ON-BOARD VOLUMETRIC FLOW DETECTOR
ON-BOARD FLOW METER
FP-4135/DF-2200

More precise and more flexible. Achieves measurement of higher level transient fuel consumption in various test environment.
More precise and more flexible. Achieves measurement of higher level in various test environment.

FP-4135/DF-2200 have high resistance to environment to support various test conditions, including an actual vehicle test and an environmental test. Compact with high function, the FP-4135 and DF-2200 enable every fuel consumption tests of internal combustion system.

**FP-4135**
On-Board Volumetric Flow Detector

More precise and more flexible. Achieves measurement of higher level transient fuel consumption in various test environment.

**Engine**
**Battery**

**Wide temperature range, high resolution, and low pressure loss**

By optimizing the detection part with the technological abilities of long time-proven volumetric flow detector and adopting a magnetic type encoder, FP-4135 has achieved temperature resistance, high resolution, and low pressure loss.

**Compact and space-saving design**

70 %* reduction in volume has been achieved by a downsized filter and the built-in temperature sensor which is required for fuel consumption measurement.

* Compared to the main unit of the FP-2140H made by Ono Sokki, excluding signal processing part.
transient fuel consumption

Having good visibility and operability

Good visual perceptivity by large display of instantaneous flow rate. One button operation allows easy switching of the display pattern among instantaneous flow rate, total flow rate, and temperature.

Wide variety of signal outputs

Wide variety of signal outputs including CAN output as well as high speed analog signal and pulse signal support various fuel measurement such as on-board vehicle measurement, measurement on an engine bench etc.
FP-4135 On-Board Volumetric Flow Detector

The FP-4135 supports wide variety of fuel rate measurement. Wide range from 0.1 to 200 L/h has been achieved by the use of a newly designed detector and new magnetic type encoder, which enables fuel measurement with the range from low load such as vehicle idling to high load. Having environmental resistance, measurement in wide temperature range is supported as standard. Also it can measure various fuels including alcohol. From on-board measurement to the test on the chassis dynamometer, wide range and wide variety of fuel rate measurement are supported.

Radial piston method

The range required for fuel measurement (from 0.1 to 200 L/h) and vibration test (up to approx. 3G) have been satisfied by vibration resistant pistonphone method and by new designed internal flow path.

Enhanced measurement functions

By the structure that the fuel detection part is separated from signal processing part for the consideration of temperature change in an engine room, it has high temperature resistance that withstands the temperature change from -30 to 100 °C.

Magnetic type encoder

By conveying the rotation motion of the crank shaft to magnetic type encoder through dividing wall, an extra loss for signal transmission is reduced. The dividing wall is also effective to reduce the risk of fuel leakage.

Compact and light weight

Ultra compact filter is installed inside of the detector as a standard specification to protect the detector from impure substances contained in fuel. The filter is removable for easy maintenance by customer.
The DF-2200 is designed to have all the required functions for fuel measurement in the compact body by improving an existing fuel flow meter widely. Those functions can sufficiently cope with not only on-board measurement, but also an evaluation on an engine bench. Space-saving design is helpful for measuring fuel flow rate in a limited space.

- The upper part of the detector is able to be replaced according to the type of an actual vehicle as additional processing. It does not need to cut the pipeline of an actual vehicle and reduces the risk of fuel leakage.
- Compact design (170 (W) x 49 (H) x 120 (D) mm) having the synchronous function of fuel flow rate, temperature and pressure data.
- 4-M6
- 4-Ø6.6
- 2-M6
- Standard Option SAE joint Option
- High speed internal sampling and exponential average function of analog output allow the averaged data output of transient measurement data.
- Conversion to mass flow rate is performed in real time by density input.
- HOLD function, and Auto stop function (option) are provided.
- Greatly improved various functions including average processing of display data.

To support various actual cars including a passenger vehicle and a large commercial vehicle, the DF-2200 accepts wide range of input power supply voltage from 12 to 24 VDC as a standard specification, and accepts 100 to 240 VAC by an optional AC adapter.

The DF-2200 provides CAN output required for actual vehicle measurement as a standard, and enables real time output of instantaneous flow rate, temperature and pressure. Optional RS-232C communication allows automatic measurement on an engine bench.
FP series Volumetric Flow Detector

**FP-4135**
On-Board Volumetric Flow Detector

**DF-2200 On-Board Flow Meter**

**Example of System**

- **FP series Volumetric Flow Detector**
  - **FP-4135**
    - **On-Board Volumetric Flow Detector**

- ** existing model of Flow Detector (FP-2140H)**

**Measurement item**
- Flow rate
- Pressure
- Temperature

**DF-2200 On-Board Flow Meter**

- **CAN (standard)**
- **RS-232C (option)**
- **DF-0223 Remote box (option)**

**Power cable for battery**

**AC adapter (option)**

**PLC**

**ANALOG**

**PULSE**

**FAMS (Flexible Automatic Measurement System) etc.**

**Personal Computer**

**FP-4135**

- **Pressure output is provided as an option.**
- **FP-2240HA/FP-2250A: Pressure output is provided as a standard.**

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**Measurement item**
- Flow rate/ Temperature

**Detection method**
- Flow rate: Positive displacement (piston method)
- Temperature: Resistance temperature detector (PT 100 ℃)

**Measurable liquid**
- Gasoline, light oil, kerosene, class-A heavy oil, engine oil, petroleum-based general hydraulic oil, methanol, ethanol, mixture of alcohol and gasoline, and brake oil
  - *Please note that this equipment might not be used in the depositing condition.*

**Measurement range**
- Flow rate: 0.1 to 200 L/h
- Temperature: -30 to 100 ℃

**Measurement accuracy**
- Flow rate: Within ±0.2 % of reading (measurement condition: 20 ℃, 50 %RH, Cleansol HS)
- Temperature: Class A

**Pressure loss**
- 4 kPa or less/at 60 L/h (gasoline)

**Minimum resolution**
- 0.01 mL

**Filter (built-in a detector)**
- Filtering capacity: 33 μm (inlet side), 770 μm (outlet side)

**Applicable display unit**
- DF-2200 On-Board Flow Meter
- FM-3500A Digital flow meter + DF-0400A measurement module
- FM-1500 Digital flow meter + DF-0400A measurement module

**Connection diameter**
- Rc 1/4

**Operating maximum pressure**
- 8 MPa

**Operating temperature range**
- Flow detection part: -30 to 100 ℃ (environment temperature, liquid temperature, unfreeze)
- Signal processing part: -30 to 70 ℃ (environment temperature)

**Vibration resistance**
- Conducted: Acceleration rms value: 27.3 m/s²
- Not-conducted: Acceleration peak value: 500 m/s²

**Weight**
- Flow detection part: Approx. 2.0 kg
- Signal processing part: Approx. 0.4 kg

**Applicable standard**
- **CE marking**
  - EMC Directive: 2014/30/EU standard
  - EN61326-1
- **RoHs Directive**: 2011/65/EU standard
  - EN60581

**Products included**
- FP-4135 (fuel detection part, signal processing part), instruction manual

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*Pressure measurement is available as an option. Please contact your nearest distributor or Ono Sokki sales office nearby for more details.*

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**Example of System**

- **FP series Volumetric Flow Detector**
  - **FP-4135**
    - **On-Board Volumetric Flow Detector**

- **Existing model of Flow Detector (FP-2140H)**

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* FP-4135: Pressure output is provided as an option. FP-2240HA/FP-2250A: Pressure output is provided as a standard.
## DF-2200 Specification

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Applicable detector</strong></td>
<td>FP-4135, FP-2132, FP-3130/3130S, FP-3132/3132S, FP-3140/3142, FP-2140/2240HA, FP-2140S, MF-3200</td>
</tr>
<tr>
<td><strong>Display method</strong></td>
<td>Fluorescent display tube (11.5 mm × 69.9 mm)</td>
</tr>
<tr>
<td><strong>Display update cycle</strong></td>
<td>Approx. 0.5 or 1 second</td>
</tr>
<tr>
<td><strong>Display item and the number of digits</strong></td>
<td>8 digits: 0.00000000 (mL or g)</td>
</tr>
<tr>
<td></td>
<td>• The position of decimal point is shifted according to the weight per selected flow rate pulse 0.001 mL/Pulse: 0.00000000</td>
</tr>
<tr>
<td></td>
<td>0.01 mL/Pulse: 0.00000000</td>
</tr>
<tr>
<td></td>
<td>• When the display value reaches its maximum, the decimal point is shifted and displayed as follows: 0.00 to 99999.999, 100000.00 to 999999.99, 1000000.00 to 9999999.99</td>
</tr>
<tr>
<td></td>
<td>• When the multiplication is ON, one decimal digit is added to the above values.</td>
</tr>
<tr>
<td><strong>Accumulated flow rate</strong></td>
<td>5 digits: 0.00000 (L/h or kg/h)</td>
</tr>
<tr>
<td></td>
<td>• When the display digit is full, the value is rounded up after the decimal point is displayed.</td>
</tr>
<tr>
<td><strong>Instantaneous flow rate</strong></td>
<td>7 digits: 0.00000000 (L/h or kg/h)</td>
</tr>
<tr>
<td></td>
<td>• The decimal point is variable according to the weight per selected pulse. 0.001 mL/Pulse: 0.00000000</td>
</tr>
<tr>
<td></td>
<td>0.01 mL/Pulse: 0.00000000</td>
</tr>
<tr>
<td></td>
<td>• When the multiplication is ON, one decimal digit is added to the above values.</td>
</tr>
<tr>
<td><strong>Pressure</strong></td>
<td>4 digits: 0.0000 kPa</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>4 digits: 0.0000 °C</td>
</tr>
<tr>
<td><strong>Voltage output (analogue)</strong></td>
<td>Instantaneous flow rate 0 to 10 V/0 to F.S. (Select the F.S. value from the following) 60/100/120/200/300 (Unit: L/h and kg/h)</td>
</tr>
<tr>
<td></td>
<td>Pressure 0 to 10 V/0 to F.S. (Select the F.S. value from the following) 200/300/1000/980 kPa</td>
</tr>
<tr>
<td></td>
<td>Temperature 0 to 10 V (Range is selected from the followings) 0 to 300, -50 to 100 °C</td>
</tr>
<tr>
<td><strong>Voltage output (pulse)</strong></td>
<td>Instantaneous flow rate 0.001/0.01/0.1 (mL/Pulse or g/Pulse) and direct</td>
</tr>
<tr>
<td></td>
<td>Number of output pulses</td>
</tr>
<tr>
<td></td>
<td>Output waveform Square wave Duty 50 % (HIGH level: 4.5 V or more, LOW level: 0.4 V or less), Depending on the input signal when set DIRECT.</td>
</tr>
<tr>
<td><strong>CAN output</strong></td>
<td>Protocol Conforms to CAN Ver 2.0 B</td>
</tr>
<tr>
<td></td>
<td>Baud rate 125 kbps/250 kbps/500 kbps/1 Mbps</td>
</tr>
<tr>
<td></td>
<td>Output item Instantaneous flow rate (L/h)/ Temperature (˚C)/ Pressure (kPa)</td>
</tr>
<tr>
<td><strong>RS-232C (option)</strong></td>
<td>Serial communication (Start-stop synchronization system) 9600 bps/38400 bps</td>
</tr>
<tr>
<td><strong>Measurement function</strong></td>
<td>Accumulation Start to stop by panel surface or external (remote box, RS-232C (option))</td>
</tr>
<tr>
<td></td>
<td>Accumulated auto stop (option) Accumulated flow rate or accumulated time from the start signal to the set time or flow rate.</td>
</tr>
<tr>
<td></td>
<td>HOLD function By pressing HOLD switch after the start signal, displays of accumulated value and time are kept although the internal operation is continued. Pressing the button again updates the accumulated value to the value of that time.</td>
</tr>
<tr>
<td></td>
<td>Instantaneous flow rate average It displays the data which has been performed the moving average processing by 0.5 to 10 seconds the instantaneous flow rate updated in 500 ms or 1 seconds.</td>
</tr>
<tr>
<td></td>
<td>Instantaneous flow rate analog output It outputs the indexation average value of instantaneous flow rate with the specified number of times from 1 to 1000 times.</td>
</tr>
<tr>
<td><strong>Indexation average</strong></td>
<td>Sampling cycle is 10 ms</td>
</tr>
<tr>
<td><strong>Power source</strong></td>
<td>Battery connection 10 to 20 VDC</td>
</tr>
<tr>
<td></td>
<td>AC adapter (option) 100 to 240 VAC, 50/60 Hz</td>
</tr>
<tr>
<td></td>
<td>Current consumption 28 VA or less (at 12 VDC)</td>
</tr>
<tr>
<td><strong>Operating temperature range</strong></td>
<td>0 to 50 °C / 0 to 40 °C</td>
</tr>
<tr>
<td><strong>Outer dimensions</strong></td>
<td>170 (W) x 49 (H) x 120 (D) mm</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Approx. 850 g</td>
</tr>
<tr>
<td><strong>Safety</strong></td>
<td>IEC61010-1: Over-voltage category II Ground Protection Class II Pollution level II (When using an optional AC adapter.)</td>
</tr>
<tr>
<td><strong>CE marking</strong></td>
<td>LVD Directive 2014/35/EU Standard EN61010-1 (with AC adapter)</td>
</tr>
<tr>
<td></td>
<td>EMC Directive 2014/30/EU Standard EN61326-1</td>
</tr>
<tr>
<td></td>
<td>RoHS Directive 2011/65/EU Standard EN50581</td>
</tr>
<tr>
<td><strong>FCC</strong></td>
<td>CFR47 Part15 SubpartB Class A</td>
</tr>
<tr>
<td><strong>List of options</strong></td>
<td>DF-0221 Auto stop function</td>
</tr>
<tr>
<td></td>
<td>DF-0222 RS-232C Communication function</td>
</tr>
<tr>
<td></td>
<td>DF-0223 Remote box</td>
</tr>
<tr>
<td></td>
<td>CT-0673 Panel mounting fixture</td>
</tr>
<tr>
<td></td>
<td>CT-0675 Protection handle</td>
</tr>
<tr>
<td></td>
<td>CT-0676 Shading hood</td>
</tr>
<tr>
<td></td>
<td>PS-P20023A AC adapter</td>
</tr>
<tr>
<td></td>
<td>VM1072-VM1700 Power cable (for Japan)</td>
</tr>
</tbody>
</table>

*Please consult us at the time of ordering for the world wide type power cable.*
Reliable and high level calibration
JCSS Accredited Calibration Laboratory

Ono Sokki provides reliable and high level calibration as “Accredited Calibration Laboratory” (fluid flow scope), which is certificated by JCSS\(^1\) calibration laboratory accreditation system, base on the skills and know-how of quality assurance system which has been acquired through many years of practice.

Under the JCSS of calibration laboratory accreditation system, Ono Sokki is assessed and accredited as Accredited Calibration Laboratories to meet the requirements of the Measurement Law, relevant regulations and ISO/IEC 17025. Ono Sokki can issue the calibration certificates with the JCSS accreditation symbol, which assures the traceability to National Measurement Standards as well as a laboratory’s technical and operational competence, and is acceptable in the world through the ilac\(^2\)-MRA\(^3\).

\(^1\) JCSS (Japan Calibration Service System)
\(^2\) ilac: International Laboratory Accreditation Cooperation
\(^3\) MRA: Mutual Recognition Arrangements

Target flow meter

<table>
<thead>
<tr>
<th>Series</th>
<th>Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>FP-3000</td>
<td>FP-3130, FP-3132, FP-3130S, FP-3132S, FP-3140, FP-3142</td>
</tr>
<tr>
<td>FP-4000</td>
<td>FP-4135</td>
</tr>
<tr>
<td>FZ-2000</td>
<td>FZ-2100</td>
</tr>
</tbody>
</table>

Outer Dimensions

**FP-4135 On-Board Volumetric Flow Detector (Detector part)**

- Connection to signal processing part
- Connection to temperature signal cable
- Fuel inlet (Rc 1/4)
- Fuel outlet (Rc 1/4)
- Directly attached cable 2 m
- 4-M6 x 1 Screw hole depth 10

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

- Connection to signal processing part
- Connection to temperature signal cable
- 4-M6 x 1 Screw hole depth 10

**DF-2200 On-Board Flow Meter**

- FRONT VIEW
- REAR VIEW

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