



Portable Ultrasonic Flowmeter

PORTAFLOW X

TYPE: FLC-2 (CONVERTER)
FLD-1 (DETECTOR)

Operation Manual



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Caution on safety

- For safety, read this instruction manual before using this instrument or consult your sales dealer.
- For safety, only qualified specialists in an electrical work or wiring are allowed.



Be sure to read the following items and record (check) the page 20 before using the flowmeter. Read these data together with the instruction manual.

1. Make sure that the inside diameter of the piping being measured conforms to the sensor type.

Detector	Type	Inside diameter (mm)	Temperature range (°C)
Small diameter sensor	FLD22	13 to 100	-40 to 100
Small sensor (standard)	FLD12	50 to 400	-40 to 100
Middle sensor	FLD41	200 to 1200	-40 to 80
Large sensor	FLD51	200 to 6000	-40 to 80
High-temperature sensor	FLD32	50 to 400	-40 to 200

2. Check the lengths of the straight pipe upstream and downstream of the sensor mounting position.

- Straight piping greater than 10D must exist on the upstream side and greater than 5D on the downstream side.
- Elements (pump, valve, etc) on the upstream side must be greater than 30D away to prevent disturbances.

3. Check if the piping setting (outside diameter, material, thickness, etc.) is correct.

- If the sensor mounting size is not calculated correctly, errors will occur such as window scan (reception range-over) or no received signal.

4. Check if the sensor is mounted correctly.

- If the transmission side of the sensor is not coated sufficiently with silicone grease, receiving signals will become unstable or errors will occur such as window scans (receiving range-over), no received signals, etc.
- If the upstream and downstream side connectors are reversed, a negative flow rate will be indicated.

5. Make sure that the zero point adjustment is completed.

- Fill the piping with measuring fluid, then stop the flow of the fluid to perform a manual zero adjustment.

6. Check to see if more than 2 indicators on the upper right of the measurement screen are working to indicate wave reception.

- If no indicator is displayed, or if only one is displayed, increase the level of the transmission voltage.


7. Check if the analog output range is set correctly.

- Even when the analog output is not used, an error of analog scale-over will occur unless the analog output range has been set properly.

(Unless the analog output is used, it should be set to 0.0)

- * **Preparations for measurement have been completed. Set the integrator, logger, printer, etc., as necessary.**



Check whether the flow rate is indicated correctly. If an error message is indicated, display the system check screen and press the  key while setting the cursor on the error checker.

At this time, the error data, the cause of the error and procedures to correct the error are indicated.

Operate the flowmeter according to the instructions.

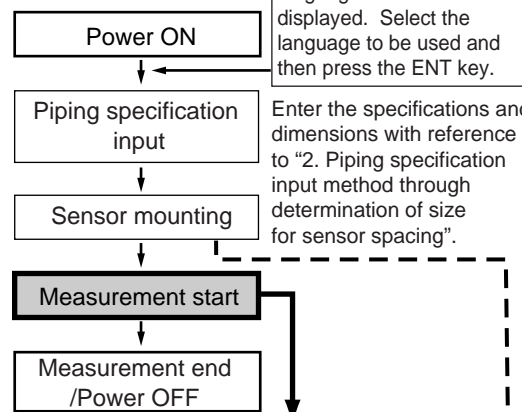
1. Preparation prior to measurement (zero adjustment, etc.)

Detector selection standard

Detector	Type	Inside diameter (mm)	Temperature range (°C)
Small diameter sensor	FLD22	13 to 100	-40 to 100
Small sensor (standard)	FLD12	50 to 400	-40 to 100
Middle sensor	FLD41	200 to 1200	-40 to 80
Large sensor	FLD51	200 to 6000	-40 to 80
High-temperature sensor	FLD32	50 to 400	-40 to 200

- * Straight piping greater than 10D must exist on the upstream side and greater than 5D on the downstream side.
- * Elements (pump, valve, etc) on the upstream side must be greater than 30D away to prevent disturbances.

Procedure before measurement



Battery alarm

- Recharge if built-in Nicad battery is not sufficiently charged.
- About 3 hours are required with the power OFF.
- When the AC adapter is connected, the battery is usable even if it is not fully charged. The battery is trickle-charged when the power is ON.

Status display

There is no problem if NORMAL is displayed with the sensor connect to the supplied cable. If it is not displayed, see "3. Error status display and corrective actions".

Selection and treatment of detector mounting position

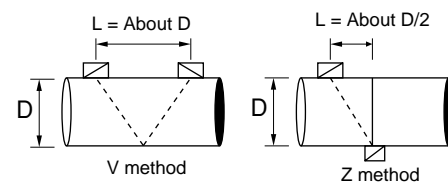
Important!

1. Selection of detector mounting position

- 1) Straight piping greater than 10D must exist on the upstream side and greater than 5D on the downstream side.
- 2) Elements (pump, valve, etc) on the upstream side must be greater than 30D away to prevent disturbances.
- 3) The piping must be filled with fluid free from air bubbles and foreign objects.

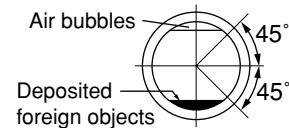
2. Selection of mounting method

- Small diameter sensor and small type (standard) sensor should be mounted by the V method. In the following cases, the Z method should be used for mounting.
- Insufficient mounting space (about 1/2 of the size of the V method)
 - Piping with mortar lining
 - Piping is old and presumed to have a deposit of a thick layer of scales inside the piping.



3. Treatment of detector mounting side

- Using thinner and sand-paper, remove the pitches, rust and uneven surface of the detector mounting piping over the entire mounting area of (L) + 200mm wide.
- When the piping exterior is wrapped with jute, remove the jute and then perform the above treatment.
- Horizontal piping should be mounted within $\pm 45^\circ$ from the horizon.
- Vertical piping can be mounted at any external position.



4. Method of mounting for small sensor (standard) and small diameter sensor

- 1) Loosen the lock nut. After setting to the mounting position, tighten the lock nut.
- 2) Coat the sensor transmission side with a sufficient amount of silicone grease.
- 3) Attach both ends (saddle) to the piping using a cloth belt.
- 4) Make sure that the sensor is mounted in parallel with the piping and that the mounting position is correct. Then, turn the element holder clockwise until the sensor is firmly fitted to the piping (clockwise; element moves down, counterclockwise; element moves up).

Description of key symbols

- ENT: ENTRY key (data registration)
- ESC: ESCAPE key (setting suspension)
- ↑: Cursor up-shift (set value feed)
- ↓: Cursor down-shift (set value return)
- ←: Cursor left-shift (scale change)
- : Cursor right-shift (scale change)
- PRINT: Display screen printout (hard copy)

- 1 TIME
- 2 TIMES
- 4 TIMES
- 8 TIMES

Adjustment with Site setup /Transmission voltage

Important!

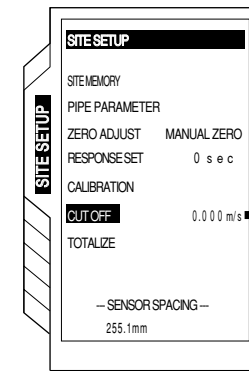
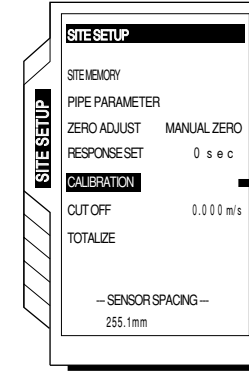
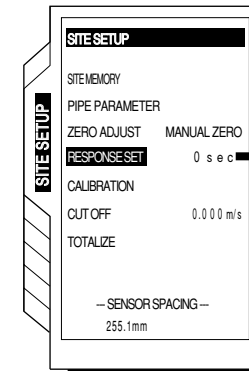
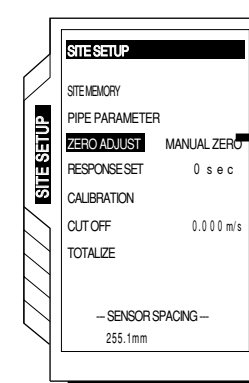
1. Paint, rust, etc must be removed from the pipe surface.
2. Insufficient coating of grease on the sensor
3. Air stays in the piping.
4. When the inside of the piping is rusted or the lining material is peeled off, the number of indicators will not increase even if the transmission voltage is raised. Change the mounting position of the detector.
5. When the transmission voltage is increased, there is not problem with measurement although wear of the driving battery may occur.

Stop the flow for zero adjustment.

Adjust indication fluctuations of the indicator.

Compensation for output

Adjust low flow cut with the flow rate set at "0".

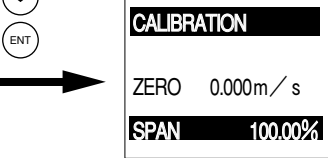


Important!

Under the flow stop condition, set the cursor for manual zero adjustment and press the ENT key.

This is used when the flow cannot be stopped. Since complete zero adjustment cannot be obtained (output is within the range of allowable error), it is used in an unavoidable circumstances.

Should normally be used in 3 or 5 seconds.



In general, 0.000m/s is used for zero, and 100.00% is used for span.

Important!

Note that when this value changes, the output deviates by the amount of the change. Example) When the span is set to 0.0%, the instantaneous value 0.0 remains unchanged.

Should normally be used within the range of 0.010 m/s to 0.030 m/s.

2. Piping specification input method through determination of size for sensor spacing

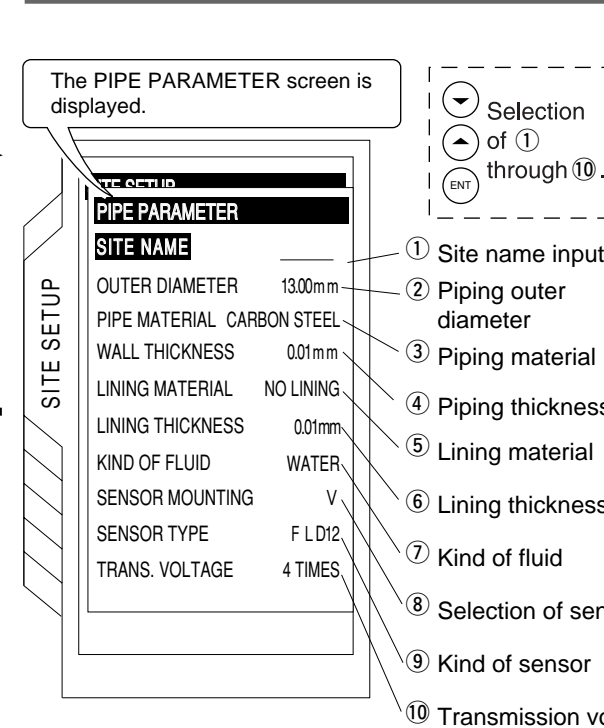
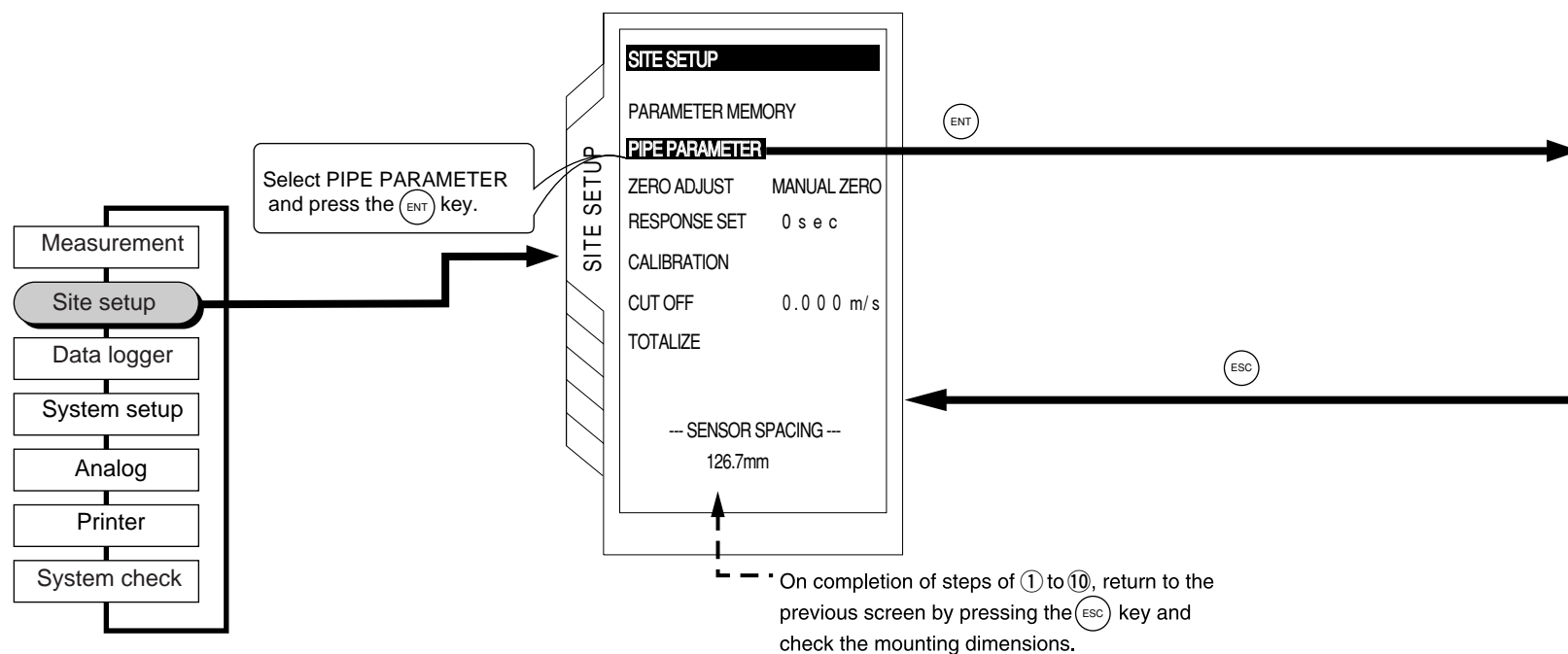


Table 1: Sonic speed of piping material

Material	Vm/s
Iron	3230
Copper	3206
Ductile cast iron	3000
Cast iron	2460
Stainless steel	3206
Steel	2260
Lead	2170
Aluminum	3080
Brass	2050
Polyvinyl chloride	2640
Acrylic resin	2644
FRP	2505
Mortar	2500
Tar epoxide	2505
Polyethylene	1900
Teflon	1240

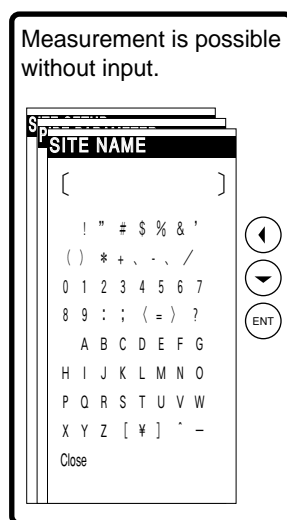
V: Sonic speed

Table 2: Coefficient of kinematic viscosity of various fluids

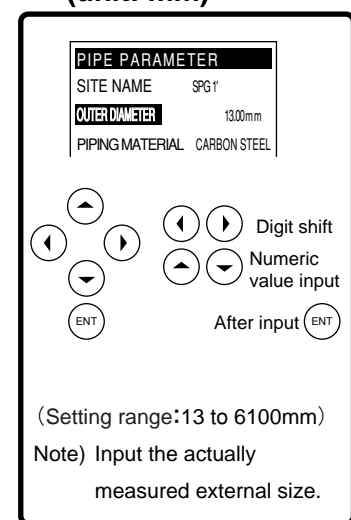
Fluid name	T°C	ρ g/cm ³	Vm/s	ν (X10-6m ² /s)
Acetone	20	0.7905	1190	0.407
Aniline	20	1.0216	1659	1.762
Ether	20	0.7135	1006	0.336
Ethylene glycol	20	1.1131	1666	21.112
Chloroform	20	1.4870	1001	0.483
Glycerin	20	1.2613	1923	1188.500
Acetic acid	20	1.0495	1159	1.162
Methyl acetate	20	0.9280	1181	0.411
Ethyl acetate	20	0.9000	1164	0.499
Heavy water	20	1.1053	1388	1.129
Carbon tetrachloride	20	1.5942	938	0.608
Mercury	20	13.5955	1451	0.114
Nitrobenzene	20	1.2070	1473	1.665
Carbon bisulfide	20	1.2634	1158	0.290
n. pentane	20	0.6260	1032	0.366
n. hexane	20	0.6540	1083	0.489
Spindle oil	32	0.9050	1324	15.700
Gasoline	34	0.8030	1250	0.4~0.5
Water	13.5	1.0000	1460	1.004 (20°C)

T: Temperature ρ : Density V: Sonic speed ν : Coefficient of kinematic viscosity

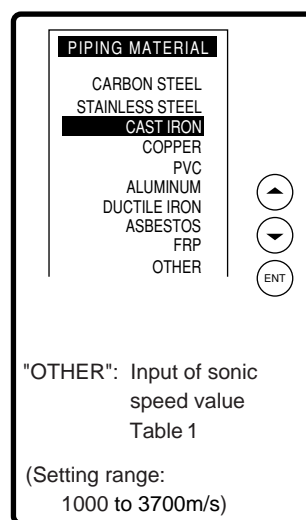
① Site name input



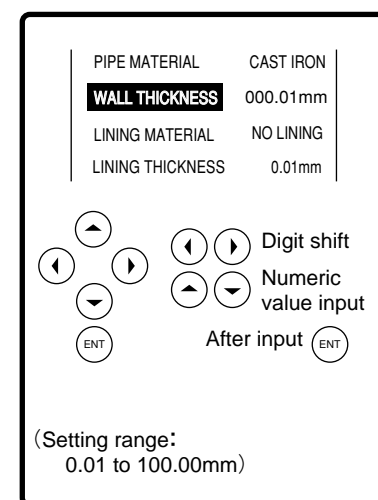
② Piping outer diameter (unit: mm)



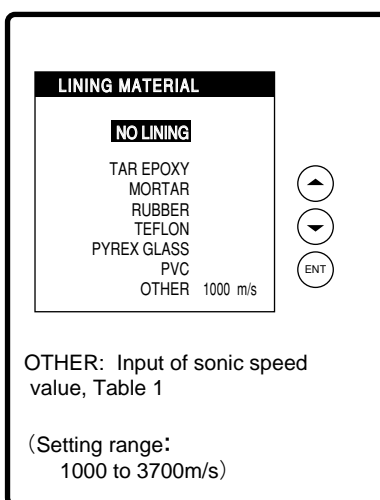
③ Piping material



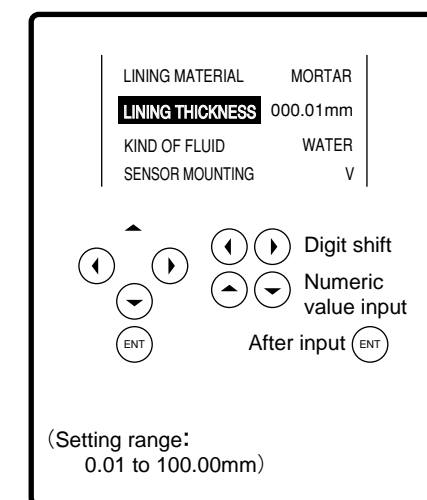
④ Piping thickness (Unit: mm)



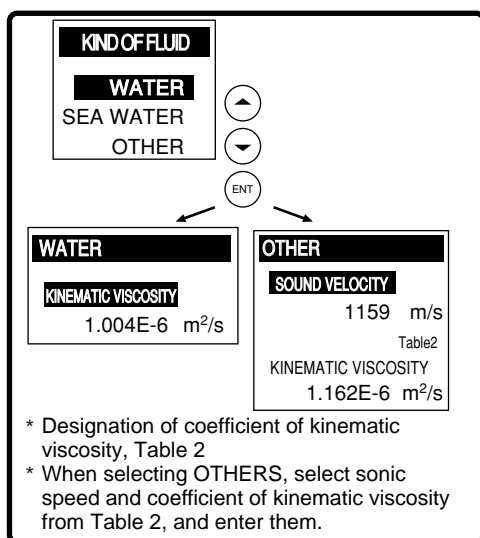
⑤ Lining material



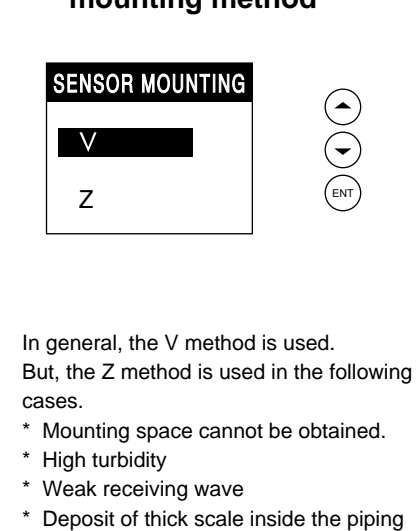
⑥ Lining thickness (Unit: mm)



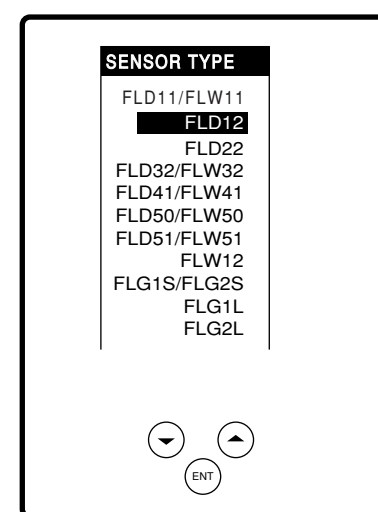
⑦ Kind of fluid



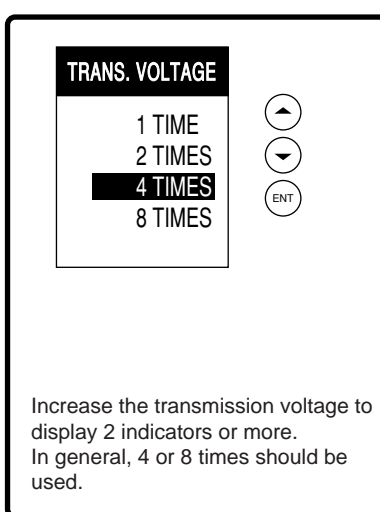
⑧ Selection of sensor mounting method



⑨ Kind of sensor



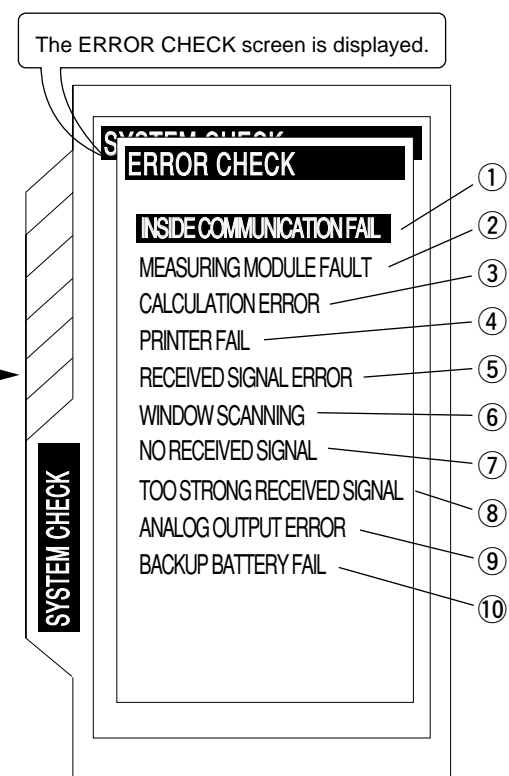
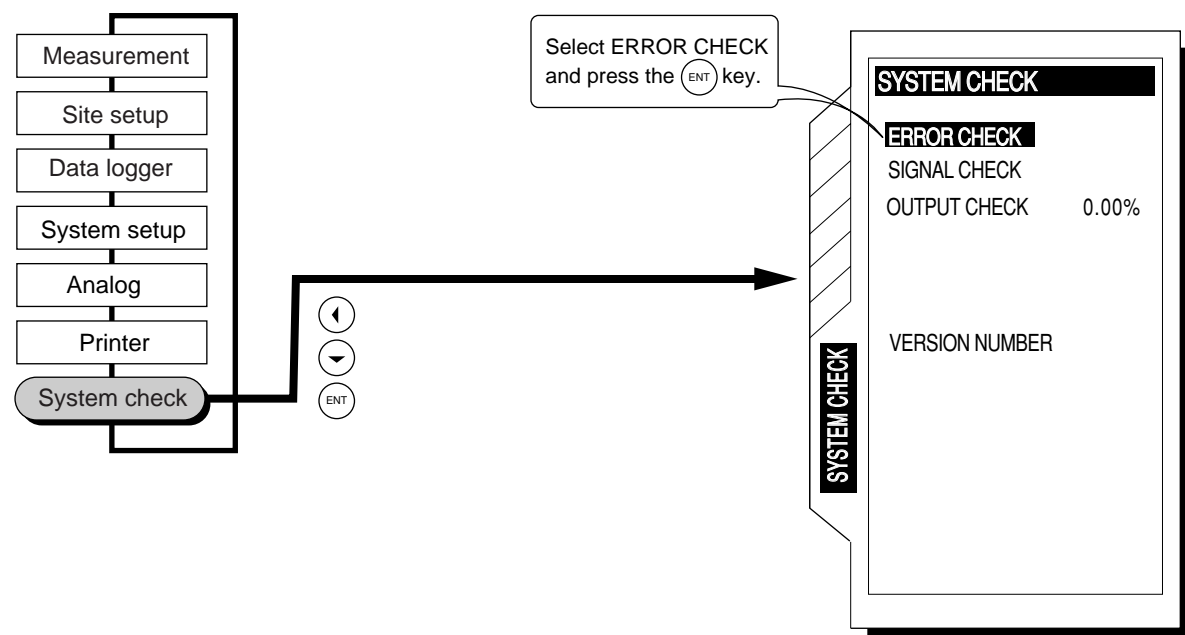
⑩ Transmission voltage



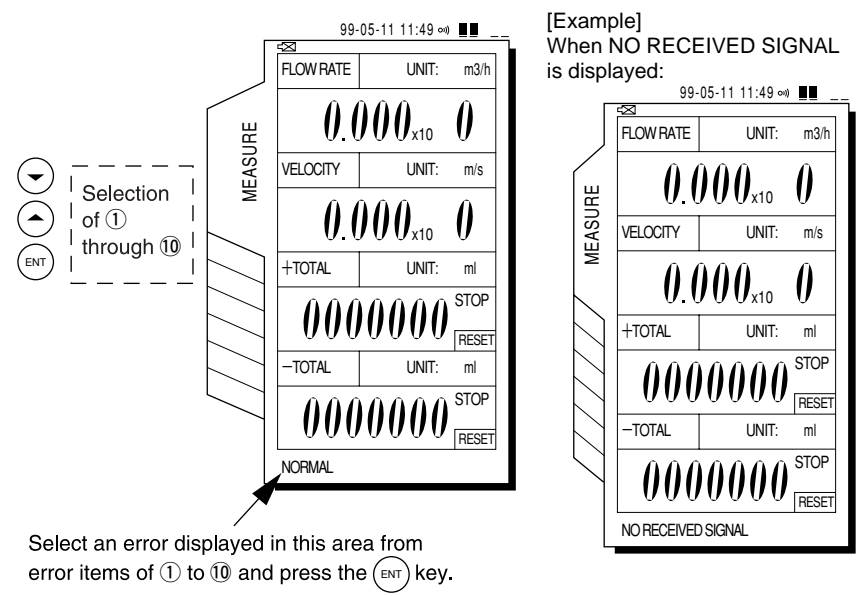
Description of key symbols

- ENT**: ENTRY key (data registration)
- ESC**: ESCAPE key (setup suspension)
- ↑**: Cursor up-shift (set value feed)
- ↓**: Cursor down-shift (set value return)
- ←**: Cursor left-shift (scale change)
- : Cursor right-shift (scale change)
- PRINT**: Display screen printout (hard copy)

3. Error status display and corrective actions



Important!
The ERROR CHECK screen displays error status and corrective actions. It is not used to display the state of occurrence of errors. (Don't take it for occurrence of too many errors).



① Module-to-module communication failure (major fault)

A data transmission error occurs between the transmitter modules (substrates).
 •Reset the power source. (SW ON → OFF)
 •If the instrument does not recover, it is an indication of malfunction. Contact your dealer for repair.

② Measurement module failure

Measurement module is abnormal and cannot be used for measurement.
 •Reset the power source. (SW ON → OFF)
 •If the instrument does not recover, it is an indication of malfunction. Contact your dealer for repair.

③ Calculation failure

Measurement calculation is abnormal.
 •Confirm the set data.
 •Reset the power source. (SW ON → OFF)
 •If the instrument does not recover, it is an indication of malfunction. Contact your dealer for repair.

④ Printer failure

The printer has a problem and cannot be used for printing.
 •Is the printer power turned on?
 •Check to see if paper is jammed. Also, make sure that the printer is connected correctly to the main unit.
 •Reset the power source for the main unit and printer.

⑤ Receiving signal fluctuation

Received ultrasonic waveform information is unstable. Measurement is impossible due to fluctuation of received ultrasonic waveform.
 •Check to see if a large quantity of air bubbles or foreign objects have entered the piping.
 •Change the sensor mounting position.
 •Remove the cause of air bubbles or foreign objects.
 •Check if the dedicated cable is improperly plugged in or disconnected.

⑥ Window scan

Received signal is lost in the measurement window. It is being searched.
 • Check the setting of piping data.
 • Open the PIPE PARAMETER screen. Measurement operation is reset and window scanning will start (It is not an error).

⑦ No received signal

Ultrasonic waveform is lost.
 • Check the setting of piping data.
 • Check the sensor mounting size.
 • Check the connection of the cable.
 • Raise the transmission voltage.

⑧ Receiving signal overflow

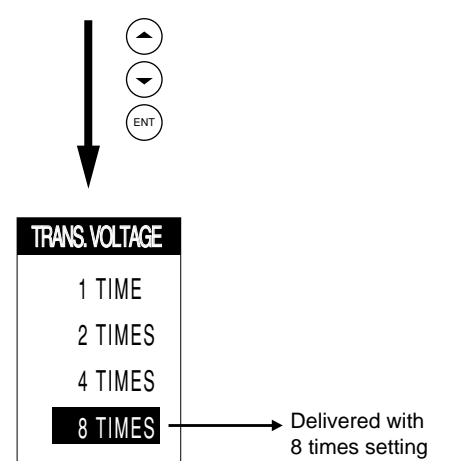
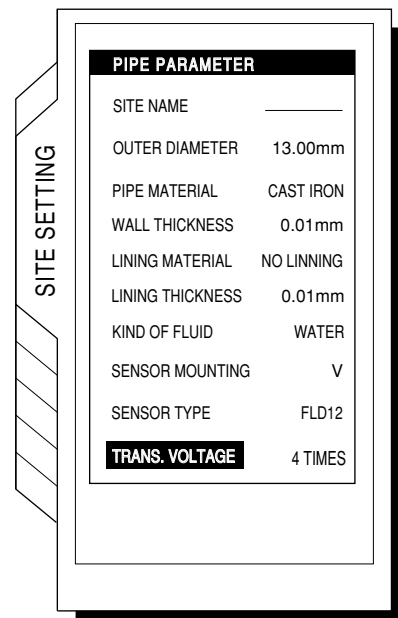
Overflow of the strength of ultrasonic received signal
 • Change the sensor mounting method.
 Z method - V method

⑨ Analog over-scale

Over-scale of analog output
 • Change the range setting. Refer to analog input/output setting.

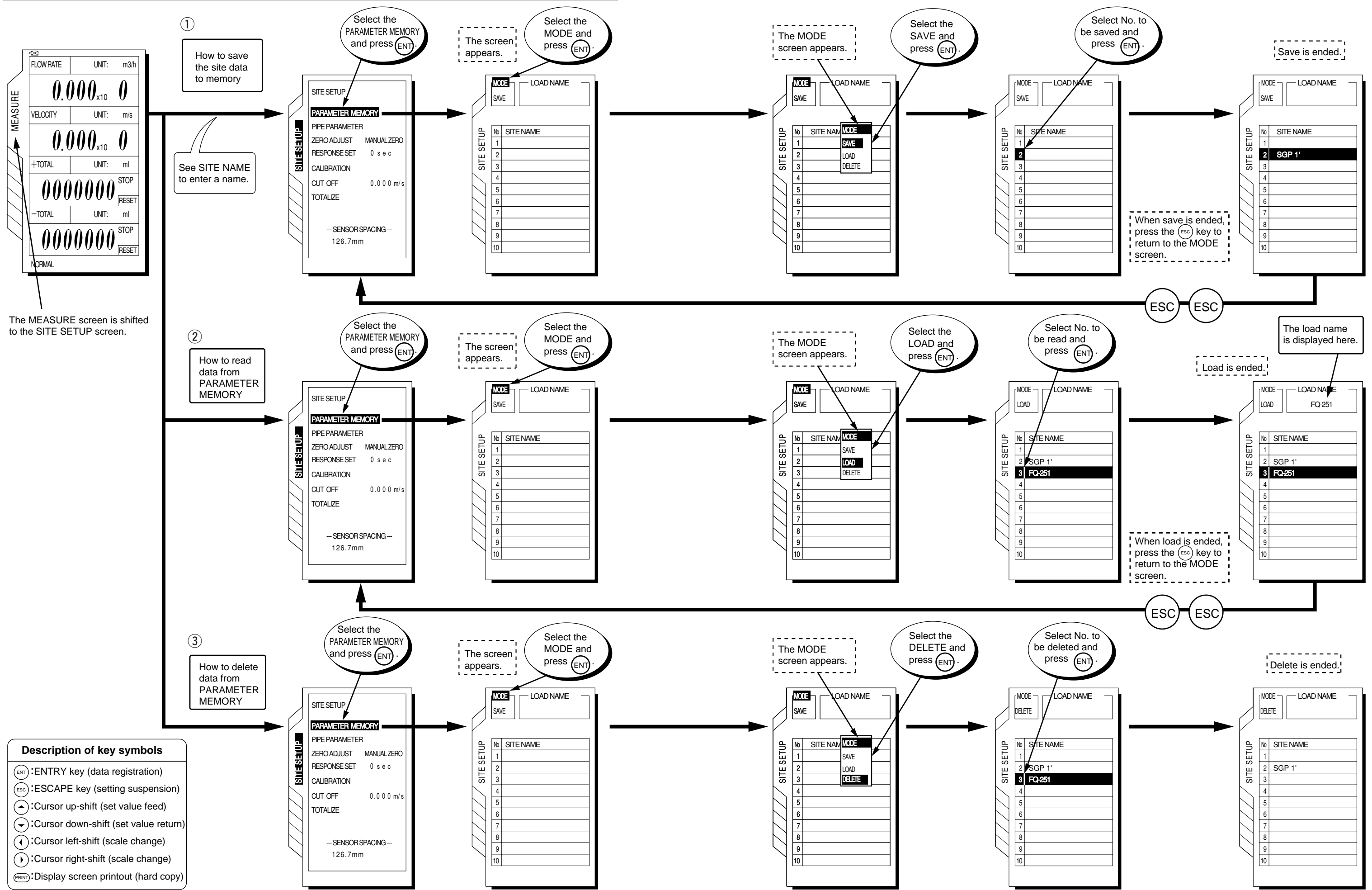
⑩ Backup failure

• Backup battery power is lost. The battery needs to be replaced. Contact our office for replacement.
 • Measurement can be made but data backup cannot be made. Error is cleared when it passes through this panel.



Description of key symbols	
	:ENTRY key (data registration)
	:ESCAPE key (setting suspension)
	:Cursor up-shift (set value feed)
	:Cursor down-shift (set value return)
	:Cursor left-shift (scale change)
	:Cursor right-shift (scale change)
	:Display screen printout (hard copy)

4. How to save and read setting data



The MEASURE screen is shifted to the SITE SETUP screen.

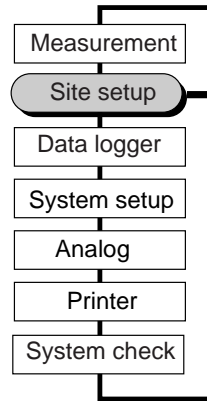
See SITE NAME to enter a name.

How to read data from PARAMETER MEMORY

How to delete data from PARAMETER MEMORY

- Description of key symbols**
- (ENT): ENTRY key (data registration)
 - (ESC): ESCAPE key (setting suspension)
 - ↑: Cursor up-shift (set value feed)
 - ↓: Cursor down-shift (set value return)
 - ←: Cursor left-shift (scale change)
 - : Cursor right-shift (scale change)
 - (PRINT): Display screen printout (hard copy)

5. Measurement of fluid with unknown sonic speed



Site setup

SITE SETUP

PARAMETER MEMORY

PIPE PARAMETER

ZERO ADJUST MANUAL ZERO

RESPONSE SET 0 sec

CALIBRATION

CUT OFF 0.000 m/s

TOTALIZE

—SENSOR SPACING—
126.7mm

PIPE PARAMETER

For details, refer to the piping input specifications.

① Selection of sensor mounting method

PIPE PARAMETER

SENSOR MOUNTING

V

Z

In general, the V method is used. But, the Z method is used in the following cases.

- * Mounting space cannot be obtained.
- * High turbidity
- * Weak receiving wave
- * Deposit of thick scale inside the piping

② Kind of sensor

SENSOR TYPE

FLD11/FLW11

FLD12

FLD22

FLD32/FLW32

FLD41/FLW41

FLD50/FLW50

FLD51/FLW51

FLW12

FLG1S/FLG2S

FLG1L

FLG2L

③ Transmission voltage

TRANS. VOLTAGE

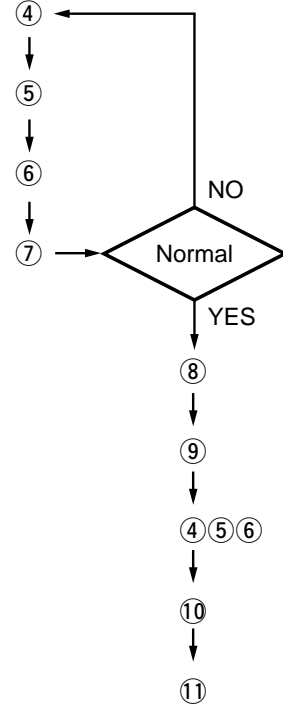
1 TIME

2 TIMES

4 TIMES

8 TIMES

① ② ③



④ Measurement of unknown fluid

Temporarily set the sonic speed and the coefficient of kinematic viscosity of an approximate fluid (water soluble fluid is regarded as water), and obtain a measured value of sonic speed. (See Table 1). If the sonic speed is not known at all, temporarily set the sonic speed by the following steps within the range 500 to 2500m/s.

$\times 0.84 \quad \times 0.84$

2500 → 2100 → 1764 → 1482 → 1245 → 1046 → 878 → 738 → 620 → 521m/s

Important!

Example of approximate fluid: Acetic acid with a concentration of 60%

KIND OF FLUID

WATER

SEA WATER

OTHER

WATER

KINEMATIC VISCOSITY $\times 10^{-6} \text{ m}^2/\text{s}$

1.004E-6

OTHER

SOUND VELOCITY

2500 m/s

KINEMATIC VISCOSITY

1.003E-6 m^2/s

Table 1: Coefficient of kinematic viscosity of various fluids

Fluid name	T/°C	$\rho/\text{g/cm}^3$	$V/\text{m/s}$	$\nu/(\times 10^{-6} \text{m}^2/\text{s})$
Acetone	20	0.7905	1190	0.407
Aniline	20	1.0216	1659	1.762
Ether	20	0.7135	1006	0.336
Ethylene glycol	20	1.1131	1666	21.112
Chloroform	20	1.4870	1001	0.383
Glycerin	20	1.2613	1923	1188.500
Acetic acid	20	1.0495	1159	1.162
Methyl acetate	20	0.9280	1181	0.411
Ethyl acetate	20	0.9000	1164	0.499
Heavy water	20	1.1053	1388	1.129
Carbon tetrachloride	20	1.5942	938	0.608
Mercury	20	13.5955	1451	0.114
Nitrobenzene	20	1.2070	1473	1.665
Carbon bisulfide	20	1.2634	1158	0.290
n. pentane	20	0.6260	1032	0.366
n. hexane	20	0.6540	1083	0.489
Spindle oil	32	0.9050	1324	15.700
Gasoline	34	0.8030	1250	0.4~0.5
Water	13.5	1.0000	1460	1.004(20°C)

T: Temperature ρ : Density V: Sonic speed
 ν : Coefficient of kinematic viscosity

⑨ Setting of SOUND VELOCITY and KINEMATIC VISCOSITY of unknown fluid

Important!

- SOUND VELOCITY: Set $\square \times \Delta \text{ m/s}$ in Item ⑧.
- KINEMATIC VELOCITY: Referring to Table 1 "Coefficient of kinematic viscosity of various fluids", set the coefficient of kinematic viscosity of an unknown fluid approximate to the fluid name (kind of fluid). (Note that this is not the coefficient of kinematic viscosity of fluid approximate to the sonic speed of the measured fluid.)

⑩ Stopping the flow for zero adjustment

SITE SETUP

SITE MEMORY

PIPE PARAMETER

ZERO ADJUST MANUAL ZERO

RESPONSE SET 0 sec

⑤ Display of mounting size

PIPE PARAMETER

SITE NAME SGP 1'

CALIBRATION

CUT OFF 0.000 m/s

TOTALIZE

—SENSOR SPACING—

255.1mm

Error of 1mm deviation at $\phi 50$:
About 1%.

Error of 1mm deviation at $\phi 500$:
About 0.1%

⑥ Mounting of sensor

⑦ Check for intensity of receiving waveform and display of status (MEASUREMENT screen)

- No received signal
- Window scan
- Received signal overflow

When the above errors appear, repeat ④, ⑤, ⑥ procedures until it becomes NORMAL.

- Measurement panel status display → NORMAL.
- More than 2 indicators are "ON" on the upper right of the screen.

⑧ Opening the system check panel

SYSTEM CHECK

ERROR CHECK

SIGNAL CHECK

OUTPUT CHECK 0.00%

VERSION NUMBER

- Select SIGNAL CHECK.
- Read measured value $\square \times \Delta \text{ m/s}$ of SOUND VELOCITY on the upper side of the panel.

⑪ Starting the flow measurement

SITE SETUP

SITE MEMORY

PIPE PARAMETER

ZERO ADJUST MANUAL ZERO

RESPONSE SET 0 sec

Measurement start

Important!

Measurement accuracy

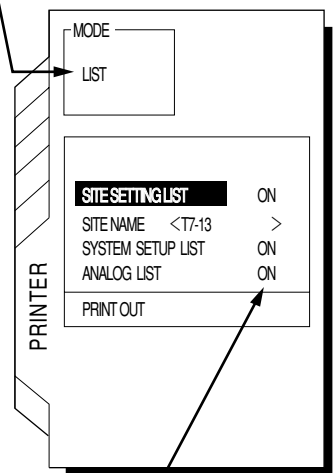
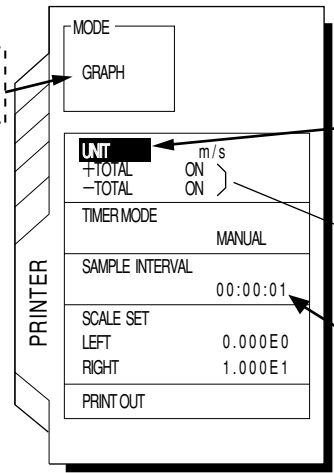
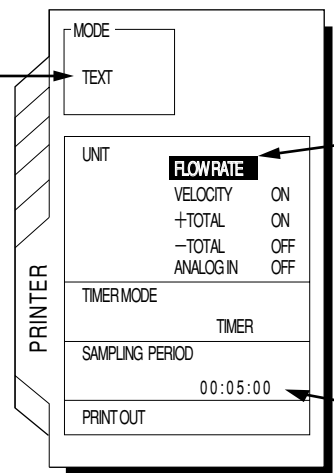
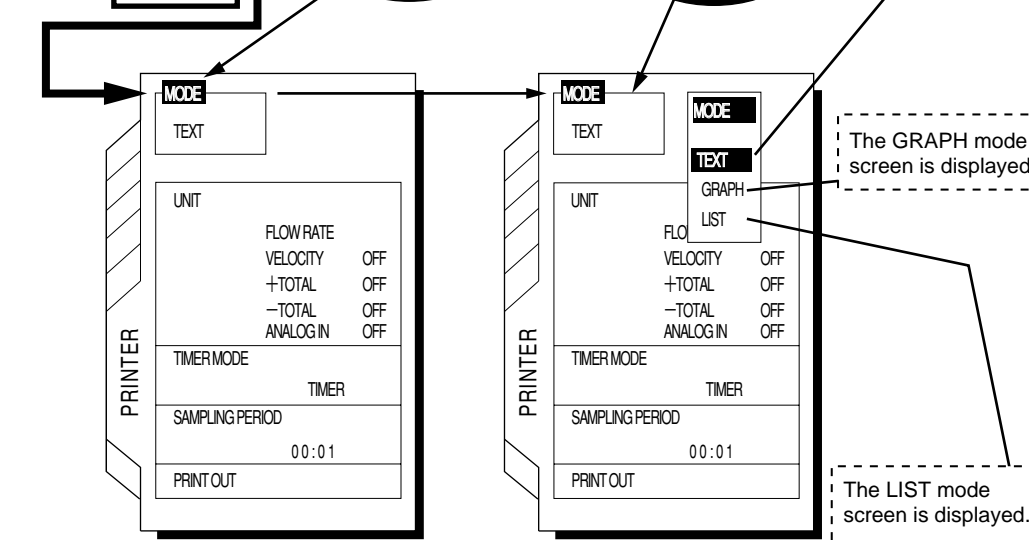
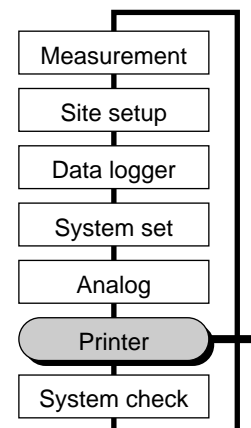
Fluid sonic speed is entered approximately, so the measurement accuracy is almost the same as "Accuracy of fluid with known sonic speed". But, the accuracy is slightly worse to the extent that the coefficient of kinematic viscosity is not actual but approximate.

Description of key symbols

- ENT: ENTRY key (data registration)
- ESC: ESCAPE key (setting suspension)
- ↑: Cursor up-shift (set value feed)
- ↓: Cursor down-shift (set value return)
- ←: Cursor left-shift (scale change)
- : Cursor right-shift (scale change)
- PRINT: Display screen printout (hard copy)

6. How to set printer printing (option)

Printer function



TIMER MODE

Point the cursor to **TIMER** and press the **ENT** key, and the screen as shown below appears.

MANUAL

- When selecting "PRINT OUT" and pressing **ENT**, continuous print out is initiated.

QUICK TIMER

- Print out is carried out for a limited period of time. To initiate printing, select PRINT OUT and press the **ENT** key. Printing is completed in the limited time.

TIMER

- Specify the start time and stop time to perform printing. If the **ENT** key is not pressed after selecting "PRINT OUT", printing is not initiated.

Select any of items displayed in the screen and press the **ENT** key, and the screen shown on the right appears.

- #### Description of key symbols
- ENT**: ENTRY key (data registration)
 - ESC**: ESCAPE key (setting suspension)
 - ↑**: Cursor up-shift (set value feed)
 - ↓**: Cursor down-shift (set value return)
 - ←**: Cursor left-shift (scale change)
 - : Cursor right-shift (scale change)
 - PRINT**: Display screen printout (hard copy)

Example of printing the TEXT mode

Point the cursor to **FLOW RATE** and press the **ENT** key, and the screen as shown on the right appears.

The item with **ON** in the **UNIT** is printed.

In case of the **TEXT** mode, 00:00 Hour: Minute (Minimum: 1 min)

FLOWRATE	UNIT
L / s	OFF
L / min	OFF
L / h	OFF
ML / d	OFF
m3 / s	OFF
m3 / min	OFF
m3 / h	OFF
Mm3 / d	OFF
B B L / s	OFF
B B L / min	OFF
B B L / h	OFF
M B B L / d	OFF

When you want to print "m3/h", move the cursor to it and press the **ENT** key.

More than 2 items can be selected.

Example of printing the TEXT mode

Date: 1999-5-31 16:45:00

Item selected from the UNIT: +2.845E+0 m/s, +1.793E+2 m³/h, +TOTAL 12345 m³, NORMAL

Measuring status: 1999-5-31 16:50:00

SAMPLING PERIOD: +2.724E+0 m/s, +1.717E+2 m³/h

Example of printing GRAPH mode

Point the cursor to **UNIT** and press the **ENT** key, and the screen as shown on the right appears.

Only a single item is selected.

In case of **GRAPH** mode: 00:00:00 Hour: Min.: Sec. (Minimum: 1 sec.)

Example of printing GRAPH mode

TIME=05-31 16:50:00 / UNIT:m³/h

SCALE SET LEFT: 0.000E1

SCALE SET RIGHT: 1.000E1

Graph showing 0m³ and +123m³ with a SAMPLING PERIOD of a span of dot.

When **TOTAL** is ON, the total value is printed at each position.

LIST

Site setup	Site name	T7-13
Outer diameter		274.70mm
Pipe material		Stainless steel
Pipe thickness		8.00mm
Lining material		No lining
Lining thickness		2.01mm
Kind of fluid		Water
Kinematic viscosity		1.004E-6 m ² /s
Seusor mounting		V
Sensor type		FLD12
Trans. voltage		8 TIMES
Zero adjust		Clear
Response set		10sec
Calibration	Zero	-1.000m/s
	Span	100.00%
Cut off		0.010m/s
Totalize	Mode	Manual
	Reset	data 0
	Total unit	m3
- Sensor spacing -		216.0mm

System setup	Communication baud rate	9600
	Parity	None
	Stop bit	1 bit
System of units		Metric
Measure mode		1
Data initialize		Off

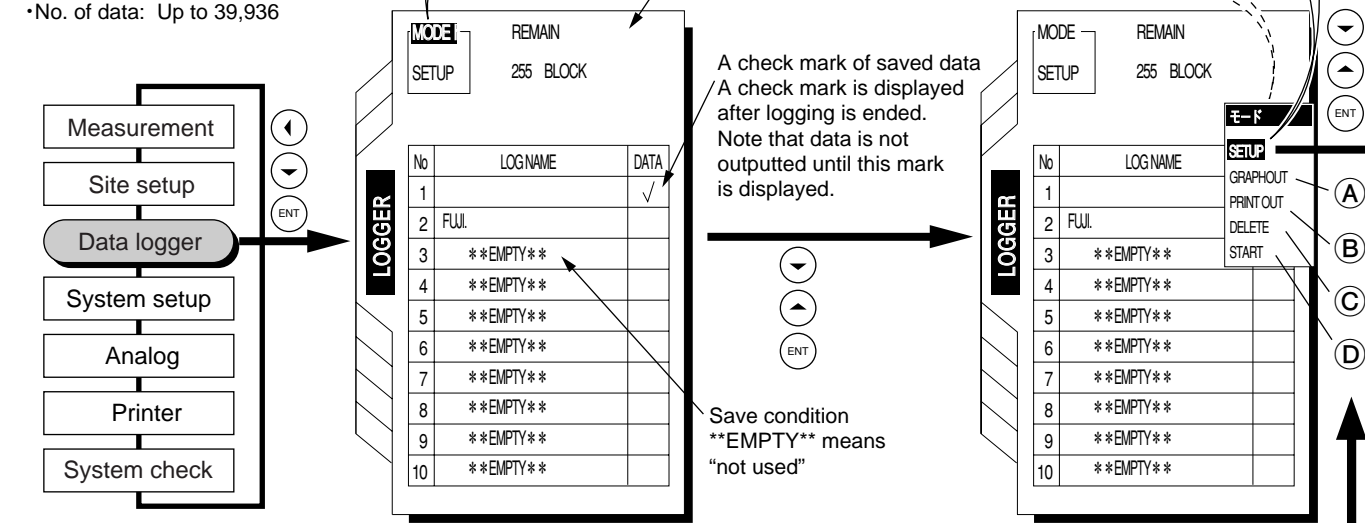
Analog input/output	Input	Input range	1.000 E2
	Output	Range unit	m / s
		Output range	0.000 E0
		Output mode	4-20mA
		Burn-out	Hold

7. How to set data logger

Setting of Logging function

After measurement, outputs of saved data, display and print are set.

- No. of measured values to be saved: Up to 20
- No. of data: Up to 39,936

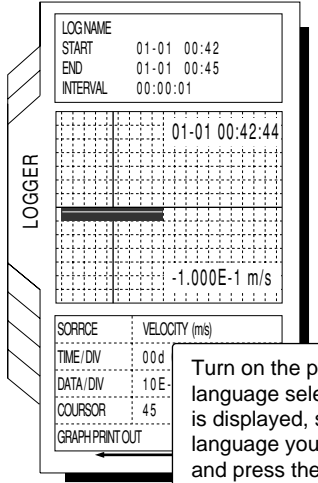


A check mark of saved data
 A check mark is displayed after logging is ended.
 Note that data is not outputted until this mark is displayed.

Save condition
 EMPTY means "not used"

A Graph display of logger data

To display Logged data in graph, select the logger name by (▼) or (▲) key and press (ENT).



Turn on the power. On the language select screen that is displayed, select the language you want to use and press the (ENT) key.

B Printing the logger data

To print Logged data in the TEXT mode, select the logger name by (▼) or (▲) key and press the (ENT) key.

```
05-20 15:15:00
+5.150E-1 m/s
+2.528E-1 L/s
+1.516E+1 L/min
+9.100E+2 L/h
+2.184E-2 ML/d
+2.528E-4 m3/s
+1.516E-2 m3/min
+9.100E-1 m3/h
+2.184E-5 BBL/s
+1.590E-3 BBL/min
+9.540E-2 BBL/h
+5.724E+0 BBL/d
+1.373E-4 MBBL/d
+TOTAL 0.000000 m3
-TOTAL 0.000000 m3
NORMAL
```

Important!
 All items with ON displayed by the UNIT setting are printed.

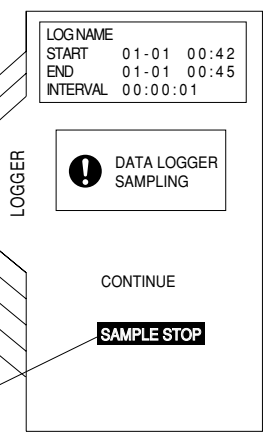
C Clearing logger data

To clear Logged data, select the logger name by (▼) or (▲) key and press the (ENT) key.

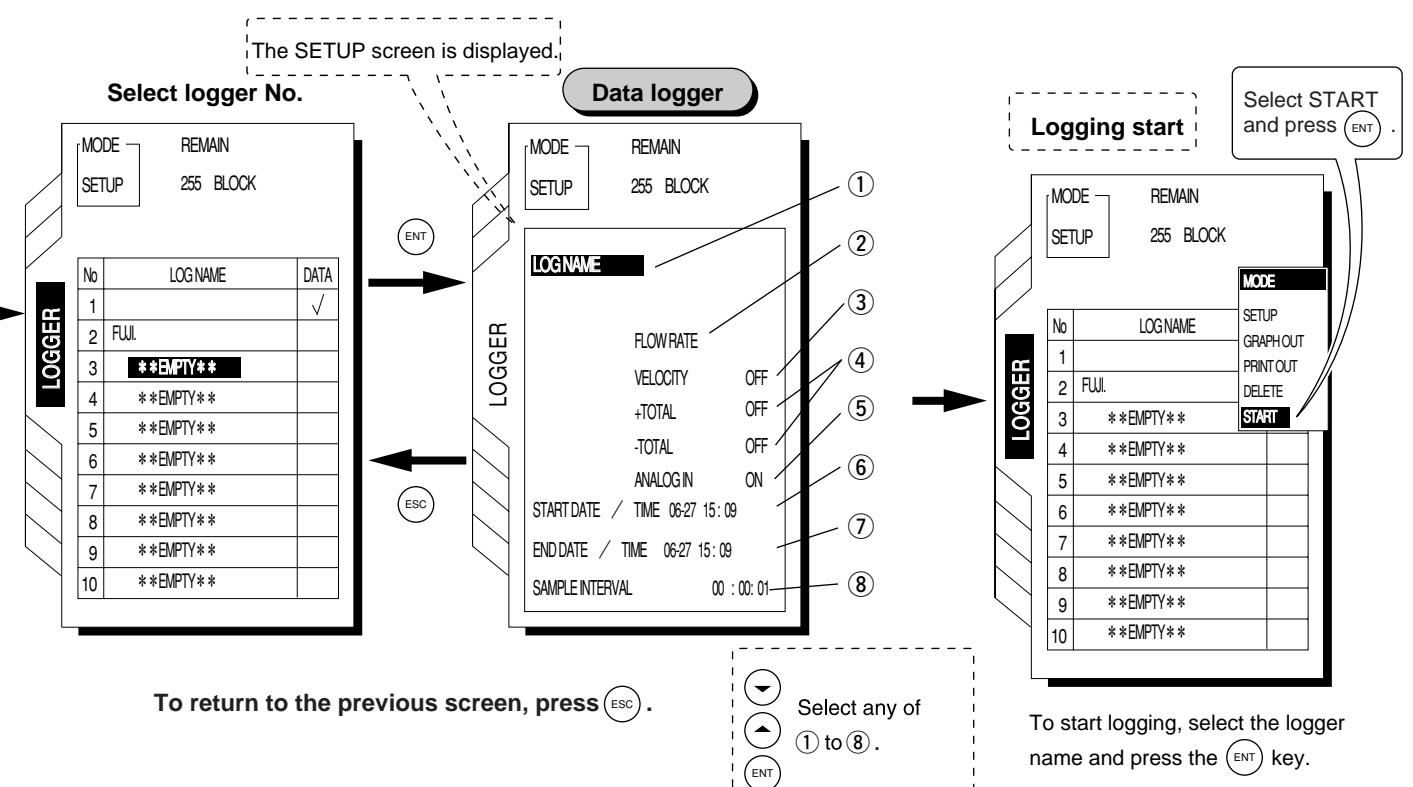
D Sampling start of logger data

To start Logging (logging on setting condition), select the logger name by (▼) or (▲) key and press (ENT).

When you want to cancel logging on the way, point the cursor to this item and press (ENT).

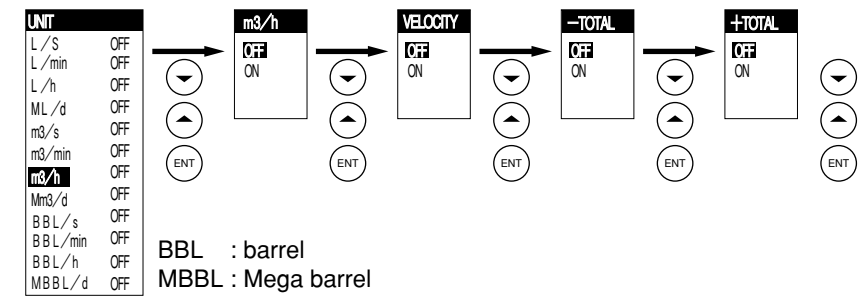


Description of key symbols	
(ENT)	:ENTRY key (data registration)
(ESC)	:ESCAPE key (setup suspension)
(▲)	:Cursor up-shift (set value feed)
(▼)	:Cursor down-shift (set value return)
(◀)	:Cursor left-shift (scale change)
(▶)	:Cursor right-shift (scale change)
(PRINT)	:Display screen printout (hard copy)



1 Register the logging position and pipe name. (Up to 20 characters including alphanumerical characters and symbols can be entered).

2 Set the unit.



Important!
 When the power is ON, all units are OFF. When selecting any of these units, select ON. One of more items can be set.

3 4 5 The units are OFF with the power ON. When performing logging, select ON.

6 Set the logging start time.

00-00 00:00
 Month Day Hour Minute
 Move the cursor by (◀) or (▶) and increment or decrement the set values by (▲) or (▼).

Important!
 Set a time with an allowance of a few minutes than the current time. If the set time passes the current time, logging will begin a year later.

7 Set the logging end time.

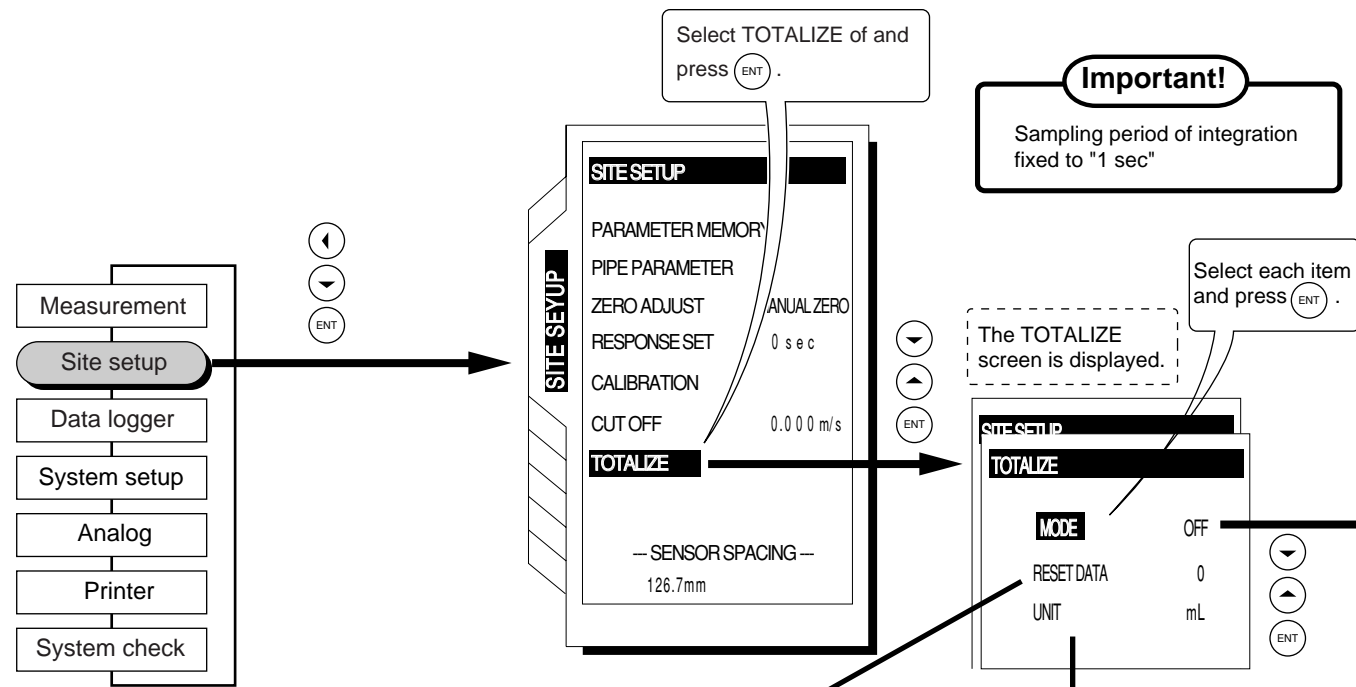
00-00 00:00
 Month Day Hour Minute
 Move the cursor by (◀) or (▶) and increment or decrement the set values by (▲) or (▼).

8 Set the logging period [The number of data contains up to 40,000 (total data in 20 positions)].

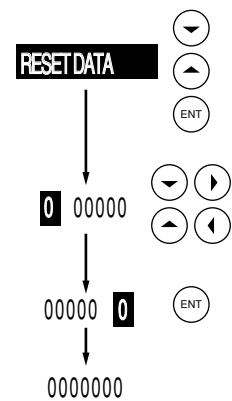
00-00 00:00
 Month Day Hour Minute
 Move the cursor by (◀) or (▶) and increment or decrement the set values by (▲) or (▼).

When measured data are saved in the memory every 0.5 hours and the number of data at a single position is 2000, 2000 (data) × 0.5 (hour) = 1000 (hours)
 Data corresponding to about 41 days can be saved. When measuring data at a single position, all of 39,936 data can be used.

8. How to set start and stop of fluid integration



② Reset data



Important!

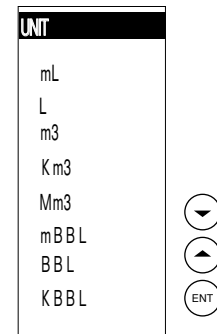
To reset integration on the MEASURE screen, set initial value of TOTAL DISPLAY.

In general, set the initial value to 0. For example, when initiating integration from 5000m³, set RESET DATA to 5000. (Effective range: 0000000 to 9999999)

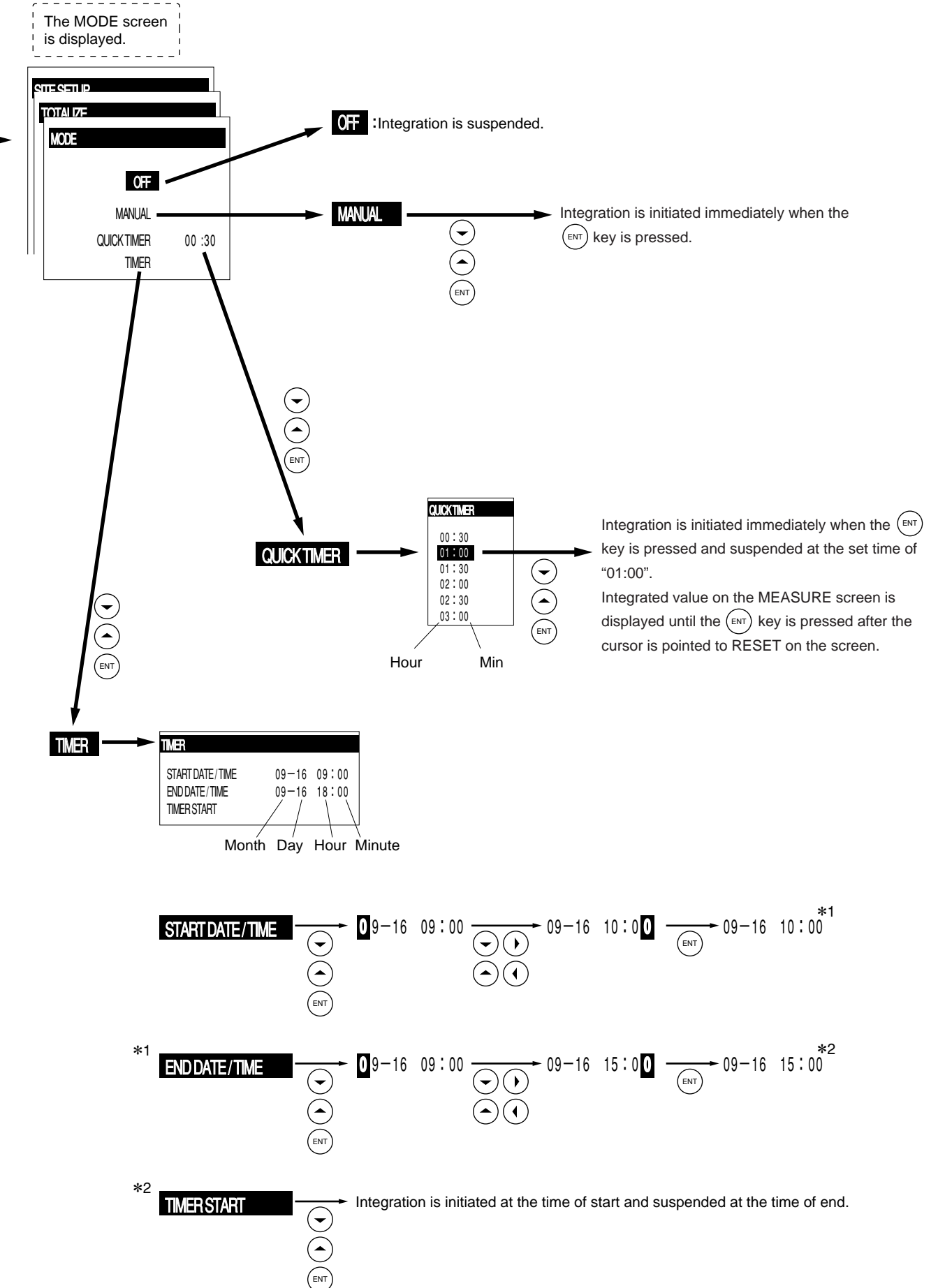
The integration value should be reset on the MEASURE screen.

① Units of integration

Select the unit of integration.



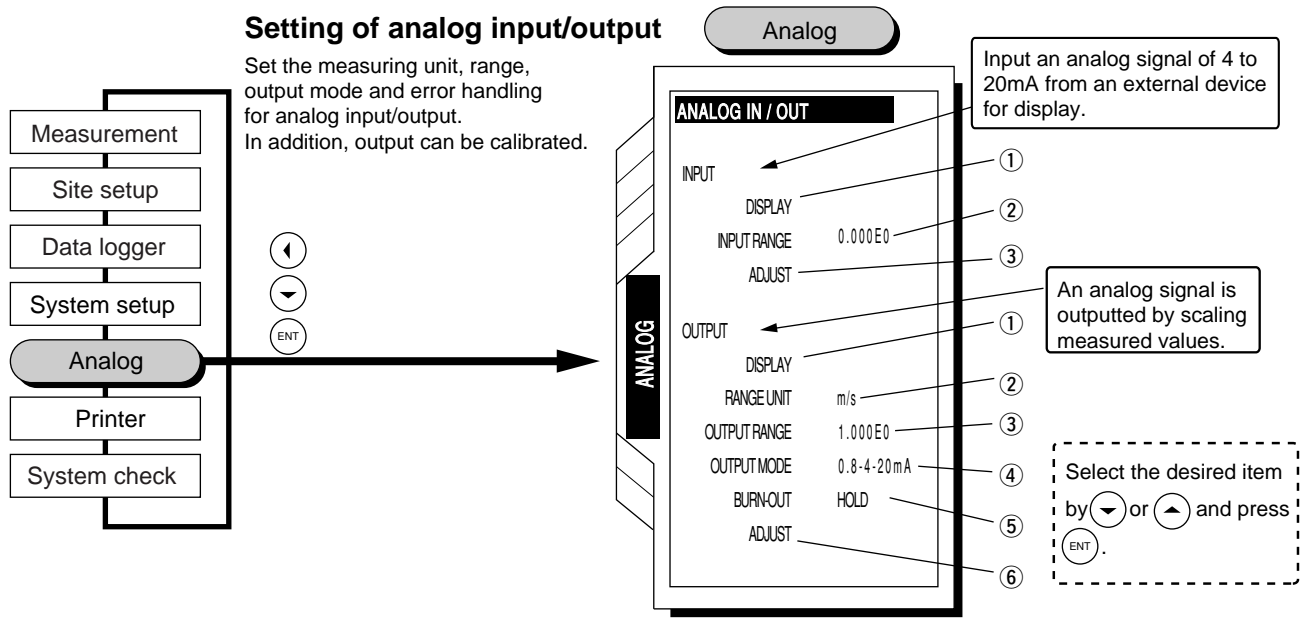
③ Start and stop



Description of key symbols

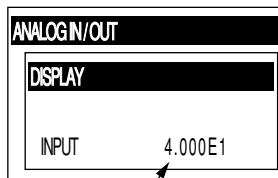
- ENT** :ENTRY key (data registration)
- ESC** :ESCAPE key (setup suspension)
- ↑ :Cursor up-shift (set value feed)
- ↓ :Cursor down-shift (set value return)
- ← :Cursor left-shift (scale change)
- :Cursor right-shift (scale change)
- PRINT** :Display screen printout (hard copy)

9. Setting of analog input/output



Analog input

① Display of current measured instantaneous flow



A numerical value proportional to the input current is displayed.

Input = Input (%) × range (setting)/100
 Example) In case of 50% input and 80 range,
 Input = 50 × 80/100=40 → 4.000E1

② Set the range to the input current.

Example 1) In case of 0 to 80 L/s with respect to 4 to 20 mA

8.000E1 (8.000 × 10) (Note 1)

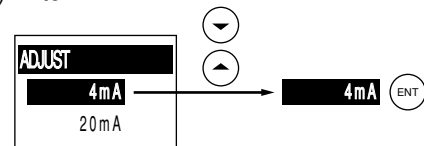
Example 2) In case of 0 to 150 L/s with respect to 4 to 20 mA

1.500E2 (1.500 × 100) (Note 1)

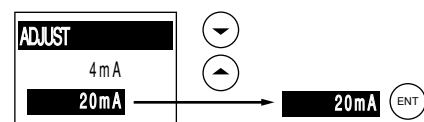
(Note 1) Index is settable to [-9 to +9] (E-9 to E9)

③ Calibrate the input.

(1) Enter 4mA.



(2) Enter 20mA.



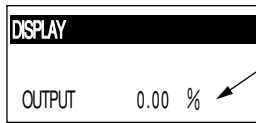
Calibration is completed.

Description of key symbols

- :ENTRY key (data registration)
- :ESCAPE key (setting suspension)
- :Cursor up-shift (set value feed)
- :Cursor down-shift (set value return)
- :Cursor left-shift (scale change)
- :Cursor right-shift (scale change)
- :Display screen printout (hard copy)

Analog output

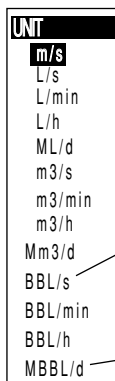
① Output display



A percentage (%) with respect to the range of currently measured instantaneous flow

Output = Instantaneous flow × 100/range (setting)
 Example) In case of instantaneous flow 40 L/s and range 80 L/s
 Output = 40 × 100/80 = 50 → 50%

② Range unit



barrel

Mega barrel

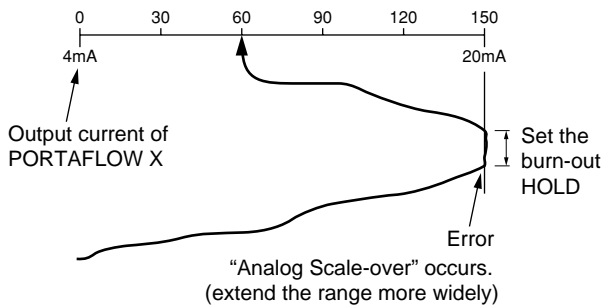
③ Set the range to the output current.

Example 1) In case of 0 to 80 L/s with respect to 4 to 20 mA
 8.000E1 (8.000 × 10) (Note 1) E1 = 10¹
 Example 2) In case of 0 to 150 L/s with respect to 4 to 20 mA
 1.500E2 (1.500 × 100) (Note 1) E2 = 10²

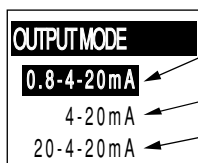
How to view the range setting
 (to prevent scale-over)

- Set the range to values of 1.2 times maximum value of flow rate to be measured.

Example) When maximum flow rate is 125 m³/m,
 125 × 1.2 = 150 m³/m → 1.500E2
 A recorder (external mounted) records as follows.

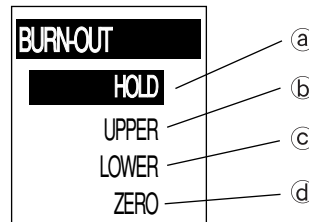


④ Set the output mode.



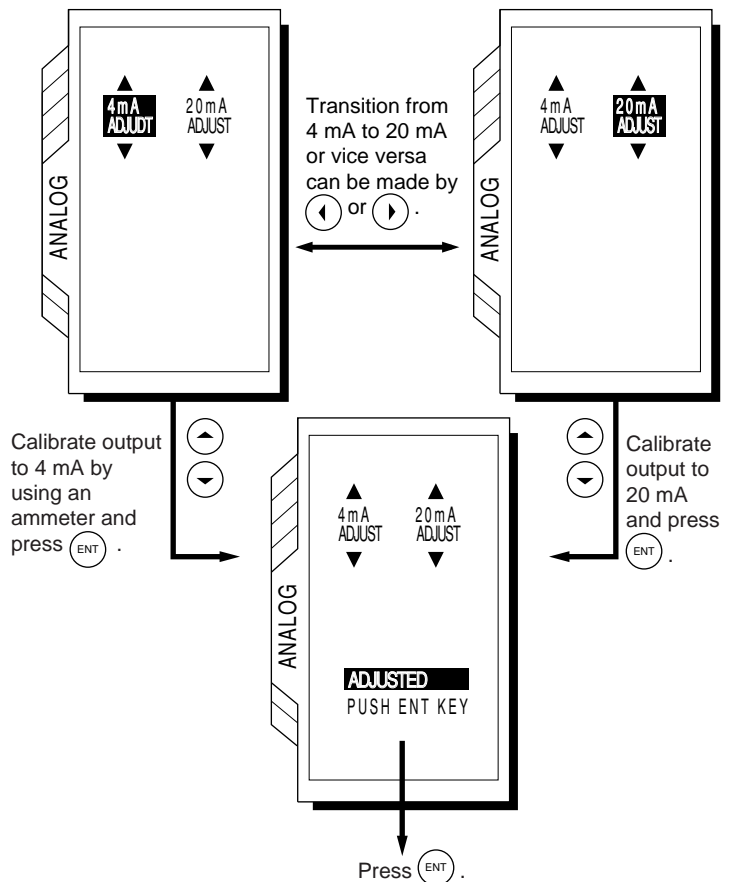
- Outputs reverse flow up to -20%.
- Cuts off reverse flow.
- Outputs reverse flow within 0 to 100% as well.

⑤ Set the burn-out.



- Hold**
 Holds displayed values before occurrence of errors
- Upper limit**
 Outputs 120%
 $16\text{mA} \times 1.2 + 4\text{mA} = 23.2\text{mA}$
- Lower limit**
 Outputs -120%
 $16\text{mA} \times (-0.2) + 4\text{mA} = 0.8\text{mA}$
- Zero**
 Outputs 4 mA.

⑥ Calibration of output circuit (using an ammeter)





Be sure to record (check) the following items before using the flowmeter.

Date of recording [day month year] Recorded by []

1. Check the inside diameter of the piping to insure it conforms to the sensor type.

Detector	Type	(Mark ○ on sensor in use)	Piping inside diameter
Small diameter sensor	FLD22		mm
Small sensor (standard)	FLD12		mm
Middle sensor	FLD41		mm
Large sensor	FLD51		mm
High-temperature sensor	FLD32		mm

2. Check for sufficient lengths of straight pipe upstream and downstream of the sensor mounting position.

	Straight piping	Pump, valve, etc.
Upstream side	D	With / Without
Downstream side	D	With / Without

D = Inside diameter of pipe

3. Check for correct piping settings (outer diameter size, material, thickness, etc.).

1. Site name		7. Kind of fluid	Water / Sea-water / ()
2. Piping outer diameter size	mm	* Sea-water/coefficient of kinematic viscosity	m ² /s
3. Piping material		* Other/fluid sound speed	m/s
* Other (sonic speed setting)	m/s	* Other/coefficient of kinematic viscosity	m ² /s
4. Piping thickness (mm)	mm	8. Sensor mounting method	V method / Z method
5. Lining material		9. Type of sensor	
* Other (sonic speed setting)	m/s	10. Transmission voltage	×1 / ×2 / ×4 / ×8
6. Lining thickness	mm	11. Mounting size	mm

4. Check for correct sensor mounting.

Silicone grease coating	No / Yes
Connector connection check	No / Yes

5. Check the zero point adjustment.

Zero point adjustment method: Manual zero or clear (stop the flow of fluid for manual zero operation. Manual clear should be used in situation where the flow of a fluid cannot be stopped).

6. Check that more than 2 indicators on the upper right of the measurement screen are working to indicate received waves.


Number of working indicators: [] (If neither indicator or only one indicator is working, increase the transmission voltage.)

7. Check if the analog output range is set properly.

Output range set value: . E

* Recording (check) has been finished. Set the integrator, logger, printer, etc., as necessary.



Check if the flow rate is indicated correctly. If an error message is indicated, display the system check screen and press the  key while setting the cursor on the error check. At this time, the error data, the cause of the error and corrective action are indicated. Follow the operating instructions displayed on the screen.

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