

Appendix 1.1 Ultra-Sonic Flowmeter

Brand: TOKYO KEIKI

Model: UFP-20

Country: JAPAN

Contents of this manual

1. Battery Charge
2. Unit Setting
3. Transducer Setting
4. Start and Stop Logging
5. Downloading Logs

1. Battery Change

Open side cover, then connect AC adaptor. Please be noted that battery charging will not start during the main unit runs



Fig. 1.2.3-4 Battery charge

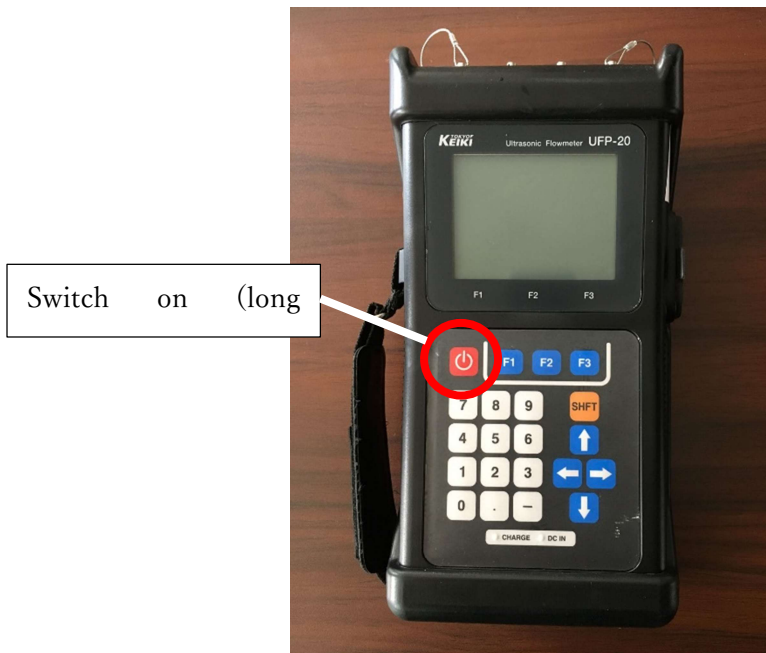
The GREEN LED will light up when DC power is supplied, also RED LED when charging has started. Charging will be completed when RED LED turns off.

Please be noted following points

- Main unit cannot be charged during power on. Please turn off the power for battery charging.
- Proper battery icon with remaining levels will be indicated on the display after a few minutes.
- In case it is NOT used for more than 1 month, battery must be disconnected from main unit and kept in a cool location.
- To comply with CE certification, do not operate the unit with the charger @legged in.

2. Unit Setting

Turn switch on. Then automatically Self Check will be carried out. After the Self Check, select “OK” <F3>



Select “Installation Wizard” on the basic menu

Select “1: Installation Wizard” by direction or numeric button. Then push “Select” key (F3 button).

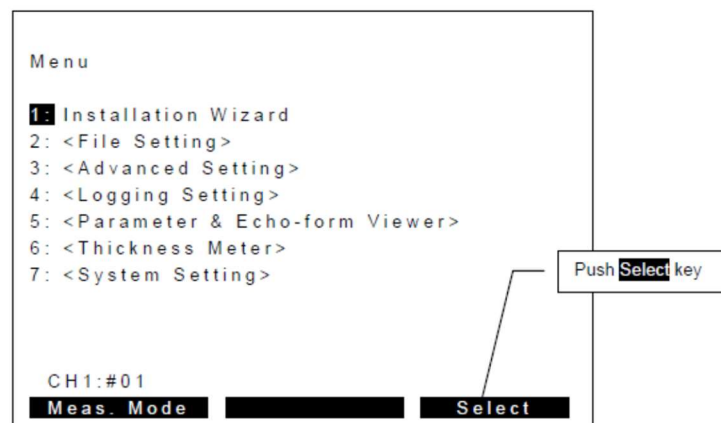


Fig. 1.2.6-2 Basic menu

Select file position as “#No.”

Please select Not-Used area by direction button, then push “Enter“ key (F3 button).

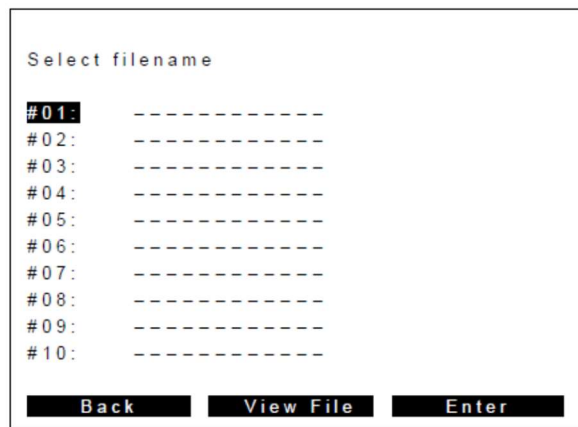


Fig. 1.2.6-3 File selection menu

Not-used area indicated as “-----” and you cannot select this position. To remove site setting file, please refer to Chapter 2. When you select used area, you can see the following indication.

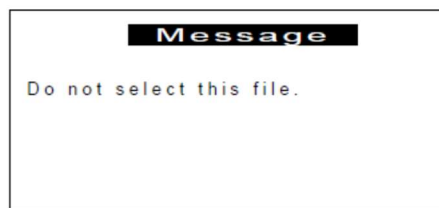


Fig.1.2.6-4 Message of selection not used area

File name input

Please input file name by direction button. Here for example, let’s input as “100/Steel/1M”.

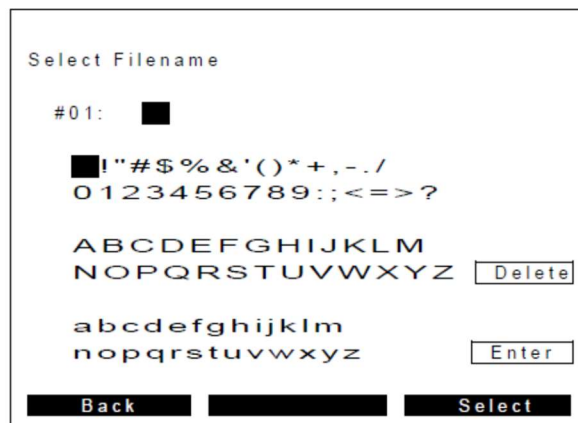


Fig. 1.2.6-5 File name input menu

Move cursor to “1” (for example) by direction button. and push “Select” key (F3 button) to select character. You can see that “1” would set first position as below.

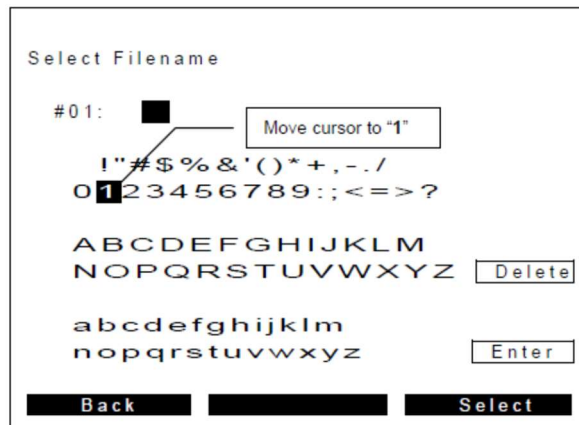


Fig. 1.2.6-6 Word selection menu

Finalizing file name

By repeating procedure of 1-4, you can input "100/Carbon Steel/1M" as follows. After finalizing the file name, proceed next menu by moving the cursor to "Enter" and push "Select" key (F3 button), otherwise [SHIFT] + F3 button makes the same step taken.

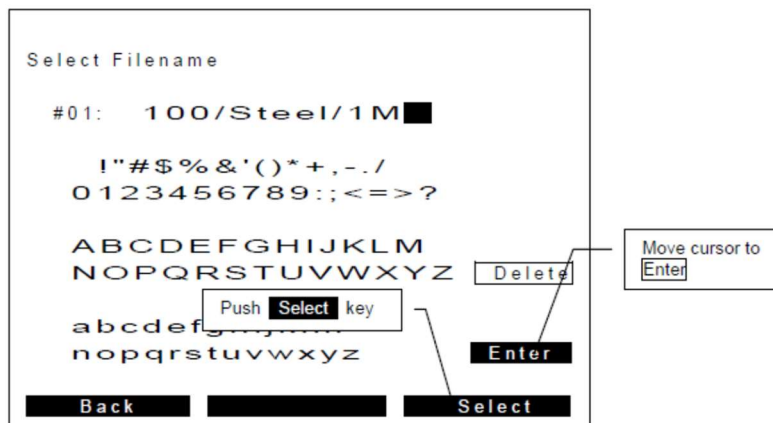


Fig. 1.2.6-9 File name finalize

Pipe size setting

Input pipe diameter-by-diameter itself or circumference of pipe. You can select which way you want by direction or numeric button. Here for example, select “1: Diameter” by push “Select” key (F3 button). Note: diameter should be OUTER diameter. Please refer to

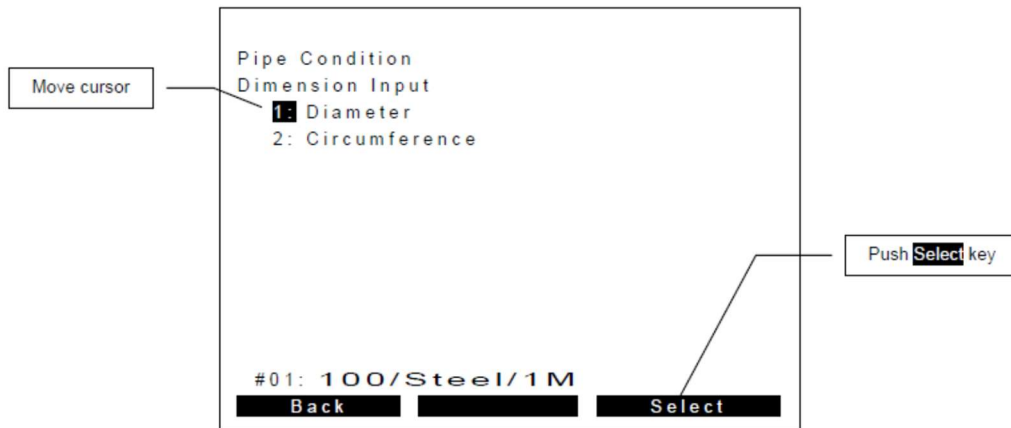


Fig. 1.2.6-10 Selection menu by diameter

Input diameter by numeric button directly. Here for example, input 114.30mm as right. Then push “Enter” key (F3 button) to proceed to next step.

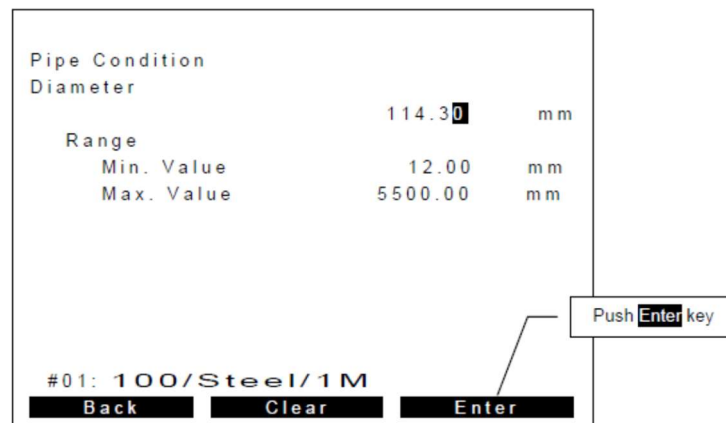


Fig. 1.2.6-11 Input menu

Pipe material

Select material of the pipe from default choices or User Defined by direction or numeric button. Here for example, select “1: Carbon Steel”, then push “Select” key (F3 button) to proceed next step.

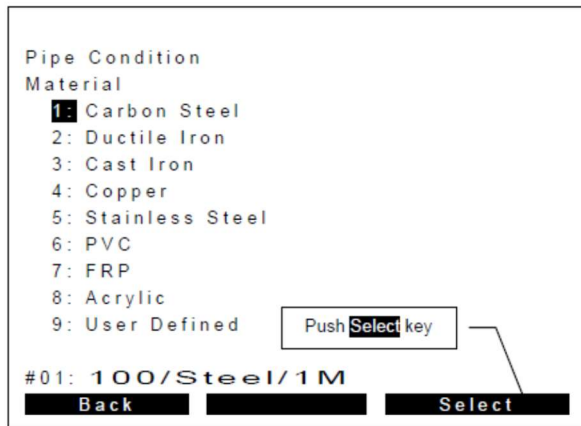


Fig. 1.2.6-12 Pipe material selection menu

Following sound speed is defined as default listed material.

Table 1.2.6-2 Selectable items of pipe material

Material	Sound speed [m/s]
Carbon Steel	3200
Ductile Iron	3000
Cast-Iron	2500
Copper	2270
Stainless Steel	3100
PVC (Poly Vinyl Chloride)	2280
FRP	2560
Acrylic	2720

After you select material, you will see predefined sound speed, normally just proceed to next. If you would like to select any un-listed materials, please select “User Defined” then enter actual sound speed of the material at the next extra menu.

Thickness of pipe

Input pipe thickness by numeric button directly. Here for example, input “4.50mm”, then push “Enter” key (F3 button) to proceed to next step.

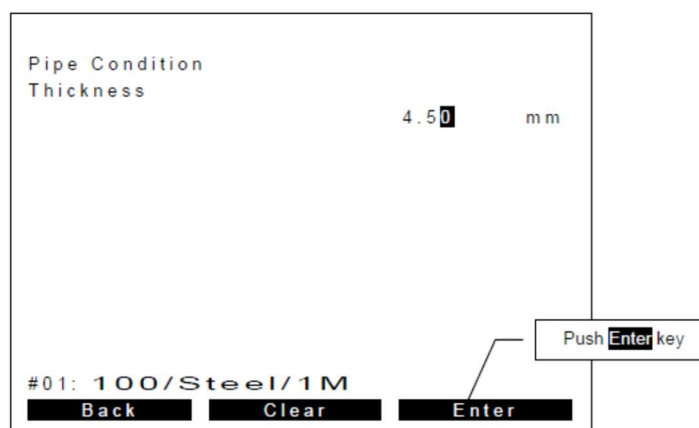
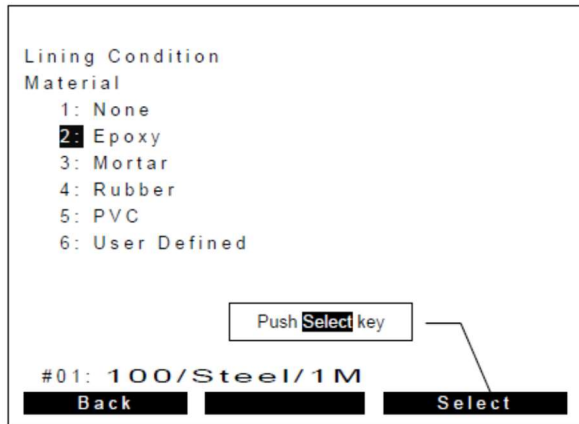


Fig. 1.2.6-13 Pipe thickness input menu

Note: Over ½ of pipe diameter is invalid value. (Max range: up to 100mm)

Lining material

Select material of the lining from default choices or User Defined by direction or numeric button. Here for example, select “2: Epoxy”, then push “Select” key (F3 button) to proceed next step.



Following sound speed is defined as default listed material.

Table 1.2.6-3 Selectable items of lining material

Material	Sound speed [m/s]
Epoxy	2000
Mortar	2500
Rubber	1900
PVC (Poly Vinyl Chloride)	2280

Fig. 1.2.6-14 Lining material selection menu

After you select material, you will see predefined sound speed, normally just proceed to next. If you would like to select any un-listed materials, please select “User Defined” then enter actual sound speed of the material later at the next extra menu.

Thickness of lining

Input lining thickness by numeric button directly. Here for example, input “1.00mm”, then push “Enter” key (F3 button) to proceed to next step.

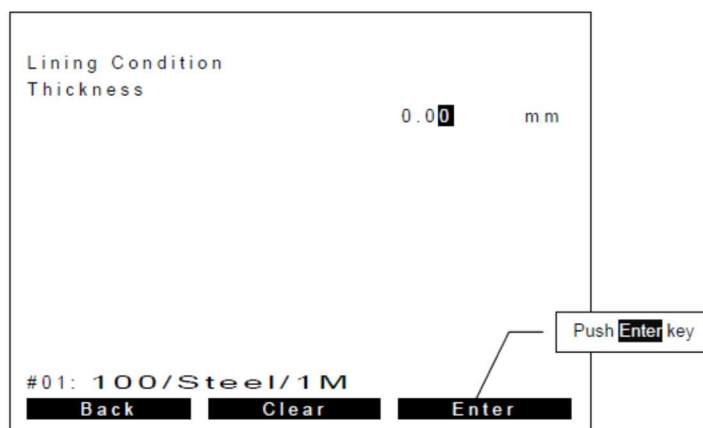


Fig. 1.2.6-15 Lining thickness input menu

Note: Over ½ of pipe diameter is invalid value. (Max range: up to 100mm)

Fluid Selection

Select fluid from default choices or User Defined by direction or numeric button. Here for example, select “1: Water”, then push “Select” key (F3 button) to proceed next step.

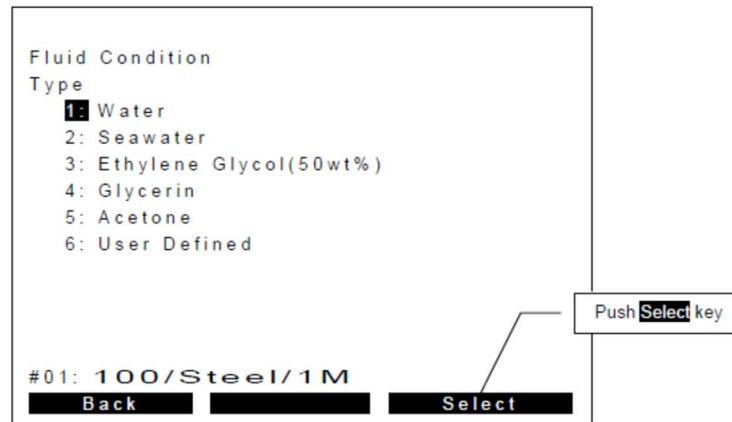


Fig. 1.2.6-16 Fluid type selection

After you select material, you will see predefined sound speed and viscosity, normally just proceed to next. If you would like to select any un-listed fluid, please select “User Defined” then enter actual sound speed of the fluid later at the next extra menu.

Table 1.2.6-4 Selectable items of fluid type

Fluid	Sound speed [m/s]	Viscosity [$\times 10^{-6}$ m ² /s]
Water	1460	1.20
Sea Water	1510	1.00
Ethylene Glycol (50wt%)	1691	4.13
Glycerin	1923	1188.50
Acetone	1190	0.41

12. Transducer type

Select transducer type from default choices by direction or numeric button. Here for example, select “2: UP10AST”, then push “Select” key (F3 button) to proceed to the next step.

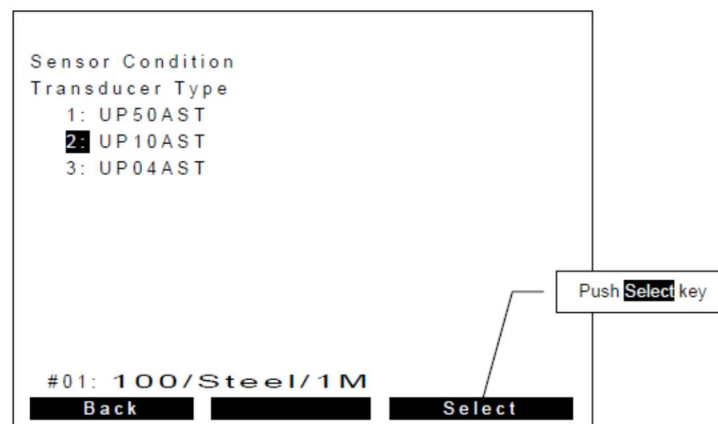


Fig. 1.2.6-17 Transducer type selection menu

Sound-path selection

Select sound-path method from default choices by direction or numeric button. Here for example, select “2: V-Path method”, then push “Select” key (F3 button) to proceed to the next step.

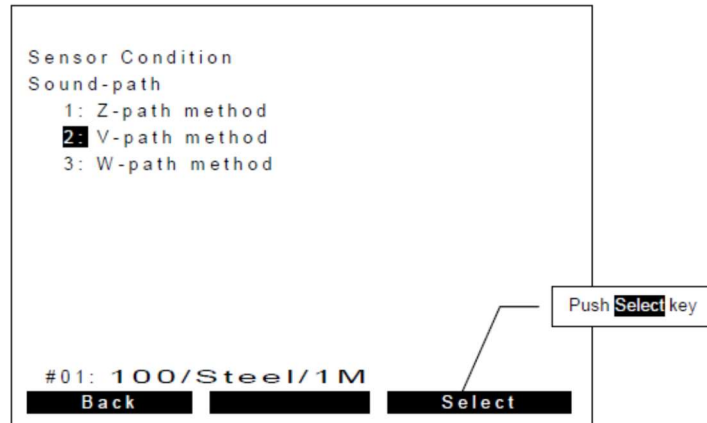


Fig.1.2.6-18 Sound-path selection menu

Flow rate unit setting

Select flow rate unit from default choices by direction or numeric button. Here for example, select “3: m³/h”, then push “Select” key (F3 button) to proceed to the next step.

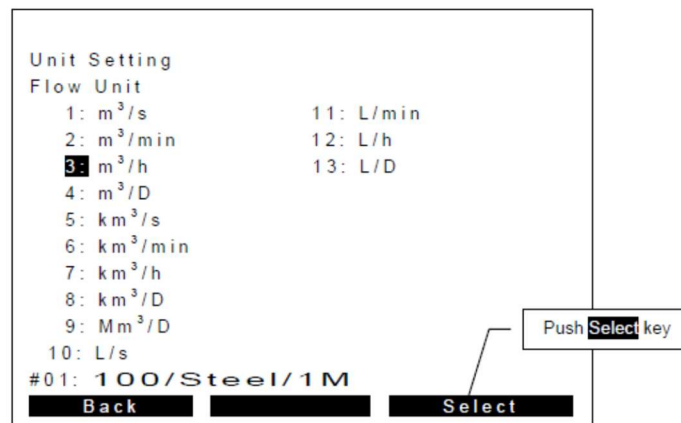


Fig. 1.2.6-22 Flow rate unit setting menu

Decimal point position

Select decimal point position from default choices by direction or numeric button. Here for example, select “***.***”, then push “Select” key (F3 button) to proceed to the next step.

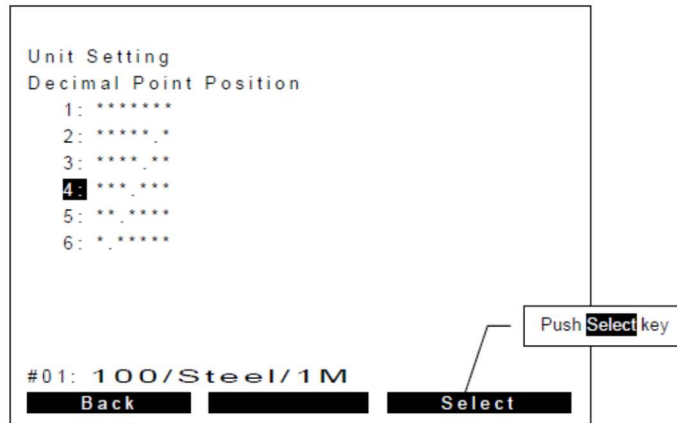


Fig. 1.2.6-23 Decimal point position setting menu

Totalizing unit setting

Select totalizing unit from default choices by direction or numeric button.

Here for example, select “1: ×1m³”, then push “Select” key (F3 button) to proceed to the next step.

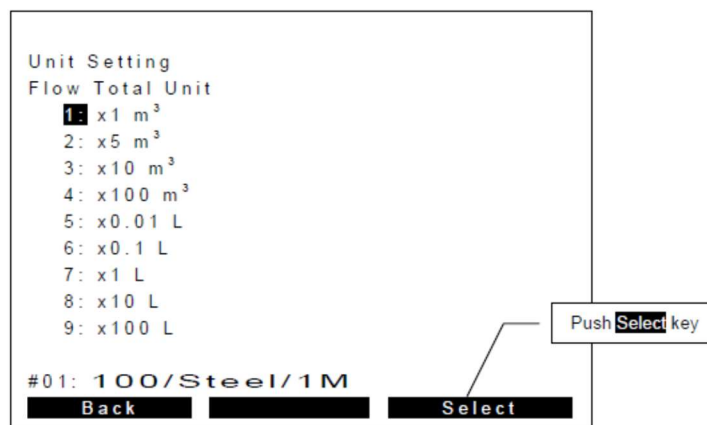


Fig.1.2.6-24 Totalizing unit setting menu

Store site data

Finalize wizard by store all data on this menu. Select “2: Yes” by direction or numeric button. Then push “Select” key (F3 button) to proceed to the next step.

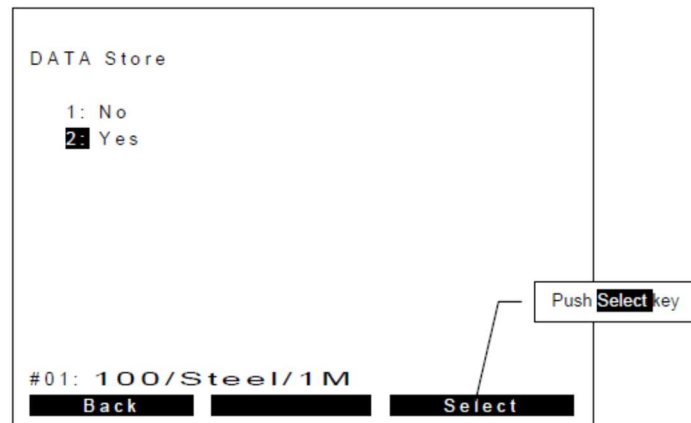


Fig. 1.2.6-25 Data storing menu

When select “2: Yes”, following message will be shown.

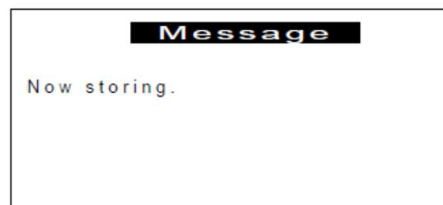


Fig. 1.2.6-26 Data storing

After storing site-setting data, following confirmation message will show up. Then push “Yes” (F3 button) to proceed to the next step. Otherwise when you select “No” (F1 button), return to initial basic menu.

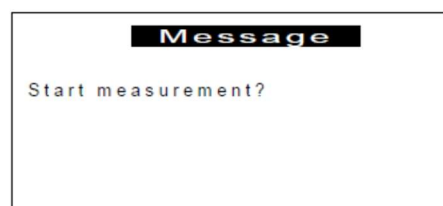


Fig. 1.2.6-28 Confirmation message to start measurement

Mounting transducers

The main unit calculates proper distance between transducers as according to the message appearing below. Then push "OK" (F3 button) to start measurement. Please set transducer mounting with indicated transducer distance in accordance with instruction on Chapter 1.2.9. On this example, distance of transducers is 63.8 mm.

Then proceed with Transducer setting.

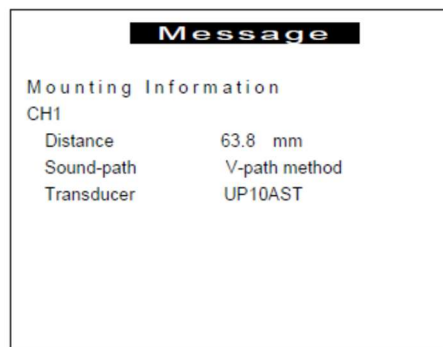


Fig. 1.2.6-29 Message of mounting information

3. Transducer Setting

Transducer distance setting

Set distance between transducers on mounting fixture in accordance with the main unit calculation.

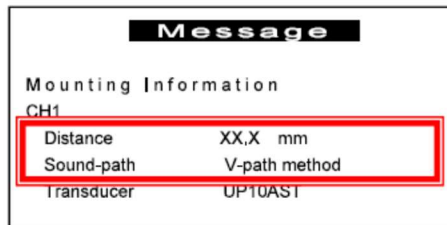


Fig. 1.2.9-9 Message of mounting information

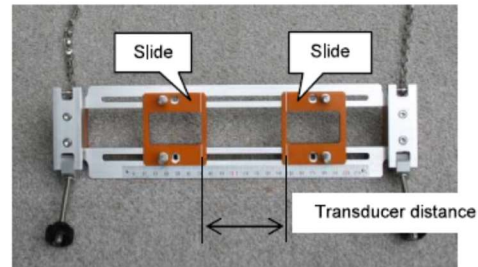


Fig. 1.2.9-10 Set transducer distance on fixture

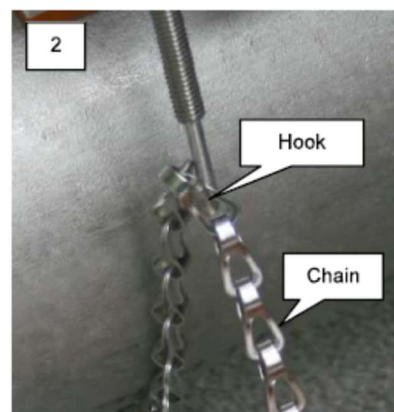
Set mounting fixture onto the pipe

Wrap the mounting chain around the pipe and hook an endo link with the hook knob arrangement.

Tighten the chain at the other end of the fixture.



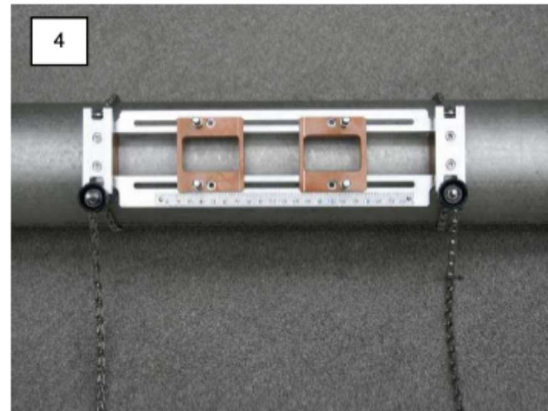
1. Roll chain around the pipe.



2. Hook the chain at appropriate length.



3. Tighten chain by knob.



4. Take same procedure on the other side, then complete.

Fig. 1.2.9-11 Set mounting fixture

Add couplant and set transducers to mounting fixture
Add silicone grease as acoustic couplant onto surface of transducers.
Then set them into mounting fixture.

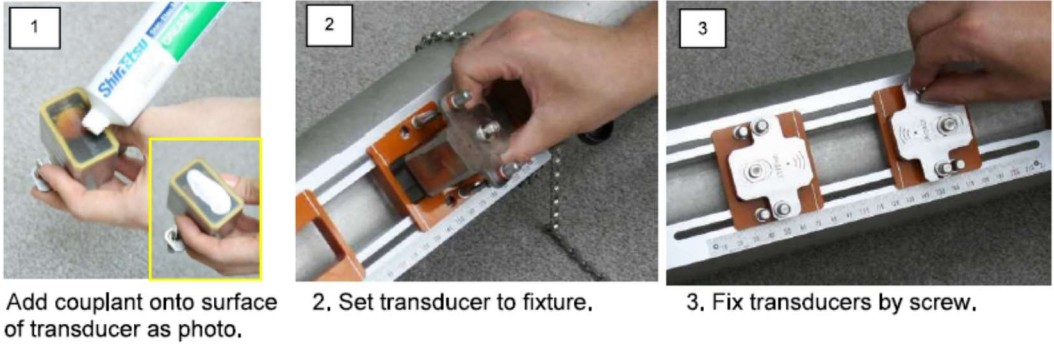


Fig. 1.2.9-12 Set the transducers into mounting fixture

Set cables with the transducers and the main unit
Connect cables with the transducers to the main unit

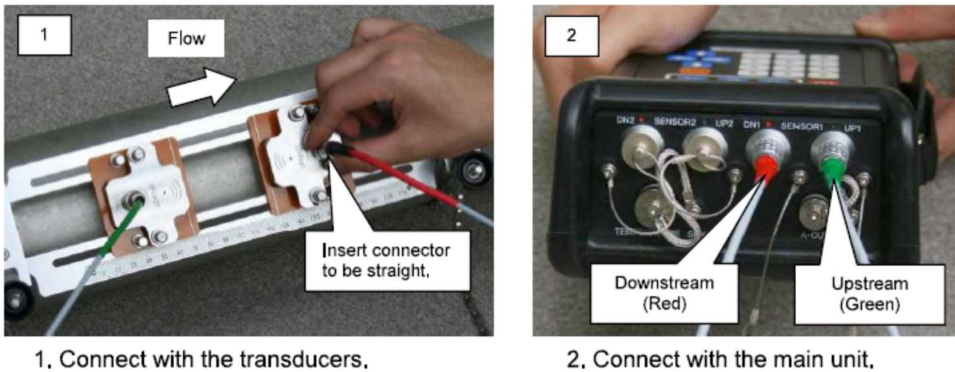


Fig. 1.2.9-13 Connect with the transducer cables

Let's start measurement
Complete preparation for measurement. Push OK key as Fig. 1.2.9-9 to start measurement (mounting information menu)

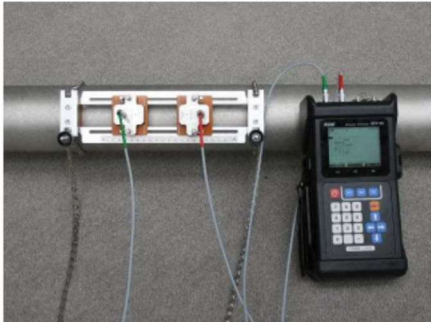


Fig. 1.2.9-14 Finished medium size transducer setting

Measurement for over DN200mm pipe

In case of measurement for over DN200mm, you need to use mounting fixture 1 and 2 for extension together as below. The distance between fixtures is 100mm.

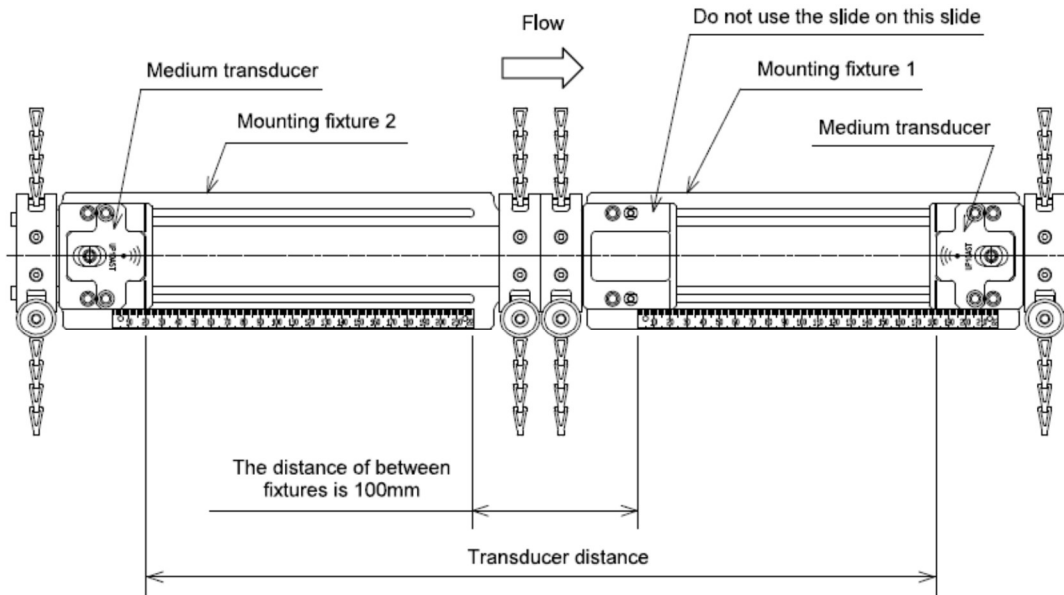


Fig. 1.2.9-15 Combine mounting fixture (over DN200mm)

When the transducer distance is 245mm(DN300mm), if Up side slide sets t 200mm point, Down side slide must be set at 125mm point. The point of scale is just a sample. Whenever transducer distance can be kept, scale point does not matter.

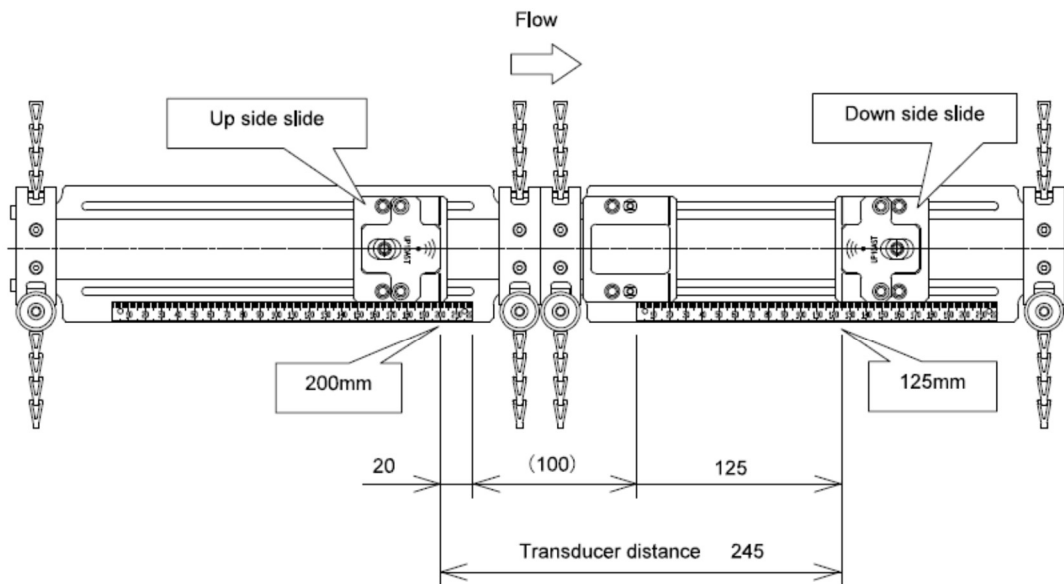
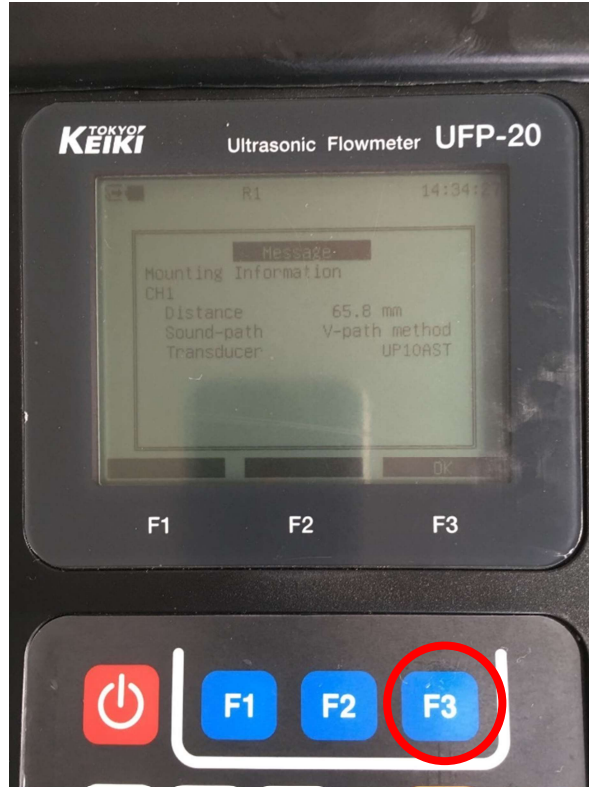


Fig. 1.2.9-16 Sample of combine mounting fixture (Transducer distance : 245mm)

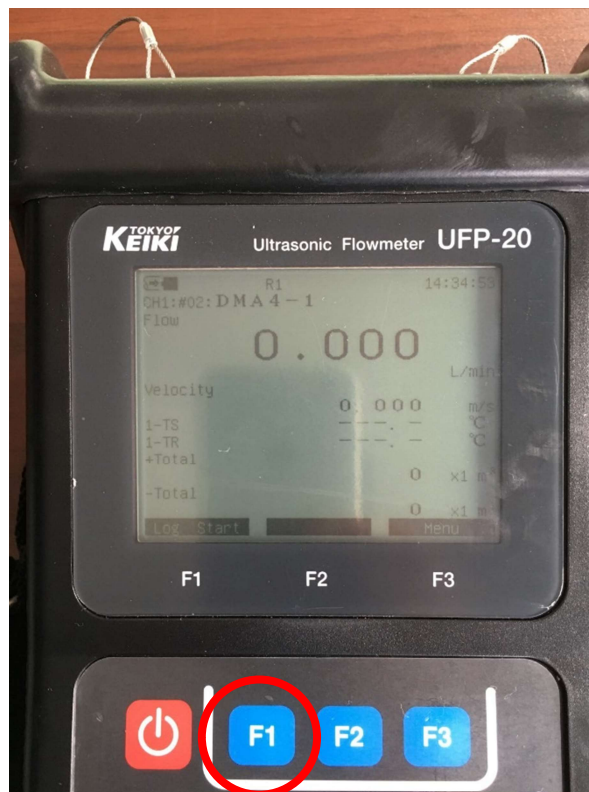
4. Start and Stop Logging

Continue from the last step of [2. Unit setting]

Select "OK" <F3>



Select "Log Start" <F1>, and then start logging.



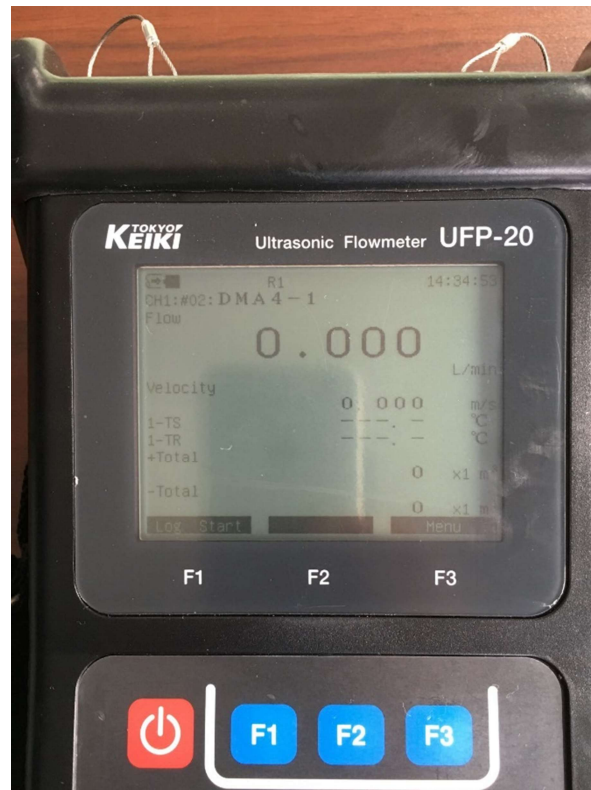
4. Start and Stop Logging

Select "Log Stop" <F1> when you want to stop logging.

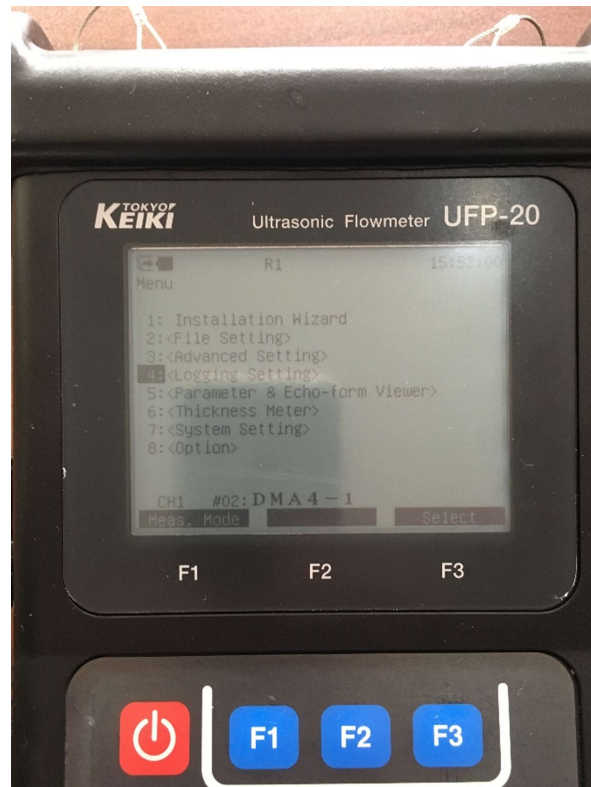


5. Downloading Logs

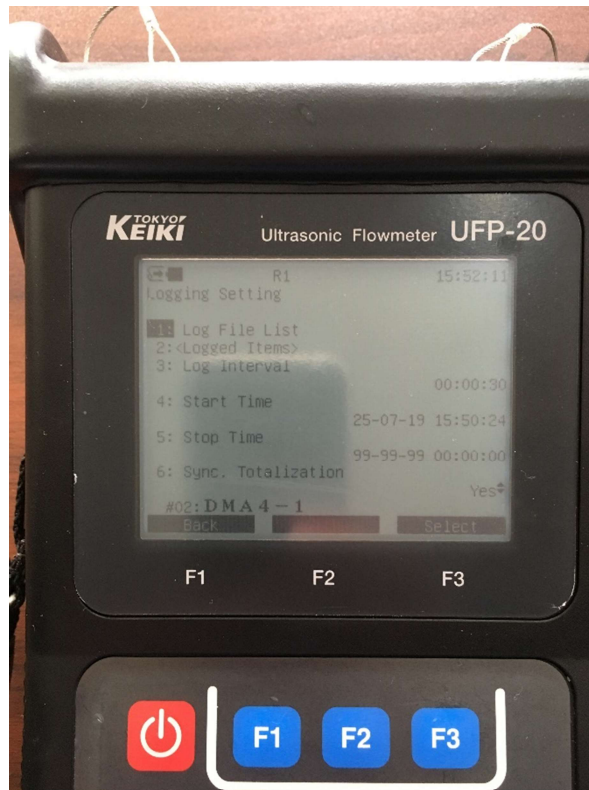
When you have stopped logging, select "MENU"<F3>.



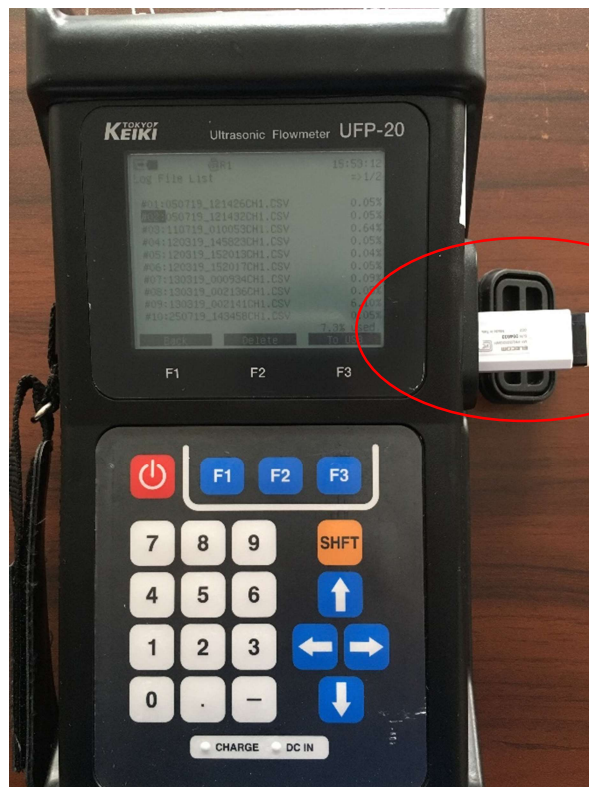
Select "Logging Setting" from the menu list<F3>.



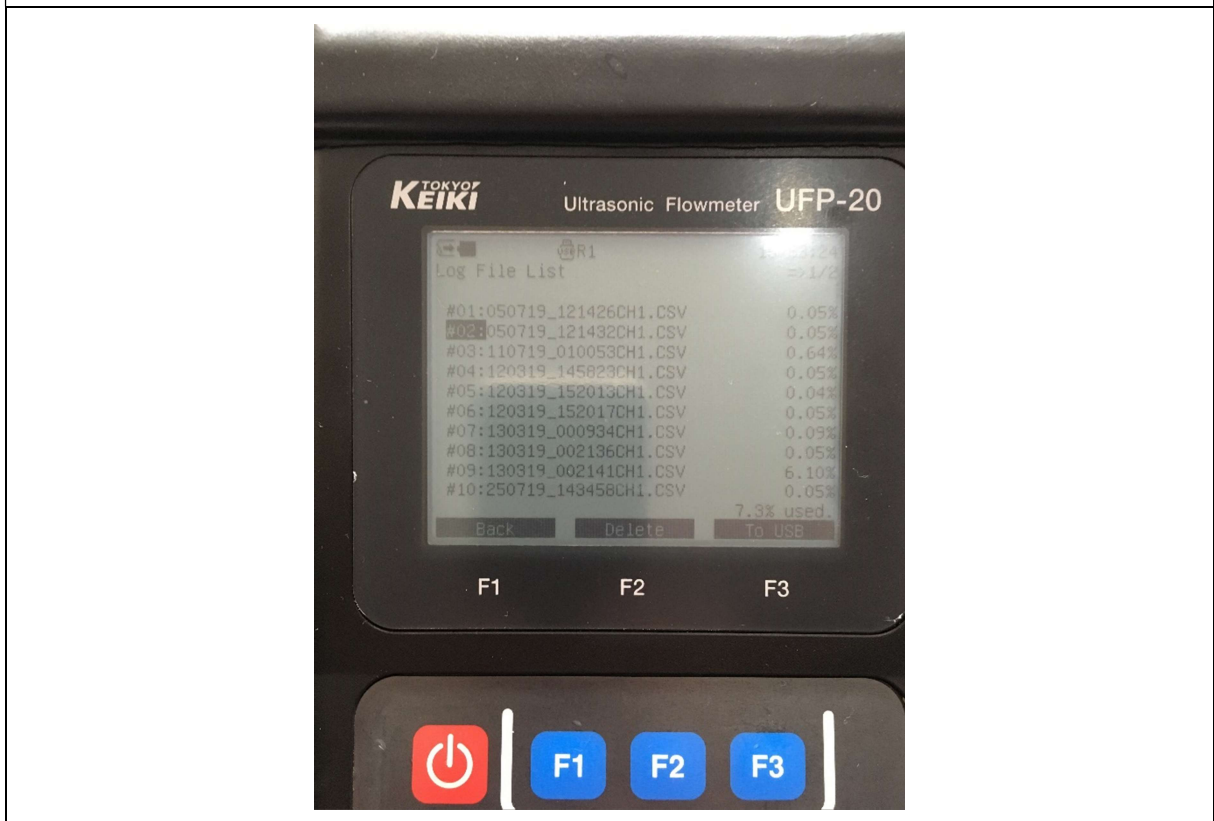
Select "1 : Log File List"



The logging filename is defined automatically. [DDMMYY.csv]
Connect a pen drive to the unit.



Choose a certain file, and then select "To USB"<F3>.



End

3.4.4 Pipe Chart (1) Cast iron

Table 3.4.4-1

Name			Water Works Type Cast Iron			Straight Pipe			Ductile Iron Pipe							
JIS Number			JIS G5521-1977			JIS G5522-1977			JIS G5526-1989							
Material			FC			FC										
Nominal Diameter	Outer Diameter	Lining Thickness	Normal Pressure	Low Pressure	Normal Pressure	Low Pressure	Normal Pressure	Low Pressure	D1	D1.5	D2	D2.5	D3	D3.5	D4	D4.5
			9	9	7.5	7.5	8	7.5	8	7.5	7.5	7.5	6	6	6	6
75	93	4							7.5							
100	118	4	9	9	7.5	7.5	8	7.5	7.5				6			
150	169	4	9.5	9	8	7.5	9	7.5	7.5				6			
200	220	4	10	9.4	8.8	8	9.4	8	7.5				6			
250	271.6	4	10.8	9.8	9.5	8.4	9.8	8.4	7.5				6			
300	322.8	6	11.4	10.2	10	9	10.2	9	7.5				6.5			
350	374	6	12	10.6	10.8	9.4	10.6	9.4	7.5				6.5			
400	425.6	6	12.8	11	11.5	10	11	10	8.5		7.5		7			
450	476.8	6	13.4	11.5	12	10.4	11.5	10.4	9		8		7.5			
500	528	6	14	12	12.8	11	12	11	9.5		8.5		8			
600	630.8	6	15.4	13	14.2	11.8	13	11.8	11		10		9		8.5	
700	733	8	16.5	13.8	15.5	12.8	13.8	12.8	12		11		10		9	
800	836	8	18	14.8	16.8	13.8	14.8	13.8	13.5		12		11		10	
900	939	8	19.5	15.5	18.2	14.8	15.5	14.8	15		13		12		11	
1000	1041	10	22						16.5		14.5		13		12	
1100	1144	10	23.5						18		15.5		14		13	
1200	1246	10	25						19.5		17		15		13.5	
1350	1400	12	27.5						21.5		18.5		16.5		15	
1500	1554	12	30						23.5		20.5		18		16.5	
1600	1650	15							25	23.5	22	20.5	19	18	17.5	16
1650	1701	15							25.5	24	22.5	21	19.5	18.5	18	16.5
1800	1848	15							28	26	24	22.5	21	20	19.5	18
2000	2061	15							30.5	28.5	26.5	25	23.5	22	21	19.5
2100	2164	15							32	30	28	26	24.5	23	22	20.5
2200	2280	15							33.5	31	29	27	25.5	24	23	21.5
2400	2458	15							36.5	34	31.5	29.5	27.5	26	25	23
2600	2684	15							39.5	36.5	34	31.5	29.5	28	27	25

(2) Steel

Table 3.4.4-2

Name JIS Number Material	Tubing Type Carbon Steel		Water Works Typ Zinc		Water Circulation Type TOFUKUSO Steel Pipe			Pressure Line Type Carbon Steel Pipe			Tubing Type Stainless Steel Pipe					
	JIS G3452-1988 STP		JIS G3442-1988 SGP-W		JIS G3443-1987 STW			JIS G3454-1988 STPG			JIS G3419-1988					
Nominal Dia.	Outer Dia.				STW290	STW370	STW400A	STW400B	Schedule 10	Schedule 20	Schedule 30	Schedule 40	SUS***TP Schedule 5	SUS***HTP Schedule 10	SUS***LTP Schedule 20	SUS***HTP Schedule 40
15	21.7	2.8	2.8									2.8	1.65	2.1	2.5	2.8
20	27.2	2.8	2.8									2.9	1.65	2.1	2.5	2.9
25	34	3.2	3.2									3.4	1.65	2.8	3	3.4
32	42.7	3.5	3.5									3.6	1.65	2.8	3	3.6
40	48.6	3.5	3.5									3.7	1.65	2.8	3	3.7
50	60.5	3.8	3.8									3.9	1.65	2.8	3.5	3.9
65	76.3	4.2	4.2									5.2	2.1	3	3.5	5.2
80	89.1	4.2	4.2		4.2	4.5						5.5	2.1	3	4	5.5
90	101.6	4.2	4.2		4.2	4.5						5.7	2.1	3	4	5.7
100	114.3	4.5	4.5		4.5	4.9						6	2.1	3	4	6
125	139.8	4.5	4.5		4.5	5.1						6.6	2.8	3.4	5	6.6
150	165.2	5	5		5	5.5						7.1	2.8	3.4	5	7.1
175	190.7	5.3														
200	216.3	5.8	5.8		5.8	6.4					7	8.2	2.8	4	6.5	8.2
225	241.8	6.2														
250	267.4	6.6	6.6		6.6	6.4					7.8	9.3	3.4	4	6.5	9.3
300	318.5	6.9	6.9		6.9	6.4					8.4	10.3	4	4.5	6.5	10.3
350	365.6	7.9					6		6.4							11.1
400	406.4	7.9					6		6.4							12.7
450	457.2	7.9					6		6.4							14.3
500	508	7.9					6		6.4							15.1
550	558.8								6.4							15.9
600	609.6								6.4							17.5
650	660.4								6.4							18.9
700	711.2						7	6	7.9	12.7						
750	762															
800	812.8						8	7								
900	914.4						8	7								
1000	1016						9	8								
1100	1117.6						10	8								
1200	1219.2						11	9								
1350	1371.6						12	10								
1500	1524						14	11								
1600	1625.6						15	12								
1650	1676.4						15	12								
1800	1828.8						16	13								
1900	1930.4						17	14								
2000	2032						18	15								
2100	2133.6						19	16								
2200	2235.2						20	16								
2300	2336.8						21	17								
2400	2438.4						22	18								
2500	2540						23	18								
2600	2641.6						24	19								
2700	2743.2						25	20								
2800	2844.8						26	21								
2900	2946.4						27	21								
3000	3048						29	22								

(3) FRPM Pipe, Vinyl Pipe, Polyethylene Pipe

Table 3.4.4-3

Name		FRPM Pipe	
JIS Number	Material	FRPM	
Type		Outer Dia.	Pipe Thickness
150			
200			
250			
300			
400			
450			
500			
600		624	12
700		728	14
800		832	16
900		936	18
1000		1040	20
1100		1144	22
1200		1248	24
1350		1404	27
1500		1560	30
1650		1716	33
1800		1872	36
2000		2080	40
2200		2288	44
2400		2496	48
2600		2704	52
2800		2912	56
3000		3120	60

Name		Vinyl Pipe		
JIS Number	Material	JIS K 6741-1984 Poly Vinyl Chloride		
Type		Outer Dia.	VP	VU
Nominal Dia.	Outer Dia.	Pipe Thickness	Pipe Thickness	Pipe Thickness
13	18	2.5		
16	22	3.0		
20	26	3.0		
25	32	3.5		
30	38	3.5		
40	48	4		2
50	60	4.5		2
65	76	4.5		2.5
75	89	5.9		3
100	114	7.1		3.5
125	140	7.5		4.5
150	165	9.6		5.5
200	216	11		7
250	267	13.6		8.4
300	318	16.2		9.9
350	370			11.2
400	420			12.6
450	470			14.1
500	520			15.6
600	630			19.2
700	732			22.6
800	835			25.8

Note) Pipe Thickness is median of tolerance in the specification.

Name		Polyethylene Pipe			
JIS Number	Material	JIS K 6761-1995			
Type		Class 1		Class 2	
Nominal Dia.	Outer Dia.	Pipe Thickness	Pipe Thickness	Pipe Thickness	Pipe Thickness
13	21.5	2.7		2.4	
20	27	3.0		2.4	
25	34	3.0		2.6	
30	42	3.5		2.8	
40	48	3.5		3.0	
50	60	4.0		3.5	
65	76	5.0		4.0	
75	89	5.5		5.0	
100	114	6.0		5.5	
125	140	6.5		6.5	
150	165	7.0		7.0	
200	216	8.0		8.0	
250	267	9.0		9.0	
300	318	10.0		10.0	