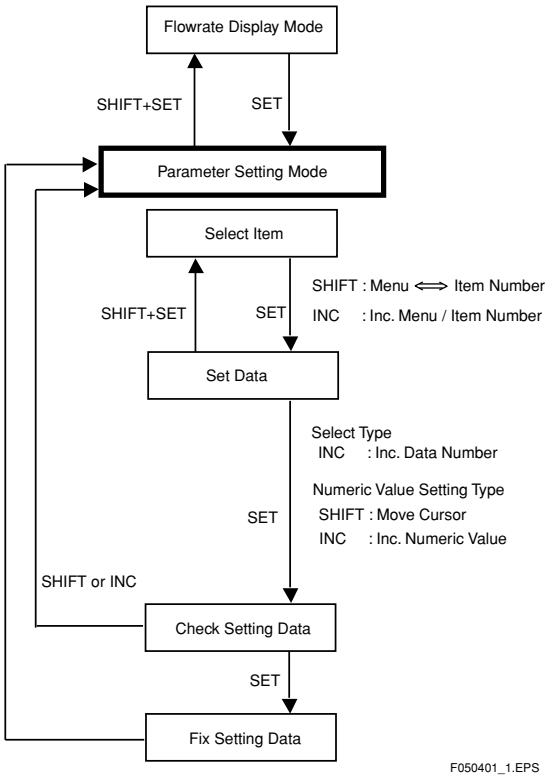


Figure 5.2 Indicator Construction and Parameter Setting Procedure

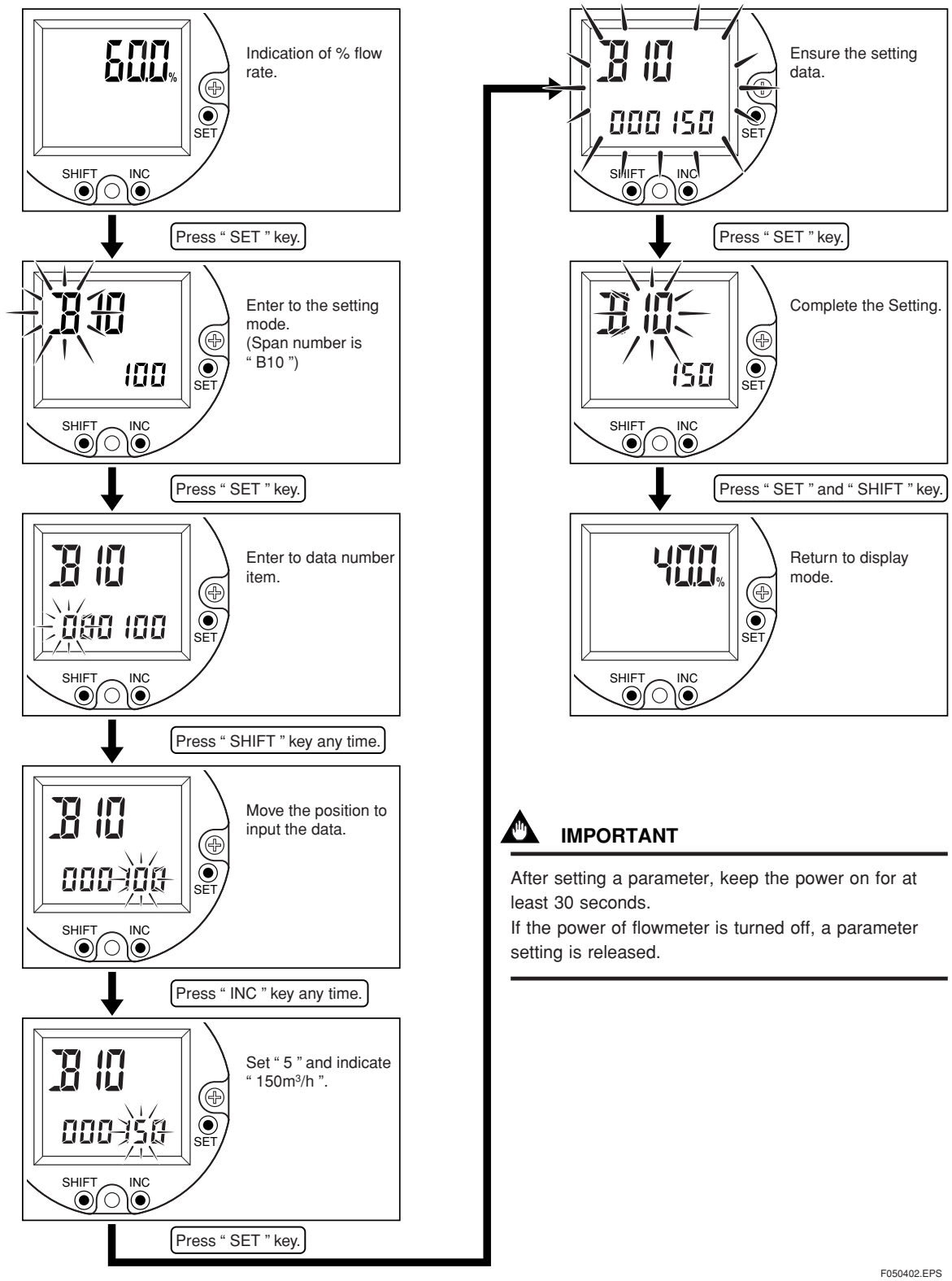
- When completing setting, press “SHIFT” key and “SET” key simultaneously. The mode move to the “display mode”.

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.

5.4.2 Method of Parameter Setting

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

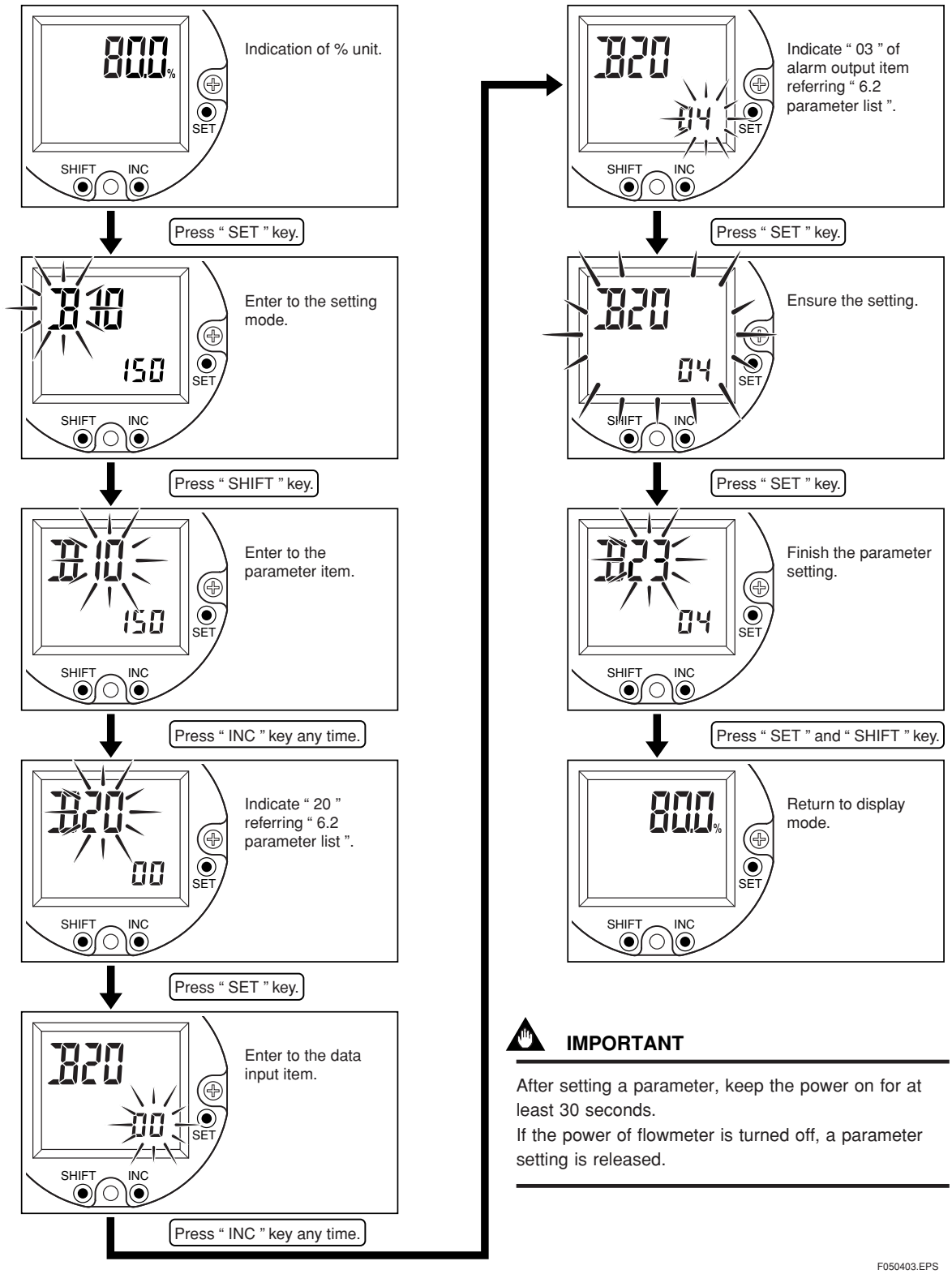


IMPORTANT

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.

F050402.EPS

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.

F050403.EPS

5.5 Operation for the BT200

This section decribes the operation procedures using a brain terminal (BT200). For details on the functions of the YEWFLO, refer to “6.2 Parameter List”. And also, see the “BT200 Instruction Manual” (IM 1C0A11-01E) for more detailed Information.

5.5.1 Connection Method of the BT200

(1) Connecting the BT200 to a 4 to 20mA DC Transfer Line

The communication signal of the YEWFLO is superimposed onto the 4 to 20mA DC analog signal to be tranferred.

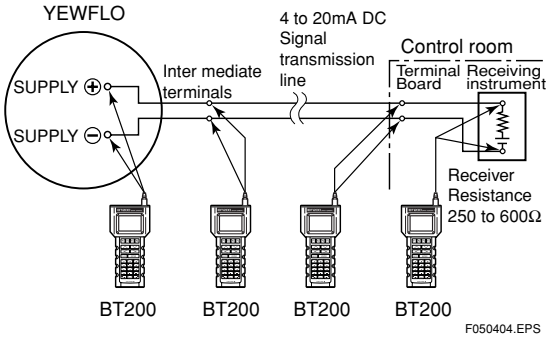


Figure 5.3 Communicating for a 4 to 20mA DC Signal Line

IMPORTANT

The communicable distance of the transmission line is restricted depending on the wiring method. Refer to “4 : WIRING”.

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.

(2) Connecting BT200 to Flow Converter

Removing a cover and indicator, the terminals for brain communication are provided on the circuit board. Connect BT200 to the terminal of HHT-COM on the circuit board.

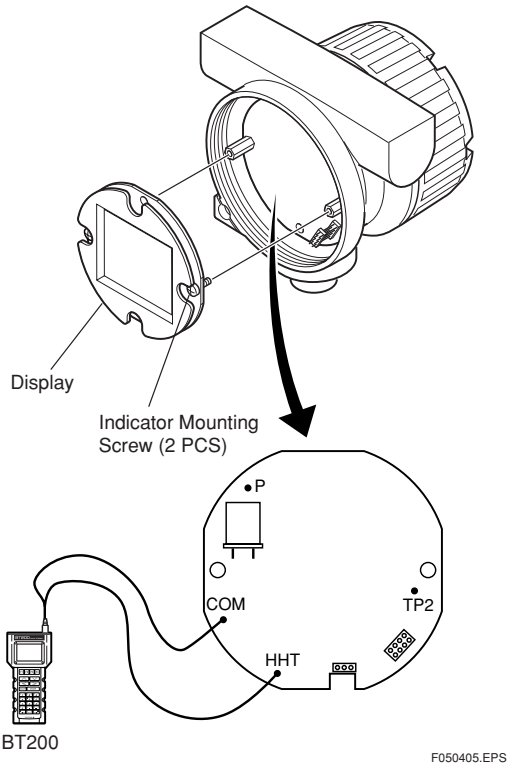
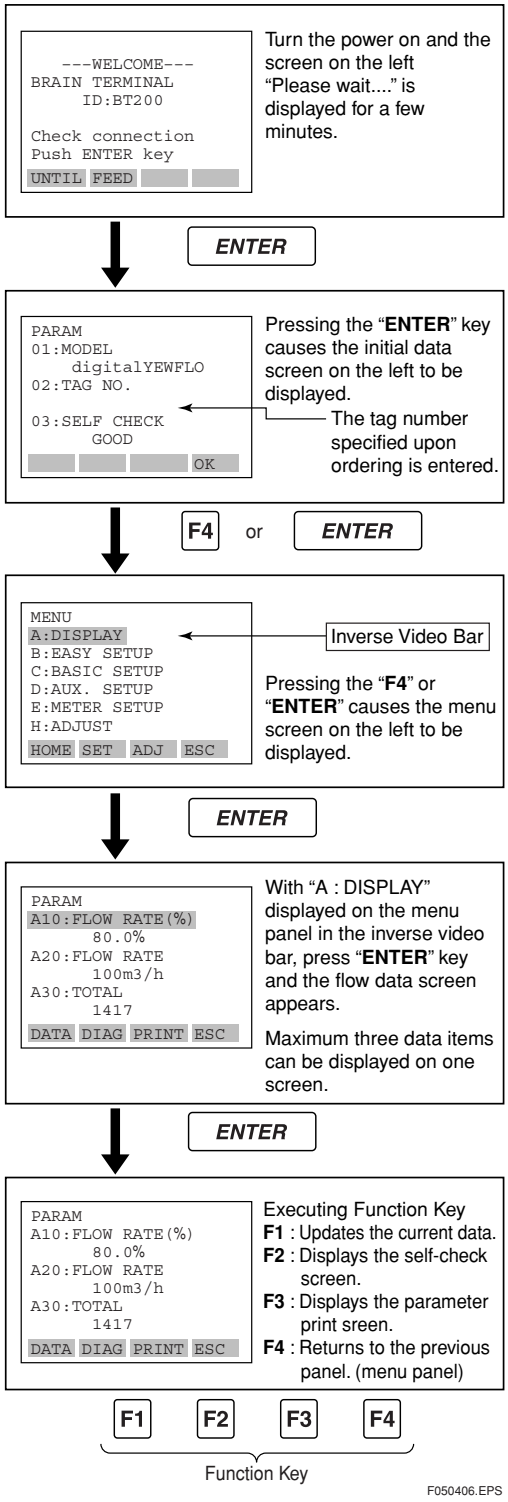


Figure 5.4 Connection of BT200 to Flow Converter

5.5.2 Displaying Flow Rate Data

Flowrate data can be displayed on the BT200 screen according to the following procedure.



F050406.EPS

● Function key

The functions of the function keys vary with the commands being displayed on the display panel.

Table 5.4

Command	Description
ADJ	Calls up the adjustment menu.
CAPS/caps	Changes the uppercase / lowercase mode.
CLR	Clears entered data / deletes all data.
COPY*	Prints parameters on the screen.
DATA	Updates parameter data.
DEL	Deletes one character.
DIAG	Calls up the self-check screen.
ESC	Returns to the preceding screen.
FEED*	Paper feed.
HOME	Calls up the home menu (A : DISPLAY).
LIST*	Prints all parameters of the menus.
NO	Setting stop / re-setting. Returns to the previous screen.
OK	Goes to the next screen.
PARM	Parameter number setting mode.
PON/POFF*	Printer output of data whose setting was changed Mode on / off.
PRINT*	Changes to the prints mode.
SET	Calls up the setting menu (B : SETTING).
SLOT	Returns to the slot selection screen.
GO*	Starts print out.
STOP*	Stops printing.
UTIL	Transfers to the utility screen.

*The command is available only for BT-200-P00

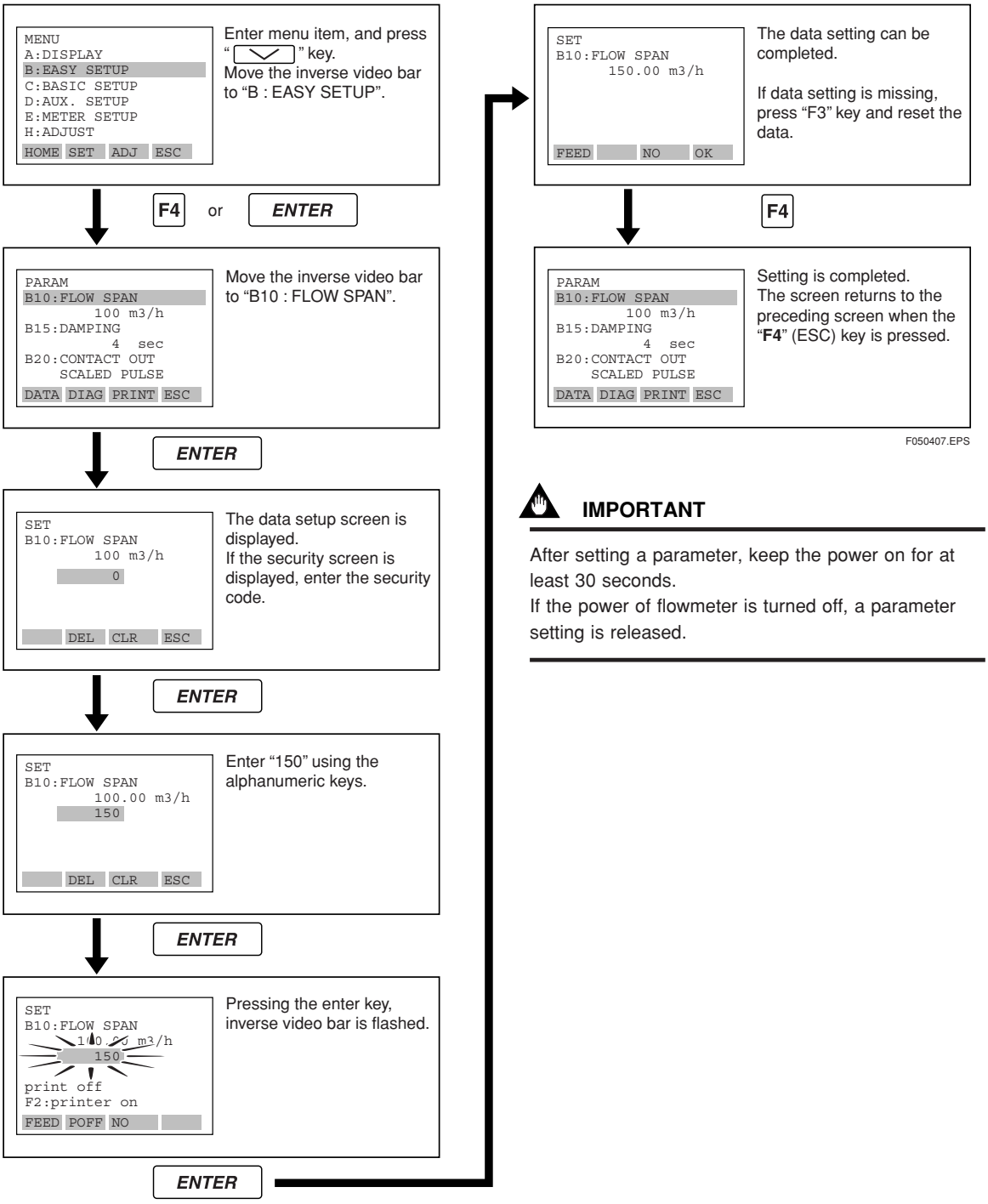
T050401.EPS

5.5.3 Setting Parameters

This section describes the setting method using a brain terminal (BT200). For details on the method, refer to "6.2 Parameter List".

(1) Setting Flow Span

Example : Change flow span 100m³/h to 150m³/h

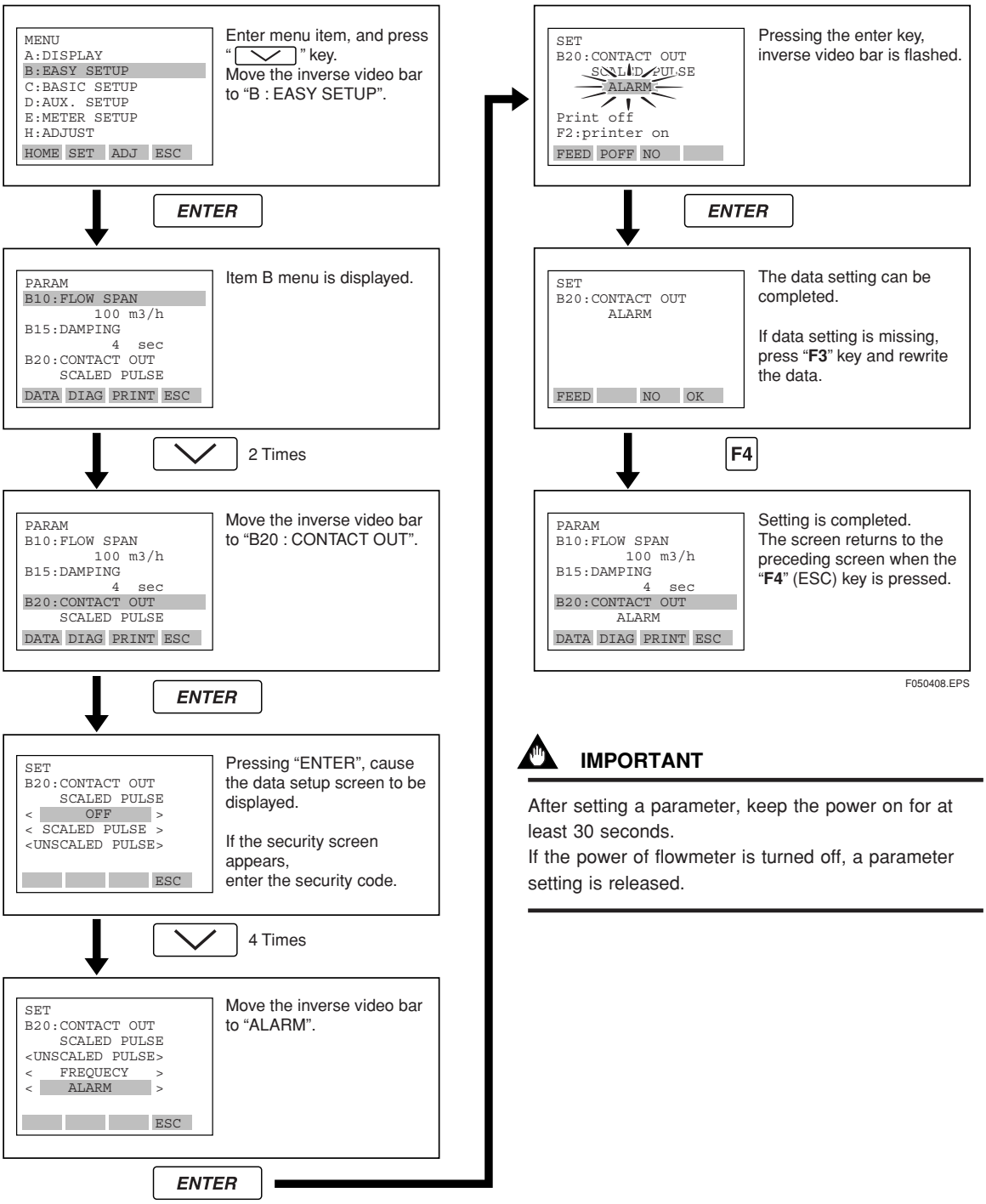


F050407.EPS

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.

(2) Change the Pulse Output to Alarm Output.



F050408.EPS

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.

5.6 Operation for HART Communication

The communication control function with HHT, BRAIN Terminal (BT200) is stated at Chapter 5, "PARAMETER SETTING IN "BRAIN" COMMUNICATIONS". YEWFLO has not only BRAIN Terminal (BT200) but also HART Communicator as remote control via HHT.

Main functions and parameters are the same with BRAIN Terminal (BT200). Moreover, YEWFLO has unique parameters of HART Communicator.

NOTE

In case of using HART Communicator, setting from indicator is not available.

CAUTION

In case of using Burst mode , setting from AMP. unit is not available.

The amplifier has been pre-configured at the factory, so no set-up should be required prior to installation. If your process conditions have changed and re-programming is required, the menu/parameter configuration list for YEWFLO can be found in 5.6.10 Menu Tree. Refer to the instructions provided with your HART communicator for operation details. The QUICK START section of this manual will address only those parameters which must be set to establish the operation of the meter for a particular application. The Menu Tree will cross-reference the BRAIN parameters to the corresponding HART parameters.

5.6.1 Hardware Recommenation

Communicaton distance :

Up to 1.5km, when using multiple twisted pair cables. Communication distance varies depending on type of cable used.

Cable length for specific applications:

Use the following formula to determine cable length for a specific application;

$$L = \frac{65\times10^6}{(R\times C)} - \frac{(Cf+10000)}{C}$$

Where:

L = length in feet or meters
R = resistance in ohms, current sense resistance
C = cable capacitance in pF/ft of pF/m
Cf= maximum shunt capacitance of reciving devices in pF/m

5.6.2 Display

The HART Communicator automatically searches for YEWFLO on the 4 to 20 mA loop when it is turned on. When the HART Communicator is connected to the YEWFLO, it displays "**Online**" menu as shown below. (If YEWFLO is not found, the communicator displays the message "No Device Found. Press OK...." Press the OK 'F4' function key and the main menu appears. Retry after confirming the connection with the YEWFLO.)

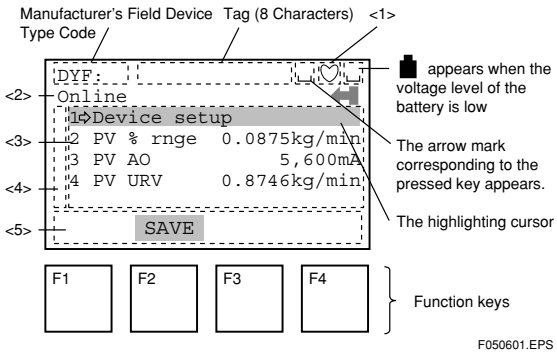


Figure 5.6.1 Display

<1> ♡ appears and flashes during communication between the HART Communicator and the YEWFLO. At Burst mode*, ♥ appears.

<2> The current display menu title appears.

<3> Each item in menu of <2> appears.

<4> ↓ and/or ↑ appear when the items are scrolled out of the display.

<5> On any given menu, the label appearing above a function key indicates the function of that key for the current menu.

5.6.3 Calling Up Menu Addresses

5.6.10 Menu Tree shows the configuration of Online Menu which is needed for the operation with HART Communicator. The desired item can be displayed with ease by understanding the menu configuration.

When the HART Commnicator is connected to the YEWFLO, "**Online**" menu will be displayed after the power is turned on (See Figure 5.6.1). Call up the desired item as follows:

Key operation

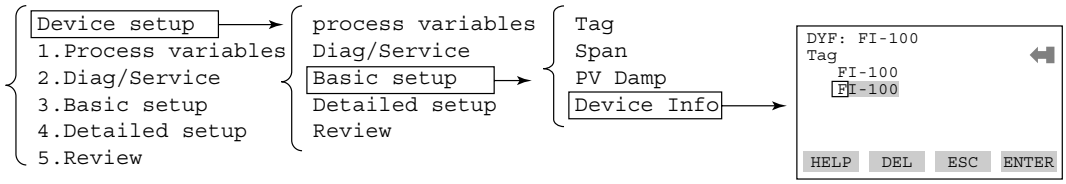
There are two choices to select the desired menu item.

1. Use the ⇩ or ⇧ key to select the desired item, and then press the ⇨ key.
2. Press the number key displayed for the desired item.
   - To return to the previous display, press the ⇦ key, **EXIT (F4)** or **ESC (F3)**.

Example: Call up the "**Tag**" to change the tag number.

F050602_1.EPS

Check where "**Tag**" is located in the menu configuration. Then, call up "**Tag**" on the display according to the menu configuration.



Display **Operation**

1
```
DYF :
Online
 1 Device setup
 2 PV
 3 PV AO
 4 PV URV
```
⇨ or STU 1

Display 1 appears when the HART Communicator is turned on.

Select "**Device setup**".

2
```
DYF :
Device setup
 1 Process variables
 2 Diag/Service
 3 Basic setup
 4 Detailed setup
 5 Review
      SAVE  HOME
```
⇩ ×2 ⇨ or YZ / 3

Select "**Basic setup**".

3
```
DYF :
Basic setup
 1 Tag
 2 Span
 3 PV Damp
 4 Device info
HELP  SAVE  HOME
```
⇩ ×4 ⇨ or MNO 5

Select "**Tag**".

4
```
DYF :
Tag
  FI-100
  FI-100
HELP  DEL  ESC  ENTER
```

The display for Tag setting appears.
(The default value of "Tag" is blank.)

F050602_2.EPS

5.6.4 Entering, Setting and Sending Data

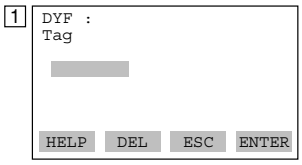
The data which are input with the keys are set in the HART Communicator by pressing **ENTER (F4)**. Then, by pressing **SEND (F2)**, the data are sent to the YEWFLO. Note that the data are not set in the YEWFLO if **SEND (F2)** is not pressed. All the data set with the HART Communicator is held in memory unless power is turned off, so every data can be sent to the YEWFLO at one lot.

Operation

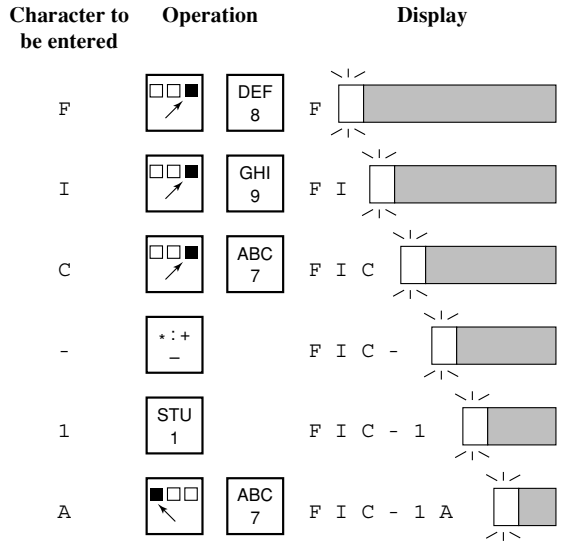
Entering data on the "**Tag**" setting display.
On alphabetic characters, only capital letters can be used for setting Tag No. with HART Communicator.

Example: Set "**FIC-1A**".
5. Tag

Call up "**Tag**" setting display.
1. Device setup → 3. Basic setup → **5. Tag**

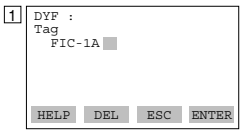


On the setting display shown above, enter the data as follows:



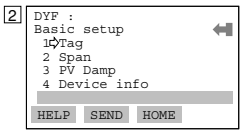
F050603_1.EPS

Display **Operation**



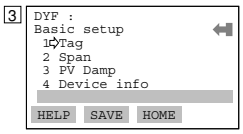
F4 (ENTER)

Press **ENTER (F4)** to set the data in the HART Communicator after entering the data.



F2 (SEND)

Press **SEND (F2)** to send the data to the YEWFLO.
* ♡is flashing during communication.



SEND label changed to SAVE label, and the transmission is completed.

Press **HOME (F3)**, and return "Online Menu".

F050603_2.EPS

5.6.5 Parameters Configuration

IMPORTANT

Do not turn off the YEWFLO just after HART Communicator settings (sending) have been made. If the YEWFLO is turned off less than 30 seconds after parameters have been set, the set data will not be stored and the data returns to previous settings.

Parameters of HART Communicator is constructed hierarchically. The menu tree for Online menu is shown in 5.6.10 Menu Tree.

See appendix "Parameter Summary" about the usage of each parameter. Note the differences between parameters on YEWFLO display and those on HART Communicator.

The Online menu summary is shown below.

Table 5.6.1 Online Menu Summary

No.	Display Item	Contents
1	Device setup	Set parameters for YEWFLO.
2	PV	Display process value in engineering unit.
3	PV AO	Display analog output in mA.
4	PV URV	Display set span in engineering unit.

T050601.EPS

5.6.6 Unique Functions of HART Communicator

Check on communication error

When each error, over run framing error, parity error or buffer overflow error is detected, the data including the informations of errors is returned, and the error message is indicated on HHT.

Real time monitoring 4-20mA output

'%' output, actual flow rate and totalized value are mentioned as same as BRAIN communicator. And furthermore 4-20mA output is monitored on real time.

Time recording

Online ⇒ 1.Device setup ⇒ 4.Detailed setup
⇒ 4. Device info ⇒ 5.Date

F050604_1.EPS

Day, month and year can be set in a number of 2 figures.

Multi drop communication

Field devices in multidrop mode refer to the connection of several field devices on a communication single line. Up to 15 field devices can be connected when set in the multidrop mode. To activate multidrop communication, the field device address must be changed to a number from 1 to 15. This change deactivates the 4 to 20mA output and turns it 4mA output and turns it 4mA.

Online ⇒ 1.Device setup ⇒ 4.Detailed setup
⇒ 4.Device info ⇒ 6.Dev id

F050604_2.EPS

Continuously data returning (Burst mode)

YEWFLO continuously sends the data stored in it when the burst mode it set "ON". Either one of instantaneous flow rate, output in % and current output can be selected and sent. (Note: This mode is preserved after the converter has been turned off.)

The interval of sending data in this mode is the same as the common specification of HART communicator.

*Calling up "Burst option" display.

⚠ CAUTION

In case of using Burst mode, setting from AMP. unit is not available

Online ⇒ 1.Device setup ⇒ 4.Detailed setup
⇒ 3.Output setup ⇒ 6.HART output ⇒ 3.Burst mode
⇒ 1.Burst option

F050604_3.EPS

Multi HHT communication

Corresponding to discriminating communication between two HHTs.

Device ID setting

Device ID is set in an unsigned integer number of 3 bytes.

5.6.7 Data Renewing

There are two methods to load the data of YEWFLO to HART Communicator, periodic data renewing and discretionary data renewing.

(1) Periodic Data Renewing
The follwing data are renewed in 0.5 to 2 seconds cycle.
PV, PV % rnge, PV AO, Totl

(2) Discretionary Data Renewing
The following data can be loaded from/to YEWFLO. Up load can be done with **SAVE (F2)** on any online menu, and down load can be done on Saved Configuration menu in Offline menu. (Refer to HART Communicator Manual.)

5.6.8 Checking for Problems

The self-diagnostic function YEWFLO is stated at Chapter 6. By using HART Communicator, it is also available to carry out in "Test/Status" parameter. Exam for each error.

*Calling up "Diag/Service" setting display.

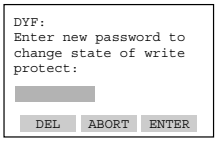
1.Device setup -> 2.Diag/Service

5.6.9 Write Protect

Write protect function is provided to inhibit parameter change. That becomes active by entering a password in "New password". Write protect status is released for 10 minutes by entering the password in "Enable wrt 10min".

Setting the Password

HOT KEY ⇒ 2.Wrt protect menu ⇒ 3.New password



The first indication of Wire protect menu is "1.Write protect ⇒ **No**" after password setting, it shows "**Yes**".
Enter a password into .
Press **ENTER(F4)**.

Enter a password into again.
Press **ENTER(F4)**.
Then, "Change to new password" is indicated.

F050605_1.EPS

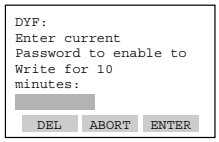
HOT KEY ⇒ 2.Wrt protect menu ⇒ 2.Enable wrt 10min

F050605_2.EPS

"Enable Write" release write protect status for 10 minutes. While write protect status is released, enter a new password in the "New Password".

It will not be possible to set a new password when 10 minutes have elapsed.

If a parameter, which is able to rewrite, it changed during it is in "Enable wrt 10min", releasing time is extended for more 10 minutes as of the time.



Enter a password into .
Press **ENTER(F4)**.
Then, "Release the write protection for 10 minutes." is indicated.

F050605_3.EPS

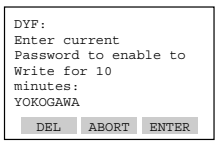
NOTE

- When the write protect function is active (its menu bar shows "Yes"), data setting changes in all parameters of YEWFLO are inhibited and cannot be changed using the HART communicator.
- If 8 characters are input as "space", the Write protect function is in release status irrespective of time.
- If both YEWFLO and HART Communicator power off and on again within 10 minutes after releasing of write protect status, "Enable Write" becomes unavailable.

Joker Password

The Joker Password is reserved for forgetting the password. Though a password had been already set, the Write protect mode is able to release to inhibit status temporary be entering the Joker Password, "YOKOGAWA".

HOT KEY ⇒ 2.Wrt protect menu ⇒ 2.Enable wrt 10min

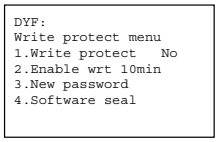


Enter a password into "YOKOGAWA".
Press **ENTER(F4)**.

F050605_4.EPS

Software seal

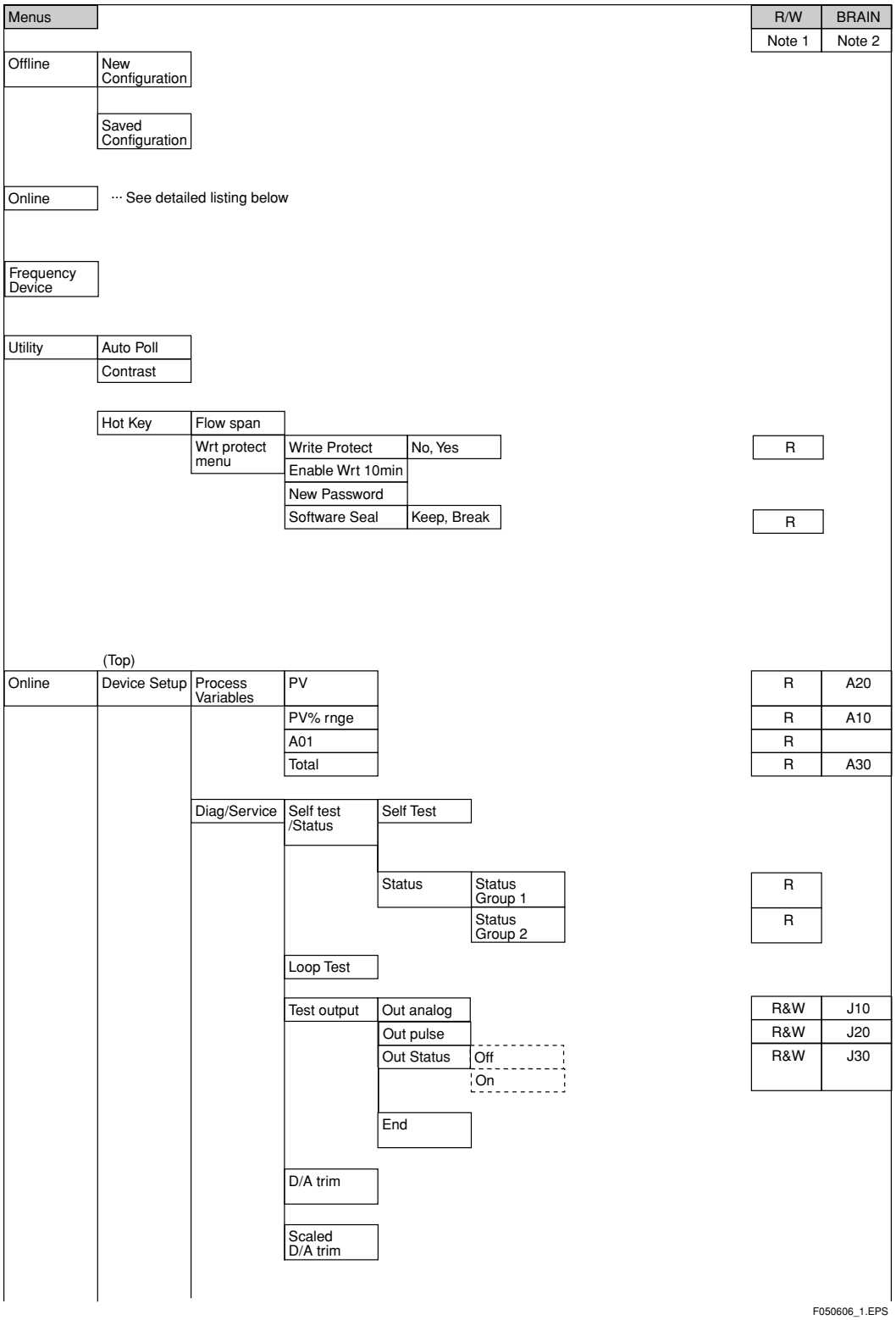
The "Software seal" menu is reserved as a evidence so that user is able to confirm whether the Joker password is used or not. This evidence is saved.



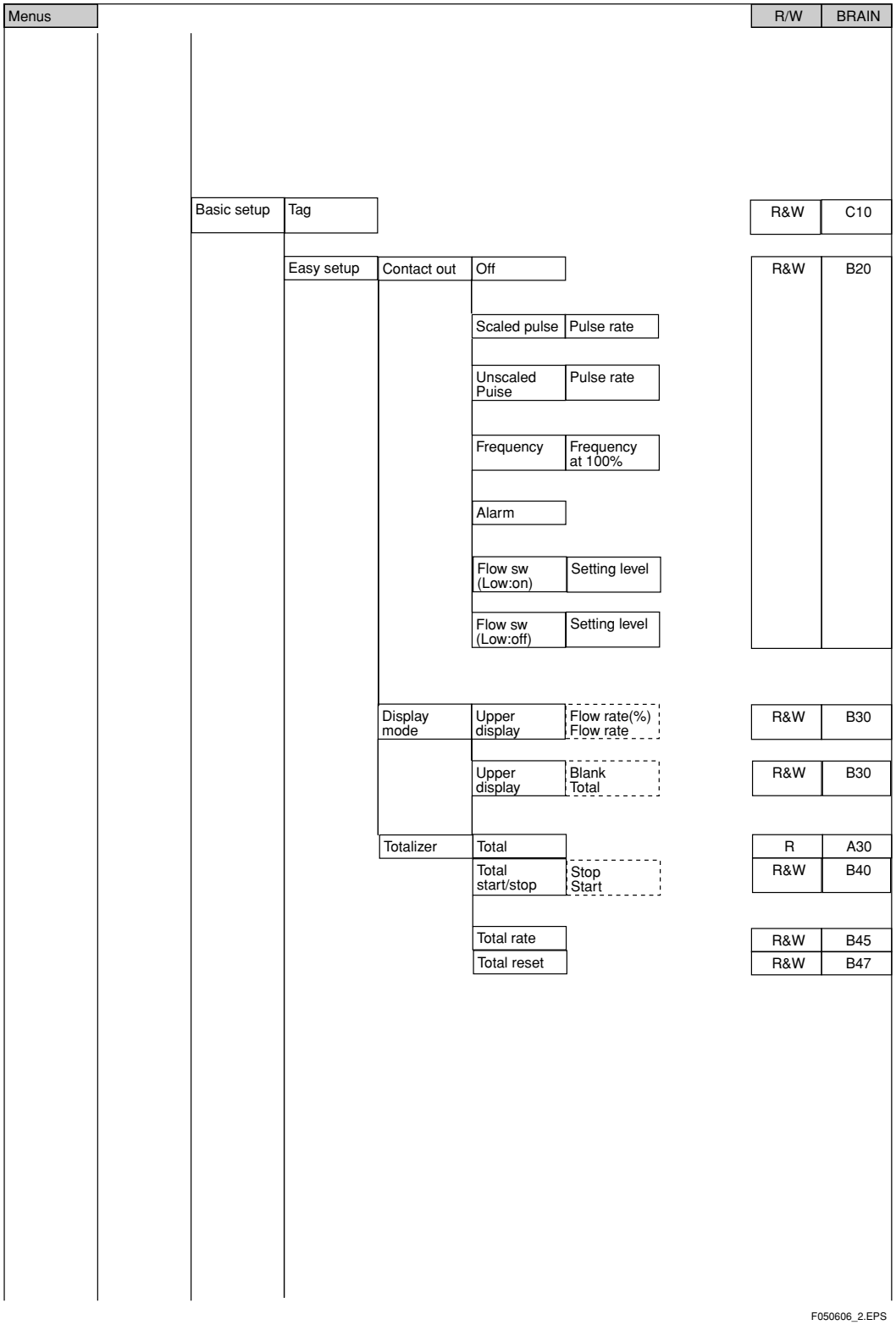
The first indication Software seal manu is "4.Software seal ⇒ keep" after the joker password setting, it shows "Break".

F050605_5.EPS

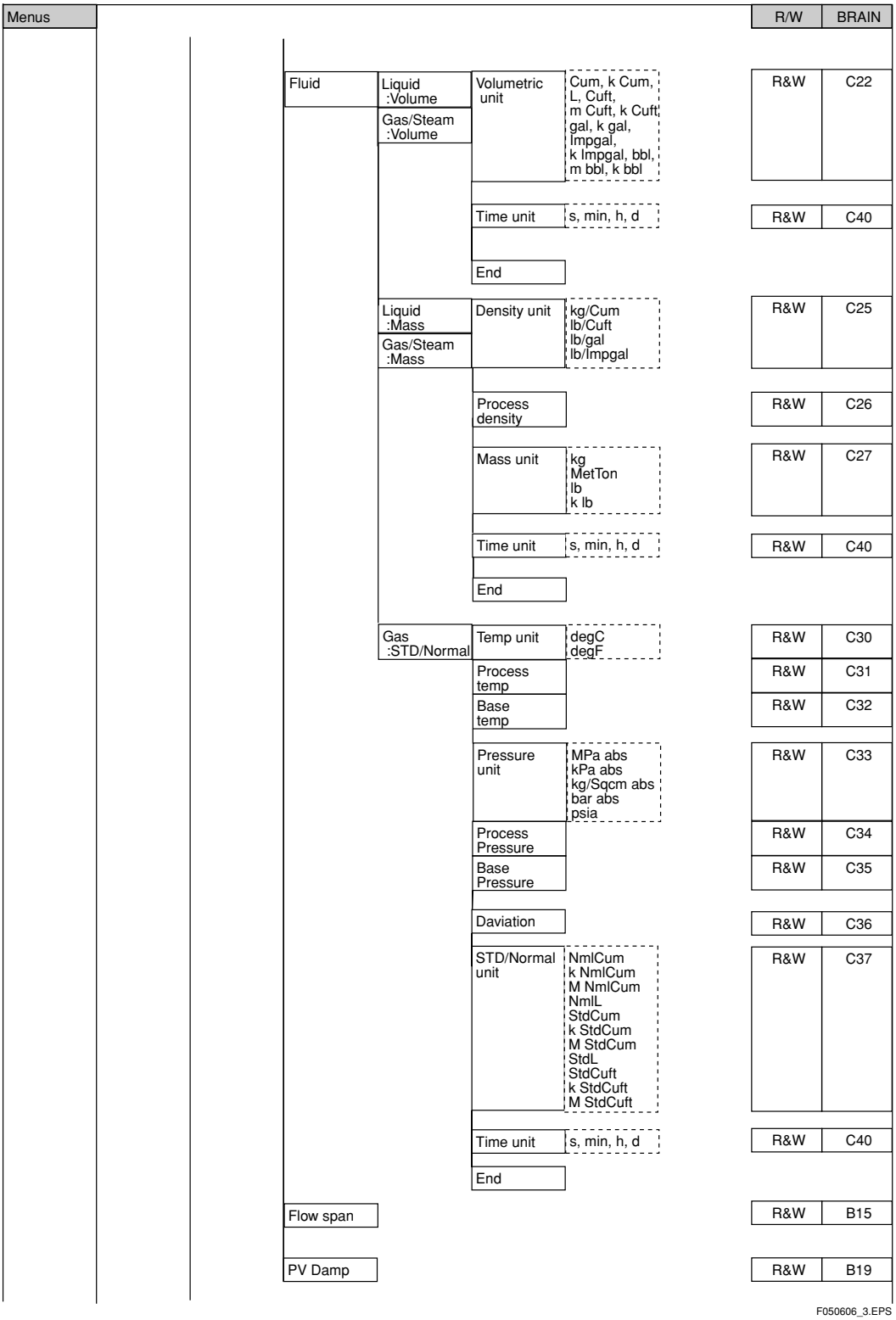
5.6.10 Menu Tree



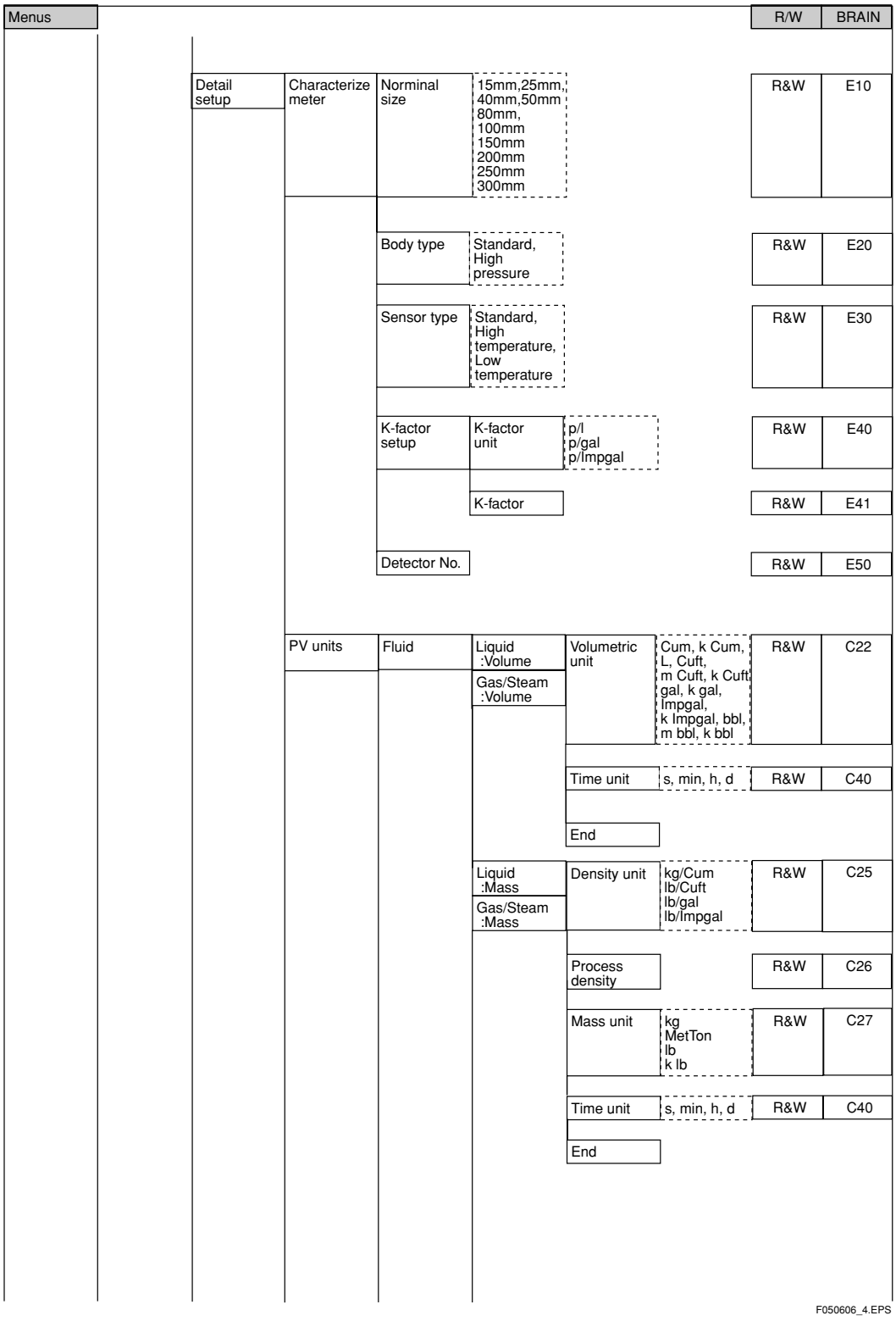
F050606_1.EPS

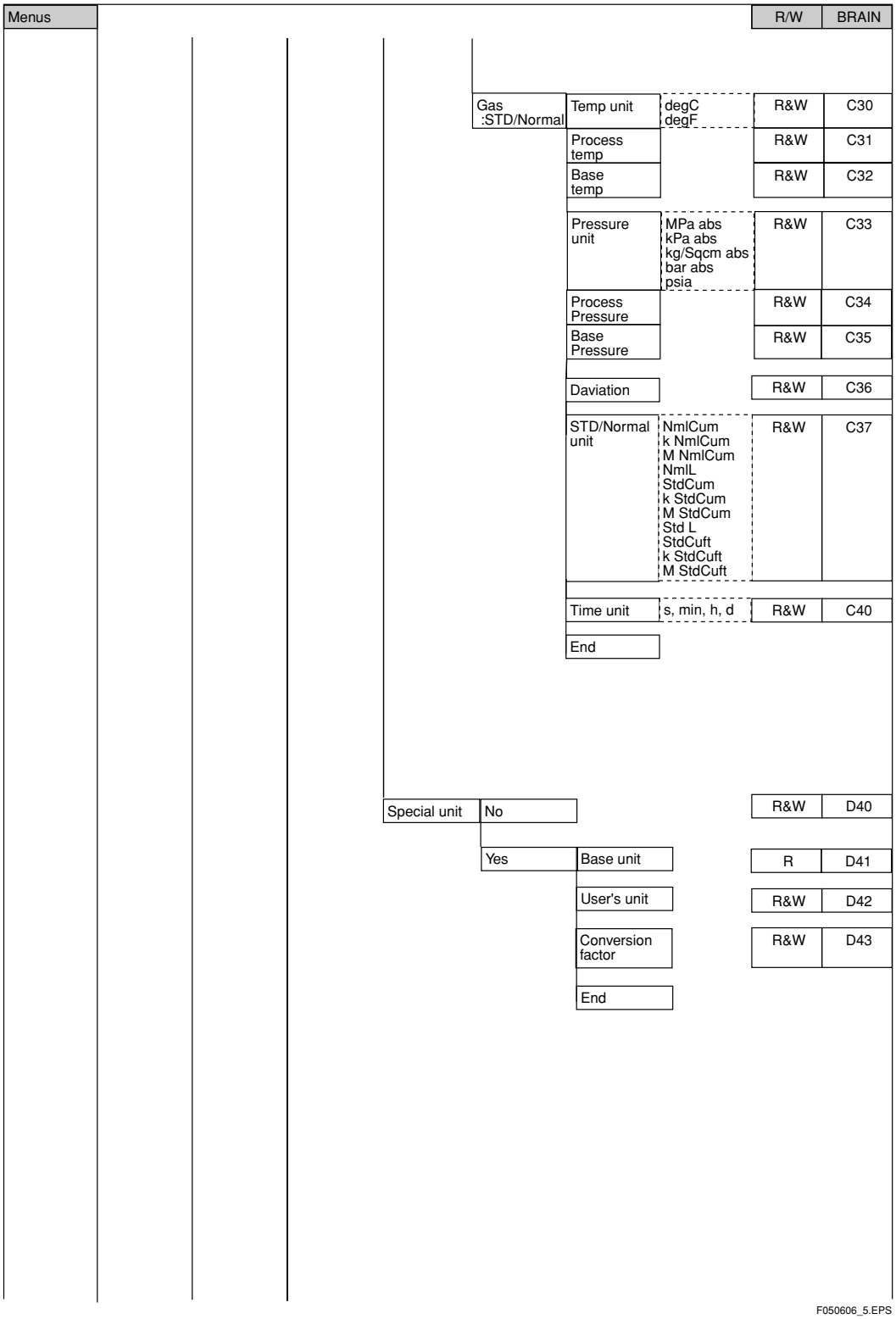


F050606_2.EPS



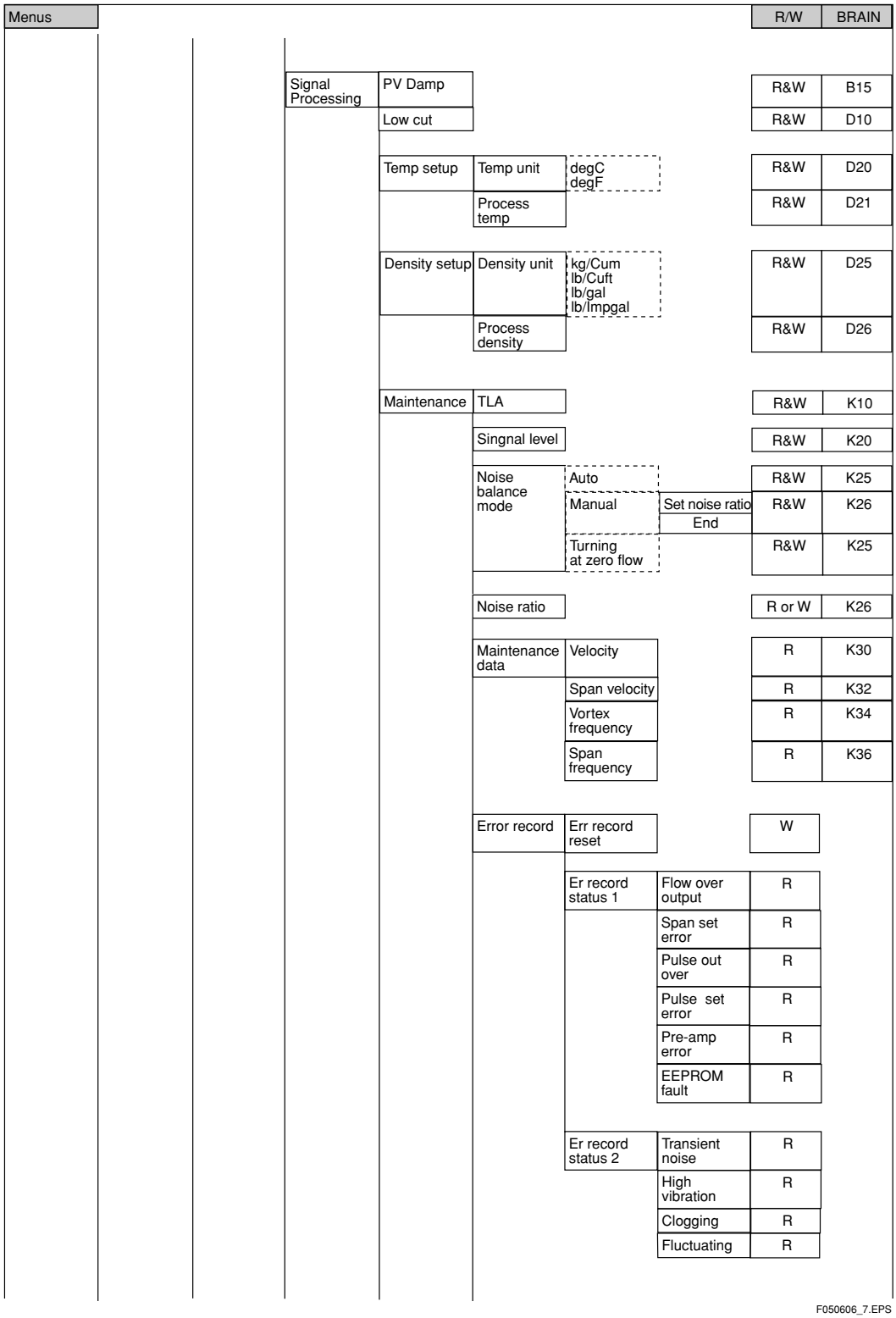
F050606_3.EPS


Menus
R/W
BRAIN
Detail setup
Characterize meter
Norminal size
15mm,25mm,
40mm,50mm
80mm,
100mm
150mm
200mm
250mm
300mm
R&W
E10
Body type
Standard,
High pressure
R&W
E20
Sensor type
Standard,
High temperature,
Low temperature
R&W
E30
K-factor setup
K-factor unit
p/l
p/gal
p/Impgal
R&W
E40
K-factor
R&W
E41
Detector No.
R&W
E50
PV units
Fluid
Liquid :Volume
Gas/Steam :Volume
Volumetric unit
Cum, k Cum,
L, Cuft,
m Cuft, k Cuft,
gal, k gal,
Impgal,
k Impgal, bbl,
m bbl, k bbl
R&W
C22
Time unit
s, min, h, d
R&W
C40
End
Liquid :Mass
Gas/Steam :Mass
Density unit
kg/Cum
lb/Cuft
lb/gal
lb/Impgal
R&W
C25
Process density
R&W
C26
Mass unit
kg
MetTon
lb
k lb
R&W
C27
Time unit
s, min, h, d
R&W
C40
End
F050606_4.EPS

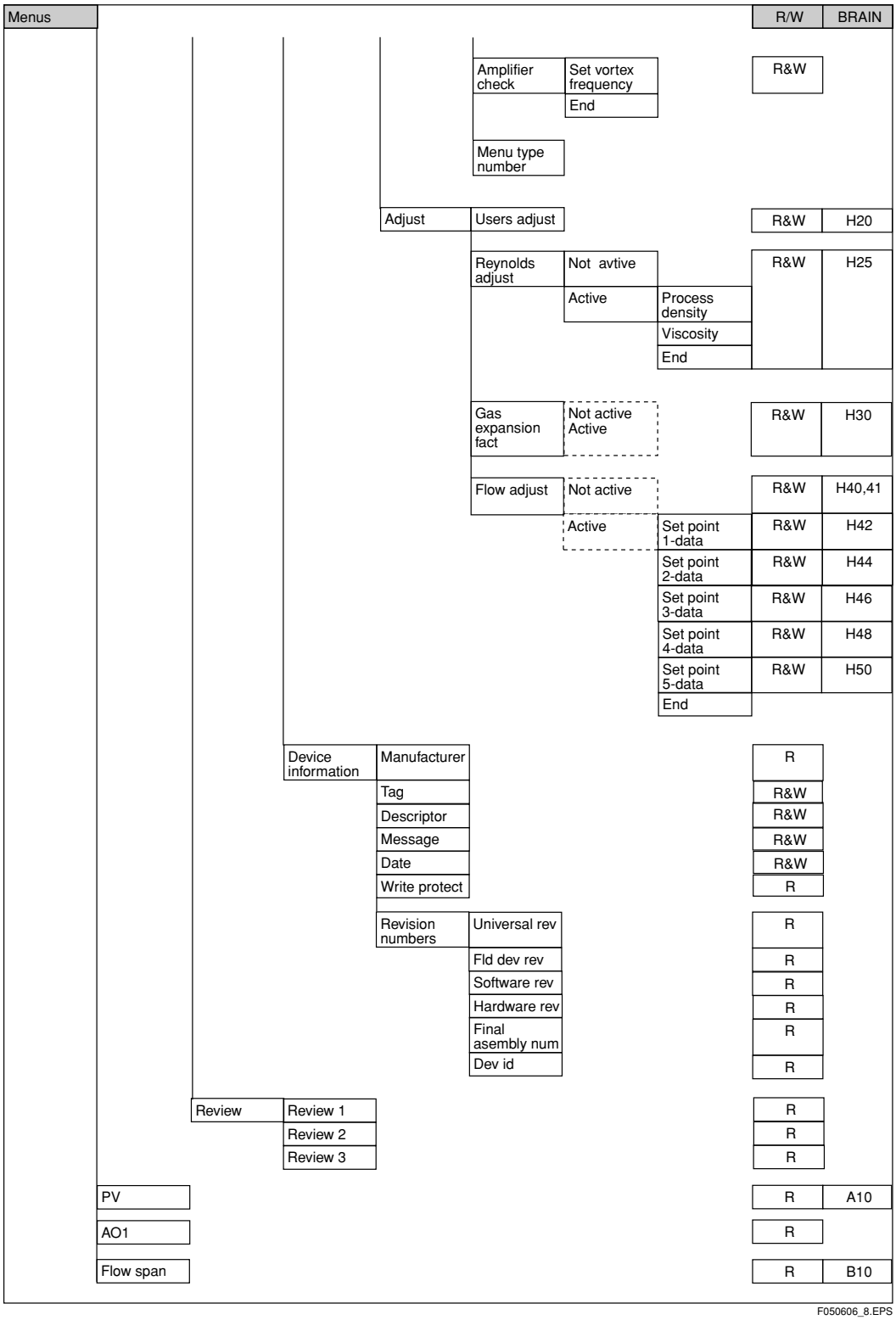

Menus
R/W
BRAIN
Gas :STD/Normal
Temp unit
degC
degF
R&W
C30
Process temp
R&W
C31
Base temp
R&W
C32
Pressure unit
MPa abs
kPa abs
kg/Sqcm abs
bar abs
psia
R&W
C33
Process Pressure
R&W
C34
Base Pressure
R&W
C35
Daviation
R&W
C36
STD/Normal unit
NmlCum
k NmlCum
M NmlCum
NmlL
StdCum
k StdCum
M StdCum
Std L
StdCuft
k StdCuft
M StdCuft
R&W
C37
Time unit
s, min, h, d
R&W
C40
End
Special unit
No
R&W
D40
Yes
Base unit
R
D41
User's unit
R&W
D42
Conversion factor
R&W
D43
End
F050606_5.EPS

Menus						R/W	BRAIN
Configure outputs	Analog output	Flow span				R&W	B10
		Output limit(H)				R&W	D30
		Burn out				R	D35
	Contact output	Off				R&W	B20
		Scaled pulse	Pulse rate				
		Unscaled pulse	Pulse rate				
		Frequency	Frequency at 100%				
		Alarm					
		Flow sw (Low:On)	Setting level				
		Flow sw (Low:Off)	Setting level				
	Display mode	Upper display	Flow rate(%) Flow rate			R&W	B30
		Lower display	Blank Total			R&W	B31
	Totalizer	Total				R	A30
		Total start/stop	Stop Start			R&W	B40
		Total rate				R&W	B45
		Total reset				R&W	B47
	HART output	Poll addr				R&W	
		Num req params				R&W	
		Burst mode	Off On			R	
		Burst option	PV %range /current Process vars /crnt			R&W	

F050606_6.EPS



F050606_7.EPS



F050606_8.EPS

Note 1: R=read W=write

Review 1
Model
Manufacturer
Distributor
Tag
Descriptor
Message
Date
Dev id
Write protect
AO alrm typ
Universal rev
Fld dev rev
Software rev
Hardware rev
Poll addr
Burst mode
Burst option
Num req preams

Review 2
Flow rate unit
Flow span
PV Damp
Contact output
Pulse rate
Frequency at 100%
Setting level
Upper display
Lower display
Total rate
Total start/stop
Fluid
Process density
Process temp
Base temp
Process pressure
Base pressure
Deviation
Low cut
Out limit (H)
Burn out

Review 3
Special unit
User's unit
Conversion faetor
Nominal size
Body type
Sensor type
K - factor
Detector No.
User adjust
Reynolds adjust
Viscosity
Gas expansion fact
Flow adjust
TLA
Signal level
Noise balance mode
Noise ratio
Span velocity
Span frequency

F050606_9.EPS

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 YEWFLO.

• 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.

T060201.EPS

(1) Item A : Indication

These items are for the indication of flowrate and total.

Item	Name	R / W	Data Range	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

T060202.EPS

(2) Item B : Easy Setting

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

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

Item	Name	R / W	Data Range	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

T060203.EPS

(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) Nl (3) Sm^3 (4) K Sm^3 (5) M Sm^3 (6) Sl (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

T060204.EPS

(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 (Additinal 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)		Selection of Temperature Unit	(0)	D	L
			deg F (1)					
D21	TEMP f	W	-999.9 to 999.9	D20	Operating Temperature (Manual Setting Value)	15.0	D	L
D25	DENSITY UNIT	W	kg/m³ (0)		Selection of Density Unit	(0)	D	L
			lb/cf (1)					
			lb/USgal (2)					
			lb/UKgal (3)					
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)		Output Direction at Burn Out	(0)	D	L
			Low (1)					
D40	SPECIAL UNIT		No (0)		Selection of change for Special Flow Unit	(0)	D	L
			Yes (1)					
(Indication and set only for D40 : Yes)								
D41	BASE UNIT	R	m³ (0)		Basic unit for conversion to special unit		D	
			k m³ (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)					
			Nm³ (17)					
			k Nm³ (18)					
			M Nm³ (19)					
			Nl (20)					
			Sm³ (21)					
			k Sm³ (22)					
			M Sm³ (23)					
			Sl (24)					
			scf (25)					
			k scf (26)					
			M scf (27)					
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

T060205.EPS

(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)		Selection of Nominal Size	(1)	D	L
			25mm (1)					
			40mm (2)					
			50mm (3)					
			80mm (4)					
			100mm (5)					
			150mm (6)					
			200mm (7)					
			250mm (8)					
			300mm (9)					
			—— (10)					
E20	BODY TYPE	W	Standard (0)		Selection of Body Type	(0)	D	L
			—— (1)					
E30	SENSOR TYPE	W	Standard (0)		Selection of Sensor Type	(0)	D	L
			High Temperature (1)					
			Low Temperature (2)					
E40	K-FACT UNIT	W	P/l (0)		Selection of K-factor Unit	(0)	D	L
			P/Usgal (1)					
			P/Ukgal (2)					
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

T060206.EPS

(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			

T060207.EPS

(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			

T060208.EPS

(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			

T060209.EPS

(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			

T060210.EPS

6.3 Parameter Description

(1) Item B : Easy Setting

These items are for the Principal items to operate YEWFLO.

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:CONTUCT 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"

T060301.EPS

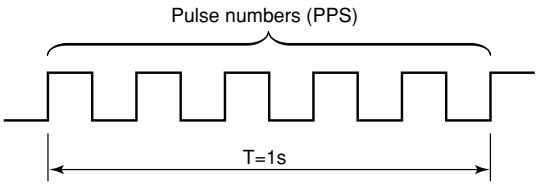
[B21:PULSE RATE] Pulse output rate

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

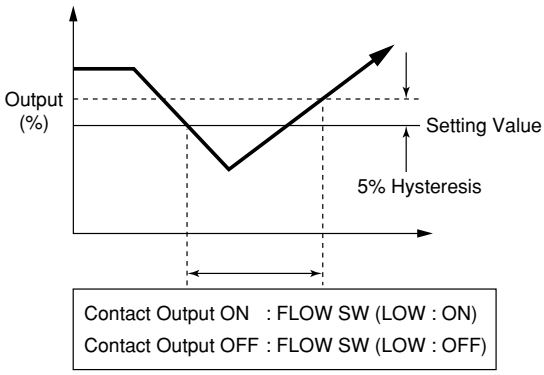
Set pulse number at 100% for one second when "FREQUENCY" in B20 is selected.



F060301.EPS

[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.



F060302.EPS

[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 excuted, the total display and communication parameter are reset.

(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

T060302.EPS

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 m^3(0), km^3(1), l(2), cf(3), mcf(4), def(5), USgal(6), kUKgal(9), bbl(10), mbbl(11), kbbl(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/m^3(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/cm^2 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 Nm^3(0), kNm^3(1), MNm^3(2), Nl(3), Sm^3(4), Km^3(5), Mm^3(6), Sl(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.

(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/m^3(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 derection 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)"

[E20:BODY TYPE] Body type for the detector

Select body type for detector from standard or high pressure.

[E30:SENSOR TYPE] Sensor type for the detector

Select sensor type for the detector from standard or HT/LT

[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.

(5) Item H (ADJUST)

This item for setting of adjustment.

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

Fine tuning adjustment of 4mA and 20mA output.

Fine tuning range is form -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 foumula below.

$$Re = 354 \times \frac{Q \bullet \rho f}{D \bullet v}$$

Q : Volumetric flow (m^3/h)
D : Internal diameter (m)
ρf : Density at operating condition
μ : Viscosity (m Pa • 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) Abscisa (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.

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

Where
Qs : 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.

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

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) 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 YEWFLO 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 voltex 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.

6.4 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	Fluctualing	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 dignostic 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.

T060401.EPS

7. MAINTENANCE

After you have installed the flowmeter into the process piping, wired the input/output terminals, set up the required parameters, the vortex flowmeter should output an accurate flow signal from its terminals as soon as the measured liquid begins to flow.

This section describes procedure of test method and adjustment method for the pre-operation.

7.1 Adjustment

7.1.1 Zero Adjustment

No zero adjustment is necessary since the zero point does not shift.

Because of the effect of electrical noise and vibration noise, YEWFLO may provide an output even when the flowrate is zero. In that case, properly eliminate the source of the noise.

Refer to “7.2 : Adjustment for manual mode”.

7.1.2 Span Adjustment

In normal application, you need not confirm the span.

If you need to ensure the output of 4 to 20mA DC, refer to “7.1.3 Loop Test”.

7.1.3 Loop test

To ensure output of 4 to 20mA DC or pulse, their loop tests can be done using parameter “J10 (Analog out)” or “J20 (Pulse test)”.

If you are verifying the analog output, follow the procedure on the verification procedure.

<Check Procedure>

1. Connect the instruments referring to Figure 7.1, and warm up for three minutes more.
2. Set span frequency in Parameter J10:OUT ANALOG.
3. In case the load resistance is 250 ohm, digital multimeter indicates 5V. Otherwise if it is known load resistance value, it indicates R x 0.02A.
4. Check output value after set about 50% frequency of span in Parameter J10.
5. Check output value after set zero in Parameter J10.

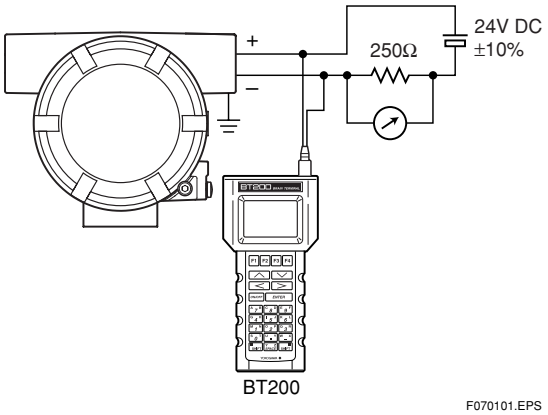


Figure 7.1 Connection of Maintenance Instruments

IMPORTANT

- When using any test-purpose measuring instruments, do not ground them.
- All of your parameter settings will be cancelled if you turn YEWFLO off less than 30 seconds after the parameter setup. Keep YEWFLO turned on at least 30 seconds after setting up the parameters.

7.1.4 Totalized Value Reset

Totalized value can be reset using the indicator or BT200.

(1) Reset operation using BT200
Enter to B42 (TOTAL RESET), and move the video bar to “EXECUTE”. Push “ENTER” key at 2times.

(2) Reset operation using indicator
Enter to “Setting mode”, move to B42 of parameter number, and enter to “01” of data Number.
Refer to “5.4 : Setting mode”.

7.1.5 Unit of Pulse Output (Scaling)

Pulse output are constructed by two units, that are “Scaled pulse and Unscaled Pulse”.

(1) Scaled Pulse

Scaled pulse output can be done by flowrate units at 1 pulse.

For example, m^3/p, l/p and so on.

(2) Unscaled Pulse

The numbers of pulses are output by using vortex number which caused by shedder bar.

Refer to “8.2: Flow calculation”.

● Pulse Rate setting

Pulse rate setting are settable by “B21:PULSE RATE”.

7.1.6 Setting the CPU Error Burnout Change-over Switch

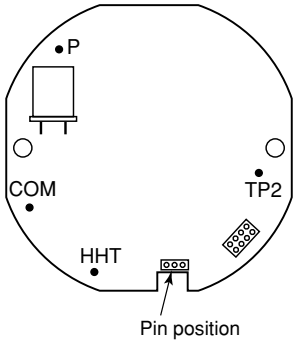
The Vortex flowmeter is equipped with a CPU error burnout function used to set the output direction upon CPU error, and a sensor burnout function that sets the direction of the output in the event of burnout of the temperature sensor. When factory-shipment under normal conditions, the output of both CPU error burnout and sensor burnout are set to HIGH, but if suffix code/C1 is specified, the CPU error burnout is set to LOW(-2.5%) output, and sensor burnout is set to LOW(-2.5%) output, respectively. The setting of the direction of output from burnout can be changed.

To change the direction of output arising from burnout, switch the setting pin on the CPU assembly (see Table 7.1). To change the direction of output arising out of sensor burnout, a dedicated hand-held terminal is required to rewrite the parameters within the transmitter. For details, refer to the instruction manual, “IM 1F6A0-01E”.

Table 7.1 Output Direction Setting Pins for CPU Error Burnout

Pin position	CPU error burnout direction	CPU error burnout output	Remark
H / L	HIGH	110% or more (21.6mA DC)	Set to HIGH upon shipment from the factory.
H / L	LOW	-2.5% or less (3.6mA DC)	Set to LOW when suffix code / C1 is provided.

T070101.EPS



F070102.EPS

7.1.7 Power Failure

When a power failure occurs, the totalized value will be protected by EEPROM (Electrically Erasable Programmable ROM). But during a power failure, the vortex flowmeter stops and also the totalizing will stop.

After a power is recovered, the vortex flowmeter and the totalizing start to work automatically.

EEPROM doesn’t need a battery for backup.

7.2 Adjustment for Manual Mode

YEWFLO does not need the initial adjustment because YEWFLO is always adjusted by itself automatically.

The following adjustment should be done when automatic adjustment is impossible.

7.2.1 Low Cut Adjustment

Adjust to noise elimination or zero flow in the low flowrate (or low frequency) range.
The settable range for low cut flowrate is below half of minimum flowrate.

7.2.2 Tuning

This adjustment should be done in case that indicator reads over zero at zero flow.
If this adjustment is executed, the following value is changed.

K25:N.B MODE = MANUAL

K26:NOISE RATIO=Constant value

K10:TLA = Changed from initial value

Minimum flowrate is increased when TLA value is changed form initial value.

1. Tuning method

(1) Ensure the condition of flowrate
The necessary condition for tuning function is zero flow.

(2) Executing the tuning function.
Set " TUNING AT ZERO" of "K25:N.B MODE".
Wait more 10 second.

(3) Finishing the tuning functions
Using the BT200
(a) Press "DATA" key of BT200 function key.
(b) Ensure the indication of "MANUAL" which is "K25:N.B MODE"
Using the indicator
(a) Press "SHIFT" and "SET" key simultaneously.
(b) Press "SET" key and ensure "01" of Lower indication.

2. TLA value

TLA values is possible to change after executing "TUNING". In this case, minimum flowrate is increased.

Minimum flowrate for TLA value is given by below equation.

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

F070201.EPS

Ensure minimum flowrate for changing TLA value.

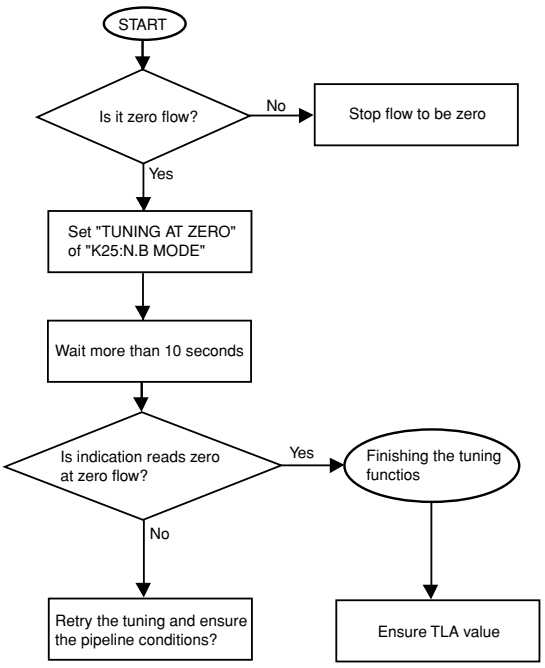
3. Output

After tuning, ensure that the indication reads is zero where no fluid is flowing.

If the indication reads over zero is done continuously, retry the tuning and ensure the below condition.

Does high vibrations occur in pipeline?

In this case, refer to "3:INSTALLATION" .



F070202.EPS

Tuning flow

7.3 Other Maintenance

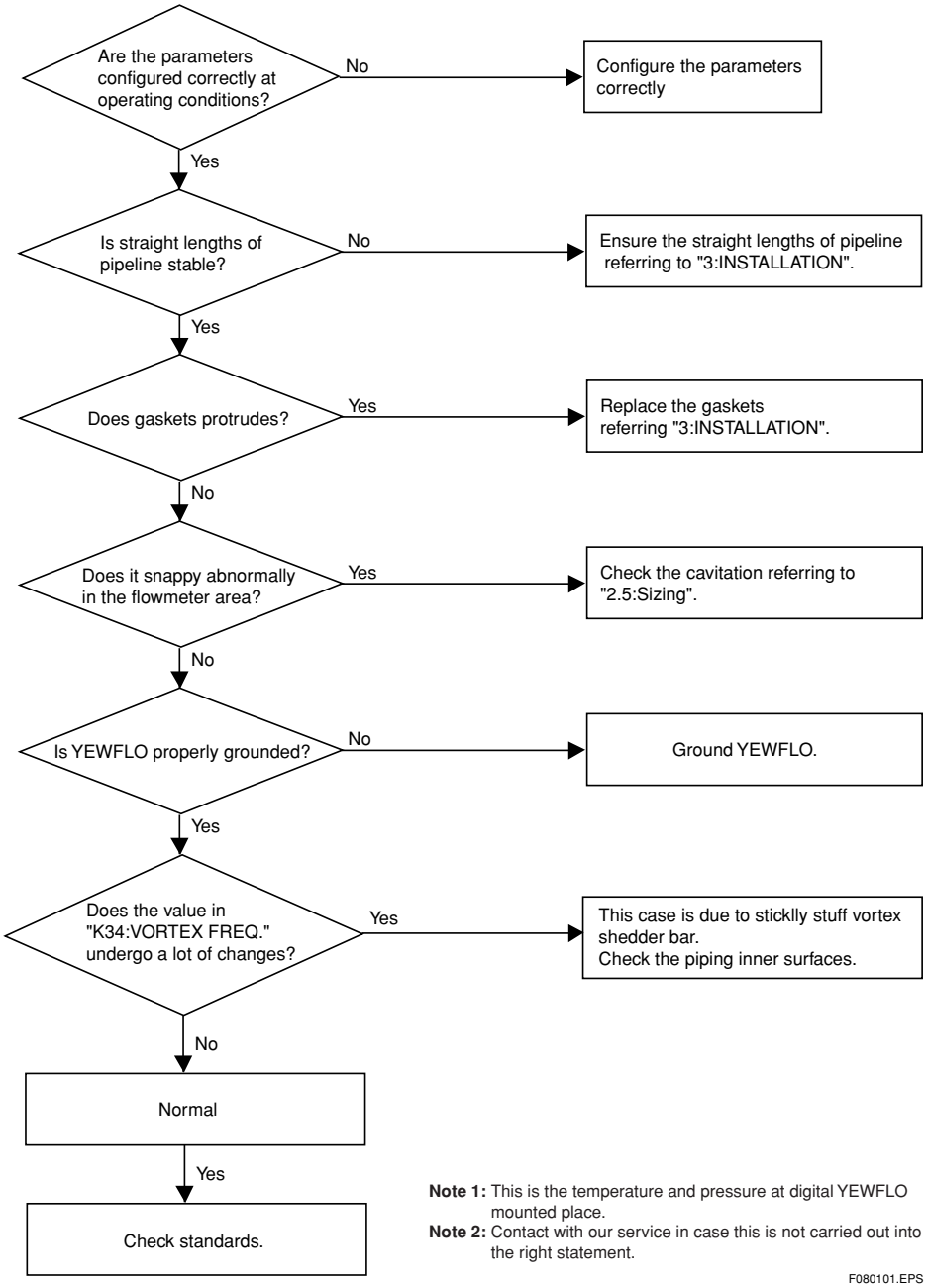
7.3.1 Cleaning Precautions

Care should be taken to prevent the build up of dirt, dust or other material on the display glass and data plate. In case of its maintenance, soft and dry cloth is used.

8. TROUBLESHOOTING

8.1 Flow

● **Large flowmeter errors and flowrate reading fluctuates.**



Note 1: This is the temperature and pressure at digital YEWFLO mounted place.
Note 2: Contact with our service in case this is not carried out into the right statement.

F080101.EPS

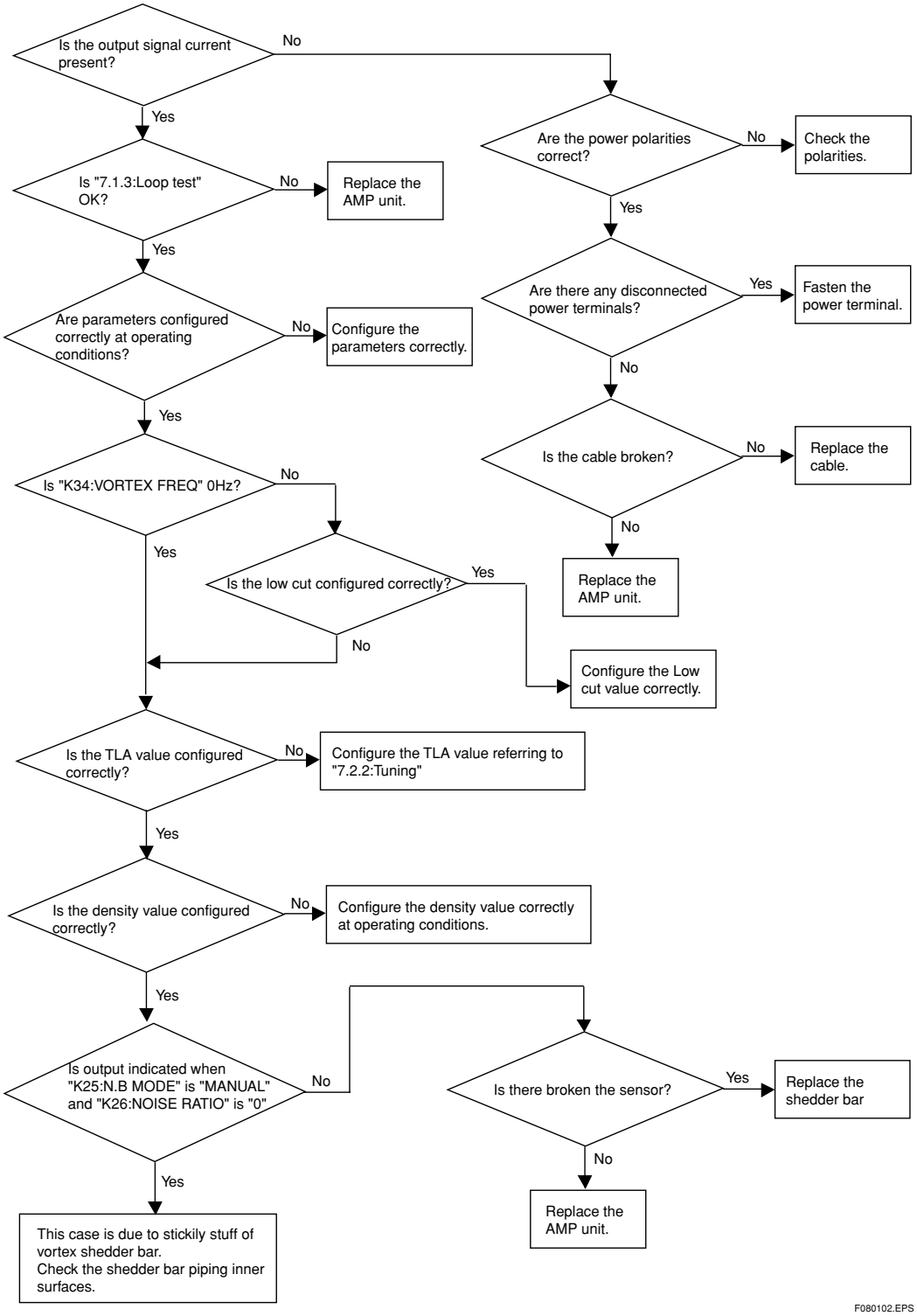
● **After the output showed correctly, the indication goes down to zero at certain time.**

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.

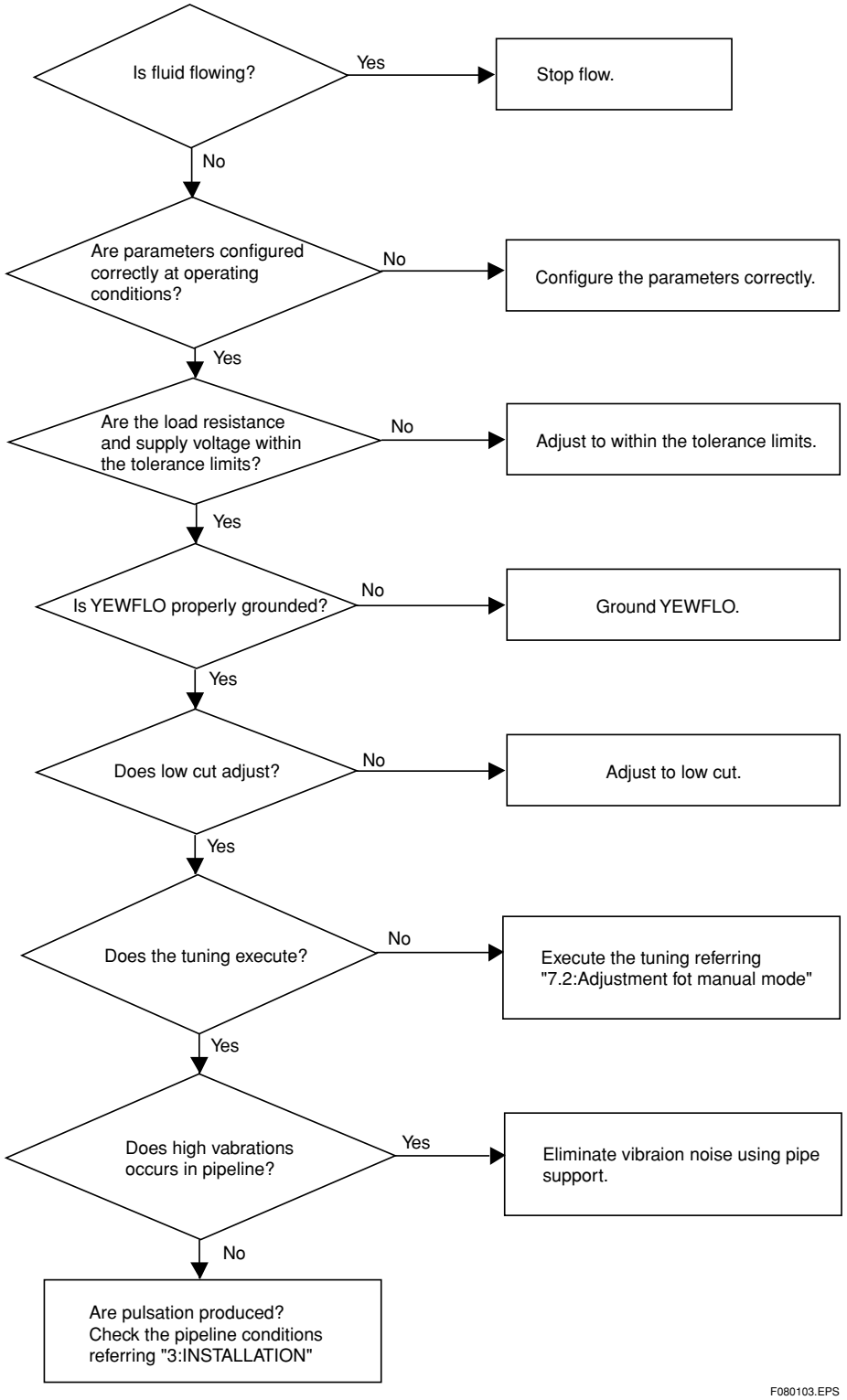
How to cope with this problem

1) Referring item 8.2 “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.

● No output is indicated when the fluid is flowing.



● Output is indicated at zero flow.



F080103.EPS

8.2 Vortex Shedder Removal

(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 8.1. The guide pin applies to the 1 to 4 inch flowmeters.
   c. The vortex shedder assembly is installed as illustrated in Figure 8.1.
   d. Tighten the sensor mounting bolts or nuts with a torque wrench, applying the torque specified below.
      Refer to figure 8 for bolt torque sequence.
      In case of High Temperature Version (Option code: HT), First time tighten Nuts with a torque wrench, applying the torque specified in "Table A". Next time loosen Nuts completely, then again tighten Nuts with a torque wrench, applying the torque specified in "Table B".
   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 8.1 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 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)

Table A HT Version

Meter Size inch (mm)	HT 1st Torque		HT 2nd Torque		HT 3rd Torque		HT 4th Torque	
1/2 (15)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
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)	153 in lb	1.75 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)	36 ft lb	4.93 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)	73 ft lb	10 kg m)
4 (100)	10 ft lb	13.7 kg m)	15 ft lb	2.1 kg m)	22 ft lb	3 kg m)	73 ft lb	10 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)	50 ft lb	6.85 kg m)
8 (200)	10 ft lb	13.7 kg m)	22 ft lb	3 kg m)	37 ft lb	5.1 kg m)	73 ft lb	10 kg m)
10 (250)	10 ft lb	13.7 kg m)	22 ft lb	3 kg m)	70 ft lb	9.6 kg m)	n/a	n/a
12 (300)	10 ft lb	13.7 kg m)	22 ft lb	3 kg m)	70 ft lb	9.6 kg m)	n/a	n/a

Table B HT Version

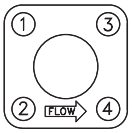
Meter Size inch (mm)	HT 5th Torque		HT 6th Torque		HT 7th Torque		HT 8th Torque Final	
1/2 (15)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1 & 1.5 (25 & 40)	25 in lb	0.29 kg m)	60 in lb	0.67 kg m)	90 in lb	1.03 kg m)	105 in lb	1.2 kg m)
2 (50)	20 in lb	0.23 kg m)	100 in lb	1.15 kg m)	120 in lb	1.37 kg m)	14 ft lb	1.9 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)	29 ft lb	3.97 kg m)
4 (100)	10 ft lb	13.7 kg m)	15 ft lb	2.1 kg m)	22 ft lb	3 kg m)	36 ft lb	4.93 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)	36 ft lb	1.93 kg m)
8 (200)	10 ft lb	13.7 kg m)	22 ft lb	3 kg m)	37 ft lb	5.1 kg m)	50 ft lb	6.85 kg m)
10 (250)	10 ft lb	13.7 kg m)	22 ft lb	3 kg m)	70 ft lb	9.6 kg m)	n/a	n/a
12 (300)	10 ft lb	13.7 kg m)	22 ft lb	3 kg m)	70 ft lb	9.6 kg m)	n/a	n/a

⚠ CAUTION

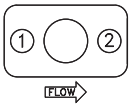
When the vortex shedder is removed, the gasket must be replaced with a new one.

Figure 8.0 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



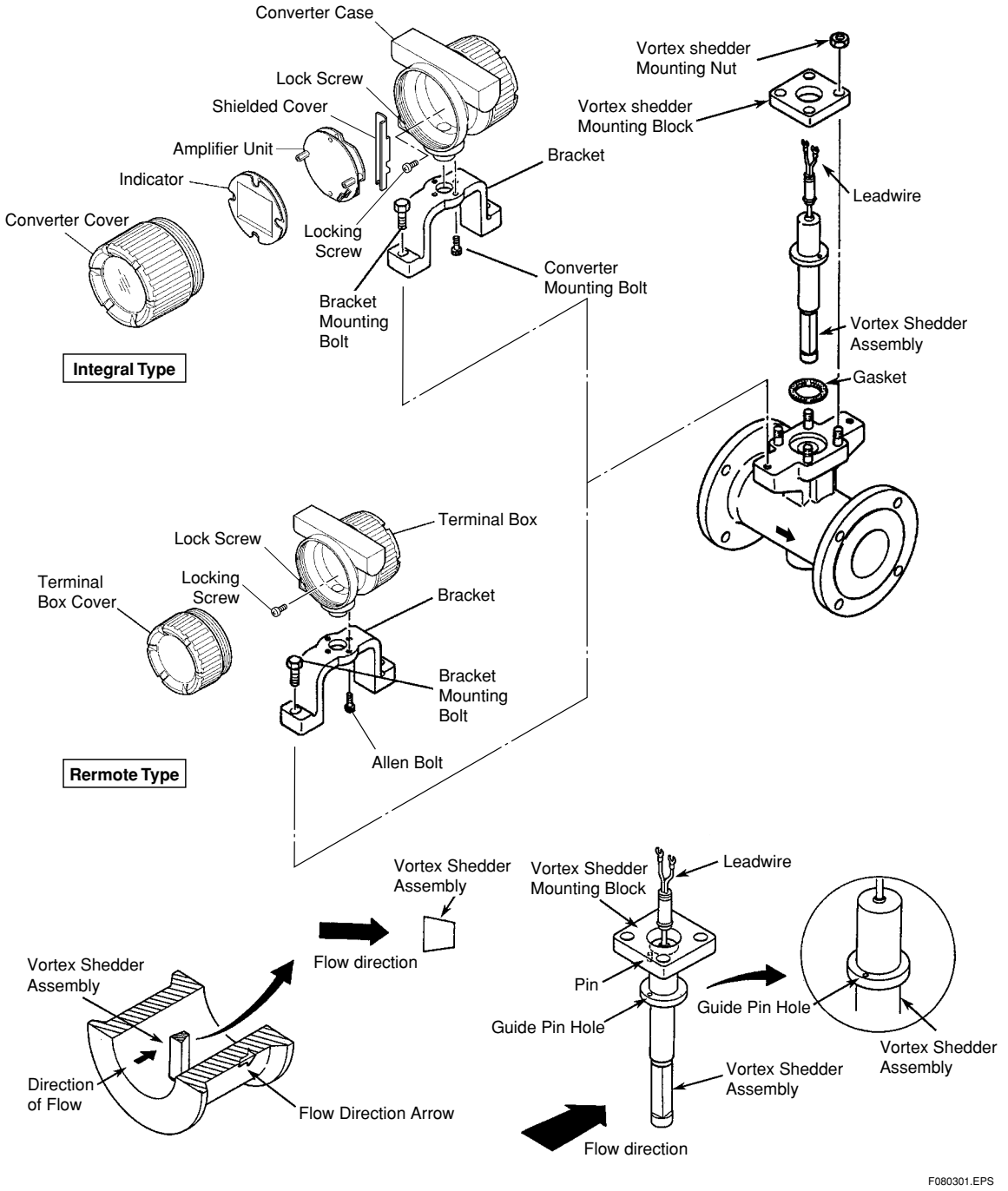


Figure 8.1 Disassembling and Reassembling the Vortex Shedder Assembly

8.3 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)

$$RATE=N\cdot\frac{1}{\Delta t}\cdot\varepsilon_f\cdot\varepsilon_e\cdot\varepsilon_r\cdot\varepsilon_p\cdot\frac{1}{KT}\cdot U_{KT}\cdot U_k\cdot U_{TM}\cdot\frac{1}{S_E} \quad \text{.... (8.1.1)}$$

$$KT=KM\cdot\{1-4.81\times(Tf-15)\times10^{-5}\} \quad \text{.... (Metric Units)} \quad \text{.... (8.1.2)}$$

$$KT=KM\cdot\{1-2.627\times(Tf-59)\times10^{-5}\} \quad \text{.... (English Units)} \quad \text{.... (8.1.3)}$$

(b) Flowrate (%)

$$RATE(\%)=RATE\cdot\frac{1}{F_S} \quad \text{.... (8.2)}$$

(c) Totalized value

$$TOTAL=N\cdot\varepsilon_f\cdot\varepsilon_e\cdot\varepsilon_r\cdot\varepsilon_p\cdot\frac{1}{KT}\cdot U_{KT}\cdot U_k\cdot\frac{1}{T_E} \quad \text{.... (8.3.1)}$$

$$TOTAL=Ef\cdot\varepsilon_e\cdot\varepsilon_r\cdot\varepsilon_p\cdot N \quad \text{.... (Unscaled pulses)} \quad \text{.... (8.3.2)}$$

(d) Velocity

$$V=N\cdot\frac{1}{\Delta t}\cdot\frac{1}{KT}\cdot U_{KT}\cdot\frac{4}{\pi D^2} \quad \text{.... (8.4.1)}$$

(e) Reynolds number

$$Red=V\cdot D\cdot\rho_f\cdot\frac{1}{\mu}\times1000 \quad \text{.... (Metric Units)} \quad \text{.... (8.5.1)}$$

$$Red=V\cdot D\cdot\rho_f\cdot\frac{1}{\mu}\times124 \quad \text{.... (English Units)} \quad \text{.... (8.5.2)}$$

where N: Number of input pulses (pulse)
Δt: Time corresponding to N (seconds)
ε_f: 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(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 Uk 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 (Mass flowrate): $U_k=U\rho_f\cdot U_k$ (kg) .... (8.6.1)
$U_k=\rho_f\cdot U_k$ (lb) .... (8.6.2)
Qf (Flowrate at operation): $U_k=U_k$ (m^3) .... (8.7.1)
$U_k=U_k$ (acf) .... (8.7.2)

(b) Gas
Qn: (Flowrate at STP):

$$U_{k\,(Nm^3)}=\frac{P_f}{P_n}\;\frac{P_f\,273.15}{P_n\,273.15}\;\frac{1}{K} \quad \text{.... (8.8.1)}$$

$$U_{k\,(scf)}=\frac{P_f}{P_n}\;\frac{\frac{5}{9}\,(T_n-32)273.15}{\frac{5}{9}\,(T_n-32)273.15}\;\frac{1}{K}$$

M: (Mass flowrate): $U_k=\rho_f\,.\,U\rho_f\,.\,U_k$ (kg) .... (8.9.1)
$U_k=\rho_f\,.\,U\rho_f\,.\,U_k$ (lb) .... (8.9.2)
Qf: (Flowrate): $U_k=U_k$ (m^3) .... (8.10.1)
$U_k=U_k$ (acf) .... (8.10.2)

(c) Liquid
Qf: (Flowrate): $U_k=U_k$ (m^3) .... (8.11.1)
$U_k=U_k$ (acf) .... (8.11.2)
M (Mass flowrate): $U_k=\rho_f\cdot U$ (kg) .... (8.12.1)
$U_k=7.481\times\rho_f\cdot U$ (lb) .... (8.12.2)
7.481 is a conversion factor of U.S gal into acf

(d) User's unit
$U_k=U_k$ (user) .... (8.13)

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)
$U_{k(kg)}$, $U_{k(cal)}$, $U_{k(Nm3)}$, $U_{k(m3)}$
$U_{k(lb)}$, $U_{k(Btu)}$, $U_{k(scf)}$, $U_{k(acf)}$: Unit conversion factors

9. EXPLOSION PROOF TYPE INSTRUMENT(NOW PREPARING)

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

WARNING

- Only trained persons use this instrument in industrial locations.

9.1 FM

9.1.1 Technical Data

Explosion proof for Class I, Division 1, Groups A,B, C and D; Dust-ignition proof for Class II/III, Division 1, Groups E, F, and G.

Enclosure Rating: NEMA TYPE 4X

Temperature Code: T6

Intrinsically safe for Class I, II, III, Division 1, Group A, B, C, D, E, F and G,T4 Nonincentive for Class I, II, Division 2, Group A, B, C, D, E, F and G, Class III, Division 1, Hazardous Location.

Ambient Temperature (Integral Type and Remote Type): –40°C to +60°C

Ambient Temperature (Remote Type detector): –40°C to +85°C

Ambient Humidity: 0 to +100% RH (No condensation) Indoors and Outdoors: NEMA 4X

Parameters: Vmax=30V dc/Imax=165mA dc/Pmax=0.9W/ Ci=6nF/Li=0.15mH

Electrical connection : ANSI 1/2 NPT female

9.1.2 Wiring

NOTE

- All wiring shall comply with National Electrical Code ANSI/NFPA 70 and Local Electrical Code.
- “FACTORY SEALED, CONDUIT SEAL NOT REQUIRED”.

WARNING

- The FM Approved Hand Held Communicator may be connected at any point in the loop between the digitalYEWFLO and the Control Equipment.

9.1.3 Operation

WARNING

- Note a warning label worded as follows.
  Warning: OPEN CIRCUIT BEFORE REMOVING COVER.
  INSTALL IN ACCORDANCE WITH THE INSTRUCTION MANUAL (IM) IF6A1-01E.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

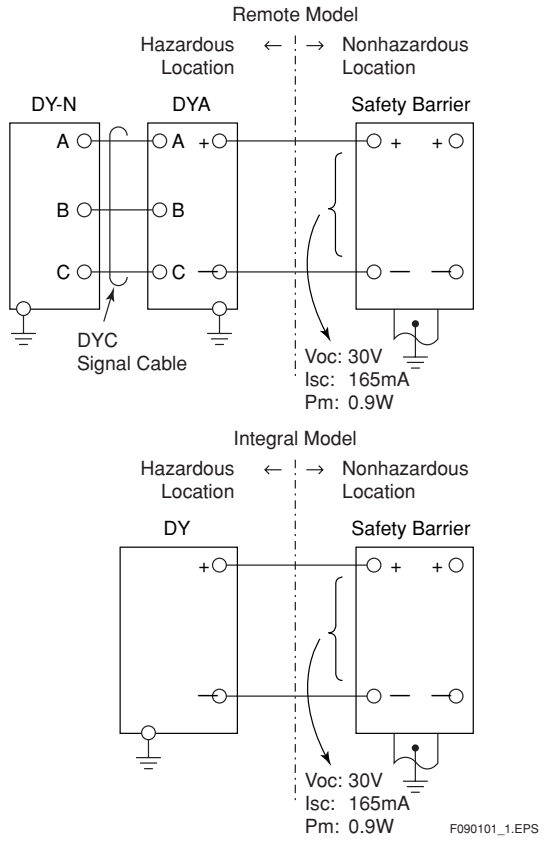
9.1.4 Maintenance and Repair

WARNING

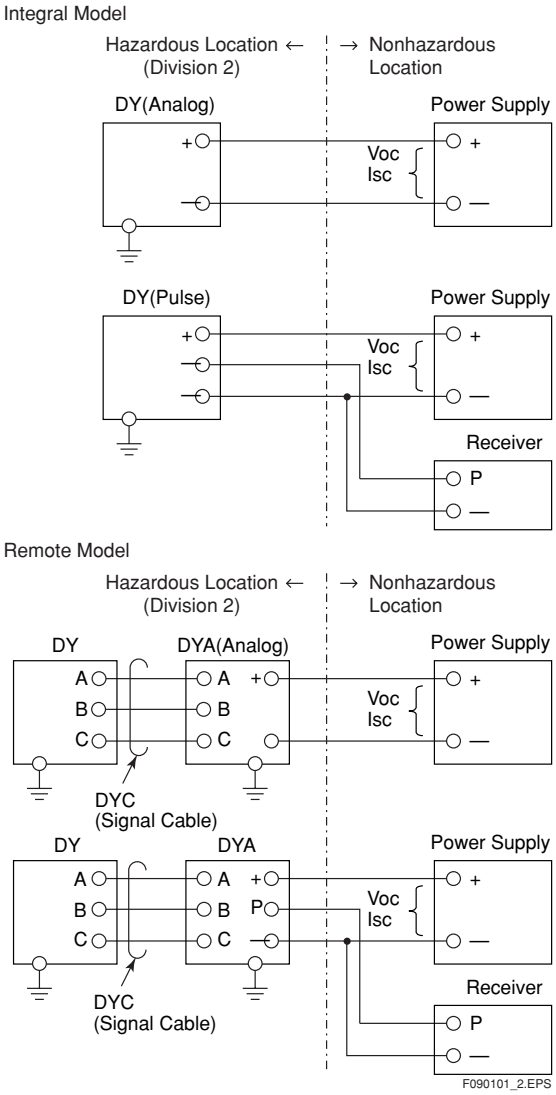
- The instrument modification or part replacements by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void the approval of Factory Mutual Research Corporation.

9.1.5 Installation Diagram

Intrinsically safe (and Note)



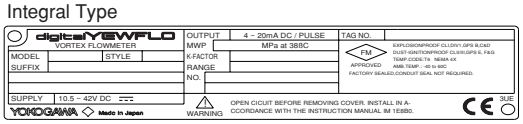
Nonincentive (and Note)



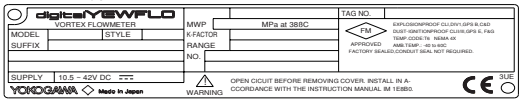
9.1.6 Data Plate

Explosion Proof

Integral Type

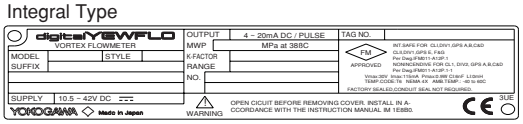


Remote Type

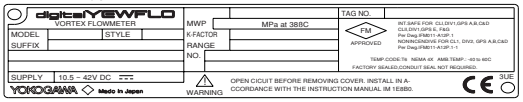


Intrinsically safe

Integral Type



Remote Type



F090102.EPS

9.2 CENELEC (ATEX directive)

9.2.1 Technical Data

Flame proof

Type of protection: EEx d IIC T6…T1

Ambient Temperature:-40°C to 60°C

Temperature Class:T6,T5,T4,T3,T2,T1

Process Temp.;T6;85°C, T5;100°C, T4;135°C, T3; 200°C, T2;300°C , T1;450°C

Electrical Connection:ANSI 1/2 NPT female, ISO M20×1.5 female

Intrinsically safe

Type of protection: EEx ia IIC T4…T1

Temperature Class:T4,T3,T2,T1

Process Temp.; T4;135°C, T3; 200°C,T2;300°C , T1;450°C

Amb. Temp(Integral type and Remote type convertor) ;-40°C to 60°C

Amb. Temp(Remote type detector); -40°C to 85°C

For connection to certified Intrinsically Safe circuit with

Ui = 30V DC

Ii = 165mA

Ci = 6nF

Li = 0.15mH

Electrical Connection:ANSI 1/2 NPT female, ISO M20×1.5 female

79-15: 1987, Electrical apparatus with IEC type of protection “n”

Ex nA IIC T4…T1

Temperature Class:T4,T3,T2,T1

Process Temp.; T4;135°C, T3; 200°C,T2;300°C , T1;450°C

Amb. Temp(Integral type and Remote type convertor) ;-40°C to 60°C

Amb. Temp(Remote type detector); -40°C to 85°C

U = 42V (Analog)/30V (Pulse)

Electrical Connection:ANSI 1/2 NPT female, ISO M20×1.5 female

9.2.2 Installation

WARNING

- All wiring shall comply with local installation requirements and local electrical code.
- Suitable heat-resisting cables shall be used for the YEWFLO Model DY Series Vortex Flowmeter when the ambient temperature exceeds +70°C and/or the process temperature exceeds 135°C.
- The cable entry devices shall be certified in type of protection flame proof enclosure “d” and suitable for the conditions of use and correctly installed.
- Unused apertures shall be closed with certified blanking elements in type of protection flame proof enclose “d”.

9.2.3 Operation

WARNING

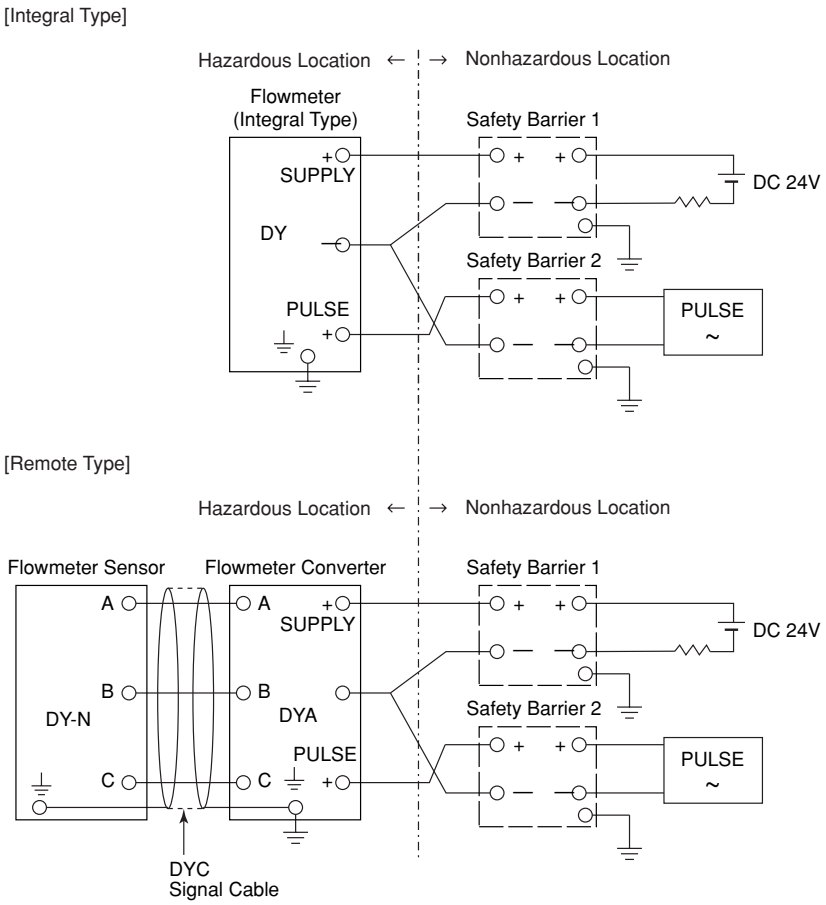
- Wait 10 min. after power is turned off, before opening the covers.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

9.2.4 Maintenance and Repair

WARNING

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void the certification.

9.2.5 Installation Diagram Intrinsically Safe (and Note)

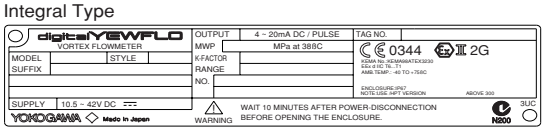


Note: In any safety barrier used output current must be limited by a resistor R such that Io=Uo/R.

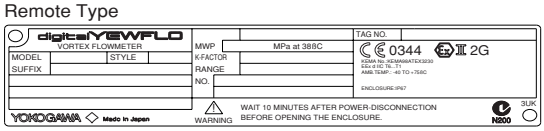
F090201.EPS

9.2.6 Data Plate

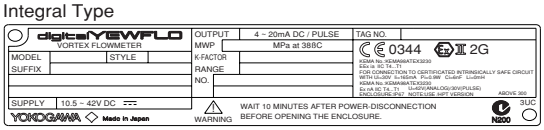
Explosion Proof
Integral Type



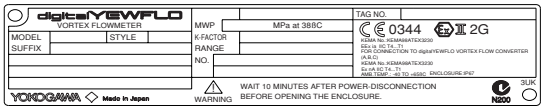
Remote Type



Intrinsically safe
Integral Type



Remote Type



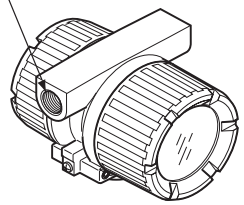
F090202.EPS

IMPORTANT

- In hazardous location, BT200 BRAIN Terminal can not be connected to the digitalYEWFLO which is approved by CENELEC (KEMA) Intrinsically Safe. (See the IM 1C0A11-01E).

9.2.7 Screw Marking

SCREW SIZE	MARKING
M20 X 1.5	M
1/2-14NPT	N



F090203.EPS

9.3 SAA

WARNING

Only trained persons use this instrument in industrial locations.

9.3.1 Technical Data

Flameproof

Exd IIC T6....T1, IP67, Class I, Zone I.

Ambient Temperature : -40 to +60°C
Max. Process Temp. : T6; 85°C, T5; 100°C, T4: 135°C, T3; 200°C, T2; 300°C, T1; 450°C
Electrical Connection : ANSI 1/2 NPT female, ISO M20×1.5 female

Intrinsically Safe

Type of Protection Ex ia IIC T4...T1, IP67, Class I, Zone 0.
Vmax = 30V DC
Imax = 165mA
Pmax = 0.9W
Ci = 6nF
Li = 0.15mH
Ex n IIC T4...T1, IP67, Class I, Zone 2.
Ui = 30V

Ambient Temperature (Integral Type and Remote Type Converter) : -40 to +60°C
Ambient Temperature (Remote Type Detector): -40 to +85°C
Electrical Connection : ANSI 1/2 NPT female, ISO M20×1.5 female

9.3.2 Installation

WARNING

- All wiring shall comply with local installation requirements and local electrical code.
- In hazardous locations, the cable entry devices shall be certified flame proof type, suitable for the conditions of use and correctly installed.
- Unused apertures shall be closed with suitable flameproof certified blanking elements.

9.3.3 Operation

WARNING

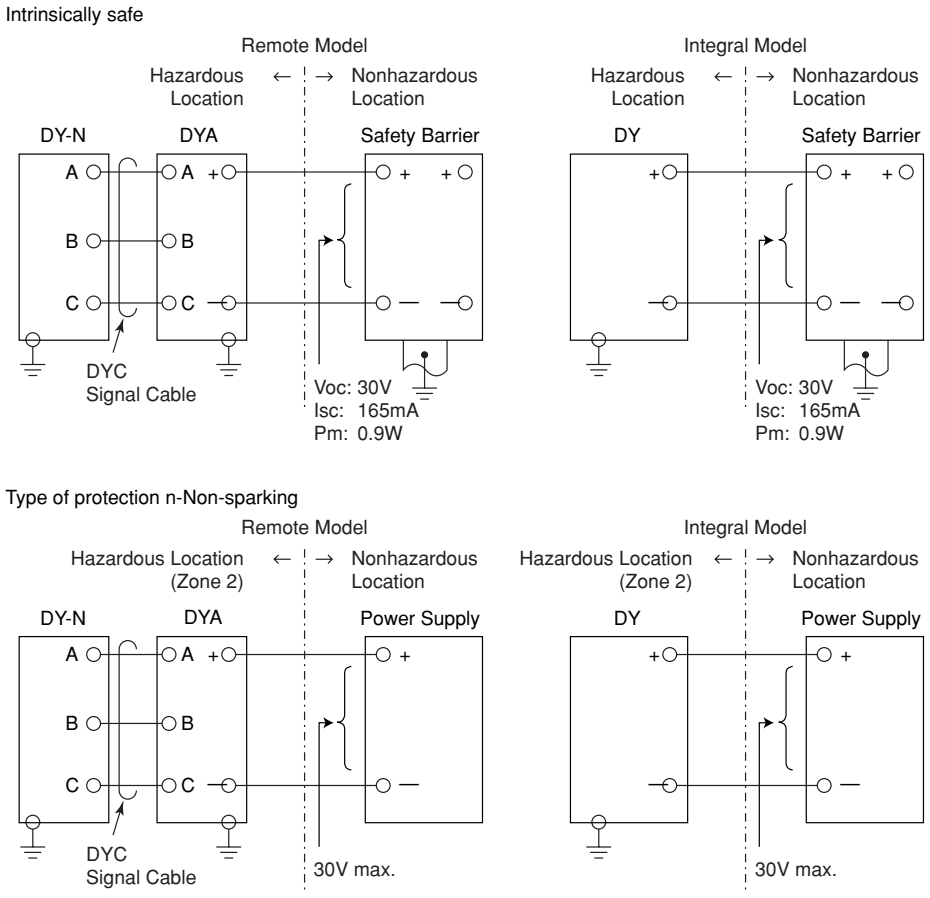
- Open circuit before opening the covers.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

9.3.4 Maintenance and Repair

WARNING

- The instrument modification or parts replacements by other than authorized representative of Yokogawa Electric Corporation are prohibited and will void the certification.

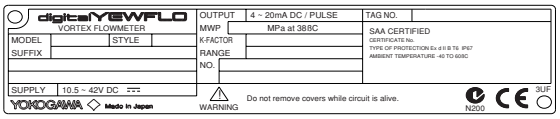
9.3.5 Installation Diagram



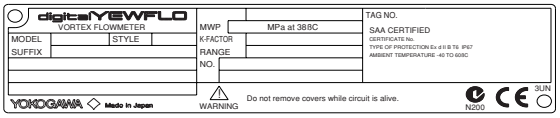
F090301.EPS

9.3.6 Data Plate

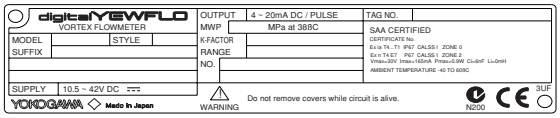
Flame Proof
Integral Type



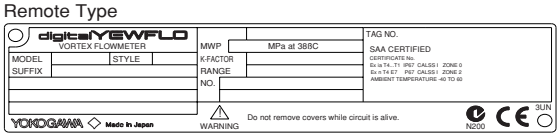
Remote Type



Intrinsically safe
Integral Type



Remote Type



F090302.EPS

9.4 CSA

9.4.1 Technical Data

Explosion proof for Class I, Division 1, B, C and D Dust-ignition proof for Class II/III, Division 1, Groups E, F and G.

"FACTORY SEALED, CONDUIT SEAL NOT REQUIRED."

Enclosure Rating: Type 4X Ambient Temperature –40 to 60°C

Temperature Code	Ambient Temperature	Process Temperature
T6	60°C	85°C
T5	60°C	100°C
T4	60°C	135°C
T3	60°C	200°C
T2	60°C	300°C
T1	60°C	450°C

T090401_1.EPS

Intrinsically safe for Class I, II, III, Division 1, Groups A, B, C, D, E, F and G

Nonincentive for Class I, II, Division 2, Groups A, B, C, D, E, F and G, Class III, Division 1

Enclosure: "Type 4X",

Temperature Class T4...T1

Amb. Temp. (Integral Type and Remote Type Converter): -40 to +60°C

Amb. Temp. (Remote Type Detector): -40 to +85°C

Max. process temp.: T4; 135°C, T3; 200°C, T2; 300°C, T1; 450°C

Vmax=30V, Imax=165mA, Pmax = 0.9W, Ci=6nF, Li=0.15mH

Electrical connection: ANSI 1/2 NPT female

Temperature Class	Ambient Temperature	Process Temperature
T4	60°C	≦135°C
T3	60°C	≦200°C
T2	60°C	≦300°C
T1	60°C	≦450°C

T090401_2.EPS

9.4.2 Wiring

WARNING

- All wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.
- In Hazardous locations, wiring shall be in conduit as shown in the figure.
- A SEAL SHALL BE INSTALLED WITHIN 50cm OF THE ENCLOSURE.
- When the equipment is installed in Division 2, "FACTORY SEALED, CONDUIT SEAL NOT REQUIRED".

9.4.3 Operation

WARNING

- Note a warning label worded as follows.
  Warning: OPEN CIRCUIT BEFORE REMOVING COVER.
- Take care not to generate mechanical spark when access to the instrument and peripheral devices in hazardous locations.

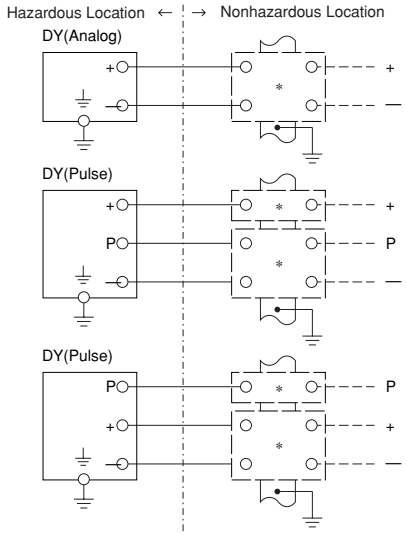
9.4.4 Maintenance and Repair

WARNING

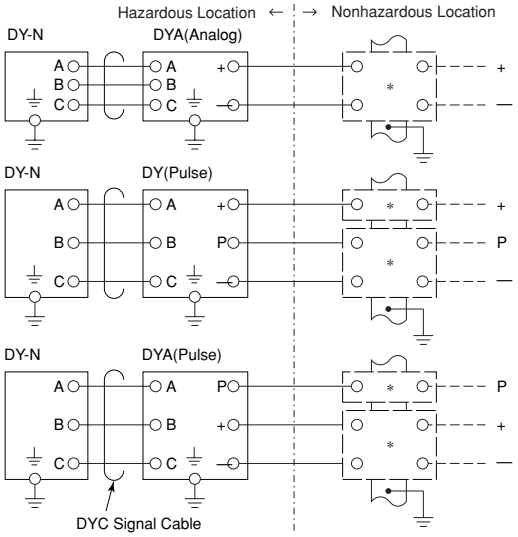
- The instrument modification or part replacements by other than authorized representatives of Yokogawa Electric Corporation are prohibited and will void CSA Certification.

9.4.5 Installation Diagram

[Integral Type]



[Remote Type]



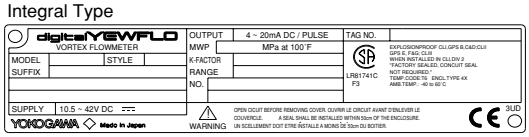
*: CSA Certified barrier with parameters of 28V/300ohms.

F090401.EPS

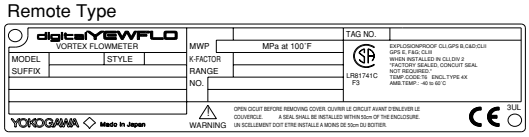
9.4.6 Data Plate

Explosion Proof

Integral Type

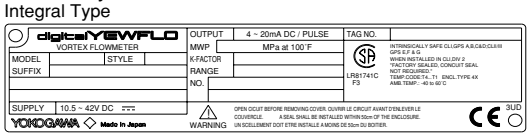


Remote Type

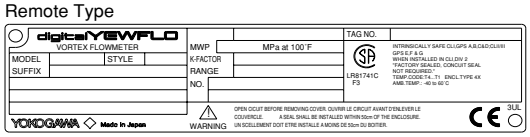


Intrinsically safe

Integral Type



Remote Type



F090402.EPS

9.5 EMC Standards

■ EMC Conformity Standards

- EN61326
- AS/NZS 2064: 1997

Note:

For remove converter type, the signal cable should be used with the metal conduit.