TOSHIBA

FCC ID : M8D62378Y06

OPERATION MANUAL FOR DENSITY METER TYPE LQ300

TOSHIBA CORPORATION

INTRODUCTION

Thank you very much for your purchase of an LQ300 Density Meter.

This manual is prepared for people in charge of installation, operation or maintenance. The manual describes the precautions in using the meter, and explains about installing, adjusting, calibrating and maintaining the LQ300 meter.

Carefully read this manual before using the meter for efficient and safe operation. Always keep the manual in a place where you can easily access.

◆ About Safety Precautions

Carefully read the Safety Precautions that appear in the following pages before using the Meter.

The safety signs used in the Safety Precautions will appear again in the following sections for your safety.

SAFETY PRECAUTIONS

Important information is shown on the product itself and in the operation manual to protect users from bodily injuries and property damages, and to enable them to use the product safely and correctly.
Please be sure to thoroughly understand the meanings of the following signs and symbols before reading the sections that follow, and observe the instructions given herein. Keep the manual in a place you can easily access to whenever you need it.

[Explanation of Signs]

Sign	Description
⚠WARNING	Indicates a potentially hazardous situation which could result in death or serious injury, if you do not follow the instructions in this manual.
⚠CAUTION	Indicates a potentially hazardous situation which may result in minor or moderate injury, and/or equipment-only-damage if you do not follow the instruction in this manual.

Note 1: Serious injury refers to cases of loss of eyesight, wounds, burns (high or low temperature), electric shock, broken bones, poisoning, etc., which leave after-effects or which require hospitalization or a long period of outpatient treatment of cure.
Note 2: Minor or moderate injury refers to cases of burns, electric shock, etc., which do not require hospitalization or a long period of outpatient treatment for cure; equipment damage refers to cases of extensive damage involving damage to property or equipment.

[Explanation of the Symbols]

Symbol	Description
	This sign indicates PROHIBITION (Do not). The content of prohibition is shown by a picture or words beside the symbol.
	This sign indicates MANDATORY ACTION (You are required to do). The content of action is shown by a picture or words beside the symbol.
	This shape or symbol indicates Hazard Alert. Be alert against hazard and be alert for safety. The content of alert is shown by a picture or words beside the symbol.

SAFETY PRECAUTIONS

For a safe use of the LQ300 Density Meter, take precautions described in this manual and observe ordinances in making the installation and operation. Toshiba is not responsible for any accident arising from the use that does not conform to above.

INSTALLATION PRECAUTIONS

⚠WARNING


DO

■The meter is heavy. To move them or relocate them may need a qualified operator for handling a crane, a hoist or a truck for safe operation. When hoisting the detector by hoisting bolts, screw the bolts fully to the base.

Overturning or dropping can cause injuries or equipment failure.


DON'T

■Do not operate where there is a possibility of leakage of flammable or explosive gas.

A fire or explosion can occur.

⚠CAUTION


DO

■Avoid installing the meter in any of the following places:

- ●Dusty place
- ●Place where corrosive gases (SO2, H2S) or flammable gases may be generated.
- ●Place exposed to vibration or shock that exceeds permissible level.
- ●Place exposed to condensation due to abrupt change in temperature.
- ●Place too cold or hot for installation
- ●Place too humid for installation
- ●Near an apparatus that generates strong radio waves or strong magnetic field.

Otherwise, a fire or equipment breakdown or failure can occur.


DO

■Install the meter in a place that is good for operation, maintenance and inspection.

A stumble or an overturn can cause injuries.

SAFETY PRECAUTIONS

WIRING PRECAUTIONS

⚠WARNING

DO ■Be sure to install a fuse and a switch to disconnect the equipment from the power source. An external disconnecting device and fuse are required for the equipment. It is recommended that they have ratings of Fuse : 250VAC 3A Switch : 250VAC 10A,2 pole and be located near the equipment and within easy operation. Mark on the switch as the disconnecting device for the eqipment. Failure to observe this can cause electric shock or equipment failure.	DO ■Be sure to ground the equipment using a grounding wire separate from those used for power tools. The grounding wire of power source cable must be connected at protective conductor terminal shown ⏚ (at the under side of L1 terminal). Without grounding, electric shock, malfunction, or equipment failure can be caused by electric leakage.
DO ■Make sure that the main power line is off before wiring or cabling. Wiring or cabling without switching off the main power line can cause electric shock.	DO ■Use crimp terminals with insulation sleeves for power line and grounding wire terminals. A disconnected cable or wire from the terminal or a loose terminal can cause electric shock or generate heat and cause a fire or equipment failure.
DO ■Wiring and cabling should be done as shown in the wiring and connection diagrams. Wrong wiring or cabling can cause malfunctions, overheating, sparking, or electric shock.	DON'T ■Do not wire or cable with wet hands. A wet hand can cause electric shock.

The label shown at left is placed near a terminal block on the equipment to which power is supplied. Be careful of electric shock.

SAFETY PRECAUTIONS

PRECAUTIONS REGARDING MAINTENANCE, INSPECTION, AND PARTS REPLACEMENT

⚠WARNING

DO ■Be sure to set the power switch on the equipment to the OFF position before doing maintenance or inspection inside the equipment or replacing its parts. Failure to observe this can cause electric shock or equipment failure.	DO ■Be sure to set the power switch on the equipment to the OFF position before replacing the fuse. Failure to observe this can cause electric shock.
DON'T ■Do not touch the terminal block during maintenance or inspection. If it is necessary to touch the terminal block, set the power switch on the equipment to the OFF position in advance. Failure to observe this can cause electric shock.	The label shown at left is placed near each terminal block on the equipment to which power is supplied. Be careful of electric shock.

[NOTE] Sign

In addition to the signs and symbols for safety precautions shown in the first several pages of the manual, the following sign is also used.

◆ [NOTE] Sign

When an explanation is made in the text regarding the Safety Precautions, the [NOTE] sign shown below appears in the left margin of a page. The [NOTE] gives you directions to follow in the following instances.

To use product correctly and effectively
To prevent abnormal or degrading performance of the product.
To prevent faulty actions.
To store the product when you do not use the product for a long time.

【NOTE】

Limited Applications of the product

This product is not designed or manufactured for the purpose of applying to the systems, such as shown below, which require the level of safety that directly concerns with human life. When your use includes potential applications in those systems, contact Toshiba for consultation.

- Main control system for atomic power generating plant/Safety protection system for nuclear facilities/Other critical safety systems/medical control system for sustaining life

Liability Exemptions

Toshiba assumes liability exemptions from the following examples.

- Damages caused by fire, earthquake, actions by third party, other accidents, abuse or faulty use whether accidental or intentional by the user, or by other uses of abnormal conditions.
- Damages or losses that are incidental to the use of or disuse of the product (loss of business profit, interruption of business operation, etc.)

Important Notes on Use of LQ300 Density Meter

Be sure to observe following instructions in order to maintain the original performance of the LQ300 Density Meter and safely use it over a long period of time.

◆Toshiba is not held responsible for any fault or result caused by not observing the precautions described in this manual or by not observing the laws or regulations in installing or using the product.

[NOTE]	Do not install or store the product in the following places. Otherwise, meter performance can deteriorate and malfunction, fault, or breakage can occur. Place exposed to direct sunlight Hot, humid place Place exposed to severe vibration and shock Place that can be under water Place of corrosive atmosphere
[NOTE]	Use a separate wire for grounding the meter. Do not share the same grounding wire with other devices. Otherwise, malfunction, fault, or breakage can occur.
[NOTE]	Lay the output signal cable through their own conduit away from the AC power cable and other sources of noise. Noise can interrupt correct measurement.
[NOTE]	Perform perodic maintenance and inspection. A long period of reliable measurement requires periodic calibration of the zero point and range. Be sure to calibrate them.
[NOTE]	Be careful not to let water or moisture into the applicator mount of the detector,converter, or cable ends. Water or moisture can adversely affect performance and shorten parts service life. Close the covers and doors securely, and make the cable outlets airtight.
[NOTE]	Do not remove the cover from the applicator mount of the detector while the meter is in operation after switching power on.
[NOTE]	Do not step on any part of the detector (temperature detector mount, applicator mount, signal processing unit, for example) when you do piping work. Do not place any heavy object on it. Otherwise, deformation or fault can occur.

Important Notes on Use of LQ300 Density Meter

[NOTE] Do not use a transceiver, handy telephone, or other wireless device nearby.
Such a device can adversely affect correct measurement. In the event one must be used, observe the following precautions.

(1) When using a transceiver, make sure that its output power is 5W or less.
(2) When using a transceiver or a handy telephone, keep the converter and signal cable at least 50cm away from the antenna.
(3) Do not use a transceiver or a portable telephone nearby while the density meter is in online operation. This is important to protect if from being affected by a sudden output power change.
(4) Do not install the fixed antenna of a wireless device in the area around the converter and signal cable.

[NOTE] Use a fuse of the specified rating.
A fuse other than that specified can cause meter malfunction or breakage.

[NOTE] Do not modify or disassemble the density meter unnecessarily. Do not use parts other than specified.
Failure can cause malfunction and meter fault.

[NOTE] When moving the meter elsewhere for installation, be careful not to drop, hit, or subject to strong shock.
Otherwise, the meter may be broken, resulting in malfunction or fault.

[FCC notice]

This equipment has been tested and found to comply with the limits for a field disturbance sensor, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, it may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures.

- Reorient the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING: This equipment has been certified to comply with the limits for a field disturbance sensor, pursuant to Subpart C of FCC Rules. Except AC power cable, shielded cables must be used between the external devices and the terminals of the converter of the equipment.
Changes or modifications made to this equipment, not expressly approved by Toshiba or parties authorized by Toshiba could void the user's authority to operate the equipment.

Contents

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1 OVERVIEW

The LQ300 Density Meter measures the density of a substance that flows through a pipe by means of a phase difference method using microwaves.

This method is little affected by the presence of contamination or bubbles. It uses no moving mechanical parts or mechanism that is often used in other measuring methods for cleaning, sampling, or defoaming. It permits continuous measurement.

The density meter, which outputs measured density in electric current, is suitable for an application in a process for monitoring and controlling.

1.1 Features

(1) Contamination and bubbles hardly affect the phase difference method using microwaves
(2) It is highly reliable because it does not use any moving mechanical parts. It is easy to maintain because it has no parts that wear out or expendable.
(3) The meter is flow-through type and is capable of continuous measurement.
(4) The measuring range (upper range and lower range) can be easily changed.
(5) The built-in microprocessor makes complex functions automatically in the density calculation, correction and alarm setting, thereby making the measurement operations easier.

1.2 Principle of Measurement

This density meter has adopted a new measuring method called "Phase difference method by microwaves." When microwaves go through a substance and comes out of it, by measuring the phase lag of the waves, we get a certain physical property of the substance that is proportional to the density.

The theory of density measurement based on the phase difference method is shown in Figure 1.1

The difference between the phase lag θ_1 of the microwave received through water (density 0%) and the phase lag θ_2 of the microwave received through the object substance, that is,

$$\Delta\theta = \theta_2 - \theta_1$$

is determined, and since the difference $\Delta\theta$ is in direct proportion to the density, the density of the object substance is measured.

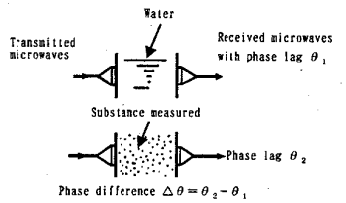


Fig. 1.1 Principle of phase angle difference

This method features following advantages over the conventional methods.

(1) The measurement is not susceptible to the effects of the stains or build-ups. The method is based on measuring the change of the propagation time of the microwaves that come through the fluid, not the change of strength of the waves, so that the window through which microwaves are transmitted or received does not have to be transparent as is the case with the optical method which cannot not be free from the effects of the stains and build-ups.

(2) Microwave method is resistant to the bubbles or foreign matters, which, in the ultrasonic wave method, affect measurement by attenuation.

(3) The density meter offers high reliability and easy maintenance because it does not have any moving parts as in the case with rotary density (consistency) meter.

(4) Measuring reliability is higher because the meter has not protruding parts inside the pipe as is the case with rotary density (consistency) meter or blade type consistency meter.

(5) Basically the method is free from the effect of the flow speed since it measures the change of dielectric constant of fluid which is proportional to the density.

2 UNPACKING

Check items by the following list and table at unpacking

2.1 Standard Components

(1) Density Meter : 1 unit
(2) Standard accessories : 1 unit

2.2 Standard Accessories

Table2.1 Standard accessories

Accessory	Specifications	Qty
Fuse	3A cartridge, glass tubular fuse, 5.2mm outer dia. x 20mm long	2
Operation manual	(The document you are reading.)	1

3 INSTALLATION

3.1 Precautions for Installation

⚠WARNING

DO The meter is heavy. To move it for relocation or installation, an qualified operator qualified for safety should handle it by using equipment such as a crane or a sling. Overturning or dropping can cause human injuries or equipment failure.	DON'T Do not operate where there is a possibility of leakage of flammable or explosive gas. A fire or explosion can occur.

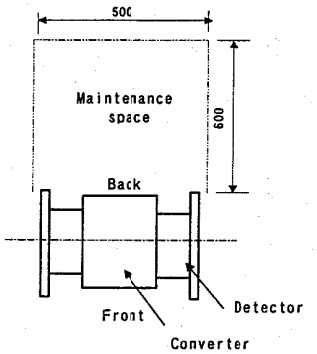
⚠CAUTION

DO Avoid installing the meter in any of the following places. ● Dusty place ● Place where corrosive gases(SO2, H2S2, etc.) or flammable gases may be generated. ● Place exposed to vibration or shock above permissible levels ● Place exposed to condensation due to abrupt change in temperature. ● Place too cold or hot for installation ● Place too humd for installation ● Near an apparatus that generates strong radio waves or a strong magnetic field. Otherwise, a fire, equipment breakdown or failure can occur.	DO Install the meter in a place where t is easy to operate, maintan, and inspect. A stumble or a fall when working can cause human injuries.

3.2 Installation Location

【NOTE】 ◆ Determine an indoor installation place in accordance with the following instructions.

(1) Choose a place that is free of vibrations and corrosive gasses, and has ample space for maintenance.
(2) Secure maintenance space in front, rear and above the signal processing unit of the detector and in front of the converter. (Refer to fig. 7)
(3) In the case of outdoor installation, provide covering against sun and rain.
(4) Recommended height for installing a converter is 1.5 meters from floor to the display window.



Note: A 500mm clearance space is needed above the converter.

Fig. 3.1 Space for Maintenance

3.3 Installation and Piping

Piping layout and detector mounting is shown in Fig. 3.2A and Fig.3.2B. Refer to the layout examples as you read following layout guide.

[NOTE] (1) Basically, install the detector in horizontal piping layout with the signal processing unit on top of the detector. In certain situations, vertical piping and mounting is preferable. Refer to (9).

(2) Detector has no fixed flow direction, or no upstream or downstream side. Straight tubes are not required in the upstream side and the downstream side. Choose direction or side for easier maintenance.

(3) When you anticipate opening or gap in connecting to a mating pipe, prepare a loose mechanism joint in advance.

(4) Install the detector into such a section where fluid fills the detector tube completely, and bubbles will not stay. When fluid does not fill the tube, it causes measuring errors or indicator fluctuations. When a pump is used in the pipeine and it runs intermittently causing a possible unfilled detector tube, use the External Synchronized operation to activate detector to measure only when the pump is in operation.

(5) Protect detecor from getting the vibration from the pump through piping.

(6) Avoid such a section for installation where solid may build up on the bottom of tube.

(7) Avoid such a section where bubbles may get into pipes. To avoid bubbles getting into pipes, we recommend installing a detector on the outlet port of a pump rather than the intake side.

(8) In making zero point adjustment, you need to drain fluid out of a detector and fill it with clean water or zero density water. To enable zero adjustment, arrange followings (Refer to Fig.3.2A, Fg.3.2B, and notes below). Install a shut-off valve on each of the upstream and downstream side of the detector. Between the detector and one of the valves, provide four ports each with a shut-off valve to be used for sampling, feeding zero water, releasing air, and draining. In addition, if you want to keep the flow running even at the time of zero adjustment, provide a bypass pipe with a shu-off valve as in Fig.3.2A and Fig.3.2B.

Note:

Sampling port:: Outlet port for sampling fluid for manual analysis. (In horizontal piping, place it on the side of the pipe)

Zero water feed port:: To feed clean water or 0% density water into the detector tube to make zero point calibration. (In horizontal piping, place it on top of the pipe.)

Air release port:: To make a vent on the upper pipe to release air for smooth drain of the fluid and smooth feed of clear water (density 0%) into the detector. (In horizontal pping, place it on the topmost part of the pipe.)

Drain port:: Outlet port to drain the fluid out of the detector before feeding clear water into it at the time of zero point calibration. (In horizontal piping, place it on the bottom (lowest porton) of the pipe.)

(9) In the following situations, we recommend vertical piping arrangement for better result

a) Bubbles may stay in the pipe.

b) Slow flow speed or other factors may cause the solids to sink or float substantially making the distribution of solids in the fluid uneven in the pipe.

(10). When you install the density meter having a larger diameter than the diameter of the main pipe and you use expanded pipes to mount the meter, adopt vertical piping.

Recommended piping and fittings

For the zero water inlet, install a 1-inch ball valve on the pipe to the detector to allow supplying water via a vinyl hose.

In the case the valve is connected to the tap water pipe, you need a separate air release

valve to release the air in the pipe.

For the sampling outlet, install a 1-1/2 inch ball valve to the side of the pipe.

For draining, install a 1-inch ball valve beneath the pipe.

Use proper packing for piping by choosing the shape in accordance with the flange rating and the material in accordance with the measured fluid.

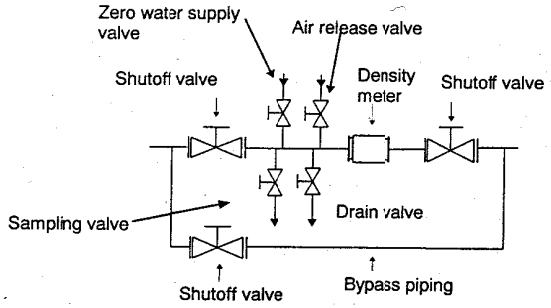


Fig.3.2A. Meter mounted horizontally (Looking from above)

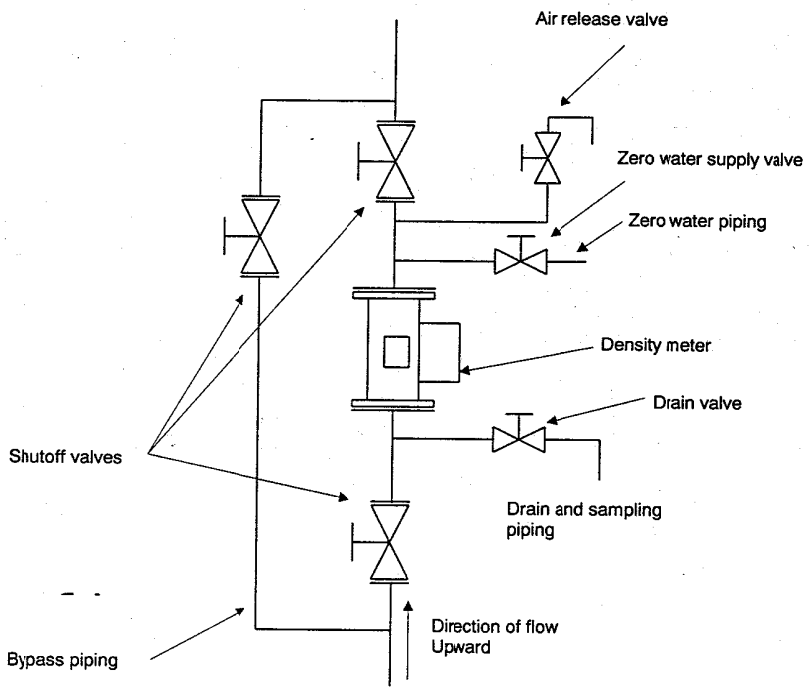


Fig.3.2B. Meter mounted vertically

3.4 Precautions for wiring

⚠WARNING

DO ■Be sure to install a fuse and a switch to disconnect the equipment from the power source. An external disconnecting device and fuse are required for the equipment. It is recommended that they have ratings of Fuse : 250VAC 3A Switch : 250VAC 10A,2 pole and be located near the equipment and within easy operation. Mark on the switch as the disconnecting device for the eqipment. Failure to observe this can cause electric shock or equipment failure.	DO ■Be sure to ground the equipment using a grounding wire separate from those used for power tools. The grounding wire of power source cable must be connected at protective conductor terminal shown ⏚ (at the under side of L1 terminal). Without grounding, electric shock, malfunction, or equipment failure can be caused by electric leakage.
DO ■Make sure that the main power line is turned off before wiring or cabling. Wiring or cabling without switching off the main power line can cause electric shock.	DO ■Use crimp terminals with insulation sleeves for power line and grounding wire terminals. A disconnected cable or wire from the terminal or a loose terminal can cause electric shock or generate heat and cause a fire or equipment failure.
DO ■Wiring and cabling should be done as shown in the wiring and connection diagrams. Wrong wiring or cabling can cause malfunctions, overheating, sparking, or electric shock.	DON'T ■Do not work with wet hand when wiring or cabling. Otherwise, you may get an electric shock.

The label shown left appears near a terminal block on the equipment to which power is supplied. Take precautions to avoid electric shock.

3.5 Wiring

Figure 3.5 on the next page shows connections to the density meter and the external units. Figure 3.6 shows wiring assignment to a converter terminal. Refer to these figures for correct wiring.

【MPORTANT】

(1) Grounding shall be 100 Ohms or less and separated from power grounding.
(2) Use 2 mm^2 wire cable for power and keep the voltage drop less than 2 volts.
(3) Lay cables with care to avoid shock and vibration to them.
Lay the cables into conduits.
(4) Lay the output signal cable in conduits separated from such cables that may generate noises as the AC power cable, control signal cable, alarm signal cable.
(5) Use a shielded two-conductor cable(CVVS 2mm^2) for the density output (4 to 20 mA) signal cable and ground the shielding wire at the signal receiving instrument. When making use of conductivity compensation, use the conductivity signal cable by connecting is shield together with the shield of the density output cable (4-conductor CVVS 2mm^2). Pull the cable outside from the converter case through the metal fittings prepared for the density output cable. (See Fig.4.3 Converter)
(6) Gaskets are provided for the cable ports to make the housing airtight. Tighten gasket securely after cabling.
If the cable diameter is smaller than the gasket inner diameter, wrap tape around the cable to increase its diameter to the gasket diameter before tightening.
(7) Securely tighten the screws of terminal blocks when connecting the cables.
Adequate torque for the screws of converter terminal block is 1.2N·m.

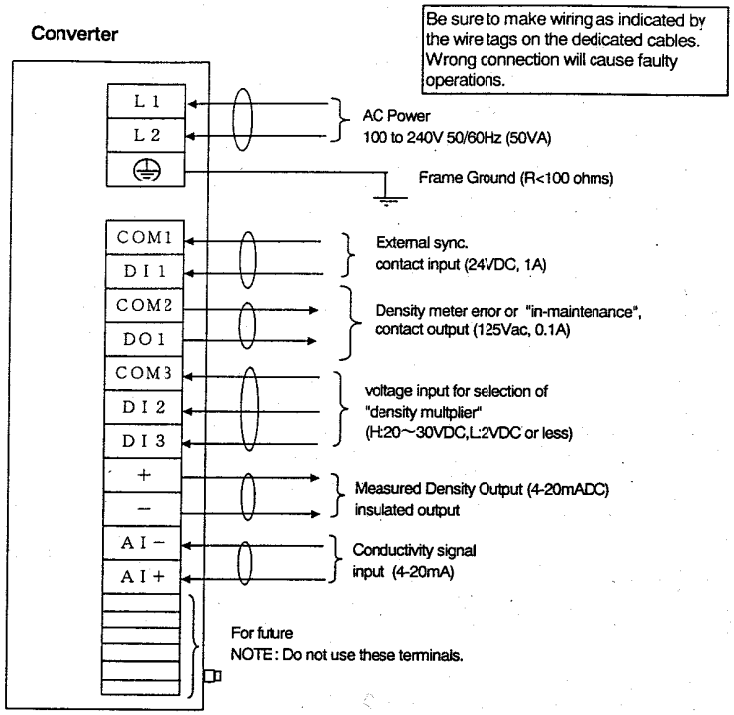


Fig. 3.5 External connection

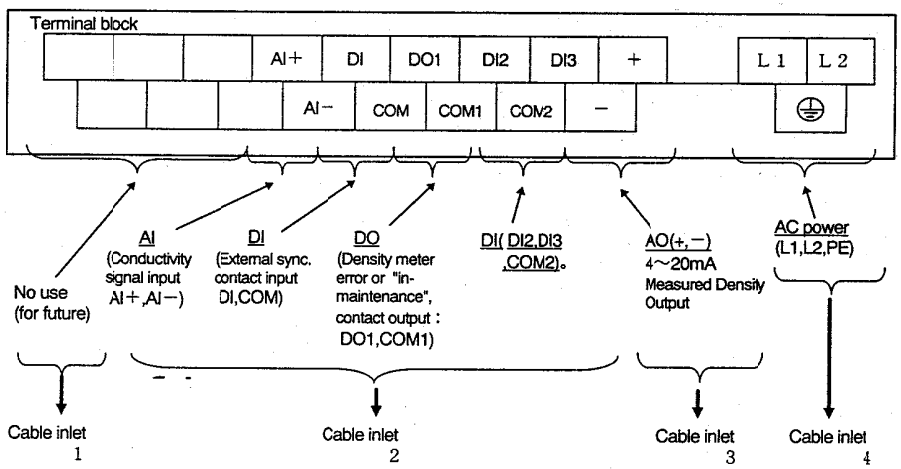


Fig. 3.6 Terminals inside the converter

4 PART NAMES AND FUNCTIONS

4.1 Detector

The detector is integrated with the converter in LQ300 Density meter. A whole of this meter and main parts of the detector are shown in Fig. 4.1. The converter is described in section 4.2.

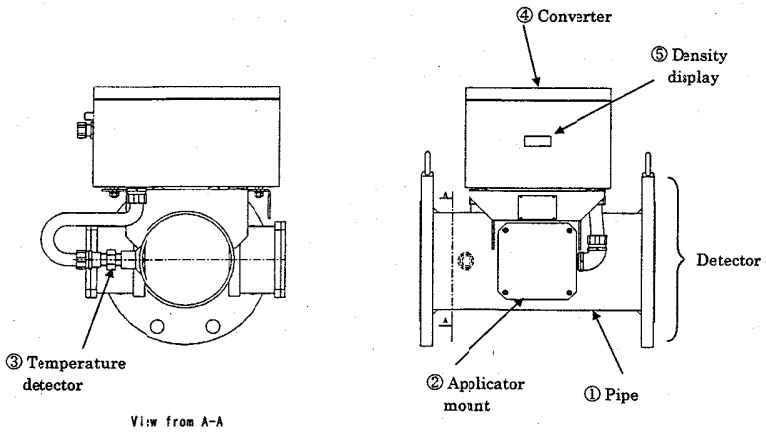


Fig.4.1 Detector

① Pipe

The pipe or tube is connected to the pipeline that carries the fluid or the substance to be measured.

② Applicator mount

The applicators for transmitting and receiving microwaves are built inside. The applicator on the front in Fig.4.1 is for transmitting and the rear is for receiving. Always keep the lids closed and the screws of the lids secured.

③ Temperature detector

The temperature detector (RTD) is for temperature correction. It measures temperature of the fluid flowing through the main pipe.

④ Converter ,⑤ Density display

See Section 4.2.

4.2 Converter

Figure 4.2 shows the converter with its door open.

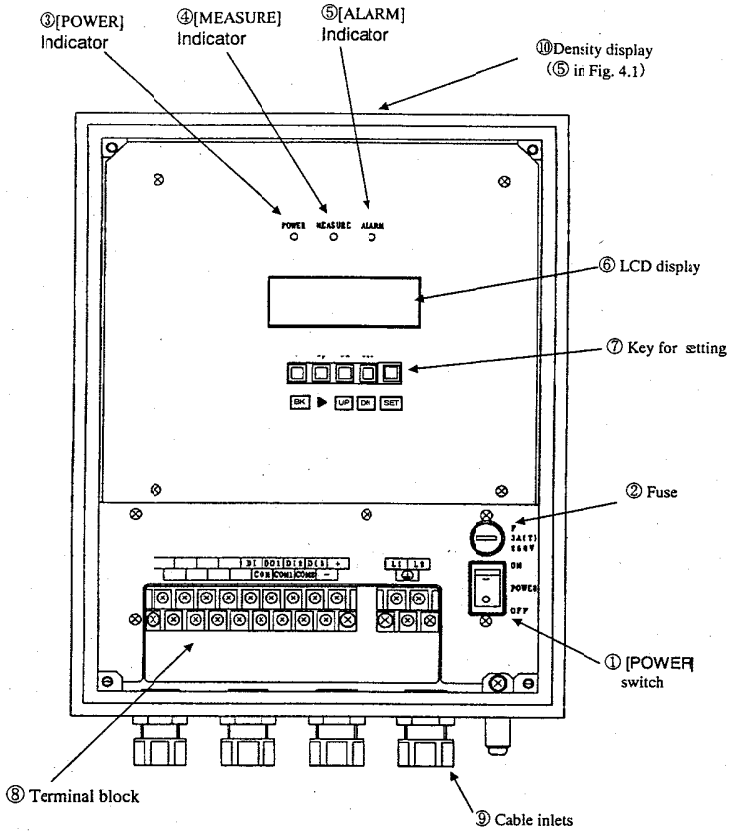


Fig. 4.2 Converter

① [POWER] switch

The power switch for the density meter. Press the switch to turn on the AC power for the density meter.

② Fuse

A 3A glass tube fuse is inside.

③ Mode switch

[AUTO] : Measuring action starts automatically at AUTO, regardless of the externally synchronized operation signal, and continues until the mode changes to [STOP].

[STOP] : At STOP, normal measuring action stops. This mode is used at the time of changing settings of converter constants, calibrating the zero point or the range, or doing other maintenance works.

[EXT] (Externally synchronized operation mode): Measuring is activated or deactivated by an external contact signal.

③ [POWER] Indicator (Green LED)

Green LED lights when AC power turns on by the power switch.

④ [MEASURE] Indicator (Green LED)

The indicator lights when measuring, and turns off when setting and when measuring stops at externally synchronized operation.

⑤ [ALARM] Indicator (Red LED)

Lights on error signal from the meter.

⑥ LCD display

LCD dot matrix display to show the measuring conditions and values.
For display details, refer to Section 5.2.

⑦ Key for setting

Keys to set measuring conditions. Used in combination with the LCD display.

⑧ Terminal block

To connect AC power cable, output signal cable, and other external connection cables.

⑨ Cable inlets

Fittings to let cables into converter box.

⑩ Density display (Red segmented LED)

Indicates the density of the measured fluid in %TS.

5 Menus and operations

5.1 Setting Measurement Conditions

The values for the measuring conditions or ranges at the time of shipment from the factory are shown in the tables 5.1.

Table 5.1 Measurement Conditions (1)

Item	Unit	Value at shipping	Range
Density multiplier (C)	—	1.00 (Standard)	0.00 ~ 9.99
UPPER RANGE	%TS	Customer specified value	1.0 ~ 99.9
LOWER RANGE	%TS	Customer specified value	0.0 ~ 99.5
DENSITY LINE SLOPE (a)	%TS/degree	As in table 5.2 by bore	-0.2000 ~ 0.2000
DENSITY INTERCEPT (b)	%TS	0.00 (Standard)	-99.99 ~ 99.99
DENSTY TEST OUT (to)	%TS	50% of FS (tentative)	0.0 ~ 99.9
DELAYED SYNC.TIME	min.	0.5 (tentative)	0.1 ~ 5.0
WATER TEMP. COEF. (α)	Degree/℃	As set at factory test	0.0 ~ 30.0
ZERO POINT PHASE (θ_1)	Degree	As set at factory test	0.00 ~ 360.00
ZERO WATER TEMP. (T_0)	℃	As set at factory test	0.0 ~ 100.0
AVERAGING TIMES	times	1	1 ~ 99
LIMIT RATE of Rate-of-Change Limit	%TS	0.00 (NONE)	0.00~9.99
LIMIT TIMES of Rate-of-Change Limit	—	0 (NONE)	0~99
UPPER RANGE of ANGLE ROTATION correction	Degree	260 (Standard)	240~360
LOWER RANGE of ANGLE ROTATION correction	Degree	100 (Standard)	0~120
DENSITY A of LINEARIZER	%TS	0.60 (tentative)	0.00~99.99
DENSITY B of LINEARIZER	%TS	1.00 (tentative)	0.00~99.99
COEF. K1 of LINEARIZER	—	1.00 (NONE)	0.00~9.99
COEF. K2 of LINEARIZER	—	1.00 (NONE)	0.00~9.99
COEF. K3 of LINEARIZER	—	1.00 (NONE)	0.00~9.99
CONDUCTIVITY COEF. (γ)	Degree /(mS/cm)	0.00 (NONE)	0.00 ~ 99.99
CONDUCTIVITY of ZERO POINT (E_0)	mS/cm	0.00	0.00 ~10.00
CONDUCTIVITY of liquid to be measured (E)	mS/cm	0.00	0.00 ~10.00

Table 5.1 Measurement Conditions (2)

Item	Unit	Value at shipping	Range
OFF/ON of ADDITIVES CORRECTION	—	OFF (NONE)	OFF/ON
Display in ADDITIVES CORRECTION	—	TOTAL	TOTAL/MAIN
Output current in ADDITIVES CORRECTION	—	TOTAL	TOTAL/MAIN
PARAMETER SET NO. of ADDITIVES CORRECTION	—	1	1~10
Sensitivity of main object (s0)	—	1.00	−9.99~9.99
Sensitivity of additive (s1)	—	0.00	−9.99~9.99
Sensitivity of additive (s2)	—	0.00	−9.99~9.99
Sensitivity of additive (s3)	—	0.00	−9.99~9.99
Sensitivity of additive (s4)	—	0.00	−9.99~9.99
Sensitivity of additive (s5)	—	0.00	−9.99~9.99
ADDITIVE RATIO (R1)	—	0.000	0.000~1.999
ADDITIVE RATIO (R2)	—	0.000	0.000~1.999
ADDITIVE RATIO (R3)	—	0.000	0.000~1.999
ADDITIVE RATIO (R4)	—	0.000	0.000~1.999
ADDITIVE RATIO (R5)	—	0.000	0.000~1.999
Output when input signal for externally synchronized operation is off.	—	4mA	4mA ,last value or test value
OFF/ON selection of Density multiplier with DI	—	OFF (NONE)	OFF/ON
Density multiplier (C2)	—	1.000	0.000~9.999
Density multiplier (C3)	—	1.000	0.000~9.999
Density multiplier (C4)	—	1.000	0.000~9.999

(NOTE) Description "(NONE)" in table 5.1 means that the function is invalid at set value .

Table 5.2 DENSITY LINE SLOPE (a)

Meter size (mm)	a
80	0.105
100	0.084
150	0.056
200	0.042
250	0.034
300	0.028

[NOTE]

◆If necessary, prepare and install a conductivity meter for continuous conductivity correction. Choose an installation place that allows accurate conductivity measurement.
◆The conductivity correction factor must be determined for individual fluid.
◆ When no conductivity correction is made, set the conductivity correction factor (γ) to zero (0).

5. 2 Menus and operations

Operations should be dore with five keys for setting, in combination with the LCD display. This section shows menus and operations.

5.2.1. main menu

Main menu is composed of three basic menus shown below. Table 5.2.1 shows the functions of each menu and performances when selected.

<main menu>

1 :MONITORING MENU
2 :SETTIIG MENU
3 :EXTERNAL SYNC.

表 5.2.1. Functions and performances of main menu

	1 :MONITORING MENU	2 :SETTING MENU	3 :EXTERNAL SYNC.
Functions	Reading of each measuring conditions (parameter), measured values, and self-diagnosis data	Changing of each measuring conditions (parameter), zero calibration and span calibration	Select OFF/ON of externally synchronized operation
Measured density output (4～20mA)	Measured value	Density Test output	ON:Measured value OFF:4mA or last value or set test value
Density display	Measured value	Density Test output	ON:Measured value OFF:4mA or last value or set test value
[Measure] indicator	On	Off	On

5.2.2 Keys for setting

Table 5.2.2 shows basic functions of five keys for setting. For detail, refer to the descriptions for each menu operation.

Table 5.2.2 Basic functions of five keys for setting

Key	Description in this manual	Basic functions
BK	[BK]	Returns the display to the menu one step above. Cancels newly set data in changing set data menu.
▶	[→]	In menu list, moves the cursor to the next menu number, or to the top menu number when the cursor is on the bottom menu number. In setting the numerical data, moves the cursor to the right digit, or to the top digit wher the cursor is on the bottom digit. To enter in "SETTING MENU", move the cursor on this menu number "2" and press [SET] key. Then the caution message "Test output will be valid" is displayed. After that, press [→] key.
UP	[UP]	Moves the display to the next menu. In setting the numerical data, enlarges the figure of the digit on which the cursor is.
DN	[DN]	Moves the display to the previous menu. In setting the numerical data, reduces the figure of the digit on which the cursor is.
SET	[SET]	In menu list, selects the menu. In setting the data, fixes the data.

5.2.3. Menus

Table 5.2.3 shows the menu List.

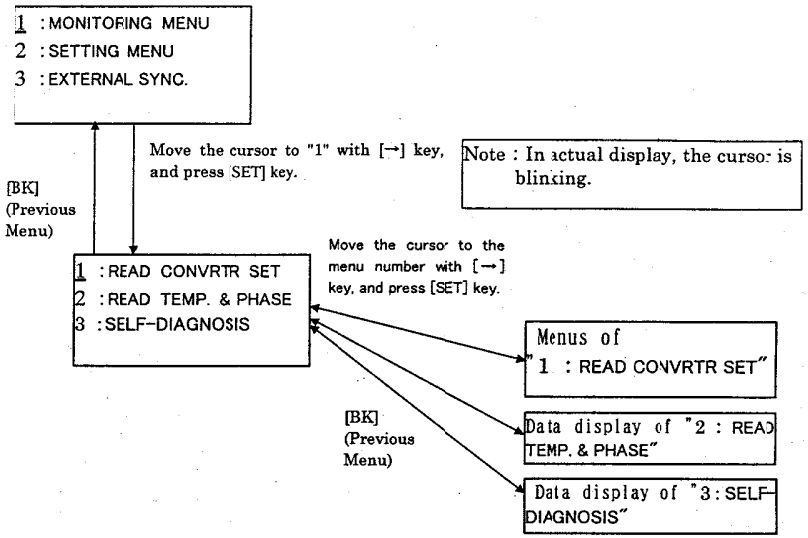
Table 5.2.3. Menu List (1)

Menu 1	Menu 2	Menu 3	Menu 4
MONITORING MENU	READ CONVRTR SET	C : DENSITY MULTIPLIER	
		UR:UPPER RANGE	
		LR:LOWER RANGE	
		a : DENSITY LINE SLOPE	
		b : DENSITY INTERCEPT	
		to : DENSTY TEST OUT	
		dt : DELAYED SYNC.TIME	
		cT:WATER TEMP. COEF.	
		zp:ZERO POINT PHASE	
		zT : ZERO WATER TEMP.	
		ma : AVERAGING TIMES	
		dX: LIMIT RATE	
		HL: LIMIT TIMES	
	READ TEMP. & PHASE	PHASE p(θ_2),TEMP. T (T_2), DENSITY X	
	SELF-DIAGNOSIS	ST: STATUS	
		SL: MICROWAVE SIG.LVL	
		F: MICROWAVE COEF.	
		G: CABINET TEMP.	
		pd: REF PHASE	
		Mc: MEMORY CHECK	
SETTING MENU	SETUP CONVERTER	UR:UPPER RANGE	Setting of "UR"
		LR:LOWER RANGE	Setting of "LR"
		a : DENSITY LINE SLOPE	Setting of "a"
		b : DENSITY INTERCEPT	Setting of "b"
		to : DENSTY TEST OUT	Setting of "to"
		dt : DELAYED SYNC.TIME	Setting of "dt"
		cT:WATER TEMP. COEF.	Setting of "cT(α)"
		zp:ZERO POINT PHASE	Setting of "zp(θ_1)"
		zT : ZERO WATER TEMP.	Setting of "zT(T_1)"
		ma : AVERAGING TIMES	Setting of "ma"
		dX: LIMIT RATE	Setting of "dX"
		HL: LIMIT TIMES	Setting of "HL"
	ZERO CALIBRATION	ZERO CALIBRATION	Execution of ZERO CALIBRATION
	SPAN CALIBRATION	SPAN CALIBRATION	Setting of C1:DENSITY MULTIPLIER
	ANGLE ROTATION	UH:UPPER RANGE	Setting of "UH"
		SH:LOWER RANGE	Setting of "SH"
		N:ROTATION	Setting of "N"

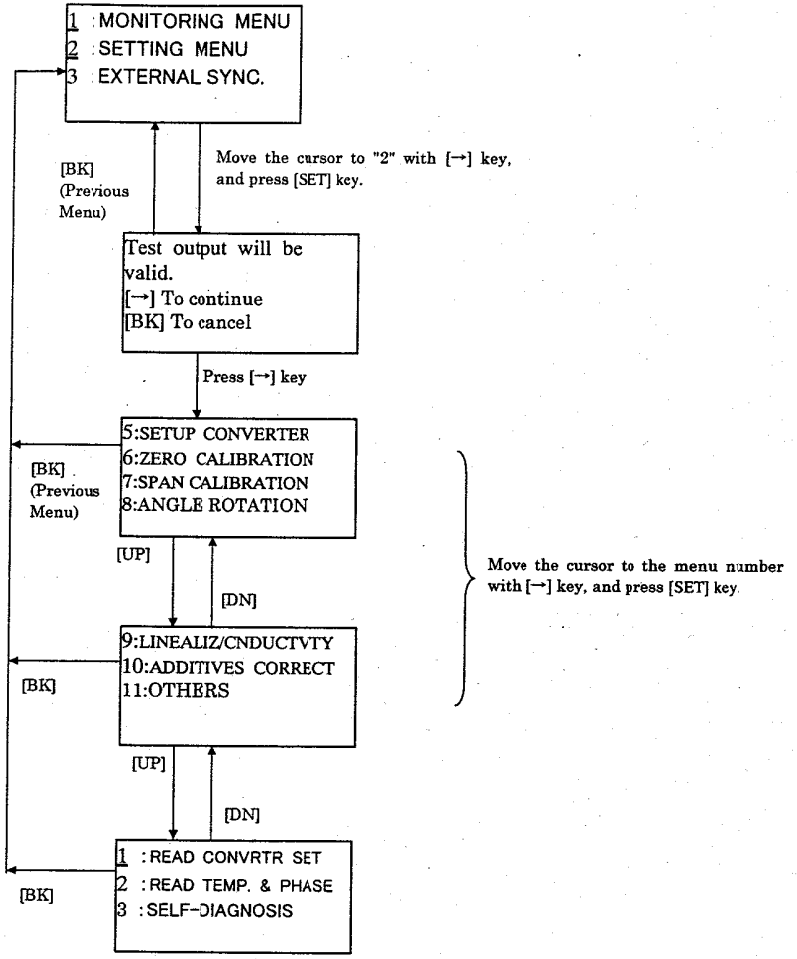
Table 5.2.3. Menu List (2)

Menu 1	Menu 2	Menu 3	Menu 4
SETTING MENU	LINEARIZ /CNDUCTVTY	LA:DENSITY A	Setting of "LA(A)"
		LB:DENSITY B	Setting of "LB(B)"
		K1:COEF.	Setting of "K1"
		K2:COEF.	Setting of "K2"
		K3:COEF.	Setting of "K3"
		r:CNDUCTVTY. COEF.	Setting of "r(γ)"
		zE:CNDUCTVTY. /ZERO	Setting of "zE"
		EC:CONDUCTIVITY	Setting of "EC"
	ADDITIVES CORRECT	AF:ADDITIVES COMP.	Setting of "OFF/ON"
		Ad:DISPLAY DENSITY	Setting of "Ad"
		Ac:OUTPUT DENSITY	Setting of "Ac"
		Ap:PARAMETER SET NO.	Setting of "Ap"
		s0:MAIN OBJ. SENS.	Setting of "s0"
		s1:ADDITIVE SENS.	Setting of "s1"
		s2:ADDITIVE SENS.	Setting of "s2"
		s3:ADDITIVE SENS.	Setting of "s3"
		s4:ADDITIVE SENS.	Setting of "s4"
		s5:ADDITIVE SENS.	Setting of "s5"
		R1:ADDITIVE RATIO	Setting of "R1"
		R2:ADDITIVE RATIO	Setting of "R2"
		R3:ADDITIVE RATIO	Setting of "R3"
		R4:ADDITIVE RATIO	Setting of "R4"
		R5:ADDITIVE RATIO	Setting of "R5"
	OTHERS	ho:output in [EXT]	Setting of "ho"
		C DI SEL. ON/OFF	Setting of "OFF/ON"
		C2:DI SELECTION	Setting of "C2"
		C3:DI SELECTION	Setting of "C3"
		C4:DI SELECTION	Setting of "C4"
EXTERNAL SYNC.	OFF/ON		

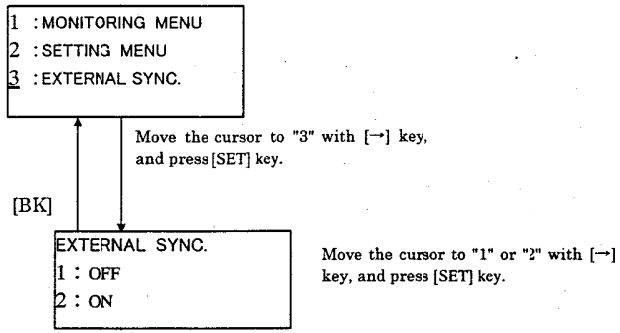
5.2.4. MONITORING MENU



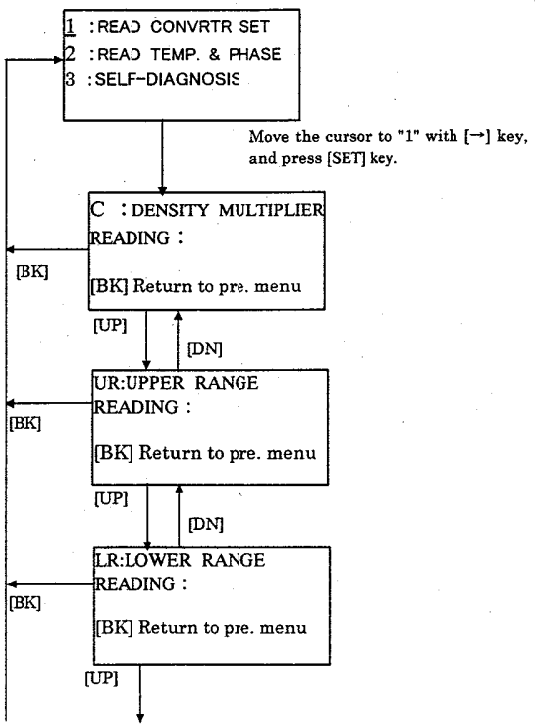
5.2.5. SETTING MENU

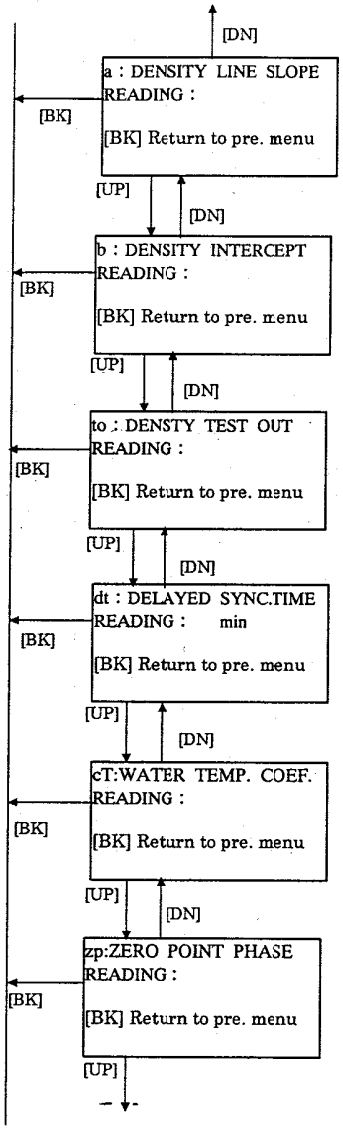


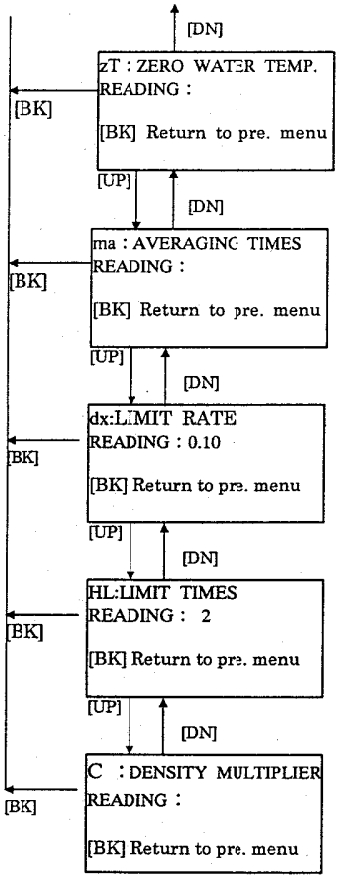
5.2.6. EXTERNALLY SYNCHRONIZED OPERATION



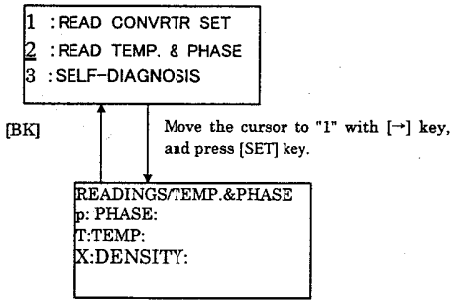
5.2.7. READ CONVRTR SET



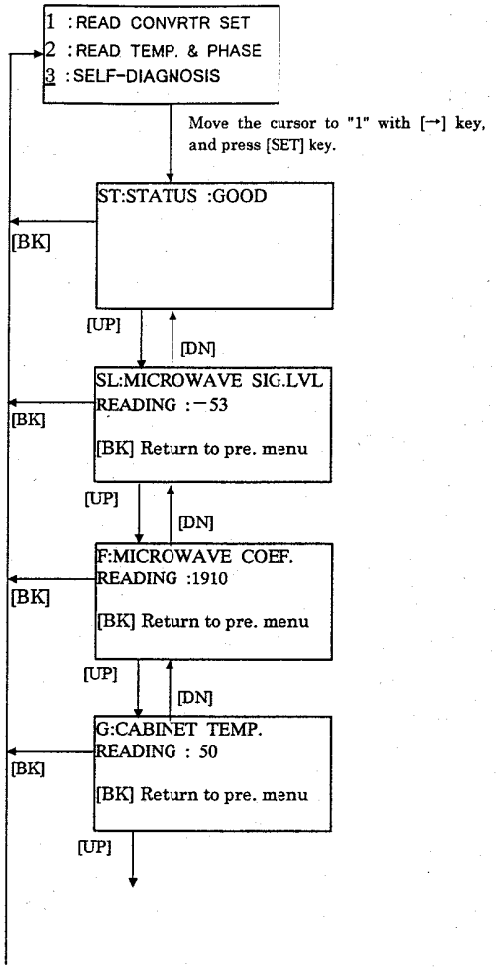


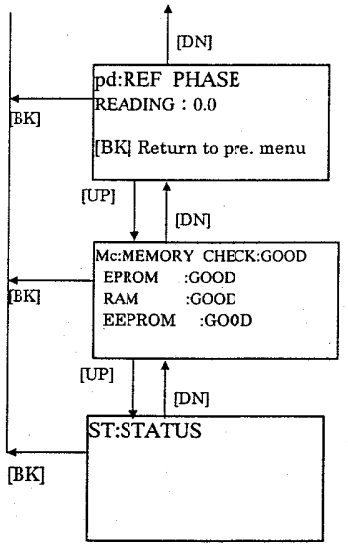


5.2.8. READ TEMP. & PHASE

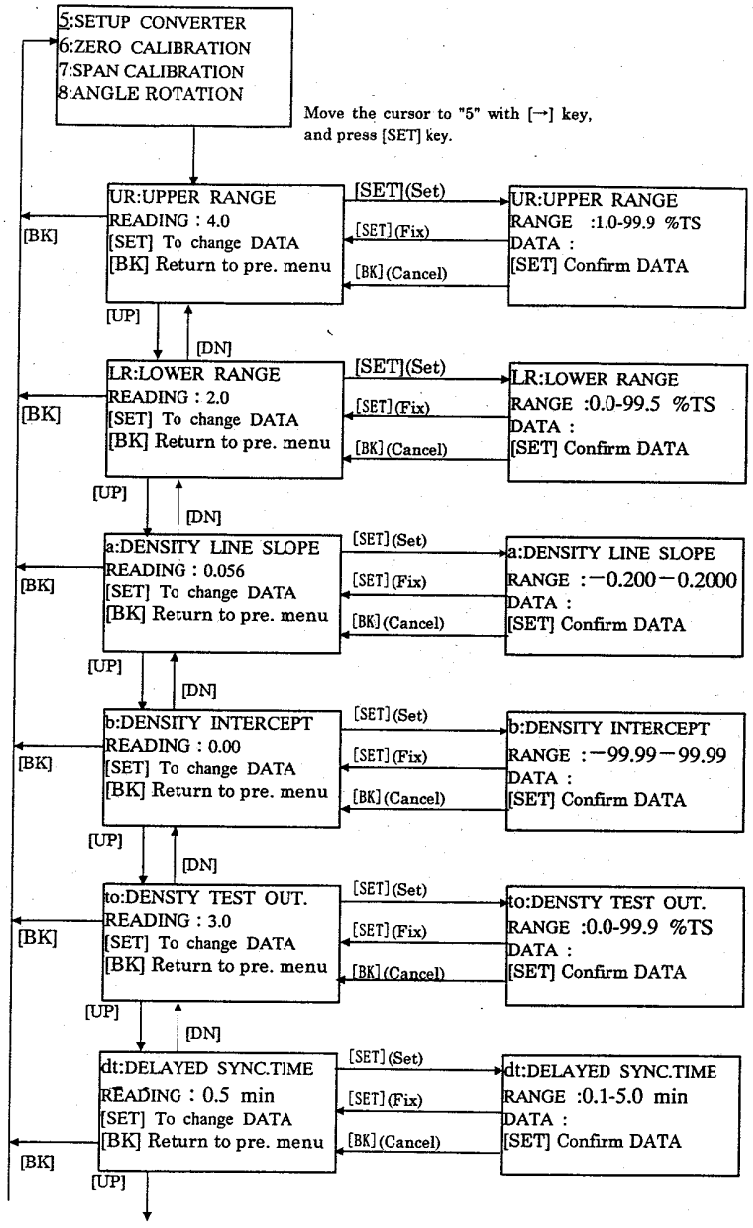


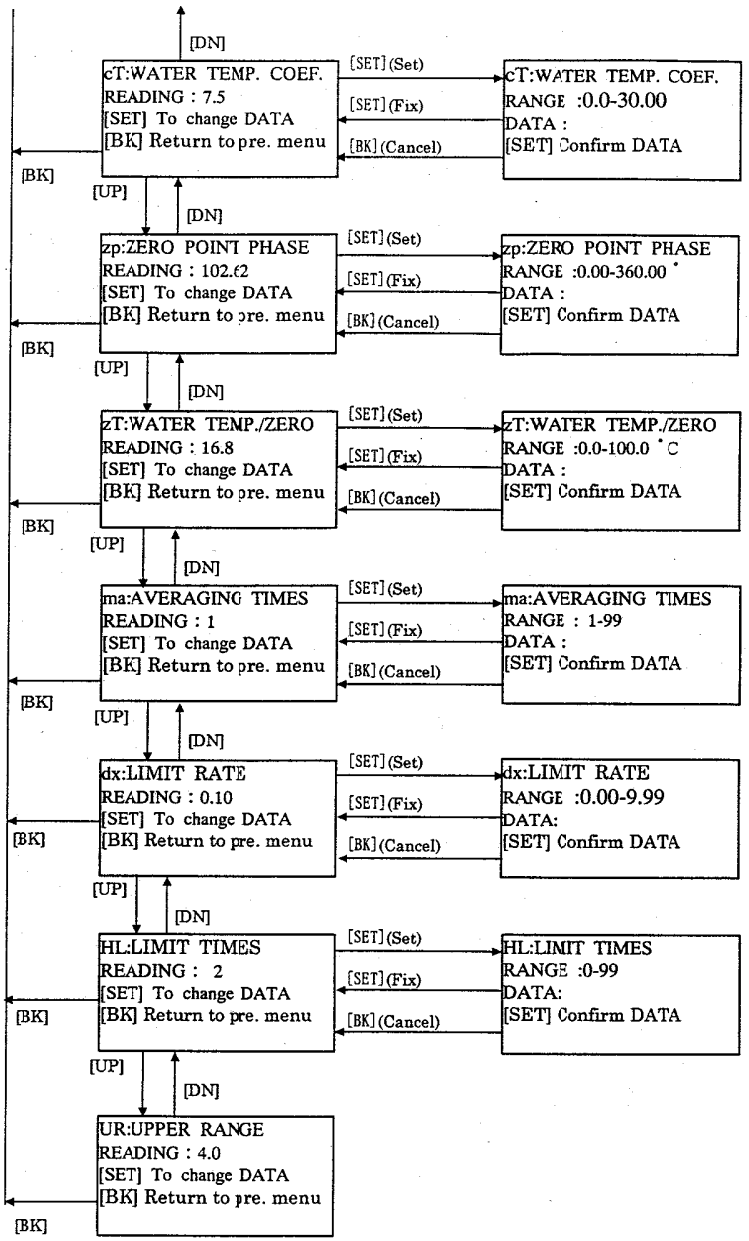
5.2.9. SELF-DIAGNOSIS





5.2.10. SETUP CONVERTER

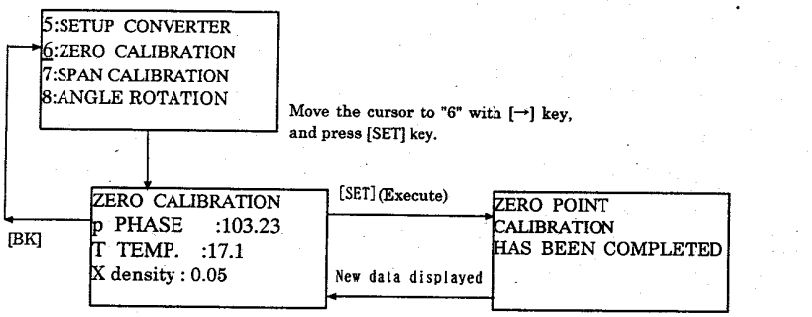




NOTE *For all menus, when data outside the allowed range is input, the error message is displayed, and the wrong data is refused. Press any key to return, and input adequate data.*

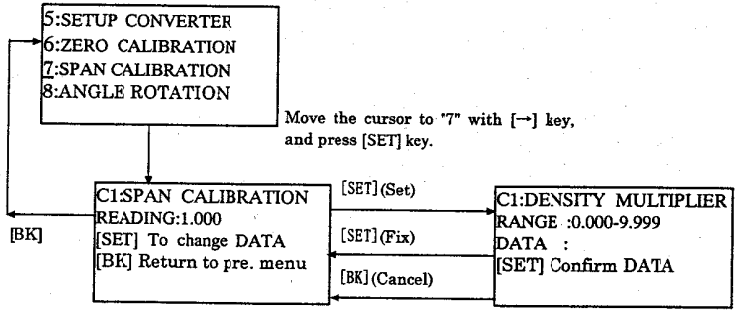
VALUE OUT OF RANGE
UR:UPPER RANGE
PRESS ANY KEY TO
RETURN

5.2.11. ZERO CALIBRATION



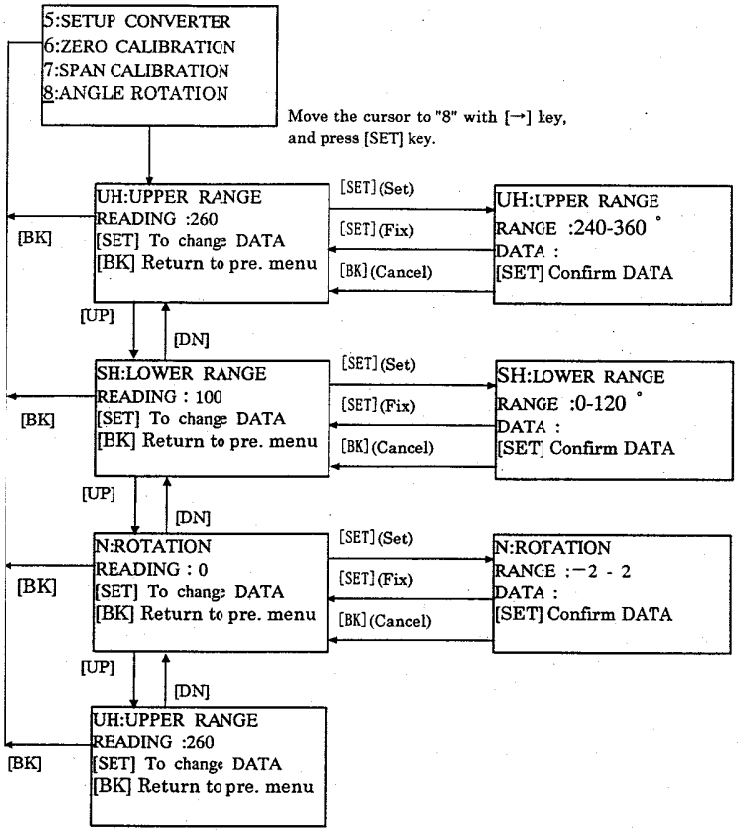
NOTE : This is displayed for one second before returning to previous display.

5.2.12. SPAN CALIBRATION

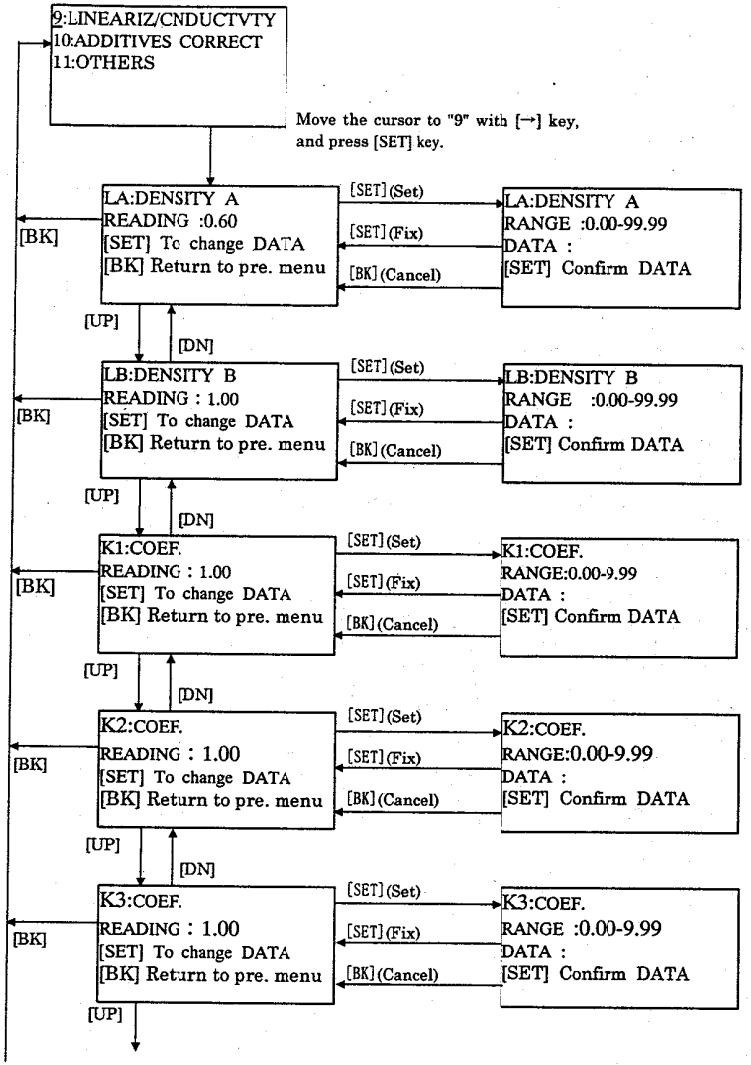


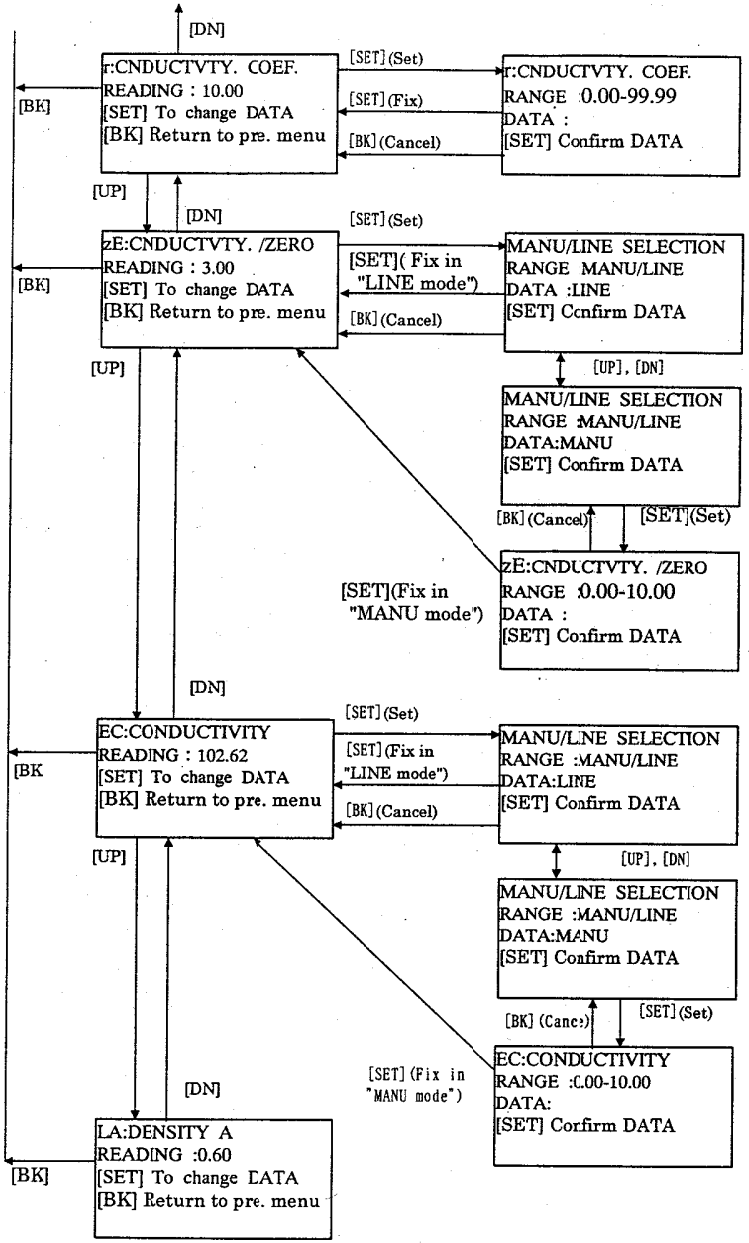
5.2.13. ANGLE ROTATION

Usually change is not necessary for this menu. If default setting of UH=260、SH=100 is changed inadequately, normal measurement might be damaged.

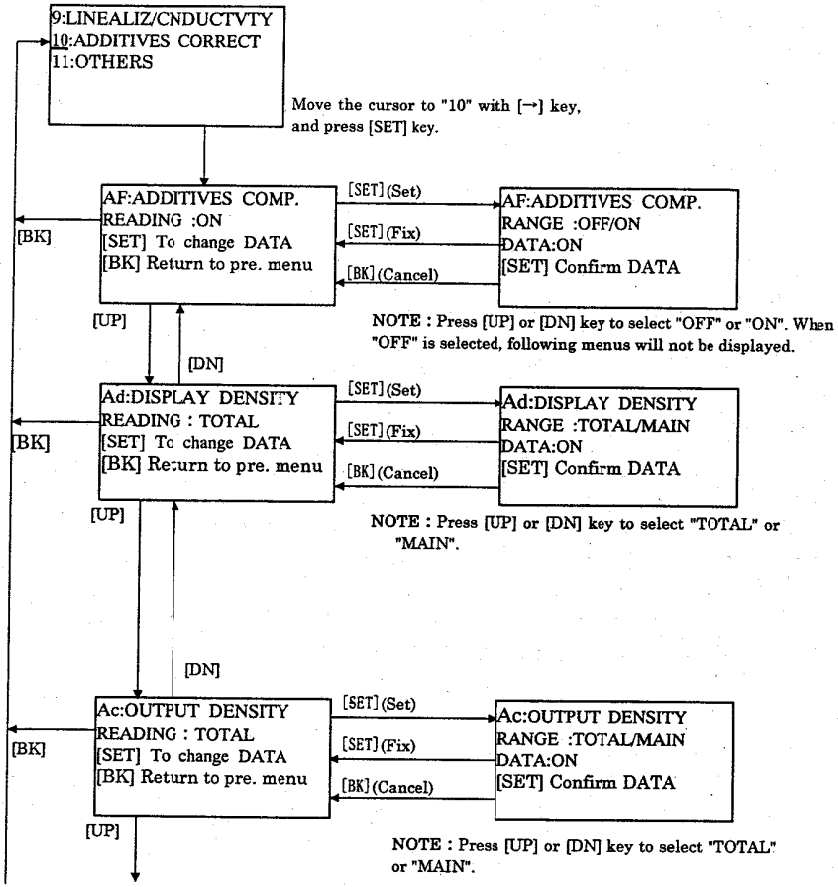


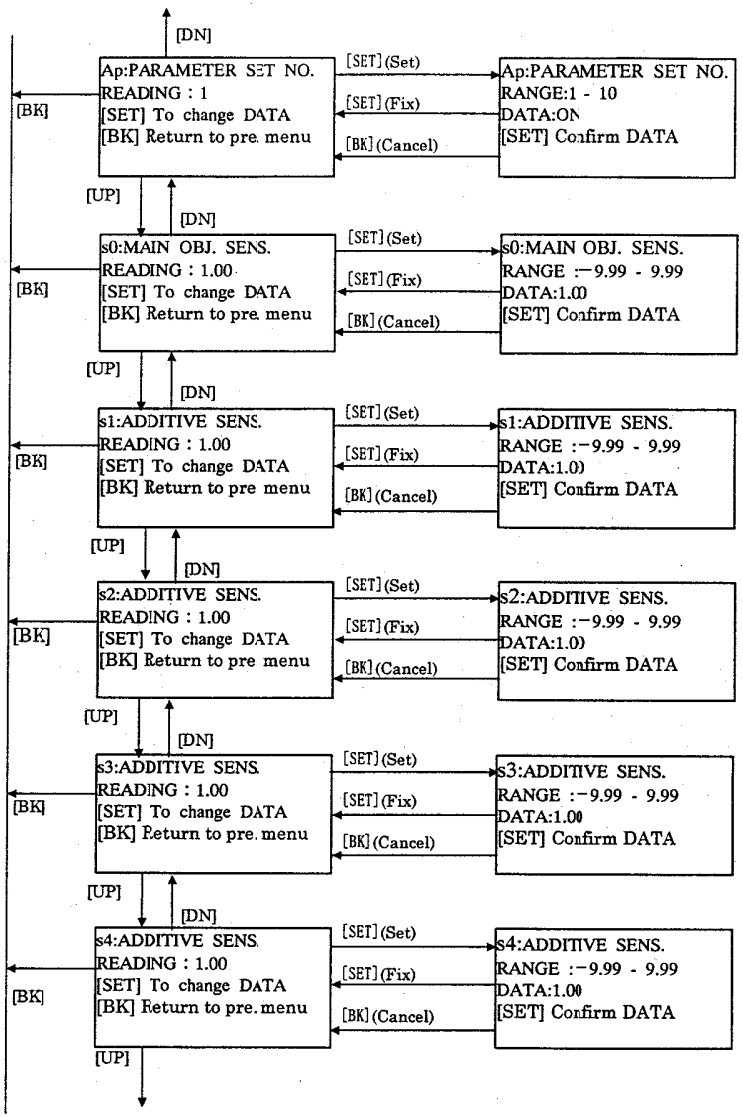
5.2.14. LINEARIZE / CONDUCTITY CORRECTION

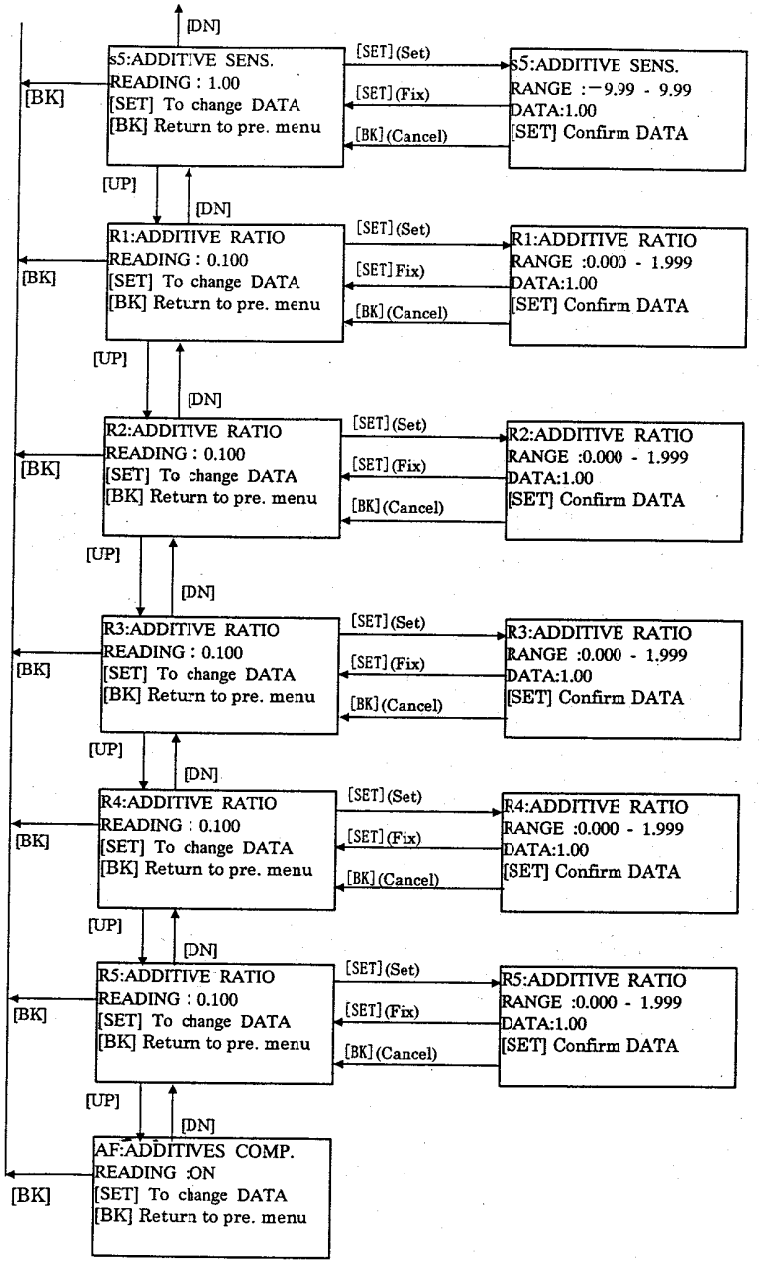




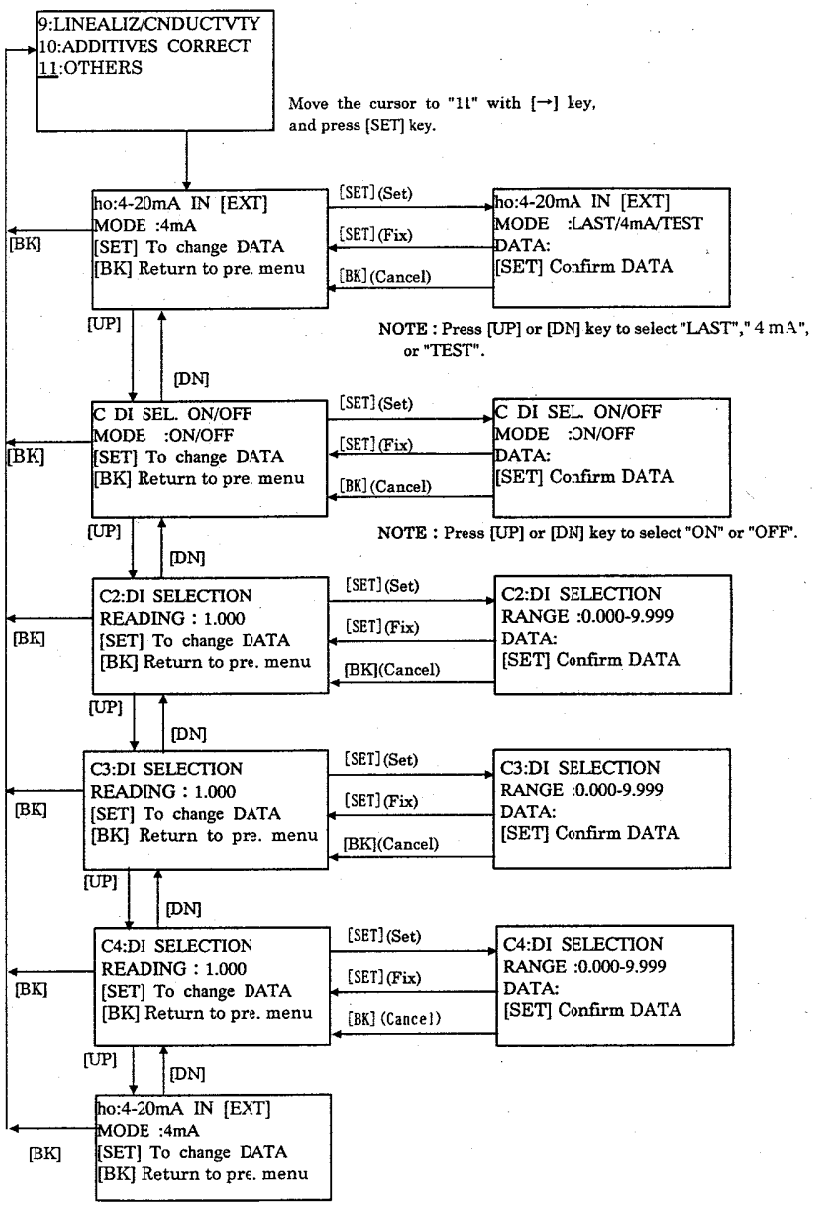
5.2.15. ADDITIVES CORRECTION




[DN]
Ap:PARAMETER SET NO.
READING : 1
[SET] To change DATA
[BK] Return to pre. menu
[SET] (Set)
[SET] (Fix)
[BK] (Cancel)
Ap:PARAMETER SET NO.
RANGE:1 - 10
DATA:ON
[SET] Confirm DATA
[BK]
[UP]
[DN]
s0:MAIN OBJ. SENS.
READING : 1.00
[SET] To change DATA
[BK] Return to pre. menu
s0:MAIN OBJ. SENS.
RANGE :−9.99 - 9.99
DATA:1.00
[SET] Confirm DATA
s1:ADDITIVE SENS.
READING : 1.00
[SET] To change DATA
[BK] Return to pre menu
s1:ADDITIVE SENS.
RANGE :−9.99 - 9.99
DATA:1.00
[SET] Confirm DATA
s2:ADDITIVE SENS.
READING : 1.00
[SET] To change DATA
[BK] Return to pre menu
s2:ADDITIVE SENS.
RANGE :−9.99 - 9.99
DATA:1.00
[SET] Confirm DATA
s3:ADDITIVE SENS.
READING : 1.00
[SET] To change DATA
[BK] Return to pre. menu
s3:ADDITIVE SENS.
RANGE :−9.99 - 9.99
DATA:1.00
[SET] Confirm DATA
s4:ADDITIVE SENS.
READING : 1.00
[SET] To change DATA
[BK] Return to pre. menu
s4:ADDITIVE SENS.
RANGE :−9.99 - 9.99
DATA:1.00
[SET] Confirm DATA


[DN]
s5:ADDITIVE SENS.
READING : 1.00
[SET] To change DATA
[BK] Return to pre. menu
[SET] (Set)
[SET] (Fix)
[BK] (Cancel)
s5:ADDITIVE SENS.
RANGE :−9.99 - 9.99
DATA:1.00
[SET] Confirm DATA
[BK]
[UP]
[DN]
R1:ADDITIVE RATIO
READING : 0.100
[SET] To change DATA
[BK] Return to pre. menu
R1:ADDITIVE RATIO
RANGE :0.000 - 1.999
DATA:1.00
[SET] Confirm DATA
R2:ADDITIVE RATIO
READING : 0.100
[SET] To change DATA
[BK] Return to pre. menu
R2:ADDITIVE RATIO
RANGE :0.000 - 1.999
DATA:1.00
[SET] Confirm DATA
R3:ADDITIVE RATIO
READING : 0.100
[SET] To change DATA
[BK] Return to pre. menu
R3:ADDITIVE RATIO
RANGE :0.000 - 1.999
DATA:1.00
[SET] Confirm DATA
R4:ADDITIVE RATIO
READING : 0.100
[SET] To change DATA
[BK] Return to pre. menu
R4:ADDITIVE RATIO
RANGE :0.000 - 1.999
DATA:1.00
[SET] Confirm DATA
R5:ADDITIVE RATIO
READING : 0.100
[SET] To change DATA
[BK] Return to pre. menu
R5:ADDITIVE RATIO
RANGE :0.000 - 1.999
DATA:1.00
[SET] Confirm DATA
AF:ADDITIVES COMP.
READING :ON
[SET] To change DATA
[BK] Return to pre. menu

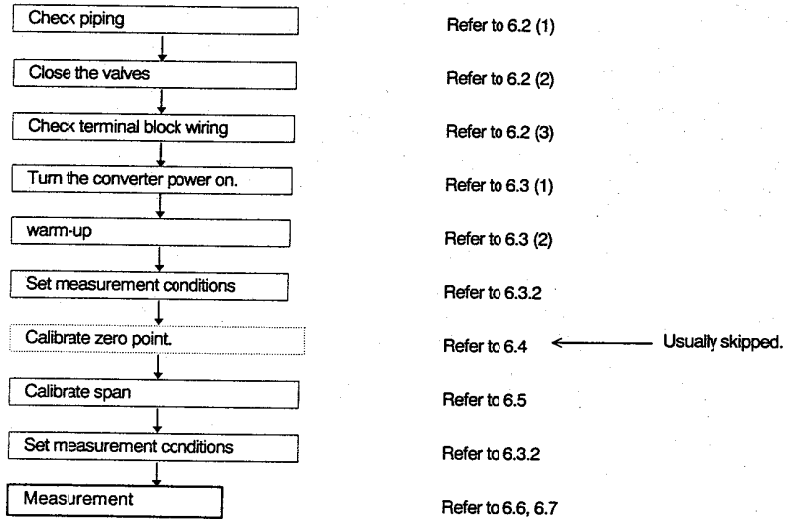
5.2.16. OTHERS



6 OPERATIONS

6.1 Procedures for preparing and running

Follow the procedures below for preparing and running the density meter operations.



6.2 Preparations before Turning on Power

(1) Check piping

Check piping and ensure that there are no loose nuts and bolts, or missing gaskets. Make sure that the density meter is properly connected in the pipeline.

(2) Close the valves

Make sure that the drain valve, sampling valve, and zero water valve, which are installed in the pipeline, are all closed.

(3) Check terminal block wiring

Confirm that cables are correctly connected.

6.3 Power on and Preparations for Measuring

6.3.1 Turning power on

(1) Turn the power switch on

Turn on the power switch of the converter and see that the power indicator, the density indicator, and the LCD display are lit.

(2) Warming-up

Please warm up for 30 minutes or more to achieve a steady measurement after turning power on.

6.3.2 Setting Measurement Conditions

When you use the density meter for the first time after its installation, you need to set following measuring conditions for the converter after the power-on.

① Change the original [UPPER RANGE] and [LOWER RANGE] to appropriate values in accordance with the operating conditions of the process.

② Tentative values have been set in the factory before shipment for [DENSITY TEST OUTPUT] and [DELAYED SYNC. TIME]. When the externally synchronized measurement is used, change these tentative values to appropriate values in accordance with the operating conditions of the process for which the density meter is used.

③ Zero-point values based on factory test data have been set for [ZERO POINT PHASE (θ_1)] and, [WATER TEMP. / ZERO (T_0)]. Therefore, usualy it is not necessary to calibrate the zero points as described in Section 6. 4. For detail, refer to Section 6. 4.

④ The standard value of 1.0 has been set for [DENSITY MULTIPLIER].
Test-run the meter and measure for about one day, then compare the density data with the values taken in the standard manual analysis measurement. Change the original [DENSITY MULTIPLIER] according to the span calibration procedures described in Section 6.5.

⑤ [AVERAGING TIMES] has been set to 1 (one) in the factory before shipment. If you want to use the moving average value for the output for controlling process, for example, change the number of times to 5 or so.

⑥ [LIMIT RATE] has been set to 0.00 , and [LIMIT TIMES] has been set to 0 in the factory before shipping. In these conditions, rate-of-change limit is invalid. If the rate-of-change of output is so high because of air bubble or other reason, change these parameters.

⑦ The other parameters for measurement conditions are set to standard defaults and do not usually need to be changed.

6.4 Zero Point Calibration

All the density meters are calibrated for zero point [zero point phase (θ_1) and zero point water temperature (T_0] at the time of shipment and parameters are set correctly. You do not need to calibrate the meter for zero point before using it at site.

In the case of the density readings are found to be way off from the result by manual analysis, or when you need to readjust the zero point for a particular reason, follow the procedures below in calibrating the zero.

(1) Calling [SETTING MENU]
Call [2:SETTINC MENU]. The density test output is selected.

(2) Stopping the flow of the fluid in the pipeline
If it is allowed to stop the flow in the pipeline on which the detector is installed, do so by, for example, turning off the pump.

● If it is not allowed to stop the fluid flow through the pipeline:
When it is not permitted to stop the flow of the line, bypass the flow by opening the valve on the bypass pipe.

(3) Close the upstream valve and downstream valve
Close the shutoff valves on both sides of the detector tightly.
Note: Be sure to close the upstream valve first.

(4) Drain the detector pipe
Open the drain valve on the pipeline to discharge the fluid from the main pipe of the detector.

(5) Open the zero water feed port
Open the valve or remove the cap to feed zero water.
◆ Make sure that the pressure of the fluid in the detector gets low enough to let the valve open without causing blow out of the fluid.

(6) Close the drain valve

(7) Feed zero water
Feed water from a nearby tap into the main tube of the detector through the zero water valve. Using a vinyl or rubber horse, fill up the main pipe until the water overflows the port meanwhile letting the air out as you fill.

(8) Clean inside of the detector main pipe
When the detector main pipe is filled with water, open the drain valve to let out the water from the main pipe.
Wash inside of the pipe by repeating steps (7) and (8) until the water density can be said to be zero against the density of the object fluid. (It is not necessary to make the water clean and transparent.)

(9) Fill up the detector pipe with zero water
After cleaning the detector main pipe, close the drain valve, and fill it with tap water.

(10) Wait
Leave the detector and water in this state for about 5 minutes.

(11) Measure the density of zero water
Call [6:ZERO CALIBRATION] in [2:SETTING MENU].

(12) Check zero water density reading
The measured density of zero water is displayed on the density indicator. If the indicator shows [-0.001], it means that the zero point is off toward the negative.

(13) Set new zero point
If the zero point is found to be off, press the [SET] key. The present data on the zero point (θ_1 , T_0) are renewed and density display shows zero.

(14) End zero calibration
This completes the zero calibration. Close the zero water valve, ensure that the sampling valve and drain valve are closed, then open the shutoff valves on both ends of the detector pipe, downstream first and upstream next. Lastly, close the shutoff valve on the bypass pipe to restore the flow of the fluid as before the calibration.

(15) Return to the measuring condition
Press the [BK] key twice. The display returns to first menu, and the density display and output current change to measured value.

6.5 Span Calibration

Span calibration is for adjusting the readings of the density meter to the values determined by manual (off-line) analysis.

(1) Preparations for manual analysis

Prepare following items for manual analysis; a moisture meter (for example, an infrared moisture meter, with the accuracy or percentage reading down to 0. 1 %) plastic bottles of about 1 liter with a wide opening, and plastic beakers of about 1 00 ml for manual analyss.

(2) Sample fluid for manual analysis

Slightly open the sampling valve on the pipeline and let out the fluid a while before filling a 1-liter bottle to half. Read and record the density value of the current fluid.

◆ Make sure to take a sample out of flowing fluid.

(3) Manual analysis

Put a part of the sample fluid into a 100-ml plastic beaker, and measure the density of it using drying and weighing method of analysis.

(4) Calculation of density multiplier C

Use the result of analysis to calculate a density multiplier using the following equation:

Density multiplier $C = A/(M/C_0)$

where M is the density by the density meter as read and recorded);
A is the result of the manual analysis
C_0 is the density multiplier before span calibration
(Initally, C_0 is equal to 1.000 which is the value set in the factory before shipping)

For example, if M = 4.0 %TS, A = 4.8 %TS and C_0=1.000

$C = 4.8 / (4.0/1.000) = 4.8/4.0 = 1.200$

◆In the case that span calibration has been done already, and density multiplier C is not 1.000, the new density multiplier C can be calculated in the following way.

For example, if M = 4.8 %TS, A = 4.2 %TS and C_0=1.200

$C = 4.2 / (4.8/1.200) = 4.2/4 = 1.050$

(5) Setting density multiplier into the meter

(5-1) Calling [SETTING MENU]

Call [2:SETTING MENU]. The density test output is selected.

(5-2) Calling span calibration menu

Call [7:SPAN CALIBRATION] in [2:SETTING MENU].

(5-3) Setting density multiplier into the meter

Press [SET] key to enter setting condition. Set the calculated density multiplier C. Press [SET] key once more to fix the data. Confirm the density multiplier C has been set correctly in the display.

(7) Terminating span calibration

Press the [BK] key twice. The display returns to first menu, and the density display and output current change to measured value.

[NOTE]

◆ In above method the correction factor is determined by a single manual analysis. It is recommended, however, to get as many data as possible and use their average value to determine the correction factor.

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7 MAINTENANCE

7.1 Precautions for Maintenance, Inspection, and Parts Replacement

⚠WARNING	
 DO ■ Be sure to turn the power switch on the equipment to OFF before doing maintenance or inspection inside the equipment or replacing its parts. Failure to observe this can cause electric shock or equipment failure.	 DO ■ Be sure to set the power switch on the equipment to OFF before replacing fuse. Failure to observe this can cause electric shock.
 DO ■ Avoid touching the terminal block during maintenance or inspection. If it is necessary to touch the terminal block, turn the power switch on the equipment to OFF in advance. Failure to observe this can cause electric shock.	 The sticker shown left is pasted near a terminal block on the equipment to which power is supplied. Take care to avoid electric shock

7.2 Maintenance and Inspection Items

Periodic maintenance and inspection is necessary for reliable measurement over a long period of time. Since the density meter has no mechanically moving parts, it requires only a few maintenance and inspection items, just zero point calibration and span calibration.

Because the meter requires no consumable parts or parts that wear, the only spare parts that must be kept on hand are fuses.

Table 7.1 Maintenance and Inspection Items

No.	Item	Period	Remarks
1	Span calibration	Every 3 months	See section 6. 5

[IMPORTANT] During the span calibration, if you find the density readings are very different from the manual analysis values, refer to section 6.4, and, if necessary, calibrate zero.

Table 7.2 Spare Parts

Part	Specifications	Qty	Remarks
Fuse	3 A (glass tube, 5.2 mm in diameter, 20 mm long)	2	for converter

◆Service life of electronic parts

In general, service life of an electronic part becomes shorter in higher ambient temperature.

Aluminum electrolytic capacitors are used in the converter and their service life is about 10 years at ambient temperature of 20 degrees C or about 3 years at 50 degrees C. For stable operating of long years, it is recommended to replace them earlier. Contact our Service Dept. for replacement of them.

When the characters on LCD display becomes weak in contrast or edge, it is considered to be the end of life. Replace the display unit. Contact our Service Dept. for replacement.

8 ERROR INDICATIONS AND TROUBLESHOOTING

8.1 Error Indications and Recovery Operations

If the density meter develops a fault in the operation of its measuring system, the error indicator [ALARM] lights and a contact signal output becomes "ON".

< Steps to take>

- Call [3:SELF-DIAGNOSIS] in [1:MONITORING MENU], and check self-diagnosis data.
- To determine whether a certain numeric value is beyond the permissible range, refer to table 8.1.
- If there is an abnormal value, turn the POWER switch off, then turn it on. If the error is displayed again as a result of diagnosis, call our Service Department and inform the results.

Table. 8.1 Self-diagnosis data

Data Item		Data Status	Data(Numericvalue range; normal data range, status)
Symbol	Item name		
ST	Status [STATUS]	Normal [GOOD] Abnormal [N.G.]	
SL	Microwave input signal level [MICROWAVE SIG.LVL]	Normal [GOOD]	Usual range: -75to -45 (dBm)
F	Microwave coef. [MICROWAVE COEF.]	Normal [GOOD] Abnormal [N.G.] (Numeric data free of error)	· Numeric value range 1825 ~ 1975 · Normal range Same as above
G	Internal temperature of box [CABINET TEMP.]	Normal [GOOD] Abnormal [N.G.]	· Numeric value range : 0.00 ~ +99.9 (℃) · Normal range - 10.0 ~ +70.0 (℃)
J	+5 V voltage [+5V POWER SUPPLY]	Normal [GOOD] Abnormal (outside normal range) [N.G.]	· Numeric value range :00.0 ~ 99.9 (V) · Normal range 4.5 ~ 5.5 (V)
pd	Reference phase error [REF PHASE]	Normal [GOOD] Abnormal [N.G.] · Outside normal range for 12 consecutive times	· Numeric range: - 9.9 ~ + 9.9 (degrees) · Normal range - 9.5 ~ + 9.5 (degrees)
Mc	Memory check [MEMORY CHECK]	Normal [GOOD] Abnormal [N.G.]	EPROM. RAM. EEPROM are checked

8.2 Troubleshooting

If any trouble has developed, make a careful check and take appropriate steps.

Table 8. 2shows possible troubles, their causes, and remedies. If anything wrong occurs, refer to the table below and take the necessary steps. If that does not remedy the trouble, send information on the trouble, in as much detail as possible, and self-diagnosis data to our Service Department.

Table 8.2 Troubleshooting (1)

No.	Trouble	Cause	Remedy
1	Converter power cannot be switched on.	AC power supply voltage not supplied.	Check terminals L1 and L2 on terminal block with voltage tester
		Fuse (3 A) is blown.	Replace fuse.
2	Too much difference between measured density and manual analysis value	Inappropriate density correction factor setting.	Calibrate span as described in section 6.5.
		Air accumulates and keep staying inside the detector. Or substance being measured is sediment.	Very slow flow can be the cause. Make the flow faster by using smaller bore detector to prevent air or substance from remaining in the detector. If this does not solve the problem, resort to vertical piping.
		Large quantity of bubbles are contained in the fluid.	Find out where the air is brought in, and make necessary adjustments. Keep mixer vanes under water. Position the pump inlet low enough. Keep fluid pressure high (0.1MPa to begin with).
	Correct indication depends on the levels of density.	Zero point is off.	Calibrate zero point as in section 6. 4, then calibrate span as in section 6.5.
3	Measured density value is negative.	Zero point is off.	Calibrate zero point as described in section 6. 4, then calibrate span 6.5
4	ALARM indicator lights; density meter error contact output.	Fault in the density meter	Check as described in 8.1 and inform the result of diagnosis to Service Dept.
5	Measured density varies widely and does not agree with manual analysis value.	Detector main pipe is not flowing filled with substance to be measured. Or bubbles stay in detector main pipe.	Keep the tube always filled up with fluid by closing the downstream valve slightly or add a relief valve. Installing the density meter on the outlet side of the pump can help eliminate the cause of those troubles. Vertical piping is recommended for filling the pipe.

Table 8.2 Troubleshooting (1)

No.	Trouble	Cause	Remedy
6	Whie the flow is stagnant, the measured density slowly increases or decreases.	Density becomes uneven because solids in the fluid in the pipe starts to go down or up, causing the density in the center portion of measured fluid increase or decrease slowly.	Use the externally synchronized measurement.
7	Input signal level of the microwaves is too ow and unstable.	Conductivity of object fluid is too high, or the converter is faulty.	Send self-diagnosis data to our Service Department

9. SPECIFICATIONS

9.1 General Specifications

Measurement method: Microwave phase difference method

Measurement range:

Span : 1 to 30% TS

Upper range (20mA) : 1 to 50%TS

Lower range (4mA) : 0 to 49%TS

Note

1) TS: Total Solids

2)Upper, lower range can be selectable in 0.1%TS increments.

Electric Resolution : Density 0.001 %

Note) Recognizable resolution of test sample: Density 0.05%TS

Repeatability: : For full scale 2%TS or over ±2 %FS

: For full scale less than 2%TS ±4 %FS

Note) Applicable for measured values of 5% or more of the full scale for test fluid.

Linearity : For full scale 2%TS or over ±2 %FS

: For full scale less than 2%TS ±4 %FS

Note) Applicable for measured values of 5% or more of the full scale for test fluid.

Ambient conditions : Temperature 0 ~ 50 ℃

Humidity 5 ~ 85 %RH (No condensation)

Structure : IP65

9.2 Detector Specifications

Nominal diameters: : 80mm 100 mm, 150mm, 200 mm, 250mm, 300mm
Flange ratings : Equivalent to ANSI 150, DIN 10, BS 10
Maximum working pressure : 1MPa
Fluid temperature
Standard : 0 to 50 degrees C (No freezing)
Optional
High temperature: 0 to 90 degrees C (No freezing)

Materials contacting liquid :

Part name	Standard spec (0 to 50 C)	High temp. spec.(0 to 90C)
Pipe	316 stainless steel	
Sheath of temp. detector	316 stainless steel	
Applicator window frame	Hardened vinyl chloride	Polysulfone (PSF)
Applicator window sealant	Fluorocarbon rubber (Viton)	

Note: Viton is a registered trademark of E.I.DuPont de Nemours

Fluid conductivity :

Nominal diameter	Fluid conductivity
80mm	12 mS/cm or less
100mm	10 mS/cm or less
150mm	7 mS/cm or less
200mm	5 mS/cm or less
250mm	3 mS/cm or less
300mm	3 mS/cm or less

Note: Fluids that contain electrically conductive substances such as carbon power or metallic power may affect density measurement by conductive particles. Avoid using this density meter to such fluids. Contact Toshiba for details.

Applicators : As an antenna to send and receive microwave signals, one set is provided.
Temperature detector : RTD (Pt100)
Measuring range : 0 ~ 100 ℃
Mounting : Direct mounting between pipes
Weights : Refer to section "9.5 Outline dimensions"

9.3 Converter Specifications

Output signals
Measured density : 4 ~ 20 mADC (load resistance: 750 ohms or less), insulated output
Density meter fault or under maintenance :
One dry "make" contact, 125VAC, 0.1A(resistance load)(max); opens when an error occurs at the density meter or when maintenance work is in progress, otherwise remains close

Input signals
Externally synchronized measurement control signal :
One dry "make" contact, contact capacity of 24VDC, 1A or more. This contact signal can be used to start or stop density measurement in synchronization with an external contact, such as the contact on the pump.
Conductivity correction input:
4 to 20mAdc; corresponding to 0 to 10mS/cm conductivity
Note : If conductivity variation is small, no conductivity correction signal is necessary. For wide variation of the conductivity, prepare a conductivity meter and mount it at an appropriate point of the process where it can measure conductivity accurately. It is necessary to determine a conductivity correction factor for each individual fluid to measure.

Arresters : Arresters are installed in the current output (4-20mAdc) and AC power supply lines.
Power supply: : 100Vac to 240Vac, 50/60Hz
(Allowable power supply voltage 85 to 264Vac)
Power consumption : Approximately 50VA
Case material : Carbon steel
Coating : Polyurethane resin coating , pearl-gray colored

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Operation Manual For Density Meter
Type LQ300