PRODUCT DATA SHEET

Stationary Ultrasonic Flowmeter

UFW-100

intelligent DIGITAL

TOKYO KEIKI

TOKYO KEIKI INC.

1. Outline

1) Transit times of ultrasonic pulses transmitted in a liquid vary with the flow velocity of the liquid and ultrasonic flowmeters utilize this characteristic to measure flow.

2) Regardless of whether the liquid is electrically conductive or non-conductive, ultrasonic flowmeters can measure various types of liquids such as potable water, river water, industrial water, agricultural water, wastewater, seawater, and pure water.

3) Transducers are clamped on to the outside of the pipe so it is not necessary to cut pipes or stop flow for installation and there is no pressure loss.

4) Flow measurements are possible over a wide range, -30m/s to +30m/s.

5) Economical measurements of flow from 25mm to 600mm can be obtained.

6) Easy Operation through PC configuration software. Through graphical user interface, it is very simple and useful for everyone to input all data.

2. Features

1) **Graphical PC configuration ‘’EZ-wizard’’**

Through EZ-wizard, all required parameters can be input.
Mounting position of transducers will be calculated by input parameters automatically.

2) **Emergency Redundancy System (Automatic Logging System)**

1 min interval for 1-month data will be logged internally and automatically with any events data.
Totally it will be over 64000 points (more than 1 month with 1 min interval)

3) **Echo-wave monitor**

Receiving echo will be indicated on the PC configuration software.

This feature helps to identify ideal mounting positions of transducers.

4) **Variety I/O port**

Analog output (Std.), Totalizing output (Std.), Digital port (Std.),

and Digital port / RS-485 MODBUS (Option) are available.

5) **Extra A-IN available**

By using optional card, 1 port for passive analog input (option)

can be available.

This info will be stored internal logged data automatically.

6) **Site Check mode**

Any Error will indicate on the LCD without PC or any software.

7) **EZ-Translation**

Any languages are configurable on the PC locally.

3. Configuration

Flowmeter components

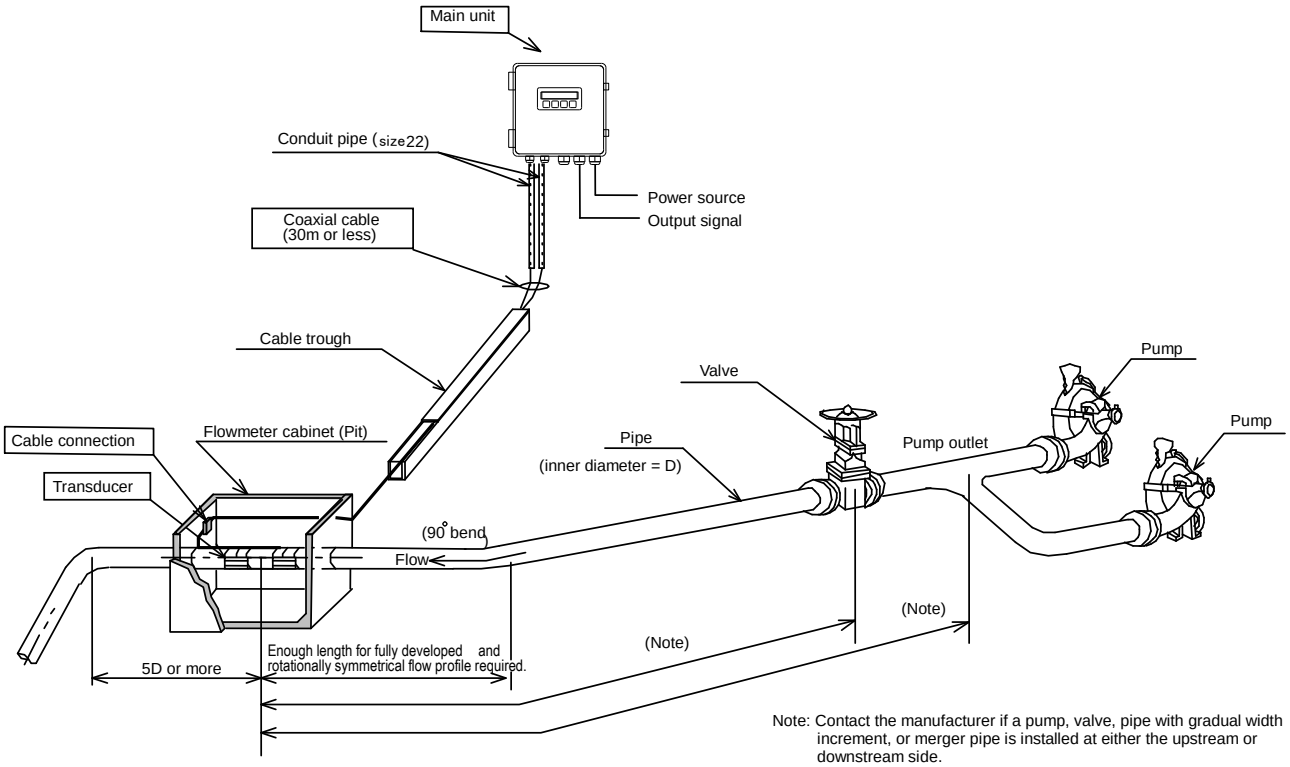
Component	Model	Quantity	Description
1. Main unit	UFW-100	1 pc	Flowmeter main unit
2. Transducers	1MHz Transducer for DN 25mm-600mm Pipe	2 pcs	Ultrasonic transmit and receiving transducers and pipe-mounting fixtures for transducer
3. Coaxial cables (*)	RG-223/U	2 pcs	Connection cable between flowmeter main unit and transducers (max. cable length: 30m)

(*) Coaxial cable is optional specifications.

1MHz transducer components are as follows.

Components	Quantity	Material	Weight (approx.)
1. Transducer	1pair (2pcs)	Case : PBT (Plastic)	180g / 2pcs
2. Holder	2pcs	PBT (Plastic)	160g / pc
3. Fastening Fixture	10pcs	SUS304	20g / pc
4. Stainless Band	15 m	SUS430	24g / m
5. Clamp	2sets	SUS304	55g / set
6. Thumb Screw (for Z-method)	4pcs	SUS303	16g / pc
7. Installation Outfit	1set		

Note: SUS is notation by Japanese Industrial Standard for kind of stainless steel material.



4-1. Overall Specifications

Measurement	Fluids	Homogeneous and ultrasonically conductive fluids (Clean water, waste water, industrial water, river water, sea water, pure water, etc.)
	Temperature range	-20°C to +60°C Note: 1) above also applicable to ambient temperature 2) For main unit, -10°C to +50°C
	Turbidity	10000 mg/L or less Note) No air bubbles
Pipes	Material	Pipes made of materials that allow stable transmission of ultrasonic waves, such as steel, stainless steel, cast iron, ductile cast iron, PVC, FRPM, etc. Note) Applicable pipe bores may vary depending on the pipe material and condition.
	Diameters	DN25mm to DN600mm
	Lining	None, tar epoxy, mortar, etc. Note) Linings must be closely adhered to the base pipe.
Measurement range	Converted to flow velocity: -30 m/s to +30 m/s	
Number of measurement paths	1 measurement path	
Measurement cycle	1 s	
Measurement Performance	DN 25 ~ 40mm	±2.5%(*) of reading, however ±0.025(*) m/s for flow velocities less than 1 m/s (*) Depending on calibration
	DN 50 ~ 90mm	±2.0% of reading, however ±0.020 m/s for flow velocities less than 1 m/s
	DN 100 ~ 250mm	±1.5% of reading, however ±0.015 m/s for flow velocities less than 1 m/s
	DN 300 ~ 600mm	±1.0% of reading, however ±0.010 m/s for flow velocities less than 1 m/s
	Repeatability	±0.5%
	Range ability	1 : 300
	Note: 1) For volumetric flow rate. 2) Fully developed and rotationally symmetrical flow profile required. 3) Verified by manufacturer's conditions.	
Measurement method	Ultrasonic pulse transit time difference method	

European compliance (CE marking)	Safety: IEC61010-1 2nd Edition EMC: EN61326-1:2006 + EN61326-2-3:2006

4-2. Main Unit

Analog output	St'd / Option	Standard
	Number of channels	1
	Output contents	Instantaneous flow rate
	Output pattern	Single system
	Output format	4 – 20mA, Burnout 20.8mA (when "no echo received" or during "failure warning" output available) Max. allowable load resistance 600ohm Insulated outputs, 10-bit equivalent accuracy
	Update cycle	125ms (8Hz)
	Terminal panel	Screw less Terminal (0.08~2.5mm^2 cable applicable)

Contact point output	St'd / Option	Standard
	Number of channels	1
	Output	Selectable from: 1. Forward flow totalized pulse 2. Backward flow totalized pulse 3. No echo received warning (ROFF) 4. Equipment failure warning 5. No echo received warning or Equipment failure 6. Hi-Limit alarm 7. Lo-Limit alarm 8. Forward flow identification 9. Always open 10. Always closed
	Pulse Width	Pulse width of contact is selectable from 1000,500,100 or 20ms. Note: 1) But not for both forward and backward.
	Output format	Photo coupler (insulated)
	Contact point capacity	DC48V, 0.4A
	Terminal panel	Screw less Terminal (0.08~2.5mm^2 cable applicable)

USB communication	St'd / Option	Standard
	Number of channels	1
	USB Cable length	Up to 3m
	Functions	Flowmeter programming, measurement value display, received signal waveform display, and log data readout using dedicated software*1 *1 Compatible with Windows 7, Vista and XP
	Connector	USB-B terminal, hot plug possible

RS-485 communication	St'd / Option	Option
	Number of channels	1
	Output format	RS-485 (insulated type)
	Protocol	MODBUS-RTU compatible
	Transmission Length	Up to 1km (depending on cable and communication speed)
	Data	Forward flow totalized value, backward flow totalized value, instantaneous flow rate, instantaneous flow velocity, equipment status, etc.
	Baud rate	4800, 9600, 19200, 38400 bps (Selectable)
	Parity	None, Even, Odd (Selectable)
	Data bit length	8 bit /1 stop bit
	Terminal panel	Screw less Terminal (0.08～2.5mm^2)

Analog input	St'd / Option	Option
	Number of channels	1
	Output format	Insulated inputs, passive method
	Input range	4-20mA Input resistance 300 Ohm or less
	Accuracy	8-bit equivalent
	Sampling cycle	1 s
	Input contents	Selectable from current ratio (%) or current value (mA)
	Terminal panel	Screw less Terminal (0.08～2.5mm^2)

Log function	St'd / Option	Standard
	Contents	Log contents: Date and time, instantaneous flow rate, instantaneous flow velocity, forward flow totalized value, backward flow totalized value, analog input value, measurement status, error status
	Number of log entries	68000 entries
	Log method	Ring buffer method
	Log cycle	Initial value: 60 s, setting range: 0 to 3600 s 1.5 months or more at a 60 s cycle (60 entries x 24 hours x 45 days = 64800 data) 1 year or more at a 600 s cycle
	Data retrieval	USB communication using dedicated software “UFW Config” or MODBUS communication (option)
	Data retention	Data is held for approximately 5 years in the power OFF status.*1 The battery can be replaced. *1 When the internal lithium battery is fully charged.

Data setting	Setting method	LCD 4-keys entry or USB communication setting through PC with dedicated software “UFW Config”

Display	Display method	LCD (16 character x 2 lines), with backlight	
	Display content	The following items displayed in the upper and lower lines on LCD can be selected. • Instantaneous flow rate and units • Instantaneous flow velocity value and units • Forward flow totalized value and units • Backward flow totalized value and units • Error code • Status (Out of full scale, No receiving echo warning, Disturbance detected, Signal Saturation, Check mode and Low battery) • Analog input value (*Option) • ROFF counter value • DIS. counter value • Upside gain amplitude • Downside gain amplitude • Date & Time	
	Display digits	Instantaneous flow rate :	Max. 7 digits including sign and decimal point
		Instantaneous flow velocity :	sign section 1 digit, integer section 2 digits and decimal fraction 3 digits fixed
		Totalized flow :	Totalized flow 8 digits including decimal point
	Warnings	Symbols are displayed at the right side of the LCD. • “R”: No echo signal received. (upper line of the LCD) • “D”: Disturbance detected. (upper line of the LCD) • “S”: Receiving echo signal saturated. (upper line of the LCD) • “C”: CHECK function is active. (upper line of the LCD) • “B”: Low voltage of coin battery (lower line of the LCD) • “E”: Error occurred by equipment failure. (upper line of the LCD) • “F.S.”: Full Scale (Upper line of the LCD) (During exceeding the maximum flow rate of measurement range, indication would be alternated flickering “the maximum value of measurement range” and “F.S." symbol at the upper & left side of LCD.) Note: 1) The priority between the above symbols (indicated at the same position) as follows. E > C > R > D > S	
	Error code	“ERR-01” to “ERR-63” displayed during equipment failure.	

Units	Flow rate units	• Multiplier u ($x10^{-6}$), m ($x10^{-3}$), x1, k ($x10^{3}$), M ($x10^{6}$) • Flow volume units L/, m^3/, g/, t/, ft^3/, bbl/, gal/, acf/ • Flow time units /s, /min, /h, /D
	Totalizing units	• Multiplier u ($x10^{-6}$), m ($x10^{-3}$), x1, k ($x10^{3}$), M ($x10^{6}$) • Decimal point position ******* (x1), ******.* (x0.1), *****.** (x0.01) • Units L, m^3, g, t, ft^3, bbl, gal, acf

Function	Low flow cut	Cuts (Zeros) flow when flow falls below prescribed instantaneous flow rate. Used in order to avoid output of flow values other than 0 when measurement value during still flow becomes disordered.
	No Echo receiving warning	If measurement cannot be made when no echo is received continuously over the setting time (determined transition time), status is changed to - Display "R" on LCD. - Selected output operation (Analog & LCD) - Contact output of warning if set. - Count up as history on ROFF counter
	Disturbance detection	Check whether processing values are measured properly or not and if determined to be disturbed conditions then measuring values are eliminated. - Display ”D” on the display - Count up as history on DIS. counter
	Zero point correction	Zero point can be independently compensated (shifted) for flow rate.
	Span correction	Slope of span line can be corrected for flow rate.
	Output Filter	Rapid flow rate changes would be smoother by this filter. Note: This value is meaning the time until measuring flow rate reaches 90% by step-up increment.
	Self-diagnostics and failure processing	If failure is diagnosed on following items, transitions to be selected status. Diagnostic checks: 1) Transmitting and receiving circuit 2) CPU 3) DSP 4) Internal clock 5) Memory Area (for setting parameter) 6) Parameters - Selected analog output transition status as follows. 0% (4mA), hold, 100% (20mA), burnout (20.8mA) - Display "ERR-**" on LCD. (** is error number.) - Contact output of warning if set.
	Data retention	Totalized flow values and all setting parameters are retained in memory with lithium battery even if power failure. Note: 1) Setting Parameters are retained in nonvolatile memory. 2) Totalized flow value, Logged data and ROFF/DIS. counters are retained in memory which held by the battery. 3) Data retained in memory which held by the battery clears if battery removed without power supply. 4) 5 year life at room temperature. 5) No battery recharging function.
	Check Function	- Simulated flow check mode - Analog output check mode - Totalized pulse output check mode

Function (cont.)	Automatic gain control (AGC Function)	Receiver gain is automatically adjusted to the optimum level in response to changes in receiver sensitivity during measurement.
	Totalized value preset	Totalized values can be freely preset. Preset Range: 0 to 99999999
	Error historic counter	Count "No Echo receiving warning" & "Disturbance detection" when it occurred.

Power supply	AC100 to 230V +/-10% (50/60 Hz ±2Hz) Option: DC24V±20% (This option must be pre-selected.)	
	Momentary outage	AC input: 20ms DC input: 0ms
Power consumption	AC100V: 19VA / AC200V: 23VA DC24V: 9W (Option)	
Fuse	AC: IEC 60127-2 SS5 Cartridge fuse-links, φ5.2x20 mm, Rating 2A/250V, Time-lag and High Breaking Capacity (1500A) DC: IEC 60127-2 SS5 Cartridge fuse-links, φ5.2x20 mm, Rating 4A/250V, Time-lag and High Breaking Capacity (1500A)	
Rush Current	Less than 15A at AC100V / Less than 25A at AC200V Less than 15A at DC24V (Option)	
Operating temperature range	-10 to +50°C	
Storage temperature range	-20 to +60°C	
Operating humidity range	Less than 90% RH, non-condensation	
Main unit construction	Protection Degree IP65 (IEC 60529)	
Wiring Connection port	I/O and power ports: PG13.5 x 3, applicable cable diameter 7 to 12.5 mm Sensor ports: PG9 x 2, applicable cable diameter 4.5 to 8 mm Other: USB-B female type for USB communication x 1	
Case material	ABS (Color: White gray)	
Weight	Approx. 2.1 kg	
Dimensions	210mm (W) x 210mm (H) x 100mm (D), not including protrusions	
European Compliance (CE marking)	EMC Directive 2014/30/EC Harmonized Standard / EN61326-1:2013 + EN 61326-2-3:2013 Separation into group / Group I Division into classes / Class A Location intended for use / In industrial locations Low Voltage Directive 2014/35/EC Harmonized Standard / EN61010-1:2010 Over voltage category II Pollution degree II Altitude up to 2000m	

4-3. Transducers

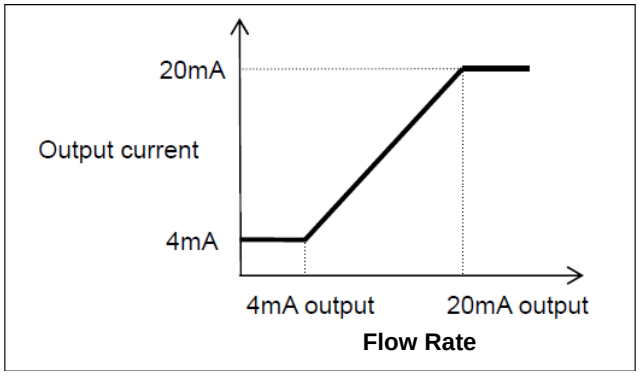
Transducer	SE104720T
Temperature range	-20～60°C
Protection class	IP65 (When filled with resin by the installer) IP67 as an option (Resin-filled product, shipped with cable connected)
Compatible cable	RG-223/U
Maximum cable length	30 m

4-4. Optional parts

IP67 detector	Shipped from the factory with a 30 m cable connected	
Power cable (*1)	St's/option	Prepared by user
	Model name	OLFLEX Classic 100
		multi-conductor, flexible power and control cable
	Part number	10060
	Manufacturer	LAPP KABEL
	Details	3 conductors AWG16, 1.5 mm^2 Nominal outer diameter 8.1 mm
Mounting plate	For wall mounting or standard pipe (DN50mm) mounting (Fig. 1-2-3-3) Consist of: Mounting plate, U bolt, Wing nut, Spring washer, Flat washer, screw M4.	
Expansion board AIN-10 (*2)	Analog input: Insulated passive input type	
Expansion board 485-20 (*2)	Digital communication functions Insulated RS-485, MODBUS-RTU compatible	

(*1)Power cable is specified to comply with EC directive.
(*2)Expansion boards can be mounted simultaneously.

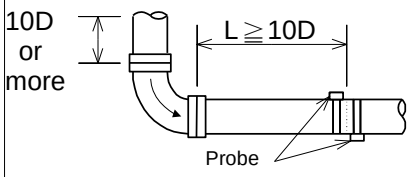
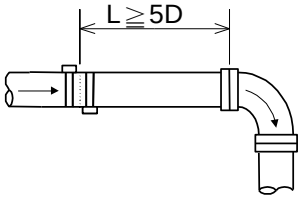
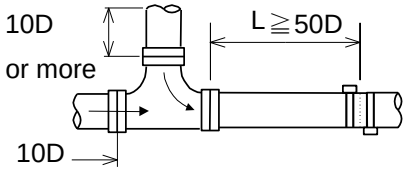
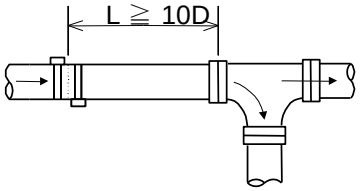
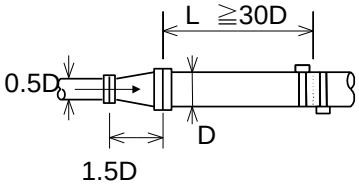
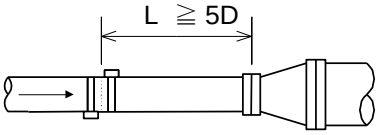
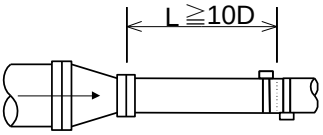
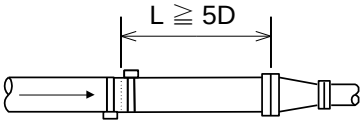
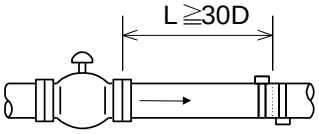
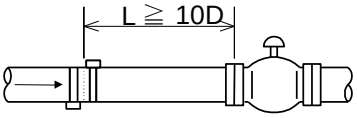
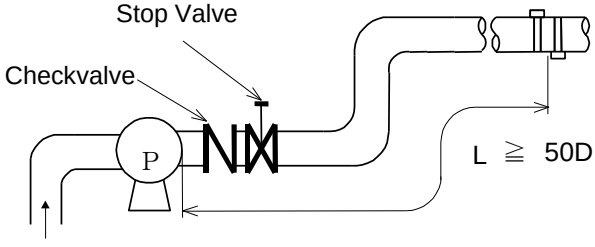
5. Analog output profiles



6. Transducer installation

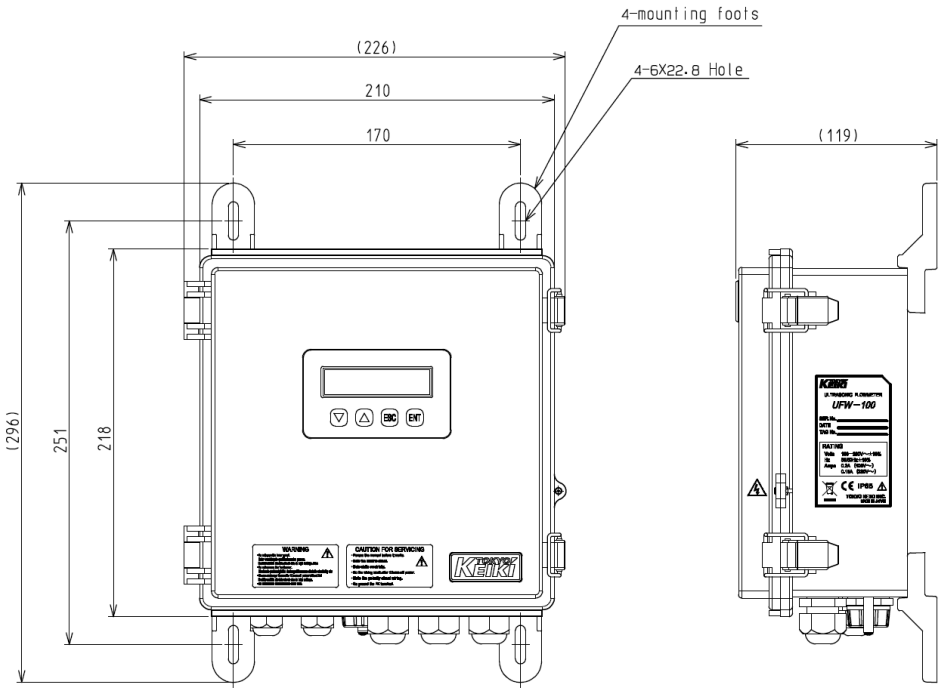
- To minimize measurement errors arising from flow profile, a straight pipe run is necessary for transducer installation.
- Liquid should fill the pipes completely and transducers should be installed in locations which have no air bubbles.
- For measurements in underground piping, the usual means is to locate the flowmeter in a pit to facilitate transducer installation, maintenance, and testing.

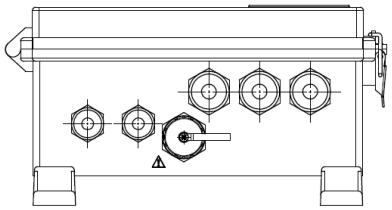
[Refer to JEMIS 032-1987]

Structural condition	Upstream straight pipe length	Downstream straight pipe length
90°bend		
T shape joint		
Increasing Diameter		
Reducing Diameter		
Control Valves	 Flow Control at upper side	 Flow Control at lower side
Pump		

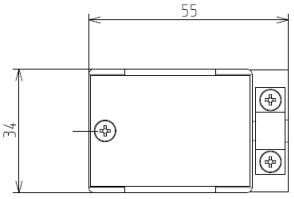
D : Pipe Diameter

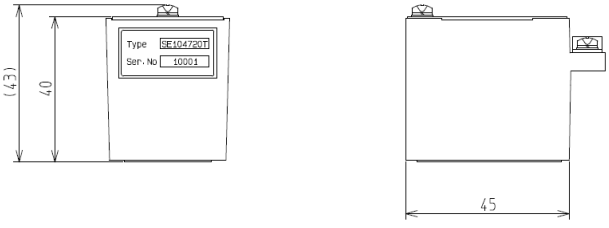
7.Dimensions



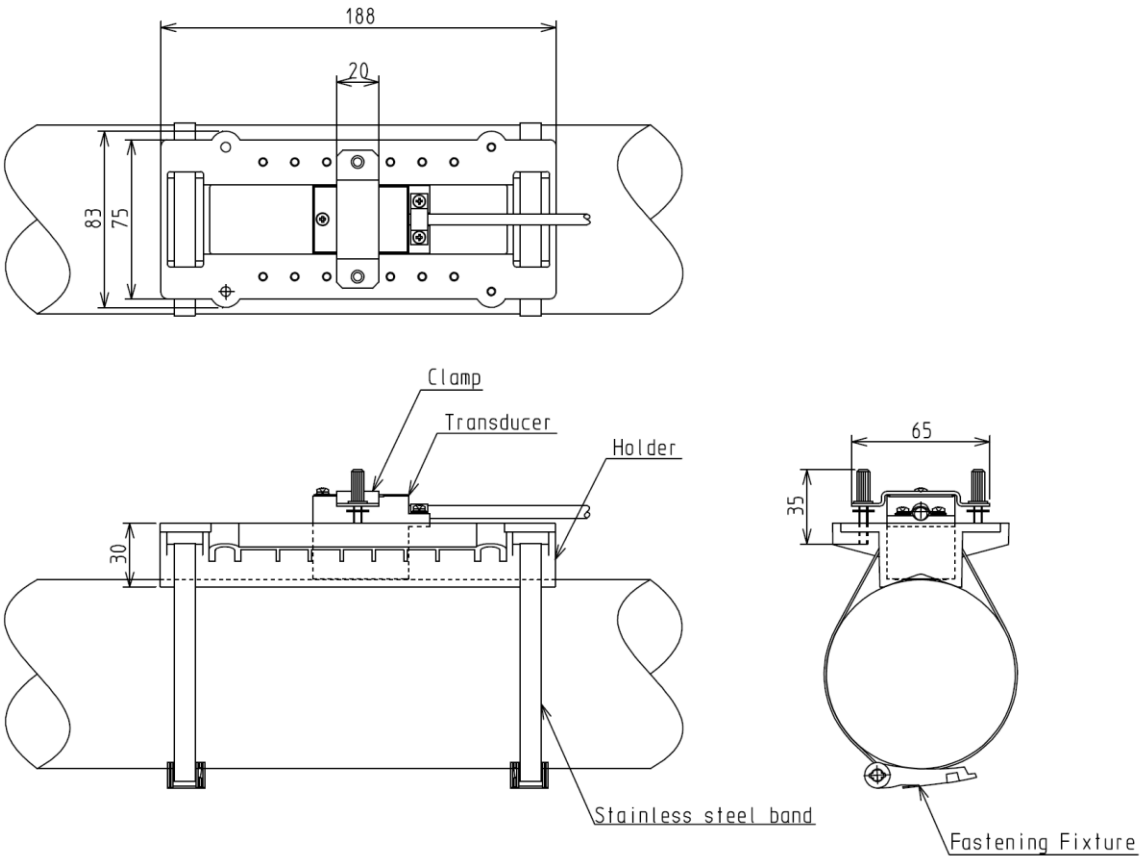


Main Unit Dimension

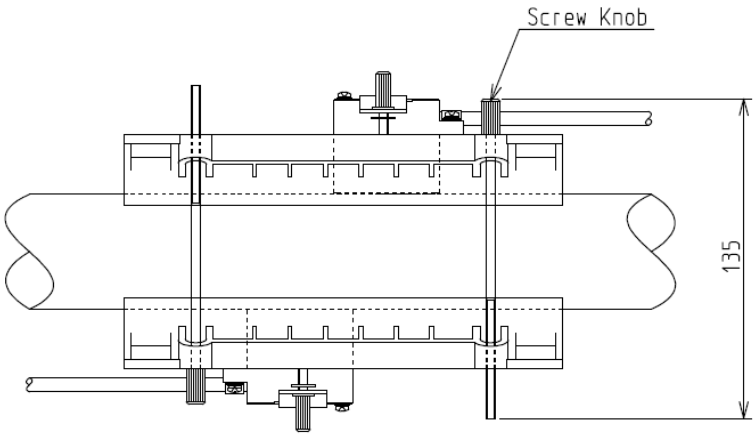




Transducer



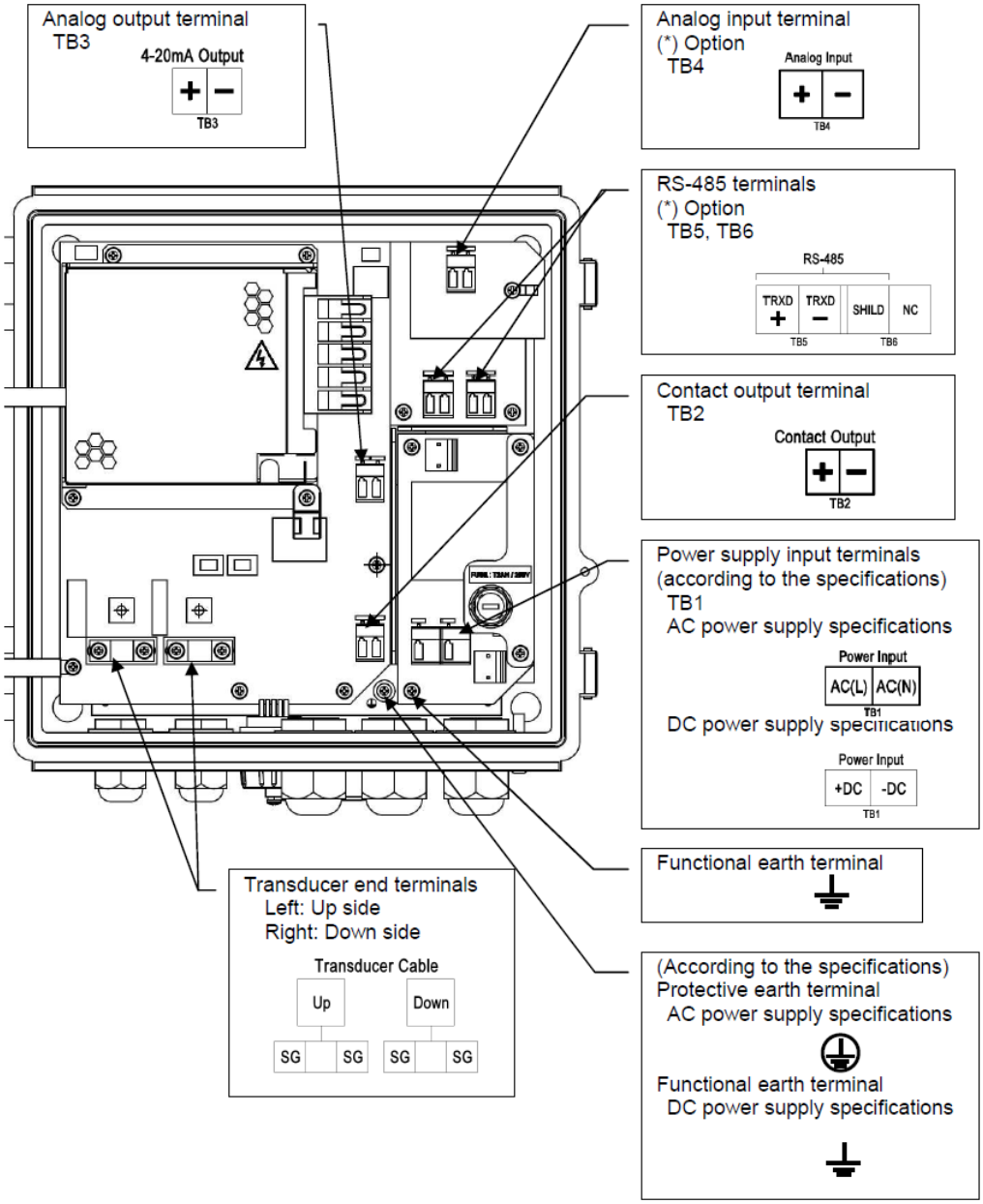
Mounting Fixture for Transducer



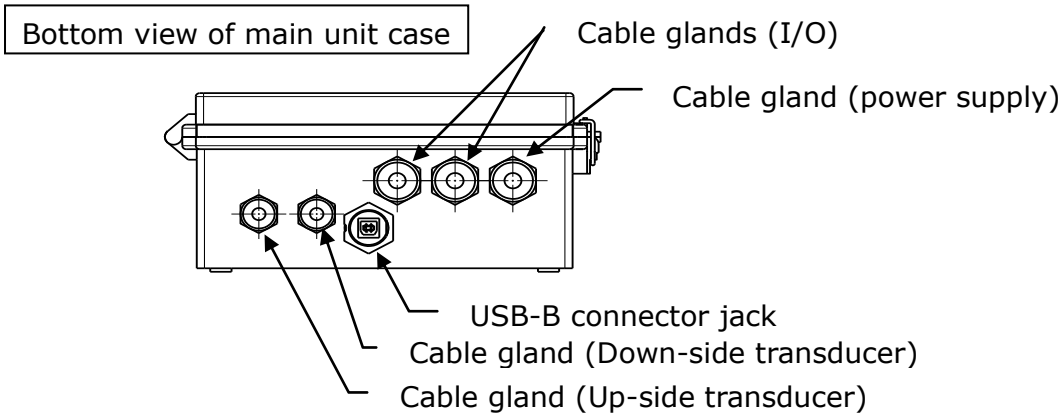
Mounting Fixture for Transducer (Z method)

8. Wiring Connection

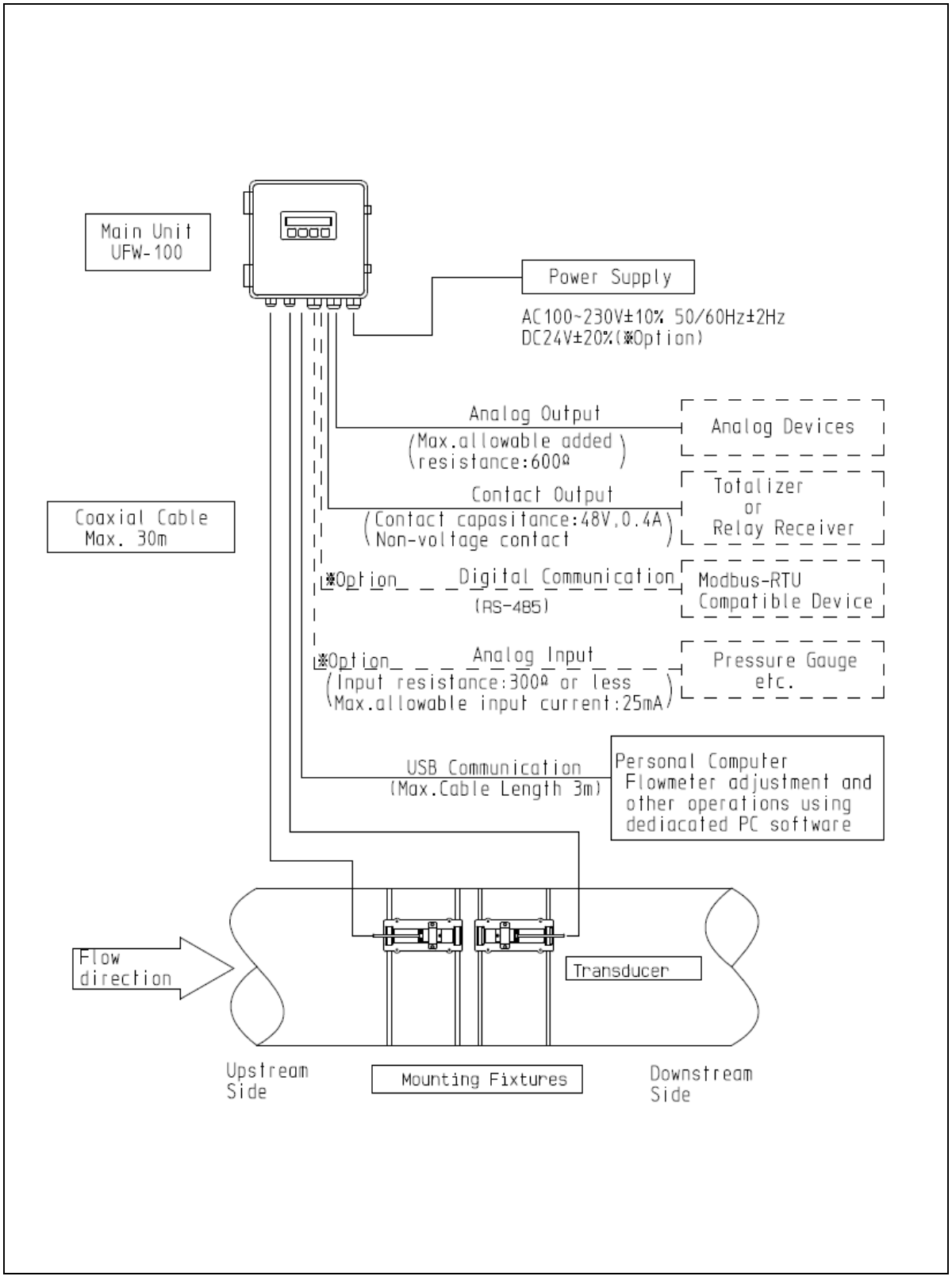
8-1. Output connection



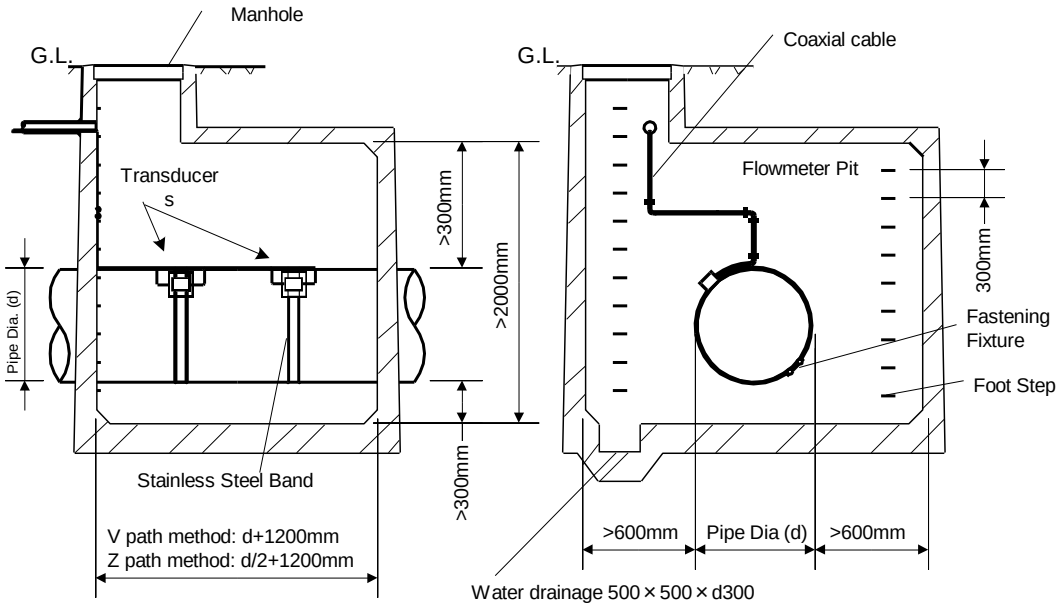
8-2. Cable entry port



9. System Wiring Connection



10. Building a flowmeter pit



- In principle, when measurement is of underground pipe, it is suggestive to prepare of dedicated flowmeter pit.

- It is not necessary to prepare a flowmeter pit in the case of indoor or outdoor piping, but proper footing should be planned for transducer mounting and equipment adjustments in the case the pipe is located high off the floor or when pipe diameter is large.

Building a flowmeter pit

1. Select pit site (taking into consideration the following points)
   1) Straight section of pipe is required for installation of transducers as explained under Part 5.
   2) Consult manufacturer if an adjustable valve or pump is used.
   3) To prevent noise interference or signal attenuation, coaxial cable used transducers and main unit should be less than 30m.

2. Size and construction of flowmeter pit
   1) Using above schematic as reference, determine size of flowmeter pit based on actual piping position and conditions. Height of pit should allow person to stand while working.
   2) Implement countermeasures for floods such as drainage gutters, etc. (Install water pump where water is liable to accumulate or flood.)
   3) Consult Manufacturer for other specific conditions. (Above dimensions are ideal and not the minimum required.)

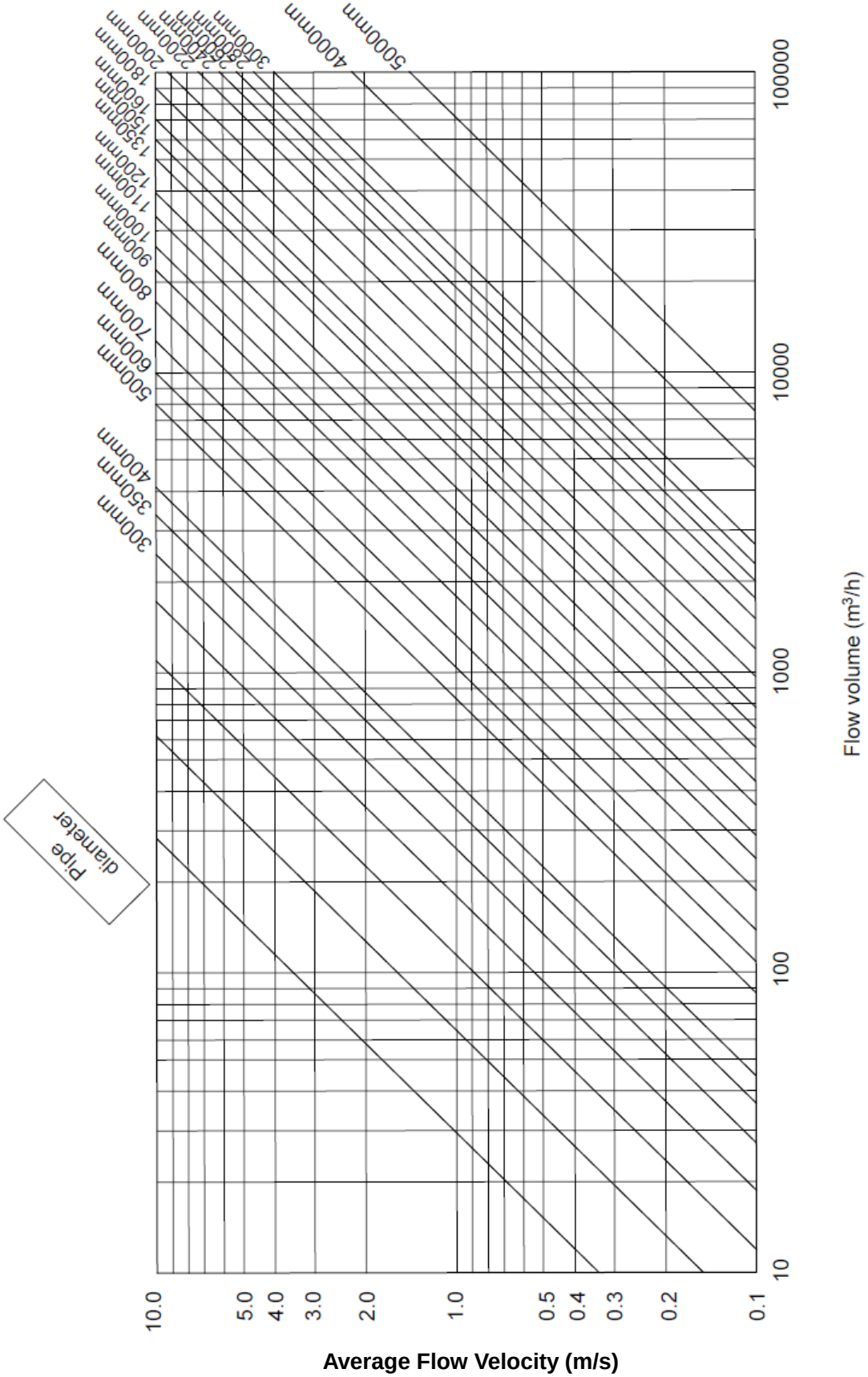
Transducer installation

1. Strip paint/coating from piping surfaces at transducer mounting locations and fix transducers on piping using the accessory mounting fixtures. When mounting transducers according to the “V” method, the distance separating the transducers should be about the diameter of the pipe. If the “Z” method is used, the distance should be one half of the diameter.

2. After installing and adjusting the transducers, remove transducer mountings, and coat pipe surface with anti-rust paint.

11. Appendix

Flow Volume and Average Flow Velocity



Required parameters for Inquiry

AA. Pipe Information

1) Process Name :

2) Line Quantity : Lines(s)/Location(s)

3) Pipe Specification : If possible, send us DWG of pipe diagrams.

Diameter Nominal : DN (mm) / Out Diameter mm

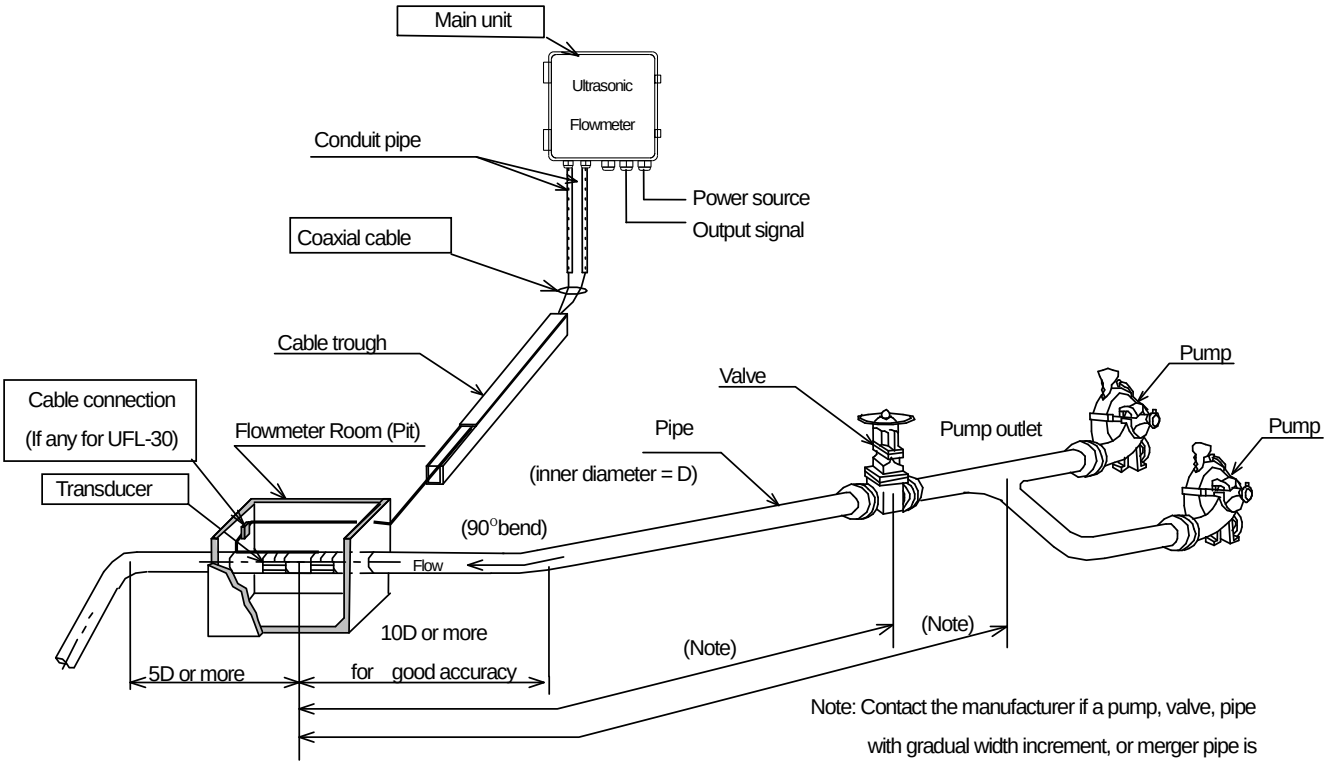
Pipe Material : / Thickness mm

Lining Material : (if any) mm / Thickness mm

4) Required cable length: From Main Unit to Transducer m

5) Straight Pipe-run : From , folds (times) for upstream side

: From , folds (times) for downstream side



Note: Contact the manufacturer if a pump, valve, pipe with gradual width increment, or merger pipe is installed at either the upstream or downstream

BB. Liquid Information

1) Liquid Name : (main component; if any)

2) Sound Speed of Liquid : (if liquid is special and identified) m/s

3) Liquid viscosity : (if liquid is special and identified) m^2/s

4) Temperature : C deg.~ C deg.

CC. Extra Information

1) End user name :

2) Atmospheric conditions : Non-Hazardous / Hazardous requirement ( )

3) Purpose of process :

4) Existing Flow instruments : (if any)

5) Any other problems at Flow : (if any)

Ultrasonic Flowmeter model UFW-100 Ordering Code List (1/2)

UFW-100-☐☐☐☐☐☐☐☐ - ☐☐☐☐

Component Code　　Site Condition Code

Component Code

☐☐☐☐☐☐☐☐

Connecting Transducer

1	DN25mm to DN600mm SE104720T (-20 to +60 deg.C)
X	Special Transducer, Consult to us.

Optional I/O Card

1	RS-485 Modbus Communication Card
2	Analog Input Card (1ch)
3	Both of RS-485 Modbus and Analog Input
0	No Need

Power Supply

A	AC 90-240V, 50/60Hz+/-2Hz (Standard)
D	DC 24V +/-20% (Optional)

Extension Length of Coaxial Cable

☐	x 10m (up to 30m) / 2lines
0	No Need

Diameter Nominal of installing pipeline

☐☐☐A	A = mm
0☐☐B	B = inch

Optional Component

S	Setup Software for Windows™ OS *1
P	Mounting Plate for Main Unit
N	Not Use

*1 Windows is trademark of Microsoft.

Ultrasonic Flowmeter model UFW-100 Ordering Code List (2/2)

UFW-100-□□□□□□□□ - □□□□

Component Code | Site Condition Code

Site Condition Code

□□□□

Pipe Material

1	Steel
2	Ductile Iron
3	Stainless Steel
4	PVC
X	Other Material ( )

@	Outside Diameter	□□□.□	mm / inch
@	Pipe Thickness	□□□.□	mm / inch

⇦ Please fill in forms with actual data.

Lining Material

1	Tar Epoxy
2	Mortar
X	Other Material ( )

@	Lining Thickness	□□.□	mm / inch

⇦ Please fill in forms with actual data.

Measuring Liquid

1	Drinking Water, Raw Water
2	Sea Water
3	Sewage Water (after Screening)
4	Lubricant (Oil)
5	Chiller Water, Heated Water
X	Other Liquid ( )

Contact Output (1 output)

0	BREAK (Normal Open)
1	MAKE (Normal Close)
2	Forward Totalizing Pulse
3	Backward Totalizing Pulse
4	Receiving Echo Error Alarm (ROFF)
5	Break Down (Unit Failure) Alarming
6	ROFF [or] Break Down
7	High Limit Alarm
8	Low Limit Alarm
9	Forward Direction
N	Not Use

Qmax. (Maximum Flow Rate)

@	

⇦ Please fill in forms with actual data.

Please show flow rate's unit also. (ex. m^3/h)

This value is related to the setting of maximum range of Analog Output & Indicate-able digits on LCD.

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