



**Liquid Vortex Flow Meter
with Temperature Correction**

FML300-N SERIES

INSTRUCTION MANUAL

KOFLOC Corp.

Please read this manual thoroughly prior to installing and using the product. This way it is possible to ensure the performance and safety of the product and prevent possible accidents and damage to the product due to incorrect use.

When the product has failed or is considered to require readjustment, please contact our sales office. Our experienced technical staff will give you appropriate advice. Please follow the instructions given.

Please note that if you repair/modify the product yourself, not only serious accidents may occur, but our warranty will become void.

The contents of the manual are subject to change without notice for improvement. Prior to shipment, every care has been taken in preparing this manual not to mention the product itself, but if you notice any imperfections, errors or omission, please contact KOFLOC.

<< Prior to use >> and << Precautions for use >>

Various alert symbols and signal words are used in this manual and attached to the product to ensure correct use of the product and to prevent possible personal injury or loss of life and property damage. The symbols and meanings of the signal words are as follows:



WARNING

Ignoring this symbol and handling the product incorrectly may result in loss of life or serious injury.



CAUTION

Ignoring this symbol and handling the product incorrectly may result in personal injury or damage to property.

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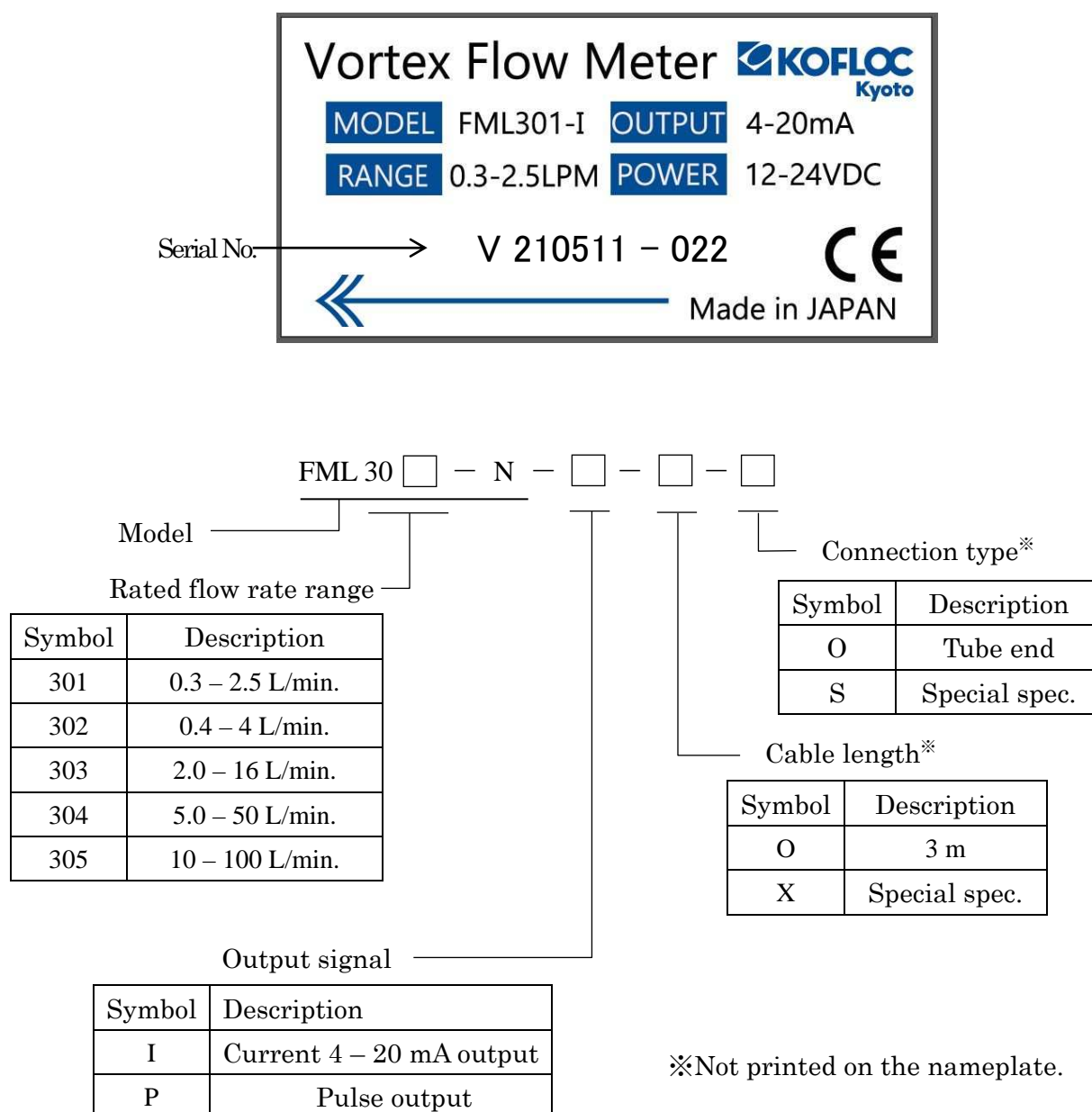
1. Foreword

Thank you for your selection of the liquid vortex flow meter with temperature correction FML300 Series. Prior to using your new equipment, please read this manual thoroughly to ensure it is used in the correct way. Please note that this manual is subject to change without notice.

2. Precautions for Use

◆ Prior to use

Every product ordered by you has been assembled and adjusted according to your specifications. The flow rate range, output spec. and other data are shown on the nameplate on the side face of the case. Please make sure they meet your ordered specifications.



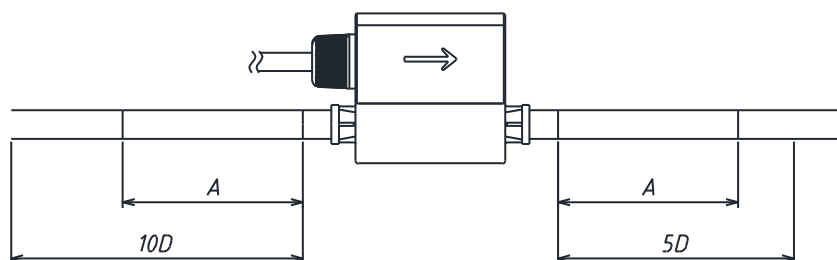
◆Handling

- (1) Use the meter with measuring tube filled with fluid to measure.
- (2) Do not apply a water pressure exceeding the proof pressure nor wash with counter flow. Such action may damage the sensor and cause troubles.
- (3) Do not use the meter in a place under direct sunlight, or hot/humid place.
- (4) Note that if fluid to measure inside the tube freezes, the sensor may be damaged. If there is a possibility of freezing, provide heat insulation measures.
- (5) FML300 Series is made of resin including the thread part. When installing it, be careful not to apply an unnecessarily strong force.
- (6) Do not hold the output cable when moving the meter. Such action may break the meter.
- (7) Do not conduct insulation resistance/withstand voltage tests. Such tests may damage the meter.
- (8) To maintain the accuracy, warm up the meter (about 10 minutes after power on).

◆Installation and piping

Take the following precautions to use the product safely and accurately over a long period of time:

- (1) Fluid to measure is liquid. Use industrial water equivalent to pure water/tap water.
- (2) Do not use the meter in a place under direct sunlight, or hot/humid place.
- (3) Install the meter in a place free of corrosive gases.
- (4) This product is of splash-proof structure, but avoid rain and water.
- (5) Install the meter in a place free of vibration and impact.
- (6) When laying piping, do not hold the cover, but hold down the body part.
- (7) The meter may be installed in any posture. Match the direction of flow with the arrow shown on the side of the main unit.
- (8) To eliminate influence of turbulence and pulsating current, provide straight pipe as long as possible. The recommended dimensions of straight pipe are as shown below.



(Unit: mm)

Model	FML301	FML302	FML303	FML304	FML305
D (ID of tube)	6.35	6.35	9.50	15.88	22.20
A (product tube length)	60.0	60.0	60.0	60.0	50.0
IN side required straight pipe length: 10D	63.5	63.5	95.0	158.8	222.0
OUT side required straight pipe length: 5D	31.8	31.8	47.5	79.4	111.0

**CAUTION**

When washing the tube of the product, be careful not to damage the inside. Scratches are a cause of deterioration of accuracy.

**WARNING**

Make sure that the connections of piping are not leaking. Using unsafe liquid without such check may possibly result in serious accidents.

◆Storage of the product

When the product is received, store it as described below until it is put in use:

- (1) Store the product in the package in which it was received from KOFLOC.
- (2) Store the product in a place free of rain and water.
- (3) Store the product in a place free of vibration and impact.
- (4) Store the product in a place of normal temperature and normal humidity (25°C, 65%RH).
- (5) Store the product in a place free of dust and corrosive gases.
- (6) Store the product free of a strong electric/magnetic field.

To store the product that has been used and has remaining measuring fluid in the tube, wash it out completely before storing the product.

**CAUTION**

When disposing of the product, follow the local ordinance.

3. Overview of the Product

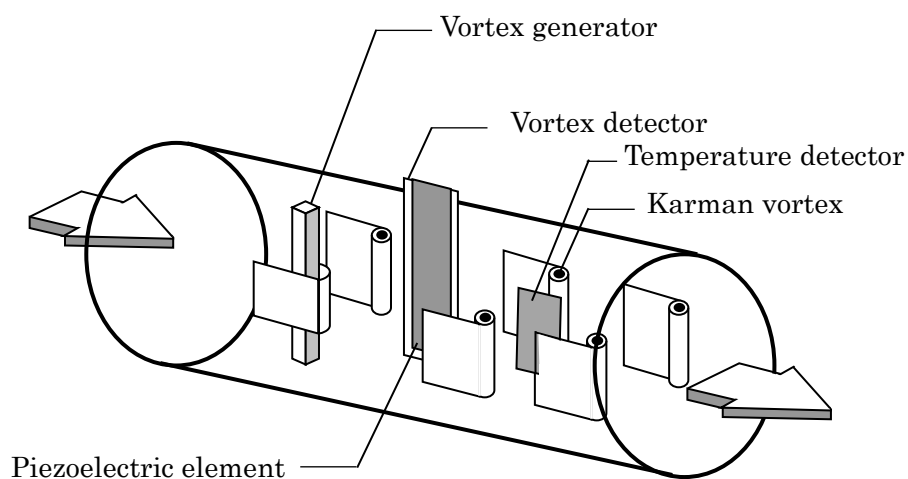
The liquid vortex flow meter with temperature correction FML300 Series is a device that measures the velocity (vortex) of liquid (water) that flows in the tube and detects a vortex frequency proportional to the velocity and then outputs appropriate values via a processing circuit.

The flow passage of the product is made of New PFA to realize high mechanical strength and chemical resistance.

Also, a simple structure with little liquid accumulation realizes a maintenance free feature requiring no periodical maintenance and inspection.

Furthermore, fluid temperature correction by means of a built-in temperature sensor enables highly accurate flow rate measurement in a wide range of fluid temperature.

Measurement principle



4. Product Specifications

Series	FML				
Model	301-N	302-N	303-N	304-N	305-N
Fluid	Pure water and chemicals				
Connection (inch)	I.D. 1/4” O.D. 3/8”	I.D. 1/4” O.D. 3/8”	I.D. 3/8” O.D. 1/2”	I.D. 5/8” O.D. 3/4”	I.D. 7/8” O.D. 1”
Max. operating pressure @25℃	1MPa			0.75MPa	0.65MPa
Material in contact with liquid	New PFA				
Flow rate range	0.3to2.5L/min	0.4to4.0L/min	2.0to16L/min	5.0to50L/min	10to100L/min
Full scale (F.S.)	2.5L/min	4.0L/min	16L/min	50L/min	100L/min
Measuring max. flow rate	110%F.S.				
Flow rate accuracy※1	±2.0%F.S. (Fluid temperature: 15℃ to 60℃)				±3.0%F.S. (Fluid temp.: 15℃ to 60℃)
Reproducibility	±0.5%F.S.				
Flow rate output	—I : Current 4-20mA output (0-100%F.S.), allowable load resistance: 24 VDC input 250 to 500Ω 12 VDC input 250Ω max. —P : Pulse output (1kHz @F.S. Duty:50% NPN open collector output Max.30VDC/80mA)				
Temperature output	1 - 5 VDC (0 - 100℃) External load resistance: 250kΩ or over ※3				
Temperature accuracy	±2℃ ±0.15×ΔT℃ ΔT : ambient temp. – fluid temp.				
Fluid temperature	0 to 90℃ (no freezing, no boiling)				
Ambient temperature	0 to 50℃ (no freezing)				
Ambient humidity	95%RH max.				
Storage temperature	-10 to 70℃ (no freezing)				
Power supply voltage	12 to 24VDC ±10% Current consumption 80mA max.				
Cover material	PPS (Color: black)				
Protection structure	Equivalent to IP65 (Drip-proof & dust-proof spec.)				
Cable	4-pair (8-core) shielded wire, length 3m, finished OD 5.0mm Conductor: Tin plated annealed stranded wire AWG26(30/0.08TA) Insulator: Lead-free heat resistant semirigid vinyl chloride mixture Insulator OD 0.79mm Sheath: Lead-free heat resistant vinyl chloride mixture Black (Matted)				
Applicable standard	RoHS2 10 Substance、CE				
Weight (cable included)	Approx. 197g	Approx. 197g	Approx. 202g	Approx. 212g	Approx. 237g

※1 Accuracy at ambient temperature 25°C.

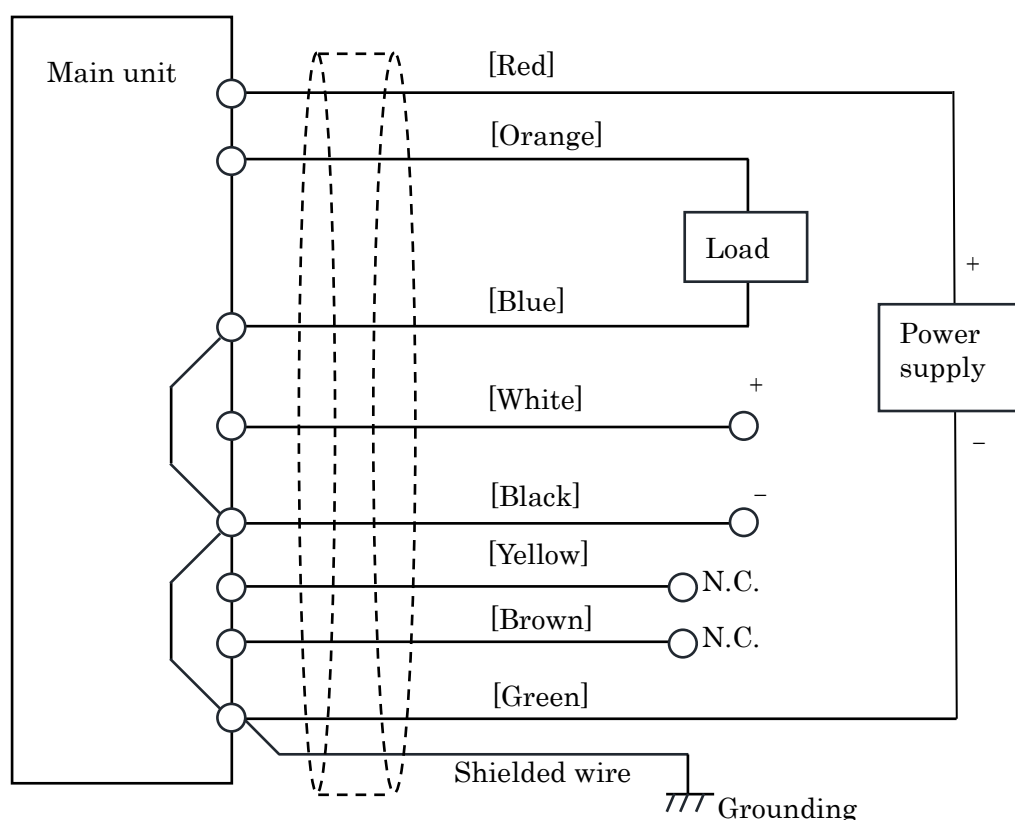
※2 The output becomes valid only when liquid is let flow.

5. Connection Specifications

◆FML30□-N-I: Current 4 – 20 mA output specifications

Wire Color	IN/OUT	Signal Name	Description	Remarks
Red	IN	VIN	12V, 24V power supply	12VDC, 24VDC $\pm 10\%$ (Current consumption: 80mA max.)
Green		GND	0V power supply	
Orange	OUT	VOUT	Flow rate output	4-20mA output (0L/min.-F.S.L/min.) Allowable load resistance: 24VDC input 250 – 500 Ω 12VDC input 250 Ω max.
Blue		GND		
White	OUT	TOUT	Temperature output	1-5VDC output (0°C – 100°C) (External load resistance 250k Ω min.)
Black		GND		
Yellow		N.C.	Not used	Provide insulation treatment or connect nothing.
Brown				
FG	—	Shield	Shielded wire	Connect to frame ground (FG).

Connection diagram

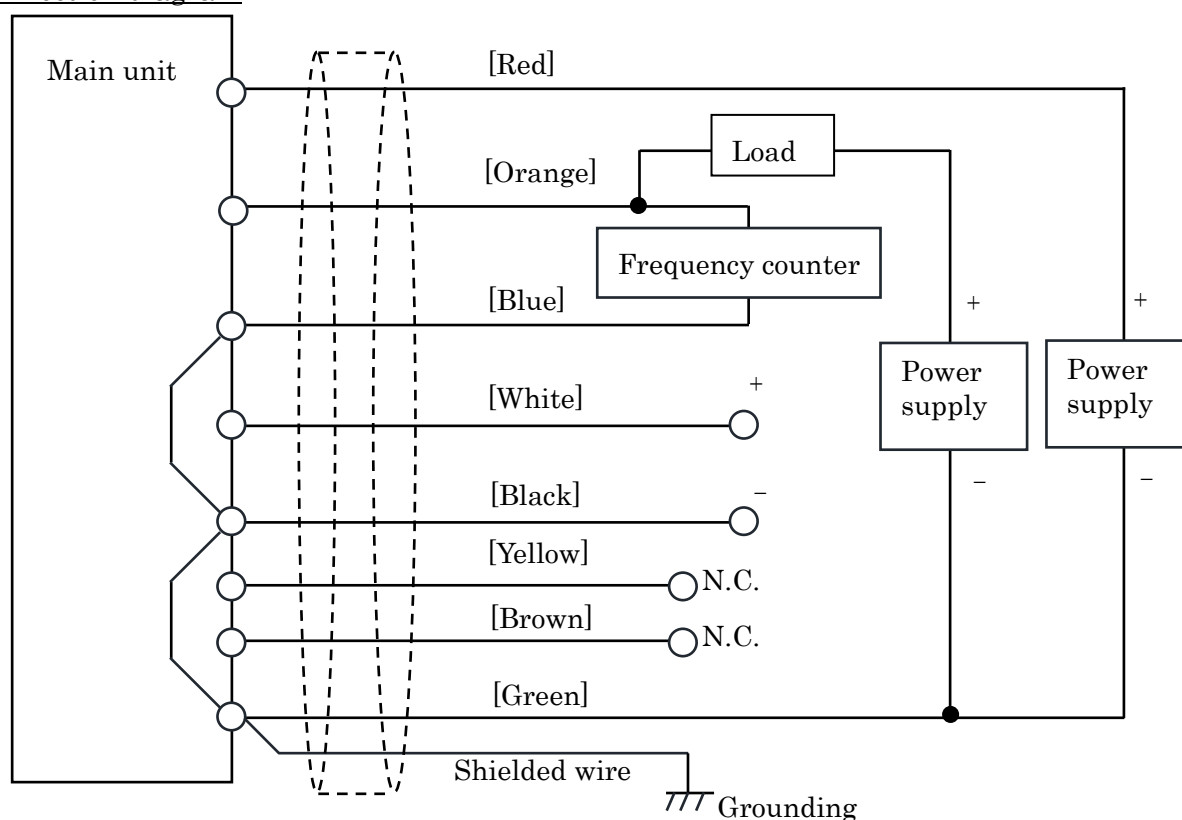


※GND has been connected inside the product.

※The shielded wire has been connected to GND inside the product.

◆FML30□-N-P: Pulse output specifications

Wire Color	IN/OUT	Signal Name	Description	Remarks
Red	IN	VIN	12V, 24V power supply	12VDC, 24VDC $\pm 10\%$ (Current consumption: 80mA max.)
Green		GND	0V power supply	
Orange	OUT	VOUT	Flow rate output	Pulse output, 1kHz @F.S., Duty 50% NPN open collector output Max. 30VDC /80mA
Blue		GND		
White	OUT	TOUT	Temperature output	1-5VDC output (0°C-100°C) (External load resistance 250k Ω min.)
Black		GND		
Yellow		N.C.	Not used	Provide insulation treatment or connect nothing.
Brown				
FG	—	Shield	Shielded wire	Connect to frame ground (FG).

Connection diagram

※GND has been connected inside the product.

※The shielded wire has been connected to GND inside the product.

**WARNING**

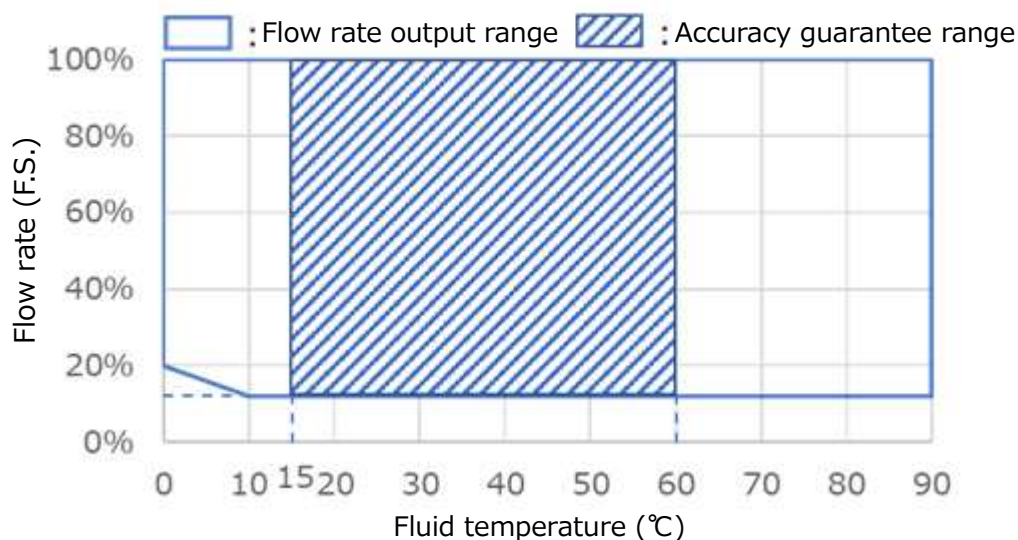
Prior to tuning on the power, make sure that wiring has been laid correctly.

Incorrect wiring is a cause of breakage, malfunction or fire.

6. Range of Use

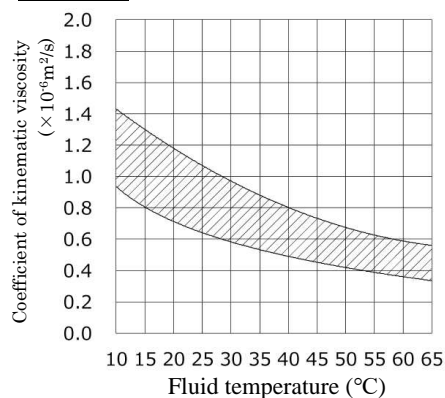
- ◆ The relation between the flow rate output range and the accuracy guarantee range is as shown below. Check to see if it matches the conditions of use again.

FML30X Series Flow Rate Output Range and Accuracy Guarantee Range

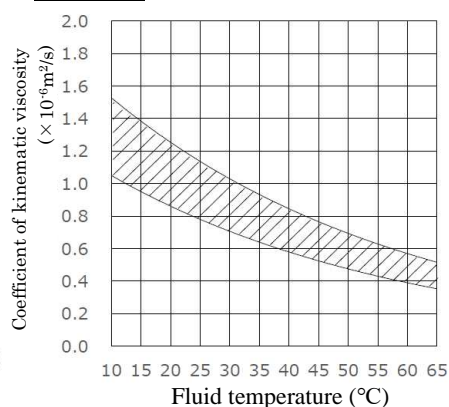


- ◆ The coefficients of kinematic viscosity to guarantee the accuracy are as shown below. Check to see if they match the conditions of use again.

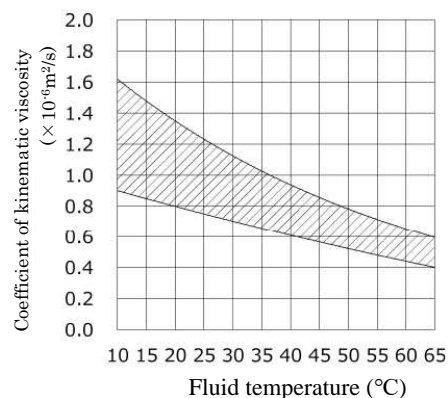
FML301



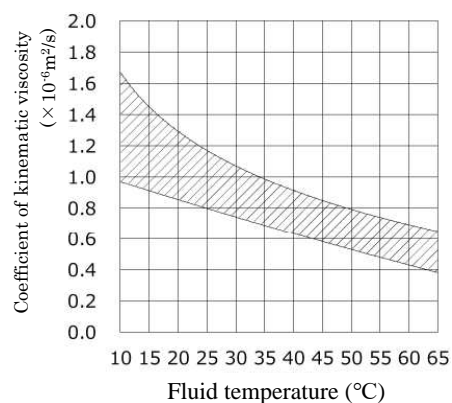
FML302



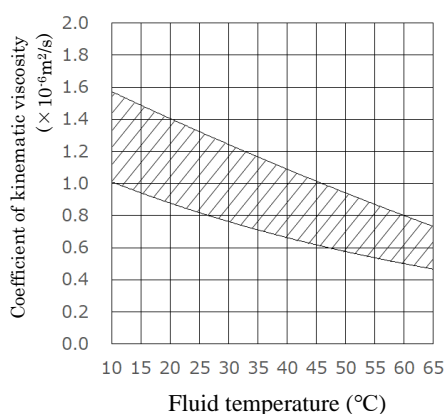
FML303



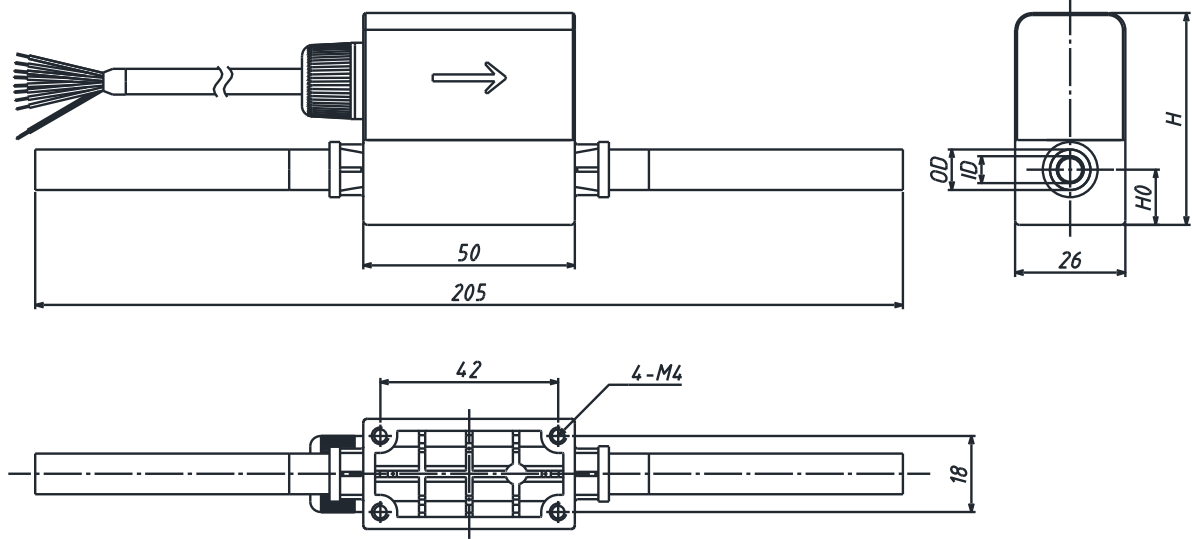
FML304



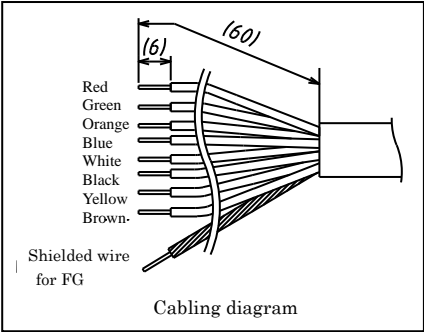
FML305



7. External View



Model	Connection tube size (OD)	Dimensions (mm)			
		O.D.	I.D.	H	H0
FML301-N	3/8 inch	9.52	6.35	50.0	13.0
FML302-N	3/8 inch	9.52	6.35	50.0	13.0
FML303-N	1/2 inch	12.70	9.52	50.0	13.0
FML304-N	3/4 inch	19.05	15.87	52.0	12.0
FML305-N	1 inch	25.40	20.20	60.7	15.7



8. Product Warranty

◆Contents of warranty

(1) Warranty period

The warranty period shall be one (1) year after the shipment from KOFLOC.

(2) Warranty scope

If the product fails during the warranty period due to reasons attributable to KOFLOC, we shall provide a substitute or repair the failed product free of charge in our factory. Please note that the warranty scope is limited to the product itself and KOFLOC shall not be held responsible whatsoever for customer's damage that may arise from failure of the KOFLOC product regardless of the magnitude of such damage

(3) Out of warranty

Even if the product fails during the warranty period, failures due to the following reasons are not covered by this warranty:

- a) Failures due to incorrect use or unauthorized repair or modification. (Failures due to difference between the manufacturing specifications and the conditions of use are also included.)
- b) Failures due to dropping or other mishandling of the product after purchase.
- c) Failures due to fire or natural disasters such as earthquake, flood damage and lightning strike or failures caused by riot/war.
- d) Failures due to intrusion of foreign matter inside the piping.
- e) Failures due to problems specific to combination with built-in equipment.
- f) Failures due to causes that are considered to be outside of KOFLOC responsibility.
- g) Damages that could have been avoided if the user's machinery for which KOFLOC product was used had been equipped with the functions, structure and safety measures that are commonly provided in the industry.

KOFLOC Corp.

URL : <http://www.kofloc.co.jp>