Fuji Electric

DATA SHEET

PORTABLE TYPE ULTRASONIC FLOWMETER

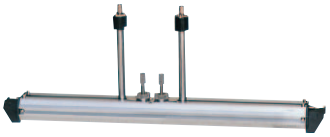
Portable type ultrasonic flowmeter consists of a compact and lightweight flow transmitter and a clamp-on detector. With the latest electronics and the digital signal processing technology, it delivers precise measurement while allowing easy operation.
New features: renewed panel design, improved display visibility and connector reliability, and more accessories.

FSC-4, FSS, FSD

Flow transmitter (FSC)

Detector (FSSC)

Large diameter type (FSSE)



High-temperature type (FSSH)

Small diameter type (FSSD)

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). (in comparison to our existing model)
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 (pipe inner diameter ø13 to ø6000mm) and low to high temperature (–40 to +200°C).
4. **High accuracy and high-speed response**
   The flowmeter is designed for high accuracy (±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.
   While battery is working, 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 the case of 512MB (option), it can be saved about 2 year measurement date(In case of saving period 30 seconds, 14 kinds of saved data). Available up to 8MB.
8. **Serial communication**
   Use of a USB port allows easy connection to a personal computer. Measured date 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.
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°C
Measuring range: 0···±0.3 to ±32m/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
ø13 to ø6000mm
Flow velocity profile measurement
ø40 to ø1000mm

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:

Pipe inner diameter	Flow velocity range	Accuracy
ø13 to ø50mm	2 to 32m/s	±1.5% to 2.5% of rate
	0 to 2m/s	±0.03m/s
ø50 to ø300mm	2 to 32m/s	±1.0% to 1.5% of rate
	0 to 2m/s	±0.02 to 0.03m/s
ø300 to ø6000mm	1 to 32m/s	±1.0% to 1.5% of rate
	0 to 1m/s	±0.01 to 0.02m/s

Note1) Reference conditions are based on JEMIS-032.
Note2) Refer to the 4 pages for the accuracy according to kind of detector.

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, output current not used and at normal ambient temperature (20°C))
Recharging time, approx. 3 hours (power adapter used)
Recharging temperature range: 0 to +40°C
Power consumption: Min. 3W and Max. 16W
The consumption varies depending on the use conditions.

Power adapter: Exclusive power adapter 100V to 240V +10%/–15% AC (50/60Hz), 90VA or less.

Display: TFT color graphic LCD
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
(Total 2 points)
Used to input temperature for heat quantity measurement, etc.

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

Otherwise, reading and saving are impossible.
File format
- Date logger: CSV file
- Screen date: Bit map file

The SDXC memory card is not supported.

Serial communication:
USB port (device* compatible):
Mini B receptacle, USB 2.0
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
Note) When the Chinese display is selected, printing is made in kanji characters.

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)

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 at normal temperature (20°C).

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, m^3/s, m^3/min, m^3/h, m^3/d, km^3/d, Mm^3/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, ft^3/s, ft^3/min, ft^3/h, ft^3/d, kft^3/d, Mft^3/d, BBL/s, BBL/min, BBL/h, BBL/d, kBBL/d, MBBL/d

Total value display function:

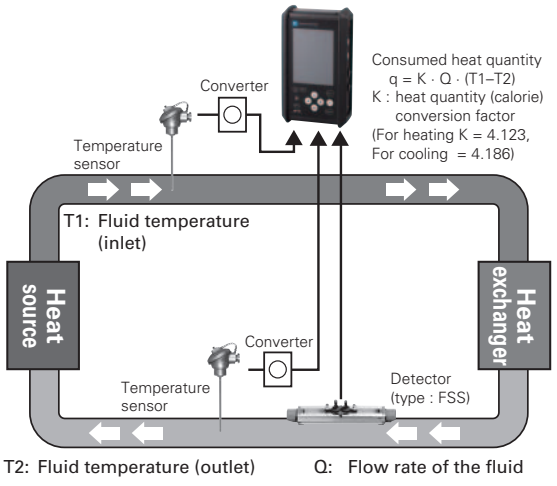
Display of forward or reverse total (reverse is displayed as minus)
Numeric value: 10 digits (decimal point is corresponding to 1 digit)
Unit: Metric/English system selectable
Metric system
Flow rate total: mL, L, m^3, km^3, Mm^3, mBBL, BBL, kBBL
English system
Flow rate total: gal, kgal, ft^3, kft^3, Mft^3, 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, kW, MW
Total heat quantity: MJ, GJ, BTU, kBTU, MBTU, kWh, MWh
J : Joule
BTU : British thermal unit
W : Watt

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 current input from temperature transmitter.
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-volantile memory.

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 date 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 displayed.

Printing function (option):

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

Type of detector:

Classification	Type	Internal pipe diameter (mm)	Fluid temperature	Frequency (MHz)
Middle diameter	FSSC	ø50 to ø1200 (*1)	-40 to 120°C	1
Small diameter	FSSD	ø13 to ø300	-40 to 100°C	2
Large diameter	FSSE	ø200 to ø6000	-40 to 80°C	0.5
High temperature	FSSH	ø50 to ø400	-40 to 200°C	2

*1) For pipes with a diameter of 300 mm or larger, we recommend to use FSSE and mount it by Z method.

Mounting method: Mounting on outside of pipe

Sensor mounting method:

V or Z method

Signal cable: Exclusive coaxial cable, 5m (Included with FSC)

Connection method:

Transmitter side: Exclusive connector
Detector side (FSSE): Screw terminal
Others: BNC connector

Ambient temperature:
–20 to +60°C

Ambient humidity:

FSSE	100%RH or less
Other	90%RH or less

Type of enclosure:

FSSC	IP65 (When waterproof BNC connector is provided)
FSSE	IP67
Others	IP52
Water-proof treatment type	IP68 (Submerged resistant structure for 5 days)

Material of detector:

Classification	Type	Sensor case	Rail material
Small diameter	FSSD	Plastic	Aluminum alloy + Plastic
Middle diameter	FSSC	Plastic	Aluminum alloy + Plastic
Large diameter	FSSE	Plastic	———
High temperature	FSSH	SUS304	Aluminum alloy

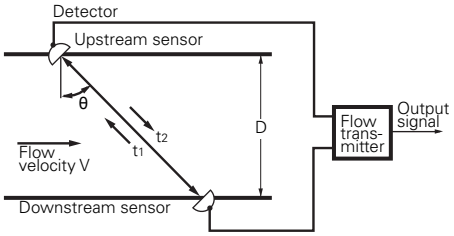
Material of mounting belt/wire:

Detector type 6th digit	Dimensions	Material
A	1.5mX2	SUS304
B	3.0mX1	Plastic cloth belt
C	1.0mX4	SUS304
D	Inner pipe diam.<ø1500mm	SUS304
E	Inner pipe diam.<ø6000mm	SUS304

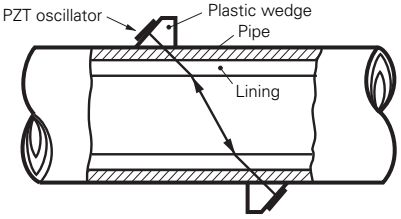
Extension cable(option):
Extended when the length of the detector signal cable is not sufficient.
Length: 10m, 50m

MEASURING PRINCIPLE

With ultrasonic pulses propagated diagonally between the upstream and downstream sensors, flow rate is measured by detecting the time difference obtained by the flow of fluid.

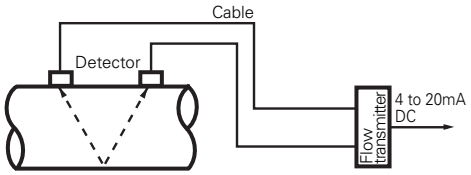


MOUNTING OF DETECTOR

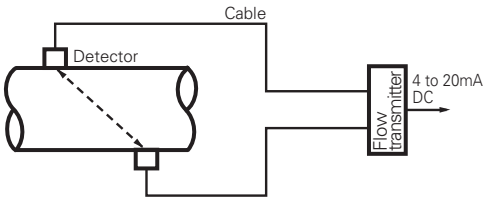


CONFIGURATION DIAGRAM

(1) When V method is used for mounting



(2) When Z method is used for mounting



DETECTOR SELECTION GUIDE (ACCURACY % of rate)

TYPE	Mounting method	Inner diameter of piping ø[mm] 13 25 50 100 150 200 250 300 400 600 1200 3000 6000
FSSD	V*2)	±1.5 to 2.5 / ±1.0
	Z*1)	±1.0
FSSC	V	±1.5 / ±1.0
	Z	±1.0
FSSE	V	±1.5 / ±1.0
	Z	±1.5 / ±1.0
FSSH	V	±1.0
	Z*1)	±1.0

*1) When FSSD or FSSH is mounted using the Z method, guide rail (option) is required additionally.
*2) For the pipe inner diameter of ø13mm, the sensor mounting dimension may be 0.0mm or less depending on pipe material and thickness. When the sensor mounting dimension is 0.0mm or less,measurement error is about 2 to 5%.

<Description of the table>
It shows pipe thickness of each material that the sensor mounting size is to be 0.0mm, when fixing a pipe. If the fluid is the one other than water, and if the sound velocity of fluid is faster than the one of water, the sensor mounting size is to be 0.0mm or more.

Required min. pipe thickness (fluid: water) (Unit: mm)			
Steel pipe	2.15 or more	FRP	3.21 or more
Stainless pipe	1.87 or more	Ductile cast iron	2.15 or more
PVC pipe	3.69 or more	PEEK	3.69 or more
Copper pipe	3.82 or more	PVDF	3.69 or more
Cast-iron pipe	2.98 or more	Acrylic pipe	2.90 or more
Aluminum pipe	1.99 or more	Polypropylene	3.69 or more

FLOW VELOCITY PROFILE DISPLAY FUNCTION (OPTION)

Pulse Doppler method enables the analysis and display of the flow velocity profile in real time. The results can be used to decide the appropriate measurement location, for flow diagnosis, and laboratory test.

SPECIFICATIONS

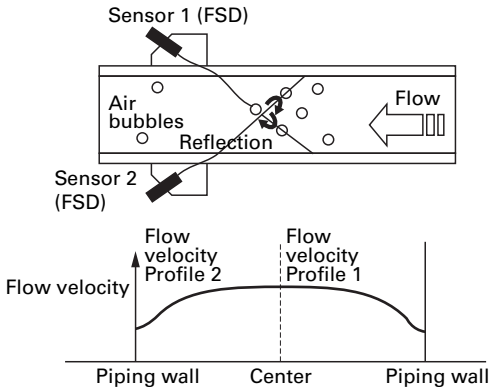
Measuring fluid: Uniform liquid in which ultrasonic waves can propagate.
Turbidity of fluid: Axisymmetric flow in a filled pipe.
Fluid temperature:
−40 to +100°C (FSDP2)
−40 to +80°C (FSDP1,FSDP0)
Air bubble quantity:
0.02 to 15vol% (Velocity is 1m/s)
Pipe size: Small type sensor : ø40 to ø200mm
Middle type sensor :ø100 to ø400mm
Large type sensor :ø200 to ø1000mm
Measurement range:
0 to ±0.3 ... ±Maximum Velocity (depending on the pipe diameter)
Refer to tables 1 and 2.
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: FSDP)

Mounting method:
on outside of existing pipe
Ambient temperature: −20 to +80°C
Ambient humidity: 100% RH or less
Enclosure: IP67 (waterproof BNC connector required.)
Material: Sensor housing: PBT
Guide frame: Aluminum alloy
Mounting belt: Plastic cloth or stainless

MEASUREMENT PRINCIPLE

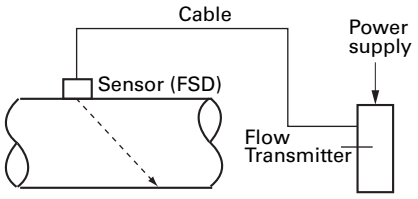
<Pulse Doppler method>
Ultrasonic pulses are transmitted through the fluid flow. Entrained bubbles and microscopic particles within the fluid create frequency phase shifts (Doppler effect.) The resulting doppler shifts are integrated across the inside pipe diameter cross section. The resulting profile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



The above shows an example when using two sensors. One detector displays the flow velocity profile for a radius.

BLOCK DIAGRAM

(1) Using one sensor



(2) Using two sensors

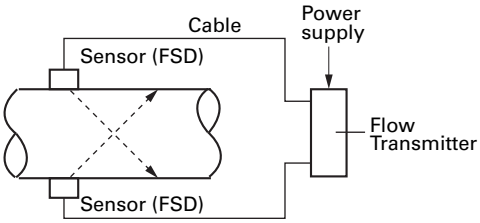


Table 1
Measurement range of pulse Doppler method varies with the pipe outer diameter, wall thickness, material, and kind of fluid. When the pipe material is stainless steel, the pipe schedule is 20s, and fluid is water, the ranges for each detector are as follows.

Maximum measurable flow velocity
Unit: m/s

Diameter	FSDP2	FSDP1	FSDP0
40A	6.56		
50A	6.52		
65A	5.31		
80A	4.65		
90A	4.12		
100A	3.69	7.25	
125A	3.08	6.08	
150A	2.63	5.20	
200A	2.04	4.05	7.77
250A		3.30	6.38
300A		2.78	5.41
350A		2.51	4.90
400A		2.20	4.31
450A			3.80
500A			3.48
550A			3.17
600A			2.91
650A			2.71
700A			2.52
750A			2.35
800A			2.21
850A			2.08
900A			1.97
1000A			1.77

Maximum measurable flow rate
Unit: m^3/h

FSDP2	FSDP1	FSDP0
33.6		
52.7		
72.1		
86.5		
102		
118	231	
147	289	
179	354	
239	474	908
	604	1168
	735	1428
	820	1598
	951	1858
		2118
		2358
		2618
		2879
		3096
		3357
		3618
		3879
		4140
		4400
		4902

PC Loader Software

The software allows you to view and edit parameter setpoints on your PC, and to load the following data: instantaneous flow rate, instantaneous velocity, error information, received waveform, analog input, and log data.
PC requirements: PC/AT compatible machine
Free hard disc capacity: 128 MB or more
Memory capacity: 52 MB or more
The operating systems on which we have tested this software are: Microsoft Windows 7/8.1/10
Interface: USB 2.0

EU Directive Compliance CE

EMC (2014/30/EU)
EN 61326-1 (Table 2)
EN 55011 (Group 1 Class A)
EN 61000-3-2 (Class A)
EN 61000-3-3
EN 61326-2-3
RoHS (2011/65/EU)
EN 50581

CODE SYMBOL

<Flow transmitter>

1	2	3	4	5	6	7	8		9	10	11	Description
F	S	C	S				4	-		0		
			S									<Specification> Standard
				1								<Converter> Basic system
				2								Basic system + Printer
					0							<Flow velocity profile measurement> None
					1							Provided (detector to measure flow velocity profile is separately required.)
						A						<Power adapter> AC power + power cord (125V AC) for Japanese and North American use
						B						AC power + power cord (250V AC) for European and Korean use
						C						AC power + power cord (250V AC) for Chinese use
							4					Modification No.
									0			<SD memory card> None
									1			Provided (512MB)
											Y	<Bound instruction manual/Language> None (Factory-set language: English)
											J	Provided/Japanese (Factory-set language: Japanese)
											E	Provided/English (Factory-set language: English)
											C	Provided/Chinese (Factory-set language: Chinese)
												(Note1) Instruction manual contained in CD is the standard attached article.
												(Note2) You can change the language by key operation.

<Detector>
(for transit time)

1	2	3	4	5	6	7	8		9	10	Description
F	S	S	C	1			1	-			
			C								<Senser type>(4th digits) ø50 to ø1200mm
				1							<Guide rail>(5th digits) Provided (Extendable rail type)
					Y						<Mounting belt>(6th digits) *2 None
					A						Stainless belt (1.0m×2)
					B						Plastic cloth belt (3m×1)
					C						SS belt fasten with screws (1.0m×4)
					D						Wire ≤ ø1500mm
						Y					<Acoustic coupler> (7th digit) *1 None
						B					Silicone-free grease (HIGH-Z)
						C					Silicone grease (G40M)
									Y		<Water-proof treatment>(9th digit) None
									B		Provided (with signal cable 10m) *Submersible in water for 5 days
										Y	<Tag plate> (10th digit) None
										A	Provided

*1: Normally select silicone grease as acoustic coupler. Silicone grease is tube (100g).
Select silicone-free grease for semiconductor manufacturing equipment or the like that is vulnerable to silicone. The silicone-free grease is water-soluble and, therefore, cannot be used in environment exposed to water or on piping subjected to a condensation. Since the grease does not set, a periodic maintenance (cleaning, refilling every about 6 months at normal temperature) is necessary.
*2: Please refer to the table 2 to serect the mounting belt at 6th digits.

[Table 2] How to select at 6th digits.

Mounting method	≤ø300mm	≤ø600mm	≤ø1200mm
V method	B, A or C	C	D
Z method	C	D	D

CODE SYMBOL

<Detector>

(for flow velocity profile measurement)

1	2	3	4	5	6	7	8	Description
F	S	D			0	Y	1	
			P	2				<Kind> Small type (ϕ40 to ϕ200mm) Middle type (ϕ100 to ϕ400mm) Large type (ϕ200 to ϕ1000mm)
			P	1				
			P	0				
					0			<Terminal mold> None
						Y		<Structure> General use
							1	Modification No.

SCOPE OF DELIVERY

<Flow transmitter : FSC>

Name of unit		Scope of delivery
1	Basic system	1) Conversion unit 2) Power adapter and Power connector conversion cord 3) Power cord 4) Analog input/output cord (1.5m) 5) USB cable (1m) 6) Carrying case 7) Strap 8) Special type signal cable (5m × 2) 9) CD-ROM (Instruction manual and Loader software for PC)
2	Option	1) Printer unit + rolled paper (1 roll) 2) SD memory card (512MB) 3) Bound instruction manual (including a detector)

<Detector : FSS, FSD>

Name of unit		Scope of delivery
1	Detector for propagation time difference (FSS)	1) Sensor unit 2) Signal cable conversion code (included with FSSE) 3) Mounting belt/wire 4) Silicone grease (Article specified)
2	Detector for flow velocity profile (FSDP)	1) Detector unit 2) Mounting belt/wire 3) Silicone grease (100g)

Note 1) Silicon grease is for filling a gap between a detector and a pipe joint area. It is provided with a detector.
Since silicon grease does not become hardened, if you use it in the long term, periodic maintenance is required. (Under the condition of room temperature, semiannual cleaning and refill is recommended.)

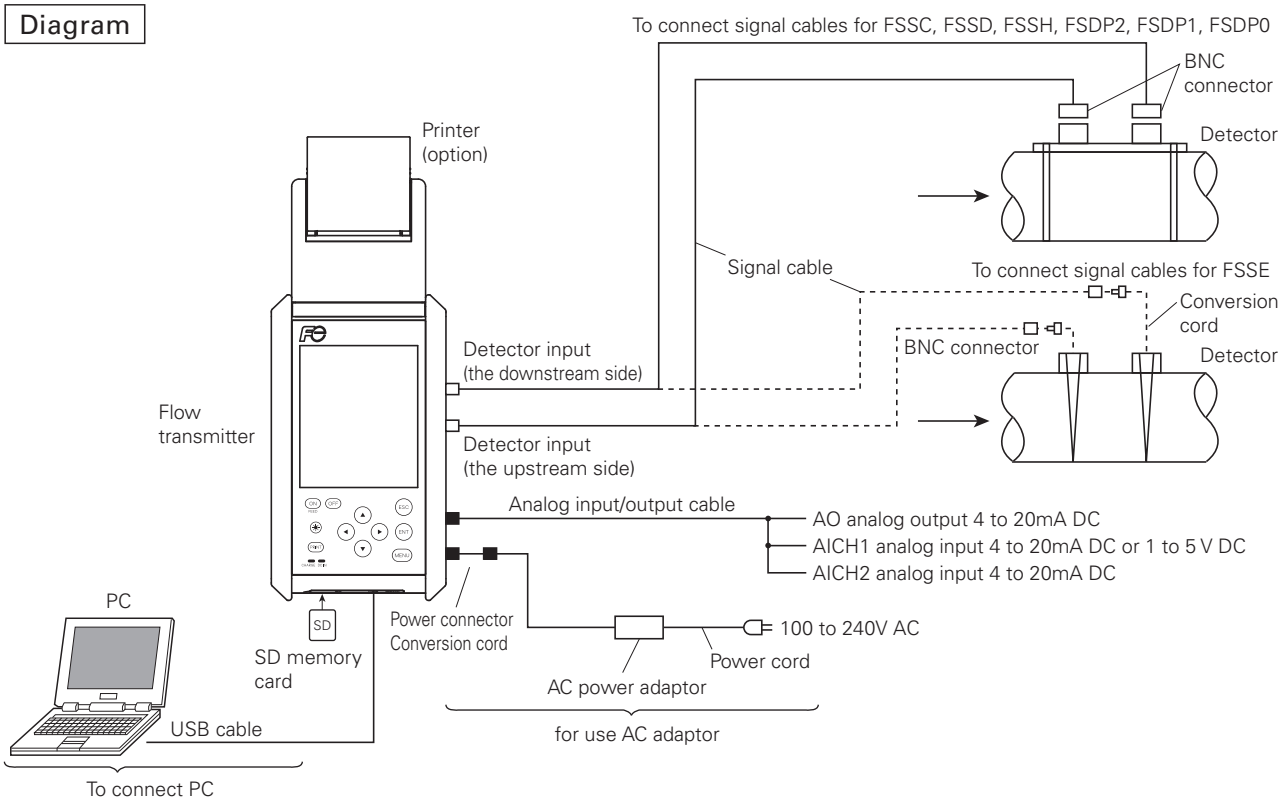
Note 2) When you order a detector alone, an instruction manual is not provided. Please request, if necessary (Onerous).

Note: The hand strap and the stand cannot be used simultaneously.

OPTIONAL ITEMS

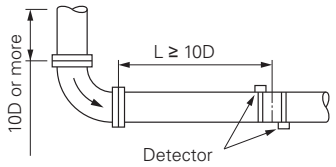
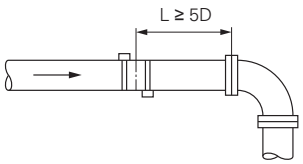
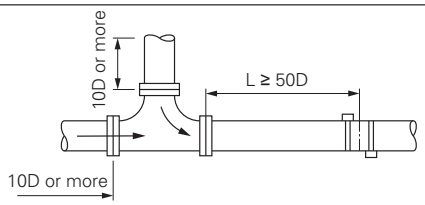
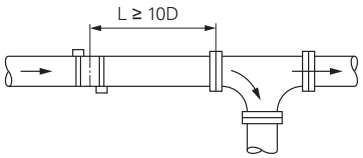
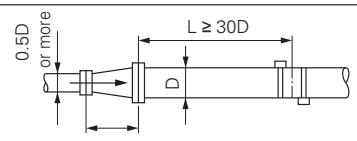
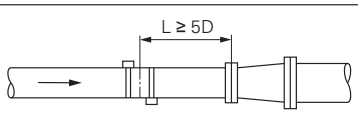
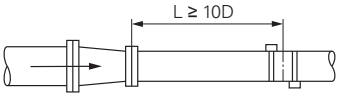
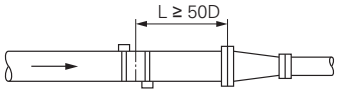
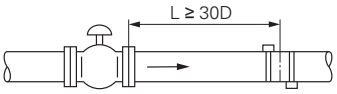
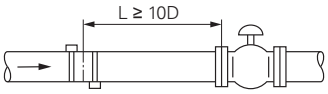
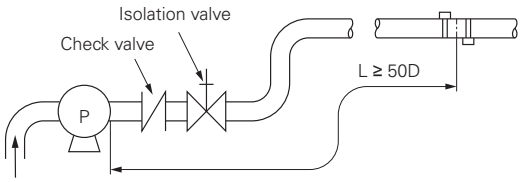
	Name	Specifications	Arrangement No.
1	Battery	Special type Li-ion battery (7.4V, 2500mAh)	ZZP*TK7N6384P1 *Order in two pairs.
2	AC power adapter 	Special type power adapter and 100 to 240V +10%/–15% AC, 50/60Hz	ZZP*TQ505735C4
3	Power code 	Japan, North America:125V AC 2m Europe, Korea: 250V AC 2m China: 250V AC 2m	ZZP*TK7N6621P1 ZZP*TK7N6608P1 ZZP*TK7N6609P1
4	Printer 	To be mounted on top of converter Thermal serial dot system (8 x 384 dot)	ZZP*TK4J2634C1
5	Printer roll paper 	Maker: SEIKO I SUPPLY Co. Ltd. Type: TP-211C-1 Specifications: Thermal roll paper Width: 58mm×ø48mm	ZZP*TK7N6381P1
6	Silicone grease	Maker: Shin-Etsu Chemical Co., Ltd. Type: · For standard use G40M, 100g · For silicone free 100g · For high temperature KS62M, 100g	 ZZP*45231N5 ZZP*TK7M0981P1 ZZP*TK7P1921C1
7	Signal cable 	Special type signal cable, 5m × 2 (connector on both - sides)	ZZP*TK7N7795C1
8	Extension signal cable	Special type coaxial cable with BNC connector · 10m × 2 · 50m × 2	 ZZP*TK468664C3 ZZP*TK468664C4
9	Analog input/output cable 	6-core cable, 1.5m, with connector	ZZP*TQ405191C1
10	Mounting belt / wire	· Plastic cloth belt · Stainless wire Nominal diameter ø200 to ø500mm ø200 to ø1000mm ø200 to ø2000mm ø200 to ø3000mm ø200 to ø6000mm · Stainless steel belt	ZZP*TK7G7979C1 ZZP*TK7G7980C1 ZZP*TK7G7980C2 ZZP*TK7G7980C3 ZZP*TK7G7980C4 ZZP*TK7G7980C5 ZZP*TK7P1943C1
11	Guide rail for high-temperature sensor (In mounting by the Z method)	· Mounting bracket material: Aluminum alloy+SUS304 For FSSH	ZZP*TK4J5917C3
12	Guide rail for small type detector (In mounting by the Z method)	· Mounting bracket material: Aluminum alloy+plastic For FSSD3 (L=540mm)	ZZP*TK4J5917C1
13	SD memory card	Maker: Panasonic, Inc. Type: RP-SDFC51CD1 Capacity: 512MB	ZZP*TK7N7680P1
14	USB cable 	Maker: Sunwa Supply Inc. Type: KU-AMB510 Specifications: Mini USB cable (1.0m)	ZZP*TK7N6622P1
15	Signal cable conversion cord	M4 clamp terminal / BNC jack, L=150mm	ZZP*TK4K6304P1
16	Hand strap 	To be attached on the side of transmitter. Strap length: 200 mm	ZZP*TQ505739C1
17	Stand 	Holds the transmitter at 45 degree angle	ZZP*TQ405196P1

Diagram



Pipe requirements

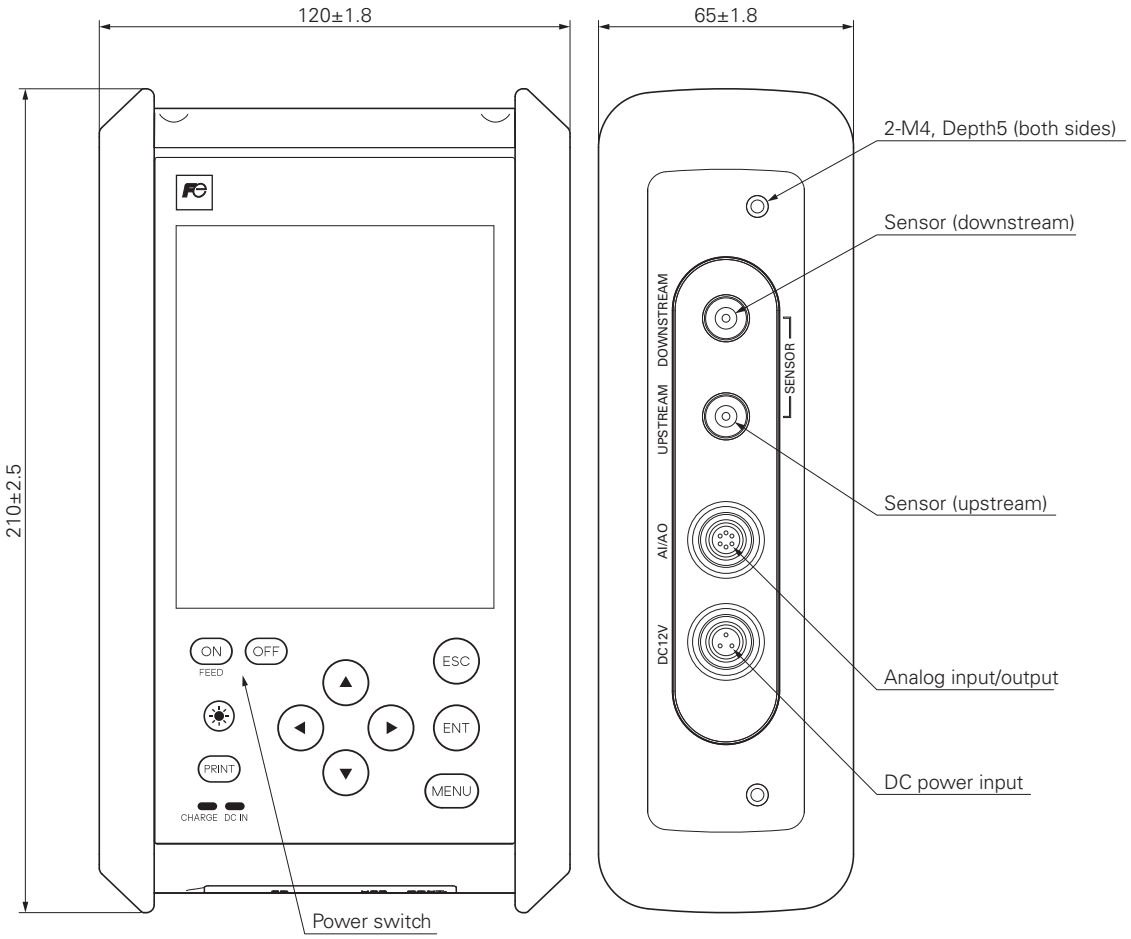
(D: Nominal diameter of pipe)

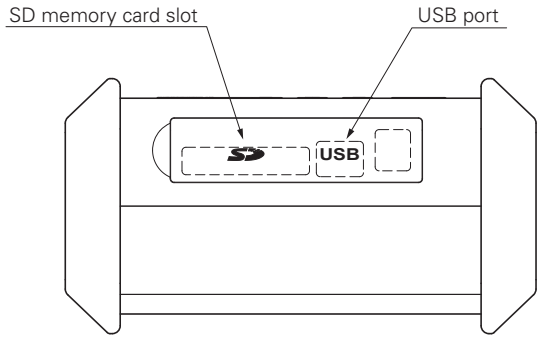
Type	Length of upstream straight pipe	Length of downstream straight pipe
90° bend		
T-shape		
Diffuser		
Tapered		
Valve	 Flow controlled upstream	 Flow controlled downstream
Pump		

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

OUTLINE DIAGRAM (Unit:mm)

Flow transmitter

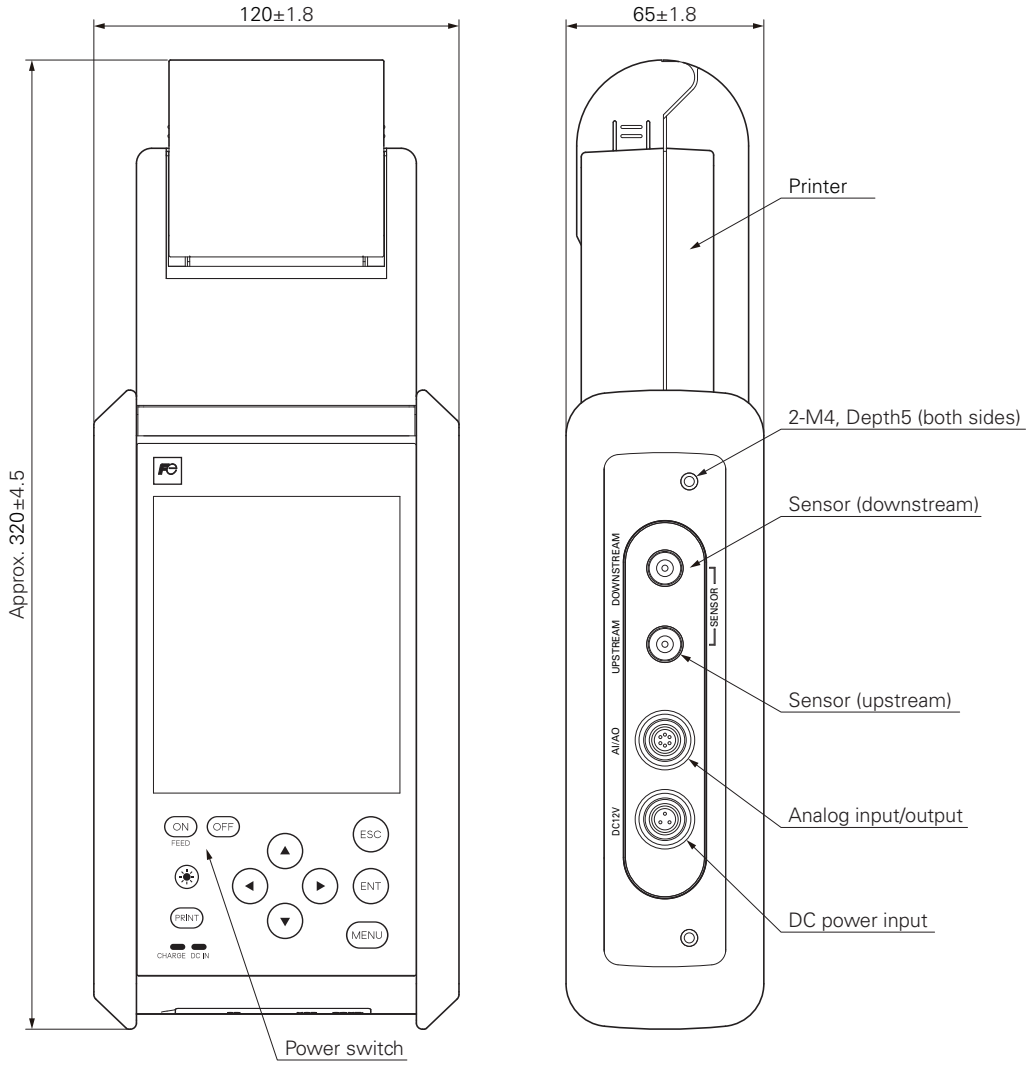


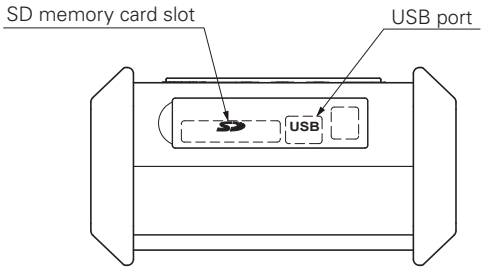


Weight : Approx. 1.0kg

OUTLINE DIAGRAM (Unit:mm)

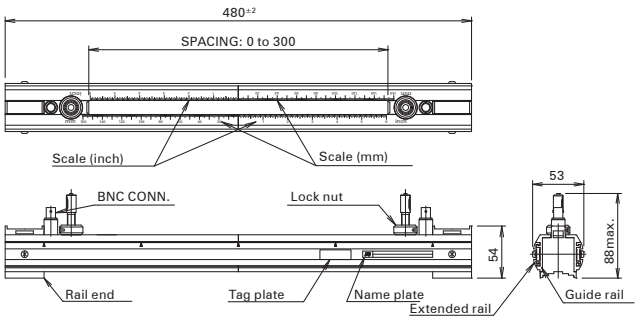
Flow transmitter (with printer)



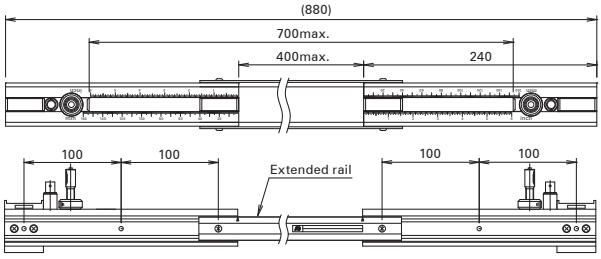


Weight : Approx. 1.2kg

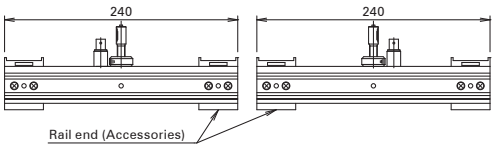
OUTLINE DIAGRAM (Unit:mm)



<Shipment style (V method)>

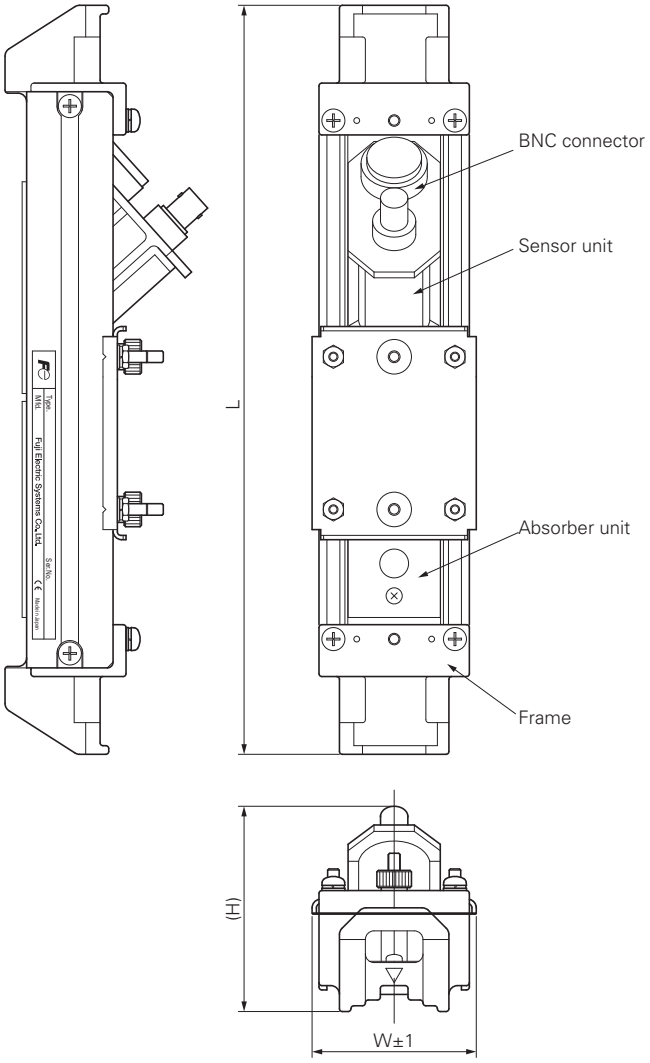


<Extended style (Longest, V method)>



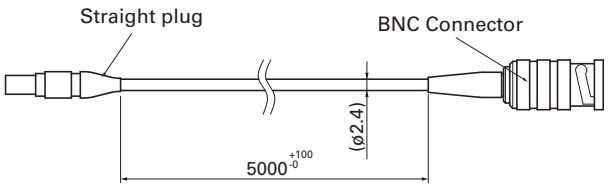
<Sepalate style (Z method)>

Detecter : Type FSSC

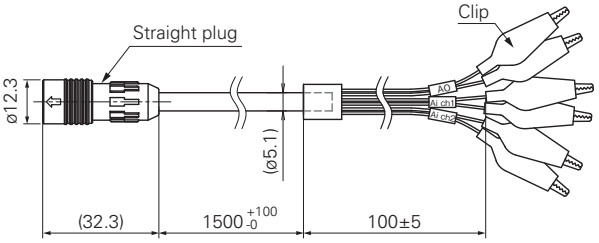


Type	Diameter (mm)	L	H	W	Weight Approx. (kg)
FSDP2	ϕ40 to ϕ200	260±1.2	70	57	0.8
FSDP1	ϕ100 to ϕ400	260±1.2	72	57	0.9
FSDP0	ϕ200 to ϕ1000	350±2.0	90	85	2.0

Detector FSDP (Detector for flow velocity profile measurement)



Signal cable

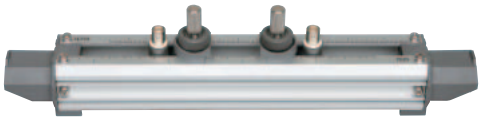


Code color	Clip color	Mark
Black (BK)	Red (R) (+)	AO
White (W)	Black (BK) (–)	
Red (R)	Red (R) (+)	AI ch1
Green (G)	Black (BK) (–)	
Yellow (Y)	Red (R) (+)	AI ch2
Brown (BN)	Black (BK) (–)	

Analog input/output cable

Detector for special application 1) detector for small diameter type

Pipe size: ø13 to 100mm (300mm max.)
Fluid temperature: –40 to 100°C
Type: FSSD□□□1-Y□



Specification

- Sensor frequency: 2MHz
- Mounting method: V method, Z method (FSSD3)
- Fluid temperature: –40 to 100°C
- Applicable pipe material: PVC, SS, carbon steel pipe, copper pipe, aluminum pipe, etc.
  [In case lining is removed from the pipe, Measurement can not be conducted]
- Rated accuracy of combination with the flow transmitter (Applicable piping: plastic, metal pipe)

Internal diameter (mm)	Velocity	Accuracy
ø13 to ø50	2 to 32m/s	±1.5% to ±2.5% of rate
	0 to 2m/s	±0.03 to ±0.05m/s
ø50 to ø100 (ø300)	2 to 32m/s	±1.0% of rate
	0 to 2m/s	±0.02m/s

- Mounting belt: according to specified code of symbol.
- Material: PBT, guide rail: aluminum alloy + plastic
- Type of enclosure: IP52
- Acoustic coupler: according to specified code of symbol.
- Mass: 0.6kg, 0.8kg

CODE SYMBOL

<Detector>

1	2	3	4	5	6	7	8		9	10	Description
F	S	S	D				1	–	Y		
			D								<Senser type>(4th digits) ø13 to ø100mm
				1							<Guide rail>(5th digits) Provided (L=320mm)≦ø100mm long rail (L=540mm)≦ø300mm
				3							
					Y						<Mounting belt>(6th digits) None
					A						Stainless belt (1.5m×2)
					B						Plastic cloth belt (3m×1)
					C						SS belt fasten with screws (1.0m×4)
						Y					<Acoustic coupler> (7th digit) None
						A					Silicon rubber (KE348)
						B					Silicone-free grease (HIGH-Z)
						C					Silicone grease (G40M)
									Y		<Water-proof treatment>(9th digit) None
										Y	<Tag plate> (10th digit) None
										A	Provided

OPTIONAL ACCESSORIES

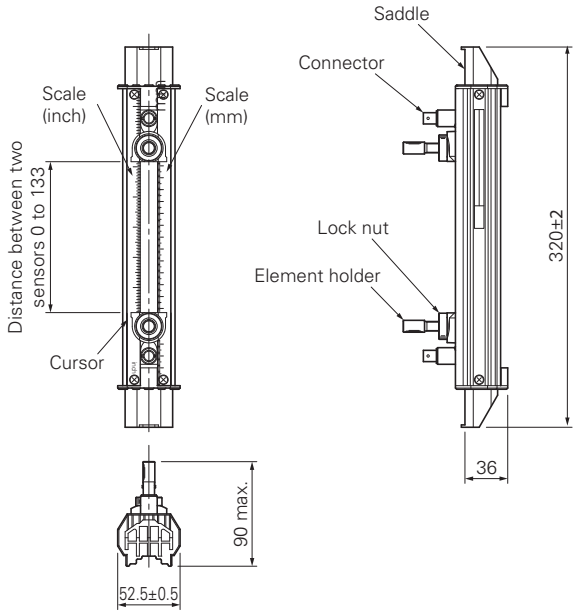
Name	Drawing No.
Sillicon grease (GM40M)	ZZP*45231N5
Sillicon-free grease (HIGH-Z)	ZZP*TK7M0981P1

Scope of delivery

- Detector, acoustic coupler and set of the mounting belt according to specified code of symbol

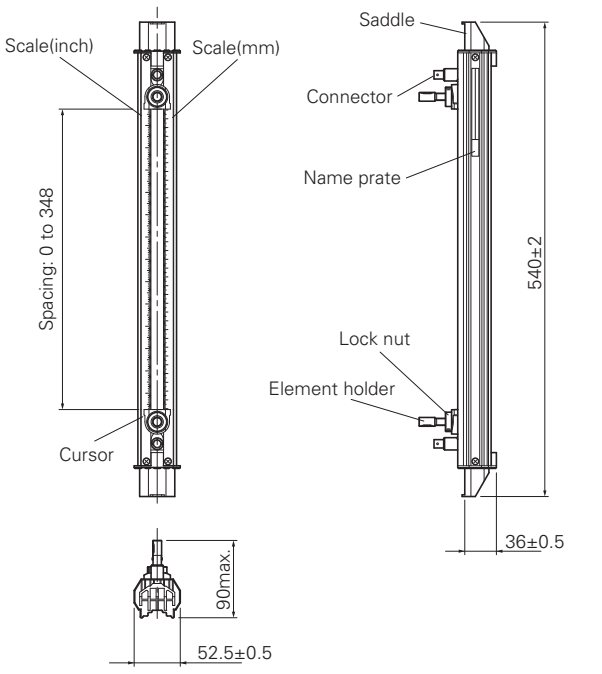
OUTLINE DIAGRAM (unit: mm)

<Detector>



Weight : Approx. 0.6kg

Small diameter sensor: FSSD1

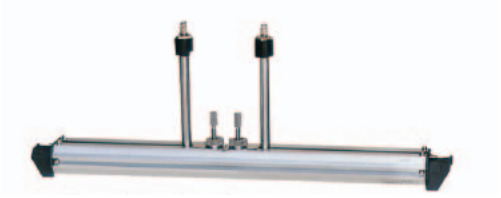


Weight : Approx. 0.8kg

Detector FSSD3

Detector for special application 2) detector for high temperature

Pipe size: ø50 to 400mm
Fluid temperature: –40 to 200°C
Type: FSSH1□□1-Y□



Specification

- Sensor frequency: 2MHz
- Mounting method: V method (ø50 to 250mm) or Z method (ø150 to 400mm)
- Fluid temperature: –40 to 200°C
- Applicable pipe material: PVC, SS, carbon steel pipe, copper pipe, aluminum pipe,etc.
  [In case lining is removed from the pipe, Measurement can not be conducted]
- Rated accuracy of combination with the flow transmitter (Applicable piping: plastic,metal pipe)

Internal diameter (mm)	Velocity	Accuracy
ø50 to ø300	2 to 32m/s	±1.0% of rate
	0 to 2m/s	±0.02m/s
ø300 to ø400	0.75 to 32m/s	±1.0% of rate
	0 to 0.75m/s	±0.0075m/s

- Mounting belt: according to specified code of symbol.
- Material: sensor housing: SUS304
  guide rail: SUS304 + aluminum alloy
- Type of enclosure: IP52
- Acoustic coupler: according to specified code of symbol.
- Mass: 1.6kg

CODE SYMBOL

<Detector>

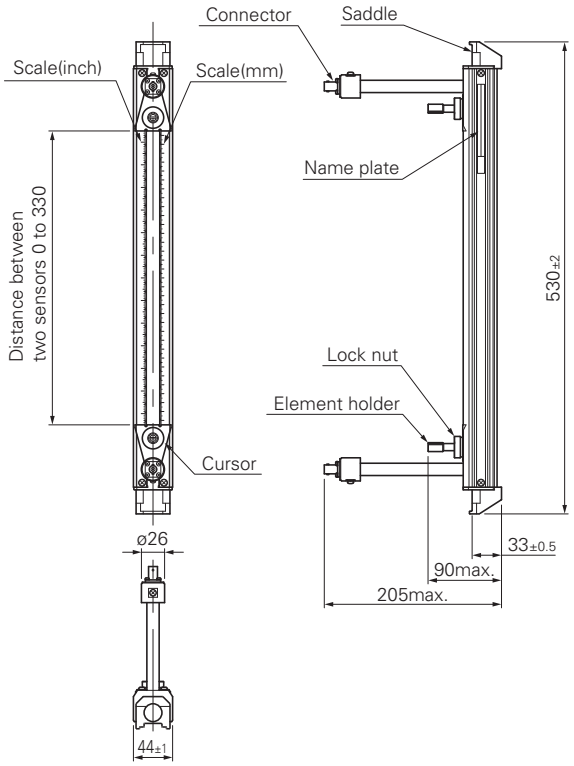
1	2	3	4	5	6	7	8		9	10	Description
F	S	S	H	1			1	–	Y		
			H								<Senser type>(4th digits) ø50 to ø400mm (-40 to 200°C)
				1							<Guide rail>(5th digits) Provided
					Y						<Mounting belt>(6th digits) None
					A						Stainless belt (1.5m×2)
					C						SS belt fasten with screws (1.0m×4)
						Y					<Acoustic coupler> (7th digit) None
						D					High-temperature grease (KS62M)
									Y		<Water-proof treatment>(9th digit) None
										Y	<Tag plate> (10th digit) None
										A	Provided

OPTIONAL ACCESSORIES

Name	Drawing No.
Guide rail for high-temperature sensor (Z method)	ZZP*TK4J5917C3
High-temperature grease(KS62M)	ZZP*TK7G7983C1

OUTLINE DIAGRAM (unit: mm)

<Detector>



High-temperature sensor: FSSH

Scope of delivery

- Detector, acoustic coupler and set of the mounting belt according to specified code of symbol

Detector for special application 3) detector for large diameter type

Pipe size: ø200 to 6000mm
Fluid temperature: –40 to 80°C
Type: FSSE1□□1-□□

Specification

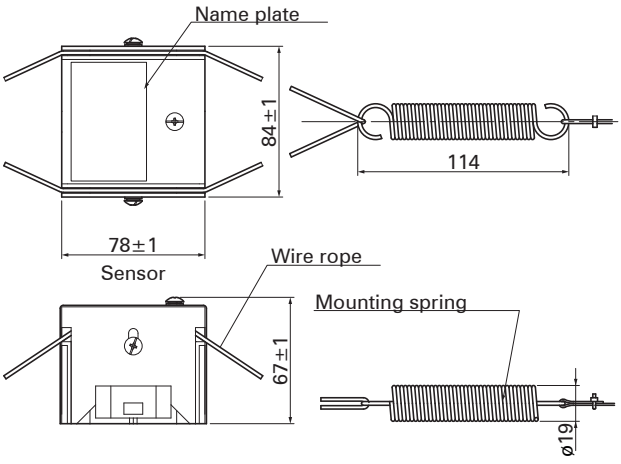
- Sensor frequency: 0.5MHz
- Mounting method: V or Z method
- Fluid temperature: –40 to 80°C
- Applicable pipe material: PVC, SS, carbon steel pipe, copper pipe, aluminum pipe,etc.
  * In case lining is removed from the pipe, Measurement can not be conducted
- Also applicable to water-proof type according to specified code of symbol (submerged resistant structure for 5days including 10m cable)
- Rated accuracy of combination with the flow transmitter (Applicable piping: plastic, metal pipe)

Internal diameter (mm)	Velocity	Accuracy
ø200 to ø300	2 to 32m/s	±1.5% of rate
	0 to 2m/s	±0.03m/s
ø300 to ø1200	0.75 to 32m/s	±1.5% of rate
	0 to 0.75m/s	±0.0113m/s
ø1000 to ø6000	1 to 32m/s	±1.0% of rate
	0 to 1m/s	±0.02m/s

- Mounting belt: according to specified code of symbol.
- Material: Sensor housing PBT, Sensor cover SUS304
- Type of enclosure: IP67
  (silicon rubber is filled up on the terminal block when connecting work)
- Acoustic coupler: according to specified code of symbol.
- Mass: 1.2kg

OUTLINE DIAGRAM (unit: mm)

<Detector>



Large sensor: FSSE

CODE SYMBOL

<Detector>

1	2	3	4	5	6	7	8	9	10	Description
F	S	S	E	1			1	–		
			E							<Senser type>(4th digits) ø200 to ø6000mm
				1						<Guide rail>(5th digits) Provided
					Y					<Mounting belt>(6th digits) None
					D					Wire ≤ ø1500mm
					E					Wire ≤ ø6000mm
						Y				<Acoustic coupler> (7th digit) None
						A				Silicon rubber (KE348)
						B				Silicone-free grease (HIGH-Z)
						C				Silicone grease (G40M)
								Y		<Water-proof treatment>(9th digit) None
								B		Provided (with signal cable 10m)
									Y	<Tag plate> (10th digit) None
									A	Provided

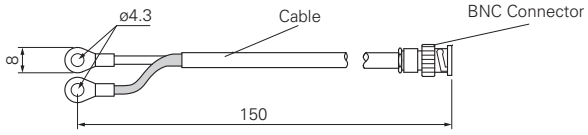
OPTIONAL ACCESSORIES

Name	Drawing No.
Wire rope for mounting the sensor	
• Spring	ZZP*TK745007P1
• Wire rope (up to ø500mm)	ZZP*TK464686C1
• Wire rope (up to ø1000mm)	ZZP*TK464686C2
• Wire rope (up to ø1500mm)	ZZP*TK464686C3
• Wire rope (up to ø3000mm)	ZZP*TK464686C6
• Wire rope (up to ø6000mm)	ZZP*TK464686C13
Sillicon grease (GM40M)	ZZP*45231N5
Sillicon rubber (KE348W)	ZZP*45735N2
Sillicon-free grease (HIGH-Z)	ZZP*TK7M0981P1

Scope of delivery

- Detector, acoustic coupler and set of the mounting belt according to specified cord of symbol
- Signal cable conversion cord

<Signal cable conversion cord>



CHECKED ITEMS BEFORE PURCHASE

Following conditions may cause failure of the measurement or to reduce the accuracy.
Please consult and ask Fuji Electric for checking with actual equipment previously if it is hard to judge the applicability.

1)Fluid
- If fluid contains a large amount of bubbles (approx. 12vol% or more at 1m/s flow rate)
- If fluid has bad turbidity 10000(mg/L) or more,
- If fluid contains slurry or solid materials (about 5wt%)
- If flow rate is low Reynolds No.10000 or less, (reference: flow rate 5m^3/h with ø100mm)
- If it is circulating oil, liquid medicine of low concentration, waste liquid and hot spring,

2)Pipe
- If inside pipe is rusty carbon steel pipe,
- If inside pipe having adhering substances and sediment
- If outer surface of cast-iron pipe is rough,
- If pipe wall is tick such as ruinous pipe, (PP material 15mm or more, PVDF material 9mm or more)
- If it is SGPW pipe,
- If lining pipe is removed from pipe, (Teflon, PVC, Glass, etc)
- If it is rubber pipe,

3) Pipe straight run
For accurate measurement, a certain length of pipe straight run is required both upstream and downstream of the measurement point. Be sure to satisfy the requirements described on Page 8.

CAUTION ON USE

1) Do not damage the sensor or signal mounted on the pipe.
2) Make sure to fill the fluid inside the pipe to measure .
3) When you use horizontal pipe, it is recommended to install the sensor horizontally.
4) When you use the grease as acoustic coupler to install the sensor for outdoor use, it is recommended to install the waterproof cover to prevent from the degradation.

Information in this catalog is subject to change without notice.
Read the instruction manuals thoroughly before using the products.

Fuji Electric Co., Ltd.

Gate City Ohsaki, East Tower, 11-2, Osaki 1-chome, Shinagawa-ku, Tokyo 141-0032, Japan
Phone: +81-3-5435-7111
www.fujielectric.com
www.fujielectric.com/products/instruments/

Printed in Japan