

# PORTABLE TYPE ULTRASONIC FLOWMETER (PORTAFLOW-C)

DATA SHEET

FSC, FLD/FSD

PORTAFLOW-C is a portable type ultrasonic flowmeter utilizing the transit time measuring method, using a clamp-on type detector.

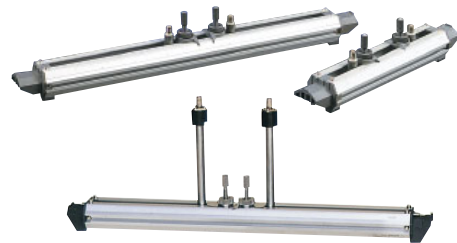
It is a compact and lightweight instrument incorporating the latest electronics and digital signal processing technologies, realizing high performance and easy operation.

## FEATURES

- 1. Compact and lightweight**  
The adoption of the latest electronics and digital signal processing technologies has reduced the size and weight of the flow transmitter by 30% and 30%, respectively, in comparison with the Fuji conventional portable flowmeter (Model FSC).
- 2. Battery operation**  
The flowmeter is designed for 12 hours of continuous operation via built-in battery which is rechargeable in 3 hours with the exclusive power adapter.
- 3. Full variety of detectors**  
The flowmeter is suitable for various types of detectors applicable for small to large diameter pipe ( $\phi 13$  to  $\phi 6000\text{mm}$ ) and low to high temperature ( $-40$  to  $+200^\circ\text{C}$ ).
- 4. High accuracy and high-speed response**  
The flowmeter is designed for high accuracy ( $\pm 1.0\%$ ). Response time is within 1 second.
- 5. Improved anti-bubble characteristic**  
Anti-bubble characteristic is greatly improved by digital signal processing.
- 6. Excellent performance and easy operation**  
Large graphic LCD that is outside but easy to read. Minimum number of function keys are used for page selection, allowing easy setting.  
The flowmeter is water resistant and tolerates exposure to rain.
- 7. Large capacity storage by SD memory card**  
Measured data is periodically stored in SD memory card. For example, in case of 256MB, it can be saved about 1 year measurement date (In case of saving period 30 seconds, 14 kinds of saved data). Available up to 8MB (Option 256MB)
- 8. Serial communication**  
Use of a USB port allows easy connection to a personal computer. Measured data collection panel and Loader software for PC (standard) which is available for display and change of parameter (site setting) are prepared.
- 9. Heat quantity (calorie) measurement**  
Heat quantity (calorie) may be measured by temperature input, making energy management easy for cooling and heating.



Flow transmitter (FSC)



Detector (FLD)

- 10. Graphic printer connection (option)**  
Easy recording with the Integral type printer.
- 11. Flow velocity profile measurement (option)**  
Flow profile may be observed in real time.

## SPECIFICATIONS

### Measuring objects

**Measurement fluid:**

Uniform liquid in which ultrasonic waves can propagate.

**Turbidity of fluid:** 10000 mg/L or less

**State of fluid:** Well-developed turbulent or laminar flow in a filled pipe.

**Fluid temperature:**  $-40$  to  $+200^\circ\text{C}$

**Measuring range:**  $0 \dots \pm 0.3$  to  $\pm 32\text{m/s}$

### Piping conditions

**Applicable piping material:**

Select from carbon steel, stainless steel, cast iron, PVC, FRP, copper, aluminum, acrylic or material of known sound velocity.

**Pipe size:**

Flow rate measurement

$\phi 13$  to  $\phi 6000\text{mm}$

Flow velocity profile measurement

$\phi 40$  to  $\phi 1000\text{mm}$

**Lining material:** Select from no lining, tar epoxy, mortar, rubber, Teflon, pyrex glass or material of known sound velocity.  
 Note) No gap allowed between the lining and the pipe.

**Straight pipe length:**  
 10D or more upstream and 5D or more downstream (D: internal pipe diameter)  
 Refer to Japan Electric Measuring Instruments Manufactures' Association's standard JEMIS-032 for details.

**Performance specifications**

**Accuracy rating:**

Piping diameter (inner diameter)	Flow velocity range	Accuracy
φ13 to φ25mm	2 to 32m/s	±2.5% of rate
	0 to 2m/s	±0.05m/s
φ25 to φ50mm	2 to 32m/s	±1.5% of rate
	0 to 2m/s	±0.03m/s
φ50 to φ300mm	2 to 32m/s	±1.0% of rate
	0 to 2m/s	±0.02m/s
φ300 to φ6000mm	1 to 32m/s	±1.0% of rate
	0 to 1m/s	±0.01m/s

Note) Reference conditions are based on JEMIS-032.

**Flow transmitter (Type: FSC)**

**Power supply:** Built-in battery or AC power adapter  
 Built-in battery: Exclusive lithium button battery (5000m Ah)  
 Continuous operation time, approx. 12 hours (without printer, back light OFF)  
 Recharging time, approx. 3 hours (power adapter used)

Power adapter: Exclusive power adapter 90V to 264V AC (50/60Hz)

Power Consumption: Approx. 3W

**LCD:** Semi-transmissive color graphic display 240 × 320 (with back light)  
 Measurement value (instantaneous flow rate, integrated flow rate) and various settings are displayed.  
 Excellent visibility even outdoors in direct sunlight.

**LED display:** Status display when using AC power adapter.  
 DC IN (green): Power supply status  
 CHARGE (red): Battery charging underway

**Operation keypad:**  
 11 buttons  
 (ON, OFF, ENT, ESC, MENU, △, ▽, ◀, ▶, LIGHT, PRINT)

**Power failure backup:**  
 Measurement value is backed up by nonvolatile memory.  
 Clock backup with lithium battery (effective term, 10 years or more)

**Response time:** 1 second

**Analog output signals:**  
 4 to 20mA DC, one point (load resistance, 600Ω or less)  
 Instantaneous velocity, instantaneous flow rate or heat quantity (calorie) after scaling.

**Analog input signal:**

4 to 20mA DC, one point (input resistance, 200Ω or less)  
 4 to 20mA DC, one point (input resistance, 200Ω or less)  
 or 1 to 5V DC, one point  
 Used to input temperature for heat quantity measurement, etc.

Total 2 points

**SD memory card:** Used for data logger function and recording screen data.  
 Available up to 8GB (Option256MB)  
 Compliant media

- SD memory card: speed class 2, 4, 6
- SDHC memory card: speed class 4, 6

Format

- FAT12: 64MB
- FAT16: 128MB to 2GB
- FAT32: 4GB, 8GB

Otherwise, reading and saving are impossible.

File format

- Date logger: CSV file
- Screen date: Bit map file

**Serial communication:**

USB port (device\* compatible):  
 Mini B receptacle  
 Connectable number of Mini B receptacles:  
 1 unit  
 Transmission distance: 3m max.  
 Transmission speed: 500kbps  
 Data:  
 Instantaneous velocity, instantaneous flow rate, total value, heat quantity (calorie) value, error information, logger data, etc.  
 \* Device: Connected plug from PC

**Printer (option):** To be mounted on top of transmitter unit  
 Thermal line dot printing

**Ambient temperature:**  
 -10 to +55°C (Without printer)  
 -10 to +45°C (With printer)

**Ambient humidity:** 90%RH or less

**Type of enclosure:** IP64 (Without printer)

**Enclosure case:** Plastic case

**Outer dimensions:** H210 × W120 × D65mm (Without printer)  
 H320 × W120 × D65mm (With printer)

**Weight:**  
 1.0kg (Without printer)  
 1.2kg (With printer)

**Various functions**

**Display language:** Selectable from Japanese, English, German, French, Spanish or Chinese (switchable by key operation).

**Clock display function:**  
 Time (year, month, day, hour, minute) display (configurable)  
 Monthly error: about 1 minutes. However, time error at power ON/OFF is not included.

**Instantaneous value display function:**  
 Instantaneous velocity, instantaneous flow rate display (The flow in reverse direction is displayed with minus "-.")  
 Numeric value: 10 digits (decimal point equals 1 digit)

Unit: Metric/English system selectable  
Metric system

Velocity: m/s

Flow rate: L/s, L/min, L/h, L/d, kL/d,  
ML/d, m³/s, m³/min, m³/h,  
m³/d, km³/d, Mm³/d, BBL/s,  
BBL/min, BBL/h, BBL/d,  
kBBL/d, MBBL/d

English system

Velocity: ft/s

Flow rate: gal/s, gal/min, gal/h, gal/d,  
kgal/d, Mgal/d, ft³/s, ft³/min,  
ft³/h, ft³/d, kft³/d, Mft³/d,  
BBL/s, BBL/min, BBL/h,  
BBL/d, kBBL/d, MBBL/d

**Total value display function:**

Display of forward or reverse total  
(reverse is displayed as minus)  
Numeric value: 10 digits (decimal point  
is corresponding to 1 digit)

Unit: Metric/English system selectable  
Metric system

Flow rate total: mL, L, m³, km³, Mm³,  
mBBL, BBL, kBBL

English system

Flow rate total: gal, kgal, ft³, kft³, Mft³,  
mBBL, BBL, kBBL, ACRE-ft

**Consumed heat quantity (calorie) display function:**

Display of consumed heating medium  
Metric system

Heat flow: MJ/h, GJ/h

Total heat quantity: MJ, GJ

English system

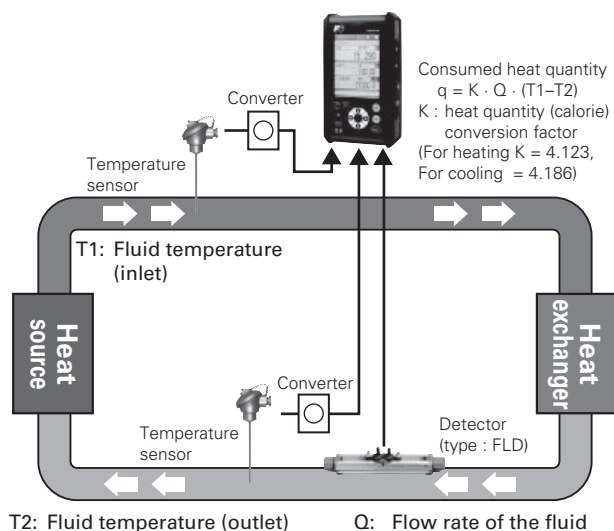
Heat flow: MJ/h, GJ/h, BTU/h, kBTU/h,  
MBTU/h

Total heat quantity:

MJ, GJ, BTU, kBTU, MBTU

**Computation function of consumed heat quantity (calorie):**

This function calculates the heat  
quantity received and sent with liquid  
(water) in cooling and heating.



**Temperature display function:**

Fluid temperature be displayed by cur-  
rent input from temperature transmit-  
ter.

Metric system

Temperature unit: °C or K

English system

Temperature unit: F or K

**Site data storage function:**

Max. 32 locations (sites) data (pipe  
size, material, fluid type and etc) can be  
stored into built-in non-volatile memo-  
ry.

**Damping:**

0 to 100sec (every 0.1sec) configurable  
for analog output and velocity/flow rate  
display

**Low flow cut:**

Equivalent to 0 to 5m/s

**Output setting function:**

Current output scaling, output type,  
burnout setting and calibration

**Serial communication function:**

Instantaneous velocity, instantaneous  
flow rate, total value, heat flow, error  
information, received waveform, analog  
input, velocity profile data, logger data,  
etc. may be downloaded to personal  
computer.

**Logger function:**

Instantaneous velocity, instantaneous  
flow rate, total value, heat flow, error  
information, received waveform, analog  
input, velocity profile data can be saved  
in a SD memory card.

**Waveform display function:**

Bi-directional received waveforms may  
be displayed.

**Graph display function:**

Flow rate trend graph may be dis-  
played.

**Printing function (option):**

Hard copy output of a screen  
Periodic printing (type: text, graph)  
Logger data (type: text, graph)

**Flow velocity profile measurement (option):**

Flow velocity profile may be observed  
in real time using the exclusive detector  
(option).  
(Refer to page 5 for details.)

**Detector (Type: FLD)**

**Type of detector:**

Kind	Type	Internal pipe diameter (mm)	Fluid temperature
Small type	FLD12	φ50 to φ300	-40 to 100°C
Small diameter	FLD22	φ13 to φ100	-40 to 100°C
High temperature	FLD32	φ50 to φ400	-40 to 200°C
Middle type	FLD41	φ200 to φ1200	-40 to 80°C
Large type	FLD51	φ200 to φ6000	-40 to 80°C

**Mounting method:**

Mounting on outside of existing pipe

**Sensor mounting method:** V or Z method

Signal cable: Exclusive coaxial cable

Standard 5m

**Method for connection:**

Flow transmitter side

Exclusive connector

Detector side

Large/middle type: Screw terminal

Others: BNC connector

**Ambient temperature:** -20 to +60°C

**Ambient humidity:** Large/middle type sensor:

100%RH or less

Others: 90%RH or less



## FLOW VELOCITY PROFILE DISPLAY FUNCTION (OPTION)

Flow velocity profile can be observed in real time using the dedicated detector from the outside. It is specifiable by the code symbol of flow transmitter.

### APPLICATION

Pulse Doppler method is applicable to observe flow velocity profile in real time, display the flow status in the pipe, and decide the appropriate measurement location. Also, it can be used for diagnosis of flow and laboratory test.

### SPECIFICATIONS

**Measuring fluid:** Uniform liquid in which ultrasonic waves can propagate.

**Turbidity of fluid:** Axisymmetric flow in a filled pipe.

**Fluid temperature:**

–40 to +100°C (FSDP2)

–40 to +80°C (FSDP1, FSDP1)

**Air bubble quantity:**

0.02 to 15Vol% (Velocity is 1m/s)

**Pipe size:** Small type sensor :  $\phi 40$  to  $\phi 200$ mm

Middle type sensor :  $\phi 100$  to  $\phi 400$ mm

Large type sensor :  $\phi 200$  to  $\phi 1000$ mm

**Measurement range:**

0 to  $\pm 0.3$ :  $\pm$ Maximum Velocity (depending on the pipe diameter)

Refer to chart, page 6.

Note) This function is to observe flow velocity profile, and it may be different from actual flow rate.

### DETECTOR FOR FLOW VELOCITY PROFILE MEASUREMENT (TYPE: FSD)

**Mounting method:**

Mounting on outside of existing pipe

**Ambient temperature:** –20 to +80°C

**Ambient humidity:** 100% RH or less

**Type of enclosure:**

IP67 (with waterproof BNC connector provided.)

**Material:**

Sensor housing: PBT

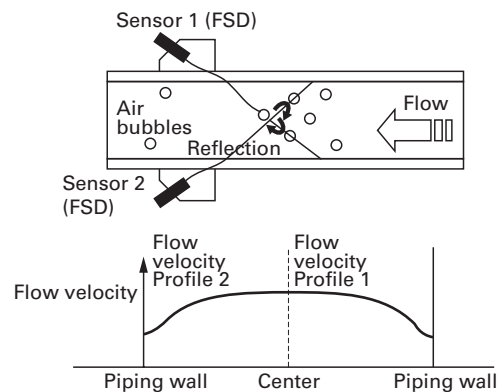
Guide frame: Aluminum alloy

Mounting belt: Plastic cloth belt/stainless belt

### Measurement principle

<Pulse Doppler method>

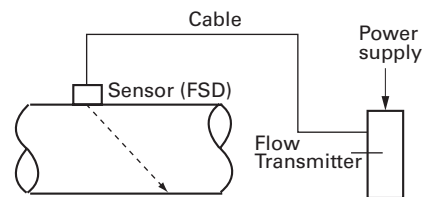
- Ultrasonic pulses are transmitted through the fluid flow. Entrained bubbles and microscopic particles within the fluid create frequency phase shifts (Doppler effect.) The resulting doppler shifts are integrated across the inside pipe diameter cross section. The resulting profile curve is a real-time dynamic display of the flow profile within the pipe.



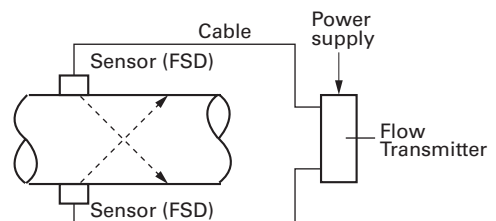
The above shows an example when using two sensors.

### Block diagram

(1) Using one sensor



(2) Using two sensors



Maximum measurement range using pulse doppler method

Refence condition: stainless steel pipe, nominal wall thickness is Sch20s, and the fluid is water.

<Maximum measurable flow velocity>

Unit: m/s

Diameter	FSDP2	FSDP1	FSDP0
40A	6.56		
50A	6.04		
65A	4.99		
80A	4.40		
90A	3.92		
100A	3.45	6.95	
125A		5.86	
150A		5.04	
200A		3.90	7.59
250A			6.26
300A			5.32
350A			4.82
400A			4.25
450A			3.80
500A			3.54
550A			3.14
600A			2.89
650A			2.69
700A			2.50
750A			2.34
800A			2.19
850A			2.07
900A			1.95
1000A			1.76

<Maximum measurable flow rate>

Unit: m³/h

FSDP2	FSDP1	FSDP0
33.68		
48.5		
67.8		
81.8		
97.1		
110.2	222.0	
	279.2	
	343.2	
	462.8	887
		1,146
		1,404
		1,572
		1,831
		2,091
		2,393
		2,587
		2,850
		3,067
		3,325
		3,590
		3,839
		4,112
		4,357
		4,852

PC Loader software

Equipped as standard

- PC/AT compatible machines.
- Operation on custom built PCs or shop-brand PCs cannot be guaranteed.
- Major functions: Performs parameter (site setting) display /change of the main unit and collects measured date. Instantaneous velocity, instantaneous flow rate, total value, error information, received waveform, analog input, logger data, etc. may be downloaded in a personal computer.

- O/S: Windows2000/XP/Vista\*
- Memory requirement: 128MB or more
- Disk unit: Windows2000/XP/Vista-compatible CD-ROM drive
- Hard disk drive capacity: Free space of 52MB or more

\* Windows Vista: Use it in basic mode.  
It is not available for Windows Aero.

CODE SYMBOL

<Flow transmitter>

1 2 3 4 5 6 7 8 9 10										Description
F	S	C					1		0	<Specification> Standard
	S									<Converter> Basic system Basic system + Printer
										<Flow velocity profile measurement> None Provided (detector to measure flow velocity profile is separately required.)
										<Power adapter> AC power + power cord (125V AC) for Japanese and North American use AC power + power cord (250V AC) for European and Korean use AC power + power cord (250V AC) for Chinese use
									1	Modification No.
									0	<SD memory card> None
									1	Provided (256MB)

## <Detector>

(for transit time)

1 2 3 4 5 6 7 8 9								
F	L	D						A
1	2							
2	2							
3	2							
4	1							
5	1							
		0						
		1						
			Y					
				1				

Description	
<Kind>	Small type (for $\phi 50$ to $\phi 300$ mm) Small diameter (for $\phi 13$ to $\phi 100$ mm) High-temperature (for $\phi 50$ to $\phi 400$ mm) <b>Note</b> Middle type (for $\phi 200$ to $\phi 1200$ mm) Large type (for $\phi 200$ to $\phi 6000$ mm)
<Application>	None Provided (Middle/Large type only)
<Structure>	General use
	Modification No.

### Note)

Use the optional guide rail, if a pipe that does not allow ultrasonic waves to pass through easily, such as when an old pipe, cast iron pipe or a pipe with mortar lining is used, or the flow or liquid high in turbidity is measured. Employ the Z method for mounting.  
Applicable diameter range: V method:  $\phi 50$  to  $\phi 250$   
Z method:  $\phi 150$  to  $\phi 400$

(for flow velocity profile measurement)

1 2 3 4 5 6 7 8							
F	S	D		0	Y	1	
P	2						
P	1						
P	0						
				0			
					Y		
						1	

Description	
<Kind>	Small type ( $\phi 40$ to $\phi 200$ mm) Middle type ( $\phi 100$ to $\phi 400$ mm) Large type ( $\phi 200$ to $\phi 1000$ mm)
<Application>	None
<Structure>	General use
	Modification No.

## SCOPE OF DELIVERY

<Flow transmitter>

Name of unit	Scope of delivery
1 Basic system	1) Conversion unit 2) Power adapter 3) Power connector conversion cord 4) Power cord 5) Analog input/output cord (1.5m) 6) USB cable (1m) 7) Carrying case 8) Strap 9) Special type signal cable (5m $\times$ 2) 10) BNC adapter 11) CD-ROM (Instruction manual and Loader software for PC)
2 Printer (option)	1) Printer unit 2) Printer rolled paper (1 roll)
3 SD memory card (option)	1) SD memory card (256MB)

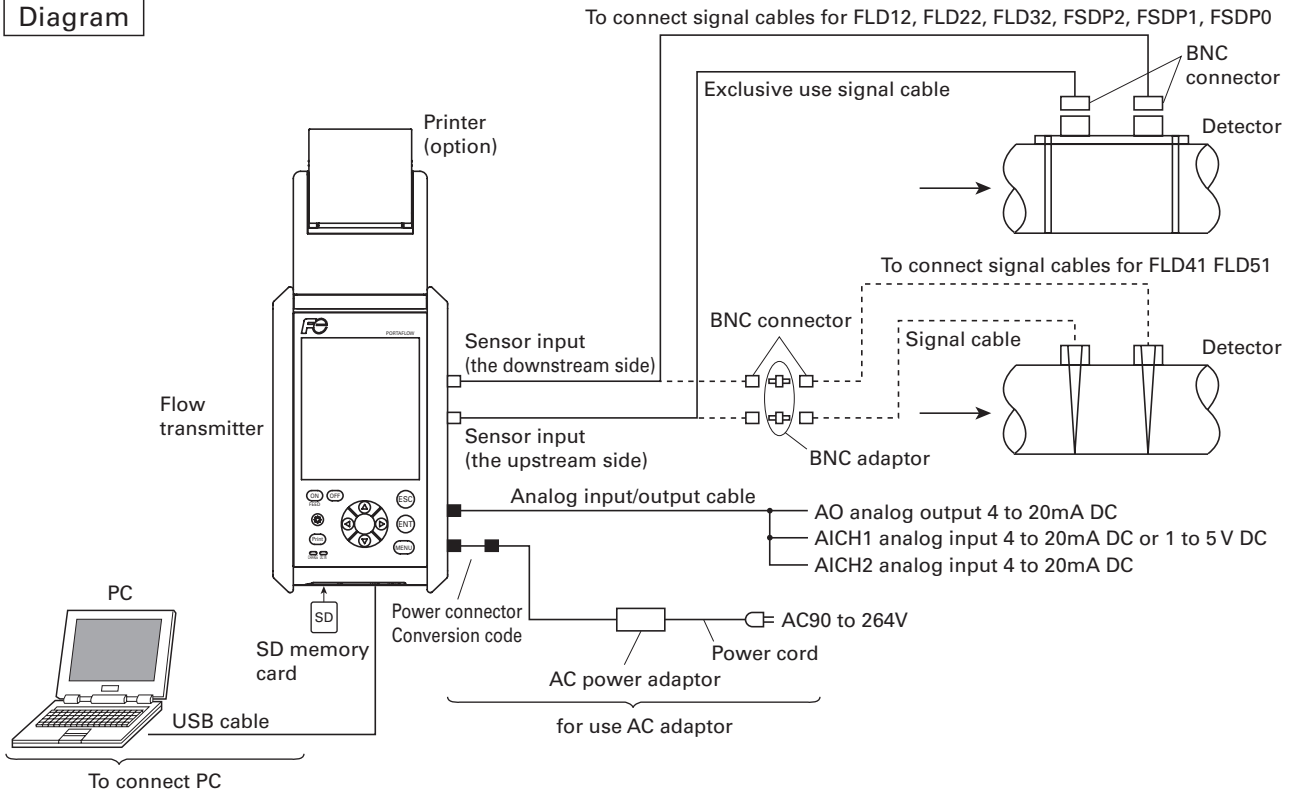
<Detector>

Name of unit	Scope of delivery
1 Small/Small diameter/High temperature/Middle/Large	1) Sensor unit 2) Signal cable (5m) 3) Mounting belt/wire 4) Silicone grease (100g)

## OPTIONAL ITEMS

	Name	Specifications	Arrange-ment No.
1	Battery	Special type Li-ion battery (7.4V, 2500mAh) $\times$ 2	ZZP*TK373312P4
2	Power adapter	Special type power adapter 90 to 264V AC, 50/60Hz · AC power adapter · Power connector conversion code	ZZP*TK7N6380P1 ZZP*TK4J2637C1
3	Power code	Japan, North America: 125V AC 2m Europe, Korea: 250V AC 2m China: 250V AC 2m	ZZP*TK7N6621P1 ZZP*TK7N6608P1 ZZP*TK7N6609P1
4	Printer unit	To be mounted on top of converter Thermal serial dot system (8 $\times$ 384 dot)	ZZP*TK4J2634C1
5	Printer roll paper	Maker: SEIKO I SUPPLY Co. Ltd. Type: LP-251L Specifications: Thermal roll paper Width: 58mm $\times$ $\phi$ 48mm, No core	ZZP*TK7G7982C1
6	Silicone grease	Maker: Shin-Etsu Chemical Co., Ltd. Type: · For standard use G40M, 100g · For high temperature KS62M, 100g	ZZP*TK7G7984C1 ZZP*TK7G7983C1
7	Signal cable	Special type signal cable, 5m $\times$ 2 Connector on both sides Red connector Blue connector · Middle type/Large type sensor: BNC connector on one side	ZZP*TK4J2640C1 ZZP*TK4J2640C2 ZZP*TK7G7987C1
8	Extension signal cable	Special type coaxial cable with BNC connector · 10m $\times$ 2 · 50m $\times$ 2	ZZP*TK468664C3 ZZP*TK468664C4
9	Analog input/output cable	6-core cable, 1.5m, with connector	ZZP*TK4J2639C1
10	Mounting belt /wire	· Small type/small diameter sensor: Plastic cloth belt · Large type sensor: Stainless wire Nominal diameter $\phi 200$ to $\phi 500$ mm $\phi 200$ to $\phi 1000$ mm $\phi 200$ to $\phi 2000$ mm $\phi 200$ to $\phi 3000$ mm $\phi 200$ to $\phi 6000$ mm · High-temperature sensor: Stainless steel belt	ZZP*TK7G7979C1 ZZP*TK7G7980C1 ZZP*TK7G7980C2 ZZP*TK7G7980C3 ZZP*TK7G7980C4 ZZP*TK7G7980C5 ZZP*TK7G7981C1
11	Guide rail for high-temperature sensor (In mounting by the Z method)	· Case material: SUS304 · Mounting bracket material: Aluminum alloy+SUS304	ZZP*TK4C6164C1
12	SD memory card	Maker: Apacer Technology, Inc. Type: AP-ESD256TPSR Capacity: 256MB	ZZP*TK7N6386C1
13	USB cable	Maker: Sunwa Supply Inc. Type: KU-AMB510 Specifications: Mini USB cable (1.0m)	ZZP*TK7N6622C1

Diagram



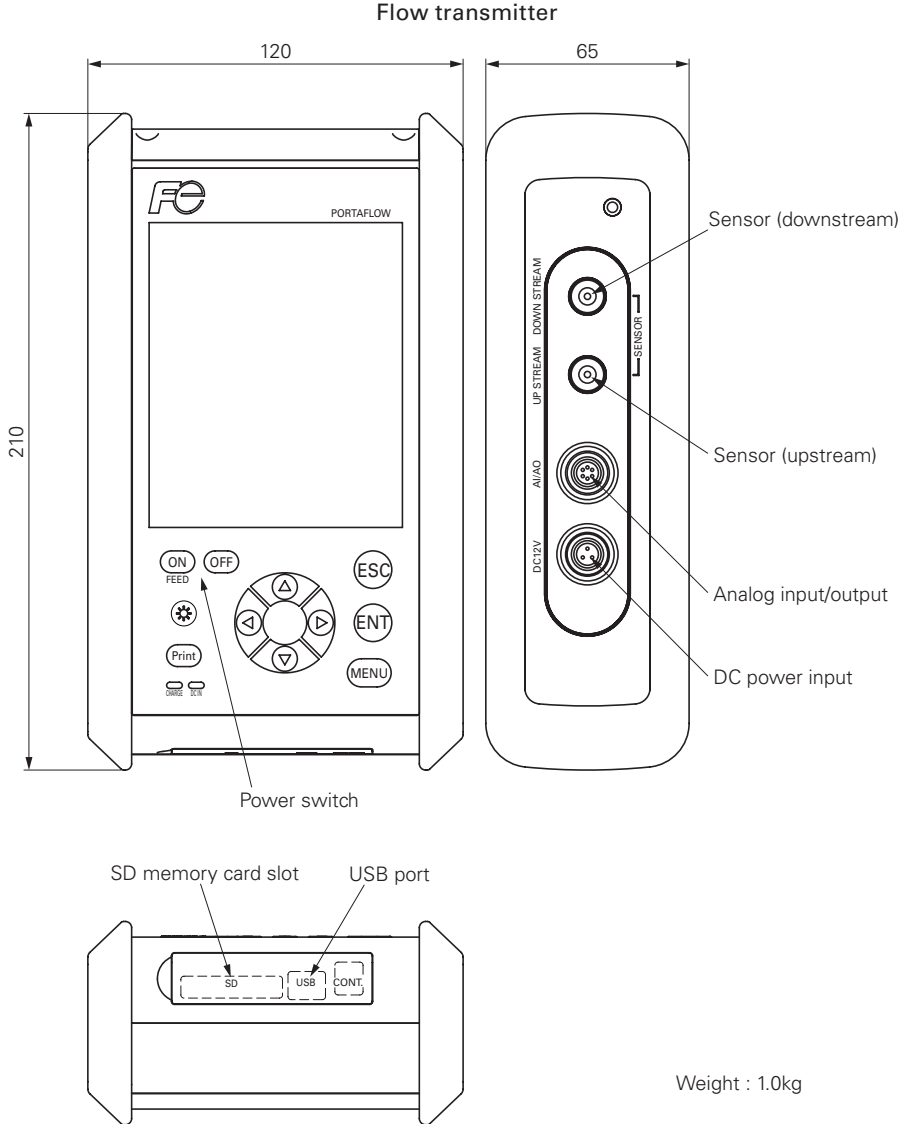
Conditions on straight pipe

(D: Nominal diameter of pipe)

Type	Length of upstream straight pipe	Length of downstream straight pipe
90° bend	<p><math>L \geq 10D</math></p> <p>10D or more</p> <p>Detector</p>	<p><math>L \geq 5D</math></p>
Tee	<p><math>L \geq 50D</math></p> <p>10D or more</p> <p>10D or more</p>	<p><math>L \geq 10D</math></p>
Diffuser	<p><math>L \geq 30D</math></p> <p>0.5D or more</p> <p>1.5D or more</p>	<p><math>L \geq 5D</math></p>
Contraction pipe	<p><math>L \geq 10D</math></p>	<p><math>L \geq 50D</math></p>
Valve	<p><math>L \geq 30D</math></p> <p>Flow controlled upstream</p>	<p><math>L \geq 10D</math></p> <p>Flow controlled downstream</p>
Pump	<p>Isolation valve</p> <p>Check valve</p> <p>P</p> <p><math>L \geq 50D</math></p>	

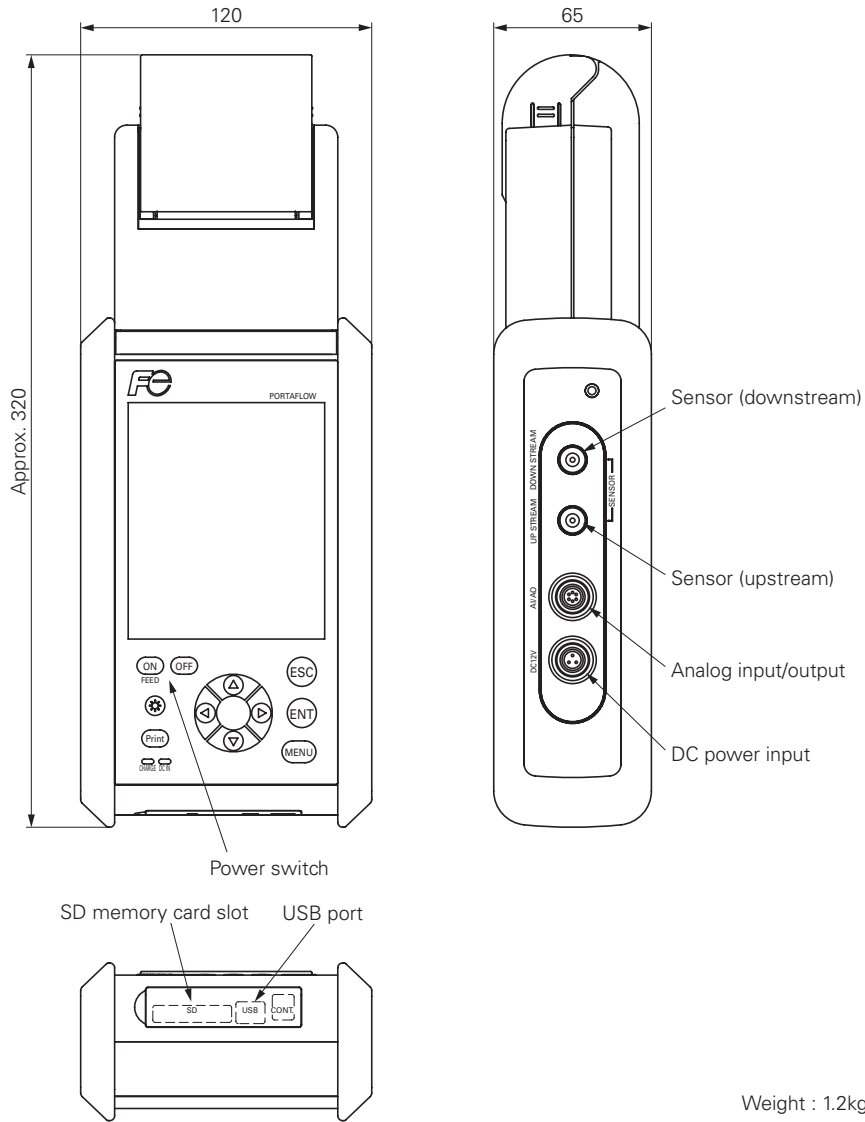
Note) Source: Japan Electric Measuring Instruments Manufacturers' Association (JEMIS-032)

**OUTLINE DIAGRAM** (Unit:mm)



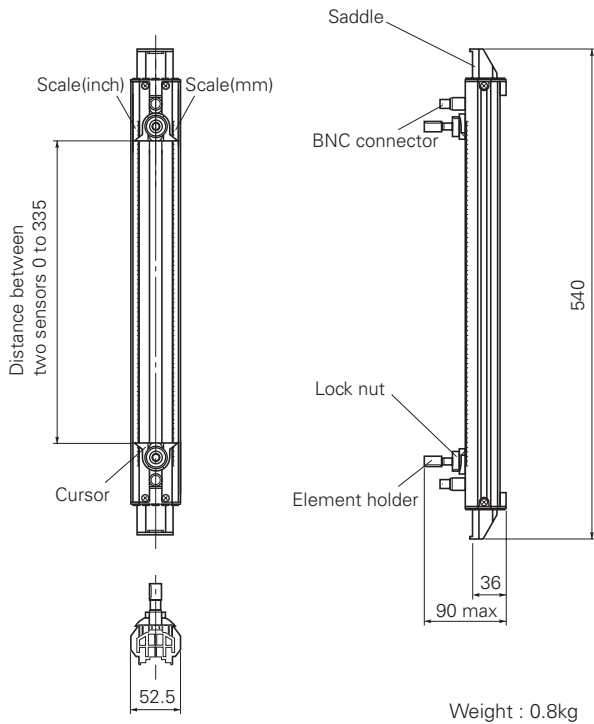
OUTLINE DIAGRAM (Unit:mm)

Flow transmitter (with printer)

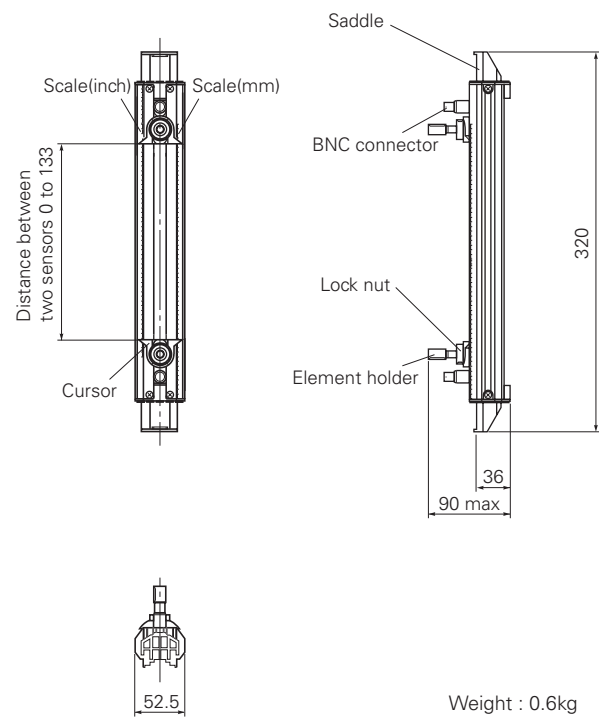


Weight : 1.2kg

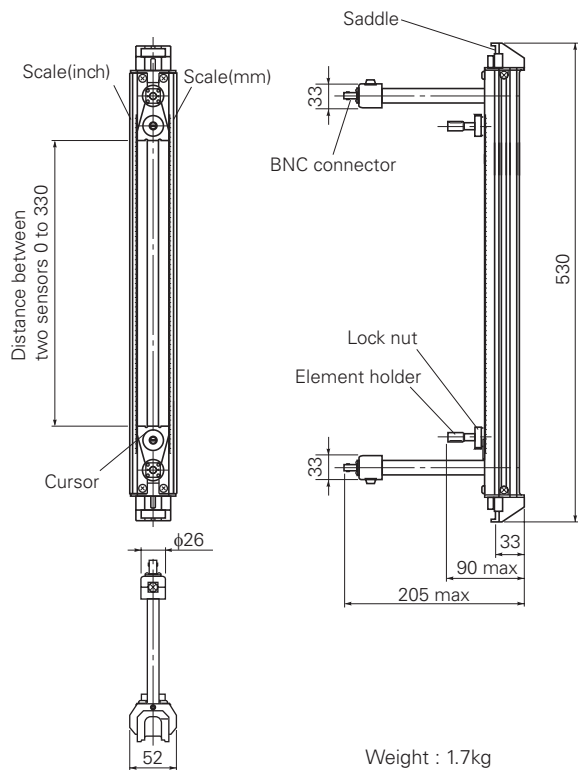
# OUTLINE DIAGRAM (Unit:mm)



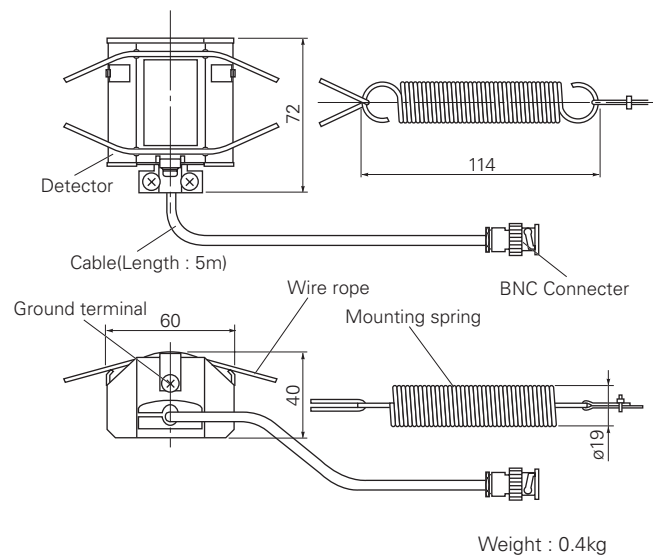
Detector FLD12 (Small type)



Detector FLD22 (Small diameter)

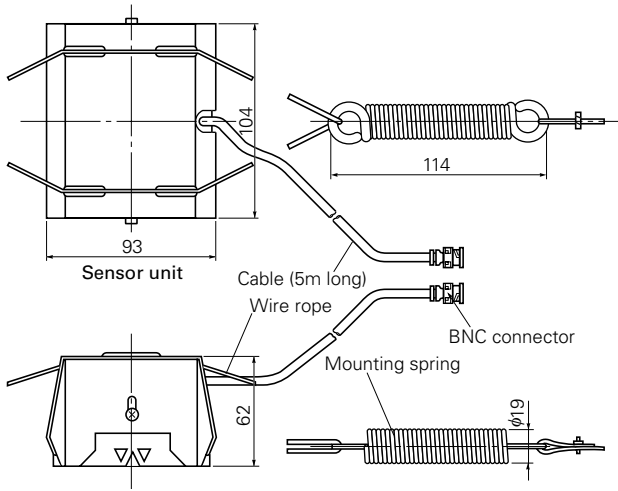


Detector FLD32 (High-temperature)

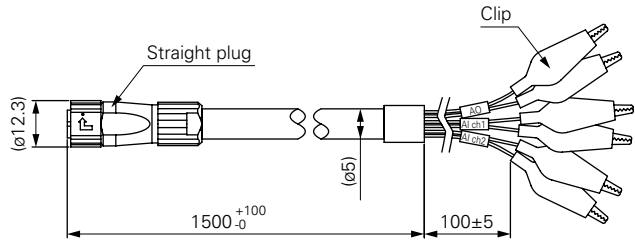


Detector FLD41 (Middle type)

**OUTLINE DIAGRAM** (Unit:mm)

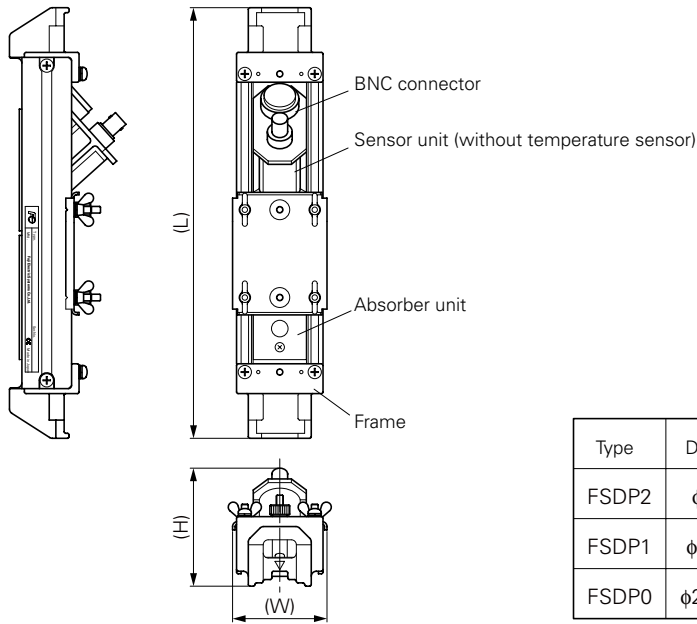


**Detector FLD51 (Large type)**



Code color	Clip color	Mark
Black (BK)	Red (R) (+)	AO
White (W)	Black (BK) (-)	
Red (R)	Red (R) (+)	AI ch1
Green (G)	Black (BK) (-)	AI ch2
Yellow (Y)	Red (R) (+)	
Brown (BN)	Black (BK) (-)	

**Analog input/output cable**



Type	Diameter (mm)	L	H	W	Weight Approx. (kg)
FSDP2	φ40 to φ200	260	70	57	0.8
FSDP1	φ100 to φ400	260	72	57	0.9
FSDP0	φ200 to φ1000	350	90	85	2.0

**Detector FSD (Detector for flow velocity profile measurement)**

⚠ Caution on Safety

\*Before using this product, be sure to read its instruction manual in advance.

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