ONO SOKKI

DF-2200

ON-BOARD FLOW METER

Instruction Manual

ONO SOKKI CO., LTD.

ONO SOKKI

https://www.onosokki.co.jp/English/english.htm

WORLDWIDE ONO SOKKI CO., LTD.
1-16-1 Hakusan, Midori-ku, Yokohama 226-8507, Japan
Phone : +81-45-935-3918 / Fax : +81-45-930-1808 (Overseas sales department)
E-mail : overseas@onosokki.co.jp

■ 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 (DF-2200 On-Board Flow Meter Instruction Manual) describes the operation, functions, specifications and handling precautions of the DF-2200 On-Board Flow Meter.

Be sure to read the warnings and precautions in this manual before use to ensure that you use the DF-2200 On-Board Flow Meter safely and correctly.

Ono Sokki assumes no responsibility or liability for failures resulting from failure to observe the warnings or precautions in this manual.

This manual describes the DF-2200 On-Board Flow Meter main unit and its optional accessories only. For details on the devices (such as detectors and peripheral equipment) to be used with the DF-2200 On-Board Flow Meter, refer to their respective instruction manuals.

● **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.

CAUTION

- 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 with our best efforts for perfection, should there be any unclear point, error, or any other questionable point, please inform us of them.
- Please be advised that we will not be held responsible for the 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

- Be sure to read this manual before using the DF-2200 On-Board Flow Meter.
- Follow the instructions in this manual when using the DF-2200 On-Board Flow Meter.
- Precautions specific to the DF-2200 On-Board Flow Meter may be shown on the flow meter unit or in other supplied instruction manuals. Follow those instructions as well when using the DF-2200 On-Board Flow Meter.
- Keep this manual in a safe place where it is readily available for future reference.
- The contents in this manual provide information as of the writing of the manual. The contact information (e.g., company address, phone number, website URL, and e-mail address) may have changed without prior notice. Thank you for your understanding.

● Meaning of notations

In this manual, the items are explained in the following way, in order for you to use the product safely. The following indicates the severity of the effects if the explained items are not followed.

⚠ **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 a hazardous situation, if not avoided, may result in property damage including failure of the equipment, system, or facility, but will not result in personal injury.

● Meanings of symbols

Information on operational hazards are given by using the three different symbols shown below. Each of the symbols are defined with the following meanings.

Symbol	Definition	Meaning	Example
	Attention	Indicates that 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.	

■ Precautions on use

⚠ CAUTION

Do not use this product in operations that are concerned with human life or those that require a high degree of reliability.

- The DF-2200 On-Board Flow Meter is not intended for control in equipment or devices, such as medical, nuclear power and aerospace equipment or devices, that are concerned with human life or those that require a high degree of reliability.
  Ono Sokki assumes no responsibility or liability for personal injury or property damage resulting from the use of the DF-2200 On-Board Flow Meter in these equipment, devices or control systems.

Precautions on use

⚠ WARNING

Do not operate the DF-2200 On-Board Flow Meter unit with wet hands.

⚠ CAUTION

Do not disassemble the DF-2200 On-Board Flow Meter.

- If the product requires disassembling due to failure or modification, please contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

Do not expose the DF-2200 On-Board Flow Meter to water.

- If the product is exposed to water, immediately stop using it and contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

Precautions on power supply

⚠ CAUTION

For on-board battery

- If power is supplied from a battery (12-24V), use the supplied LC-0082 Battery Power Cable. Using a cable other than the specified one may cause electric shock or fire.

For AC adapter

- Be sure to use the specified AC adapter. Using an AC adapter other than the specified one may result in electric shock or fire.

For other DC power sources

- To use a DC power source other than the AC adapter or battery, contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

Precautions regarding disposal

⚠ CAUTION

When you dispose of the DF-2200 On-Board Flow Meter main unit and/or optional products installed on it, follow the disposal rules of your local government.

- Contact your local government for details on the disposal rules.

Precautions regarding electromagnetic environment

⚠ CAUTION

The DF-2200 On-Board Flow Meter is intended for use in an industrial electromagnetic environment.
Using the DF-2200 On-Board Flow Meter in a household may cause electromagnetic interference. In such a case, users may be required to take appropriate actions.

Precautions regarding storage

NOTICE

The DF-2200 On-Board Flow Meter is a precision electronic device. Do not leave the product in a place where temperature becomes excessively high or low.

Precautions when installing the engine

WARNING

Always make sure that the engine is stopped before installing or removing the detector.

- Working on the product with the engine running is very dangerous. Your clothes or hand may get caught by moving parts.

The engine is extremely hot immediately after it is stopped. Therefore, check that the engine temperature has dropped before installing or removing the detector.

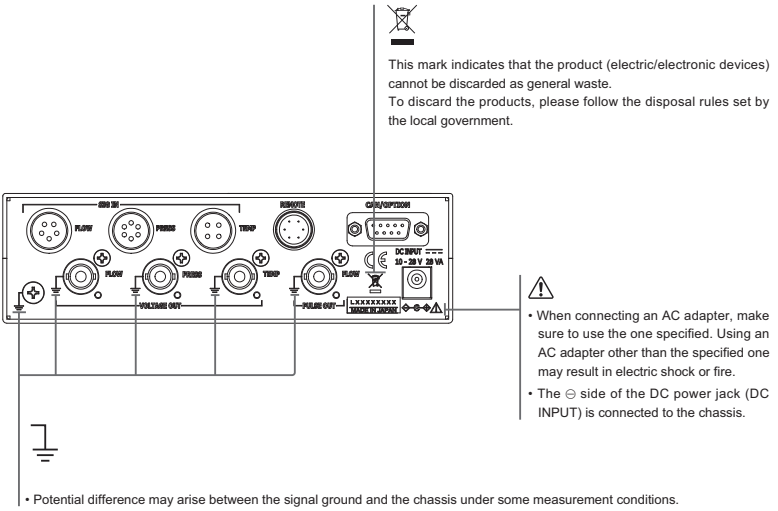
- Installing or removing the detector when the engine is hot is very dangerous. You may get burnt if you touch a hot part.

CAUTION

- For other precautions when installing the detector on the engine, refer to the instruction manual of the detector.

Caution symbols and warning labels on the product

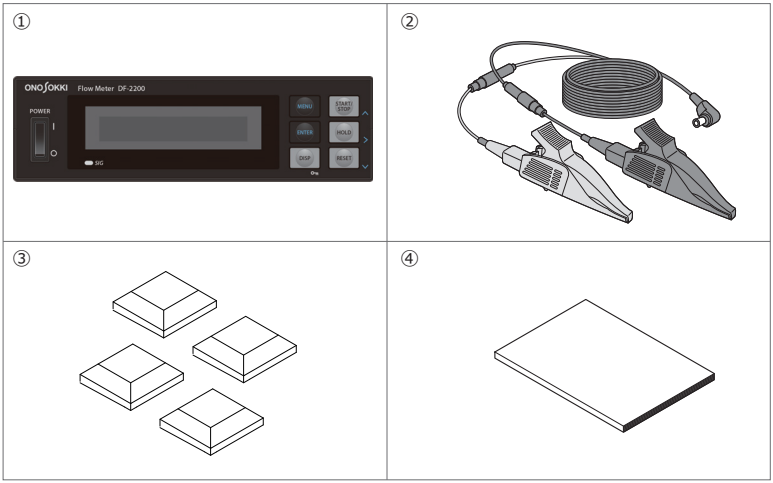
The positions and meanings of the caution symbols and warning labels on the DF-2200 On-Board Flow Meter main unit (rear panel) are as follows: Be sure to check these symbols and warning before use.



Unpacking

When you have unpacked the DF-2200 On-Board Flow Meter, first check that all of the following items are included in the package.

■ Supplied items



Symbol	Name	Quantity	Remarks
①	DF-2200 On-Board Flow Meter	1	
②	LC-0082 Battery Power Cable	1	DC Power Cable
③	Rubber foot	4	Not attached (See “When using by laying on top of a table” on page 23.)
④	Instruction manual	1	This manual

CAUTION

- If any item is missing or damaged in the package, immediately stop using the product and contact the nearest Ono Sokki sales office or the distributor where you purchased the product.
- The items listed here will be delivered when you purchase a product with standard specifications. Optional items are not included.

Contents

Chapter 3 Setting Mode and Menu Reference

Chapter 4 Interface Reference

Chapter 5 Reference Data

Chapter 1
Outline of DF-2200

1. Overview and features

1.1 Outline and features of DF-2200

DF-2200 On-Board Flow Meter is a compact on-board fuel flow meter developed for our FP-series Volumetric Flow Detectors.

This flow meter corresponds to 3 kinds of resolutions, 0.001 to 0.1 mL/Pulse, in order to be used with our FP-series volumetric flow detector. It also corresponds to the pulse signals A and B that have phase differences, and includes the backward flow correction function for flow back.

Displaying and measuring the mass flow rate is made possible through entering the value of standard density of the fuel in use, and its temperature and density coefficient (1/° C). Besides the flow rate, the items of time / temperature (resistance temperature detectors) / pressure (voltage input) can also be measured.

The rear port (BNC) of the DF-2200 On-Board Flow Meter outputs the voltage corresponding to the values of instantaneous flow rate/temperature/pressure and the pulse corresponding to the instantaneous flow rate value.

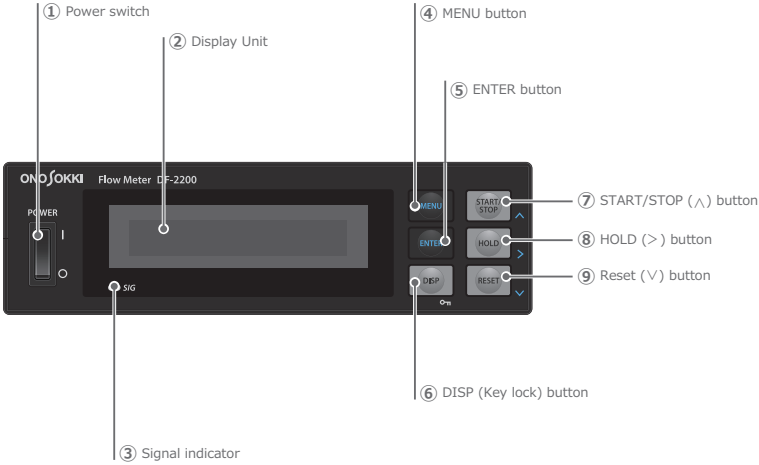
CAN and RS-232C (optional) are also equipped as communication functions with external devices.

Features

- ☐ Compact type which is easy to install in a vehicle, optimum for on-board testing
- ☐ The flow rate/temperature/pressure can be measured with just this 1 unit.
- ☐ Analog output fast response (with average processing function)
- ☐ Installing 2 types of communication systems; CAN output (standard) and RS-232C (optional)
- ☐ Employing total auto stop function (optional)
- ☐ Corresponding to the power input of DC10 to 28 V that are used for various test vehicles

2. Name and function of each part

2.1 DF-2200 front panel



① POWER: Power button
Switch the power of the main body of the DF-2200 On-Board Flow Meter to ON (|) or OFF (○).

CAUTION

- If the conditions are changed in the menu mode, please wait for 3 seconds or more before turning OFF(○) the power.
  If the power is turned OFF(○) within 3 seconds after changing the condition, the changes will not be reflected. Please be careful.

② Display unit (fluorescent display tube)
Displays the menu for setting the measurement value and conditions.
For details, refer to “3. Type of screens and display items” on page 15.

③ SIG: Signal indicator LED
When the flow signal from the detector is detected, it will light or flash with a green color.

④ MENU button
A button for switching the mode (measurement or menu).
Operations differ depending on the current mode as shown below.

Under the measurement mode	Switch to the menu mode to display the menu screen.
Under the menu mode	Switch to the measurement mode to display the measurement screen.

⑤ ENTER button
A button available when in menu mode. Determines items or values in the process of setting.
For details of the menu, refer to “Setting Mode and Menu Reference” on page 39.

⑥ DISP (Key locking) button
Functions differ depending on the operation.

Operation	Description
Press one time	The display items (flow rate/pressure/temperature) of the measured values and the display system (1-stage/2-stage indication) will be switched in the following order. 1-stage indication: Instantaneous flow rate value (L/h or kg/h) → 2-stage indication: Instantaneous flow rate value (L/h or kg/h), Total flow value (mL or g), Total time (s) → 2-stage indication: Instantaneous flow rate value (L/h or kg/h), Pressure (kPa), Temperature (℃) → 1-stage indication: Instantaneous flow rate value (L/h or kg/h) → ···
Hold	Press the button for 1 sec or more to switch between making key protection valid ( ) or invalid.

⑦ START/STOP (∧) Button
This works as a START/STOP button under the measurement mode, and as a ∧ button under the menu mode, respectively.

Mode	Function	Description
Measurement mode	START/STOP	For details, refer to “Controlling integration operation with buttons” on page 36.
Setting mode	∧	For details, refer to “1.2 Basic operation of the conditions and numeric Values in the setting mode” on page 40.

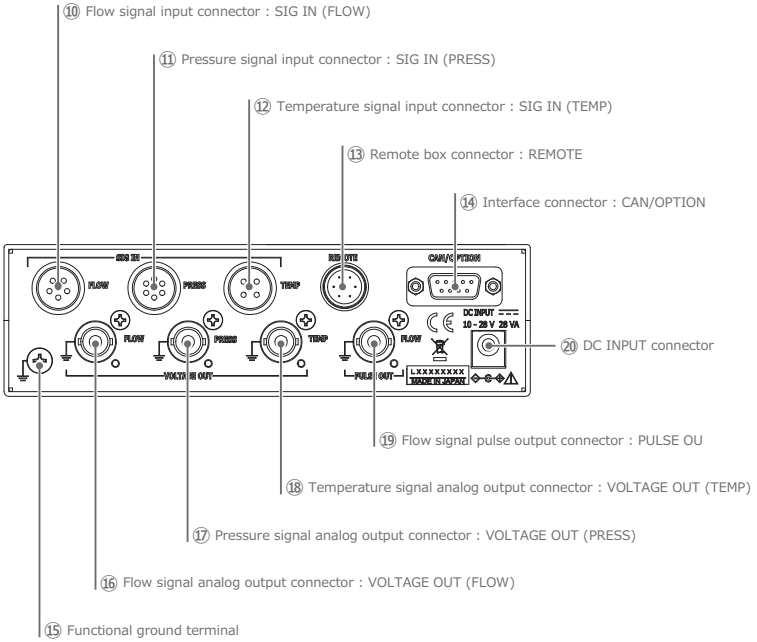
⑧ HOLD (>) Button
This works as a HOLD button under the measurement mode, and as a > button under setting mode, respectively.

Mode	Function	Description
Measurement mode	HOLD	For details, refer to “Controlling integration operation with buttons” on page 36.
Setting mode	>	For details, refer to “1.2 Basic operation of the conditions and numeric values in the setting mode” on page 40.

⑨ RESET (∨) Button
This works as a RESET button under the measurement mode, and as a ∨ button under setting mode, respectively.

Mode	Function	Description
Measurement mode	RESET	For details, refer to “Controlling integration operation with buttons” on page 36.
Setting mode	∨	For details, refer to “1.2 Basic operation of the conditions and numeric Values in the setting mode” on page 40.

2.2 DF-2200 rear panel



⑩ Flow signal input connector: SIG IN (FLOW)
This connector connects a flow signal cable (separately sold). Connects a FP series volumetric flow detector with the flow signal cable.

⑪ Pressure signal input connector: SIG IN (PRESS)
This connector connects a pressure signal cable (sold separately). Connects a pressure sensor with a pressure signal cable.

⑫ Temperature signal input connector: SIG IN (TEMP)
This connector connects a temperature signal cable (sold separately). Connects a temperature sensor with the temperature signal cable.

⑬ Remote box connector: REMOTE
Connects a cable originally fixed to the remote controller (separately sold DF-0223 Remote Box).

⑭ Interface connector: CAN/OPTION
Functions as a CAN interface by default. CAN stands for Controller Area Network.
For the settings of the CAN Interface, refer to “2.9 CAN-OUT: set the CAN output conditions” on page 55.
For the details of outline and specifications of CAN Interface, refer to “1. CAN output interface” on page 60.

If an optional DF-0222 is installed, this will be used as a connector for the RS-232C Interface.
For the settings of RS-232C Interface, refer to “2.11 RS232C: set the conditions for the RS-232C interface” on page 58.
For the details of the outline and specifications of the RS-232C Interface, refer to “2. RS-232C interface” on page 62.

⑮ Functional ground terminal
This is a terminal for functional earth.

CAUTION

- For using this on board, connect this with the functional earthing terminal and the body of a vehicle as necessary.

⑯ Flow signal analog output connector: VOLTAGE OUT (FLOW)
It is possible to enter into a recorder, the voltage output (0 to 10 V) according to the conditions/units (L/h or kg/h) at a set flow rate.

Connect the BNC cable. Please note that the BNC cable is not included as an accessory. Please purchase it separately.

⑰ Pressure signal analog output connector: VOLTAGE OUT (PRESS)
It is possible to enter into a recorder, the voltage output (0 to 10 V) according to the conditions at a set pressure.

Connect the BNC cable. Please note that the BNC cable is not included as an accessory. Please purchase it separately.

⑱ Temperature signal analog output connector: VOLTAGE OUT (TEMP)
It is possible to enter into a recorder, the voltage output (0 to 10 V) according to the conditions at a set temperature.

Connect the BNC cable. Please note that the BNC cable is not included as an accessory. Please purchase it separately.

⑲ Flow signal pulse output connector: PULSE OUT
It is possible to pulse output with the weighting (flow rate value per 1 pulse) according to the condition/unit (mL/P or g/P) set with the flow rate, and enter it into a pulse counter, etc.

Connect the BNC cable. Please note that the BNC cable is not included as an accessory. Please purchase it separately.

⑳ DC INPUT connector
This is a connector for connecting with the power supply.

For the power supply, 2 types can be used, batteries or an AC adapter (optional).

For details, refer to “2.2 Connecting the power source” on page 26.

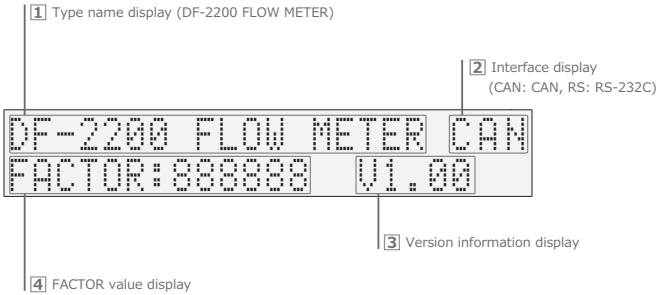
3. Type of screens and display items

When the POWER button on the DF-2200 On-Board Flow Meter is turned to the ON (|) side, the startup screen will first appear, then, switch to the measurement screen (DISP1).

Pressing the MENU button will change the measurement screen to the menu screen. To return to the measurement screen, press the MENU button again.

3.1 Display items on the startup screen

When the POWER button on the DF-2200 On-Board Flow Meter is turned to the ON (|) side, the startup screen will first be shown for a few seconds.



1 Model name display
Display the product model name (DF-2200 FLOW METER)

2 Interface display (CAN: CAN, RS: RS-232C)
Display the communications device equipped to the interface connector on the rear panel of DF-2200.

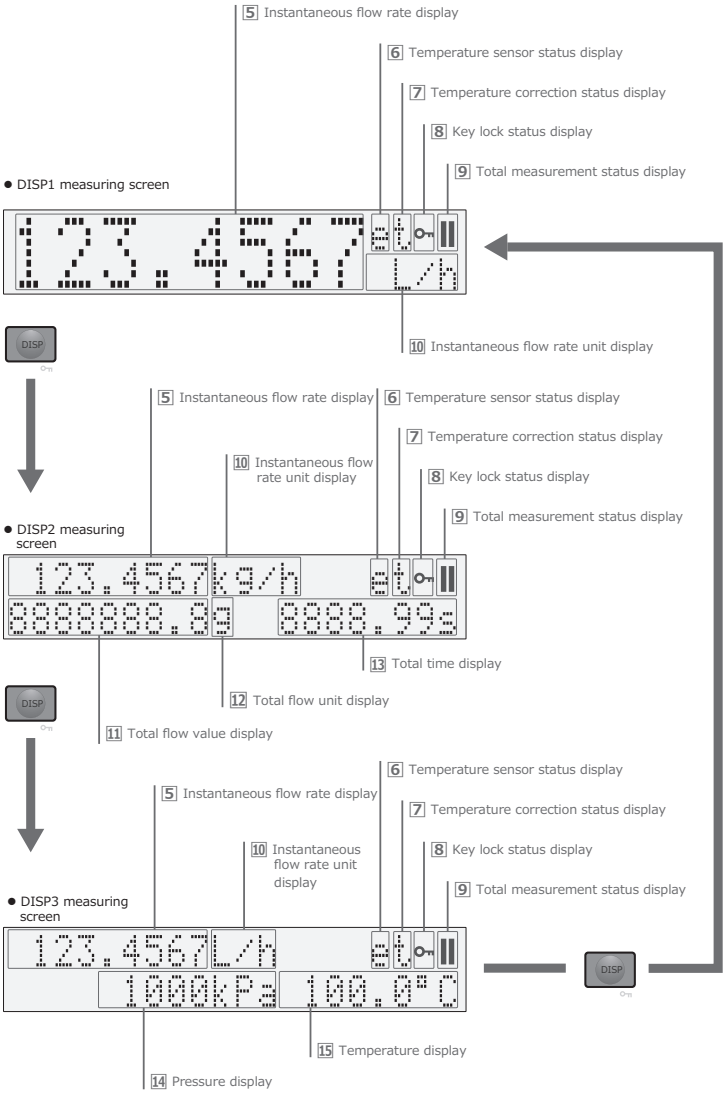
Display	Interface	Description
CAN	CAN Output	A default CAN output function is equipped.
RS	RS-232C	An optional RS-232C function is equipped.

3 FACTOR value display
Display the FACTOR value by an integer.

4 Version information display
Display the version information of DF-2200 On-Board Flow Meter.

3.2 Display items on the measurement screen

After the startup screen is shown for a few seconds, it will change to the following measurement screen (DISP1). The measurement screen will change in the order of DISP1 → DISP2 → DISP3 → DISP1 →··· every time the DISP button is pressed.



5 Instantaneous flow rate display
Display the instantaneous flow rate by a numerical value.

6 Temperature sensor status display

Display	Description
No display	The condition is normal.
e	Detects a burnout, short circuit, or fault of the sensor, and displays e (error).

7 Temperature correction status display

Display	Description
t	Display t (temperature) when the temperature sensor is connected, and the sensor operates normally to correct the temperature.
e	Displays e (error) when temperature correction is not performed. The causes of this error could be a burnout, short circuit, or a fault of the sensor.

8 Key Lock Status
Displays whether key protection is valid/invalid. Nothing is displayed when key protection is invalid. Pressing the DISP button for 1 second or more will switch the key protection to valid, and display the mark ( ).

9 Total measurement status display
Displays the total measurement status

Display	Description
▶	Under integration
II	Integration display suspended
■	Integration suspended

10 Instantaneous flow rate unit display
Displays the unit of instantaneous flow rate

11 Total flow value display
Displays the integrated flow value by a numerical value.

12 Total flow unit display
Displays the units of total flow value.

13

Total time display
Displays the total time in s (seconds) units.

14 Pressure display
Displays the pressure in kPa numerical value units. Displays – – – – kPa when no signal is input from the pressure sensor.

15 Temperature display
Displays the temperature in °C units. Displays – – – – . – °C when no signal is input from the temperature sensor.

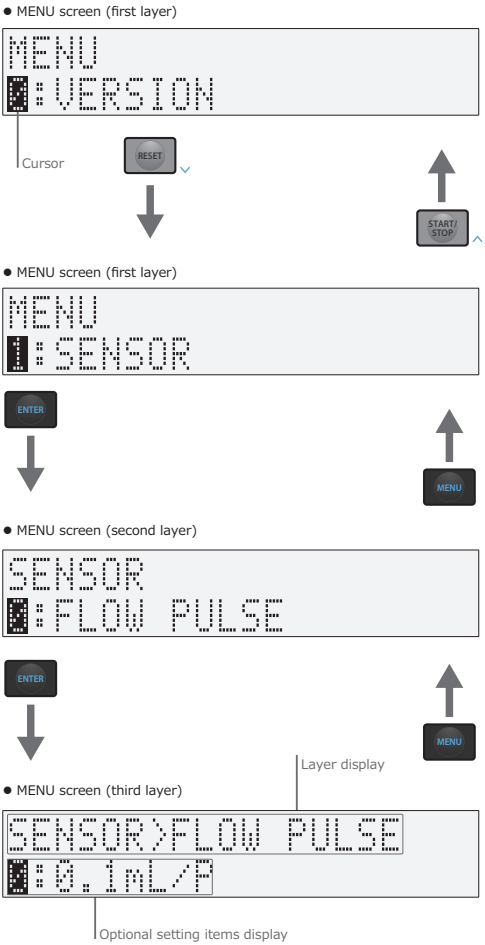
3.3 Display items on the menu screen

Pressing the MENU button will switch the mode to the menu mode, and change the measurement screen to the menu screen. To return to the measurement screen, press the MENU button again to change the mode to the measurement mode.

On the menu screen, screens for setting various conditions are stored. To set a condition, press the ENTER button until the screen where the condition to be set appears, and move to the lower layer, 1 layer at a time.

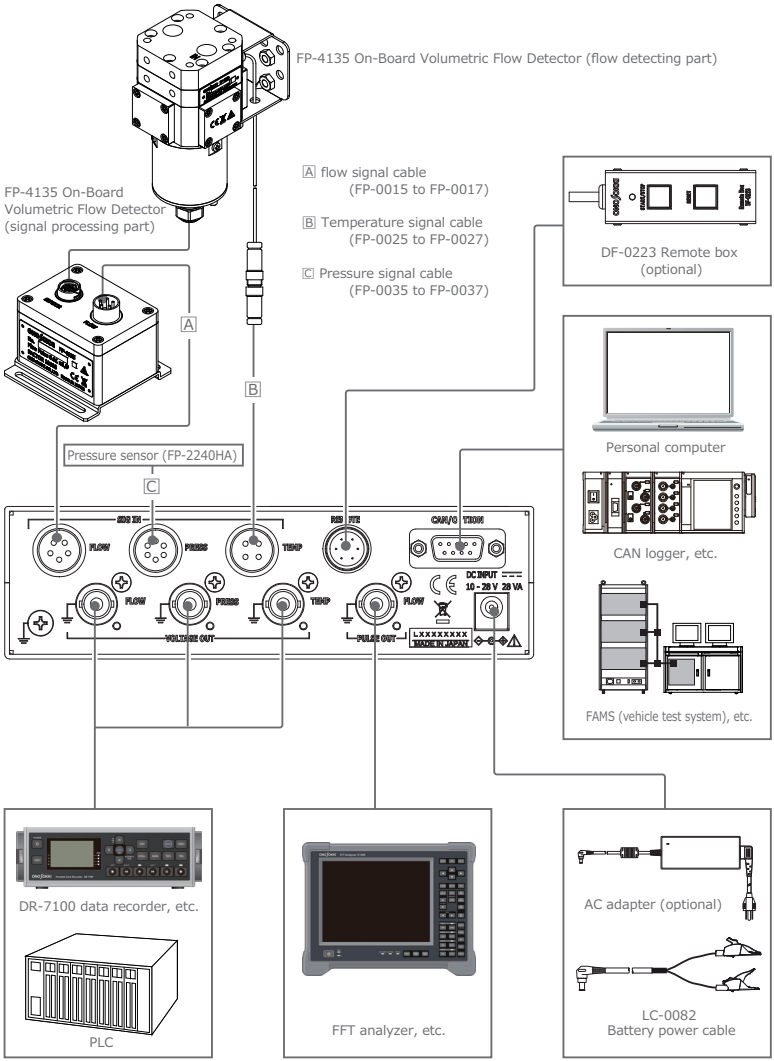
The layer which has been moved down, can be returned to an upper layer, one layer at a time by pressing the MENU button once for each layer.

Refer to “Setting Mode and Menu Reference” on page 39 for the details of the setting operation of the menu, and the details of each condition stored on the menu screen.



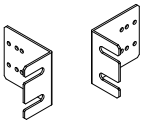
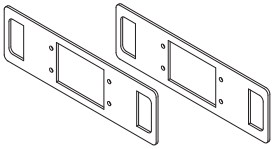
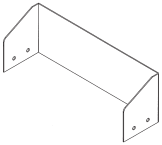
4. System configuration

4.1 DF-2200 measurement system configuration examples



4.2 DF-2200 options

The following are the options that are set for the DF-2200 On-Board Flow Meter.

Model	Name	Remarks
DF-0221	Auto stop function	
DF-0222	RS-232C Communication function	
DF-0223	Remote Box	
CT-0673	Panel mount fitting	Fixture for panels 
CT-0675	Protection handles	For on-board use 
CT-0676	Light shield	Blocks off outside light reflections such as reflected glares from lighting equipment 

CAUTION

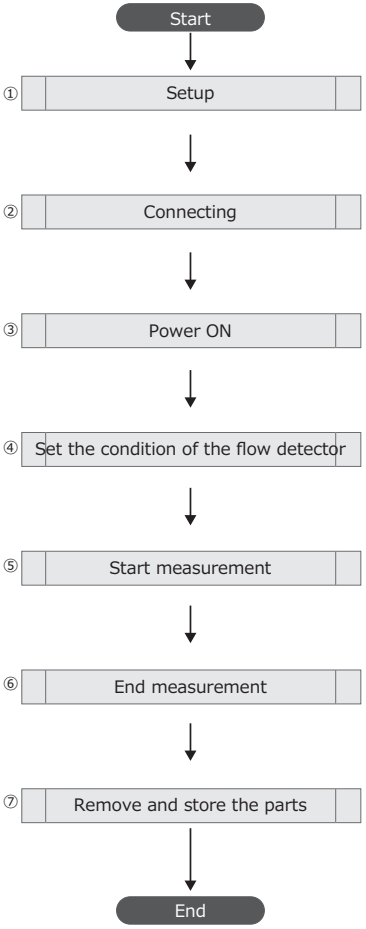
- For details of purchasing or installing the optional accessories, consult the nearest Ono Sokki sales office or the distributor where you purchased the product.

Chapter 2
Preparing DF-2200 and Measurement

1. Measurement procedure using DF-2200

1.1 Outline and features of DF-2200

The basic procedure from preparing the DF-2200 On-Board Flow Meter to performing measurement is shown below. Follow the steps below to prepare the DF-2200 On-Board Flow Meter and perform measurement.



- DF-2200 can be used by setting in three different ways as follows according to the application or purpose.

  Install/on-board/panel mounting on the desk

- Connect the devices with DF-2200 in the following order.
  ① Connect power
  ② Connect the flow detector
  ③ Connect the peripheral equipment for measurement

- When setting and connecting are completed, switch the power on for the peripheral equipment first, then for DF-2200.

- Set the condition of the connected flow detector on the menu screen displayed when the mode is switched to the setting mode.
  On the menu screen, other conditions can be set according to the purpose or object.

- Start measurement.

- End measurement.
  After completing the measurement, halt the measuring objects.

- After measurement, remove the connected parts from DF-2200 by the following order.
  ① Remove the power source
  ② Remove the flow detector
  ③ Remove the peripheral equipment for measurement

  Removed parts must be kept under the proper conditions including temperature and humidity.

2. From setup to measurement

Each step in the flowchart in “1. Measurement procedure using DF-2200” on page 22 is described in detail below.

2.1 Installation of DF-2200

The DF-2200 On-Board Flow Meter can be used in three ways (on a desktop, on board a vehicle, and installed on a panel), as shown below.

■ When using by laying on top of a table

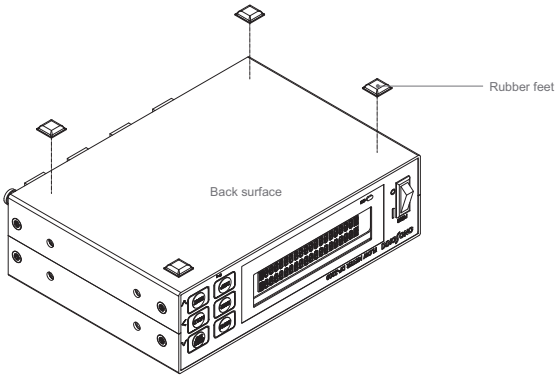
The supplied rubber feet prevent slip and vibration.

When using the DF-2200 On-Board Flow Meter by laying on top of a table, attach the four rubber feet to the bottom of the main unit, as shown below.

1 Turn over the DF-2200 On-Board Flow Meter and remove oil, moisture, dust and dirt from the surfaces where the rubber feet are to be attached.

2 Peel the rubber feet from the adhesive strip and attach them to the bottom of the DF-2200 On-Board Flow Meter.
After attaching them, press hard with your thumb.

3 Check that the rubber feet are firmly attached.



CAUTION

- Adhesive force will reduce if you touch the adhesive surface of the rubber feet or if you reattach them repeatedly. Reduced adhesive force may cause the rubber feet to come off.
If the adhesive force has reduced, please purchase new rubber feet. When purchasing new rubber feet, contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

■ When using on board the vehicle

CAUTION

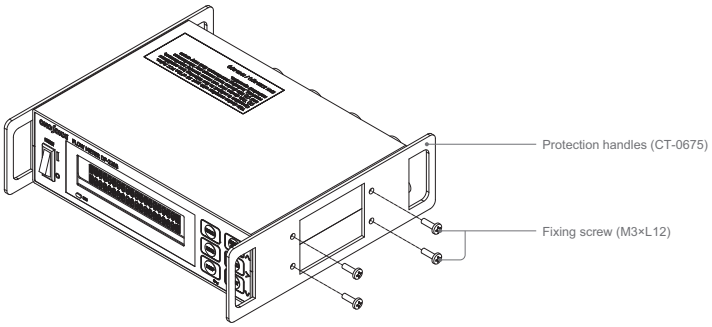
- Do not use the DF-2200 main unit on a dashboard. If you use the DF-2200 main unit on a dashboard, it may drop during driving, resulting in injury or equipment damage.
When using the DF-2200 main unit on board a vehicle, install it on the passenger seat by referring to the illustrations and procedure shown below.

CAUTION

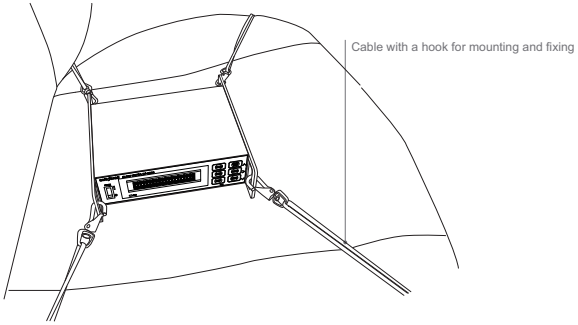
- Please purchase the optional CT-0675 Protection handles if you use the unit on board a vehicle. For information on optional accessories or installation, consult the nearest Ono Sokki sales office or the distributor where you purchased the product.
  Also use cables with hooks to secure the DF-2200 main unit on board a vehicle.

Install the DF-2200 On-Board Flow Meter on the passenger seat by referring to the illustrations and procedure shown below.

1 Install the optional CT-0675 Protection handles on the DF-2200 On-Board Flow Meter.
Secure the optional CT-0675 Protection handles using the supplied screws on the option installation screw holes on the right and left sides of the DF-2200 On-Board Flow Meter.



2 Secure the DF-2200 On-Board Flow Meter on the passenger seat of the vehicle where the unit is installed.
Connect the cables with hooks to the CT-0675 Protection handles, then pull the cables to the right and left sides of the seat to firmly secure the unit so that it will not move suddenly.



CAUTION

- To conduct measurement on public roads with a vehicle equipped with the DF-2200 On-Board Flow Meter, you may require a permission from the local police or authorities concerned. For details, contact your local police station.

When using by attaching to a panel

CAUTION

- You are required to purchase the optional CT-0673 Panel mount fitting if you use the unit on a panel such as a control panel.
  For information on optional accessories or installation, consult the nearest Ono Sokki sales office or the distributor where you purchased the product.

Install the DF-2200 On-Board Flow Meter on the panel by referring to the illustration and procedure shown below.

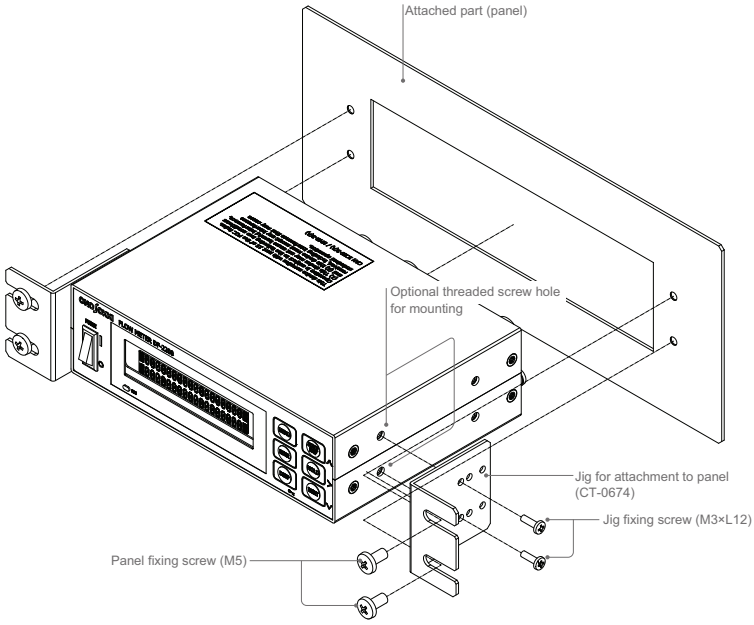
1 Install the optional CT-0673 Panel mount fitting on the DF-2200 On-Board Flow Meter.
Secure the optional CT-0673 Panel mount fitting using the supplied screws on the option installation screw holes on the sides of the DF-2200 On-Board Flow Meter.

Each of the CT-0673 Panel mount fitting has fixing screw holes in three locations. Use the holes in the location that allows the unit to be installed in the best position on the panel.

Use the supplied screws (M3 x L12) to secure the CT-0673 Panel mount fitting. Do not use long screws, which may damage internal components. Make sure that the screw-in depth does not exceed 10 mm.

2 Insert the DF-2200 On-Board Flow Meter into the hole in the panel.
Insert the DF-2200 On-Board Flow Meter main unit, starting from the rear panel, into the panel hole.

3 Secure the DF-2200 On-Board Flow Meter to the panel.
Secure the DF-2200 On-Board Flow Meter with the CT-0673 Panel mount fitting to the panel using the supplied panel fixing screws (M5). The tightening torque for the panel fixing screws (M5) is 0.49 to 0.69 N·m.



2.2 Connecting the power source

First, connect the power source. Either a battery or the optional AC adapter can be used to supply power to the DF-2200 On-Board Flow Meter.

When using a battery

- It may be difficulty to use a battery depending on its position in your vehicle. Be sure to check the battery position before use by referring to the vehicle' s instruction manual. To avoid contingencies, never leave the vehicle in which the unit is installed during use.
- Be very careful to ensure connection in a correct polarity (⊕ and ⊖) of the battery. Connecting in a wrong polarity may cause damage to the internal circuit.
- Carefully run the power cable so that it will not be caught by the fan belt or pulleys.
- Batteries of 12 to 24 V are supported. To use the unit with a voltage lower than 12 V or higher than 24 V, consult the nearest Ono Sokki sales office or the distributor where you purchased the product.

● Connecting power from the battery

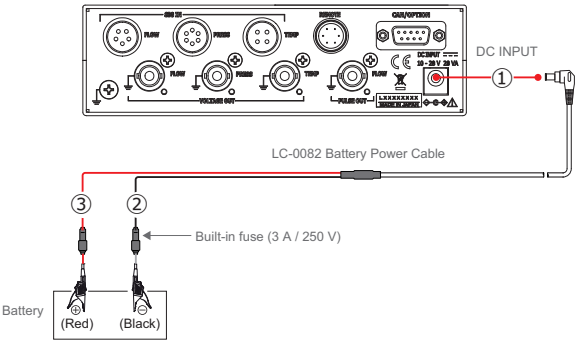
If power is supplied from a battery, use the supplied LC-0082 Battery Power Cable.

Connect the power cable to the battery as shown below.

1 Check that the [POWER] switch of the DF-2200 On-Board Flow Meter is in the OFF (○) position.

2 Connect the battery.
First, securely insert the plug of the supplied LC-0082 Battery Power Cable into the power connector (DC INPUT) provided on the rear panel of the DF-2200 On-Board Flow Meter.

Then, connect the black end of the LC-0082 Battery Power Cable to the pole ⊖ and the red end of the LC-0082 Battery Power Cable to the pole ⊕ of the battery terminal, respectively.



When using the AC adapter

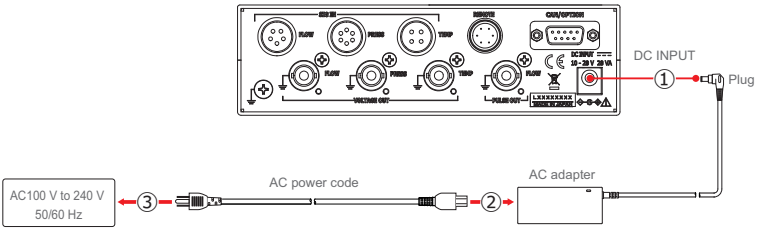
- Make sure to use the specified AC adapter (PS-P20023A) and power cord. Using an AC adapter other than the specified one may cause fire or electric shock.
- The specified AC adapter (PS-P20023A) must be operated within the rated voltage range. The power supply voltage for the AC adapter is in the range of 100 to 240 VAC (50/60 Hz). Using a power source other than the specified one may cause fire or electric shock.
- The power cord supplied with the specified AC adapter (PS-P20023A) can withstand voltage of up to 125 V. It cannot be used for voltage higher than 125 V.
  If you use a voltage higher than 125 V, consult the nearest Ono Sokki sales office or the distributor where you purchased the product.

Connect the optional AC adapter as shown below.

1 Check that the [POWER] switch of the DF-2200 On-Board Flow Meter is in the OFF (○) position.

2 Connect the AC adapter.
Securely insert the AC adapter plug into the power connector (DC INPUT) provided on the rear panel of the DF-2200 On-Board Flow Meter.

Next, connect the AC power cord to the AC adapter, then insert the power plug into the triplex AC power outlet (100 to 240 VAC).



2.3 Installing and connecting a flow detector

The following flow detectors from Ono Sokki can be connected to the DF-2200 On-Board Flow Meter.

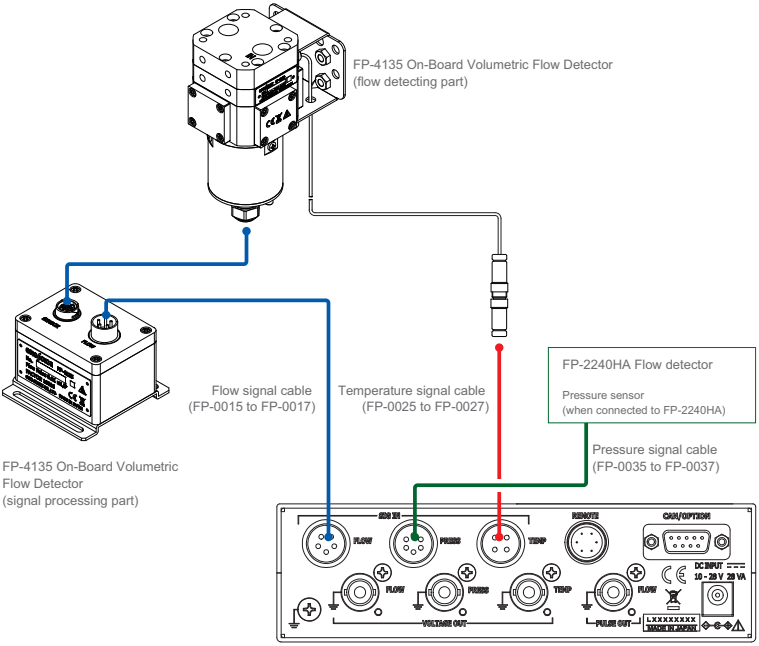
Model	Type	Measured item		
		Flow rate	Temperature	Pressure
FP-4135	On-board/wide range/simultaneous temperature measurement type	○	○	-
FP-2140S	Wide range/low pressure loss/high resolution type	○	-	-
FP-213	Small flow rate/high resolution type	○	-	-
FP-213S	Small flow rate/low pressure loss/high resolution type	○	-	-
FP-2140H	Standard flow rate type	○	-	-
FP-2240HA	Standard flow rate/simultaneous pressure and temperature measurement type	○	○	○
FP-3130/3132	Small flow rate/high resolution/ explosion-proof type	○	-	-
FP-3130S/3132S	Small flow rate/high resolution/internal pressure explosion-proof type	○	-	-
FP-3140/3142	Standard flow rate/explosion-proof type	○	-	-

CAUTION

- The installation methods for the DF-2200 On-Board Flow Meter and measurement target vary depending on the flow detector to be used. There can be various installation methods other than those shown in this manual depending on the measurement target.
For details, refer to the instruction manual supplied with your flow detector, or contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

■ Configuration diagram of a flow detector to the DF-2200

Referring to the illustration below, connect the cable (for flow rate/pressure/temperature) from the flow detector installed on the measurement target to the SIG IN (FLOW/PRESS/TEMP) connector on the rear panel of the DF-2200 On-Board Flow Meter.



■ Connecting cables

CAUTION

- The signal cables or BNC cables shown below are not supplied with the product. These cables need to be purchased separately. When purchasing any of these cables, consult the nearest Ono Sokki sales office or the distributor where you purchased the product.
- For details on the cables for connecting the DF-2200 On-Board Flow Meter and flow detectors, refer to Ono Sokki FP Series catalog, visit our Web site (https://www.onosokki.co.jp), or contact the nearest Ono Sokki sales office or the distributor where you purchased the product.
- Of the flow detectors that work with the DF-2200 On-Board Flow Meter, the FP-4135 and FP-2240HA are capable of temperature measurement. The FP-2240HA allows pressure measurement.

● Connecting the flow signal cable

Use the following flow signal cables to connect the flow detector to the FLOW connector on the rear panel of the DF-2200 On-Board Flow Meter.

Flow detector model	Flow signal cable (optional)
FP-4135/FP-2140S	FP-0015 (5 m)
	FP-0016 (10 m)
	FP-0017 (20 m)
Other than above	FP-0011 (5 m)
	FP-0012 (10 m)
	FP-0014 (20 m)

● **Connecting the temperature signal cable**

Use the following temperature signal cables to connect the flow detector to the TEMP connector on the rear panel of the DF-2200 On-Board Flow Meter.

Flow detector model	Temperature signal cable (optional)
FP-4135/2240HA	FP-0025 (5 m)
	FP-0026 (10 m)
	FP-0027 (20 m)

● **Connecting the pressure signal cable**

Use the following pressure signal cables to connect the flow detector to the PRESS connector on the rear panel of the DF-2200 On-Board Flow Meter.

Flow detector model	Pressure signal cable (optional)
FP-2240HA	FP-0035 (5 m)
	FP-0036 (10 m)
	FP-0037 (20 m)

● **Connecting the voltage output cable**

Connect BNC cables (optional) to the FLOW/PRESS/TEMP connectors (VOLTAGE OUT) on the rear panel of the DF-2200 On-Board Flow Meter as required.

● **Connecting the pulse output cable**

Connect a BNC cable (optional) to the PULSE-OUT connector on the rear panel of the DF-2200 On-Board Flow Meter as required.

Connectors

● **SIG IN (FLOW) connector**

Connector	RM12BRD-5PH		
	 **FLOW**		
	Connector pin assignment	Pin No.	Signal
		1	SIG A
		2	SIG B
		3	COM
		4	Shield
		5	+12 VDC power
Flow signal cable	Other than FP-4135/FP-2140S	FP-0011 (5m)/FP-0012 (10 m)/FP-0014 (20 m)	
	FP-4135/FP-2140S	FP-0015 (5 m)/FP-0016 (10 m)/FP-0017 (20 m)	

● **SIG IN (PRESS) connector**

Applicable sensor	FP101-B31-CN0A/V1/Z (Yokogawa Electric Corporation)
Input type	Voltage signal
Input impedance	Approx. 10 k Ω
Input signal amplitude range	0.0 to +5.0 V
Power supply	+15 V ± 5%
Maximum supply current	20 mA
Applicable connector	RM12BRD-6PH

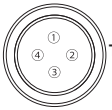
PRESS

Connector pin assignment	Pin No.	Signal
	1	+15 VDC power
	2	SIG
	3	COM
	4	COM
	5	NC
	6	NC

Pressure signal cable	FP-0035 (5 m) / FP-0036 (10 m) / FP-0037 (20 m)
Input linearity	0.5 %/F.S.

● **SIG IN (TEMP) connector**

Applicable temperature sensor	Resistance temperature detectors (Pt100) Bridge three-wire system
Guaranteed input temperature range	-50 to 100 ° C
Applicable connector	RM12BRD-4PH



TEMP

Connector pin assignment	Pin No.	Signal
	1	Pt100 SIG
	2	Pt100 SIG
	3	Pt100 COMP (Corrects errors generated by lead resistance)
	4	COM shield

Temperature signal cable	FP-0025 (5 m) / FP-0026 (10 m) / FP-0027 (20 m)
Input linearity	0.5 % /F.S.

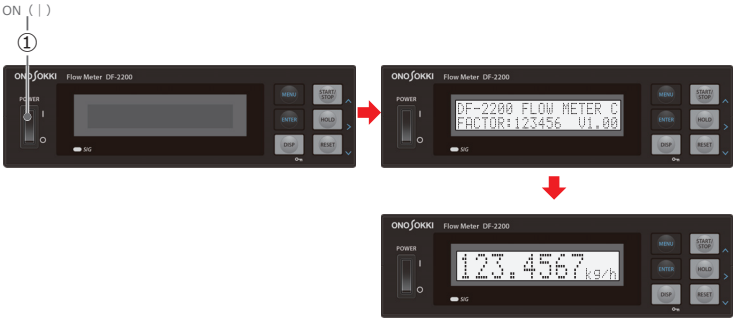
2.4 Powering on

When the setup of the DF-2200 On-Board Flow Meter and connections are complete, turn on the power as follows.

1 Power up the peripheral equipment.

2 Set the [POWER] switch of the DF-2200 On-Board Flow Meter from the OFF (○) to ON (|) positions.
When the unit is switched on, the startup screen is displayed for a few seconds, then Measurement Mode is started and the measurement screen (DISP1) is displayed on the display unit.

3 Power up the target to be measured.



2.5 Setting measurement conditions

Set measurement conditions (SENSOR) for the connected flow detector on the menu screen which is switched by pressing the [MENU] button. Next, set other conditions according to your application and purpose as necessary.

CAUTION

- The setting items [7: CAN-OUT], [8: AUTO STOP] and [9: RS232C] may not be displayed depending on the availability of the options and option settings.
  If the setting items for options are not displayed, the prefix numbers (7, 8, 9) of the setting items differ from those shown in this manual.

■ Setting the conditions for detectors and sensors

Set the conditions (SENSOR) for the connected detectors and sensors as follows.

1 Press the [MENU] button to enter the Setting Mode.
When the Setting Mode is entered, the measurement screen changes to the menu screen.
In menu screen, each time you press the ∧ (upward) button, the setting item changes in the order of 0: VERSION → 1: SENSOR → 2: DENS → 3: V-OUT → 4: P-OUT → 5: CAL → 6: DISPLAY → 7: CAN-OUT → 8: AUTO STOP (Option) → 9: RS232C (Option) → 0: VERSION →…

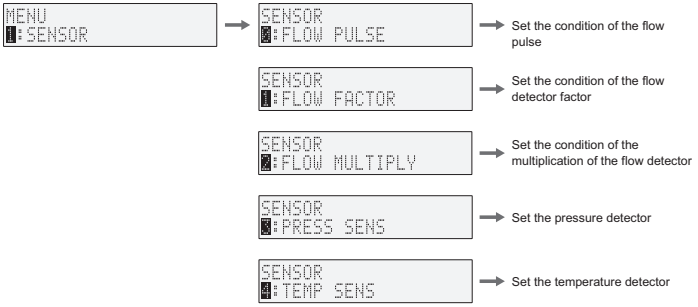
2 Select the detector/sensor setting (1: SENSOR).
Press the ∧ (upward) button to select “1: SENSOR” , then press the [ENTER] button to confirm the selection of flow detector setup.

There are 5 setting items for flow detectors. Each time you press the ∧ (upward) button, the setting item changes in the order of 0: FLOW PULSE → 1: FLOW FACTOR → 2: FLOW MULTIPLY → 3: PRESS SENS → 4: TEMP SENS → 0: FLOW PULSE →···

3 Set the conditions for the detectors and sensors.
Set 5 items (0 to 4) for the detectors and sensors.

For details on each condition setting item, refer to "2.3 SENSOR: set the connection detector" on page 45.

4 Return to the Measurement Mode.
Press the [MENU] button to return from the Setting Mode to the Measurement Mode. The menu screen changes to the measurement screen.



Setting the temperature correction for density

To measure mass flow rate, the temperature correction conditions for density values need to be set.

1 Press the [MENU] button to enter the Setting Mode.

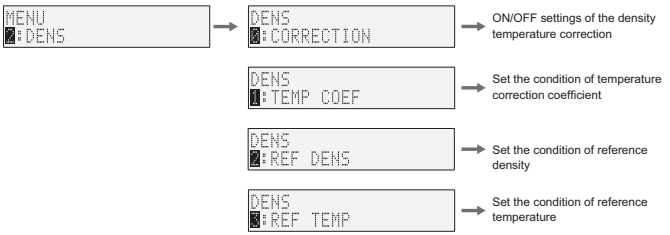
2 Select the temperature correction setting for density (2: DENS).
Press the ∧ (upward) button to select "2: DENS" , then press the [ENTER] button to confirm the selection of the setup of temperature correction for density setup.

There are four setting items (0 to 3) for temperature correction for density. Each time you press the ∧ (upward) button, the setting item changes in the order of 0: CORRECTION → 1: TEMP COEF → 2: REF DENS → 3: REF TEMP → 0: CORRECTION →···

3 Set the conditions for temperature correction for density.
Set four items for temperature correction for density.

For details on each condition setting item, refer to "2.4 DENS: sets the temperature density correction" on page 47.

4 Return to the Measurement Mode.
Press the [MENU] button to return from the Setting Mode to the Measurement Mode. The menu screen changes to the measurement screen.

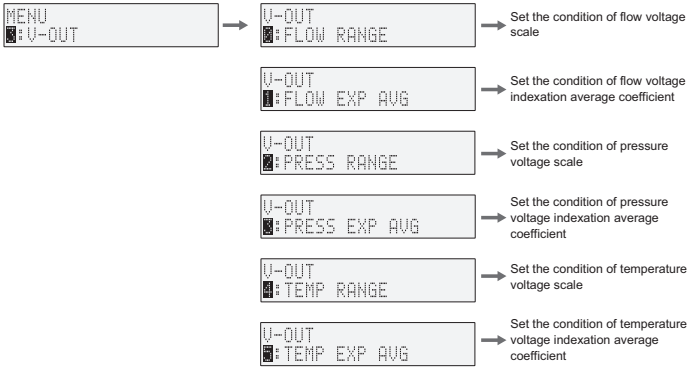


Setting the analog output conditions

To use analog output of measurements, the conditions for analog output need to be set.

1. Press the [MENU] button to enter the Setting Mode.
2. Select the detector/sensor setting (3: V-OUT).
   Press the ∧ (upward) button to select “3: V-OUT” , then press the [ENTER] button to confirm the selection of analog output setup.

   There are six setting items (0 to 5) for analog output. Each time you press the ∧ (upward) button, the setting item changes in the order of 0: FLOW RANGE → 1: FLOW EXP AVG → 2: PRESS RANGE → 3: PRESS EXP ANG → 4: TEMP RANGE → 5: TEMP EXP AVG → 0: FLOW RANGE →…
3. Set the conditions for analog output.
   Set six items for analog output. For details on each condition setting item, refer to “2.5 V-OUT: set the analog output” on page 49.
4. Return to the Measurement Mode.
   Press the [MENU] button to return from the Setting Mode to the Measurement Mode. The menu screen changes to the measurement screen.



Setting the pulse output conditions

To use pulse output of flow rate, the conditions for pulse output need to be set.

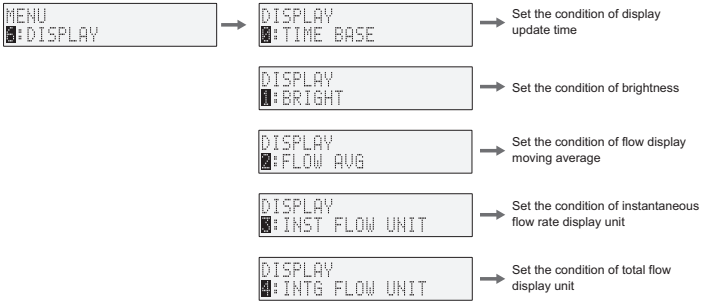
1. Press the [MENU] button to enter the Setting Mode.
2. Select the pulse output setting (4: P-OUT).
   Press the ∧ (upward) button to select “4: P-OUT” , then press the ENTER button to confirm the selection of pulse output. There is one setting item (0: FLOW) for pulse output.
3. Set the conditions for pulse output .
   Set one item (0: FLOW) for pulse output.

   For details on each condition setting item, refer to “2.6 P-OUT: set the pulse output” on page 51.
4. Return to the Measurement Mode.
   Press the [MENU] button to return from the Setting Mode to the Measurement Mode. The menu screen changes to the measurement screen.

Setting the display conditions of the fluorescent display tube

To change the display items, etc. of the fluorescent display tube, display conditions of the tube need to be set.

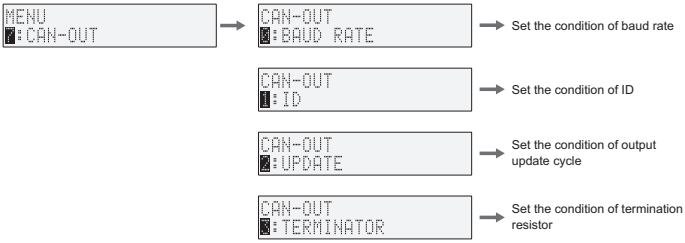
1. Press the [MENU] button to enter the Setting Mode.
2. Select the display setting for the fluorescent display tube (6: DISPLAY).
   Press the ∧ (upward) button to select “6: DISPLAY” , then press the ENTER button to confirm the selection of fluorescent display tube.
   There are five setting items (0 to 4) for fluorescent display tube. Each time you press the ∧ (upward) button, the setting item changes in the order of 0: TIME BASE → 1: BRIGHT → 2: FLOW AVG → 3: INST FLOW UNIT → 4: INTG FLOW UNIT → 0: TIME BASE →···
3. Set the display conditions of the fluorescent display tube.
   Set five items for the fluorescent display tube.
   For details on each condition setting item, refer to “2.8 DISPLAY: set the display conditions of the fluorescent display tube” on page 52.
4. Return to the Measurement Mode.
   Press the [MENU] button to return from the Setting Mode to the Measurement Mode. The menu screen changes to the measurement screen.



Setting the CAN output conditions

To use CAN output of measurements, the conditions for CAN output need to be set.

1. Press the [MENU] button to enter the Setting Mode.
2. Select the CAN output setting (7: CAN-OUT).
   Press the ∧ (upward) button to select “7: CAN-OUT” , then press the [ENTER] button to confirm the selection of CAN output.
   There are four setting items (0 to 3) for CAN output. Each time you press the ∧ (upward) button, the setting item changes in the order of 0: BAUD RATE → 1: ID → 2: UPDATE → 3: TERMINATOR → 0: BAUD RATE →···
3. Set the conditions for CAN output.
   Set four items for the CAN display settings.
   For details on each condition setting item, refer to “2.9 CAN-OUT: set the CAN output conditions” on page 55.
4. Return to the Measurement Mode.
   Press the [MENU] button to return from the Setting Mode to the Measurement Mode. The menu screen changes to the measurement screen.



Setting the auto stop conditions

CAUTION

- The auto stop setting (8: AUTO STOP) is effective when this option is used. For purchase or details of options, contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

To use the Auto Stop Function in total flow measurement, the conditions for auto stop need to be set.

1 Press the [MENU] button to enter the Setting Mode.

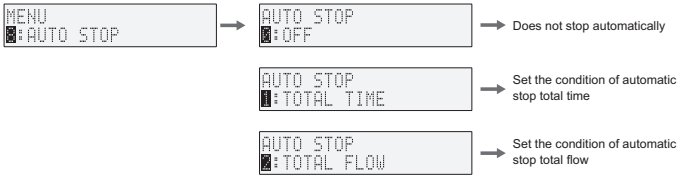
2 Select the auto stop setting (8: AUTO STOP).
Press the ∧ (upward) button to select "8: AUTO STOP" , then press the [ENTER] button to confirm the selection of auto stop setup.

There are three setting items (0 to 2) for auto stop. Each time you press the ∧ (upward) button, the setting item changes in the order of 0: OFF → 1: TOTAL TIME → 2: TOTAL FLOW → 0: OFF →…

3 Set the conditions for auto stop.
Set three items for auto stop.

For details on each condition setting item, refer to "2.10 AUTO STOP: set the conditions for auto stop" on page 56.

4 Return to the Measurement Mode.
Press the [MENU] button to return from the Setting Mode to the Measurement Mode. The menu screen changes to the measurement screen.



Setting the RS-232C interface conditions

CAUTION

- The RS-232C interface setting (9: RS232C) is effective when this option is used.
For purchase or details of options, contact the nearest Ono Sokki sales office or the distributor where you purchased the product.

To use the RS-232C Communication Function, the conditions for the RS-232C interface need to be set.

1 Press the [MENU] button to enter the Setting Mode.

2 Select the RS-232C setting (9: RS232C).
Press the ∧ (upward) button to select "9: RS232C" , then press the [ENTER] button to confirm the selection of RS-232C interface setup.
There is one setting item (0: BAUD RATE) for RS-232C interface.

3 Set the conditions for RS-232C interface.
For details on each condition setting item, refer to "2.11 RS232C: set the conditions for the RS-232C interface" on page 58.

4 Return to the Measurement Mode.
Press the [MENU] button to return from the Setting Mode to the Measurement Mode. The menu screen changes to the measurement screen.

2.6 Start and end of measurement

■ Measurement items

The measurement items for the DF-2200 On-Board Flow Meter are shown below.

Measurement item	Unit
Instantaneous Flow Rate	[L/h], [kg/h]
Total Flow	[mL], [g]
Instant Temperature	[° C]
Instant Pressure	[kPa]
Total Time	[s]

■ Controlling integration operation with buttons

On the DF-2200 On-Board Flow Meter, the [START/STOP], [HOLD] and [RESET] buttons are used to control integration operation.

● **Limitations**

State	Limitation
Reset state	The [HOLD] and [RESET] buttons are disabled.
Start (measurement) state	The [RESET] button is disabled.
Hold state	The [RESET] button is disabled.
Stop state	The [HOLD] button is disabled.

START/STOP button

State	Operation
Reset state	When you press the [START/STOP] button, integration operation starts to enter the measurement state. • When the measurement state is entered, the measurement mark (▶) is displayed on the display unit.
Start (measurement) state	When you press the [START/STOP] button, integration operation stops to enter the stop state, and data is stored at the same time. • When the stop state is entered, the stop mark (■) is displayed on the display unit.
Hold state	When you press the [START/STOP] button, integration operation stops to enter the hold (pause) state. • When the hold state is entered, the hold mark (❙❙) is displayed on the display unit.
Stop state	When you press the [START/STOP] button, integration operation restarts to return to the measurement state. • When the measurement state is returned, the measurement mark (▶) is displayed on the display unit.

HOLD button

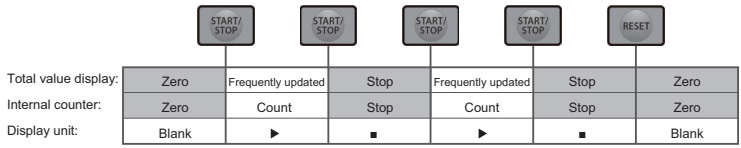
State	Operation
Start (measurement) state	When you press the [HOLD] button, display update stops to enter the hold state. • When the hold state is entered, the hold mark (❙❙) is displayed on the display unit.
Hold state	When you press the [HOLD] button again in the hold state, the value on the display unit is updated to the integrated value at the time when the [HOLD] button is pressed. However, the hold state continues. • The hold mark (❙❙) is displayed on the display unit while in the hold state.

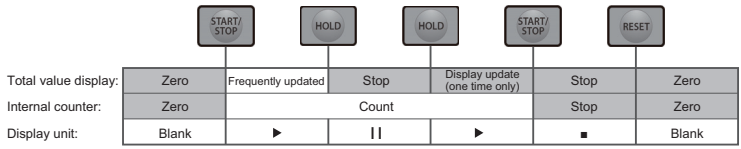
RESET button

State	Operation
Stop state	When you press the [RESET] button, the integrated value is set to zero to enter the reset state. • When the reset state is entered, the state indication mark on the display unit disappears.

● **Key operation and integration operation**

The relationship between the [START/STOP], [HOLD] and [RESET] key operation and the integration operation is shown below.





■ Start of measurement

When setup, connection and condition settings are all complete, follow the steps below to start measurement.

1 Enable key protection.
Enable key protection to prevent settings to be changed due to inadvertent button operation.
Pressing the > (right) button for more than 1 second enables key protection. The key protection mark ( ) is displayed to the lower right of the Measurement Mode.
When key protection is enabled, all buttons except the > (right) button are disabled.
Pressing the > (right) button again for more than 1 second releases key protection.

2 Start measurement.

■ End of measurement

When measurement is complete, follow the steps below to terminate measurement.

1 Stop running the measured equipment such as an engine or rotating object.
Power off the measured equipment such as an engine or rotating object as required.

2 Power off the peripheral equipment.

3 Turn off the [POWER] switch of the DF-2200 On-Board Flow Meter.
Set the [POWER] switch of the DF-2200 On-Board Flow Meter from the ON (|) to OFF (○) positions.

2.7 Removing and storing the parts

After terminating measurement, follow the steps below to disconnect and store the equipment.

■ ① Remove the power source

Follow the steps in “2.4 Powering on” on page 31 in reverse to remove the power source from the DF-2200 On-Board Flow Meter.

■ ② Remove the flow detector

First, remove the flow detector installed on the measurement target.

Next, remove the detector from the DF-2200 On-Board Flow Meter.

Store the removed detector and cables within the storage temperature and humidity ranges shown in the instruction manual supplied with the product.

■ ③ Remove the peripheral equipment

Remove the peripheral measurement equipment connected to the DF-2200 On-Board Flow Meter.

Store the removed peripheral measurement equipment and cables within the storage temperature and humidity ranges shown in the instruction manual supplied with the products.

Chapter 3
Setting Mode and Menu Reference

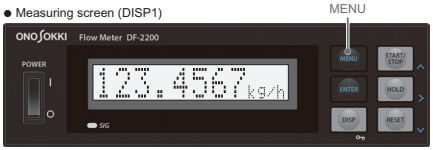
1. Outline of the setting mode

1.1 Switch to the setting mode

Pressing the MENU button after confirming that the total measurement state is under the reset state, switches the measurement mode to setting mode. When the mode is switched to the setting mode, the menu screen is shown.

Pressing the MENU button again switches the setting mode to the measurement mode, and the measurement screen is shown.

● Measuring screen (DISP1)



Caution! You can switch to the setting mode only when the total measurement condition is under the reset state.

● MENU screen (first layer)

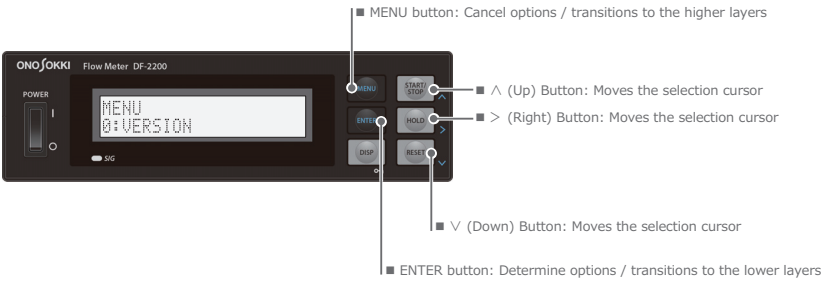
CAUTION

- If the conditions are changed in the setting mode, please wait for 3 seconds or more before turning OFF (○) the power.
  If the power is turned OFF (○) within 3 seconds after changing the condition, the change will not be reflected. Please be careful.

1.2 Basic operation of the conditions and numeric values in the setting mode

Under setting mode, some buttons become dedicated buttons for the setting mode.

The following are the dedicated buttons and functions (function are indicated on the lower right of the buttons) for the setting mode.



■ Changeover of settings conditions and confirmation operation

The operation to set the rated pressure of the pressure sensor at 500 kPa is explained below as an example.

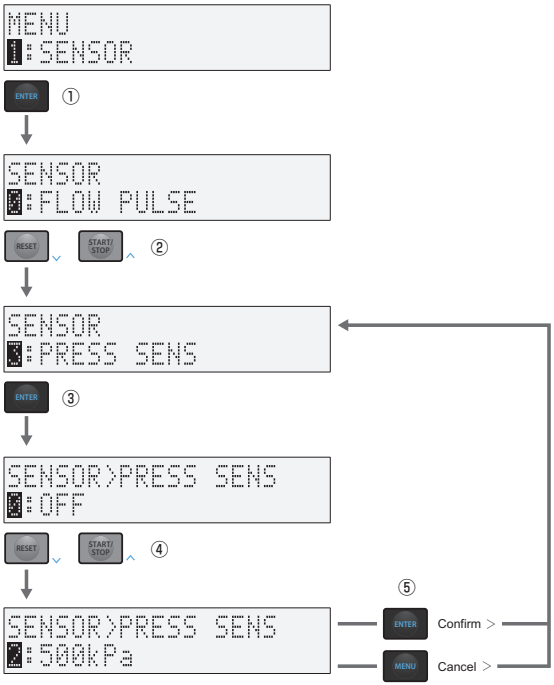
1 Switch to the conditions setting screen of the connection detector (SENSOR)
Keep pressing ∧ (upward) button or ∨ (downward) button until 1: SENSOR is displayed on the menu screen.

Pressing the ENTER button switches to the conditions setting screen of the connection detector (SENSOR).

2 Switch to the rated pressure settings screen of the pressure sensor (PRESS SENS).
Keep pressing the ∧ (upward) button or ∨ (downward) button until 3: PRESS SENS is displayed on the SENS screen. Pressing the ENTER button switches the screen to the rated pressure settings screen of the pressure sensor (PRESS SENS).

3 Set (Decide) the rated pressure of the pressure sensor at 500 kPa.
Keep pressing ∧ (upward) button or ∨ (downward) downward) button until 2: 500 kPa is displayed on the PRESS SENS screen.

Pressing the ENTER button sets the rated pressure of the pressure sensor to 500 kPa, and the screen returns to the SENS screen. Pressing MENU button cancels the setting, and the screen returns to the SENS screen.



■ Change the numeric values (increase and decrease) and confirm operation

An operation setting the reference temperature (REF TEMP) of the temperature density correction (DENS) from the default +20.0 to -10.0 is explained below as an example.

1 Switches to the condition settings screen for temperature density correction (DENS).
Keep pressing ∧ (upward) button or ∨ (downward) button until 2: DENS is displayed on the MENU screen.

Pressing the ENTER button switches the screen to the condition settings screen for temperature density correction (DENS).

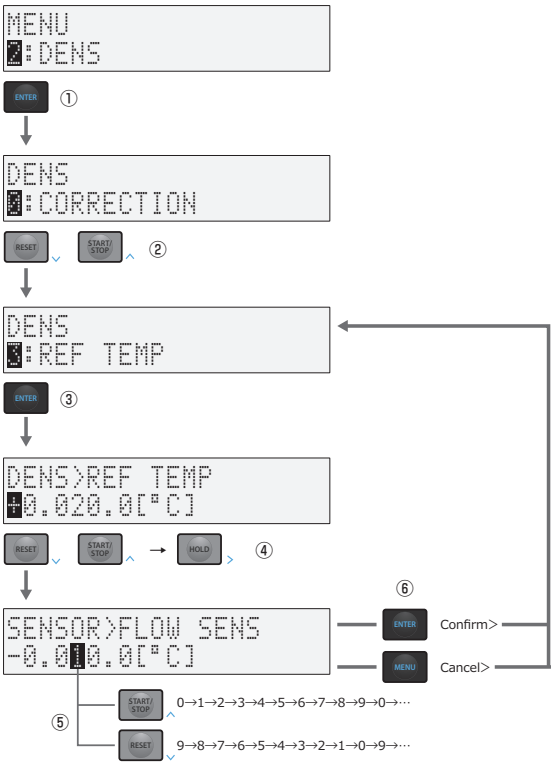
2 Switches to the settings screen for the reference temperature (REF TEMP).
Keep pressing the ∧ (upward) button or ∨ (downward) button until 3: REF TEMP is displayed on the DENS screen. Pressing the ENTER button switches the screen to the settings screen for the reference temperature (REF TEMP).

3 Set (Confirm) the reference temperature (REF TEMP) at -010.0.
Confirm that the selection cursor is placed on the mark at the left end.
The selection cursor moves towards the right when pressing the > (right) button. Once it reaches the right end, it moves toward the left end. Then, keep pressing the ∧ (upward) button or ∨ (downward) button until the mark changes to "-" .

Press the > (right) button to move the selection cursor to the multiples of 10 position.

Then, keep pressing th ∧ (upward) button or ∨ (downward) button until the value changes to 1.

Pressing the ENTER button sets the reference temperature (REF TEMP) to -010.0, and the screen returns the screen to the DENS screen. Pressing MENU button cancels the setting, and the screen returns to the DENS screen.



2. Menu reference

CAUTION

- The 3 items of the setting items [7: CAN-OUT], [8: AUTO STOP] and [9: RS232C] may not be displayed depending on the availability of the options and their combinations.
  If the setting items for the options are not displayed, the prefix numbers (7, 8, 9) of the setting items differ from those shown in this manual. Please be careful.

2.1 List of menu configurations

The followings are the list of settings stored in the menu screen of DF-2200 On-Board Flow Meter.

Item	Description		Reference
0: VERSION	Version display		Page 44
1: SENSOR	Set the connection detector		Page 45
	0: FLOW PULSE	Set the pulse conditions	Page 45
	1: FLOW FACTOR	Set the factor conditions	Page 46
	2: FLOW MULTIPLY	Set the multiplication conditions	Page 46
	3: PRESS SENS	Set the pressure sensor	Page 46
	4: TEMP SENS	Set the temperature sensor	Page 47
2: DENS	Set the conditions for temperature density correction		Page 47
	0: CORRECTION	ON/OFF settings for the temperature density correction	Page 48
	1: TEMP COEF	Set the condition of temperature correction coefficient	Page 48
	2: REF DENS	Set the reference density	Page 48
	3: REF TEMP	Set the reference temperature	Page 49
3: V-OUT	Set the analog output		Page 49
	0: FLOW RANGE	Set the flow range	Page 49
	1: FLOW EXP AVG	Set the flow voltage indexation average coefficient	Page 50
	2: PRESS RANGE	Set the pressure range	Page 50
	3: PRESS EXP AVG	Set the pressure voltage indexation average coefficient	Page 50
	4: TEMP RANGE	Set the temperature range	Page 51
	5: TEMP EXP AVG	Set the temperature voltage indexation average coefficient	Page 51
4: P-OUT	Set the pulse output		Page 51
	0: FLOW	Set the flow pulse output	Page 51
5: CAL	Set the calibration output		Page 52
	0: CAL-OUT	Set the voltage calibration signal output	Page 52

Item	Description		Reference
6: DISPLAY	Set the display conditions of the fluorescent display tube		Page 52
	0: TIME BASE	Set the display update time	Page 53
	1: BRIGHT	Set the condition of brightness	Page 53
	2: FLOW AVG	Set the condition of flow display moving average	Page 53
6: DISPLAY	3: INST FLOW UNIT	Set the condition of instantaneous flow rate display unit	Page 54
	4: INTG FLOW UNIT	Set the condition of total flow display unit	Page 54
7: CAN-OUT	Set the conditions of CAN output		Page 55
	0: BAUD RATE	Set the condition of baud rate	Page 55
	1: ID	Set the condition of ID	Page 55
	2: UPDATE	Set the condition of output update cycle	Page 55
	3: TERMINATOR	Set the condition of termination resistor	Page 56
8: AUTO STOP	Set the conditions of auto stop		Page 56
	0: OFF	Does not stop automatically	Page 56
	1: TOTAL TIME	Set the condition of automatic stop total time	Page 57
	2: TOTAL FLOW	Set the condition of automatic stop total flow	Page 57
9: RS232C	Set the conditions for the RS-232C Interface		Page 58
	0: BAUD RATE	Set the condition of baud rate	Page 58

2.2 VERSION: version display

Pressing ENTER button after selecting 0: VERSION under the setting mode switches to VERSION.

■ Display version information (0: VERSION)

On VERSION, the versions of DSP and FPGA are indicated. Not used normally.
Press the MENU button after confirming the version has returned to setting mode.

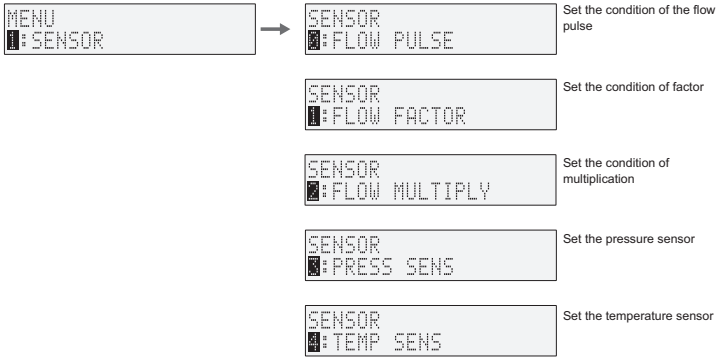
Item	Description
VERSION	• DSP Displays the version of the digital signal processor (DSP) installed on DSPDF-2200 On-Board Flow Meter. • FPGA Displays the version of the Field Programmable Gate Array (FPGA) installed on the FPGA DF-2200 On-Board Flow Meter.

2.3 SENSOR: set the connection detector

Pressing the ENTER button after displaying 1: SENSOR on the menu screen switches the screen to the condition setting screen of the connection detector (SENSOR).

On the SENSOR screen, the detailed set items of 0: FLOW RATE, 1: FLOW FACTOR, 2: FLOW MULTIPLY, 3: PRESS SENS, and 4: TEMP SENS are stored.

On the SENSOR screen, set the conditions of the FP-series Volumetric Flow Detector, pressure sensor, and temperature sensor that are connected to DF-2200 On-Board Flow Meter.



■ Set the condition of the flow pulse (0: FLOW PULSE)

Pressing the ENTER button after displaying 0: FLOW PULSE on the SENSOR screen switches to the condition setting screen of the flow pulse (FLOW PULSE).

Item	Description
FLOW PULSE	Switch the pulse count of the flow sensor to either [0: 0.1 mL/P] [1: 0.01 mL/P], or [2: 0.001 mL/P]. Default value is 0: 0.1 mL/P.

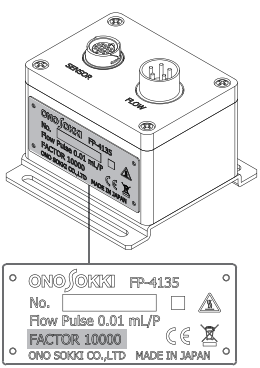
Refer to the following chart regarding the combination of the detector specifications and the condition of the flow pulse to be set.

Model	Encoder pulse	Flow pulse
FP-4135	-	1: 0.01 mL/P
FP-213/213S	120 P/R	1: 0.01 mL/P
	1200 P/R	2: 0.001 mL/P
FP-2140H/2240HA	120 P/R	0: 0.1 mL/P
	1200 P/R	1: 0.01 mL/P
FP-2140S	1440 P/R	1: 0.01 mL/P
FP-3130/3130S	120 P/R	1: 0.01 mL/P
FP-3132/3132S	1200 P/R	2: 0.001 mL/P
FP-3140	120 P/R	0: 0.1 mL/P
FP-3142	1200 P/R	1: 0.01 mL/P

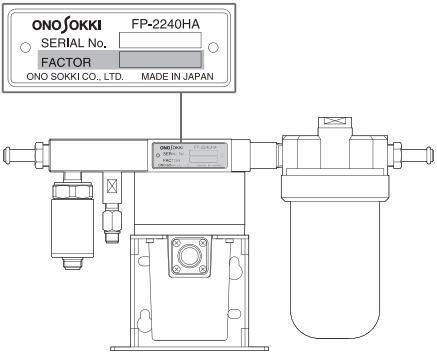
Set the condition of the flow detector factor (1: FLOW FACTOR)

Pressing the ENTER button after displaying 1: FLOW FACTOR on the SENSOR screen switches the screen to the condition setting screen of the flow detector factor.

Item	Description
FLOW FACTOR	Set the factor of the flow detector within the range of 1000 to 100000. Default value is 10000. • Set the value referring to the nameplate (FACTOR) of the flow detector.



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



For FP-2000/200 Series
Volumetric Flow Detector

Set the conditions of the multiplication of flow detector (2: FLOW MULTIPLY)

Pressing the ENTER button after displaying 2: FLOW MULTIPLY on the SENSOR screen switches the screen to the condition setting of the flow detector multiplication (FLOW MULTIPLY).

Item	Description
FLOW MULTIPLY	Switch the multiplication set value of the flow detector to [0: *1] or [1: *10]. Default value is 0: *1. • By setting at *10, the calculation with the pulse multiplied by 10 against the flow meter encoder pulse inside the counter is performed. There, one digit is added to the digit of displayed decimal points.

Set the pressure sensor (3: PRESS SENS)

Pressing the ENTER button after displaying 3: PRESS SENS on the SENSOR screen switches the screen to the condition setting screen of the pressure sensor (PRESS SENS).

Item	Description
PRESS SENS	Switch the rated pressure of the pressure sensor to either [0: OFF], [1: 200kPa], [2: 500kPa], [3: 1000kPa], or [4: 980kPa]. Default value is 4: 980kPa.

CAUTION

- Measurement of pressure is valid when the flow detector connected to DF-2200 On-Board Flow Meter is FP-2240HA.
- For measuring pressure, please use the designated pressure sensor. Connecting a pressure sensor other than the designated sensors may cause an error in measuring. Please be careful.

■ Set the temperature sensor (4: TEMP SENS)

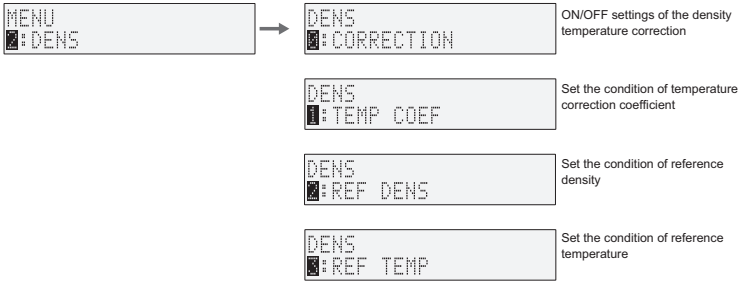
Pressing the ENTER button after displaying 4: TEMP SENS on the SENSOR screen switches the screen to the condition setting screen of the temperature sensor (4: TEMP SEN)

Item	Description
TEMP SENS	Switch the type name of the temperature sensor to [0: OFF] or [1: PT100]. Default value is 0: OFF.

2.4 DENS: sets the temperature density correction

Pressing the ENTER button after displaying 2: DENS on the menu screen switches the screen to the condition setting screen for the temperature density correction (DENS).

On the SENSOR screen, the detailed set items of 0: CORRECTION, 1: TEMP COEF, 2: REF DENS, and 3: REF TEMP are stored.



● Calculate the temperature density correction

Mass flow rate which is temperature corrected against the density can be obtained when the mass flow rate is calculated from the volumetric flow based on our FP-series Volumetric Flow Detector and the set density value.

Instantaneous mass flow rate [*kg/h*] = Instantaneous volumetric flow [*L/h*] $\times \rho_T$

ρ_T is the temperature corrected density, and obtained through the formula below.

- When the temperature sensor is valid, the condition of the temperature detector ("Set the temperature sensor (4: TEMP SENS)" on page 47) is set at 1: PT100.

$$\rho_T = \rho_{T0} \times [1 - K \times (T - T_0)]$$

ρ_{T0} Reference density [g/cm^3] 2: Set at REF DENS

K Temperature correction coefficient [$1/°C$] 1: Set at TEMP COEF

T Measured temperature [°C] Use the temperature measured by the temperature detector

T_0 Reference temperature [°C] 3: Set at REF TEMP

- When the temperature sensor is invalid, the condition of the temperature detector ("Set the temperature sensor (4: TEMP SENS)" on page 47) is set at 0: OFF.

$$\rho_T = \rho_{T0}$$

ρ_{T0} Reference density [g/cm^3] 2: Set at REF DENS

■ ON/OFF settings for temperature density correction (0: CORRECTION)

Pressing ENTER button after displaying 0: CORRECTION on the DENS screen switches the screen to the screen for setting the ON/OFF condition of the temperature density correction (CORRECTION).

Item	Description
CORRECTION	Switch the temperature density correction function to OFF (not use) or ON (use). Default value is 0: OFF.

■ Set the temperature correction coefficient (1: TEMP COEF)

Pressing the ENTER button after displaying 1: TEMP COEF on the DENS screen switches the screen to the screen setting the condition for the temperature correction coefficient (TEMP COEF).

Item	Description
TEMP COEF	Set the temperature correction coefficient (coefficient of the correction value against the change in temperature) K within the range of 0.00001 [$1/$ ℃] to 0.00999 [$1/$℃]. Default value is 0.00100 [$1/$℃].

■ Set the reference density (2: REF DENS)

Pressing the ENTER button after displaying 2: REF DENS on the DENS screen switches the screen to the screen setting the conditions for the reference density (REF DENS).

Item	Description
REF DENS	Set the reference density ρ_{T0} within the range of 0.0001 [g/cm^3] to 9.9999 [g/cm^3]. Default value is 1.0000 [g/cm^3].

■ Set the reference temperature (3: REF TEMP)

Pressing the ENTER button after displaying 3: REF TEMP on the DENS screen switches the screen to the screen setting the conditions for the reference temperature (REF TEMP).

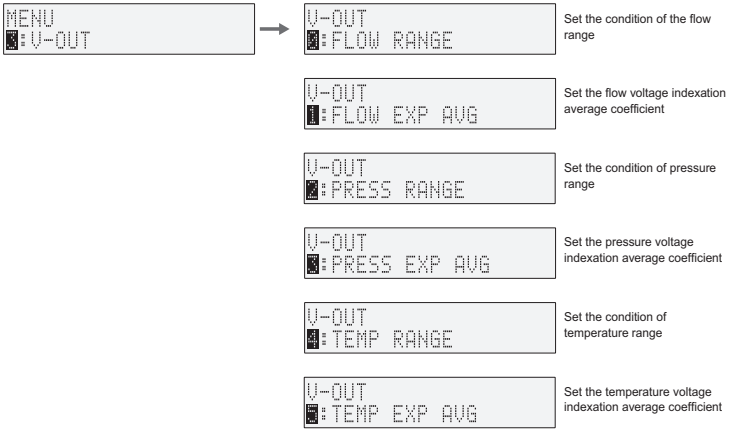
Item	Description
REF TEMP	Set the reference temperature T_0 within the range of -50.0 [℃] to +200.0 [℃]. Default value is +20.0 [℃].

2.5 V-OUT: set the analog output

Pressing the ENTER button after displaying 3: V-OUT on the menu screen switches the screen to the screen setting the conditions for the analog output (V-OUT).

On the V-OUT screen, the detailed set items of 0: FLOW RANGE, 1: FLOW EXP AVG, 2: PRESS RANGE, 3: PRESS EXP AVG, 4: TEMP RANGE, 5: TEMP EXP.AVG, and 6: FLOW ZERO are stored.

On the V-OUT screen, set the conditions such as scaling, in outputting the measured flow, pressure, or temperature as an analog voltage.



■ Set the flow range (0: FLOW RANGE)

Pressing the ENTER button after displaying 0: FLOW RANGE on the V-OUT screen switches the screen to the screen setting the flow range (FLOW RANGE).

Item	Description
FLOW RANGE	Switch the scaling and units of the flow voltage output. • Switch the scaling of the flow voltage output to either [0: 0-60], [1: 0-100], [2: 0-120], [3: 0-200](default value), or [4: 0-300]. • Switch the units to [L/h] (default settings) or [kg/h].

■ Set the flow voltage indexation average coefficient (1: FLOW EXP AVG)

Pressing the ENTER button after displaying 1: FLOW EXP AVG on the V-OUT screen switches the screen to the screen setting the conditions for the flow voltage indexation average coefficient (FLOW EXP AVG).

Item	Description
EXP.AVG	Set the indexation average coefficient of the flow analog output within the range of 1 to 1000. Default value is 30. • Flow analog output outputs the results of the following formulas. $Y_i = \frac{1}{N} \times X_i + \frac{N-1}{N} \times Y_{i-1}$ X_i i th measured value Y_i i th indexation average value N Indexation average coefficient $N = \frac{\tau}{\Delta t}$ τ : The time required to allow the output to reach approximately 63% when the time constant (measured value) changes from 0 → 100% Δt : Sampling period (10 ms)

■ Set the pressure range (2: PRESS RANGE)

Pressing the ENTER button after displaying 2: PRESS RANGE on the V-OUT screen switches the screen to the screen setting the conditions for the pressure range (PRESS RANGE).

Item	Description
PRESS RANGE	Switch the scaling of the pressure voltage output to either 0: 0-200 [kPa], 1: 0-500 [kPa], 2: 0-1000 [kPa], or 3: 0-980 [kPa].

■ Set the pressure voltage indexation average coefficient (3: PRESS EXP AVG)

Pressing the ENTER button after displaying 3: PRESS EXP AVG on the V-OUT screen switches the screen to the screen setting the conditions for the pressure voltage indexation average coefficient (PRESS EXP AVG).

Item	Description
PRESS EXP AVG	Set the indexation average coefficient of the pressure analog output within the range of 1 to100. Default value is 20. • Pressure analog output outputs the results of the same formulas with that for flow analog output. For details on formulas, refer to “Set the flow voltage indexation average coefficient (1: FLOW EXP AVG)” on page 50.

■ Set the temperature range (4: TEMP RANGE)

Pressing the ENTER button after displaying 4: TEMP RANGE on the V-OUT screen switches the screen to the screen setting the conditions for the temperature range (TEMP RANGE).

Item	Description
TEMP RANGE	Switch the scaling of the voltage temperature output to [0: 0-100℃] or [1: -50-100℃]. Default value is [0: 0-100℃].

■ Set the voltage temperature indexation average coefficient (5: TEMP EXP AVG)

Pressing the ENTER button after displaying 5: TEMP EXP AVG on the V-OUT screen switches to the screen setting the conditions for the voltage temperature indexation average coefficient (TEMP EXP AVG).

Item	Description
TEMP EXP.AVG	Set the indexation average coefficient of the temperature analog output within the range of 1 to 10. Default value is 2. • Temperature analog output outputs the results of the same formula with that for flow analog output. For details on formulas, refer to “Set the flow voltage indexation average coefficient (1: FLOW EXP AVG)” on page 50.

2.6 P-OUT: set the pulse output

Pressing the ENTER button after displaying 4: P-OUT on the menu screen switches the screen to the screen setting the conditions for the pulse output (P-OUT).

On the P-OUT screen, the detailed set items of 0: FLOW are stored.

■ Set the flow pulse output (0: FLOW)

Pressing the ENTER button after displaying 0: FLOW on the P-OUT screen switches the screen to the screen setting the conditions for the flow pulse output (FLOW).

Item	Description
FLOW	Set the pulse weight value and unit of the flow pulse output. • Switch the pulse weight value (flow value per pulse) of the flow pulse output to either [0: DIRECT], [1: 1], [2: 0.1], [3: 0.01], or [4: 0.001]. Default value is 2: 0.1. • DIRECT directly outputs the pulse from the encoder that is not corrected by the factor value. • Switch the units to [mL/P] or [g/P]. Default value is mL/P.

2.7 CAL: set the calibration output

Pressing the ENTER button after displaying 5: CAL on the menu screen switches the screen to the screen setting the conditions for the calibration output (CAL).

On the CAL screen, the detailed set items of 0: CAL-OUT are stored.

■ Set the voltage calibration signal output (0: CAL-OUT)

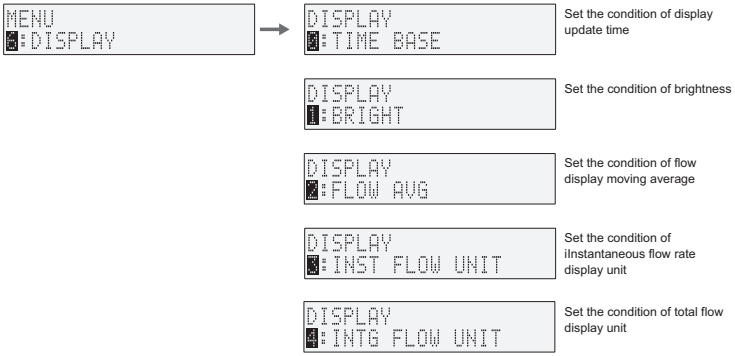
Pressing the ENTER button after displaying 0: CAL-OUT on the CAL screen switches the screen to the screen setting the conditions of the voltage calibrating signal output (CAL-OUT).

Item	Description
CAL OUT	Switch the voltage for the connection device correction output from the analog output (flow/ pressure/temperature) either to [0: OFF], [1: ZERO], or [2: FULL]. Default value is 0: OFF. • When each menu item is displayed without pressing the ENTER button, for example, when 2: FULL item are displayed, FULL is output. Similarly, when 1: ZERO is displayed, ZERO is output, and when 0: OFF is displayed, the value corresponding to the current measurement value is output.

2.8 DISPLAY: set the display conditions of the fluorescent display tube

Pressing the ENTER button after displaying 6: DISPLAY on the menu screen switches the screen to the screen setting the display conditions for the fluorescent display tube (DISPLAY).

On the DISPLAY screen, the detailed set items of 0: TIME BASE, 1: BRIGHT, 2: FLOW AVG, 3: INST FLOW UNIT, and 4: INTG FLOW UNIT are stored.



■ Set the display update time (0: TIME BASE)

Pressing the ENTER button after displaying 0: TIME BASE on the DISPLAY screen switches the screen to the screen setting the conditions for the display update time (TIME BASE).

Item	Description
UPDATE	Switch the display update cycle to [0: 0.5s] or [1: 1.0s]. Default value is 1: 1.0s.

■ Set the condition of brightness (1: BRIGHT)

Pressing the ENTER button after displaying 1: BRIGHT on the DISPLAY screen switches the screen to the screen setting the conditions for the brightness (BRIGHT).

Item	Description
BRIGHT	Switch the brightness of the fluorescent display tube to either [0: 25%], [1: 50%], [2: 75%], or [3: 100%]. Default value is 3: 100%. • Switch the brightness according to the usage environment. For example, if the brightness is set high in the dark, such as at 100%, it may be too bright to see the display. Please be careful.

■ Set the conditions of flow display moving average (2: FLOW AVG)

Pressing the ENTER button after displaying 2: FLOW AVG on the DISPLAY screen switches the screen to the screen setting the conditions for flow display moving average (FLOW AVG).

Item	Description
FLOW AVG	Set the average moving time of the instantaneous flow rate display. Configurable minimum value and notch differ as below, according to the display update cycle settings of “Set the display update time (0: TIME BASE)” on page 53 • When the settings for display update time (TIME BASE) is 1.0 s, configurable range: 1 to10s, configurable notch: 1 s • When the settings for display update time (TIME BASE) is 0.5s, configurable range: 0.5 to10.0s, configurable notch: 0.5s

■ Set the conditions for the instantaneous flow rate display unit (3: INST FLOW UNIT)

Pressing the ENTER button after displaying 3: INST FLOW UNIT on the DISPLAY screen switches the screen to the screen setting the conditions for the instantaneous flow rate display unit (INST FLOW UNIT).

Item	Description
INST FLOW UNIT	Switch the units of the Instantaneous flow display to [0: L/h] or [1: kg/h]. Default value is 0: L/h.

■ Set the conditions for total flow display unit (4: INTG FLOW UNIT)

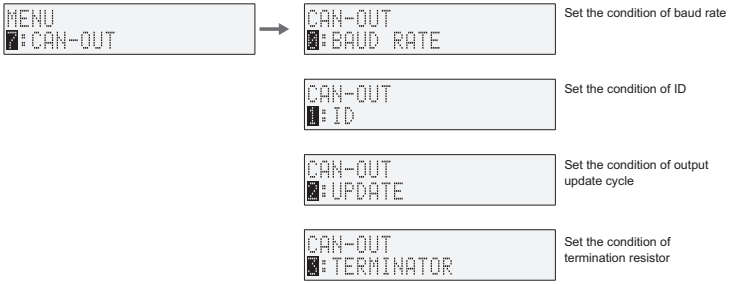
Pressing the ENTER button after displaying 4: INTG FLOW UNIT on the DISPLAY screen switches the screen to the screen setting the conditions for the total flow display unit (INTG FLOW UNIT).

Item	Description
INTG FLOW UNIT	Switch the unit of total flow display to [0: mL] or [1: g]. Default value is 0: mL.

2.9 CAN-OUT: set the CAN output conditions

Pressing the ENTER button after displaying 7: CAN-OUT on the menu screen switches to the screen setting the conditions of the CAN output (CAN-OUT).

On the CAN-OUT screen, the detailed set items of 0: BAUD RATE, 1: ID, 2: UPDATE, and 3: TERMINATOR are stored.



■ Set the conditions for the baud rate (0: BAUD RATE)

Pressing the ENTER button after displaying 0: BAUD RATE on the CAN OUT screen switches the screen to the screen setting the conditions for the baud rate (BAUD RATE).

Item	Description
BAUD RATE	Switch the baud rate of the CAN output signal (communication speed) to either [0: 125kbps], [1: 250kbps], [2: 500kbps], or [3: 1Mbps]. Default value is 0: 125kbps.

■ Set the condition of ID (1: ID)

Pressing the ENTER button after displaying 1: ID on the CAN OUT screen switches the screen to the screen setting the conditions for ID (ID).

Item	Description
ID	Set the ID of the CAN output signal within the range of 0x001 to 0x7FF. Default value is 0x721.

■ Set the conditions for the output update cycle (2: UPDATE)

Pressing the ENTER button after displaying 2: UPDATE on the CAN OUT screen switches the screen to the screen setting the conditions for the output update cycle (UPDATE).

Item	Description
UPDATE	Switch the output update cycle of CAN output signal to either [0: OFF], [1: 1], [2: 2], [3: 5], [4: 10], [5: 20], [6: 100], or [7: 1000]. The unit is Hz. Default value is 0: OFF.

■ Set the conditions for the termination resistor (3: TERMINATOR)

Pressing the ENTER button after displaying 3: TERMINATOR on the CAN OUT screen switches the screen to the screen setting the conditions for the termination resistor (TERM).

Item	Description
TERM	Switch the termination resistor of CAN output to [0: OFF] or [1: ON]. Default value is 0: OFF.

2.10 AUTO STOP: set the conditions for auto stop

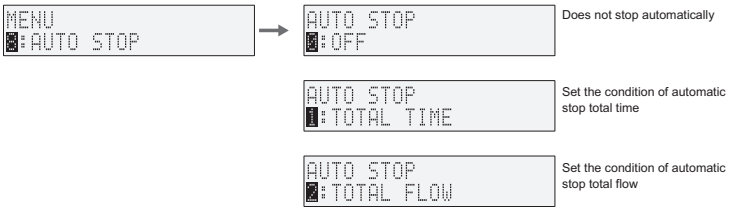
CAUTION

- The auto stop setting (8: AUTO STOP) is effective when this option is used.
  For purchase or details of the options, consult the nearest Ono Sokki sales office or the distributor where you purchased the product.

Pressing the ENTER button after displaying 8: AUTO STOP on the menu screen switches the screen to the screen setting the conditions for the automatic stop (AUTO STOP).

On the AUTO STOP screen, the detailed set items of 0: OFF, 1: TOTAL TIME, and 2: TOTAL FLOW are stored.

On the screen to set the conditions for automatic stop (AUTO STOP), set the conditions for the function to stop integration automatically when the value reaches the set conditions (total time or total flow value) during total measurement.



■ Does not stop automatically (0: OFF)

Pressing the ENTER button after displaying 0: OFF on the AUTO STOP screen sets the automatic stop function OFF, and the layer goes up by 1 rank (MENU).

Item	Description
OFF	Switch the automatic stop function to OFF (does not use). • To return the automatic stop function to ON (use), press the ENTER button after displaying 0: OFF on the AUTO STOP screen.

■ Set the conditions for automatic stop total time (1: TOTAL TIME)

Pressing the ENTER button after displaying 1: TOTAL TIME on the AUTO STOP screen switches the screen to the screen setting the conditions for the automatic stop total time (TOTAL TIME).

Item	Description
TOTAL TIME	Select the automatic stop by the total time, and set the total time for automatic stop within the range of 1s to 9999999s. Default value is 1s.

■ Set the conditions for automatic stop total flow (2: TOTAL FLOW)

Pressing the ENTER button after displaying 2: TOTAL FLOW on the AUTO STOP screen switches the screen to the screen setting the conditions for the automatic stop total flow (TOTAL FLOW).

Item	Description
TOTAL FLOW	Select the automatic stop by the total flow, and set the total flow for automatic stop within the range of 1 to 999999. Switch the units to [mL] or [g]. Default value is 1000 mL.

2.11 RS232C: set the conditions for the RS-232C interface

CAUTION

- The RS-232C interface (9: RS232C) is valid when the option is installed.
  For purchase or details of the options, consult the nearest Ono Sokki sales office or the distributor where you purchased the product.

Pressing the ENTER button after displaying 9: RS232C on the menu screen switches the screen to the screen setting the conditions for the RS-232C interface (RS232C).

On the RS232C screen, the detailed set items of 0: BAUD RATE are stored.

■ Set the conditions for the baud rate (0: BAUD RATE)

Pressing the ENTER button after displaying 0: BAUD RATE on the RS232C screen switches the screen to the screen setting the conditions for the baud rate (BAUD RATE).

Item	Description
BAUD RATE	Switch the baud rate (transmission speed) to [0: 9600bps] or [1: 38400bps]. Default value is 0: 9600bps.

Chapter 4
Interface Reference

1. CAN output interface

CAUTION

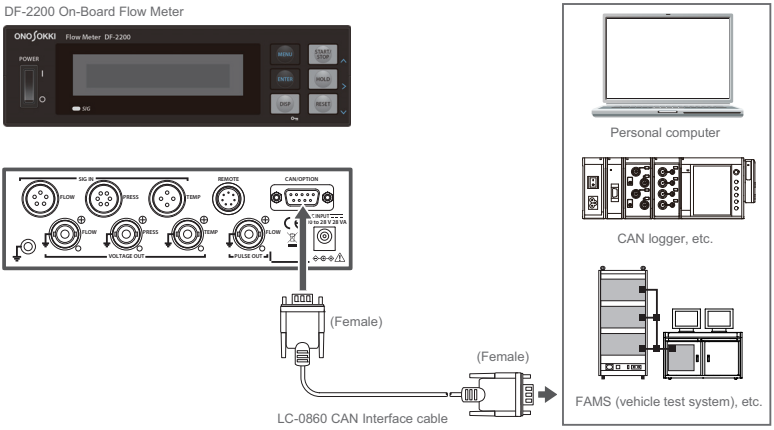
- CAN Interface (Standard) and RS-232C Interface (Optional DF-0222 RS-232C communication function) cannot be installed/used at the same time. Only one or the other can be installed (used) at a time. Please be careful.

1.1 Outline of CAN output interface

CAN stands for Controller Area Network.

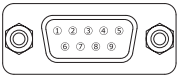
■ CAN system configuration

As shown below, connect the LC-0860 CAN Interface cable (sold separately) to the CAN communication connector arranged on the rear panel of DF-2200 On-Board Flow Meter.



■ CAN communication connector specifications

The following are the CAN communication connector specifications.

Connector specifications	D-Sub, 9-pin, male connector (on main unit)
CAN communication connector Pin assignment	

PIN No.	Function	PIN No.	Function
1	NC	6	NC
2	CAN_Low (Output side)	7	CAN_High (Output side)
3	COM	8	NC
4	NC	9	NC
5	COM		

1.2 CAN data format

Output rate specifications

Output update rate	1 Hz / 2 Hz / 5 Hz / 10 Hz / 20 Hz / 100 Hz
Output baud rate	125 kbps / 250 kbps / 500 kbps / 1 Mbps

Output items

No.	Item	Estimated measurement range	Required byte	Description
1	Instantaneous flow rate	0 to 9999999	4 byte	Numeric string of the instantaneous flow rate value (L/h) without the decimal information
2	Pressure	0 to 1000	2 byte	Pressure value (kPa)
3	Temperature	-500 to 1000	2 byte	Temperature value (° C) × 10

Output correspondence table

	Format	Endian: Big Endian (Motorola)							
No.	STANDARD_ID	Data Bytes							
1	0x721 configurable range 0x001 to 0x7FF	1	2	3	4	5	6	7	8
		Instantaneous flow rate				Pressure		Temperature	

Data format

No.	Data content	Type	Description
1	Instantaneous flow rate	32 bit unsigned integer	Numeric string of the instantaneous flow rate (L/h) without the decimal information
			MAX: 9,999,999
			MIN: 0
2	Pressure	16bit unsigned integer	Pressure value (kPa)
			MAX: 1000
			MIN: 0
3	Temperature	16bit signed integer	Temperature value (° C) × 10
			MAX: 1000
			MIN: -500

2. RS-232C interface

CAUTION

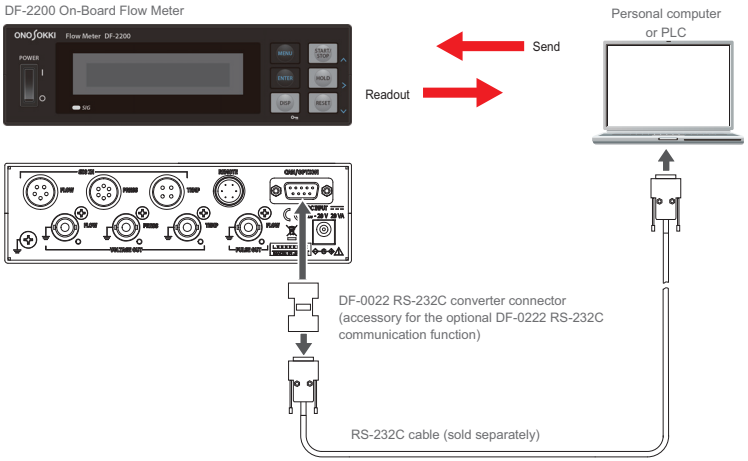
- CAN Interface (Standard) and RS-232C Interface cannot be installed (used) at the same time. Only one or the other can be installed (used) at a time. Please be careful.
- RS-232C Interface functions effectively when the optional DF-0222 RS-232C communication function is installed.
  For the specifications of DF-0222 RS-232C communication function and how to purchase it, contact your nearest Ono Sokki sales office or the distributor you purchased the RS-232C Interface.

2.1 Outline of RS-232c interface

DF-2200 On-Board Flow Meter is controlled by a PC or a Programmable Logic Controller (PLC) which is connected to the flow meter via RS-232C Interface.

RS-232c system configuration

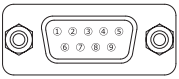
Connect the RS-232C connector arranged to the rear panel of the DF-2200 On-Board Flow Meter and the PC or PLC using the RS-232C cable via the DF-0022 RS-232C connector attached to the optional DF-0222 RS-232C communication function.



- RS-232C cable (sold separately) must be connected via a DF-0022 / RS-232C converter connector.
  Connecting an RS-232C cable directly to a CAN/OPTION connector may damage the internal circuit of DF-2200 On-board Flow Meter.

RS-232c communication connector specifications

The followings are the rs-232c connector specifications.
The following shows the state when the DF-0022 RS-232C conversion connector is installed.

Connector specifications	D-Sub, 9-pin, male connector (on main unit)
RS-232C connector pin assignment	

PIN No.	Function	PIN No.	Function
1	NC	6	NC
2	RxD	7	NC
3	TxD	8	NC
4	NC	9	NC
5	COM		

RS-232c specifications

Communication system	Asynchronous type
Transmission speed	9600/38400 bps (Select)
Character length	8 bit
Parity check	None
Stop-bit length	1 bit
X Parameter control	None
Hardware flow control	None
Terminator	CR + LF
Signal level	Conforming to EIA-232

2.2 RS-232C command reference

Commands

The following commands are available for RS-232C Interface included in DF-2200 On-Board Flow Meter.

Kinds of commands	Description	Reference
Measurement control commands	A command for controlling measurements like starting/ending the integration measurement	Page 64
Display control command	A command changing display items	Page 65
State readout command	A command for reading out the measurement state	Page 65
Display condition command	A command for setting and reading out the display conditions	Page 65
Display data readout command	A command for reading out the measured values and units	Page 67
Settings command	A command for setting and reading out the settings	Page 65
Voltage output settings command	A command for setting and reading out the voltage output settings	Page 71
Measurement data command	A command for reading out the measurement data	Page 73
Unit command	A command for reading out the unit of each measured item	Page 74
Calibration output command	A command for correcting the voltage	Page 75
Other commands	Commands not applied to the above	Page 76

Measurement control commands

Command	Format and function
STT	Start integration • Commands can be accepted under the state of STOP or RESET in the measurement mode. • “ACK” is replied when the command is accepted, if not, “NAK” is replied
HLD	Hold integration • Commands can be accepted under the state of START or HOLD in the measurement mode • “ACK” is replied when the command is accepted, if not, “NAK” is replied
STP	Stop integration • Commands can be accepted under the state of START or HOLD in the measurement mode • “ACK” is replied when the command is accepted, if not, “NAK” is replied

RST	Reset integration • Commands can be accepted only under the state of STOP in the measurement mode • “ACK” is replied when the command is accepted, if not, “NAK” is replied

■ Display control command

Command	Format and function	
MSD	Change display items	
	Set parameter	1: 2-stage display (First stage Instantaneous flow rate, Second stage Pressure + Temperature) 2: 2-stage display (First stage Instantaneous flow rate, Second stage Total flow + Total time) 3: 1-stage display (Instantaneous flow rate) • “ACK” is replied when the command is accepted, if not, “NAK” is replied

■ State readout command

Command	Format and function	
STS	Readout the integration state	
	Readout parameter	?: Reply with the following response values according to the measurement state • When parameters other than ‘?’ are entered, reply with the text string “NAK”
	Response value	Z: Reset state S: Start state H: Hold state P: Stop state

■ Display condition command

Command	Format and function	
DUT	Set/readout the TIME BASE (update period) of the indicator tubes	
	Set parameter	1: 0.5 [s] 2: 1.0 [s] • “ACK” is replied when the command is accepted, if not, “NAK” is replied
	Readout parameter	?: TIME BASE (update period) of the indicator tubes Reply with the following values according to the settings
	Response value	1: 0.5 [s] 2: 1.0 [s]

Command	Format and function		
DBL	Set/readout the brightness of the indicator tubes		
	Set parameter	1: 25 [%] 2: 50 [%] 3: 75 [%] 4: 100 [%] • "ACK" is replied when the command is accepted, if not, "NAK" is replied	
	Readout parameter	?: TIME BASE (update period) of the indicator tubes Reply with the following values according to the settings	
		Response value	1: 25 [%] 2: 50 [%] 3: 75 [%] 4: 100 [%]
DFA	Set/readout the average moving time of the instantaneous flow rate for display		
	Set parameter	0.5 to 10 [s] • "ACK" is replied when the command is accepted, if not, "NAK" is replied	
	Readout parameter	?: Average moving time of the instantaneous flow rate for display Reply with the following values according to the settings	
		Response value	0.5 to 10 [s]
DSU	Set/readout the display conditions • Commands are accepted only under the RESET state		
	Set parameter	Display, Unit 1, Unit 2 • "ACK" is replied when the command is accepted, if not, "NAK" is replied • Parameters are separated by ", " • Details of each parameter are shown below	
		Display	Measurement items to be displayed 1: First stage INSTANT FLOW, Second stage PRESS & TEMP 2: First stage INSTANT FLOW, Second stage INTEGRATION FLOW 3: First and second stages shown together INSTANT FLOW
		Unit 1	Unit of display for the first stage 1: L/h 2: kg/h
		Unit 2	Unit of display for the second stage Settings are not required when Display is 1 for setting the total flow 1: mL 2: g
	Readout parameter	?: A parameter indicating that this is a readout command Reply with the following response values according to the display settings	
		Response value	Display, Unit 1, Unit 2 • The contents of each response value is the same as that of the parameters set as above • When the response value of Display is 1, the response value of Unit 2 is omitted

Display data readout command

Command	Format and function		
DDR	Readout the measured value of the measurement items displayed at the counter		
	Readout parameter	?: Reply with the measured value of the items displayed at the counter.	
		Response value	Data 1, Data 2, Data 3 • Details of the respective data are as follows. Data1: First line (Instantaneous flow rate) display value Data2: Second line left stage (Total flow or temperature) display value Data3: Second line right stage (Total time or pressure) display value • Respective data are separated by comma • When "---" is shown in the temperature / pressure display, the output of those items are omitted • The number of decimal places will be the same as that of the displayed value
DDU	Readout the unit of measurement items displayed at the counter		
	Readout parameter	?: Reply with the units of the items displayed on the counter	
		Response value	Unit 1, Unit 2, Unit 3 • Respective output data are separated by commas • When "---" is shown in the temperature / pressure display, the output of those items are omitted • The details of the respective data are as follows
			Unit 1: First line Unit of (Instantaneous flow rate) 12: L/h 9: kg/h
			Unit 2: Second line left stage Units for (Total flow or temperature) 15: mL 13: g 18: °C
			Unit 3: Second line right stage Display values for (Total time or pressure) 1: s 17: kPa
DSR	Readout up to 7 kinds (provisional) of arbitrary measured data		
	Readout parameter	Data 1, ? • Details of the respective data are as follows. 1: Instantaneous flow rate measured value (volume) [L/h] 2: Instantaneous flow rate measured value (weight) [kg/h] 3: Instant temperature measured value [° C] 4: Instant pressure measured value [kPa] 5: Total flow measured value (volume) [mL] 6: Total flow measured value (flow amount) [g] 7: Total time measured value [s]	
		Response value	Data1, Data2, · · · • Respective display data are separated by commas • When the temperature and pressure sensors are OFF (the display value is "---"), reply with "NAK" as the corresponding data

Settings command

Command	Format and function	
FMP	Set/readout the instantaneous flow rate pulse input weight ([g/P] or [mL/P])	
	Set parameter	1: 0.1 ([g/P] or [mL/P]) 2: 0.01 ([g/P] or [mL/P]) 3: 0.001 ([g/P] or [mL/P]) • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout • Commands are accepted only under the RESET state
	Readout parameter	?: Instantaneous flow rate pulse input weight Return the following values according to the condition values
	Response value	1: 0.1 ([g/P] or [mL/P]) 2: 0.01 ([g/P] or [mL/P]) 3: 0.001 ([g/P] or [mL/P])
FFC	Set/readout the flow sensor factor • Commands are accepted only under the RESET state	
	Set parameter	1000 to 100000 • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the factor value
	Response value	1000 to 100000
MLT	Set/readout the multiplication of the input pulse • Commands are accepted only under the RESET state	
	Set parameter	1: *1 2: *10 • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply the following values according to the multiplication settings of input pulse ([*1]or [*10])
	Response value	1: *1 2: *10
FFP	Set/readout the pressure sensor conditions • Commands are accepted only under the RESET state	
	Set parameter	0: OFF 1: Pressure sensor 980 kPa 2: Pressure sensor 1000 kPa 3: Pressure sensor 500 kPa 4: Pressure sensor 200 kPa • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout

Command	Format and function	
FFP	Readout parameter	?: Reply with the following values according to the pressure sensor selection
	Response value	0: OFF 1: Pressure sensor 980 kPa 2: Pressure sensor 1000 kPa 3: Pressure sensor 500 kPa 4: Pressure sensor 200 kPa
TTP	Select/readout the temperature sensor type • Commands are accepted only under the RESET state	
	Set parameter	0: OFF 1: PT100 • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the following values according to the temperature sensor selection
	Response value	0: OFF 1: PT100
CSL	Select/readout ON/OFF of the density temperature correction function • Commands are accepted only under the RESET state	
	Set parameter	0: OFF 1: ON • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the condition value of the density temperature correction function
	Response value	0: OFF 1: ON
CFC	Set/readout the density correction temperature coefficient [1/° C] • Commands are accepted only under the RESET state	
	Set parameter	0.00001 to 0.00999 • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the density correction temperature coefficient value [1/°C]
	Response value	0.00001 to 0.00999 • Ex.) When the density correction temperature coefficient is 0.00235 [1/° C]: 0.00235
CRD	Set/readout the density correction standard density [g/cm3] • Commands are accepted only under the RESET state	
	Set parameter	0.0001 to 9.9999 • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the density correction standard density value [g/cm3]
	Response value	0.0001 to 9.9999 • Ex.) When the standard density is 0.7500 [g/cm3]: 0.7500

Command	Format and function	
CRT	Set/readout the standard temperature [° C] • Commands are accepted only under the RESET state	
	Set parameter	-50.0 to 200.0 • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the standard temperature [° C]
	Response value	-50.0 to 200.0 • Ex.) When the standard temperature is +10.5 [° C]: +10.5
SMD	* Optional commands Select/readout the automatic stop mode • Commands are accepted only under the RESET state	
	Set parameter	0: Automatic stop OFF 1: Total time automatic stop ON 2: Total flow automatic stop ON • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the following response values according to the selected state of the automatic stop
	Response value	0: Automatic stop OFF 1: Total time automatic stop ON 2: Total flow automatic stop ON
SPT	* Optional commands Set/readout the automatic stop total time • Commands are accepted only under the RESET state	
	Set parameter	1 to 9999999: Total time [s] • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the automatic stop total time [s]
	Response value	1 to 9999999 • Ex.) 10: When the automatic stop total time is 10 [s]
SPF	* Optional commands Set/readout the automatic stop total flow • Commands are accepted only under the RESET state	
	Set parameter	1 to 9999999 ([mL] or [g]) • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the automatic stop total flow
	Response value	1 to 9999999 • Ex.) 10: When the automatic stop total flow is 10 ([mL] or [g])

Command	Format and function	
SPU	* Optional commands Set/readout the automatic stop total flow unit • Commands are accepted only under the RESET state	
	Set parameter	13: Switch the units to g 15: Switch the units to mL • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the following response values according to the set units
	Response value	13: g units 15: mL units

■ Voltage output settings command

Command	Format and function	
VFR	Set/readout the instantaneous flow rate analog output range ([L/h] or [kg/h]) • Commands are accepted only under the RESET state	
	Set parameter	1: 0-60 2: 0-100 3: 0-120 4: 0-200 5: 0-300 • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Instantaneous flow rate analog output range ([L/h] or [kg/h]) Return the following values according to the condition values
	Response value	1: 0-60 2: 0-100 3: 0-120 4: 0-200 5: 0-300
VFE	Set/readout the average index coefficient of the instantaneous flow rate analog output • Commands are accepted only under the RESET state	
	Set parameter	1 to 1000 • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Average index coefficient of the instantaneous flow rate Return the following values according to the condition values
	Response value	1 to 1000

Command	Format and function	
VPR	Set/readout the pressure analog output range [kPa] • Commands are accepted only under the RESET state	
	Set parameter	1: 0-980 [kPa] 2: 0-1000 [kPa] 3: 0-500 [kPa] 4: 0-200 [kPa] • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Pressure analog output range [kPa] Reply with the following values according to the settings
	Response value	1: 0-980 [kPa] 2: 0-1000 [kPa] 3: 0-500 [kPa] 4: 0-200 [kPa]
VTR	Set/readout the temperature analog output range [° C] • Commands are accepted only under the RESET state	
	Set parameter	1: +0 to +100 2: -50 to +100 • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Temperature analog output range [° C] Reply with the following values according to the settings
	Response value	1: +0 to +100 2: -50 to +100
VPE	Set/readout the average index coefficient of the pressure analog output • Commands are accepted only under the RESET state	
	Set parameter	1 to 100 • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Average index coefficient of the pressure Return the following values according to the condition values
	Response value	1 to 100
VTE	Set/readout the average indexation coefficient of the temperature analog output • Commands are accepted only under the RESET state	
	Set parameter	1 to 10 • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Average index coefficient of the temperature Return the following values according to the condition values
	Response value	1 to 10

Command	Format and function	
PFW	Set/readout the instantaneous flow rate pulse output weight ([g/P] or [mL/P]) • Commands are accepted only under the RESET state	
	Set parameter	1: 0.1 ([g/P] or [mL/P]) 2: 0.01 ([g/P] or [mL/P]) 3: 0.001 ([g/P] or [mL/P]) 4: DIRECT • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Instantaneous flow rate pulse output weight Return the following values according to the condition values
	Response value	1: 0.1 ([g/P] or [mL/P]) 2: 0.01 ([g/P] or [mL/P]) 3: 0.001 ([g/P] or [mL/P]) 4: DIRECT
PFU	Set/readout the unit of instantaneous flow rate pulse output weight ([g/P] or [mL/P]) • Commands are accepted only under the RESET state	
	Set parameter	1: g/P 2: mL/P • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Instantaneous flow rate pulse output weight ([g/P] or [mL/P]) Return the following values according to the condition values
	Response value	1: g/P 2: mL/P

■ Measurement data command

Command	Format and function	
RIF	Readout the instantaneous flow rate ([kg/h] or [L/h])	
	Readout parameter	?: Reply the instantaneous flow rate data ([kg/h] or [L/h])
	Response value	0.0000 to 9999999.9 • The number and unit of decimal places will be the same as that of the displayed value
RIP	Readout the instant pressure [kPa]	
	Readout parameter	?: Reply the instant temperature data [kPa]
	Response value	0 to 1000
RIT	Readout the instant temperature [° C]	
	Readout parameter	?: Reply with the instant temperature data [° C]
	Response value	-50.0 to 100.0

RTF	Readout the total flow ([g] or [mL])	
	Readout parameter	?: Reply with the total flow data ([g] or [mL])
	Response value	0.0000 to 9999999.9 • The number and unit of decimal places will be the same as that of the displayed value (condition value)
RTT	Readout the total time	
	Readout parameter	?: Total time data [s]
	Response value	0.00 to 9999999 • The number of decimal places will be the same as the value on the liquid crystal display

Unit command

Command	Format and function	
UIF	Set/readout the instantaneous flow rate units ([kg/h] or [L/h]) • Commands are accepted only under the RESET state	
	Set parameter	9: kg/h 12: L/h • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the instantaneous flow rate unit ([kg/h] or [L/h])
	Response value	9: kg/h 12: L/h
UTF	Set/readout the total flow units ([g] or [mL]) • Commands are accepted only under the RESET state	
	Set parameter	13: g 15: mL • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the total flow unit ([g] or [mL])
	Response value	13: g 15: mL
UIP	Readout the pressure units [kPa]	
	Readout parameter	?: Reply with the instant pressure units [kPa]
	Response value	17: kPa
UIT	Readout the temperature units [°C]	
	Readout parameter	?: Reply with the instant temperature units [°C]
	Response value	18: °C

VFU	Commands are accepted only under the RESET state where the instantaneous flow rate voltage output unit is selected/readout.	
	Set parameter	9: kg/h 12: L/h • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the following values according to the instantaneous flow rate voltage output condition values
		Response value: 9: kg/h, 12: L/h

Calibration output command

Command	Format and function	
CAO	Set/readout the CAL ON/OFF settings • Commands are accepted only under the RESET state	
	Set parameter	1: OFF 2: ZERO 3: FULL • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the following values according to the CAL output settings
		Response value: 1: OFF, 2: ZERO, 3: FULL
VCF	Set/readout the execution of the flow CAL output • Commands are accepted only under the RESET state	
	Set parameter	1: OFF 2: ZERO 3: FULL • "ACK" is replied when the command is accepted, if not, "NAK" is replied • No limit for readout
	Readout parameter	?: Reply with the following values according to the run settings of flow CAL output
		Response value: 1: OFF, 2: ZERO, 3: FULL

Other commands

Command	Format and function	
KPT	Set/readout the key locking	
	Set parameter	1: Start key locking 2: Cancel key locking • "ACK" is replied when the command is accepted, if not, "NAK" is replied
	Readout parameter	?: Reply with the following values according to the settings of key locking
	Response value	1: Start key locking 2: Cancel key locking

Chapter 5
Reference Data

1. Specifications

1.1 Input section specifications

Applicable detector	FP-4135 On-Board Volumetric Flow Detector	
	FP-213/213S Volumetric Flow Detector	
	FP-3130/3130S Explosion-proof Type Volumetric Flow Detector	
	FP-3132/3132S Explosion-proof Type Volumetric Flow Detector	
	FP-2140H Volumetric Flow Detector	
	FP-2240HA Volumetric Flow Detector	
	FP-3140/3142 Explosion-proof Type Volumetric Flow Detector	
	FP-2140S Volumetric Flow Detector	
Pulse	TTL Level (common to all models)	
	Duty	50%, A/B 90° Phase (except for FP-4135 / 2140S)
	FP-4135	20 μ s in width, B phase 10 μ s phase delay (equivalent to 25 kHz)
	FP-2140S	30 μ s in width, B phase 15 μ s phase delay (equivalent to 16.7 kHz)
	Maximum input frequency	100 kHz
Weight per pulse	0.1. 0.01, 0.001 mL/Pulse	
Multiplication	ON (multiplied by 10) or OFF	
Power supply to the detector	DC12 V ± 5 % 1.2 A	
FLOW (SIG IN) Flow signal input connector	Applicable connector	RM12BRD-5PH 
	Pin assignment	Pin No. / Signal
		1 / SIG A
		2 / SIG B
		3 / COM
		4 / Shield
		5 / +12 V DC Power source
	Flow signal cable	• Except for FP-4135 / FP-2140S: FP-0011 (5 m) / FP-0012 (10 m) / FP-0014 (20 m)
		• FP-4135/FP-2140S: FP-0015 (5 m) / FP-0016 (10 m) / FP-0017 (20 m)
TEMP (SIG IN) Temperature signal input connector	Applicable temperature sensor	Resistance temperature detectors (Pt100 Ω) Bridge three-wire system
	Guaranteed input temperature range	-50 to 100 ° C
	Applicable connector	RM12BRD-4PH (equivalent to) 

TEMP (SIG IN) Temperature signal input connector	Pin assignment	Pin No.	Signal
		1	Pt100 SIG
		2	Pt100 SIG
		3	Pt100 COMP (Correct errors generated by a lead resistor)
		4	COM Shield
	Temperature signal cable	FP-0025 (5 m) / FP-0026 (10 m) / FP-0027 (20 m)	
	Input linearity	0.5 %/F.S.	
PRESS (SIG IN) Pressure signal input connector	Applicable sensor	FP101-B31-CN0A/V1/Z (Yokogawa Electric)	
	Input type	Voltage signal	
	Input impedance	Approx. 10 k Ω	
	Input signal amplitude range	0.0 to +5.0 V	
	Power Supply	+15 V ± 5 %	
	Maximum power supply	20 mA	
	Applicable connector	RM12BRD-6PH 	
	Pin assignment	Pin No.	Signal
		1	+15 V DC Power source
		2	SIG
		3	COM
		4	COM
		5	NC
		6	NC
	Pressure signal cable	FP-0035 (5 m) / FP-0036 (10 m) / FP-0037 (20 m)	
	Input linearity	0.5 %/F.S.	
REMOTE Remote Box connector	• START/STOP/RESET/HOLD can be commanded externally using the optional remote buttons. • Available as an external control signal		
	Control signal	No-voltage contact signal, or TTL voltage signal (negative logic)	
	Pin assignment		
		Pin No.	Signal
		1	START/STOP Input
		2	RESET Input
		3	NC
		4	+5 V Output
		5	START LED Output
		6	COM

1.2 Output section specifications

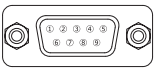
Instantaneous flow rate	Voltage Output	0 to 10 V
	Range settings	0 to 60 / 100 / 120 / 200 / 300 (Unit: L/h and kg/h)
	Offset the output	Within ± 10 mV
	Temperature coefficient	± 0.02 % / F.S. / ℃
	Output impedance	Approx. 150 Ω
	Recommended load resistance	100 k Ω or higher
	Output terminal	BNC
	Linearity	Within ± 0.1 % / F.S.
	Update period	Approx. 10 ms • Average indexation settings: 1 ≤ N ≤ 1000 (initial value N=30)
Temperature	Voltage Output	0 to 10 V
	Range settings	Select from 0 to100, -50 to 100℃
	Offset the output	Within ± 10 mV
	Temperature coefficient	± 0.02 % / F.S. / ℃
	Output impedance	Approx. 150 Ω
	Recommended load resistance	100 k Ω or higher
	Output terminal	BNC
	Output precision	± 0.5 % / F.S. (when RL > 100 k Ω)
	Update period	Approx. 100 ms • Average indexation settings: 1 ≤ N ≤ 10 (initial value N=2)
Pressure	Voltage Output	0 to 10 V
	Range settings	Select 200 / 500 / 1000 / 980 kPa (For Input: 0 to +5 V)
	Offset the output	Within ± 10 mV
	Temperature coefficient	± 0.02 % / F.S. / ℃
	Output impedance	Approx. 150 Ω
	Recommended load resistance	100 k Ω or higher
	Output terminal	BNC
	Output precision	± 0.5 % / F.S. (when RL > 100 k Ω)
	Update period	Approx. 10 ms • Average indexation settings: 1 ≤ N ≤ 100 (initial value N=20)
Pulse output	Output items	Instantaneous flow rate
	Output waveform	Square wave Duty 50 % • During unloading • Depending on the input signal when set DIRECT
		HIGH Level: + 4.5 V or higher
		LOW Level : + 0.4 V or lower
	Recommended load resistance	100 k Ω or higher
	Output terminal	BNC
	The number of output pulse	0.001 / 0.01 / 0.1 (mL/Pulse or g/Pulse) and Direct

Pulse output	Minimum pulse duration	Approx. 1 μ s
	Accuracy	± 0.5 % (to the sampling data)

1.3 Display section specifications

Display	11.45 mm × 69.85 mm (2-stage display)	
Display items	Instantaneous flow rate on the first stage (L/h or Kg/h) Select Total flow (mL or g) and Total time (s), or Pressure (kPa) and Temperature (℃) for the second stage • Sig (Indicator is lit per pulse input from FP) • Measurement state and lock state are shown in the display unit	
Display update period	Approx. 0.5s or approx. 1s	
Display digit	Total flow	○○○○○○○ . ○ • Decimal point is variable according to the weight per selected pulse. The third decimal point: 0.001 mL/Pulse The second decimal point: 0.01 The first decimal point: 0.1 • When the display value reaches its maximum, change and display the decimal point as follows; 0.000 to 99999.999, 100000.00 to 999999.99, 1000000.0 to 9999999.9 • When the multiplication setting is ON, add one decimal digit to the above values
	Instantaneous flow rate	○○○ . ○○○○ • Decimal point is variable according to the weight per selected pulse. The third decimal point: 0.001 mL/Pulse The second decimal point: 0.01 The first decimal point: 0.1 • When the multiplication setting is ON, add one decimal digit to the above values
	Pressure	○○○○ (without after the decimal point) • Display unit: kPa
	Temperature	○○○ . ○ (to the first decimal point) • Display unit: ℃
	Total time	○○○○ . ○○ (to the second decimal point) • Display unit: s • When the display digits become full, display the value by carrying up after the decimal point
Brightness	Regard the maximum as 100%, set four steps of 25, 50, 75, and 100%	

1.4 Function section specifications

Average instantaneous flow rate	Display the data obtained through moving average the instantaneous flow rate, updated and displayed per 500 ms or 1 s, by 0.5 to 10 s	
Instantaneous flow rate analog output Indexation average	OFF/ON (N=1 to 1000)	
Backward flow correction	Detect a backward flow and correct the flow amount	
Density temperature correction function (convert into weight)	Correction function to know the weight flow from volumetric flow	
Output calibration (CAL)	V_OUT ZERO	0 V
	V_OUT FULL	10 V
Factor	1000 to 100000	
Button	START/HOLD (↑)	
	STOP (→)	
	RESET (↓)	
	MENU	
	ENTER	
	DISP	
REMOTE	An optional Remote Box is connectable	
CAN Output	Protocol	Conforms to CAN Ver2.0B
	Baud rate	125k bps / 250k bps / 500k bps / 1M bps
	Output update period	Select from OFF / 1 Hz / 2 Hz / 5 Hz / 10 Hz / 20 Hz / 100 Hz
	Output items	Instantaneous flow rate (L/h) / Temperature (℃) / Pressure (kPa)
	Connector	D-SUB 9PIN (Male)
	Termination resistor	ON/OFF
	Bus data format	Endian: Big Endian (Motorola)
		ID: 0x721 (Initial value) 0x001 to 0x7FF Variable
	Connector pin assignment	

PIN No.	Signal
1	NC
2	CAN_L
3	COM
4	TxD
5	COM
6	NC
7	CAN_H
8	RxD
9	NC

RS-232C (Optional)	Serial communication (start-stop system)	9600 bps / 38400 bps
	Connector	D-SUB 9 PIN (Male)
	Connector pin assignment	See “RS-232c communication connector specifications” on page 63 for details

1.5 General specifications

Power source	Battery connecting	DC 10 to 28 V, or
	When using AC adapter (optional)	AC100 to 240 V 50 / 60 Hz
Current consumption	28 VA or lower (at DC12 V)	
Operating environment	Indoor, in a vehicle	
Altitude	Elevation 2000 m or lower	
Operating temperature range	0 to +50° C *Operating temperature range of AC adapter is 0 to +40° C	
Storage temperature range	-10 to +60° C	
Operating humidity range	5 to 80 %	
Storage humidity range	5 to 85 %	
Shape size	170 mm × 120 mm × 50 mm or smaller	
Safety	IEC61010-1: Over-voltage category II Protection Class I Pollution level II • When using an optional AC adapter	

1.6 Conforming standards

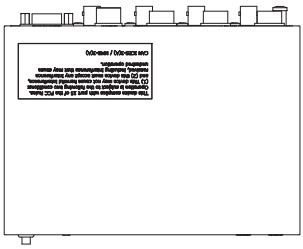
CE marking	LVD Directive 2014/35/EU	Standard EN61010-1 (with AC adapter)
	EMC Directive 2014/30/EU	Standard EN61326-1
	RoHS Directive 2011/65/EU	Standard EN50581
FCC	CFR47 Part15 Subpart B Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant 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.	

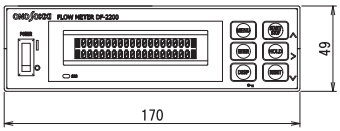
• For details , see https://www.onosokki.co.jp/English/english.htm

1.7 Others

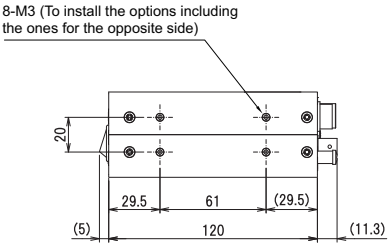
Resume functions	Store the condition value even during the power is OFF. (Display the total value at the time of power OFF)

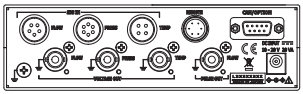
2. Outline dimensional drawing





FRONT VIEW





REAR VIEW

3. Error messages and remedy

CAUTION

- If the remedy introduced in this manual/passage does not solve the problem, stop using the device immediately; and consult the nearest Ono Sokki sales office or the distributor where you purchased the product.

List of error messages

DF-2200 On-Board Flow Meter displays a message when an error occurs.

The following error message will be shown when an abnormal action occurs in the internal circuit of DF-2200 On-Board Flow Meter.

When this error message is displayed, turn the power OFF immediately; and consult the nearest Ono Sokki sales office or the distributor where you purchased the product.

Message	Description in the message	Error causes
BOOT ERROR!	Boot error of FPGA Data was not readout correctly.	The magic number read-in value in the FPGA assigned area is abnormal.
MEM ERROR!	Condition memory error occurs.	The checksum of memory at the time of booting is abnormal.

Initialization procedure

The following procedure initializes the state of DF-2200 On-Board Flow Meter set with various conditions to factory default.

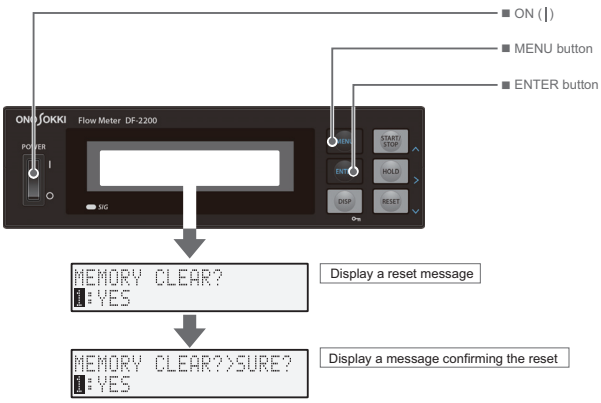
1 Switch POWER button of DF-2200 On-Board Flow Meter to ON (|) side while pressing [ENTER] button and [MENU] button at the same time.
A message “MEMORY CLEAR?” appears to start or cancel initialization.

2 ∧ Use UPWARD switch to switch to “1: YES” , then press [ENTER] button.
A message “MEMORY CLEAR? > SURE?” appears to re-confirm the starting of initialization.

3 ∧ Use UPWARD switch to switch to “1: YES” , then press [ENTER] button. Initialization will start.
When initialization is completed, the state of DF-2200 On-Board Flow Meter will return to factory default.
To cancel initialization, use ∧ UPWARD switch to switch to “0: NO” , then press [ENTER] button.

CAUTION

- The initialization will not initialize the data stored in the condition memory.
- Once the initialization is completed, the state cannot be restored. If the current state should not be deleted, please store it in the condition memory.


■ ON (|)
■ MENU button
■ ENTER button
ONO SOKKI Flow Meter DF-2200
POWER
I
O
SIG
MENU
START/ STOP
ENT
HOLD
DISP
RESET
MEMORY CLEAR?
:YES
Display a reset message
MEMORY CLEAR?>SURE?
:YES
Display a message confirming the reset

Index

E

F

G

H

I

K

L

M

N

O

P

R

S

T

U

V

W

ONO SOKKI

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

HOME PAGE: https://www.onosokki.co.jp/English/english.htm

WORLDWIDE
ONO SOKKI CO., LTD.
1-16-1 Hakusan, Midori-ku,
Yokohama 226-8507, Japan
Phone : +81-45-935-3918
Fax : +81-45-930-1808
E-mail : overseas@onosokki.co.jp

B00002556 / IM16112504(1.0)