

INSTRUCTION MANUAL
CONCENTRATION METER
FUD-1 MODEL-52

FOR YOUR SAFETY

Read this manual thoroughly and understand the contents before operation the system.

In particular , read the WARNINGS and CAUTION very carefully because those contents are very important for you to use the system safely.

The label and explanation of a WARNING and CAUTION are as follows.

WARNING

Failure in following instructions may lead the user in death or severe injury.

CAUTION

Failure in following instructions may lead the system in trouble.

- ※ After you read this manual , store it in a place where you will able to read it again whenever you want to.

TABLE OF CONTENTS

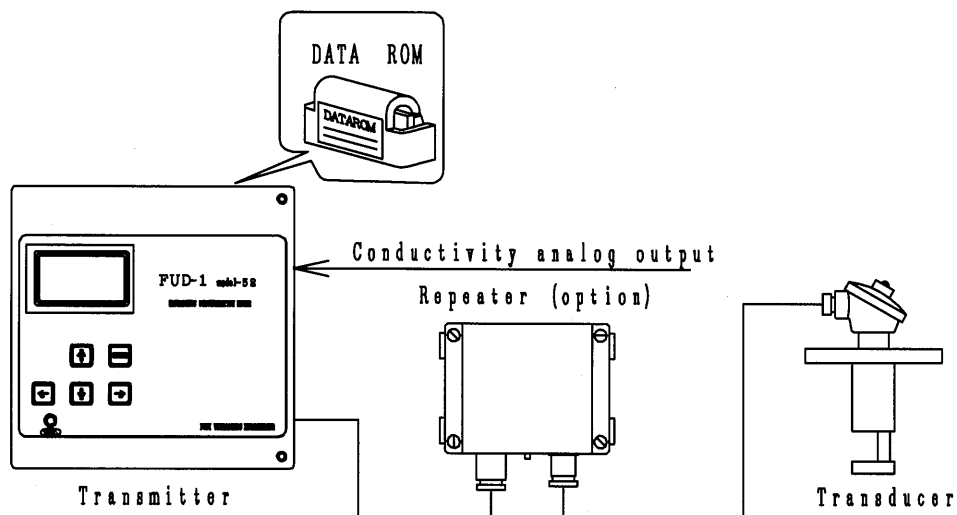
1.	OUTLINE	3
2.	CONSTRUCTION	3
3.	APPLICATION	4
4.	SPECIFICATION	4
	APPEARANCE Transmitter	5
	Transducer	6
	Repeater	7
5.	CAUTION ON HANDLING	8
6.	INSTALLATION	8
	6-1 Transmitter	8
	6-2 Transducer	8
	6-3 Repeater	9
	6-4 Conductivity meter	9
	6-5 Refer to attached cable of ultrasonic concentration meter and connection cable of transmitter guidance. --	9
7.	CONNECTION	12
	7-1 Connection	12
	7-2 Terminal diagram.....	13
	7-3 Connection diagram.....	15
	7-4 Assembly method of repeater cable outlet	19
8.	PRINCIPLES AND EXPLANATION OF EACH PART	20
	8-1 Principle of measurement.....	20
9.	OPERATION	21
	9-1 Usual operation.....	21
	9-2 Name of each part and its function---	22
	9-3 Explanation of operation key.....	24
	9-4 Contents display.....	25
10.	HOW TO USE THE REAR PAUEL TERMINAL BOARD.....	30
	10-1 Channel change with outer switch.....	30
	10-2 Alarm output	30
	10-3 Measurement ERROR output	30
11.	BASIC MOVENENT CONFIRMATION	31
12.	TROUBLE SHOOTING	32
13.	RS232C DIGITAL OUTPUT	35
	13-1 Digital output.....	35
	13-2 Digital input.....	35
	13-3 DIGITAL SPEC.	36
14.	INFORMATION FOR REFERENCE	
	Temperature characteristic of thermistor.....	37
	Characteristic list of ultrasonic velocity of distilled water	38
	Warranty Regulations	40

1. OUTLINE

Ultrasonic propagates in the solution and its velocity is decided by concentration and temperature of the solution. This analyzer measures accurately concentration of the solution by this ultrasonic characteristic. It measures temperature of the solution and ultrasonic velocity, which propagates in the solution and calculates by the internal CPU in order to measure concentration in the wide range. Moreover it displays concentration by digital and can control the process by analog output and RS232C output .

2. CONSTRUCTION

FUD-1 MODEL-52



- | | |
|------------------------------|-----------------------|
| ① Transmitter ----- 1 | ④ Cable ----- 1 set |
| ② Transducer ----- 1 | ⑤ Fuse ----- 1 pcs. |
| ③ Repeater(option) ----- 1 | ⑥ Manual ----- 2 sets |

5. CAUTION ON HANDLING

- 1) Transmitter, Transducer and Cable between Transmitter and Transducer are calibrated at the factory adjusting to specification. Don't cut the cable or shock to transducer.

CAUTION

Unit trouble If the unit should not be able to measure the correct concentration. Please it to us for repair and calibration.

- 2) Measurement accuracy may fluctuate on account of the condition of the solution installation and environment etc. If there is an error in concentration measurement you can compensate it easily. Please refer to the item of compensation of OFFSET volume and GAIN volume (P27)
- 3) If the transducer is electrified for the cleaning process, etc, it may cause the trouble of the unit. Check each process and take measures against electrification before use.

CAUTION

Unit trouble The unit may not measure the correct concentration, and at that time please return the unit to us for repair and adjustment.

- 4) Once turning the power switch off, turn the switch on after 10 seconds. If you plug out the unit while the power switch is on, turn the switch off once and plug in after 10 seconds.

6. INSTALLATION

6-1 Transmitter

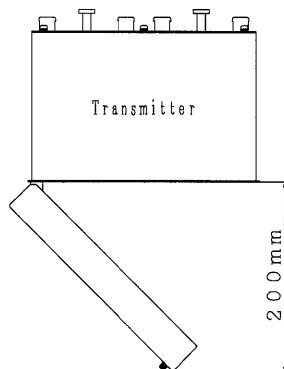
- 1) This unit is not the construction of explosion proof. Don't install the unit in the danger zone where explosion gas is generated.
- 2) Install the unit at the place of slow change of temperature in the range of 0~50°C no dust, vibration, flood and corrosion gas..
- 3) Ground the transmitter absolutely.

WARNING

Beware of electric shock

Ground the transmitter absolutely. It may well be that you will receive an electric shock.

- 4) It is necessary to place in the space where opening and shutting of a front panel of transmitter. It is necessary for maintenance work for opening and shutting of door front desk panel. Following Chart shows the dimensions that it is necessary.



6-2 Transducer

- 1) Air bubbles

If solution contains air bubbles, ultrasonic signal diffuses and ultrasonic velocity may change. Take gas out fully if you install the unit at the lower of the pipe.

- 2) Installation of transducer to the vertical piping

The inside of pipe where the transducer is installed must be filled up with solution. Install the transducer in the vertical pipe to avoid the influence by deposit or adhesive things. (refer to how to install the transducer on P10)

- 3) Temperature change of the solution
Rapid temperature change of the solution compared with the temperature time constant (approximate 30 seconds) of thermometer causes the error of measurement. Install the unit at the place of slow change of temperature. The temperature time constant of the thermometer is different according to the material, form etc. of the transducer.
- 4) Wash the deposit and the adhesive things in the pipe away periodically. They cause the error of measurement.
- 5) When tighten the joint of the resin transducer, Fix the body of the joint tightened and tighten the nut. If the body is not fixed, stress is placed on the body and welding part of the transducer and causes leakage. Fix the body of the joint tightened absolutely and tighten the nut.
- 6) Pressure change causes the error of measurement. Use it under fixed pressure.

6-3 Repeater (option)

- 1) Install it at the place of 0~50°C and no rapid temperature change, no dust no vibration, no flood and no corrosive gas.
- 2) The repeater is not the construction of rain proof. If you set it out of doors, put it into the box of rain proof.

6-4 Conductivity meter

Refer to the manual of conductivity meter in case other types.

6-5 Refer to attached cable of ultrasonic concentration meter and connection cable of transmitter guidance.

- 1) Transmitter-Transducer cable.(Including repeater: Transmitter-Transducer, Repeater-Transducer cable.)Refer to including connection cable to transmitter such as analogue output cable guidance. Because it is possible to catch mixing damage by electric surge and electrostatic induction such as thunder and electromagnetic induction That It might lead to malfunction and the machinery damage of a concentration meter transmitter, we recommend installation of an independent cable.
- 2) We recommend a cable with a shield resisting a noise for connecting cable to transmitter. But. Cause there is not a shield joint to the transmitter side that we recommend shield connection to another part joint.

How to install the transducer

As the ultrasonic dislikes air bubbles, there should be no air bubbles in the installation place of the transducer. Considering sedimentation of sludge and maintenance it is the best way to install it at the bypass line and the vertical pipes in order that the volume of flowing water and pressure may change

Install the measuring part (ultrasonic receiving part) in the flowing pass. (Fig. J below is bad)

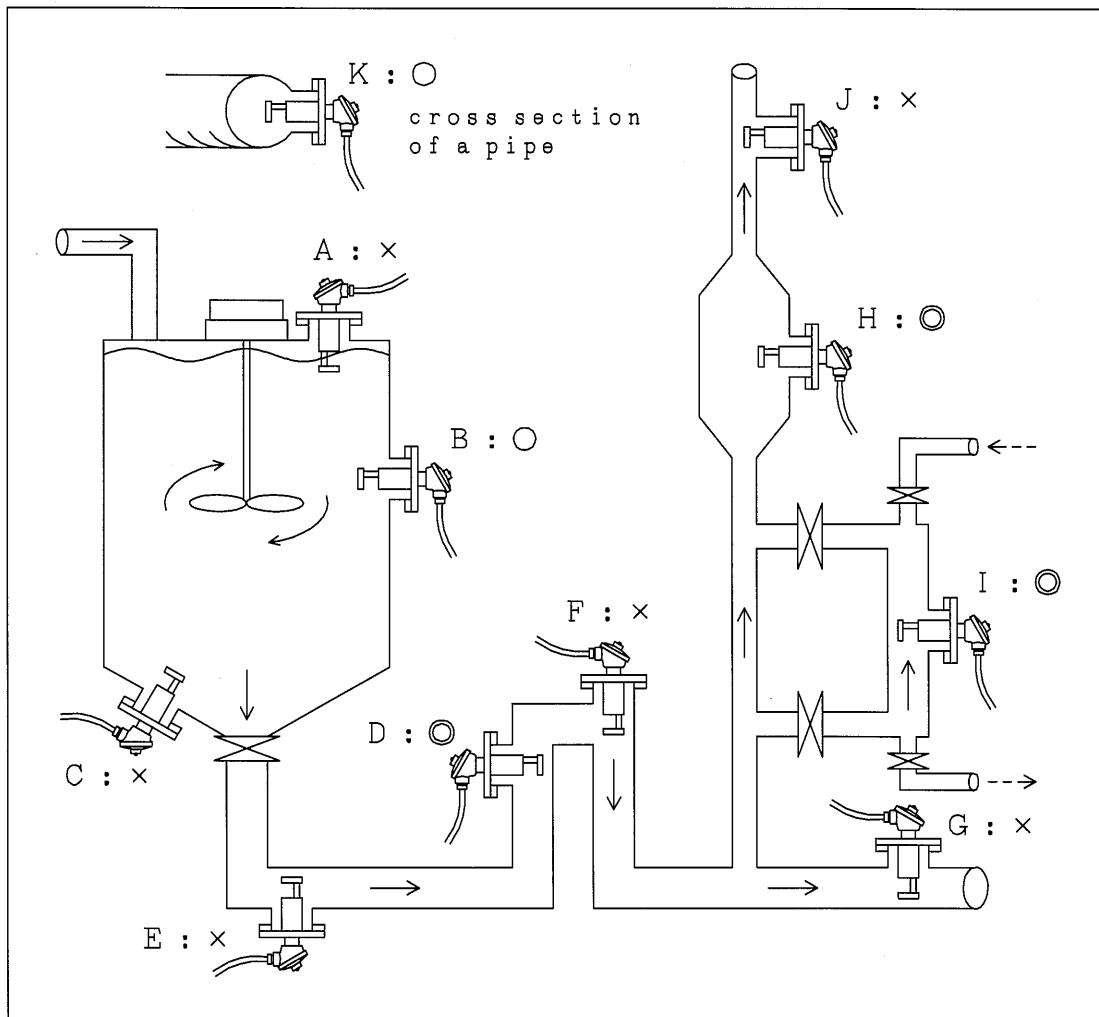
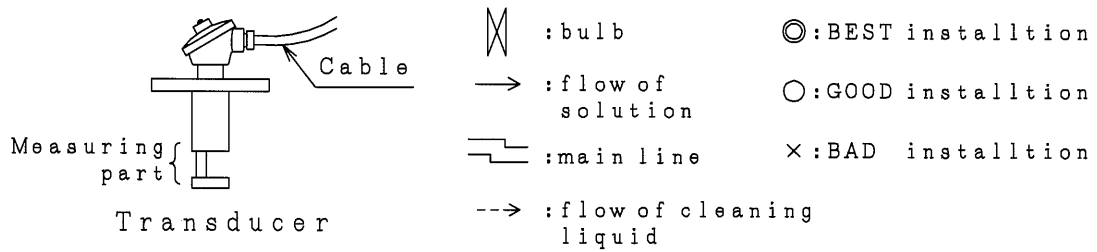


Fig-4 (A) Details are on the next page

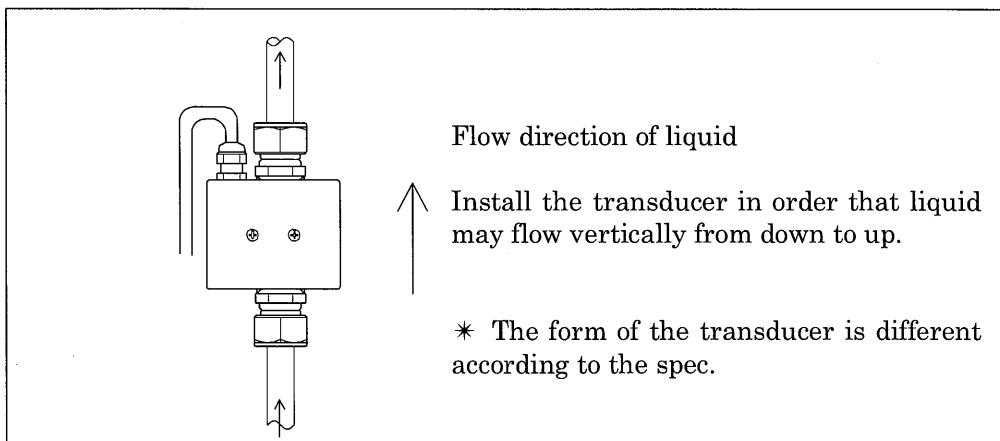
How to install the transducer

Installation position	Best installation	Comments
A	×	It may be impossible to measure due to a fall of the surface of liquid and adhesion of air bubbles to the reflection plate.
B	○	The sensor is installed horizontally and it is a good position.
C	×	Dirt and deposit are easy to collect on the flange. Air bubbles are easy to stick to the reflection plate.
D	◎	The position on the pipeline is the best.
E	×	Deposit is easy to collect on the sensor and the flange. Air bubbles are easy to attach to the reflection plate.
F	×	If there are air bubbles at the same time turbulence is generated, they are easy to collect and it may be impossible to measure.
G	×	Dirt and air bubbles are easy to collect on the receiving part of sensor.
H	◎	If diameter of the pipe is small, use the reducer.
I	◎	Elimination of air bubbles by pressurization due to the installation at the bypass line is easy and the pipe for cleaning is also installed.
J	×	The measuring part is not installed perfectly in the flow pass, and deposit is easy to collect on the sensor.
K	○	If the solution is not filled up, it may be impossible to measure.

※ (I) is the case to be measured at the bypass.

- Measurement is not influenced in case of an usual current.
- Install the transducer where there is no pressure change. If it is influenced by air bubbles, give additional pressure. (About 0.1~0.4Mpa in case of flange type and under 0.2Mpa in case of cell type)

How to install the transducer of cell type



7. CONNECTION

7-1 Connection

- 1) Refer to the pages after next for the connection of the transducer and the transmitter and the wiring and connection of input and output to the outside.
- 2) Transducer, cable and transmitter (include repeater) are calibrated at the factory as one unit. Please do not cut the cable absolutely.

! CAUTION

Unit trouble

If the unit should not be able to measure the correct concentration. Please it to us for repair and calibration.

- 3) Do not load high voltage to the unit when checking wiring.

! CAUTION

Unit trouble

If the unit should not be able to measure the correct concentration or lose the partial function. Please it to us for repair and calibration.

- 4) Confirm the connection before powering on.
- 5) The unit is not compatible and combine and connect the transducer, transmitter and repeater of a same body number. The body number is stated on the side panel of the transmitter, on the flange of the transducer and beside the case or on the lid of the case of the repeater.

FUD-1 MODEL-52

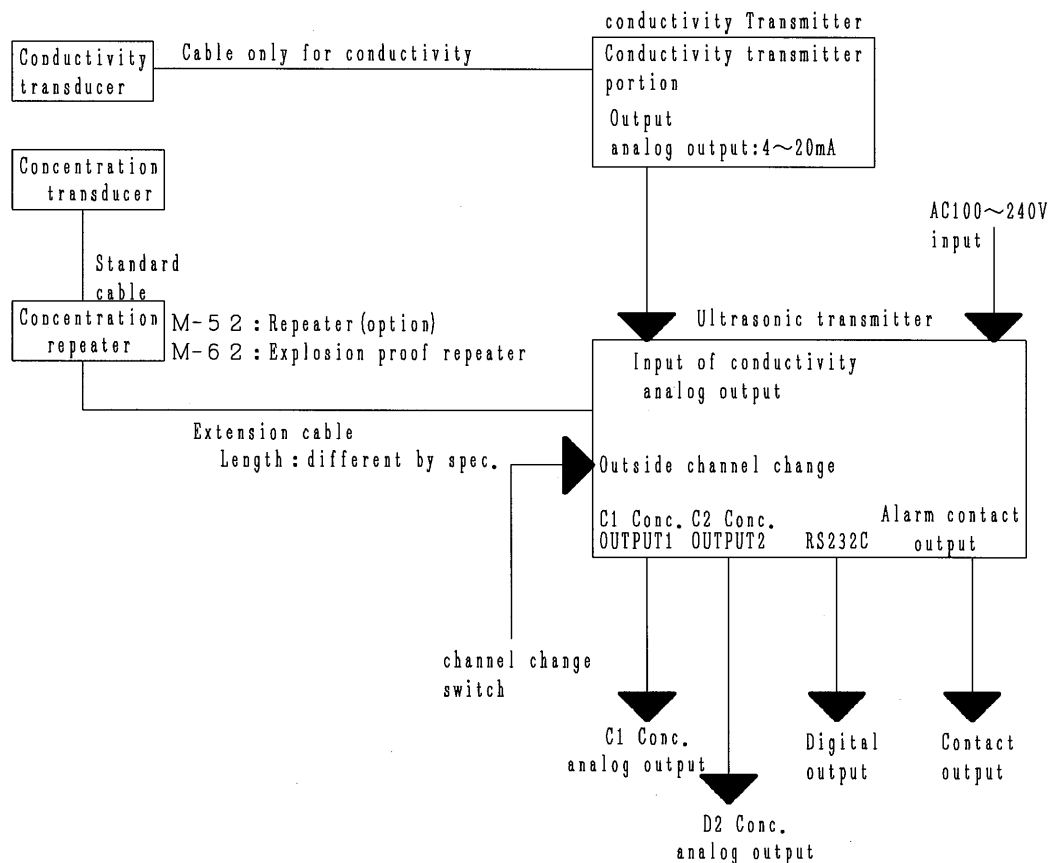


Fig-5 MODEL-52 connections

* The form of the transducer is different according to the spec.

7-2 Terminal diagram

Figure-6
Terminal of transmitter
(NM-3-1)

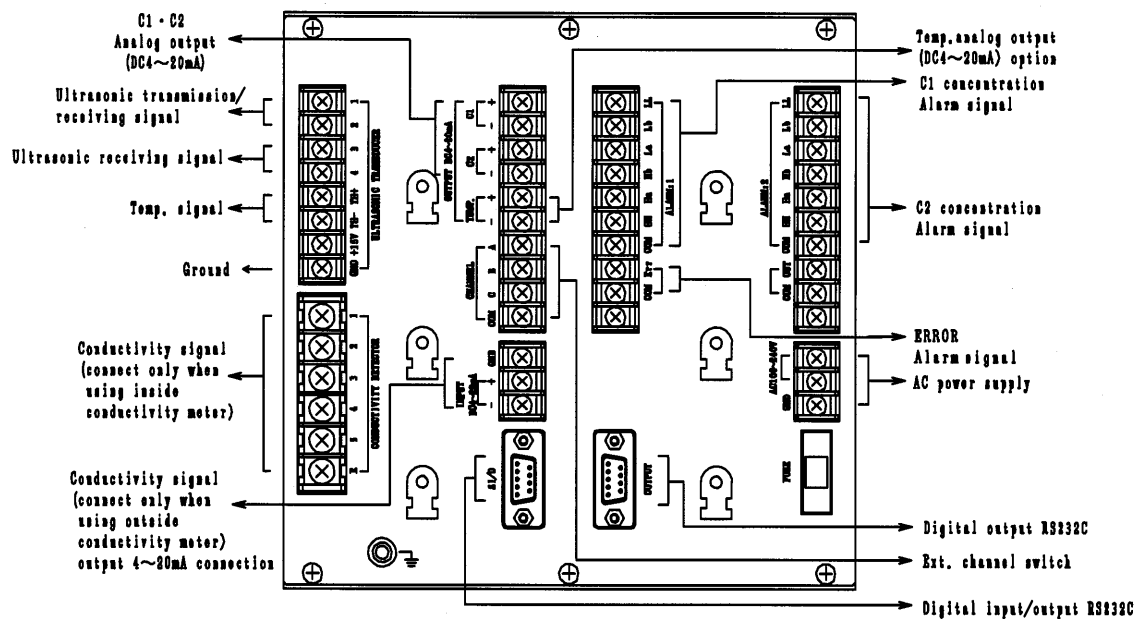


Figure-7
Terminal of transducer
Reflection type
(ST-20J, S6-20J, S6-20H)

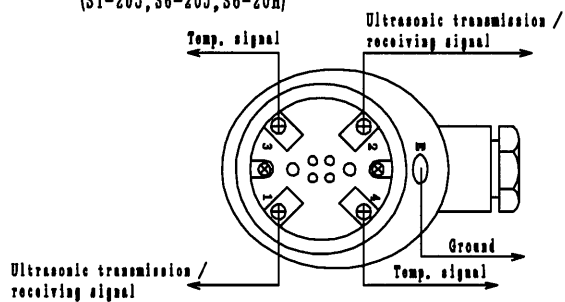


Figure-8
Terminal of repeater (PR-21)

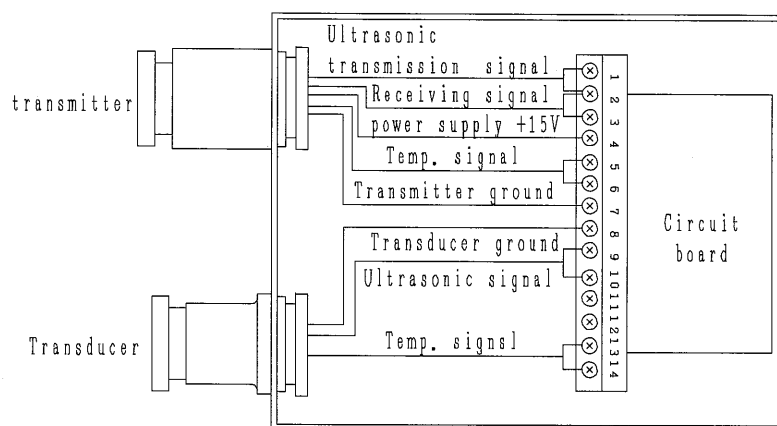


Figure-9
Terminal of transducer
Over lap type (SA-20M, SF-20M, etc)

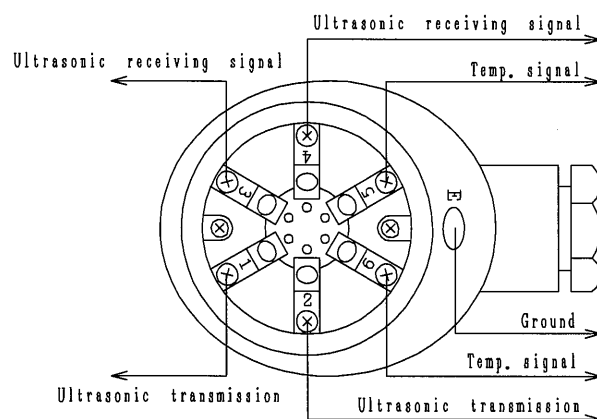
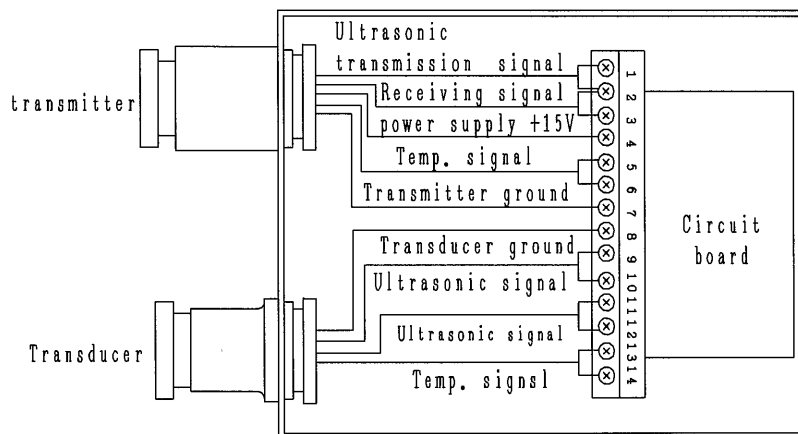


Figure-10
Terminal of repeater (PR-21)



7-3 Connection diagram

FUD-1 MODEL-52 (Reflection type transducer)

Figure-11

Connection and wiring

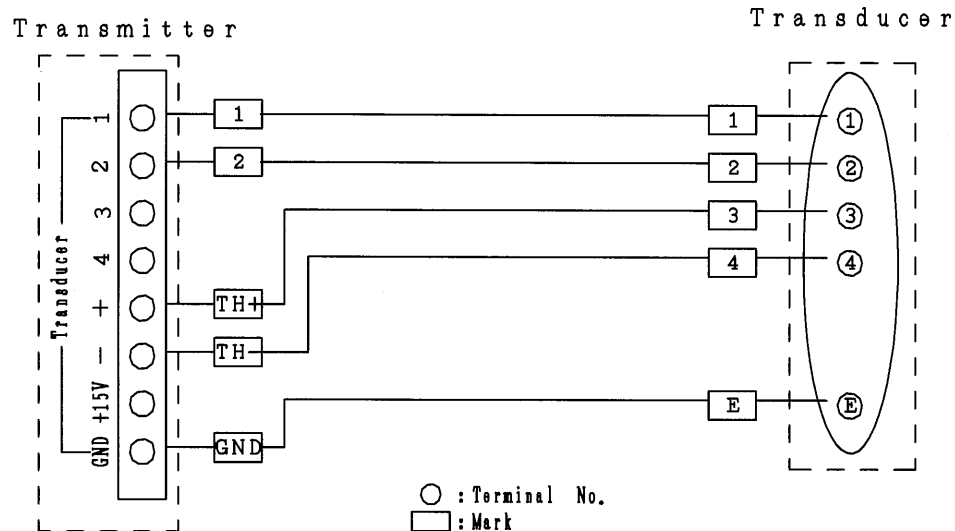


Figure-12

Cable specification

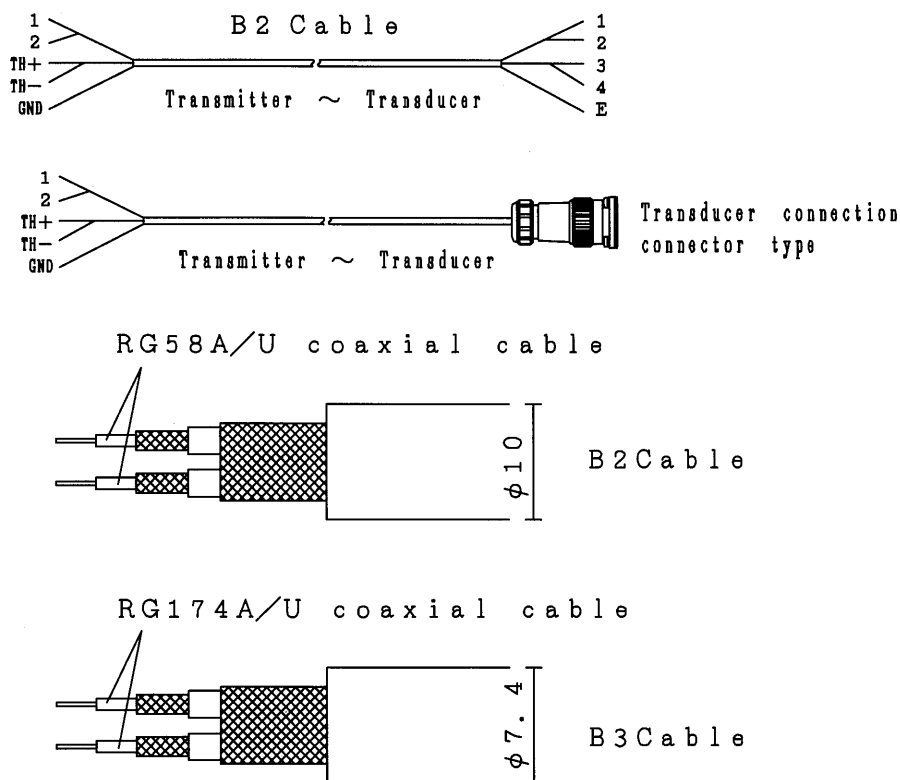


Figure-13
Connection and wiring

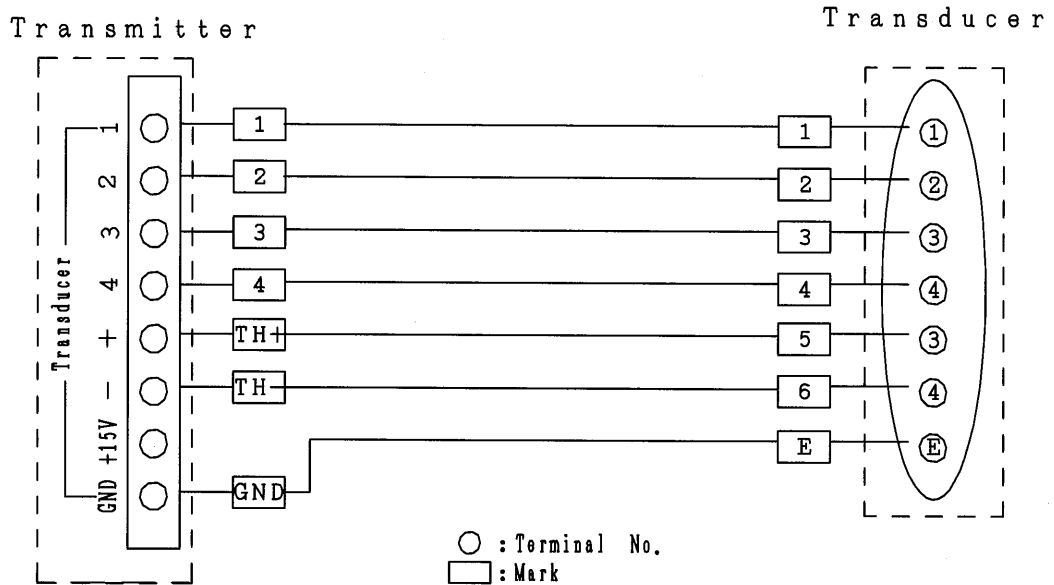
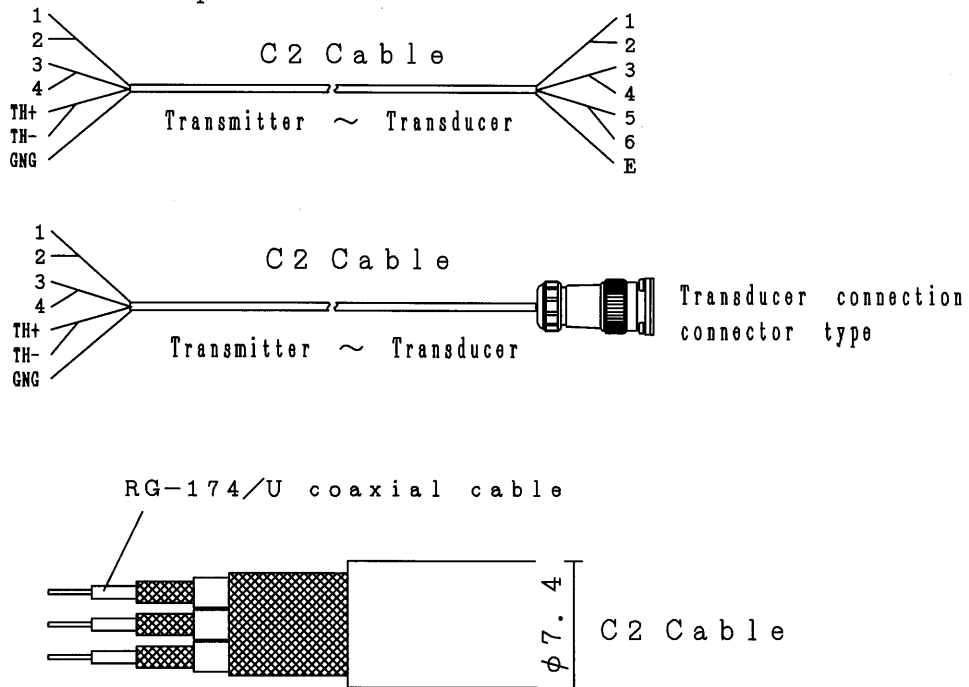


Figure-14
Cable specification



FUD-1 MODEL-52 (option : with repeater PR-21)
(Reflection type transducer)

Figure-15
Connection and wiring

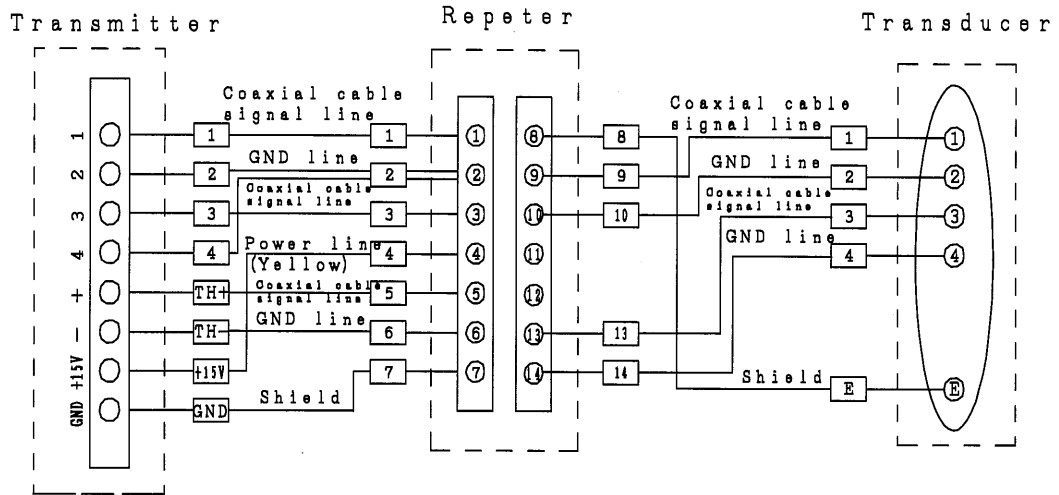
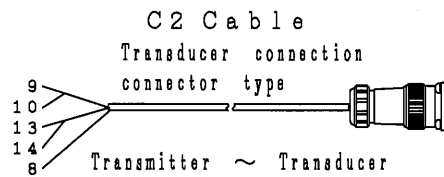
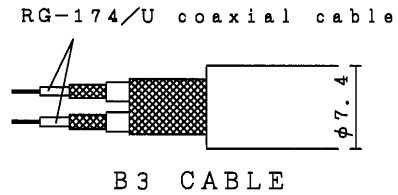
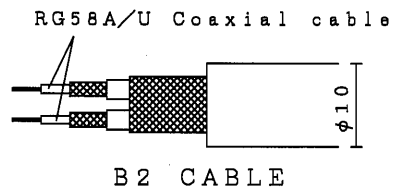
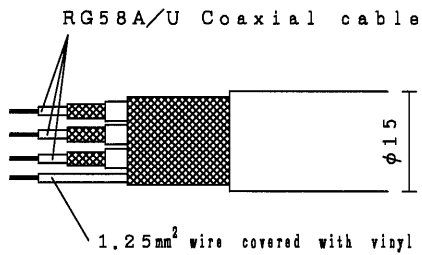
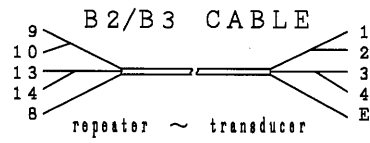
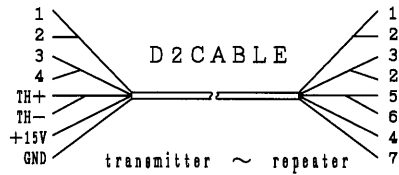


Figure-16
Cable specification



FUD-1 MODEL-52 (option : with repeater PR-21)
(Over lap type transducer)

Figure-17
Connection and wiring

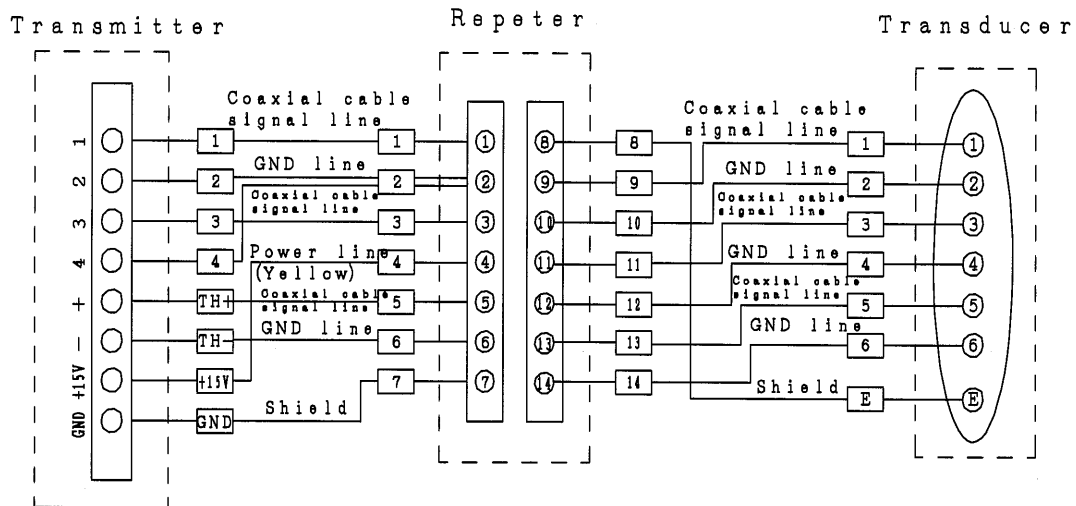
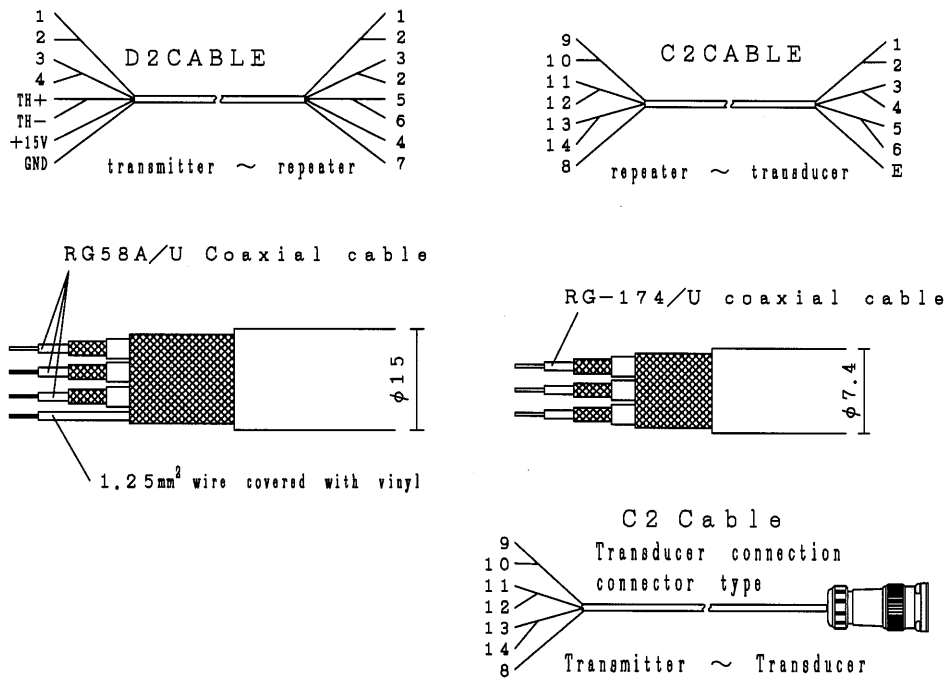


Figure-18
Cable specification



7-4 Assembly method of repeater cable outlet

FUD-1 MODEL-52 (option : with repeater PR-21)

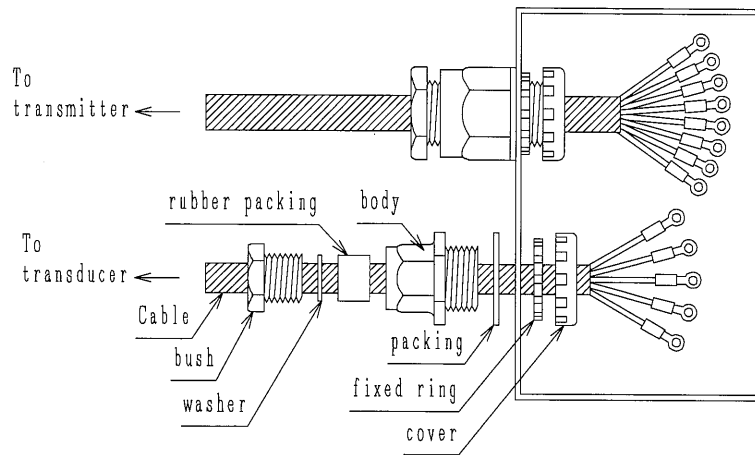


Fig-19 Assembly diagram of repeater

Assembly method (only side on the transducer)

- ① Pass each part through the cable according to the diagram.
- ② Fix a body to the repeater with a fixed ring.
- ③ Screw a cover into the screw part of the body.
- ④ Tighten a bush and fix a cable.
- ⑤ Connect the wire according to connection diagram.

※ We deliver the repeater under the condition that wiring on the side of transmitter and assembly of cable outlet has finished. Please use the unit under the current condition.

8. PRINCIPLES AND EXPLANATION OF EACH PART

8-1 Principle of measurement

The fundamental relationship among ultrasonic propagation velocity in the solution density of the solution and bulk modules of the solution is as follows.

$$V^2 = E / \rho \quad \text{----- (1)}$$

V : ultrasonic velocity in the solution

E : bulk modules of the solution

ρ : density of the solution

Bulk modules E and Density change according to concentration and temperature of the solution. Ultrasonic propagation velocity V also changes by Formula (1).

Consequently concentration of the solution is decided if ultrasonic propagation velocity and temperature are measured. This relation is :

$$D = F(T_c, V) \quad \text{----- (2)}$$

D : concentration of the solution

F(T_c, V) : 2 variable function of temperature and
ultrasonic propagation velocity

T_c : temperature of the solution

and to measure concentration is possible. This 2 variable function is decided according to each solution.

When a solution is consisted of three ingredients, each concentration is determined by measuring three kinds of physical

i.e., ultrasonic velocity, temperature and conductivity of the solution. Therefore the concentration of each ingredient in the solution is as follows.

$$D_n = F(V, T_c, C)$$

D_n : Comp. 'n' Concentration of the liquid

V : the ultrasonic velocity in the solution

T_c : the temperature of velocity in the solution

C : the conductivity of velocity in the solution

9. OPERATION

9-1 Usual operation

- 1) Check each input and output terminal of transmitter, outer equipment, power source(AC100~240V) and connection of earth, etc before operation.
Confirm inside of pipes in transducer is filled with the solution.

WARNING

Beware of electric shock

Don't touch the terminal board after
Connection the power. It may well be that you will
receive an electric shock.

- 2) When you turn the power switch of transmitter on, concentration measurement value and others are displayed in the display.

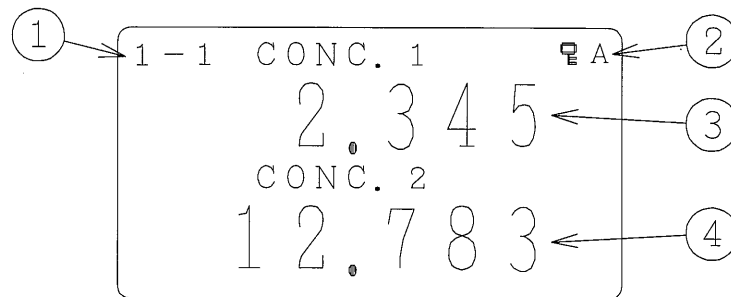




Fig-20 Contents of display

- ① [1-1] 1:channel No.
2:Display No. of each channel
- ② [ ·A]  :Display Lock (refer to P26)
A:A.E.C. function display (refer to P28)
- ③ Current concentration measurement C1
- ④ Current concentration measurement C2

- 3) DC4~20mA is output for analog output terminal corresponding to concentration output range. RS232C digital output is also available.
- 4) Turn power switch off when you stop the operation.
- 5) In case of operation stop for a long time, solid things may attach to transducer. Check it when operated again.(P31)

9-2 Name of each part and its function

(Front Panel)

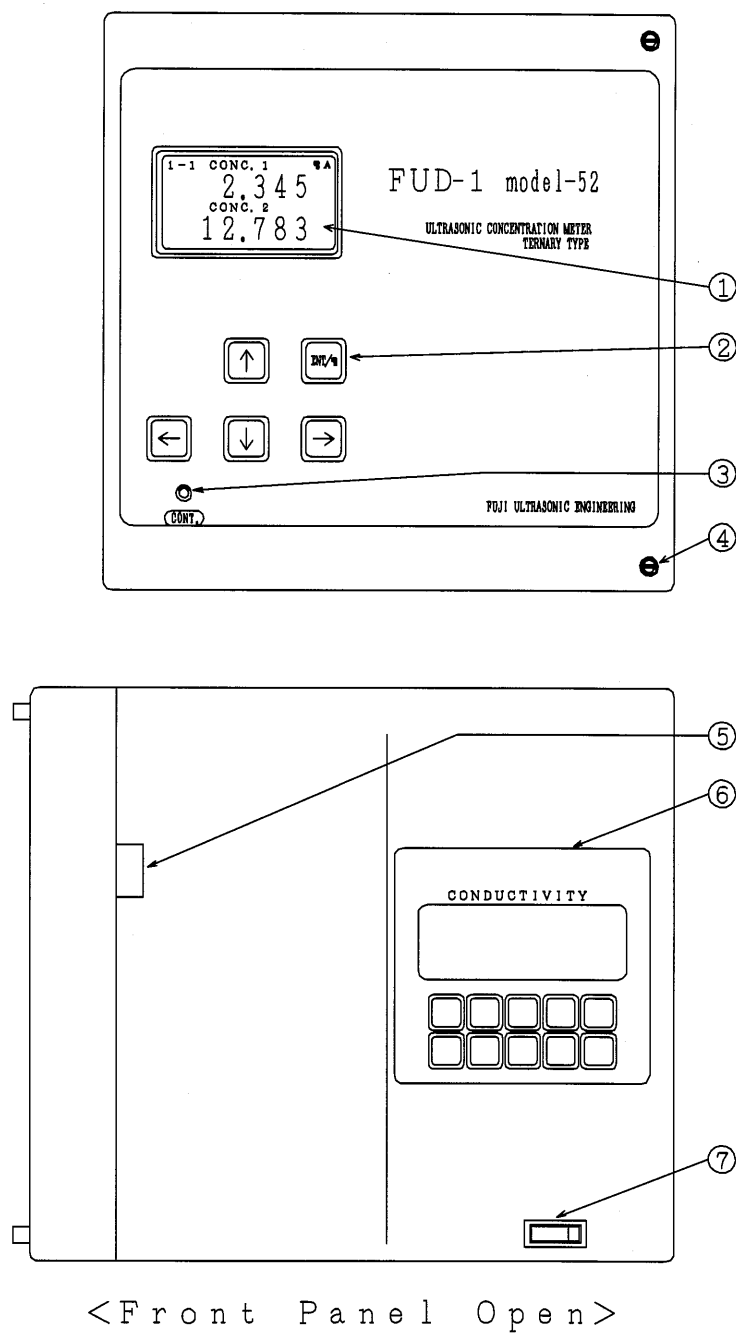


Fig-21 Front panel

- | | |
|----------------------|--|
| ① Display | Display of contents of measurement value and parameter |
| ② Operation key (5) | Used when parameter setting is changed |
| ③ Contrast | Used when contrast of the screen is adjusted |
| ④ Panel fixing screw | front panel fixing screw |
| ⑤ Data rom | Element memorizing calibration curve |
| ⑥ Conductivity meter | Front panel of conductivity meter |
| ⑦ Switch | ON and OFF of power source |

(Rear Panel)

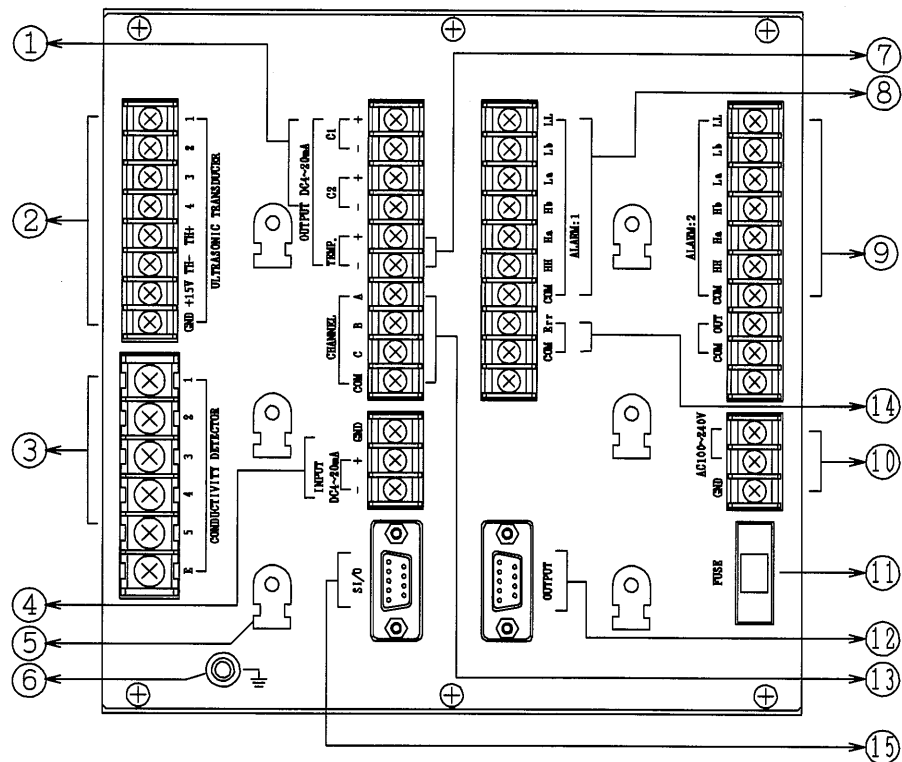


Fig-22 Rear panel

- ① Cable connection terminal(4~20mA C1,C2--- Analog output connection)
- ② Cable connection terminal
(TRANSDUCER --- Cable connection between transducer and transmitter)
- ③ Cable connection terminal (Conductivity sensor ---Sensor connection)
- ④ Cable connection terminal (Conductivity analog input --- No connection)
- ⑤ Cable support 6pcs.
- ⑥ Earth terminal
- ⑦ Cable connection terminal (4~20mA --- Analog output Temp.(option))
- ⑧ Cable connection terminal (C1 alarm output--- Relay contact)
- ⑨ Cable connection terminal (C2 alarm output--- Relay contact)
- ⑩ Cable connection terminal (AC100~240--- Power cable connection)
- ⑪ Fuse case
- ⑫ OUTPUT RS232C connector(RS485 is option)
- ⑬ Cable connection terminal
(CHANNEL SELECT --- Connect when change channel from outside)
- ⑭ Cable connection terminal
(ERROR alarm output ---Relay contact)
- ⑮ S I/O Digital input/output RS232C

9-3 Explanation of operation key

(↑) key

- Used for channel change (option) in the initial display.
- Used for selection of parameter and raising up the setting value in the parameter setting display.

(↓) key

- Used for moving to CHANGE PARAMETER screen in the initial display.
- Used for selection of parameter and lowering the setting value in the parameter setting display.


(←) key

- Used for displaying VEL (velocity), TEMP (temperature) to increase decimal places in the initial display. (Usually display by 1 decimal place)
- Used for rising up the position of setting figure while setting parameter.

(→) key

- Used for displaying VEL (velocity), TEMP (temperature) to decrease decimal place in the initial display.
- Used for lowering the position of setting figure while setting parameter.

(ENTER) key

- The key mark () on the right top in the initial display is canceled in the measurement 1~4display , and you can enter into the setting display (condition of the key is recommended when you don't change the setting)
- Used before and after change in the parameter setting display. When pushing (ENTER) in the parameter setting display , parameter part blinks and change the setting display with (↑), (↓)key. Change the position of figure with «←», «→» key. When pushing (ENTER) key again, the blink of the setting value finishes and the change finishes.

9-4 Contents display

★Display 1 (Concentration display)

```

1 - 1  CONC. 1  ERR A
      2 . 3 4 5
      CONC. 2
      1 2 . 7 8 3
  
```

MAIN LCD Concentration display measuring now

Note) [ERR] blinks in case of error.

Note) Regarding the concentration of C1 and C2, figure less 0 shows 0.

★Display 2 (Present measuring display)

```

1 - 2                                     A
C 1      :      2 . 3 4 5
C 2      :      1 2 . 7 8 3

VEL      : 1 5 4 3 . 2 1 0 m / s
TEMP     :      3 2 . 5 6 7 ° C
COND     : 1 2 3 . 4 5 6 mS / cm
ERR      :                               0
  
```

C1 : C1 concentration value

C2 : C2 concentration value

VEL : Velocity value

TEMP : Temperature value

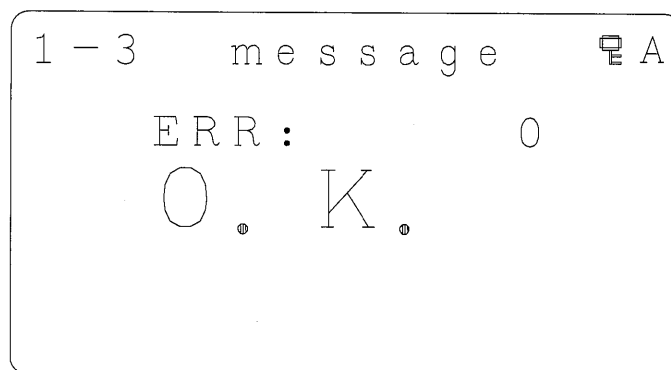
COND : Conductivity value

ERR : Display of measuring status

Note) Value of C1 and C2 are calculated by calibration curves.

[The unit can display -(minus)]

★Display 3 (ERROR display)

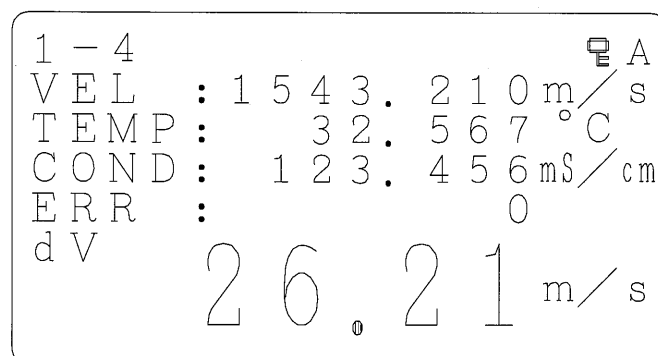


Display contents in case of troubles

Error code	Contents of error
0	Normal (O.K.)
1	Concentration measurement value is out of spec
20	Concentration calculation impossible (Concentration value is not gained)
300	Temperature is out of spec or in the status of cutting or short circuit
4000	Receiving wave is damping (check bubbles)
50000	Velocity measurement values vary greatly
600000	Conductivity is out of spec or in the state of cutting short circuit


Note) In case of many contents of errors, all contents of errors are displayed.

★Display 4 (Velocity difference with distilled water)



Display the velocity difference with distilled water , and used when checking the unit.

At display 1~4

When  (key mark) is displayed, you cannot go into parameter setting display. Key mark is canceled by pushing(ENTER) key for about 2 seconds in the display 1~3 display (any display is ok). (It is keylocked by push (ENTER) key again) Display 1~4 is displayed in turn when keylocked .

★Display 5 (C1 Parameter setting 1)

1 - 5	CONC.	1			
OUT	H		5.	000	
OUT	L		0.	000	
ALM	HH		3.	500	
ALM	H		3.	000	
ALM	L		2.	000	
ALM	LL		1.	500	

OUT H : upper limit of analog output
 OUT L : lower limit of analog output
 ALM HH : over upper limit of analog output
 ALM H : upper limit of analog
 ALM L : lower limit of analog
 ALM LL : under lower limit of analog output

Note) : Input the setting value of alarm output under the following condition.

Over upper limit of \geq upper limit of $>$ lower limit of \geq under lower limit of
 alarm output alarm output alarm output alarm output

The set value has hysteresis.

(2% within the range of alarm output)

It returns to the state of OFF when returning up to 2% in the alarm setting value,

It enters the state of ON when the alarm setting value is exceeded.

★Display 6 (C1 Parameter setting 2)

1 - 6	CONC.	1			
OFFSET			0.	000	
GAIN			1.	000	
DEC. POINT					3

•OFFSET (Setting of OFFSET volume)

- Set the OFFSET compensation volume in case there is an error between concentration value and analysis value. OFFSET volume can be set in the range of ± 100.000 .

(Example)

When you want to display concentration value higher by 5%, set the offset volume at +5.000.

In case the concentration shows 0 at display 1, check the value of C1 on the display 2 and input the offset value.

[Note : The unit cannot display -(minus) on the display1.]

•GAIN

- Set gain (slant) when there is an error between concentration value and analysis value. GAIN volume can be set in range of 0.001~10.000.

(Example)

2.000→display 2.000 times as much as concentration measurement value

*Relation between OFFSET and GAIN is

$y=ax+b$ (a: gain b: offset y: display value x: measurement value)

• DEC. POINT

- Set the figure number (0~3) down to the decimal place in the initial display.

★Display 7 (C2 Parameter setting 1)

★Display 8 (C2 Parameter setting 2)

It is the parameter setting display of conc. 2. Set by the same way as 1-5, 1-6 display for conc. 2.

★Display 9 (Parameter setting)

```

1 - 9
AVERAGE
F. S. M.
A. E. C.
START
ERR 1
ERR 2
END

```

• AVERAGE TIME

- Set the moving average number of times of concentration value. Optional setting is possible in the range of 1~100.

(Example)

1.0 → Measurement value in real time

2.0 → Average value of past two times of measurement value

100.0 → Measurement value of past one hundred times of measurement value

• F.S.M.

- In case the analyzer is used for the control of concentration, fail-safe function is equipped with in order analog output to work for safety side in case of troubles. Set fail-safe mode (F.S.M.) according to the following step.

(Example)

F.S.M. 4 --- In case of troubles (error 2 or 5) fix analog output to 4mA

F.S.M. 20 --- In case of troubles (error 2 or 5) fix analog output to 20mA

F.S.M. 0 --- Output corresponding to concentration value in case of troubles (error 2 or 5) *It is set at "0" when shipping.

- A.E.C.(auto error canceller function setting)

You can stabilize output not to renew concentration display , analog output alarm output and digital output when unusual value is found during measuring.

*Unusual value

Compare the average value of concentration values of past (A) times with the latest concentration value, and decide concentration value different over $\pm(B)$ as unusual value, and both display and output are not renewed. However if there is an unusual value, average concentration values of past (A) times except unusual values, and compare it.

- A.E.C. start condition

Compare concentration values of past (A) times with their average value.

When all values are in the range of difference within $\pm(B)$, start A.E.C. (When A.E.C. function works, "A" is displayed on the upside of the right corner of the screen of concentration display)

- A.E.C. finish condition

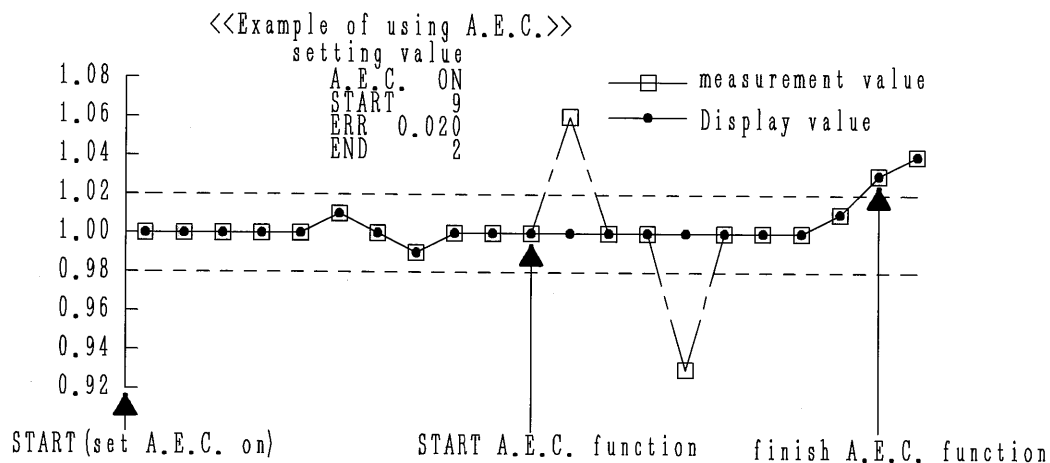
In case there are unusual values of (C) times in concentration values of past (A) times and the new concentration value is unusual, finish A.E.C. After finishing A.E.C. unusual values are reflected in each output, therefore when concentration values increase or decrease continuously, these values are traced.

(When A.E.C. function finishes, "A" display on the upside of the right corner of the screen of concentration display will disappear.)

- A.E.C. ON/OFF
- START(above A) 1~50 times
- ERR1(above B) 0.001~999.999
- ERR2(above B) 0.001~999.999
- END(above C). 1~50 times

Input the setting value of $START \geq END$.

Indicate the example using A.E.C. (auto error canceller function) on the next page.



measurement time	1	2	3	4	5	6	7	8	9	11	12	13	14	15	16	17	18	19	20	21	...
measurement value	1.00	1.00	1.00	1.00	1.00	1.01	1.00	0.99	1.00	1.00	1.06	1.00	1.00	0.93	1.00	1.00	1.00	1.01	1.03	1.04	...
display value	1.00	1.00	1.00	1.00	1.00	1.01	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	1.03	1.04	...
average value	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.01	...
A.E.C. function	Non-working (usual concentration measurement)								working (stable concentration measurement)									Non-working			...

※If stable measurement continues more than (A) setting value, A.E.C. function starts.

★Display 10 (Baud rate and character format setting)

```

1 - 1 0
  BAUD RATE      9 6 0 0
  BIT LENGTH     7 B I T
  PARITY BIT     E V E N
  STOP BIT       2 B I T

```

Adjust spec. of interface (RS232C) of the unit to the setting of the outer equipment connected to the unit.

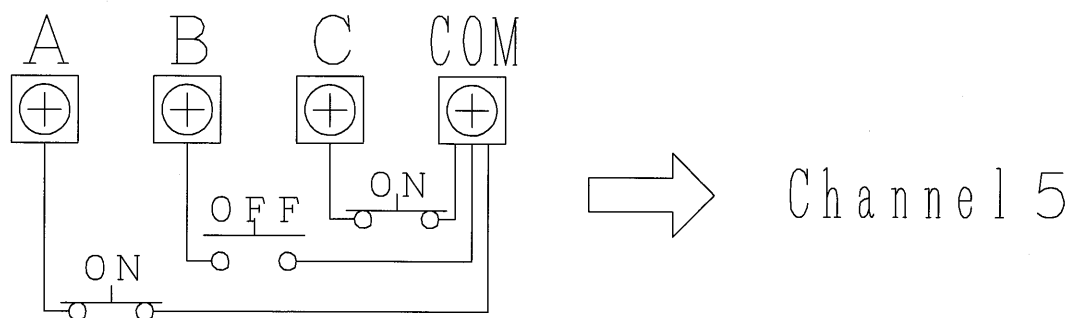
10. HOW TO USE THE REAR PANEL TERMINAL BOARD

10-1 Channel change with outer switch

When you change the channel with outer switch, connect the following terminal. This channel change doesn't move when solution is one. Data Rom should be changed when there are 2 or more solutions, so please call us.

Terminal No.	A	B	C	D	Solution (channel)
Outer channel change	ON	OFF	OFF	OFF	Channel 1
	OFF	ON	OFF	OFF	Channel 2
	ON	ON	OFF	OFF	Channel 3
	OFF	OFF	ON	OFF	Channel 4
	ON	OFF	ON	OFF	Channel 5

(Example of outer change)



Note) The load resistance of connecting cable should be less than 5Ω.

The outer switch is given priority when outer change switch is used and CHANNEL display doesn't work.

10-2 Alarm output

You can use the contact point output from the rear panel board by setting over upper limit (HH)·upper limit(H)·lower limit(L)·under lower limit (LL) of the range of alarm output.

Kinds of contact point

Alarm contact point upper·lower limit ---- Both Ha·La(a contact point output) and Ha·Lb(b contact point output) are available.

Alarm contact point over upper limit ---- HH·LL(a contact point output)
·under lower limit contact point output

Contact point capacity should be used under AC125V 0.3A , DC30V 1A.

! CAUTION

Unit trouble

If you use the unit over the capacity of the contact point in above alarm output , the unit may not work normally or lose the partial functions.

10-3 Measurement ERROR outside output

When there is an error of measurement, the contact point output is available from the terminal board.

(In case of measurement error (P26) the contact point output is made)

The kind of contact point ---- a contact point output

Contact point capacity should be used under AC125V 0.3A , DC30V 1A

! CAUTION

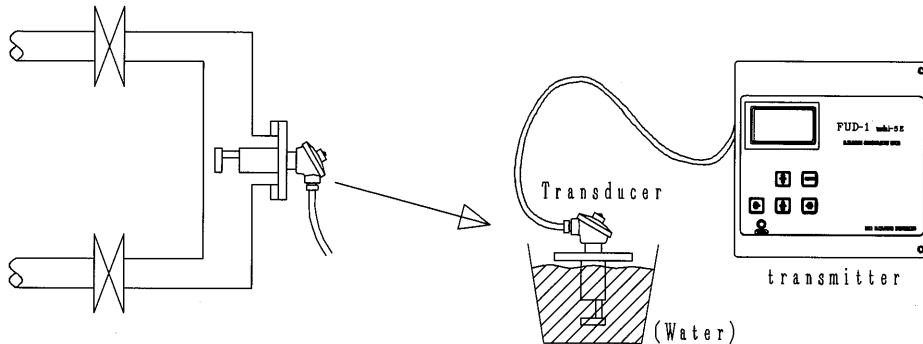
Unit trouble

If you use the unit over the capacity of the contact point in above alarm output , the unit may not work normally or lose the partial functions.

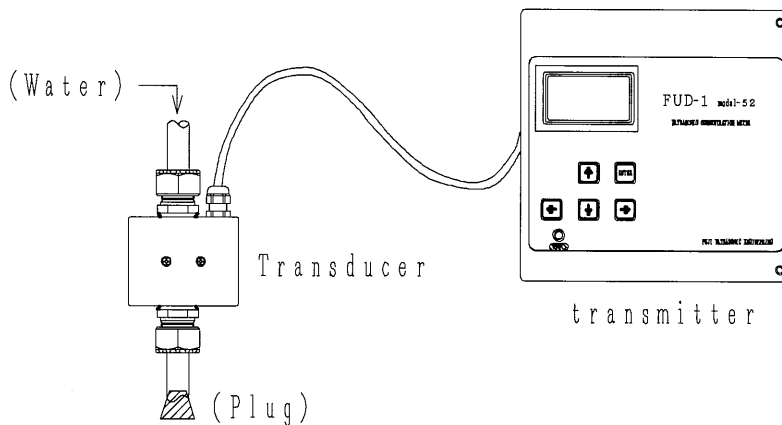
11. BASIC MOVEMENT CONFIRMATION

Measure velocity and temperature by water as the following figure to confirm the basic movement.

Put water into a bucket (tap water is OK) and remove the transducer and measure velocity and temperature of water.



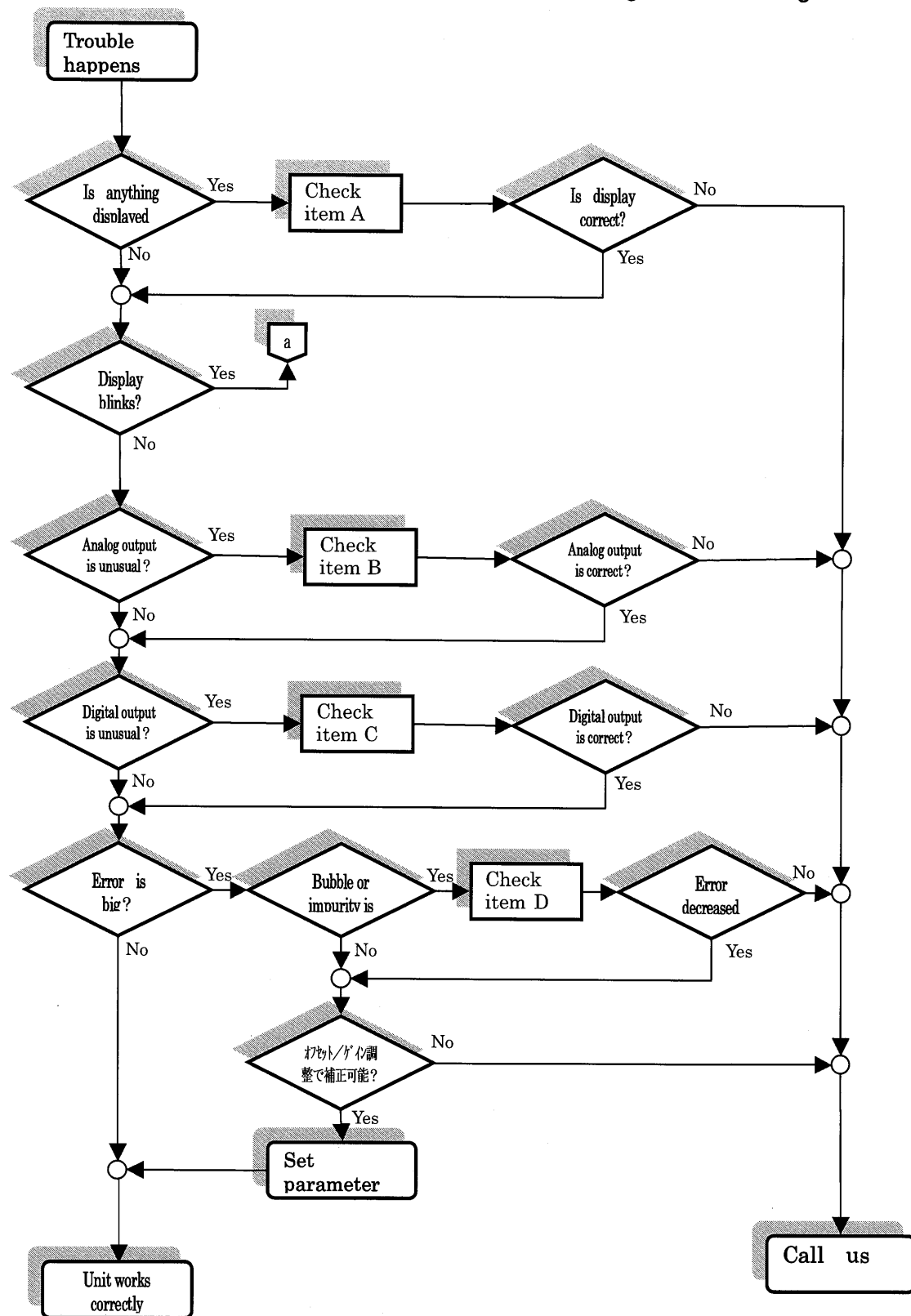
Remove the transducer and put water into the transducer and measure velocity and temperature of water for cell type transducer.
(Measure it after stabilizing temperature)

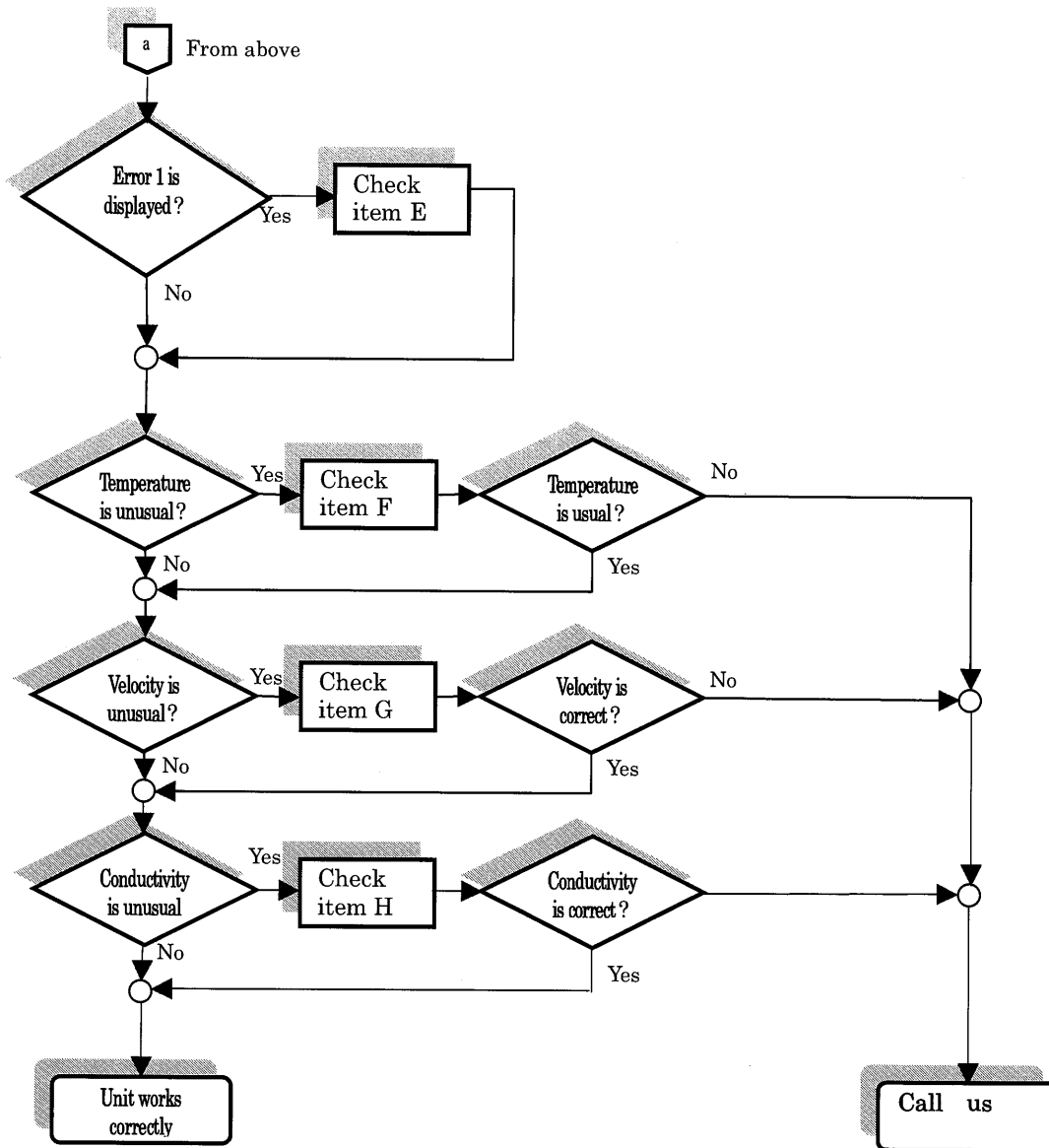


Compare this measurement value with characteristic list of ultrasonic velocity of distilled water on Fig-2(P38). The maximum permissible volume of difference of velocity is $\pm 2\text{m/sec}$. If it is over above volume, please call us. Measurement value may differ from other thermometers by $\pm 1^\circ\text{C}$, but it is not trouble.

12 TROUBLE SHOOTING

In case of trouble take good countermeasures according to the following flow chart





A. ①Check the connection of the cord again.

②Check if fuse burns out.

B. ①Analog output corresponds to the range of concentration.

Check the range of concentration.

Note) If there is any trouble in measuring, analog output is fixed to 4 or 20mA by F.S.M.

②If analog output doesn't work or fixed though measurement is correct, check wiring or load resistance value (Load resistance 500Ω or less)

C. ①Check the connection of connector. (Check the spec of cable wiring)

②Check communication condition.

D. If impurity or bubble other than measuring solution is mixed when calibration curve is made, it leads to the increase of error or impossible calculation. Check the solution.

Study the setting method by referring to "transducer setting" of the manual.

E. ①Concentration value is over the range of output concentration. Check the setting of the range of concentration output.

②Check the concentration of the solution.

③The solution and its calibration curve may be different. Check the calibration curve (channel).

- F. ①When the temperature is -10°C on the screen, the line may be cut in the temperature measuring unit. Check the wiring in the transmitter terminal, the repeater and the transducer terminal box.
- ②When the temperature is 160°C on the screen, thermistor may be shorted. Remove the cable TH+, TH- from the transmitter terminal, and check the thermistor resistance value.
- G. ①Remove the transducer and put it into water in the vessel (cap water is OK) and Check temperature and velocity.
- Note) Don't give a shock to the detective part of the transducer. If the difference of velocity is in the range of $\pm 2\text{m/s}$ compared with the attached list, the unit is usual.
- Check temperature and velocity with water for cell type transducer. At this time be careful to fill the water in the transducer.
- (P31 refer to the basic movement)
- ②If the measuring value is usual by checking with water, there may be influence by bubbles. Check if there are bubbles or not in the pipe line. The cell type transducer may have bubbles in the cell according to the setting condition. Check the setting condition.
- ③Check if there is an erosion of the part touching to the solution by the transducer.
- ④Check if there is any stick such as dirty things to the reflection panel or sending and receiving plate of the transducer.
- ⑤If there is a trouble in the conductivity, refer to manual of the conductivity.
- H. ①Connection of the transmitters between concentration meter and conductivity and shipping check are done in our office, so the wiring between transmitter and transducer of the conductivity may be wrong. Check the wiring of the transducer of the conductivity.
- ②Check if electromagnetic conductivity range in the shipping check list of the concentration meter and electromagnetic conductivity output of the conductivity ($4\sim 20\text{mA}$) are same. (We ship after setting, but confirm again. Refer to the manual of electromagnetic conductivity for setting)
- ③Check if measurement values of electromagnetic conductivity and electromagnetic conductivity on the display of the transmitter of the concentration meter are almost same. (within about 1%f.s.)
- Almost same
- There is no problem in both the ultrasonic transmitter and the electromagnetic Conductivity.
- Not almost same
- Signal receiver of electromagnetic conductivity in the ultrasonic transmitter and the electromagnetic conductivity may be unusual. (advise to return the unit for inspection)

13. RS232C DIGITAL SIGNAL

13-1 DIGITAL output

- 1) Mode Asynchronous mode
- 2) Baud rate 9600·19200 bps
- 3) Character parameter Stop bit 1·2
Even parity check
Bit length 7-8 bit ASCII code
(Refer to the setting display of display 10(P29)baud rate , character format)

4) Data format

Receiving data

* CR	* Symbol(start symbol)
0 2 CR	channel
0 0 0 2 3 5 6 CR	C1 Concentration
0 0 0 1 2 1 5 CR	C2 Concentration
0 0 2 2 3 4 1 CR	Temperature
1 5 3 6 5 1 1 CR	Velocity
0 0 2 5 2 5 0 CR	Conductivity
0 0 4 0 0 0 CR	Error

Contents of data

Channel No.	2 digits	Ex. 02 → Channel No.2
C1 Concentration	7 digits	Ex. 0002356→ 2.356%
C2 Concentration	7 digits	Ex. 0001215→ 1.215%
Temperature	7 digits (3 place of decimal)	Ex. 0022341→ 22.341℃
Velocity	7 digits (3 place of decimal)	Ex. 1536511→ 1536.511 m/sec
Conductivity	7 digits (3 place of decimal)	Ex. 0025250→ 25.25℃
ERROR	6 digits	Ex. 004000 → ERROR 4

13-2 DIGITAL input

Channel select

Receiving data

*	Symbol(start symbol)
0 2	Channel (Channel No.)
Receiving data	
* 0 2	To channel 2
* 0 5	To channel 5

Note •Outer channel change is preferred at first for channel change.

•Max. numbers of channel are different according to the units.

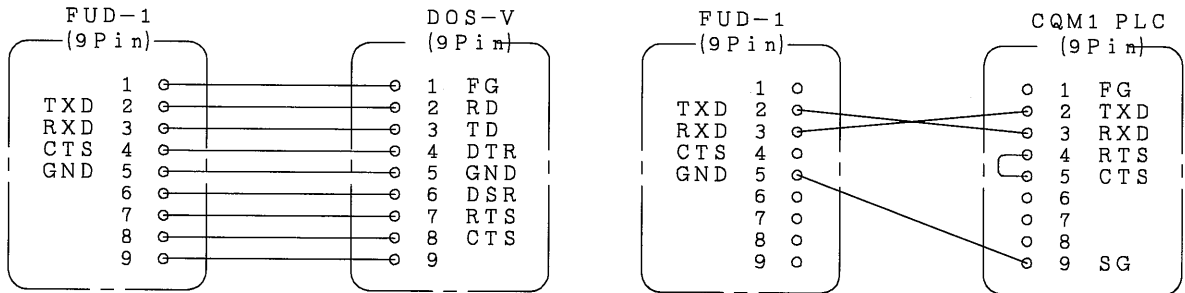
13-2 DIGITAL SPEC.

1) FUD-1

Pin No.	SIGNAL NAME	CONTENTS	I/O
2	TXD	Transmitted Data	O
3	RXD	Received Data	I
5	GND	Signal Ground (Common Return)	

- ① Signal name indicates the contents of concentration meter.
- ② I/O (input / output) indicates the status on the side of concentration meter.
- ③ Cable connector is female D-sub 9 pin
- ④ 7pin and 9pin connected in the transmitter.

RS232C Cable connecting example



2) "WRSCHECK" Windows edition (option) of reception software for PC.

Characteristic list of temperature of thermistor

Consider the values in chart as standard.

$$R0=14.885k\Omega \quad R25=5.300k\Omega \quad R50=2.159k\Omega$$

$$R75=0.991k\Omega \quad R100=0.4976k\Omega$$

<i>Temperature</i> ℃	<i>Resistance</i> <i>kΩ</i>	<i>Temperature</i> ℃	<i>Resistance</i> <i>kΩ</i>
0	14.885	42	2.838
2	13.638	44	2.647
4	12.506	46	2.471
6	11.477	48	2.309
8	10.541	50	2.159
10	9.690	52	2.021
12	8.915	54	1.892
14	8.210	56	1.773
16	7.567	58	1.663
18	6.980	60	1.561
20	6.445	62	1.466
22	5.956	64	1.378
24	5.508	66	1.296
26	5.099	68	1.220
28	4.725	70	1.148
30	4.382	72	1.082
32	4.067	74	1.020
34	3.778	76	0.963
36	3.513	78	0.909
38	3.269	80	0.858
40	3.044		

List-1

The above is a typical example calculated by general formula indicating characteristic of temperature-resistance of thermistor (Type PSB-S3 made by Shibaura Electronics Co., Ltd.) used in our concentration meter, and it is a little different from the unit delivered to you.

Characteristic list of ultrasonic velocity of distilled water

<i>Temperature</i> °C	<i>Velocity</i> <i>m/s</i>	<i>Temperature</i> °C	<i>Velocity</i> <i>m/s</i>
1	1408	26	1500
2	1413	27	1502
3	1417	28	1505
4	1422	29	1507
5	1427	30	1509
6	1431	31	1512
7	1435	32	1514
8	1439	33	1516
9	1444	34	1518
10	1448	35	1520
11	1452	36	1522
12	1455	37	1524
13	1459	38	1526
14	1463	39	1527
15	1466	40	1529
16	1470	41	1531
17	1473	42	1532
18	1476	43	1534
19	1480	44	1535
20	1483	45	1537
21	1486	46	1538
22	1489	47	1539
23	1492	48	1541
24	1494	49	1542
25	1497	50	1543

List-2

The above are the values calculated by experiment formula of Greenspan-Tschiegg.

Ultrasonic concentration meter

FUD-1 Sampling data

Customer's :

Body No. :

Solution :

Conc. range【C1】: ~ 【C2】 ~

Temp. range: ~

Cond. Range: ~ mS/cm

[illegible]

◀ Setting value ▶

DECIMAL POINT

•

AVERAGE

•

C1 OFFSET

(OFFSET volume) :

$$\vdots$$

C1 GAIN

(GAIN volume)

:

C2 OFFSET

(OFFSET volume) :

$$\vdots$$

C2 GAIN

(GAIN volume)

•

FUJI ULTRASONIC ENGINEERING CO., LTD.

Warranty Regulations

Warranty Period: The warranty period is 2 years from the date of shipment by our company. Should a product failure for which our company is responsible occur during that period, we will repair it free of charge. (The date of shipment is inscribed on the side of the transmitter.)

The following will be repaired for a fee even if occurring within the warranty period.

1. Product failure or damage caused by fire, disaster, abnormal voltage, etc.
2. Product failure or damage caused by inappropriate handling.
3. Product failure or damage caused by voltage, noise, etc., coming from the surrounding facilities, etc.
4. Product failure or damage caused by a failure of connected equipment.
5. Product failure or damage resulting from this product being dropped, hit, etc., while being transported or moved following its delivery.
6. Product failure or damage caused by inappropriate operation or maintenance, or by modification, etc.
7. Product failure or damage caused by corrosion, penetration, etc., of the transmitter by a measured liquid.
8. Product failure or damage caused by use or storage outside the specified range (of liquids, temperature, humidity, pressure, etc.).

Whether a repair will be free-of-charge or for-a-fee shall be determined by our company's Technology Department.

Scope of Warranty: This warranty applies to the main body of the product alone.

Miscellaneous:

1. Maintenance parts for this product shall be available for at least 7 years after the product is shipped. After 7 years, maintenance parts may be difficult to obtain and repairs may be impossible to carry out.
2. Should a separate contract, etc., exist the product shall be warrantied in accordance with its provisions.

*Please understand that the contents of the instruction manual may be changed without prior notice due to improvements in product quality or another reason deemed appropriate by our company.

CONTACT:
FujiUltrasonic Engineering Co., Ltd.
1068Iida-cho Minami-ku, Hamamatsu-city
Shizuoka-pref. 435-0028 Japan
TEL: +81-53-464-6449
FAX: +81-53-465-3815