

**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.

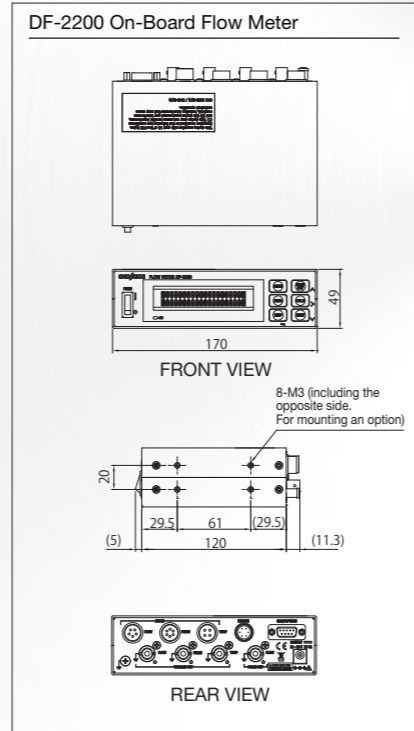
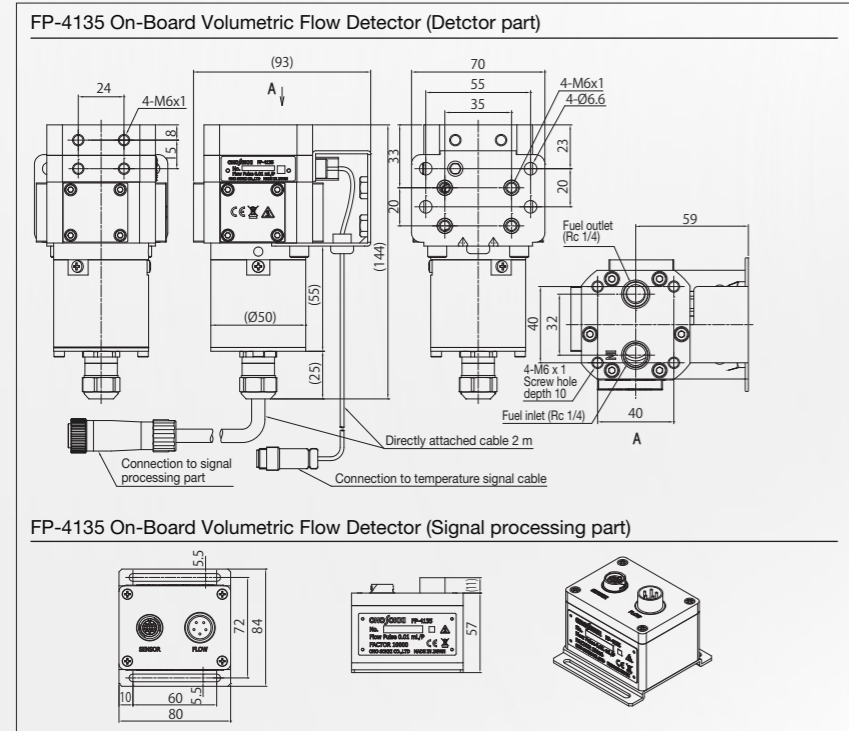
\*1 JCSS (Japan Calibration Service System)  
\*2 ilac: International Laboratory Accreditation Cooperation  
\*3 MRA: Mutual Recognition Arrangements



**Target flow meter**

- FP-2000/200 series : FP-213, FP-213S, FP-2140H, FP-2240H, FP-2240HA
- FP-3000 series : FP-3130, FP-3132, FP-3130S, FP-3132S, FP-3140, FP-3142
- FP-4000 series : FP-4135
- FZ-2000 series : FZ-2100

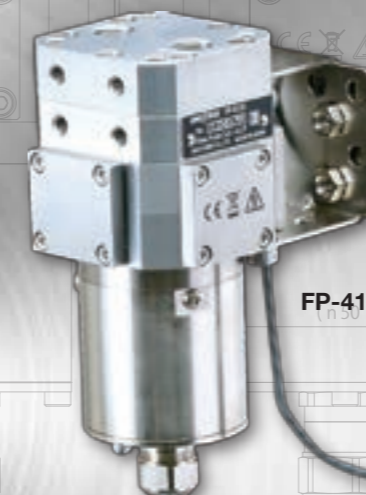
**Outer Dimensions**



**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.**



FP-4135 On-Board Volumetric Flow Detector



DF-2200 On-Board Flow Meter



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\*Outer appearance and specifications are subject to change without prior notice.  
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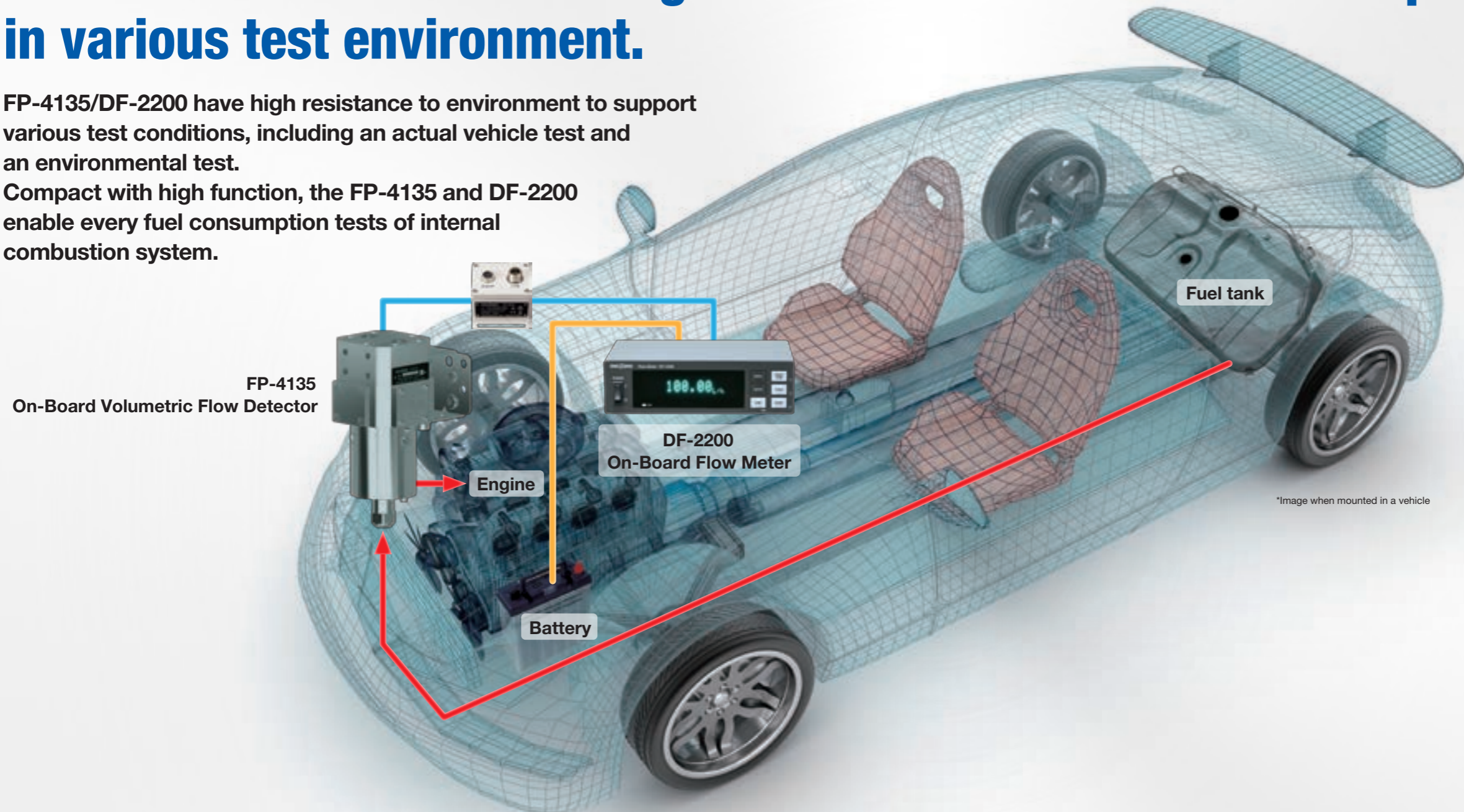
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# More precise and more flexible. Achieves measurement of higher level transient fuel consumption in various test environment.

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.



1

**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.

2

**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.

3

**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.

4

**Wide variety of signal outputs**

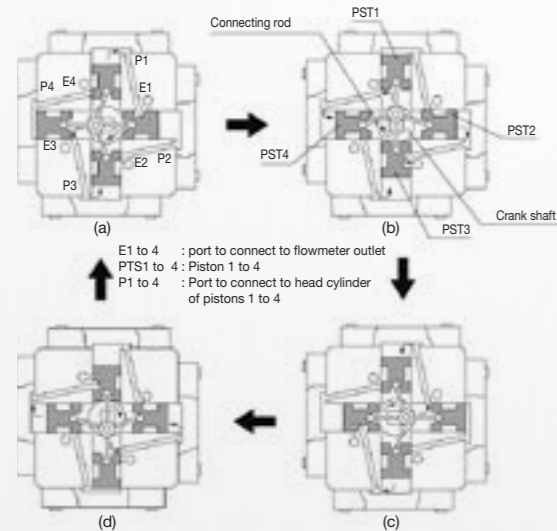
Wide variety of signal outputs including CAN output as well as high speed analog signal and pulse signal support various fuel measurement such as on-board vehicle measurement, measurement on an engine bench etc.

# 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.



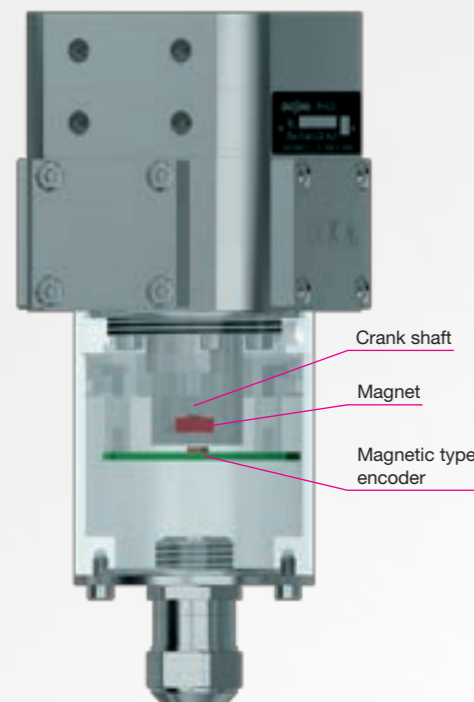
## Enhanced measurement functions

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.



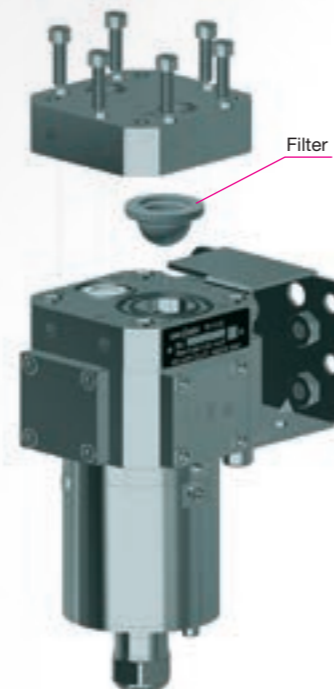
## Magnetic type encoder

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.



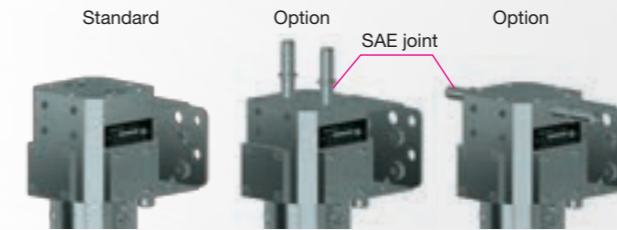
## Compact and light weight

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.



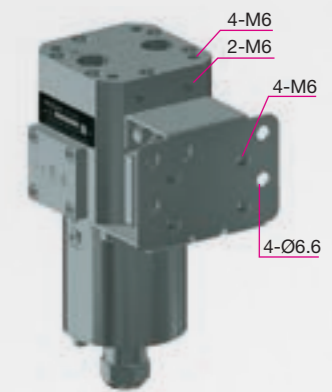
## Actual vehicle joint option

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.



## Various detector installation options

In addition to metal fittings, various taps are provided on all sides of a detector to fix it in a limited space of engine room.



# DF-2200 On-Board Flow Meter

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.



## Compact design suitable for on-board measurement

Compact design (170 (W) x 49 (H) x 120 (D) mm) having the synchronous function of fuel flow rate, temperature and pressure data.



## Enhanced measurement functions

- 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.

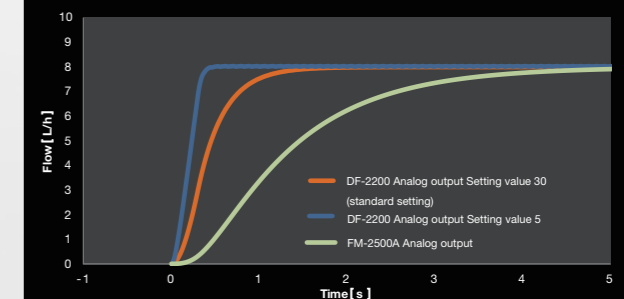
## Accepts wide range of input power supply voltage

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

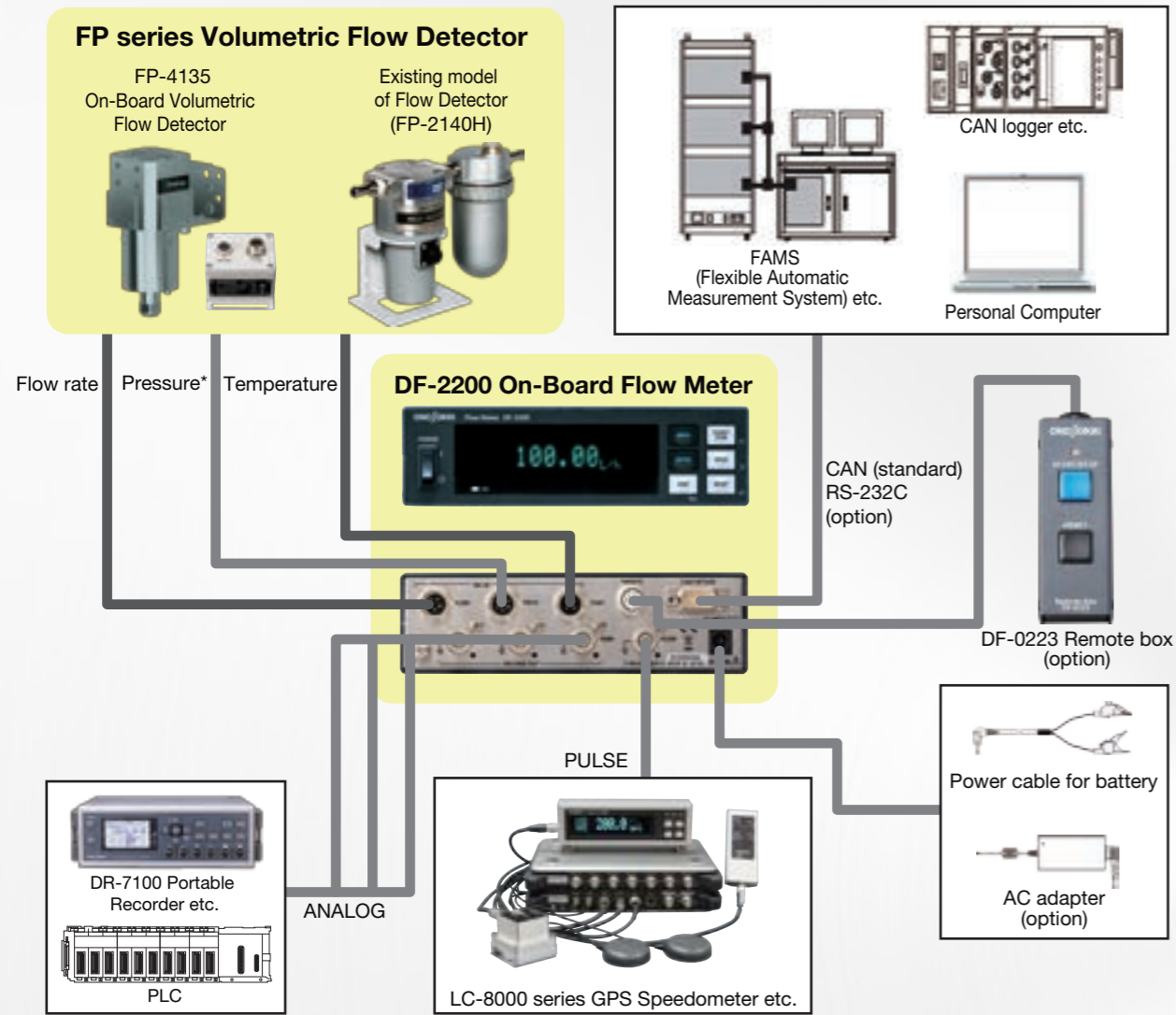
## CAN output as a standard

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.

## Comparison of Analog Output Response



## Example of System



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

## FP-4135 Specification

Measurement item	Flow rate/ Temperature
Detection method	Flow rate: Positive displacement (piston method) Temperature: Resistance temperature detector (PT 100 Ω)
Measurable liquid	Gasoline, light oil, kerosene, class-A heavy oil, engine oil, petroleum-based general hydraulic oil, methanol, ethanol, mixture of alcohol and gasoline, and brake oil *Please note that this equipment might not be used in the depositing condition.
Measurement range	Flow rate: 0.1 to 200 L/h Temperature: -30 to 100 °C
Measurement accuracy	Flow rate: Within ±0.2 % of reading (measurement condition: 20 °C, 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-2500A 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 °C (environment temperature, liquid temperature, unfreeze) Signal processing part: -30 to 70 °C (environment temperature)
Vibration resistance	Conducted: Acceleration rms value : 27.3 m/s <sup>2</sup> 10 to 1000 Hz random vibration/ 1 hour for each direction of each 3 axis Not-conducted: Acceleration peak value : 500 m/s <sup>2</sup> Both directions in the direction of the 3 axes: total of 18 times, 3 times each for ±X/Y/Z Sine half-wave: Operating time 11 ms
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 EN50581
Products included	FP-4135 (fuel detection part, signal processing part), instruction manual

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

## DF-2200 Specification

Item	Specification		
Applicable detector	FP-4135 FP-213/213S FP-3130/3130S, FP-3132/3132S, FP-3140/3142 FP-2140H/2240HA, FP-2140S MF-3200		
Display method	Fluorescent display tube (11.5 mm x 69.9 mm)		
Display update cycle	Approx. 0.5 or 1 second		
Display item and the number of digits	Accumulated flow rate	8 digits: ○○○○○○○○ (mL or g) • The position of decimal point is shifted according to the weight per selected flow rate pulse 0.001 mL/ Pulse: ○○○○○.○○○ 0.01 mL/ Pulse: ○○○○○.○○ 0.1 mL/ Pulse: ○○○○○.○	
	Accumulated time	5 digits: ○○○.○○ s • When the display digits become full, the value by round up after the decimal point is displayed.	
	Instantaneous flow rate	7 digits: ○○○○○○○ (L/h or kg/h) • The decimal point is variable according to the weight per selected pulse. 0.001 mL/ Pulse: ○○○○.○○○ 0.01 mL/ Pulse: ○○○○.○○ 0.1 mL/ Pulse: ○○○○.○	
Voltage output (analog)	Pressure	4 digits: ○○○○ kPa	
	Temperature	4 digits: ±○○○.○ °C	
	Instantaneous flow rate	0 to 10 V/ 0 to F.S. (Select the F.S. value from the followings) 60/100/120/200/300 (Unit: L/h and kg/h)	
Voltage output (pulse)	Pressure	0 to 10 V/ 0 to F.S. (Select the F.S. value from the followings) 200/500/1000/980 kPa	
	Temperature	0 to 10 V (Range is selected from the followings) 0 to 100, -50 to 100 °C	
	Instantaneous flow rate	0.001/0.01/0.1 (mL/Pulse or g/Pulse) and direct 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	
CAN output	Protocol	Conforms to CAN Ver 2.0 B	
	Baud rate	125 kbps/ 250 kbps/ 500 kbps/ 1 Mbps	
	Output item	Instantaneous flow rate (L/h)/ Temperature (°C)/ Pressure (kPa)	
RS-232C (option)	Serial communication (Start-stop synchronization system)	9600 bps/38400 bps	
Measurement function	Accumulation	Start to stop by panel surface or external (remote box, RS-232C (option))	
	Accumulated auto stop (option)	Accumulated flow rate or accumulated time from the start signal to the set time or flow rate.	
	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.	
	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.	
	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.	
Indexation average	Sampling cycle is 10 ms		
General specification	Power source	Battery connection	10 to 28 VDC
		AC adapter (option)	100 to 240 VAC, 50/60 Hz
	Current consumption	28 VA or less (at 12 VDC)	
	Operating temperature range	0 to 50 °C *AC adapter: 0 to 40 °C	
	Outer dimensions	170 (W) x 49 (H) x 120 (D) mm	
	Weight	Approx. 800 g	
	Safety	IEC61010-1: Over-voltage category II Ground Protection Class II Pollution level II (When using an optional AC adapter.)	
	CE marking	LVD Directive 2014/35/EU	Standard EN61010-1 (with AC adapter)
		EMC Directive 2014/30/EU	Standard EN61326-1
	FCC	RoHS Directive 2011/65/EU	Standard EN50581
CFR47 Part15 SubpartB Class A			
Products included	DF-2200 main unit LC-0082 Power cable for battery Rubber foot x 4 Instruction manual		

## List of options

DF-0221	Auto stop function
DF-0222	RS-232C Communication function
DF-0223	Remote box
CT-0673	Panel mounting fixture
CT-0675	Protection handle
CT-0676	Shading hood
PS-P20023A	AC adapter
VM1072-VM1700*	Power cable (for Japan)

\*Please consult us at the time of ordering for the world wide type power cable.

