

INSTRUCTION MANUAL

CONCENTRATION METER

This instruction manual covers the following products.

FUD-1 Model-12

Binary type standard model

Transmitter: Panel-mount type(NM-1-1)

FUD-1 Model-12

Binary type / Temp. output(Option) model

Transmitter: Panel-mount type(NM-1(T)-1)

FUD-1 Model-12C

Binary type / CE marking model

Transmitter: Panel-mount type(NM-1C-1)

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.

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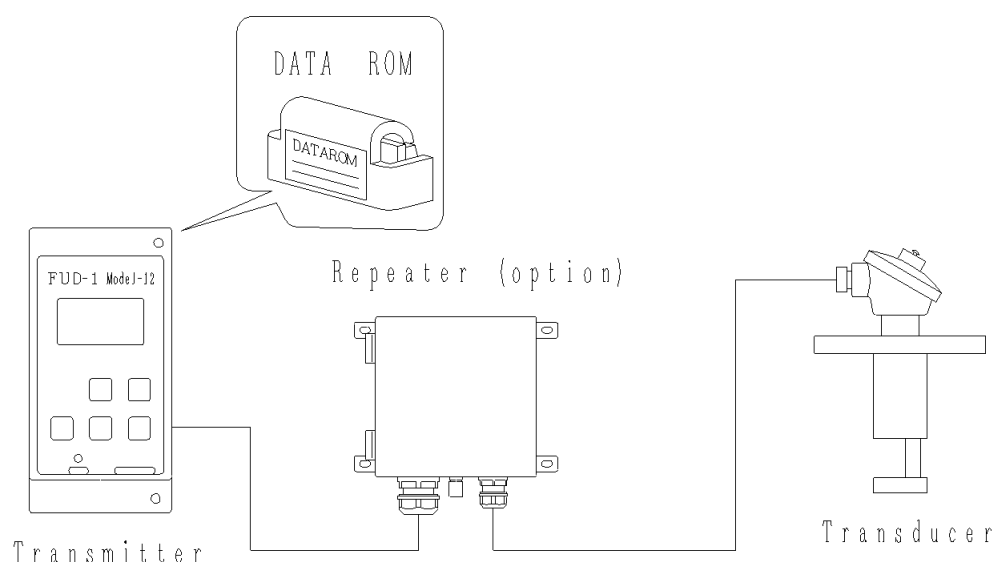
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1. OUTLINE

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-12/12C



- | | | | |
|------------------------|-------|-------------------------------------|-------|
| ① Transmitter | 1 | ⑥ Manual | 2pcs. |
| ② Transducer | 1 | ⑦ Inspection sheet | 1pcs. |
| ③ Repeater(option) ... | 1 | ⑧ Data ROM specification report ... | 1pcs. |
| ④ Cable | 1set. | | |
| ⑤ Fuse (spare) | 1pcs. | | |

3. APPLICATION

Measuring items, concentration range and the temperature range are specified in the separate inspection sheet.

4. SPECIFICATION

Measurement method	Ultrasonic propagation velocity method (Sing-around method)		
Temperature sensor	Thermistor		
Display (LCD)	Concentration	【 CONC. 】 6 digits (Max.)	0~3 decimal places
	Temperature	【 TEMP 】 6 digits (Max.)	0~3 decimal places
	Velocity	【 VEL 】 7 digits (Max.)	0~3 decimal places
Accuracy	In the separate inspection sheet.		
Output signal	Analog	DC4~20mA (correspond to concentration range)	
	Digital	RS232C	
Operational environment	Transmitter	0~50℃ RH85% or less	
	Transducer	0~100℃	
Power supply	AC100~240V±10V , 50/60Hz		
Power requirement	30VA or less		
Dimensions	Transmitter	Figure·1	
	Transducer	Figure·2	
Cable length	Transmitter ~ Transducer 10m (Power cable is not included)		
Notes			

变换器图面

発信器図面

中継器図面

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 (P 26).
- 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, don't turn the switch on until 10 or more 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

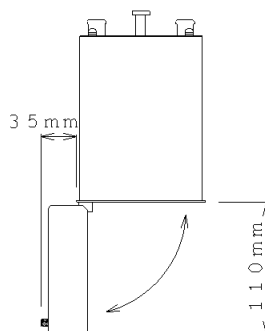
Beware of electric shock

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.

Transmitter



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 pipe in the transducer 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 P9)

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.

6-3 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 effective as IP55 enclosure when the fastener is locked completely.

3) The earth of the repeater must be grounded.

4) Don't remodel the repeater of the transducer.

6-4 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.

6-5 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)

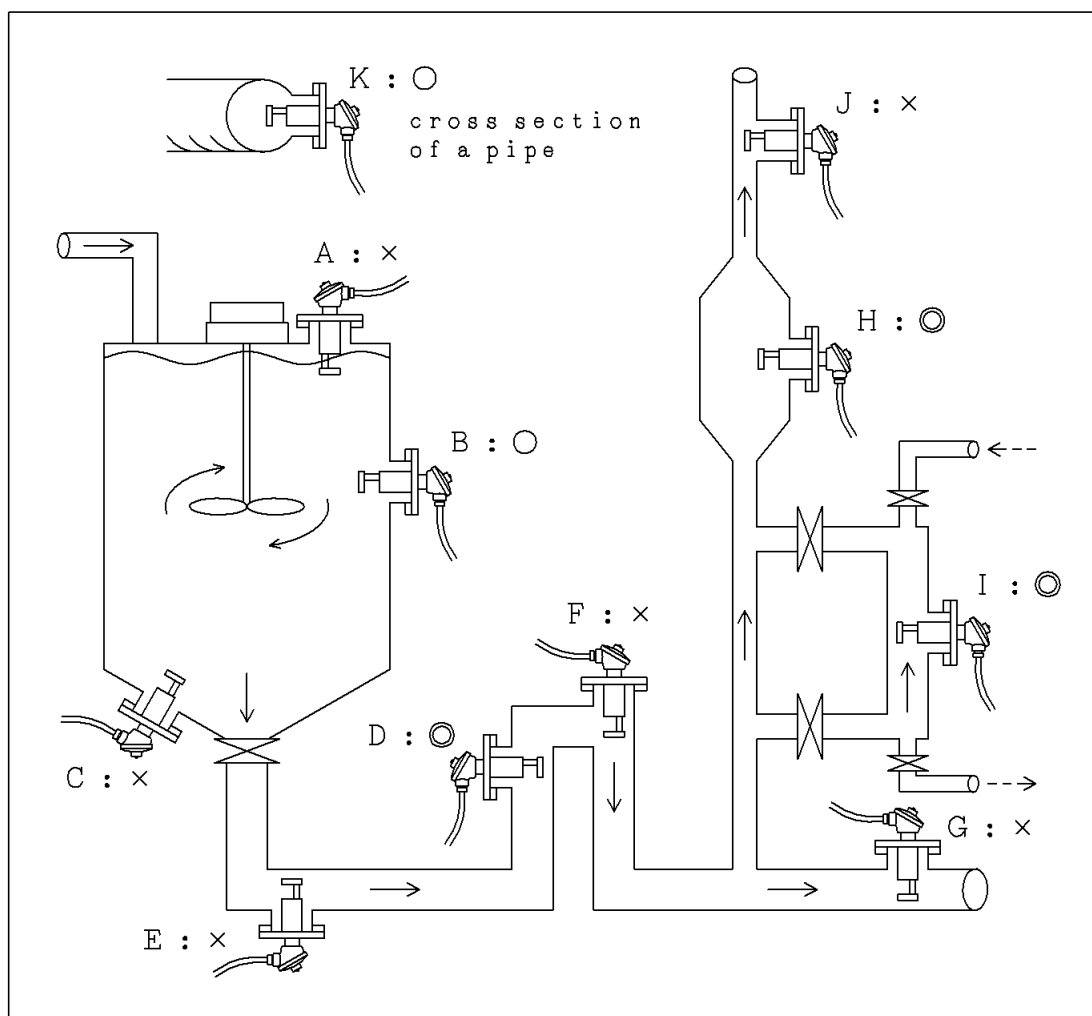
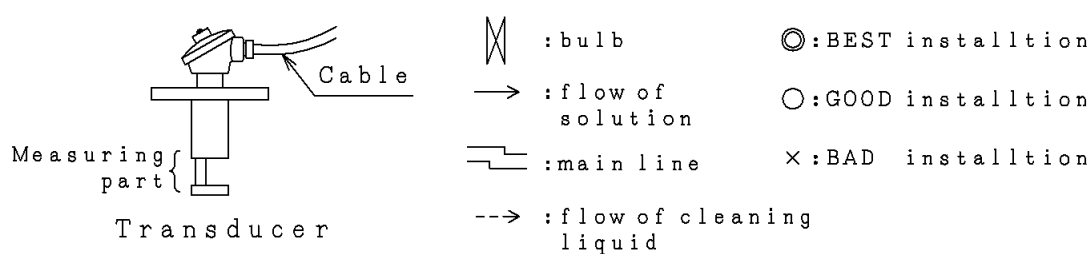


Fig-4 (A) Details are on the next page

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 if it is 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

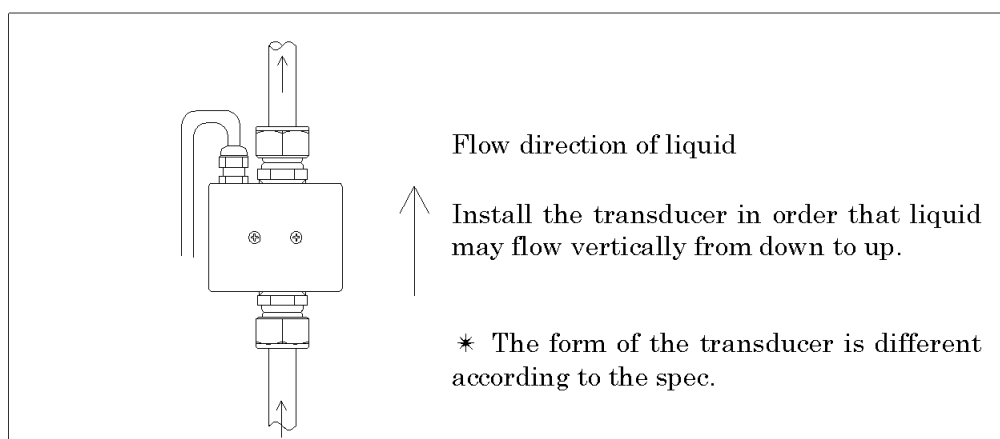


Fig-4 (B)

7. 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) The power switch of the transmitter is on when shipping the unit. Confirm the connection before giving the power.
- 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-12/12C

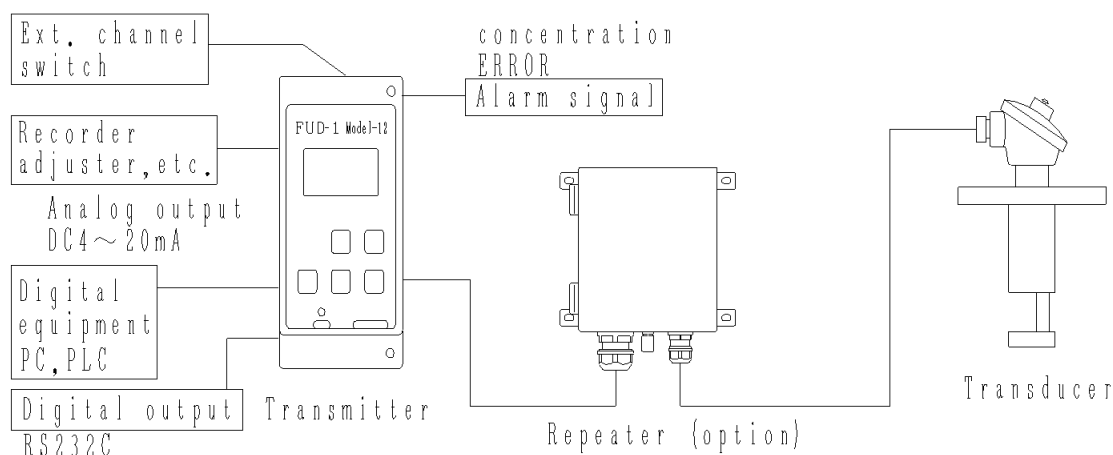


Fig-5 Model-12/12C connections

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

7-1 Terminal diagram

Fig-6 Terminal of transmitter

FUD-1 Model-12
(NM-1(T)-1, NM-1I-1)

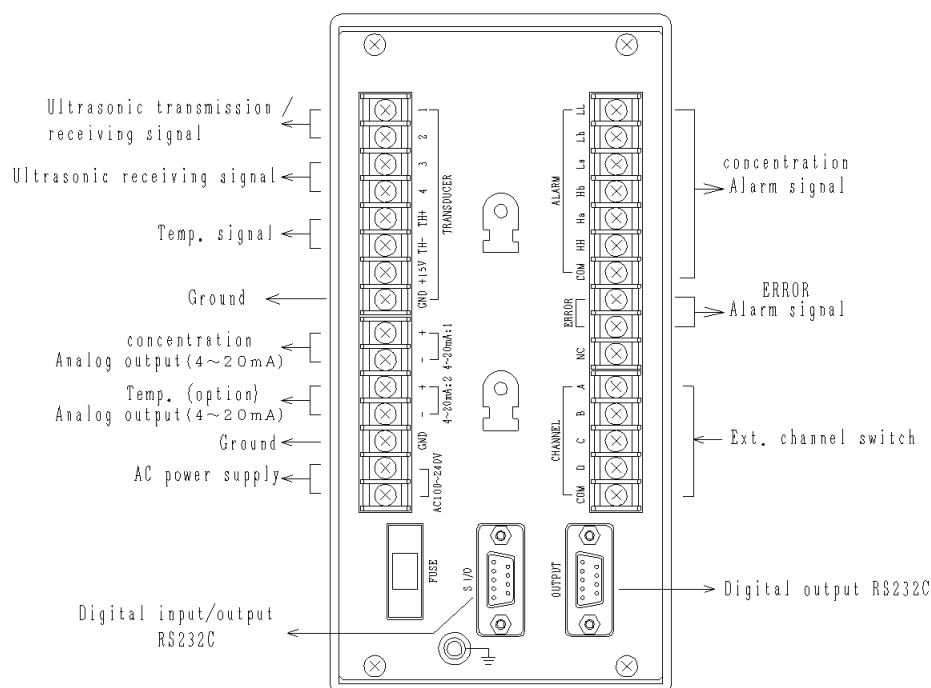
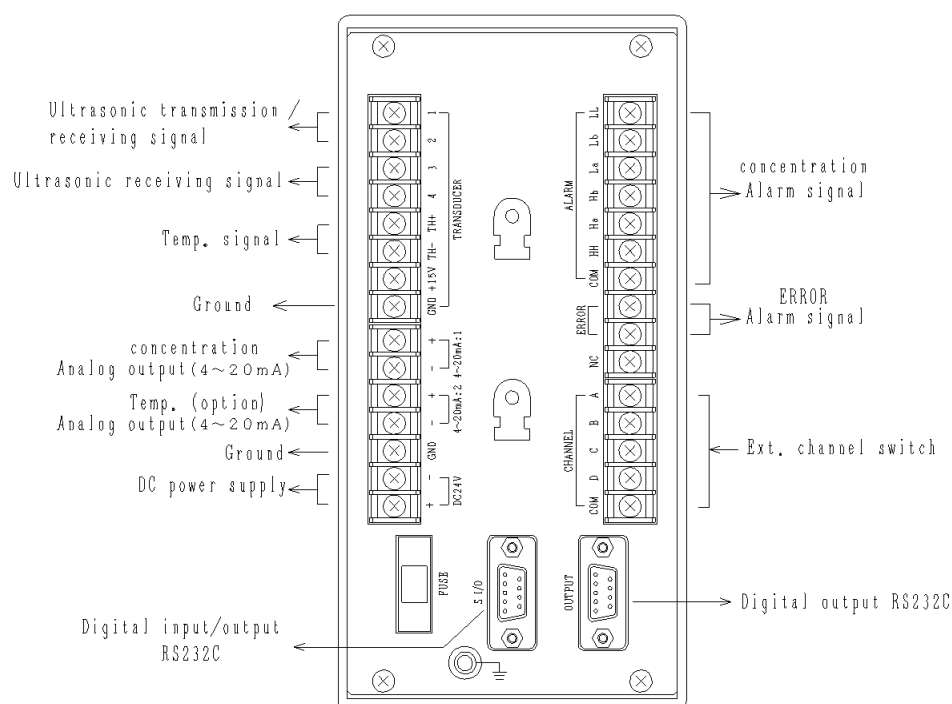
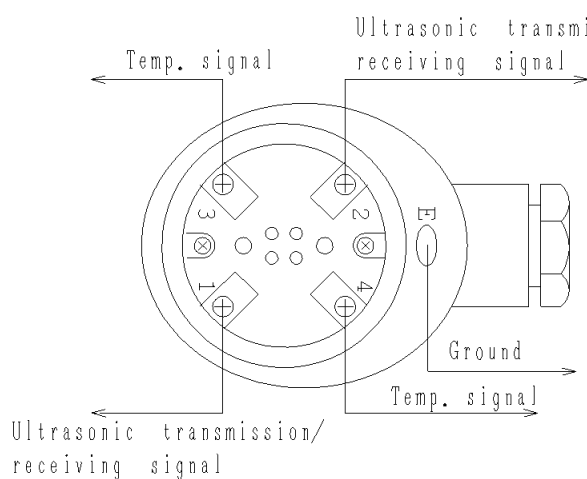


Fig-7 Terminal of transmitter

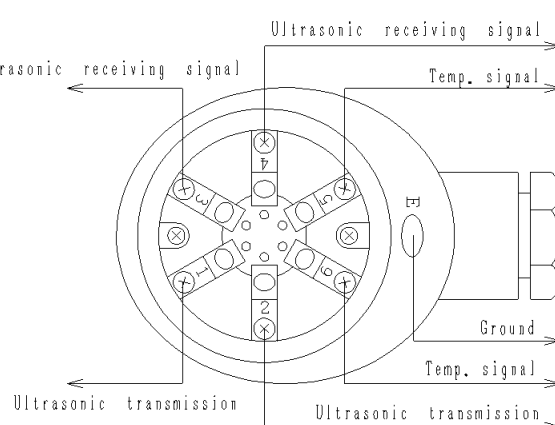
FUD-1 Model-12C
(NM-1C(T)-1)



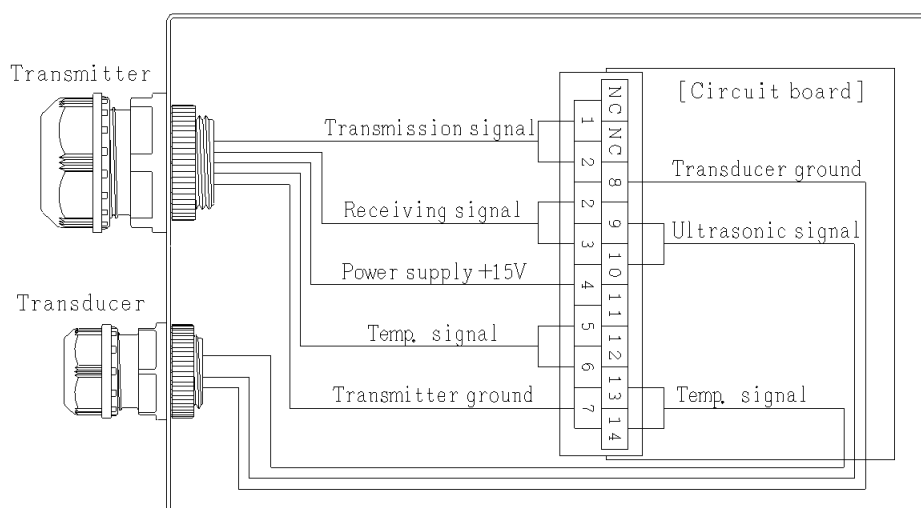
**Fig-8 Terminal of transducer
Reflection type
(S6-20J,ST-20J,S6-20H etc.)**



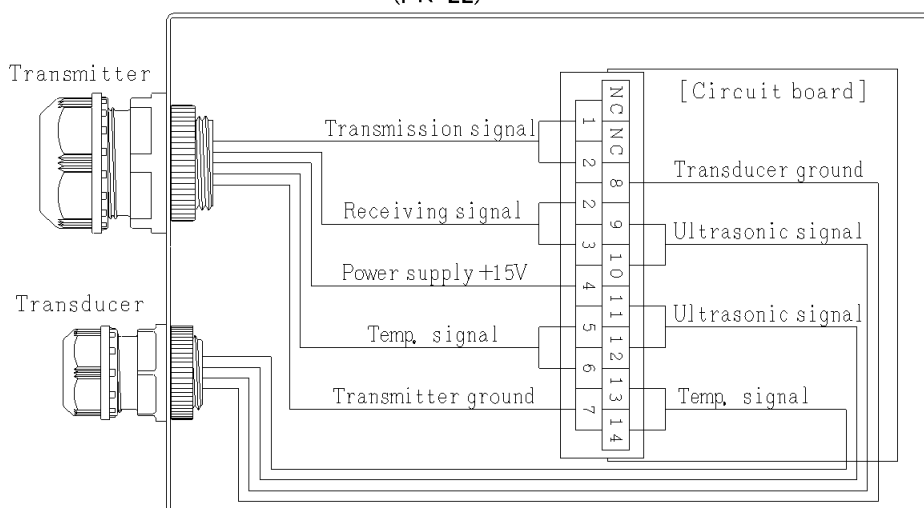
**Fig-9 Terminal of transducer
Over lap type
(SA-20M,SF-20M etc.)**



**Fig-10-1 Terminal of repeater(Reflection type transducer)
(PR-22)**



**Fig-10-2 Terminal of repeater(Over lap type transducer)
(PR-22)**



7-2 Connection diagram

FUD-1 Model-12/12C Reflection type transducer

Figure-11

Connection and wiring

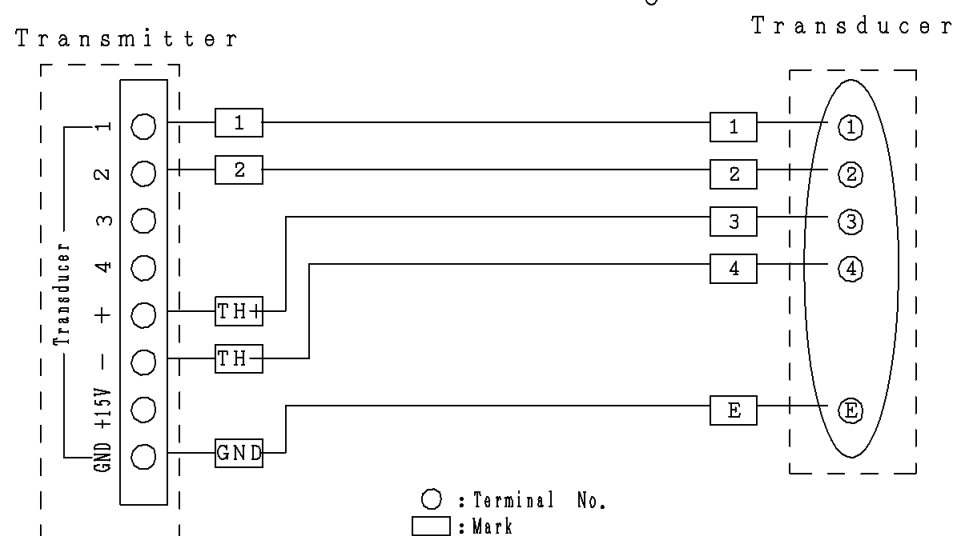


Figure-12

Cable specification

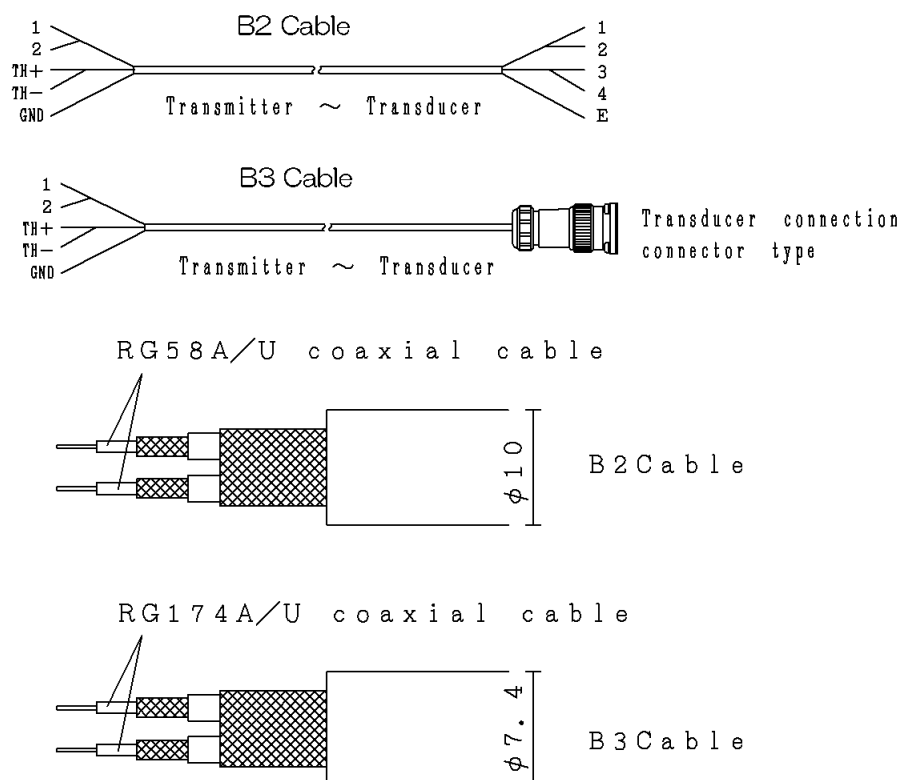


Figure-13
Connection and wiring

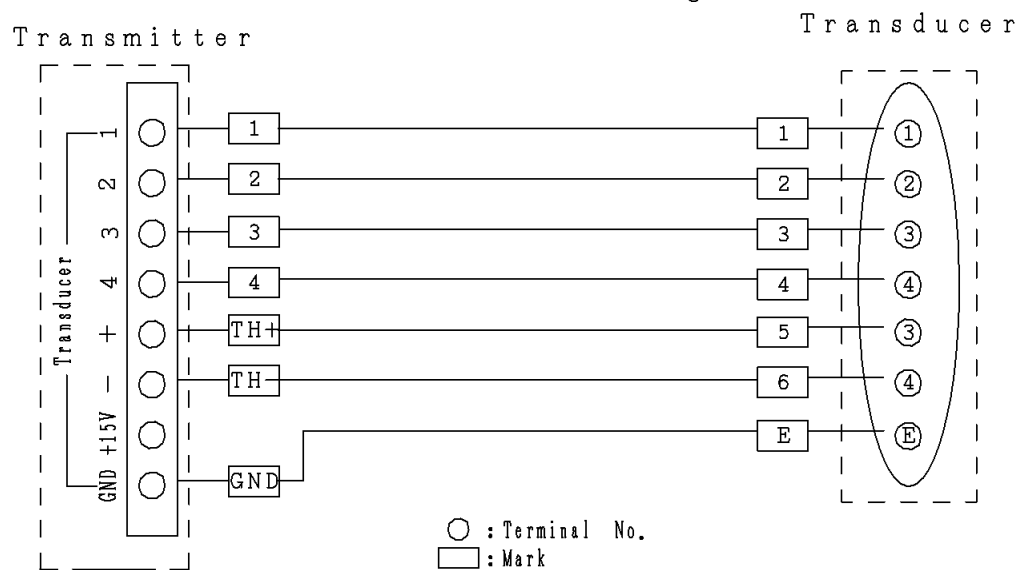


Figure-14
Cable specification

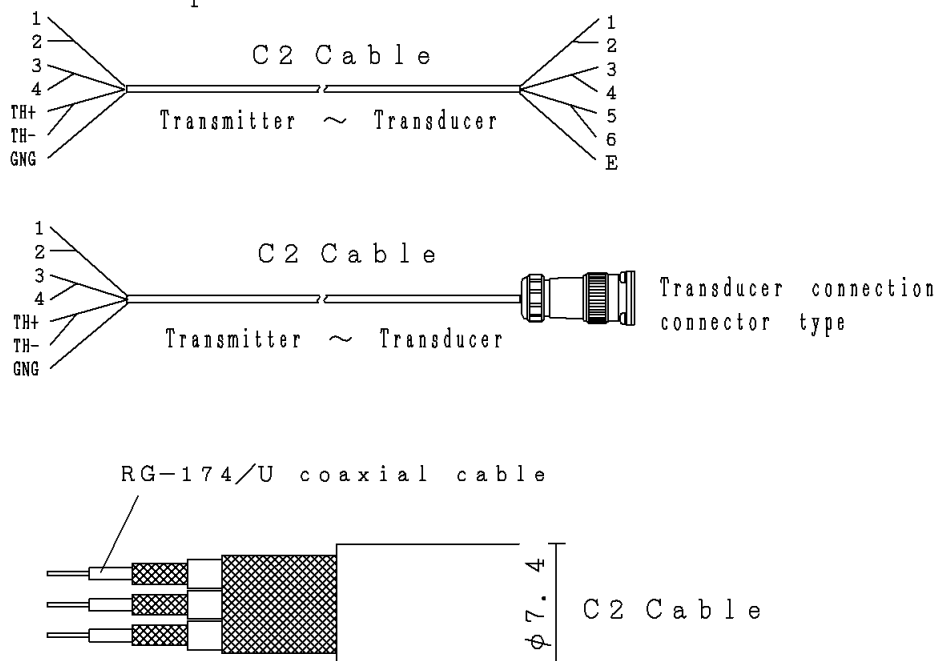


Figure-15
Connection and wiring

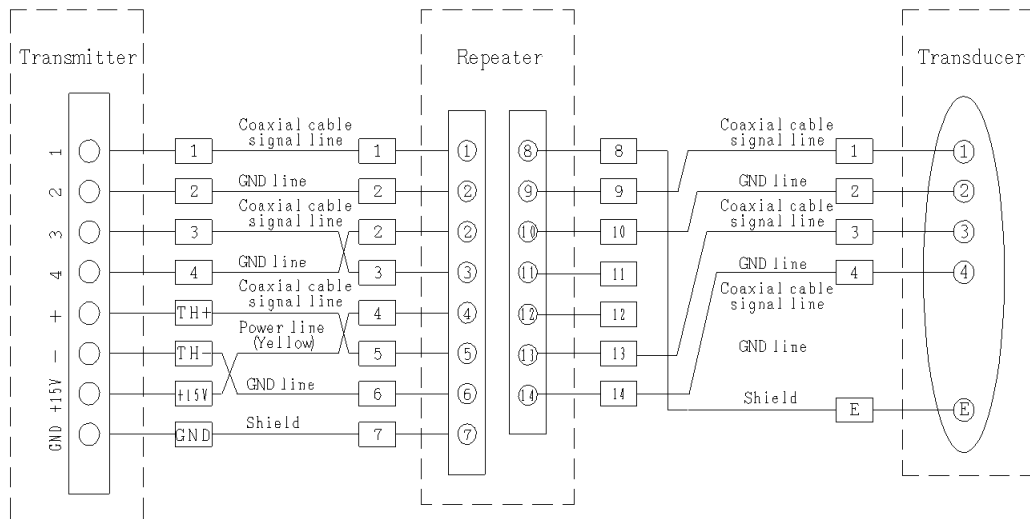


Figure-16
Cable specification

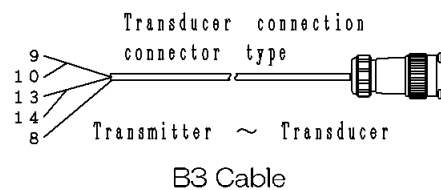
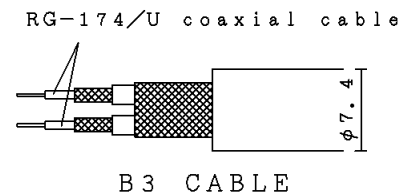
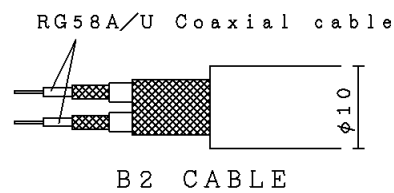
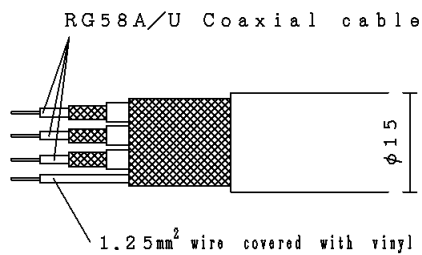
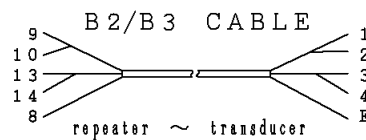
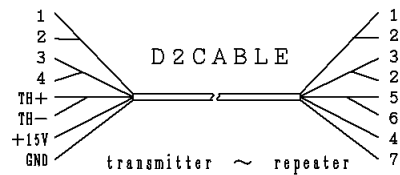


Figure-17
Connection and wiring

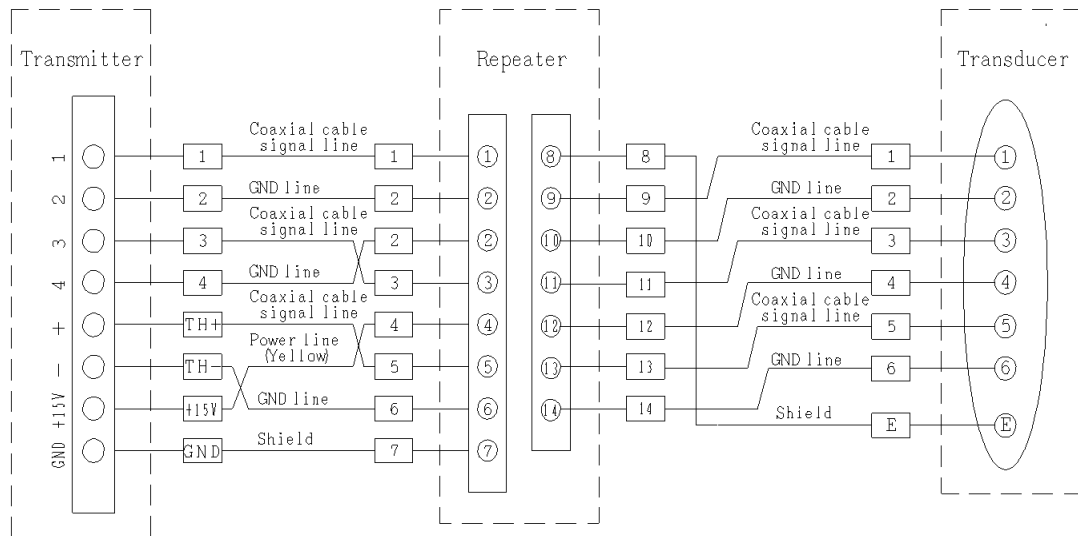
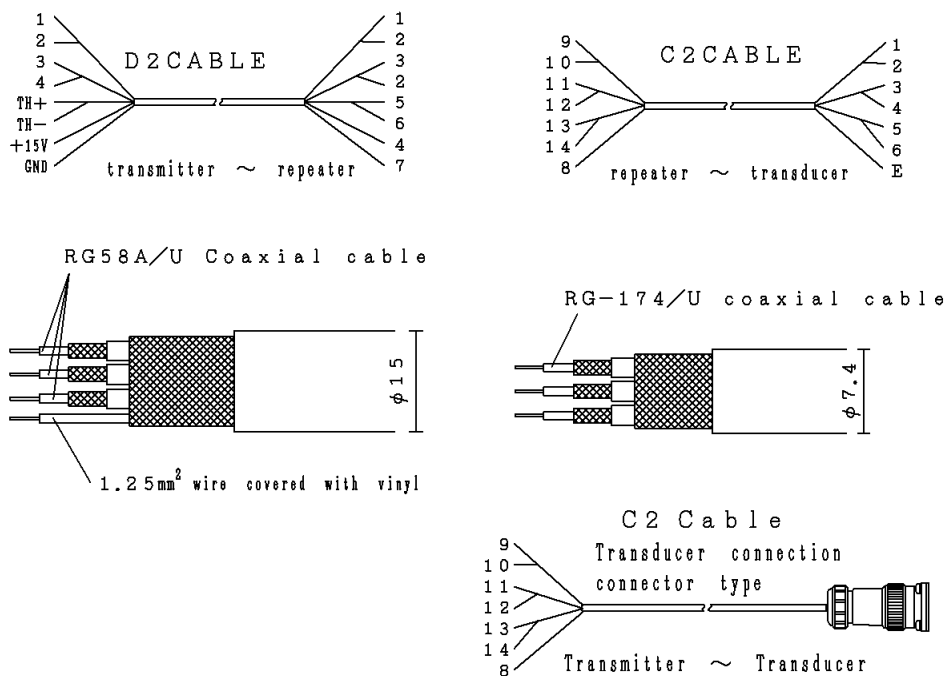


Figure-18
Cable specification



7-3 Assembly method of repeater cable outlet

FUD-1 Model-12/12C (option : with repeater PR-22)

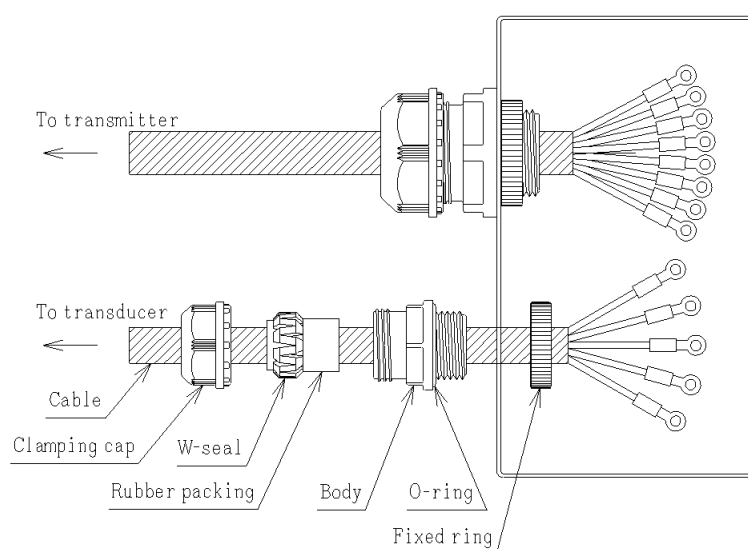


Fig-19 Assembly diagram of repeater Assembly method (only side on the transducer)

- ① Pass each part through the cable according to the diagram.
 - ② Fix a body to the repeater with a fixed ring.
 - ③ Insert the rubber packing into the body.
 - ④ Tighten the clamping cap 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

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.

9. OPERATION

9-1 Usual operation

- 1) Check each input and output terminal of transmitter, outer equipment, power source 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) Connecting the power from the source, measurement value and others are displayed on the screen.

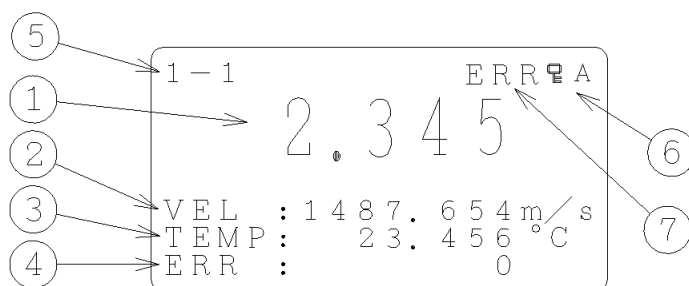
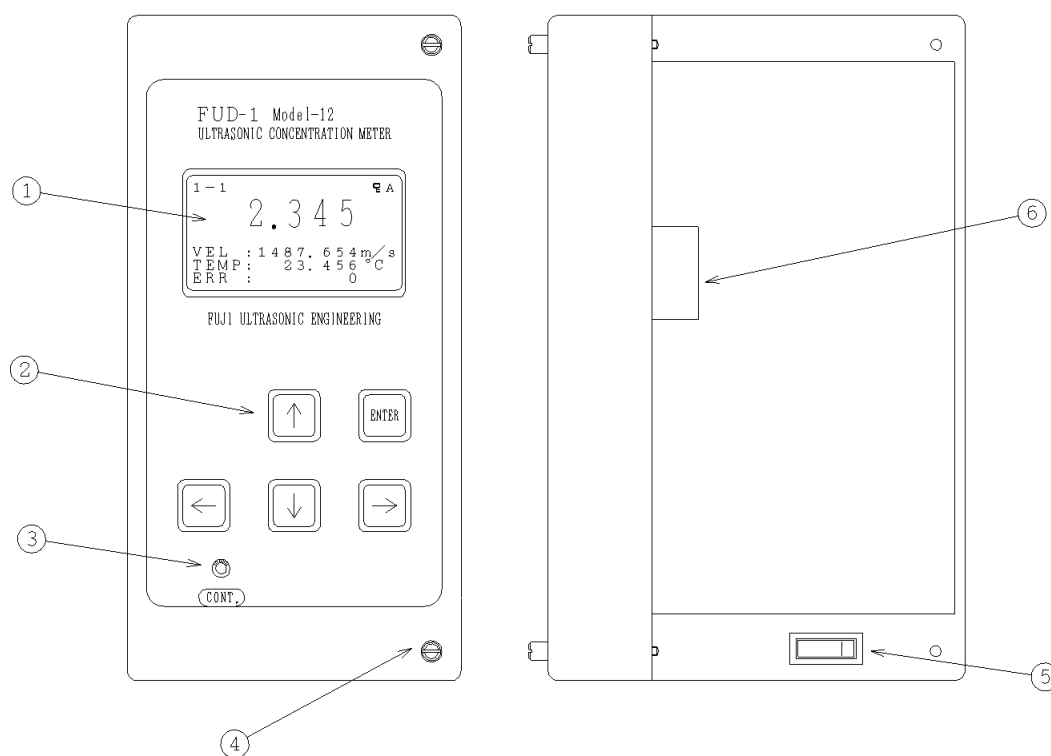


Fig-20 Contents of display

- ① Display of concentration measurement value
 - ② Display of velocity measurement value
 - ③ Display of temperature measurement value
 - ④ Display of error code
 - ⑤ [1·1] 1:channel No.
 2:Display No. of each channel
 - ⑥ [·A] :Display Lock (refer to P25)
 A:A.E.C. function display (refer to P27)
 - ⑦ [ERR] Light and blink when measurement error occurs (refer to P24)
- 3) DC4~20mA is output for analog output terminal corresponding to concentration output range. RS232C digital output is also available.
 - 4) Disconnecting the power from the source, when using 2 or more channels, the channel in use is memorized.

9-2 Name of each part and its function

(Front Panel)



< Front panel open >

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 Power switch | ON and OFF of power |
| ⑥ Data ROM | Element memorizing calibration curve |

(Rear Panel)

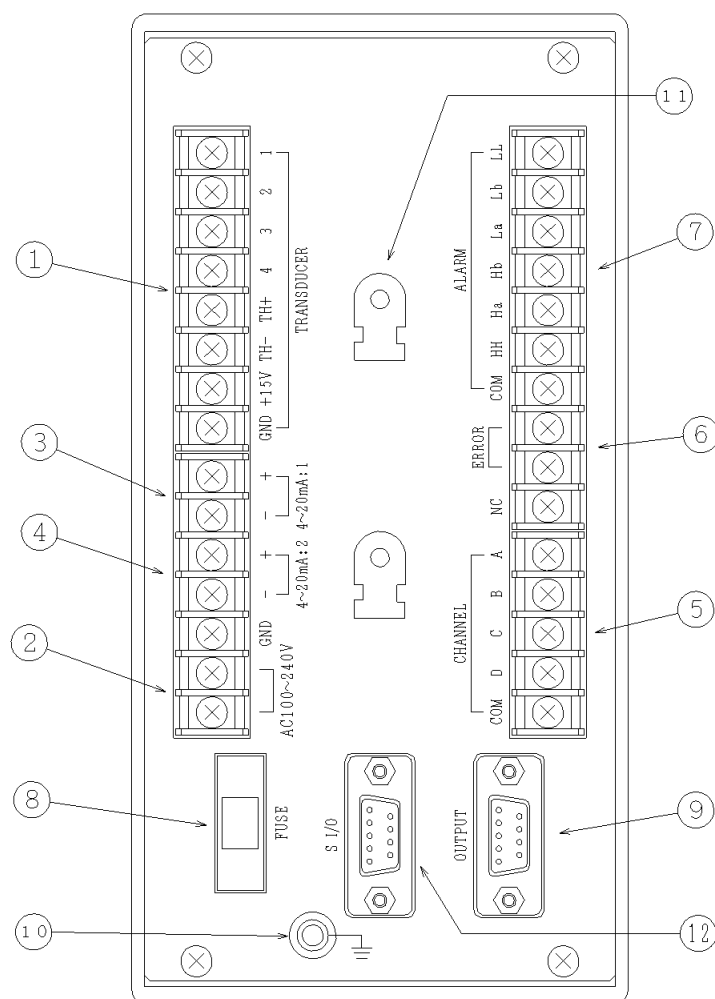


Fig-22 Rear panel

- ① Terminal(TRANSDUCER) Cable connection for transducer
- ② Terminal (AC100~240V or DC24V) ... Power cable connection
(GND) Earth cable connection
- ③ Terminal (4~20mA:1) Analog output connection(Concentration)
- ④ Terminal (4~20mA:2) Analog output connection(Temp.(option))
- ⑤ Terminal (CHANNEL SELECT) Connect if you change the channel from outside
- ⑥ Terminal (ERROR) Relay contact point(Measurement ERROR)
- ⑦ Terminal (ALARM) Relay contact point(ALARM)
- ⑧ Fuse case 250V 3A
- ⑨ D-sub 9p Female (OUTPUT) RS232C output connection(Output only)
- ⑩ Earth terminal Earth cable connection
- ⑪ Cable support
- ⑫ D-sub 9p Female (OUTPUT) RS232C output connection(Input or output)

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

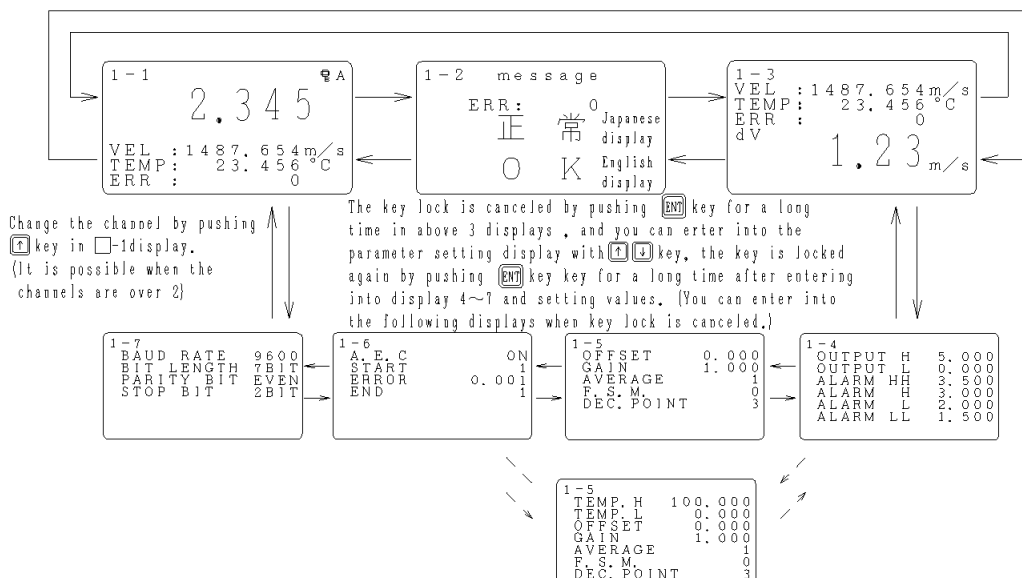
- Used for displaying VEL (velocity), TEMP (temperature) to increase decimal places in the initial display. (Usually display by 1 decimal place)
- Used for rising up the position of setting figure while setting parameter.

(→) 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.

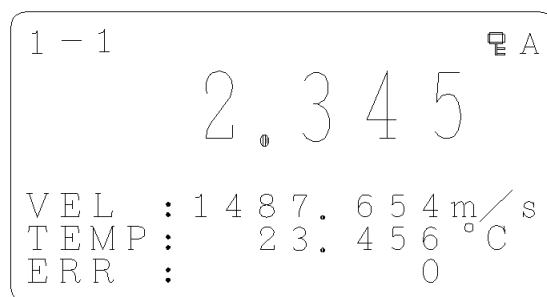
(ENTER) key

- The key mark () on the right top in the initial display is canceled in the measurement 1~3 display , 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. When pushing (ENTER) key again , the blink of the setting value finishes and the change finishes.



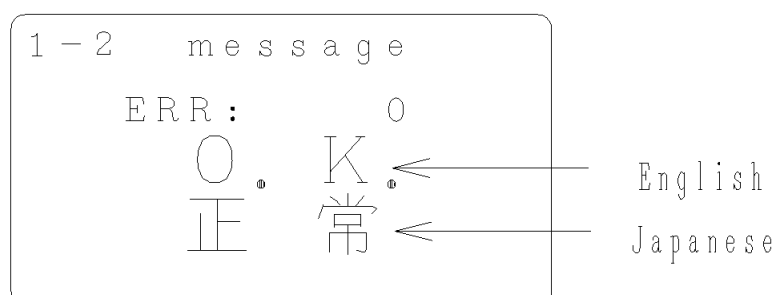
9-4 Contents display

★Display 1 (Concentration display)



- Concentration display (initial display)
 - Powering on after installation, initial display is indicated and indicates concentration, velocity, temperature and error of the solution.
- Contents of error code are shown below.

★Display 2 (ERROR display)



Display contents in case of troubles (English)

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

Display contents in case of troubles (Japanese)

Error code	Contents of error
0	Normal (正常)
1	Concentration measurement value is out of spec (出力範囲外)
20	Concentration calculation impossible (演算異常)
300	Temperature is out of spec or in the status of cutting or short circuit (温度異常 配線の確認)
4000	Receiving wave is damping (受信波異常 気泡の確認)
50000	Velocity measurement values vary greatly (音速異常)

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

★Display 3 (Velocity difference with distilled water)


```

1 - 3
VEL : 1 4 8 7 . 6 5 4 m/s
TEMP :      2 3 . 4 5 6 °C
ERR :                      0
dV
      1 . 2 3 m/s

```

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

Note) In case of error LCD blink

When  (key mark) is display (ENTER) key for about 2 seconds in the display 1 ~3 (any display is available). (lock by push it again) When it is locked, the display 1~3 is display by turns.

★Display 4 (Parameter setting 1)

```

1 - 4
▶ OUTPUT H      5 . 0 0 0
  OUTPUT L      0 . 0 0 0
  ALARM HH      3 . 5 0 0
  ALARM H       3 . 0 0 0
  ALARM L       2 . 0 0 0
  ALARM LL      1 . 5 0 0

```

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	: over 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 5 (Parameter setting 2)

Standard model

```

1 - 5
OFFSET      0. 000
GAIN        1. 000
AVERAGE    1
F. S. M.    0
DEC. POINT  3
  
```

•TEMP. H

Set the upper limit of analog output

•TEMP. L

Set the lower limit of analog output

•OFFSET

Set the OFFSET compensation volume in case there is an error in concentration value. Optional setting is possible in the range of ± 50.000 .

(Ex.) When you want to display concentration value higher by 3.33%, set the offset volume at +3.330.

•GAIN

Set gain (slant) when there is an error between concentration measurement value and analysis value. Optional setting is possible in range of 0~10.000.

(Ex.) 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: indicated value x: measured value)

•AVERAGE TIME

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

(Ex.) 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.

(Ex.) "4" --- In case of troubles (error 2 or 5) fix analog output to 4mA

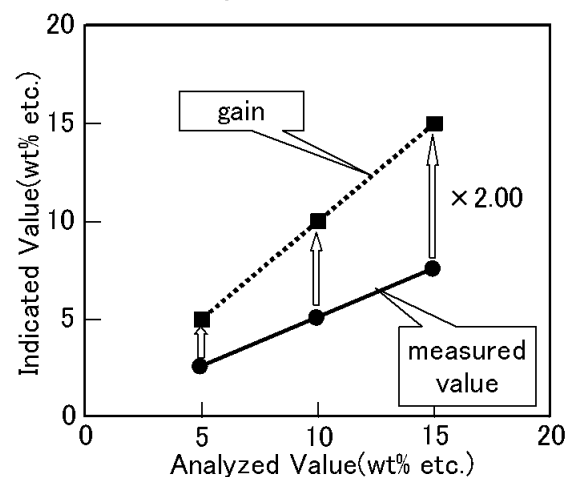
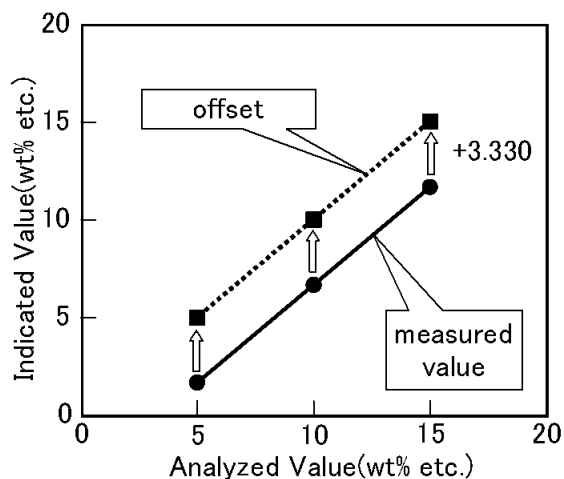
"20" --- In case of troubles (error 2 or 5) fix analog output to 20mA

"0" --- Output corresponding to conc. value in case of troubles(error 2 or 5)

Conc. and Temp. analog output model

```

1 - 5
TEMP. H    1 0 0. 000
TEMP. L    0. 000
OFFSET     0. 000
GAIN       1. 000
AVERAGE    1
F. S. M.    0
DEC. POINT  3
  
```



•DEC. POINT

Set the figure number (1~3) down to the decimal place.

★Display 6 (Parameter setting 3)

```

1 - 6
A . E . C          O N
S T A R T          1
E R R O R          0 . 0 0 1
E N D              1

```

•A.E.C.(Auto Error Celler 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

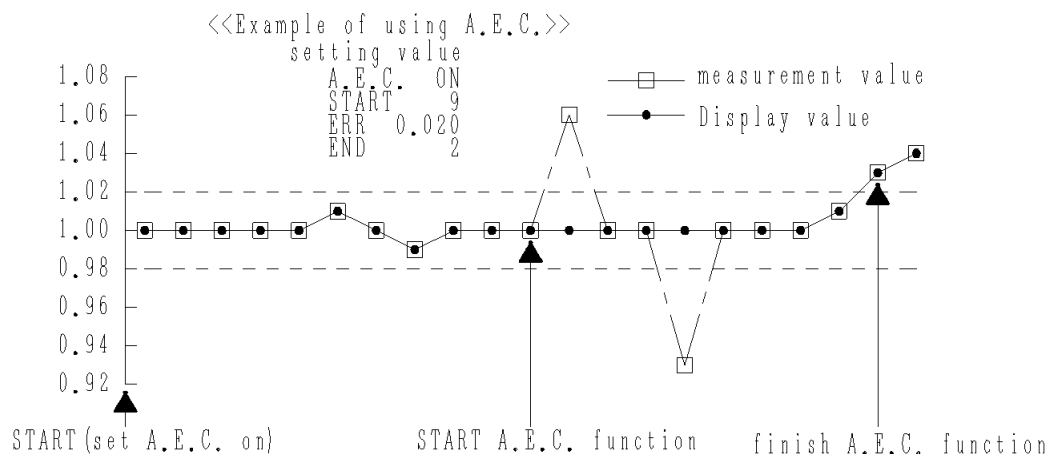
In case there are unusual values of (C) times in concentration values of past (A) times and the new concentration value is unusual, finish A.E.C. After finishing A.E.C. unusual values are reflected in each output, therefore when concentration values increase or decrease continuously, these values are 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
- ERR (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 7 (RS232C spec. setting)

```

1 - 7
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.

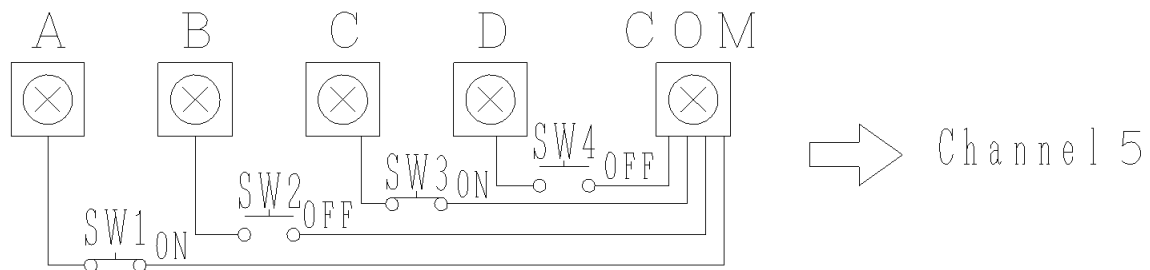
10. HOW TO USE THE REAR PANEL TERMINAL BOARD

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
	OFF	ON	ON	OFF	Channel 6
	ON	ON	ON	OFF	Channel 7
	OFF	OFF	OFF	ON	Channel 8
	ON	OFF	OFF	ON	Channel 9
	OFF	ON	OFF	OFF	Channel 10

(Example of outer change)



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

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

10-2 Concentration 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.

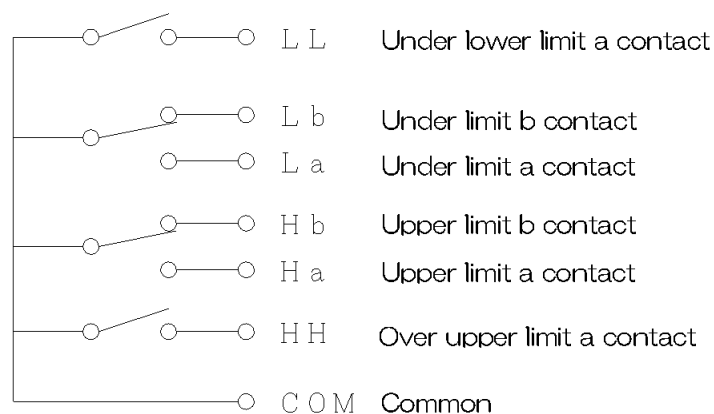
Alarm contact point over upper limit HH•LL(a contact point output)
•under lower limit contact point output

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.

Circuit diagram of ALARM TERMINAL



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 (P24) 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

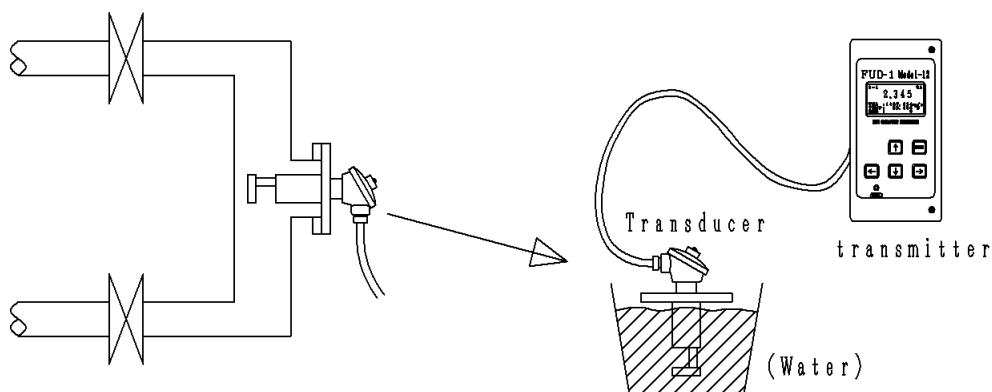
CAUTION Unit trouble

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.

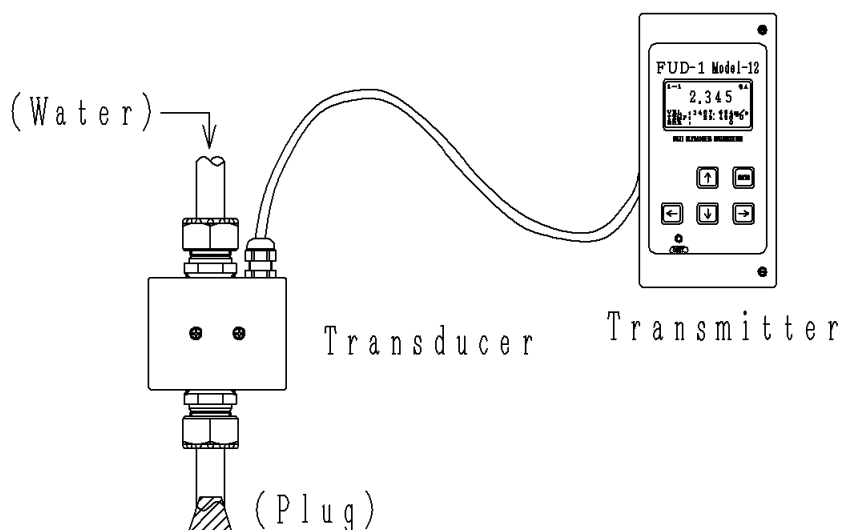
11. BASIC MOVEMENT CONFIRMATION

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

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



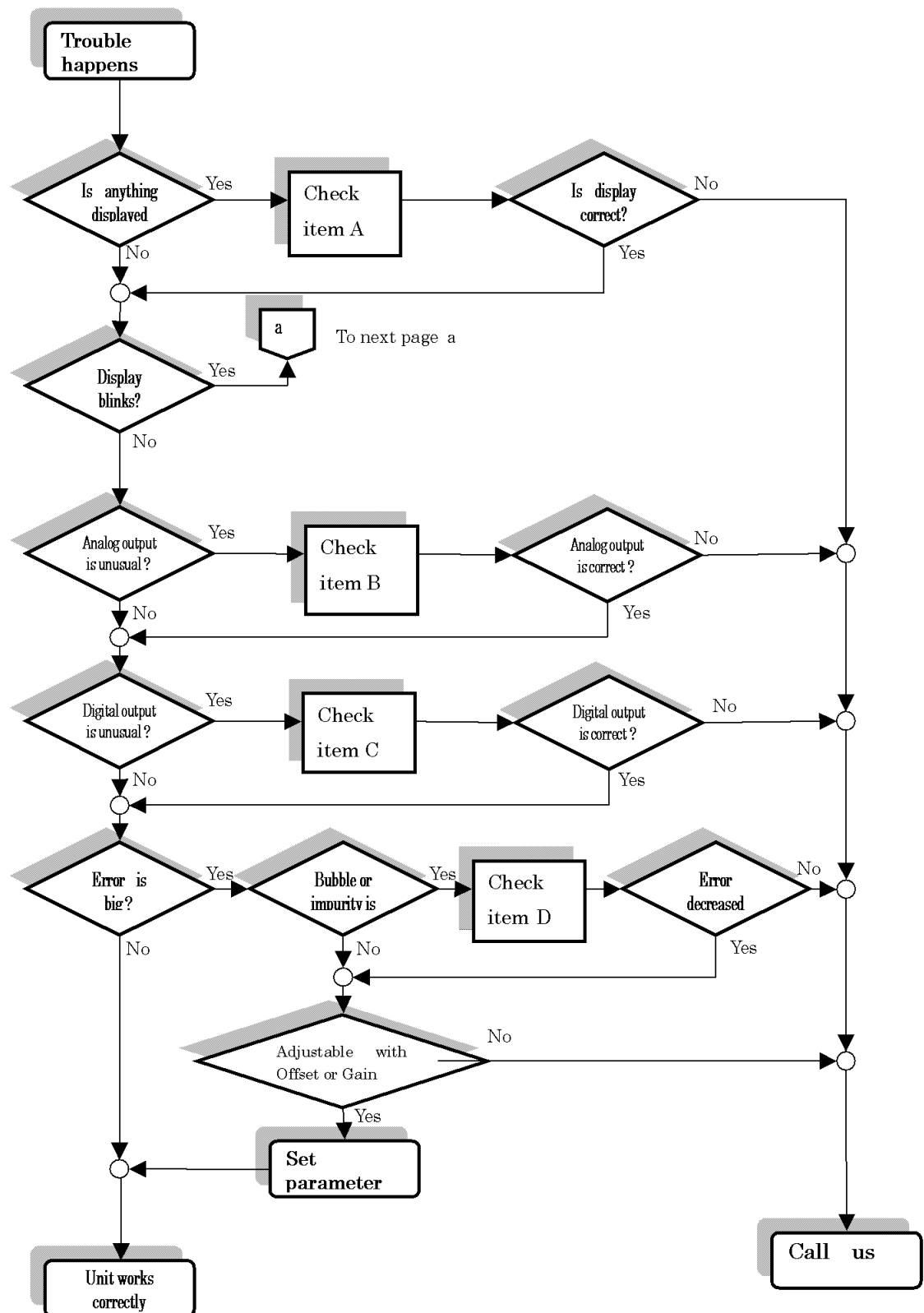
Remove the transducer and put water into the transducer and measure velocity and temperature of water for cell type transducer.
(Measure it after stabilizing temperature)

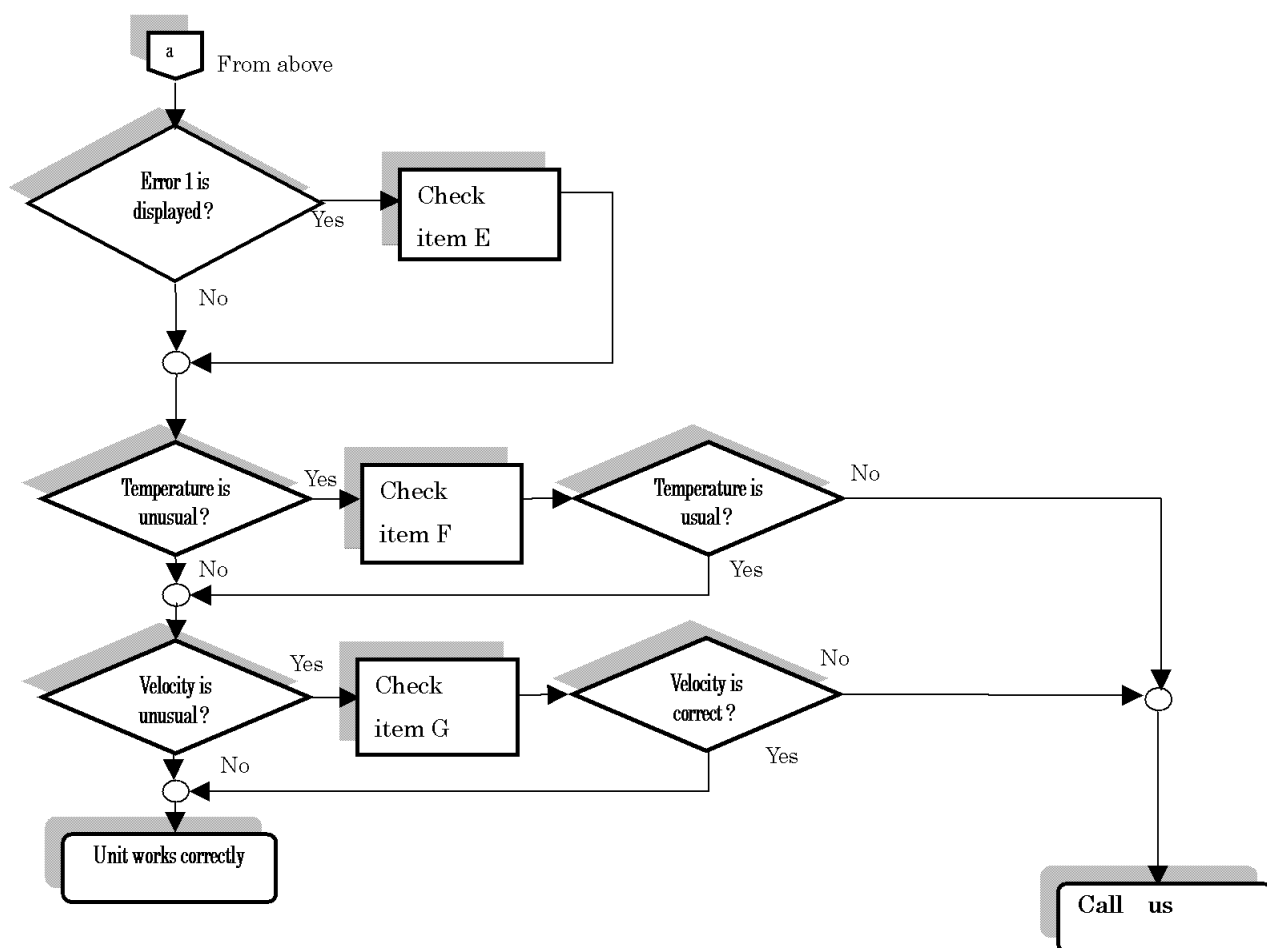


Compare this measurement value with characteristic list of ultrasonic velocity of distilled water on List-2(P38). The maximum permissible volume of difference of velocity is $\pm 2\text{m/sec}$. If it is over above volume, please call us. Measurement value may differ from other thermometers by $\pm 1^\circ\text{C}$,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

12 TROUBLE SHOOTING

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





A. ① Check the connection of the cord again.

② Check if fuse burns out.

B. ① Analog 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.

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

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

② Check 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. ① Concentration value is over the range of output concentration Check the setting of the range of concentration output.

② Check the concentration of the solution.

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

- F. ① When 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.
- ② When 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. ① Remove 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.
- (P·31 refer to the basic movement)
- ② If 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.
- ③ Check if there is an erosion of the part touching to the solution by the transducer.
- ④ Check if there is any stick such as dirty things to the reflection panel or sending and receiving plate of the transducer.
- ⑤ If there is a trouble in the conductivity , refer to manual of the conductivity.

13. RS232C DIGITAL SIGNAL

13-1 DIGITAL OUTPUT

- 1) Mode Asynchronous mode
- 2) Baud rate 9600 or 19200 bps
- 3) Character parameter Stop bit 2 or 1
Even or odd parity check
7 or 8-bit ASCII code (Refer to P29)

4) Data format

Sending data

* CR	* Symbol
0 2 CR	Channel No.
0 0 0 1 2 1 5 CR	Concentration
1 5 3 6 5 1 1 CR	Velocity
0 0 0 2 3 4 1 CR	Temperature
0 4 0 0 0 CR	Error

Contents of data

Number of figure	2 digits	Ex. 02	→ Channel 2
Concentration	7 digits	Ex. 0001215	→ 1.215%
Velocity	7 digits (3 place of decimal)	Ex. 1536511	→ 1536.511 m/sec
Temperature	7 digits (3 place of decimal)	Ex. 0002341	→ 2.341°C
ERROR	5 digits	Ex. 04000	→ ERROR 4

13-2 DIGITAL INPUT

Channel select

Receiving data

*	*Symbol
0 2	Channel (2 digits)

Receiving data

* 0 2	To channel 2
* 0 5	To channel 5

- Note) • Terminal at rear panel for channel select is prior to other channel select sources.(All others)
- Maximum channel numbers is as specification of the item.

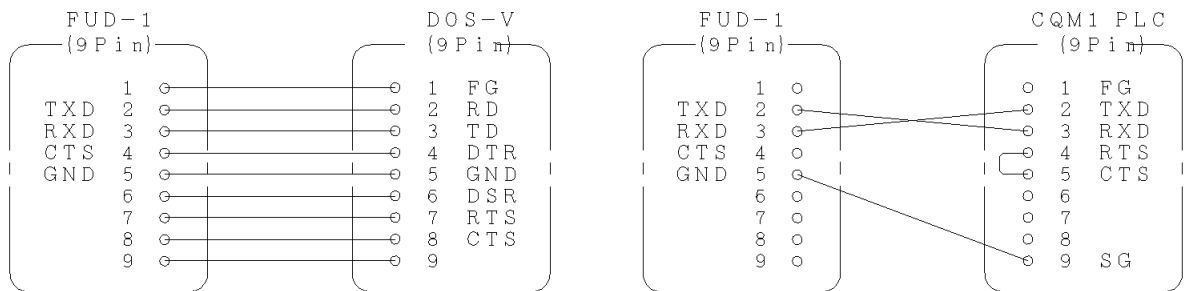
13-3 WIRING

1) Signal name and contents

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 8pin connected in the transmitter.

2) RS232C Cable connecting example



3) We have “WRS CHECK” Windows edition (option) of reception software for PC.

14. LIST

List-1 Characteristic list of temperature of thermistor

Consider the values in chart as standard.

$$R_0=14.885k\Omega \quad R_{25}=5.300k\Omega \quad R_{50}=2.159k\Omega$$

$$R_{75}=0.991k\Omega \quad R_{100}=0.4976k\Omega$$

<i>Temperature</i> °C	<i>Resistance</i> kΩ	<i>Temperature</i> °C	<i>Resistance</i> kΩ
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) used in our concentration meter, and it is a little different from the unit delivered to you.

List-2 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.

No.

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 warranted 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.

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