ONO SOKKI

FP-4135

ON-BOARD VOLUMETRIC FLOW DETECTOR

Instruction Manual

ONO SOKKI CO., LTD.

ONO SOKKI

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■ WARRANTY ■

1. This product is covered by a warranty for a period of one year from the date of purchase.
2. This warranty covers free-of-charge repair for defects judged to be the responsibility of the manufacturer, i.e., defects occurred while the product is used under normal operating conditions according to descriptions in this manual and notices on the unit label.
3. For free-of-charge repair, contact either your sales representative or our sales office nearby.
4. The following failures will be handled on a fee basis even during the warranty period.
   (a) Failures occurring through misuse, mis-operation, or modification
   (b) Failures occurring through mishandling (dropping) or transportation
   (c) Failures occurring through natural calamities (fires, earthquakes, flooding, and lightening), environmental disruption, or abnormal voltage.

＊ For repairs after the warranty period expired, contact your sales representative or our sales office nearby.

＊ Outer appearance and specifications are subject to change without prior notice.

Introduction

This manual describes the installation, mounting, piping, specifications and precautions during the use of the FP-4135 On-Board Volumetric Flow Detector.

If you are using the FP-4135 On-Board Volumetric Flow Detector for the first time, read this manual before you start installing, piping or measuring.

Especially, some items described under “Precautions” in this manual might cause property damage. Be sure to follow the instructions in this manual.

Also, if you are using the FP-4135 On-Board Volumetric Flow Detector in combination with the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter/Data Recorder, then you should read the manuals for each of those equipment also.

Keep this manual in a safe place even after you finish reading because this document also serves as a warranty.

CAUTION

- The FP-4135 On-Board Volumetric Flow Detector went through stringent inspections before delivery and it has been verified that it operates normally.
  After unpacking the product, please check for damage during transfer. Next, check the basic operations by referring to this manual.
- If any of the items are damaged or does not operate as described in this manual, immediately contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

● How to use this manual

Throughout this manual, the following symbols are used in addition to the safety and caution symbols. Before reading this document, be sure to check the meanings of these symbols.

CAUTION	Indicates information about supplementary explanation or restrictions. We recommend reading the information followed by this symbol.
IMPORTANT	Indicates important safety instructions that need to be observed. Be sure to read the instructions followed by this symbol.

IMPORTANT

- The contents of this manual are subject to change without notice.
- No part of the contents of this document may be reprinted or reproduced without authorization.
- While the contents of this document have been prepared in our best efforts for perfection, should there be any unclear point, error, or any other questionable point, please advise us of them.
- Please be advised that we should not be responsible for results of your operation, regardless of the preceding paragraph.
- All corporate names and product names used herein are either trade names or registered trade names of their respective holders.

For Your Safety

- Please read this manual before using the FP-4135 On-Board Volumetric Flow Detector.
- The FP-4135 On-Board Volumetric Flow Detector must be used by following the described contents in this manual.
- Precautions might be also described on the FP-4135 On-Board Volumetric Flow Detector unit itself or detailed in other attached user manuals. Use while following the contents of those manuals too.
- Keep this manual in a safe place where it is readily available for future reference.
- Note that this manual merely covers the information at the time of publication. The contact information (e.g., company address, phone number, website URL, and e-main address) may be changed without prior notice. Thank you for your understanding.

● Meaning of notations

In this manual, matters regarding the safe usage of the product is detailed in the following.

Each signal word indicates the degree of hazard caused by negligence of the suggested instructions or precautions.

WARNING	Indicates a hazardous situation that, if not avoided, will result in death or serious injury.
CAUTION	Indicates a hazardous situation that, if not avoided, may result in minor injury or property damage.
NOTICE	Indicates hazardous situation, if not avoided, may result in property damage including failure of the equipment, system, or facility, though not result in personal injury.

● Meanings of symbols

Information on operational hazard are given by using the 3 different symbols shown below. The following meanings are defined for each symbol:

Symbol	Definition	Meaning	Example
	Attention	Indicates failure to observe the instructions may cause a hazardous situation. The drawing in the symbol indicates the type of hazard involved.	
	Prohibition	Indicates the actions you must avoid. The drawing in the symbol illustrates the actions you must avoid.	
	Mandatory	Indicates the things you have to do. The drawing in the symbol illustrates the thing you have to do. To avoid hazards, it is necessary to perform the instruction given in this symbol.	

■ Warning regarding use

WARNING

Always conduct measurements under the hazardous materials officers' supervision.

- This equipment measures highly hazardous materials such as gasoline and light oil. Always conduct measurements under the hazardous materials officers' supervision.

Be careful of sources of fire.

- As this equipment measures highly hazardous materials such as gasoline and light oil, be careful of sources of fire. Always conduct measurements under the hazardous materials officers' supervision.

Make sure that detector is not contained in a closed space.

- If the detector is filled with liquid and is in a sealed condition with the outlet/inlet valve closed, the internal pressure might rise due to a rise in temperature, causing a fire from the leaked liquid.
- Make sure the liquid does not create a sealed condition by taking measures such as making an air layer inside the piping.

Never let the liquid inside the detector evaporate.

- The evaporated liquid is highly inflammable and may cause an explosion or fire. Never let the liquid inside the detector evaporate.
- The FP-4135 is designed to use the liquid to be measured as a lubricant for each operating part and if this liquid evaporates (gasifies), there will be not enough lubrication resulting in incorrect measurements.

Use this equipment within the operating temperature range designated in the specifications.

- The environment/liquid operating temperature range for the flow detector part of the FP-4135 is -30 to +100°C (non-freezing) and -30 to +70°C for the signal processing unit.
- Avoid measurement in abnormally high temperature as it might cause a fire or explosion.

Do not pour any other liquid other than those given in the specifications.

- The FP-4135 can measure the following liquids only. If you pour any other liquid other than those specified, it might cause corrosion or damage to the detector's internal parts and may cause injury to personnel.
  For details, contact the nearest Ono Sokki sales office or the distributor where you purchased the product.
  Gasoline, light oil, kerosene, petroleum-based general hydraulic oil, class-A heavy oil, engine oil, methanol, ethanol, mixture of alcohol and gasoline and brake oil.
- This equipment might not be usable when in a depositing condition.

Avoid applying any vibration or impact.

- FP-4135 is a high precision equipment. Do not use or store it where any vibrations exist.
- Do not drop or handle it in a way which causes a strong impact on the equipment. Otherwise, it will cause failure or malfunction of the equipment which may lead to injury.

■ Warning regarding installation

WARNING

Warning about line filter

- Do not use any other line filters than the one built into the detector. It might cause liquid leak which may cause fire or explosion.
- The built-in filter in the detector is designed to remove large debris in the piping connection, so use other line filters upstream of the liquid inlet of the detector.

To mount the detector, use the mounting screws of the detector or screws included in the product only.

- The detector may tilt, or the equipment may fail or malfunction due to vibration, which may lead to personal injury. To mount the detector, use the mounting screws on the detector or fixtures included in the product only.
- If you have to use any other screws, contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

The engine right after it is stopped is at a very high temperature. Before installing or removing the detector, make sure that the engine is cooled off.

- Otherwise, it might cause burns.

■ Warning about piping

WARNING

Make sure the power is disconnected (OFF) before starting piping.

- Make sure the power of the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter are turned OFF.
- To switch the power on/off, use the power switch on the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter after connecting the FP-4135 to the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter with the flow signal cable.

Flush the detector before piping.

- The FP-4135 is delivered filled with oil to make sure internal parts are fully lubricated. Start measurement after flushing thoroughly by pouring measurement liquid to within the specified flow rate of the detector.

Do not use air for flushing.

- If flushed with plant air or other air, it might cause over speeding of the detector leading to a failure. Do not flush with any other liquid other than the ones specified.

When flushing, do not exceed the flow rate beyond the measurement range.

- Including during measurement, if you pour more liquid than the measurement range, it might cause a failure.
- Special care should be taken when excess air exists in the piping such as when you pour liquid into the piping for the first time as an excess flow rate can occur. Increase the flow rate gradually from zero.

Be careful not to cut yourself on the screws or couplings in the detector's inlet/outlet.

- Wear a pair of gloves to prevent cutting your fingers or hands when you mount the couplings to change the joints.

When measurement liquid leaks from the piping, it might cause a fire or explosion.

- Remember to check the couplings or pipings for any leaks or looseness before pouring liquid.

■ Precautions on installation

WARNING

Handle the equipment as a precision equipment.

- FP-4135 is a high precision equipment. Install it in a place within the operating temperature range (-30 to +100°C) with no large temperature fluctuations or vibrations.

Install it at a lower position than the liquid tank.

- To gain supply pressure to the detector by height difference, install the detector at a lower position than the liquid tank to prevent the formation of air pockets and negative pressure.

■ Precautions on piping

CAUTION

Do not confuse the IN and OUT parts of the detector.

- The detector has an inlet (IN) and an outlet (OUT) for the liquid. Recheck the inlet and the outlet when piping.

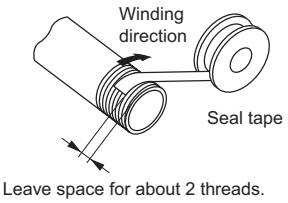
Recommendations on bypass valve installation

- Installing a bypass valve in piping is recommended to maintain the measured system such as an engine, release air pockets out of the piping, or to repair detector malfunctions.

Pay attention to how to wind the seal material.

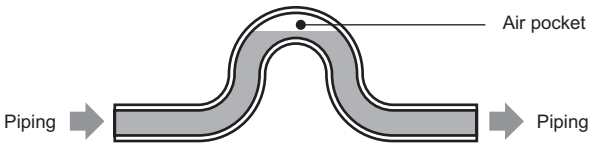
Follow the instructions below to wind a Teflon seal tape on the screws to change the couplings.

- The seal tape should be wound around 2 to 2.5 times on a screw with the last 1 to 2 threads of a screw not tightened.
- When using a liquid seal material, be careful not to leak the liquid material into the piping.



Do not bend piping into the shape of an arch.

- If pipings are bent into an arc shape, air pockets can be form in the top part and become hard to remove.
- If the piping has any air pockets, measurement will be incorrect. Take care.



Fix the piping in front and to the rear of the detector.

- Use the appropriate fixtures on the piping in front and to the rear of the detector to prevent leakage and damage to the connection part of the detector by vibrations.

■ Precautions on Electromagnetic Environment

CAUTION

- This product is intended the equipment to be used in industrial electromagnetic environment.
- Using this product in a household may cause electromagnetic interference. In such a case, users may be required to take appropriate actions.

Table of contents

1. Overview (Structure and Operating Principle)

In this section, the product overview, the flow rate and the operating principle of rotation conversion part of the FP-4135 On-Board Volumetric Flow Detector is detailed.

1.1 Product overview

The FP-4135 On-Board Volumetric Flow Detector is the high-precision positive displacement flow detector to measure the fuel flow rate of liquids such as gasoline, light oil and kerosene combined with the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter.

Because the flow rate range is as wide as 0.1 to 200 L/h (measurement range ratio 2000:1), it can measure, for example the fuel efficiency of an engine from very low flow rate in an idling state to a high-load state when a fuel with a low heating value such as alcohol is used.

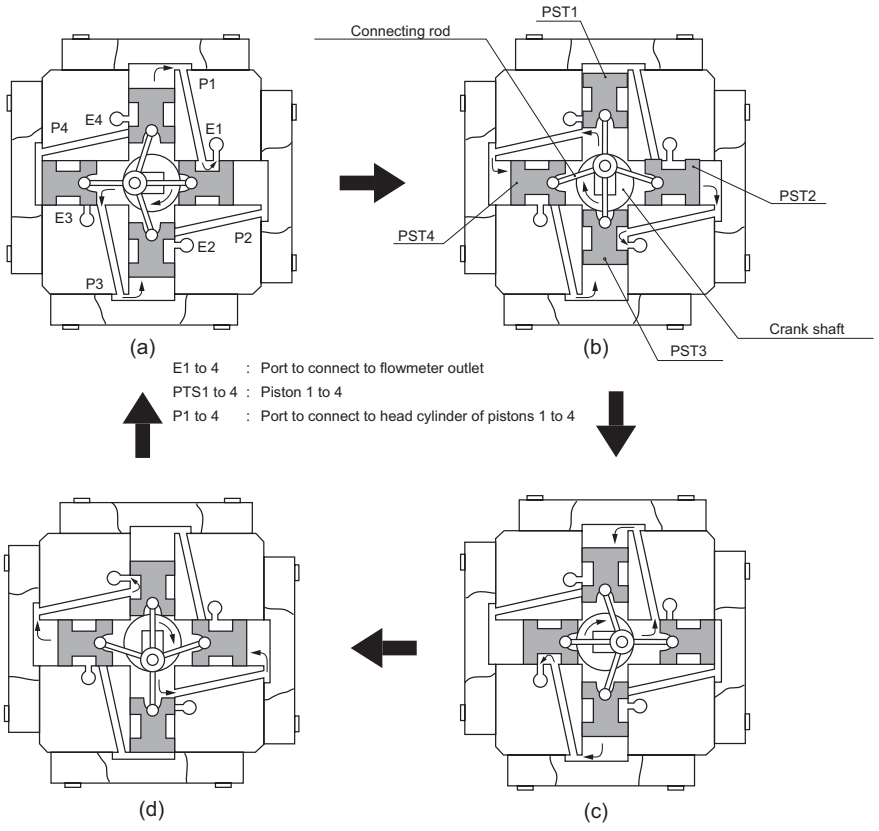
Also, because the flow detecting part is compact and its operating temperature range is -30 to +100°C, it can be installed inside an engine to measure the actual driving fuel efficiency.

1.2 Structure and operating principle

4 pistons are installed in a radial fashion on the flow rate detecting part of the equipment where they repeat a back and forth motion with the liquid flowing in and out of the inlet/outlet. The movement of pistons is converted to a rotating motion by the crank shaft and transfered to the rotation detecting part.

Then, a pulse signal corresponding to movement amount of the pistons is generated by the rotary encoder of the rotation detecting part and the instantaneous value or accumulated flow rate are displayed on the calculated display section of the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter.

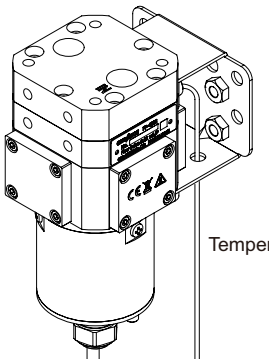
The output pulse signal consists a pair of pulses with different phases so that the rotation direction can be recognized. Because of that, correct measurement is possible regardless of whether the flows are reversed or pulsed.



2. System Configuration

Configure the system according to your intended use and purpose, referring to the table below.

- FP-4135 On-Board Volumetric Flow Detector -
(flow detecting part)



Temperature detector (straight out from cable 2 m)

Connector

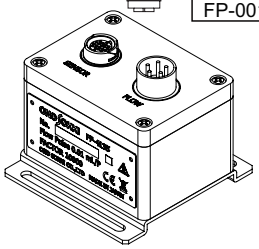
Temperature signal cable

Model name of temperature signal cable	Full length
FP-0025	5 m
FP-0026	10 m
FP-0027	20 m

Flow Detector (straight out from cable 2 m)

Flow Signal Cable

Model name of flow signal cable	Full length
FP-0015	5 m
FP-0016	10 m
FP-0017	20 m



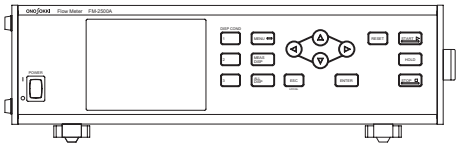
- FP-4135 On-Board Volumetric Flow Detector-
(signal processing part)

- Display Unit -

●DF-2200 On-Board Flow Meter

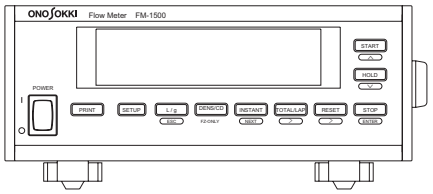
Model name	DF-2200
Measuring item	Instantaneous flow rate/ Accumulated flow rate/ Accumulated time/ Temperature/Pressure*1
Output signal	Analogue pulse/CAN/RS-232C*2

●FM-2500A Digital Flowmeter



Model name	FM-2500A + DF-0400A
Measuring item	Instantaneous flow rate/ Accumulated flow rate/ Accumulated time/ Temperature/Pressure*1
Output signal	Analogue pulse/RS-232C/GP-IB*2

●FM-1500 Digital Flowmeter



Model name	FM-1500 + DF-0400A
Measuring item	Instantaneous flow rate/ Accumulated flow rate/ Accumulated time/ Temperature/Pressure*1
Output signal	Analogue pulse/RS-232C/GP-IB*2

*1: FP-4135 On-Board Volumetric Flow Detector does not come with a pressure sensor. If you need to measure pressure, please contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

*2: It is an optional function.

CAUTION

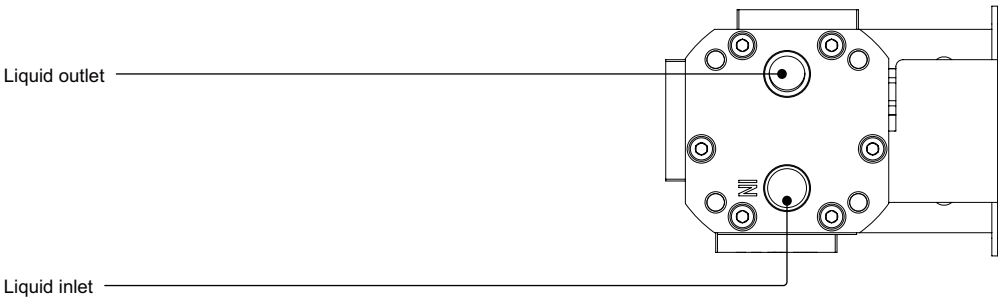
- For some measurement targets, you might need detectors other than the FP-4135 On-Board Volumetric Flow Detector. For details, contact the nearest Ono Sokki sales office or the distributor where you purchased the product.
- The FP-4135 On-Board Volumetric Flow Detector is separated into a flow detecting part and a signal processing part.
- The FM Series Digital Flowmeter requires the detecting module DF-0400A.
- FP-4135 On-Board Volumetric Flow Detector does not come with a pressure sensor. If you need to measure pressure, please contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

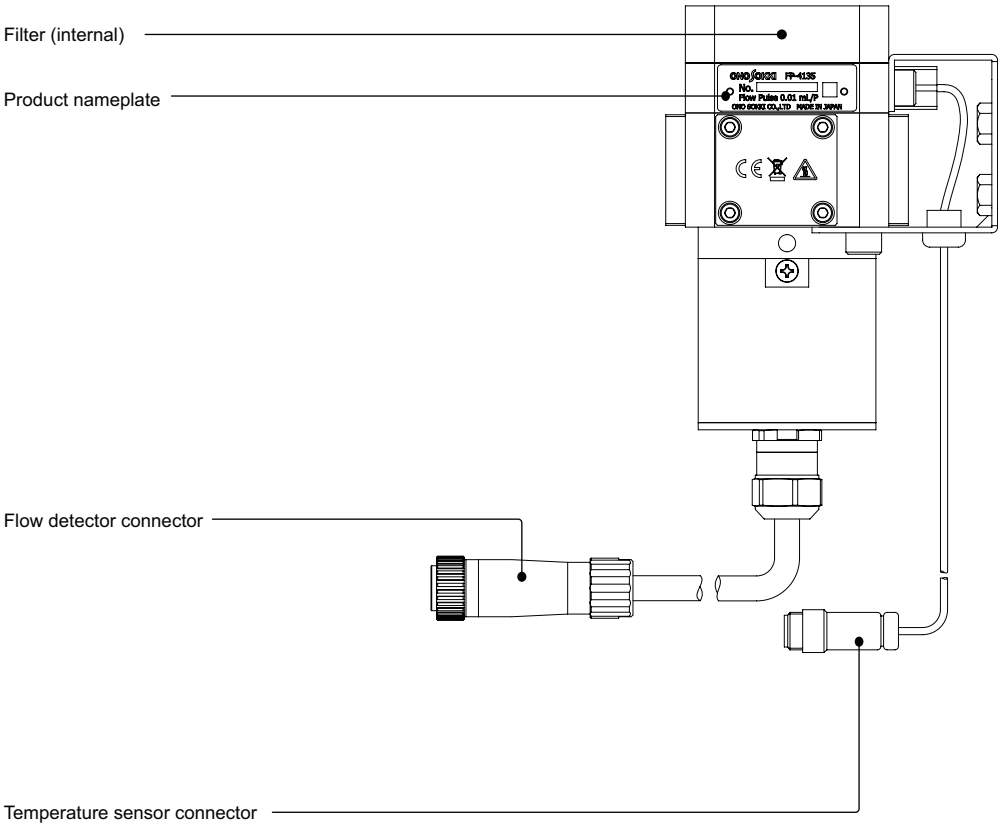
3. Installation Method

This section describes installation and mounting of the FP-4135 On-Board Volumetric Flow Detector.
Be sure to read the precautions before installation.

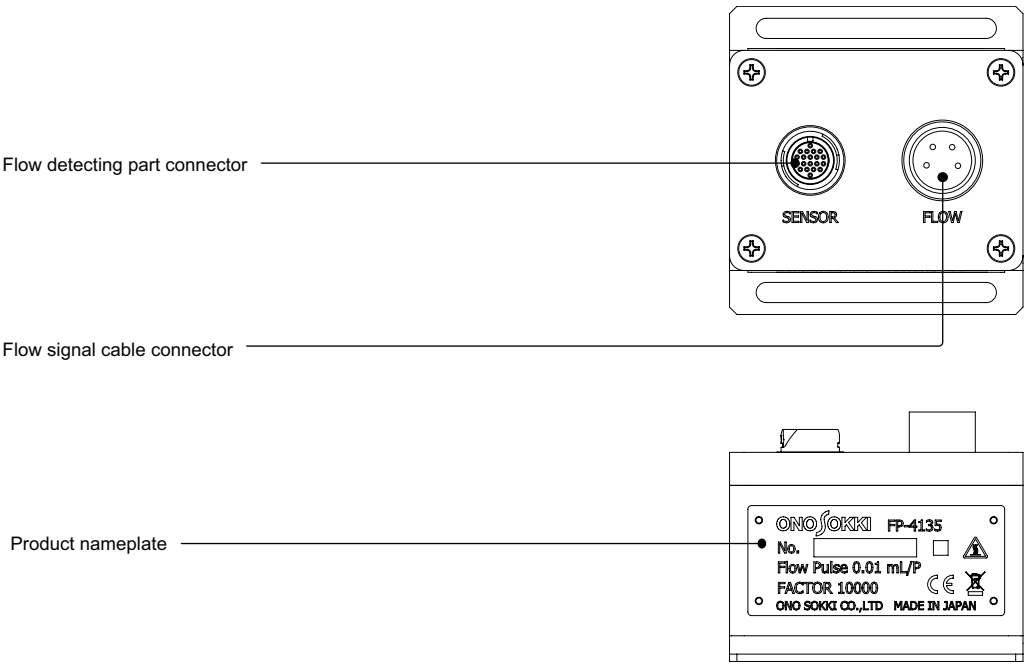
3.1 Name of components

■ Flow detecting part





■ Signal processing part



3.2 Precautions on installation

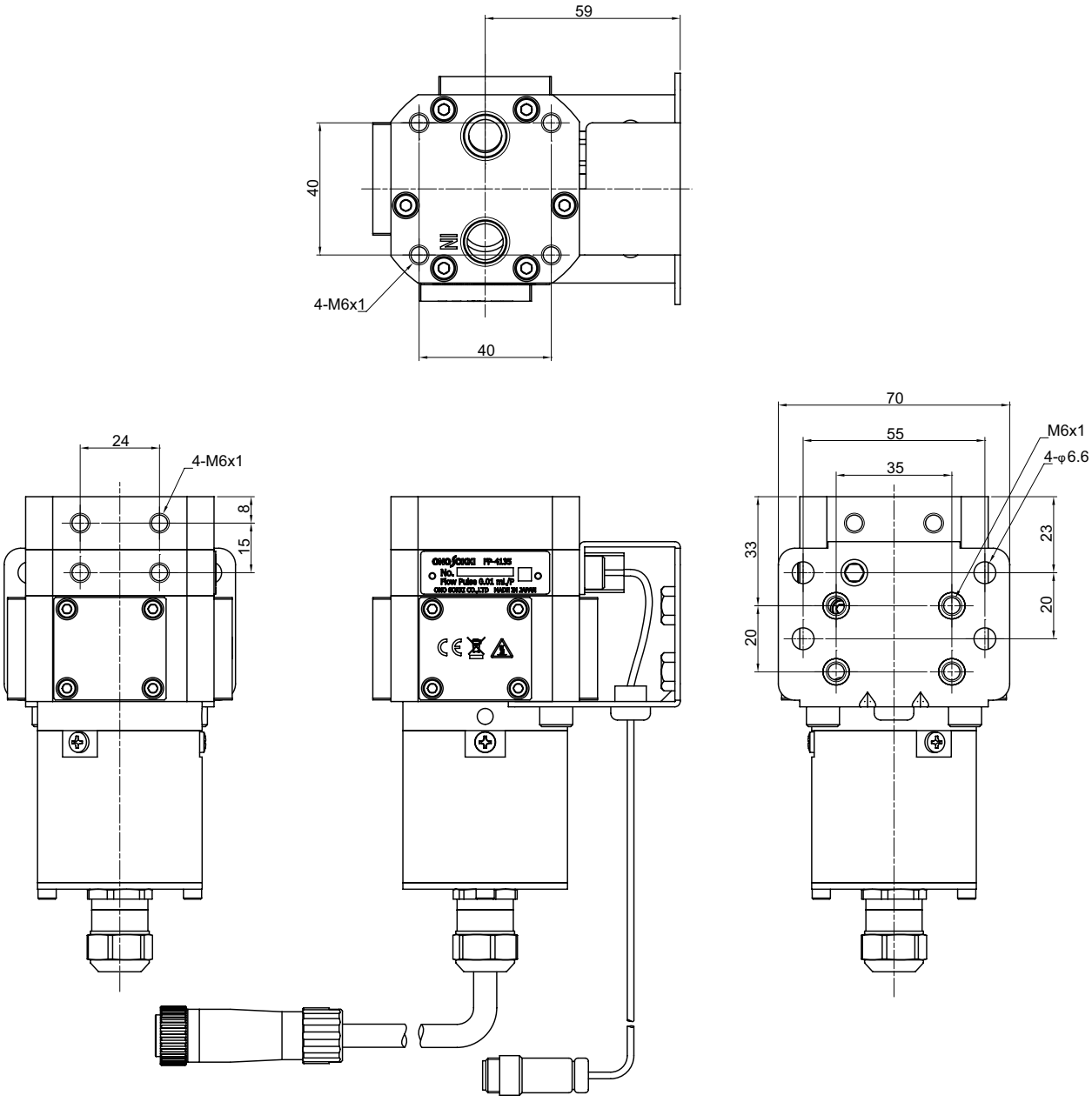
Before installing the FP-4135 On-Board Volumetric Flow Detector, read the following precautions.

- Please handle this equipment as a high-precision equipment.
  The FP-4135 On-Board Volumetric Flow Detector is a high-precision equipment.
  Use in a place within the environmental temperature range (flow detecting part: -30 to +100°C, signal processing part: -30 to +70°C) with no large temperature fluctuations and within the specified vibration range.
- Install the FP-4135 On-Board Volumetric Flow Detector in a upright position (within ±15 degrees).
- To mount the flow rate detector, use the fixtures of the detector or screws included in the product only.
- Install it lower than the liquid tank.
  To gain the supply pressure to the FP-4135 On-Board Volumetric Flow Detector by height difference (natural fall method), install so as to prevent air pockets and negative pressure.
  To do this, install the FP-4135 On-Board Volumetric Flow Detector in a position lower than the liquid tank.
- Do not remove the line filter from the detector.
  The line filter is built into the FP-4135 On-Board Volumetric Flow Detector. So, it should not be removed from the detector.
  The built-in line filter in the detector is designed to remove large debris in the piping connection, so use the other line filters upstream of the liquid inlet of the detector.

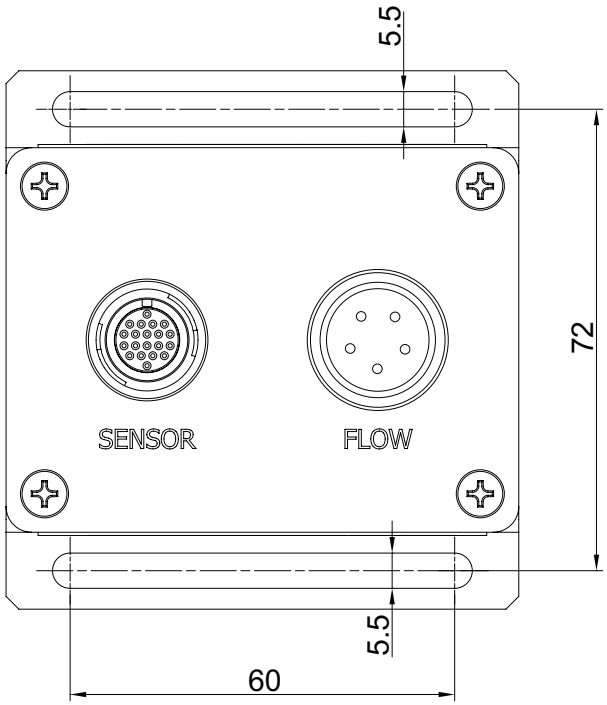
3.3 Installation

Install referring to the following dimension diagram.

■ Flow detecting part



Signal processing part



4. Piping Method

Then, after reviewing the precautions, connect the FP-4135 On-Board Volumetric Flow Detector.

- **Do not remove the line filter from the detector.**

The line filter is built into the FP-4135 On-Board Volumetric Flow Detector. So, it should not be removed from the detector.

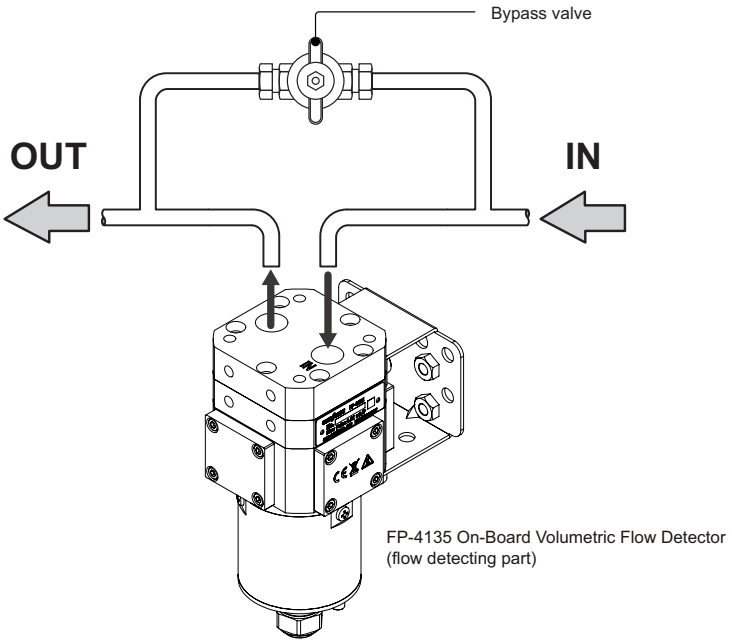
The built-in line filter in the detector is designed to remove large debris in the piping connection, so use the other line filters upstream of the liquid inlet of the detector.

- **Check the IN and OUT of the detector.**

The detector has an inlet (IN) and an outlet (OUT) for the liquid. Recheck the inlet and the outlet when piping.

- **Recommendations on bypass valve installation**

Installing a bypass valve in the piping as follows is recommended to maintain the measured system such as an engine, release air pockets out of the piping, or to repair a detector malfunction.



- **Make sure the power is disconnected (OFF) before starting piping.**

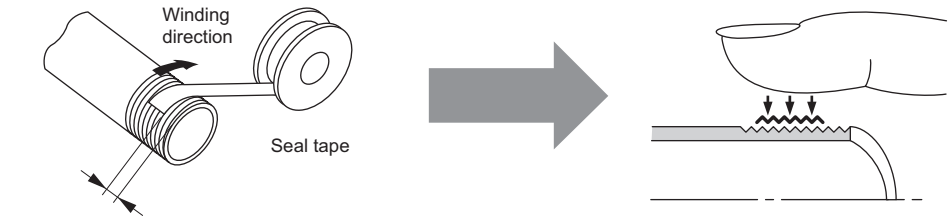
Make sure the power of the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter are disconnected (OFF).

To switch the power on/off, use the power switch of the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter after connecting the FP-4135 On-Board Volumetric Flow Detector to the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter with the flow signal cable, or use the power switch on the side of Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter.

- **Pay attention to how to wind the seal material.**

Follow the instructions below to wind a Teflon seal tape on screws, for example when changing the joints.

- A seal tape should be wound 2 to 2.5 times to a screw with the last 1 to 2 threads of a screw not tightened. The number of times you need to wind may differ depend on the thickness of the seal tape.
- When using liquid seal material, be careful not to leak the liquid material to piping.
- The standard tightening torque for the joint R1/4 is 12 to 14 N•m.



Leave space for about 2 threads

- **Be sure to flush detector before piping.**

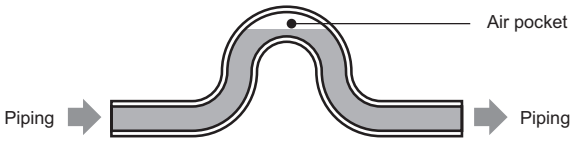
The FP-4135 On-Board Volumetric Flow Detector is delivered filled with test liquid to make sure internal parts are fully lubricated.

Start measurement after flushing thoroughly by pouring liquid into the detector within the specified flow rate for the detector.

- **Do not bend piping into an arc shape.**

If pipings are bent into an arc shape, air pockets can form in the top part.

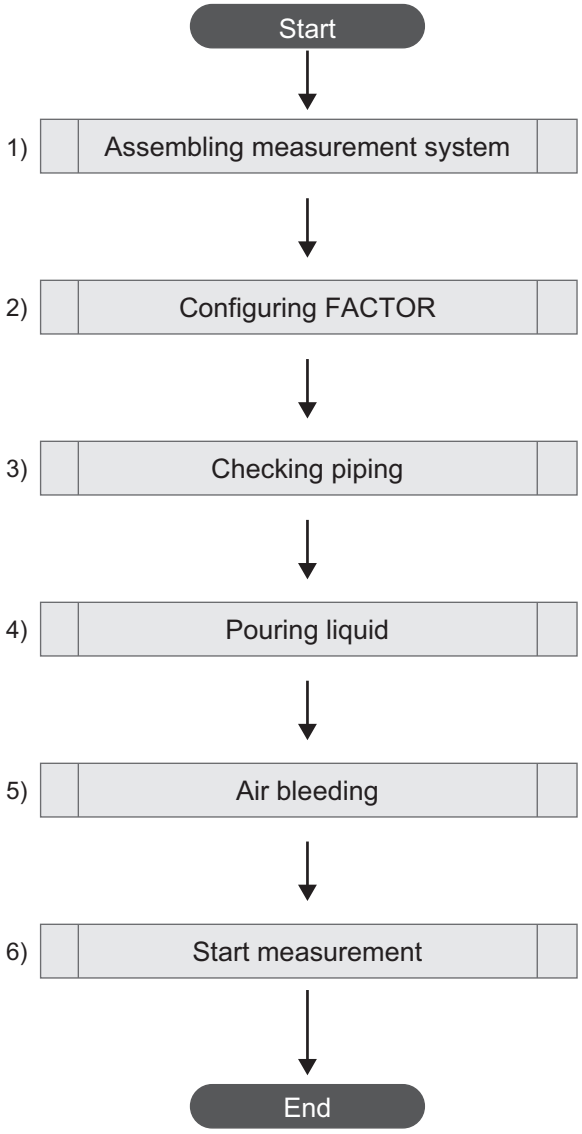
If the piping has any air pockets, measurement will be incorrect.



5. Measuring Method

This section describes the measurement procedure combining the Ono Sokki DF-2200 On-Board Flow Meter or FM Series Digital Flowmeter to the FP-4135 On-Board Volumetric Flow Detector.

5.1 Basic measurement procedure



- Assembling the measurement system means the procedures up to connecting the FP-4135 On-Board Volumetric Flow Detector to the DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter using the signal cables.
- Input (configure) the FACTOR value and the Flow Pulse to Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter.
- Before pouring liquid into the FP-4135 On-Board Volumetric Flow Detector, check again that the piping is correct.
- Pour liquid into the FP-4135 On-Board Volumetric Flow Detector.
- After checking the piping for any leaks before measurement, bleed the air completely from the piping and the FP-4135 On-Board Volumetric Flow Detector. If the air is not vented completely, it might cause measurement errors and/or fluctuation of the instantaneous flow rate.
- After every preparation and procedure is complete, start the measurement.

5.2 Assembling the measurement system

CAUTION

- Ono Sokki DF-2200 On-Board Flow Meter/FM Series Digital Flowmeter and the flow signal cable (FP-0015/0016/0017) and the temperature signal cable (FP-0025/0026/0027) are sold separately. Purchase the appropriate product according to your usage and purpose.
  For details, contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

Connect the FP-4135 On-Board Volumetric Flow Detector to the Ono Sokki DF-2200 On-Board Flow Meter/FM Series Digital Flowmeter with the flow signal cable (FP-0015/0016/0017) and the temperature signal cable (FP-0025/0026/0027) following the procedure below.

[1] Connecting flow detecting part and signal processing part of the FP-4135 On-Board Volumetric Flow Detector

Connect the cable for the flow detecting part of FP-4135 On-Board Volumetric Flow Detector to the SENSOR connector of the signal processing part.

[2] Connecting signal processing part and flow detecting part of FP-4135 On-Board Volumetric Flow Detector

Connect the flow signal cable to the FLOW connector in the signal processing part of FP-4135 On-Board Volumetric Flow Detector.

[3] Connecting temperature sensor of FP-4135 On-Board Volumetric Flow Detector to temperature signal cable

Connect the temperature signal cable to the temperature sensor connector of the FP-4135 On-Board Volumetric Flow Detector.

[4] Connecting flow signal cable and temperature signal cable to Ono Sokki DF-2200 On-Board Flow Meter/FM Series Digital Flowmeter

First, turn off the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter.

Then, connect the flow signal cable to the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter rear panel FLOW connector.

In the same manner, connect the temperature signal cable to the TEMP connector.

CAUTION

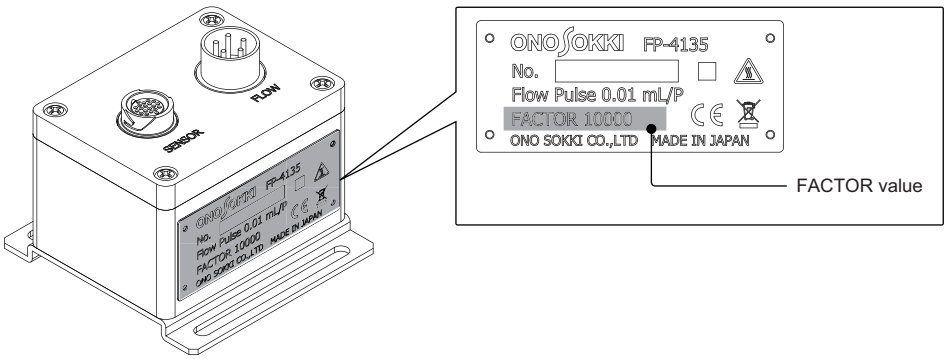
- The combination of the flow rate detecting part and the signal processing part of the FP-4135 On-Board Volumetric Flow Detector is pre-defined. Connect after verifying that the manufacturing number of the flow rate detecting part and the signal processing part matches.
- Do not put any unnecessary force on the cables or connectors when wiring.

5.3 Configuring the FACTOR

The FACTOR value of the FP-4135 On-Board Volumetric Flow Detector is “10000”. This value must be entered (configured) into the Ono Sokki DF-2200 On-Board Flow Meter or FM Series Digital Flowmeter before measurement. For details on configuration, refer to the attached instruction manual for the Ono Sokki DF-2200 On-Board Flow Meter or FM Series Digital Flowmeter.

■ Checking FACTOR value

The FACTOR value is imprinted on the nameplate of the FP-4135 On-Board Volumetric Flow Detector.



5.4 Configuring Flow Pulse

The Flow Pulse of the FP-4135 On-Board Volumetric Flow Detector is 0.01 mL/P. This value must be entered (configured) into the Ono Sokki DF-2200 On-Board Flow Meter or FM Series Digital Flowmeter before measurement.

The description below explains only the overview of the configuration of the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter. For details on the setting conditions or configuration procedures, please refer to the instruction manual attached to each product.

The configuration procedure varies depending on the type of the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter.

■ Configuring the Flow Pulse of the DF-2200 On-Board Flow Meter

From the MENU screen displayed when you enter the menu mode, select “1:SENSOR” > “0:FLOW PULSE” > “1:0.01 mL/P”, and “1:SENSOR” > “2:FLOW MULTIPLY” > “0:*1.”

■ Configuring the Flow Pulse of the FM-2500A Digital Flowmeter

From the MENU screen displayed when you enter the menu mode, select “DF0400A setup” > “sensor” > “select” > “FP213.”

Next, in the “Encoder Pulse” screen, select “120 (360)”.

■ Configuring the Flow Pulse of the FM-1500 Digital Flowmeter

Start the SETUP mode, and in the “Sensor Select” screen, select “(1) FP213”.

Then, select “(1) 120 [360] P/R” in the “Sensor Pulse” screen.

5.5 Checking piping

Check the pipe condition again before pouring the liquid to be measured.

- Check that the piping is correctly and firmly connected.
- Check that no liquid is leaking or seeping from the piping.

5.6 Pouring liquid

Pour the liquid to be measured into the FP-4135 On-Board Volumetric Flow Detector in the following manner.

[1] Turn on the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter.

[2] Pour the liquid at a low flow rate (less than 5 L/h).

[3] After making sure that the liquid is filling the detector, increase the amount gradually.

CAUTION

- The FP-4135 On-Board Volumetric Flow Detector is designed to lubricate internals with the liquid to be measured. Start pouring the liquid to be measured at a low flow rate (less than 5 L/h).
- Please note that pouring a large amount of the measurement liquid before the FP-4135 On-Board Volumetric Flow Detector is filled with liquid may cause a malfunction.

5.7 Air bleeding

Bleed the air inside the piping completely and the On-Board Volumetric Flow Detector before starting measurement. If the air is not vented completely, it might cause measurement errors and/or fluctuation in the instantaneous flow rate.

Please note that the air bleeding procedure with and without a bypass valve are different from each other.

■ Air bleeding procedure with a bypass valve

[1] Bleed the air out of the piping.

First, pour the liquid to be measured with the bypass valve fully open.

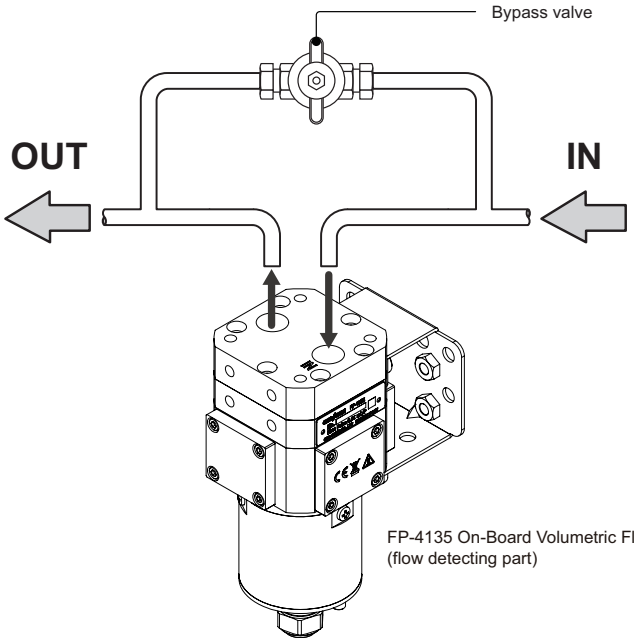
Next, with the bypass valve open, keep pouring the liquid. This releases the air out of the piping in front and to the rear of the detector naturally.

[2] Bleed the air out of inside the detector.

After checking that the air has been vented out of the piping and the filter, close the bypass valve gradually. This bleeds the air out of inside the detector.

When bleeding the air out of inside the detector, pay attention not to pour a large amount of liquid. Remember to adjust the opening/closing of the bypass valve while checking the instantaneous flow value with the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter.

Finally, close the bypass valve completely. By following the procedure below, the air can be bled completely out of inside the detector.



FP-4135 On-Board Volumetric Flow Detector
(flow detecting part)

CAUTION

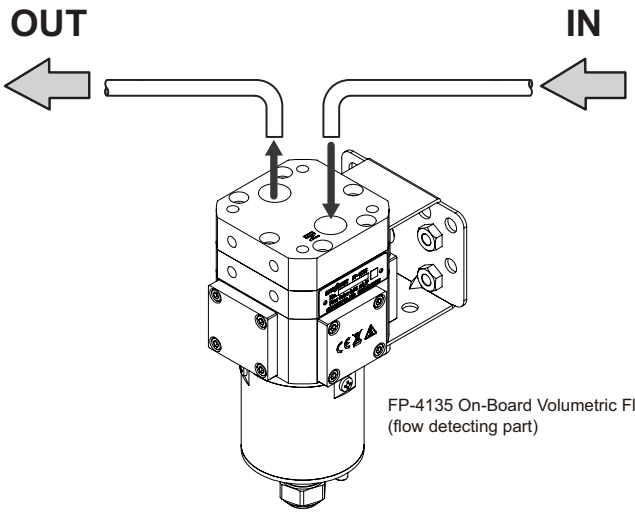
- While the liquid to be measured is being poured, the instantaneous flow rate value of the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter might fluctuate. This phenomenon is seen when the air is not bled completely. Repeat the procedures “Air bleeding procedure with a bypass valve” on page 18 to bleed the air.

■ Air bleeding procedure without a bypass valve

[1] Bleed the air out of the piping and the inside of the detector.

Increase the poured amount gradually being careful not to pour a large amount of liquid.

Finally, keep pouring the large amount of liquid. By following the procedure below, the air can be bled completely out of inside the detector.



FP-4135 On-Board Volumetric Flow Detector
(flow detecting part)

CAUTION

- While the liquid to be measured is being poured, the instantaneous flow rate value of the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter might fluctuate. This phenomenon is seen when the air is not bled completely. Repeat the procedures “Air bleeding procedure with a bypass valve” on page 18 to bleed the air.

6. Maintenance and Storage

This section describes the inspection, calibration, cleaning and maintenance which you should conduct periodically and the maintenance during storage of the FP-4135 On-Board Volumetric Flow Detector.

6.1 Daily check

Before use, remember to check for any liquid leak from the piping.

If any leaks are found, take measures before use.

6.2 Periodic inspection and calibration

Periodic inspection and calibration is recommended to maintain the performance of the FP-4135 On-Board Volumetric Flow Detector for a long period of time.

For details on periodic inspection and calibration, contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

6.3 Checking filter and cleaning

■ Checking filter and type.

The reusable stainless mesh filter is built into the FP-4135 On-Board Volumetric Flow Detector.

The filter is a critical component to maintain the performance of the FP-4135 On-Board Volumetric Flow Detector for a long period of time. It is recommended to check it periodically.

■ Cleaning filter and precautions

Clean the filter as necessary. Follow the precautions below when cleaning the filter.

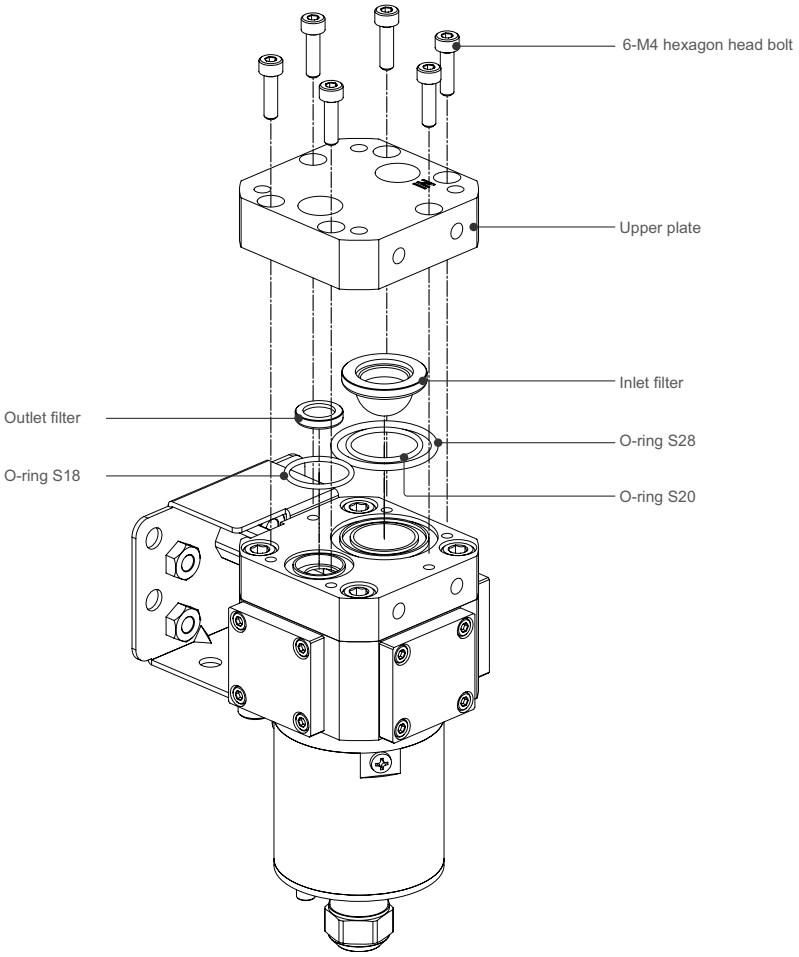
CAUTION

- To put back the filter, be careful so that no dust or debris gets inside.
- Assemble the O-ring for sealing correctly. If you find any damages or scratches on the O-ring, replace it with a new one.
  * The O-ring with NEXUS-SLT material by Morisei-kako Co., Ltd. should be used.
  * For details on purchasing an O-ring, contact the nearest Ono Sokki sales office or the distributor where you purchased the product.
  * Never use the O-ring with the material other than specified. Fuel leaks might occur.
- Use an ultrasonic cleaning machine to clean the filter.
- It is recommended to clean the filter once a month.
- The filter used for the certain period will not be fully restored even by cleaning. Replace it with the new one if it becomes filthy or it has been used for a long period of time.

■ Removing and installing filter

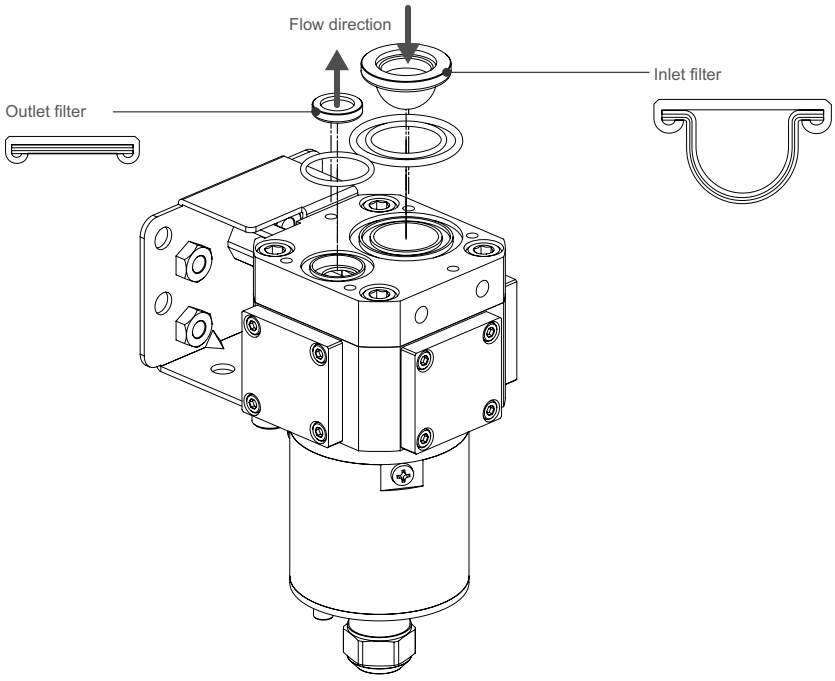
● **Removing filter**

Remove the top panel by loosening the 6 M4 bolts with hexagon holes by referring to the figure below.



- **Installing filter**

Install the filter paying attention to its orientation referring to the figure below. The tightening torque of the M4 bolts with hexagon holes is 3N•m.



6.4 Storage of On-Board Volumetric Flow Detector

After measurement is finished or if you are not using the FP-4135 On-Board Volumetric Flow Detector for a long period of time, store it following the procedure below.

■ Purpose of storage

The procedure and method for the FP-4135 On-Board Volumetric Flow Detector is specified with the following purpose.

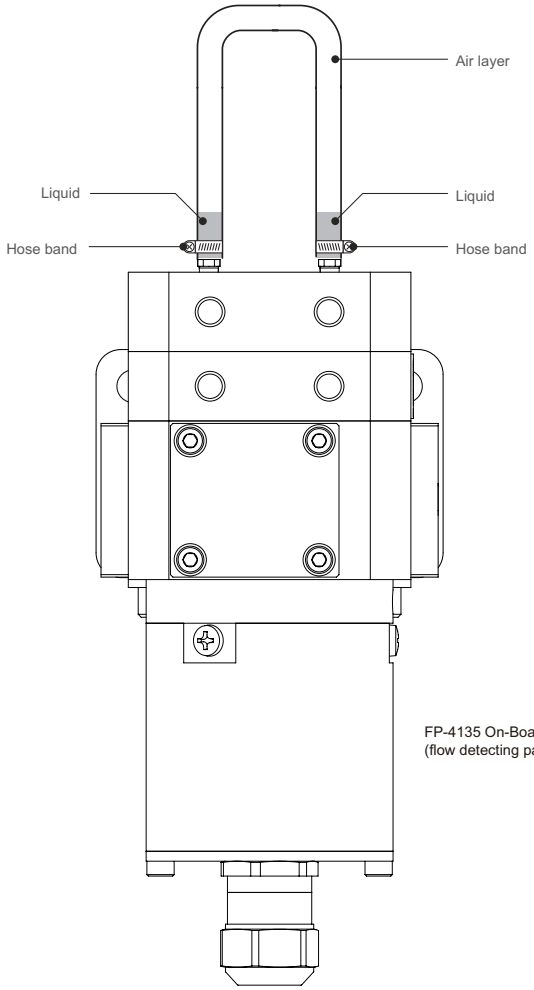
- To prevent foreign objects entering the liquid from the inlet/outlet
- To prevent fuel leaks
- To lubricate inside the detector and prevent evaporation of the liquid or drying of inside the detector.

■ Storage procedure

Make sure to follow the specified procedure and method in this manual.

Connect the liquid inlet and outlet with a hose as follows. Fix with a hose band so the hose is not disconnected from the joint part.

And with all flow passages filled with liquid, fuel leaks might occur due to the increased pressure caused by a temperature rise. To prevent this phenomenon, make sure to leave an air layer inside the hose connecting the inlet and outlet.



FP-4135 On-Board Volumetric Flow Detector
(flow detecting part)

CAUTION

- To store the equipment in which easy to evaporate liquid such as gasoline was poured, fill the inside with hard to evaporate liquid such as light oil and follow the procedure “Storage procedure” on page 22.

7. Appendix

7.1 Troubleshooting

Phenomenon	Cause	Action
Instantaneous flow rate displayed on the counter fluctuates	Air inside piping and inside the detector has not been bled completely.	• Bleed the air. See “5. Measuring method” on page 15 for details.
	Not enough supply pressure for flow	• Increase the supply pressure. • Recheck the piping condition.
	The liquid inside the piping and inside the detector are evaporating.	• Keep the piping and the detector away from any heat sources. • Increase the supply pressure. • Cool liquid using devices such as an oil cooler.
	Ripple adjustment of detector is misaligned.	• Requires repair
Liquid not flowing smoothy	Bottleneck in piping	• Remove the bottleneck.
	Filter is clogged.	• Clean the built-in filter in the detector. • Clean the prepared filter.
	Air in piping (in case of natural fall method)	• Bleed the air.
The counter points to 0 (zero) value even though the fluid is flowing.	The flow signal cable is not connected.	• Connect the flow signal cable.
	Inlet and outlet of detector are connected in reverse.	• Connect the inlet and outlet of detector correctly.
	FACTOR of the counter is set to 00000.	• Reset the FACTOR value correctly.
	Bypass valve is open (when bypass valve exists)	• Close the bypass valve.
No liquid is flowing.	Supply pressure of the liquid points to zero	• Increase the supply pressure.
	Flow-rotation conversion part of the detector is not functioning smoothly.	• Requires repair
Counter points to 0 (zero) with low flow and points to small amount with large flow rate	Bypass valve is open	• Close the bypass valve.
Measurement with low flow fluctuates	Flow-rotation conversion part of the detector is not functioning smoothly.	• Requires repair
Different measurement from actual flow value	FACTOR of the counter is not set correctly.	• Reset the FACTOR value correctly.
	Reverse flow is also measured due to the wrong piping.	• Check the piping condition again and correct the connection.
Flow decreases gradually as liquid is poured.	Filter is clogged.	• Clean the built-in filter in the detector. • Clean the prepared filter.

- Requires repair: For details, contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

7.2 Specifications

Measuring item	Flow/Temperature	
Detection method	Flow	Positive Displacement (piston method)
	Temperature	Resistance temperature detector (Pt100 Ω)
Measurable liquid	Gasoline, light oil, kerosene, class-A heavy oil, engine oil, petroleum-based general hydraulic oil, methanol, ethanol, mixture of alcohol and gasoline and brake oil • Please note that this equipment might not be used in the depositing condition.	
Material for contacting liquid part (flow detecting part)	Parts	Material
	Body/Side panel/con rod/ crank axis/pin/upper panel	SUS303
	Bearing case	SUS316
	Piston	SUS303 (hard chrome plating)
	Bearing/crank pin	SUS440C
	Magnetic	Neodymium magnet (Ni plated)
	O-ring	NEXUS-SLT
	Filter	SUS304
Material for contacting liquid part (temperature detecting part)	SUS316	
Measurement range	Flow	0.1 - 200 L/h
	Temperature	-30 - 100°C
Measurement accuracy	Flow	Within ±0.2% of read value (measurement condition: 20°C, 50%RH, Cleansol HS)
	Temperature	Class A
Pressure loss	With less than 4 kPa/60 L/h (gasoline)	
Minimum resolution	0.01 mL	
Filter (built-in to detector)	Filter capacity	33 µm (inlet side), 770 µm (outlet side)
Compliant display unit	DF-2200 On-Board Flow Meter	
	FM-2500A Digital Flowmeter + DF-0400A FP Series Measuring Module for Detector	
	FM-1500 Digital Flowmeter + DF-0400A FP Series Measuring Module for Detector	
Output signal (flow)	Cable	FP-0015 (5 m) / FP-0016 (10 m) / FP - 0017 (20 m)
	Connector	TC1108-21B10-5M-1 (Detector side)
		TC1108-12B10-5F8.3 (Cable side)
	Pin assignment	(1) SIG1
		(2) SIG2
		(3) COMMON
		(4) Shield COMMON
		(5) Power supply DC12V
Output signal (temperature)	Cable	FP-0025 (5 m) / FP-0026 (10 m) / FP-0027 (20 m)
	Connector	R03-PB3F (cable side)
		R03-JB3M (sensor side)
	Pin assignment	A SIG1
		B SIG2
		C SIG3
Inlet/Outlet port	Rc1/4	

■ General Specifications

Operating maximum pressure	8 MPa	
Operating temperature range	Flow detecting part	-30 to 100°C (environment temperature, liquid temperature, non-feezing)
	Signal processing part	-30 to 70°C (environment temperature)
Operating humidity range	5 to 80% RH (no condensation)	
Storage temperature range	Flow detecting part	-40 to 110°C (environment temperature, liquid temperature, non-feezing)
	Signal processing part	-40 to 80°C (environment temperature)
Storage humidity range	5 to 85% RH (no condensation)	
Anti-vibration (turned on)	Acceleration rms value: 27.3 m/s²	
	10 to 1000 Hz random vibration	
	1 hour for each direction of 3 axis	
Anti-impact (turned off)	Acceleration peak value: 500 m/s²	
	Both directions in the direction of the 3 axes: total of 18 times, 3 times each for ±X/Y/Z	
	Sine half-wave: Operating time 11 ms	
Input power supply voltage	DC12 V • Power is supplied from the Ono Sokki DF-2200 On-Board Flow Meter or the FM Series Digital Flowmeter	
Weight	Flow detecting part	Approximately 2.0 kg
	Flow detecting part	Approximately 0.4 kg
Accessories	Instruction Manual (this manual)	

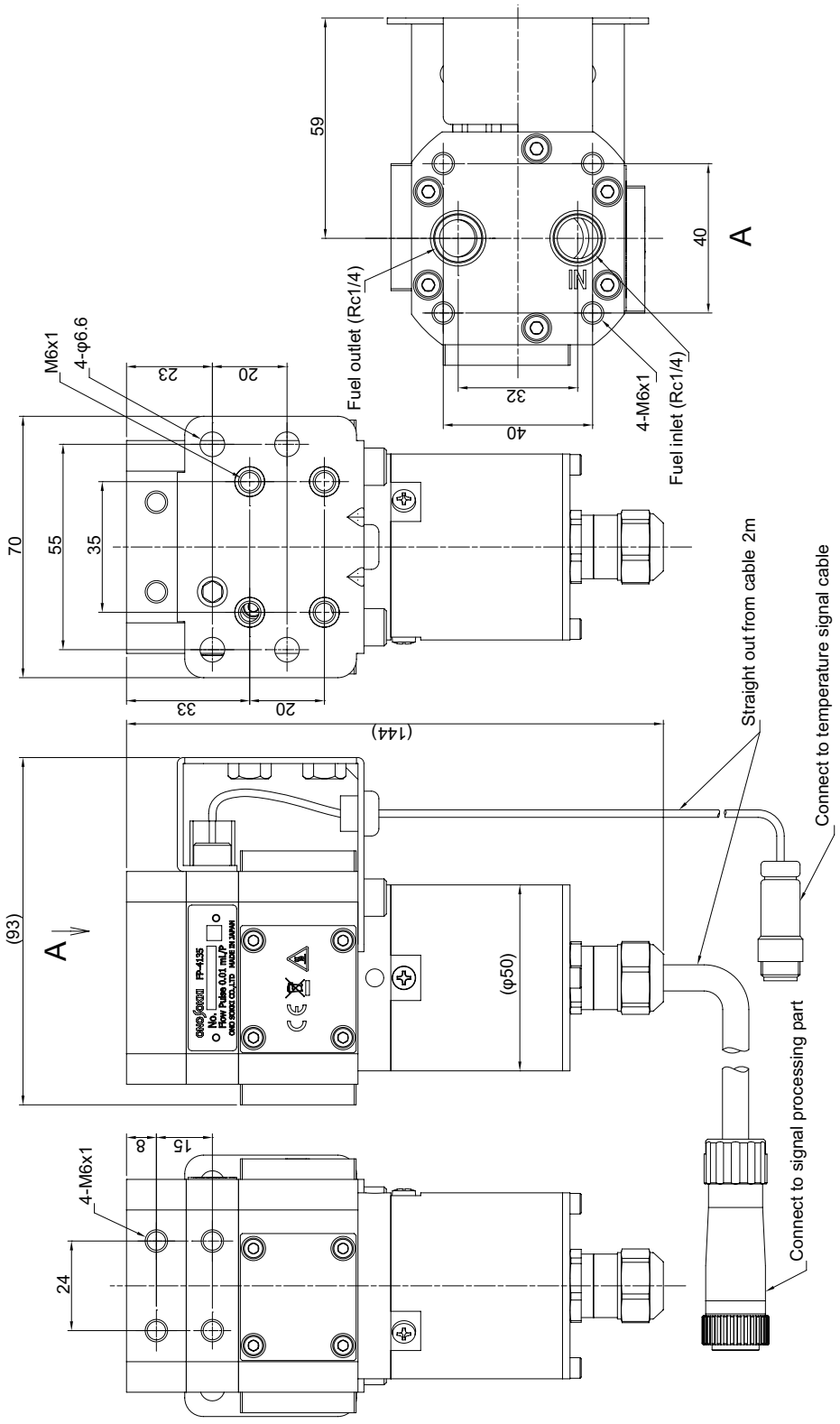
■ Conforming Standards

CE Marking	EMC Directive 2014/30/EU Standard EN61326-1
	RoHS Directive 2011/65/EU Standard EN50581
FCC	CFR47 Part15 Subpart B Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

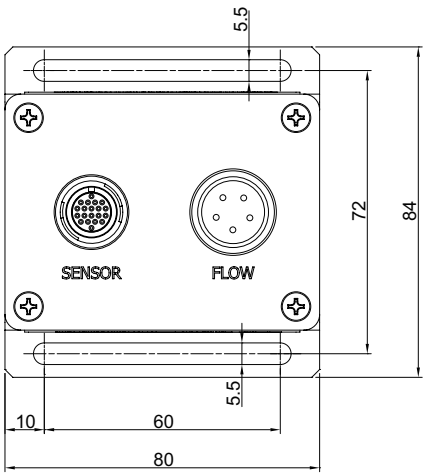
For details , see:https://www.onosokki.co.jp/English/english.htm

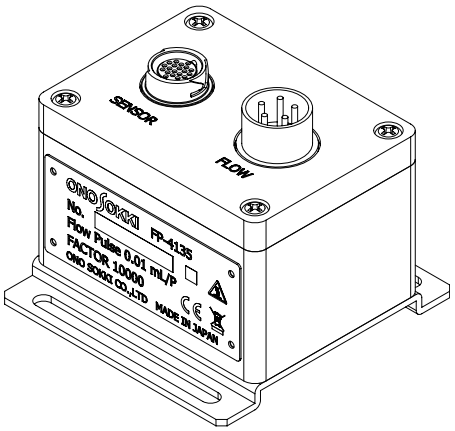
7.3 Outline dimensional drawing

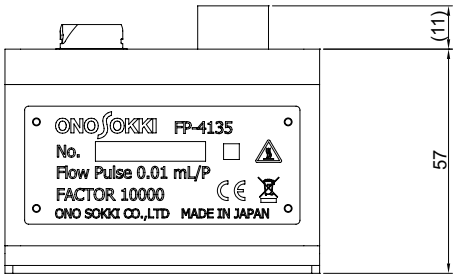
■ FP-4135 On-Board Volumetric Flow Detector (flow detecting part)



■ FP-4135 On-Board Volumetric Flow Detector (signal processing part)







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*Outer appearance and specifications are subject to change without prior notice.

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