User's Manual

Model TB600G
Laser Turbidity Meter

IM 12E7A1-01E

YOKOGAWA
Yokogawa Electric Corporation

IM 12E7A1-01E
2nd Edition

PREFACE

The Laser Turbidity Meter TB600G is a process-use instrument to detect turbidity in water and comprises a converter, a detector, and a sampling system. The TB600G accommodates many applications: it can be used as a turbidity meter for detecting filter breakage and for monitoring sand filtration processes. It is strongly suggested to read this instruction manual through before the use to ensure the optimum performance of the instrument.

This instruction manual explains how to handle the Laser Turbidity Meter TB600G, in installation, piping, wiring, inspection and maintenance. We recommend that all personnel technically involved with the instrument: installation designers, construction workers for piping and wiring, operators, and maintenance engineers, should read this instruction manual.

An exclusive User's Manual might be attached to the products whose suffix codes or option codes contain the code "Z". Please read it along with this manual.

Confirmation

Unpack the crates carefully and check the components for any damage due to transportation. And make sure that the delivered instruments have the specifications as you specified in regard to power supply and mounting method, by checking the model code described on the nameplate inside the instrument. Refer to Section 1.3 for description on model and suffix codes.

Product Disposal

TB600G uses laser diode. The following disposal methods are recommended when disposing of this product.

- Engaging the services of a contractor certified in the collection, transport and intermediate treatment of items containing arsenic
- Managing the product through to final disposal as specially managed industrial waste which is handled separately from general industrial waste and household waste.

Notes on Handling User's Manuals

- Please hand over the user's manuals to your end users so that they can keep the user's manuals on hand for convenient reference.
- Please read the information thoroughly before using the product.
- The purpose of these user's manuals is not to warrant that the product is well suited to any particular purpose but rather to describe the functional details of the product.
- No part of the user's manuals may be transferred or reproduced without prior written consent from YOKOGAWA.
- YOKOGAWA reserves the right to make improvements in the user's manuals and product at any time, without notice or obligation.
- If you have any questions, or you find mistakes or omissions in the user's manuals, please contact our sales representative or your local distributor.

Media No.IM 12E7A1-01E 2nd Edition :Apr. 2017 (YK)

◆ Safety Precautions

■ Safety, Protection, and Modification of the Product

- In order to protect the system controlled by the product and the product itself and ensure safe operation, observe the safety precautions described in this user's manual. We assume no liability for safety if users fail to observe these instructions when operating the product.
- If this product is used in a manner not specified in this user's manual, the protection provided by this product may be impaired.
- If any protection or safety circuit is required for the system controlled by the product or for the product itself, prepare it separately.
- Be sure to use the spare parts approved by Yokogawa Electric Corporation (hereafter simply referred to as YOKOGAWA) when replacing parts or consumables.
- Modification of the product is strictly prohibited.
- The following safety symbols are used on the product as well as in this manual.

⚠ WARNING

This symbol indicates that an operator must follow the instructions laid out in this manual in order to avoid the risks for the human body and health including risk of injury, electric shock, or fatalities. or the damages to products. The manual describes what special care the operator must take to avoid such risks.

⚠ CAUTION

This symbol indicates that the operator must refer to the instructions in this manual in order to prevent the product (hardware) or software from being damaged, or a system failure from occurring.

The following are signal words to be found only in our instruction manuals.

CAUTION

This symbol gives information essential for understanding the operations and functions.

NOTE

This symbol indicates information that complements the present topic.

■ Drawing Conventions

Some drawings may be partially emphasized, simplified, or omitted, for the convenience of description.

Some screen images depicted in the user's manual may have different display positions or character types (e.g., the upper/lower case). Also note that some of the images contained in this user's manual are display examples.

■ Trademark policy

- All names of company, brand of product used in this manual are registered trademarks.
- TM or ® to signify brand or trademarks are not used in this manual.

Model TB600G
Laser Turbidity Meter

IM 12E7A1-01E 2nd Edition

CONTENTS

1. General

This chapter explains:

- Product general information
- General specifications
- Model and suffix codes
- External dimensions

1.1 Product General Information

Applications and features

With the recent development in membrane filtration technologies, organic filters have come into practical use as a high-performance treatment method for drinking water. In the use of this filter treatment, constant monitoring of filter performance has been recognized as a critical issue since filter breakage may caused by a long-term operation. This is where a turbidity meter that can detect a cut of hollow thread and breakage of pinholes is required.

The Laser Turbidity Meter TB600G detects intensity variations of the transmitted light of semiconductor laser when suspended matter passes through the cell, and converts them into turbidity. With the semiconductor laser, the TB600G can detect particles of even 0.1µm, allowing the instrument to be used as a turbidity meter for detecting filter breakage.

Furthermore, the TB600G can be applied as a turbidity meter installed at outflows from filtration reservoirs where the water quality control is required under “the Provisional Guideline for Cryptosporidium Compliance.”

The TB600G features the following:

- the semiconductor laser method
- high-sensitivity measurement in 0.0001 mg/l
- not affected by colors, particle sizes, and components of water sample
- arresting the generation of air bubbles due to dissolved air by utilizing the pressure-type defoaming tank
- simple installation through easy wiring and piping, aided by a self-supporting stanchion where the turbidity meter is mounted

Measurement principle

Figure 1.1 illustrates the measurement principle.

Light intensity variations of the transmitted light of semiconductor laser, occurring when suspended matter passes through the cell, are detected and converted into turbidity.

Detecting each turbidity-causing particle individually and calculating the total per millilitre of its projected area enable such a low turbidity measurement.

As Figure 1.1 represents, when a focused laser beam passes through the sample cell, the light scattered by the particle in a water sample forms interference and produces a diffraction fringe along with a light intensity variation. The fringe is detected according to a particle size and transformed into a projected area, whereby a signal corresponding to turbidity can be obtained. By this method it has become able to measure a degree of 0.0001 mg/l turbidity accurately. In addition, a measurement in this method is hardly affected by drift due to a temperature and time, and in general does not require calibration for one year.

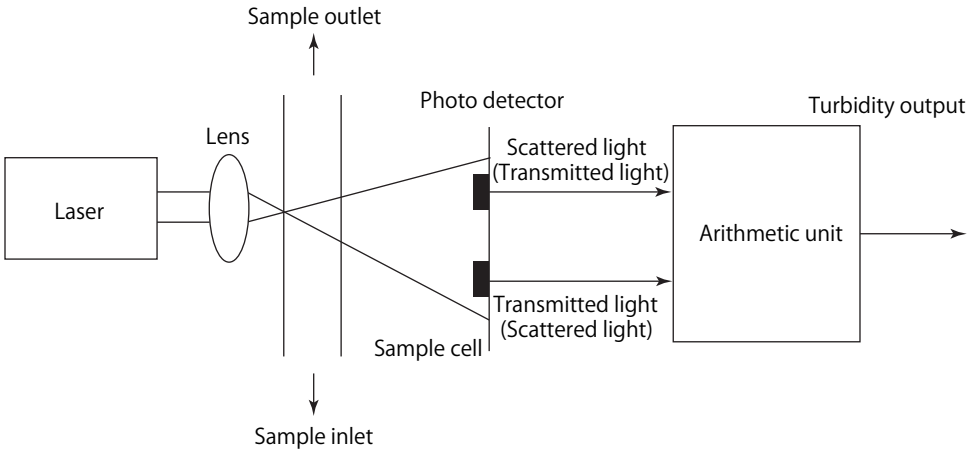


Figure 1.1 Measurement Principle

1.2 General Specifications

Measured objects: Detection of membrane breakage on membrane filtration treatment and measurement of turbidity at outflows from filtration reservoirs at drinking water treatment plants

Measuring method: Semiconductor laser method

Measuring range: 0.0000 to 2.0000 mg/l or NTU

Measurement cycle: Selectable from among 6 seconds/1 minute/10 minutes. An average of the selected time is indicated. (Data is updated every six seconds.)

Output range: Specified setting with a minimum span of 0 to 0.1 mg/l or 0 to 0.1 NTU

Output signal: 4 to 20 mA DC (Maximum load resistance: 550 Ω), RS-232C

Serial communication:

- Method; Unilateral communication start-stop synchronizing method
- Transmission code; ASCII
- Transmission speed; 9600 BPS
- Data length; 8 bit
- Stop bit; 2 bit
- Parity check; None

Communication data:

- Time; e.g. #12:00$C_R L_F$
- Measured turbidity value; e.g. #0.7981$C_R L_F$
- Data output time is selected from among 1 minute/10 minutes/60 minutes/alarm occasion

Contact output; Alarm contact output (Closed when alarm outputs),
Fail contact output (Closed when fail outputs)

Contact capacity; AC100V 0.2A
0.2 A/DC 30V 0.2 A (Resistive load)

Display: Digital indication (Resolution 0.0001 mg/l)

Materials:

- Wetted part; Quartz glass, PTFE, PFA, PP
- Converter case; Polyurethane resin, backed finish, aluminum alloy casting
- Detector case; Polycarbonate
- Piping; Rigid vinyl chloride, stainless steel, polyethylene resin, polypropylene resin
- Stanchion; Polyurethane resin, baked finish, carbon steel board or stainless steel

Colors: Converter; unsell 0.6GY3.1/6.0 and Munsell 2.5Y8.4/1.2
Stanchion; Munsell 0.6GY3.1/2.0
Ambient temperature: 0 to 40°C (Heating protection is required when water sample freezes)
Ambient humidity: 5 to 85% RH (non-condensing)
Installation location: Indoors
Installation space: 1200 x 1200 mm, including clearance for maintenance access
Mounting: Converter, single detector: rack mounting or 2-inch pipe mounting
With sampling system: anchor bolt mounting
Cable connection: 4 cable glands (For power supply, output signal, contact output)
Outer diameter of applicable wire: ø6 to ø12 mm
Piping connection:
Without sampling system: Inlet; Rc1/4
Drain port; Rc1/4
With sampling system: Inlet; VP16
Drain port; VP40
Water sample conditions: Flow rate; 0.5 to 5 l/min (Detector flow rate: 50 ml/min)
Pressure; 20 to 300 kPa
Temperature; 0 to 40°C
Power supply: 100 to 240 V AC 50/60 Hz
Power consumption: 15 VA or less
Weight: Approximately 45 kg (with sampling system)
Detector; Approximately 2 kg
Converter; Approximately 6 kg
Characteristics
Minimum resolution: 0.0001 mg/l
Repeatability: ±3% F.S. or less

1.3 Model and Suffix Codes

[Style : S2]

Model	Suffix code	Option code	Specifications
TB600G	- - - - - - - - - - - - - - -	- - - - - - - -	Laser turbidity meter
Sampling system	**-NN**	- - - - - - - -	Without sampling system (Note 1)
	-AD	- - - - - - - -	With sampling system, bottom piping installation
	-AB	- - - - - - - -	With sampling system, rear piping installation
	-SD	- - - - - - - -	With sampling system, bottom piping installation Stainless steel stanchion
	-SB	- - - - - - - -	With sampling system, rear piping installation Stainless steel stanchion
-	**-NN**	- - - - - - - -	Always -NN
Optional specifications	**/R**	- - - - - - - -	With rack and pipe mounting brackets (Note 2)

Note 1: Without sampling system means that a detector, a converter and a 1-m cable used for between the converter and the detector, are delivered. A defoaming tank and/or flowmeter should be arranged separately, if necessary.
Note 2: This applies when selecting an option of "without sampling system (-NN)"
Note: Other instruments cannot be combined with the unit.

Accessories

Name	Q'ty	Remarks
Fuse	1	250V 1A
Desiccant	3	For three times
Brush	1	For cleaning

Auxiliary parts

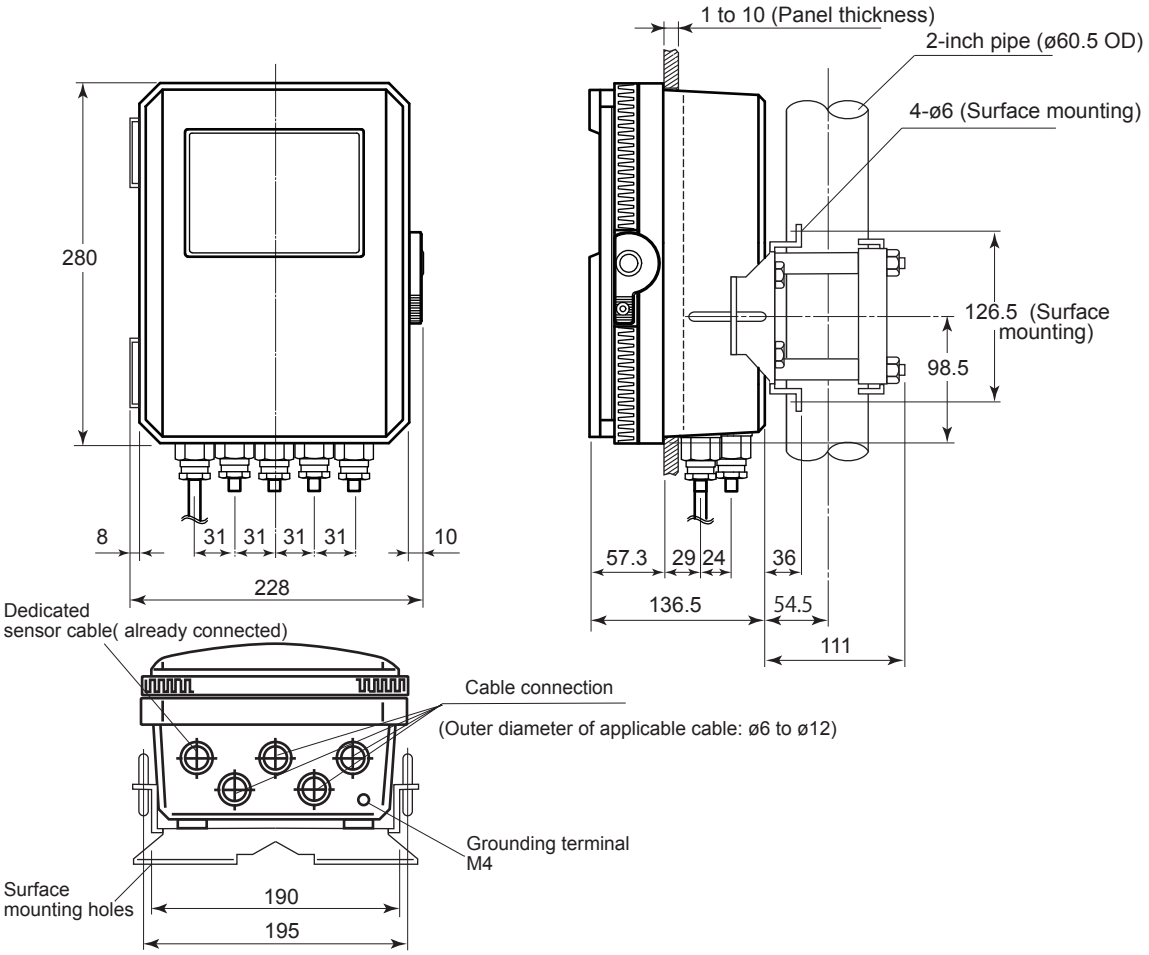
Name	Part Number
Fuse	K9058RT
Detector cover	K9058RW
Pressure-type defoaming tank (with mounting brackets)	K9725WA
Flowmeter	B1000EU
Desiccant (For once)	K9324PC
Lithium battery *	K9058RS
	A1090EB
Brush (For cleaning)	K9058RX

* : Date of manufacture of the product determines compatible lithium battery with the product.
Contact YOKOGAWA .We will help you know the right battery to your product.
K9058RS : 3 V cylindrical cell
A1090EB : 3 V button cell (CR2032)

1.4 External Dimensions

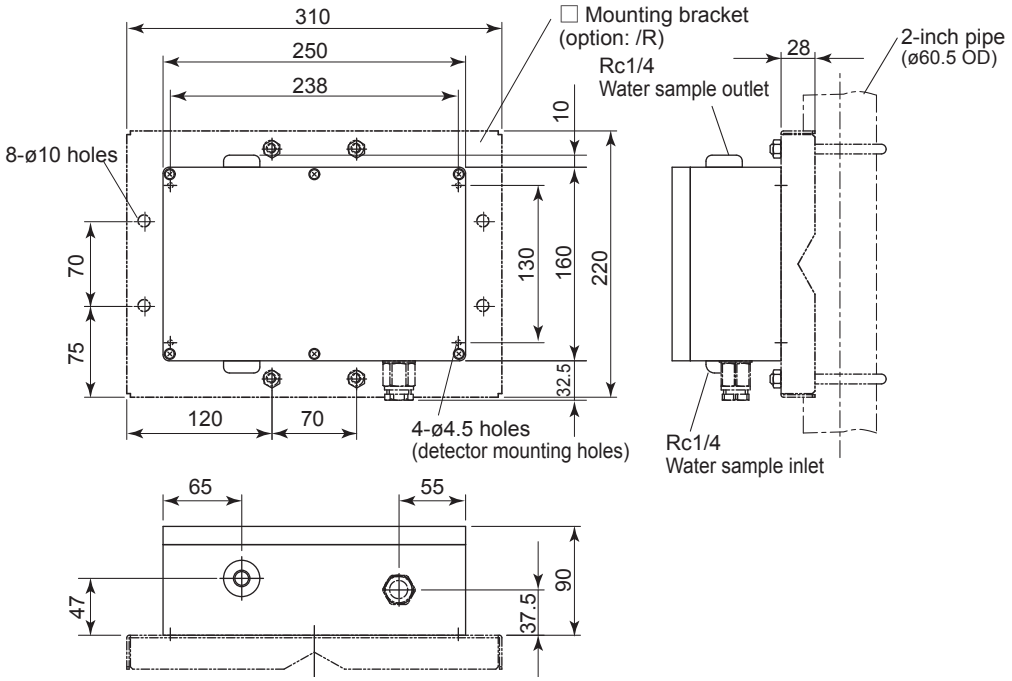
Without sampling system, TB600G-NN-NN

Converter



Unit: mm

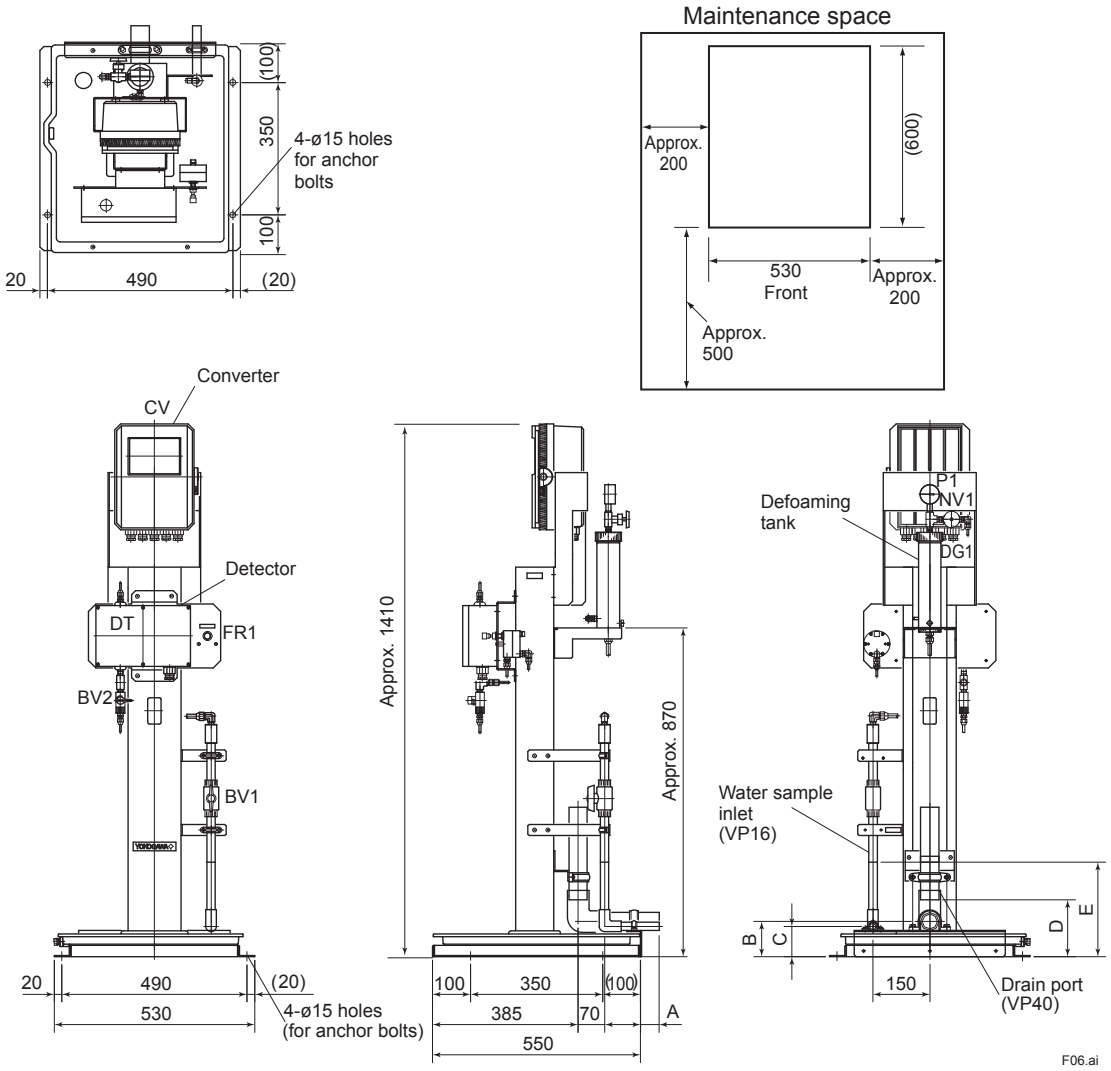
Detector



Unit: mm

Figure 1.2 External Dimensions of TB600G without Sampling System

With sampling system, TB600G-A□,S□-NN



	Model and Suffix Code	Piping	A	B	C	D	E
	TB600G-AD-NN	Bottom piping installation, vertical	-	-	-	150	250
	TB600G-AB-NN	Rear piping installation, horizontal	50	93	80	-	-
	TB600G-SD-NN	Bottom piping installation, vertical	-	-	-	150	250
	TB600G-SB-NN	Rear piping installation, horizontal	50	93	80	-	-

Unit: mm

Figure 1.3 External Dimensions of TB600G with Sampling System

2. Installation

The Laser Turbidity Meter TB600G is installed indoors or in a cubicle.

This chapter explains the following installation procedures of the TB600G.

- Installation
- Piping
- External wiring

2.1 Installation

2.1.1 Unpacking

The Laser Turbidity Meter TB600G is shipped and delivered in adequate crates to prevent damages during transportation. When they arrive, unpack the crates with care. As for the unit with a sampling system, unpack the crates near the location where they are to be installed.

2.1.2 Site Conditions

The TB600G should be installed in a place with the following conditions:

- No exposure to the rain, i.e. indoors and in a cubicle
- No vibration should be allowed
- Corrosive gases are limitedly present
- No excessive moisture should be allowed
- Ambient temperature nearest to the normal temperature should be kept with minimum temperature variations
- Enough clearance and easy-to-work environment for maintenance.
- A drain is equipped with

2.1.3 Installation

The TB600G is installed in different ways according to whether it is equipped with a sampling system or not.

When the TB600G is equipped with the sampling system, secure the entire system with anchor bolts (M12) on a well-drained concrete base.

When the TB600G is equipped without the sampling system, mount the detector and the converter onto a rack or pipe with their respective, special mounting brackets, which are delivered with the instrument only when they are specified.

CAUTION

The detector should be vertically installed with the WATER IN inlet facing downward.

2.2 Piping

Piping should be carefully constructed so that the instrument can keep a constant flow rate even if an original pressure changes, and cannot take in air bubbles, since flow rate variations and air bubbles affect the measurement of the instrument. And reducing pressure of a water sample may cause dissolved oxygen to be generated. Therefore in piping work, take care not to reduce pressure of water samples in order to prevent the generation of dissolved oxygen.

2.2.1 Without Sampling System: TB600G-NN-NN

(1) Piping for water sample

A piping connection for the water sample inlet is designed for Rc1/4. A coupling for connecting a tube or pipe to the water sample inlet should be used for connecting. If a water sample has pressure, construct adequately strong piping to stand the pressure. Make sure of the detector being kept free from air bubbles, which affect the measurement, by installing a pressure-type defoaming tank or taking relevant measures, if necessary.

Note: With an open-type defoaming tank, dissolved oxygen may be generated, affecting the measurement.
Use a tube or pipe with an inner diameter of 4 mm, otherwise it would result in a trouble of water samples flow or air bubbles generation, which may affect the measurement.

(2) Piping for drain

A piping connection for the drain port is designed for Rc1/4. A coupling for connecting a tube or pipe to the drain port should be used for connecting. If a water sample has pressure, construct adequately strong piping to stand the pressure.

CAUTION

In order to prevent the generation of dissolved oxygen, keep the pressure of the way from the water sample supplying line through the detector outlet unchanged by installing a throttle in the drain piping.

2.2.2 With Sampling System: TB600G-A☐, S☐-NN

Figure 2.1 illustrates a flow chart of a whole system including a sampling system.

Mark	Part Name
BV1,2	Ball valve
NV1	Needle valve
FM1	Flowmeter

Mark	Part Name
DG1	Defoaming tank
P1	Pressure gauge
DT	Detector

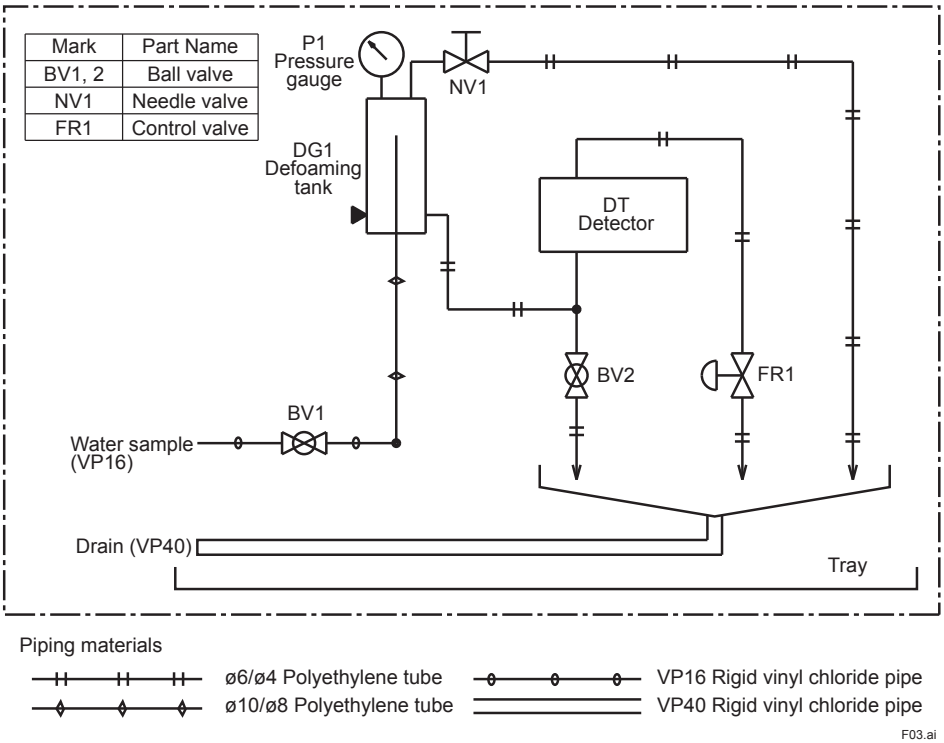


Figure 2.1 Flow Chart of TB600G with Sampling System

(1) Piping for water sample

This is piping for supplying water samples to the pressure-type defoaming tank and the detector. A piping connection is designed for a rigid PVC resin tube with a nominal diameter of 16 (outer diameter of ø22 mm). Specified couplings, including unions and flanges, in conformity with this pipe diameter should be mounted for piping.

The pressure condition of a water sample is 20 to 300 kPa.

(2) Piping for drain

This is piping for draining water samples that have been supplied to the pressure-type defoaming tank and the detector, to a drainage canal or the like.

A piping connection is designed for a rigid PVC resin tube with a nominal diameter of VP40. The rigid PVC tube with VP40 (VU40) or greater in nominal size should be used to prevent sediment from settling and effluent from standing in the pipe.

2.3 External Wiring

WARNING

Do not apply the power on power supply wires before completing and confirming the power supply wiring. An electric shock accident is likely to result in death or serious injury.

CAUTION

With the unit with a sampling system, strip a seal of the piping connection for wiring.

Wiring for the turbidity meter includes:

(1) Wiring for power supply and grounding

(2) Analog output wiring

(3) Digital output wiring

(4) Contact output wiring

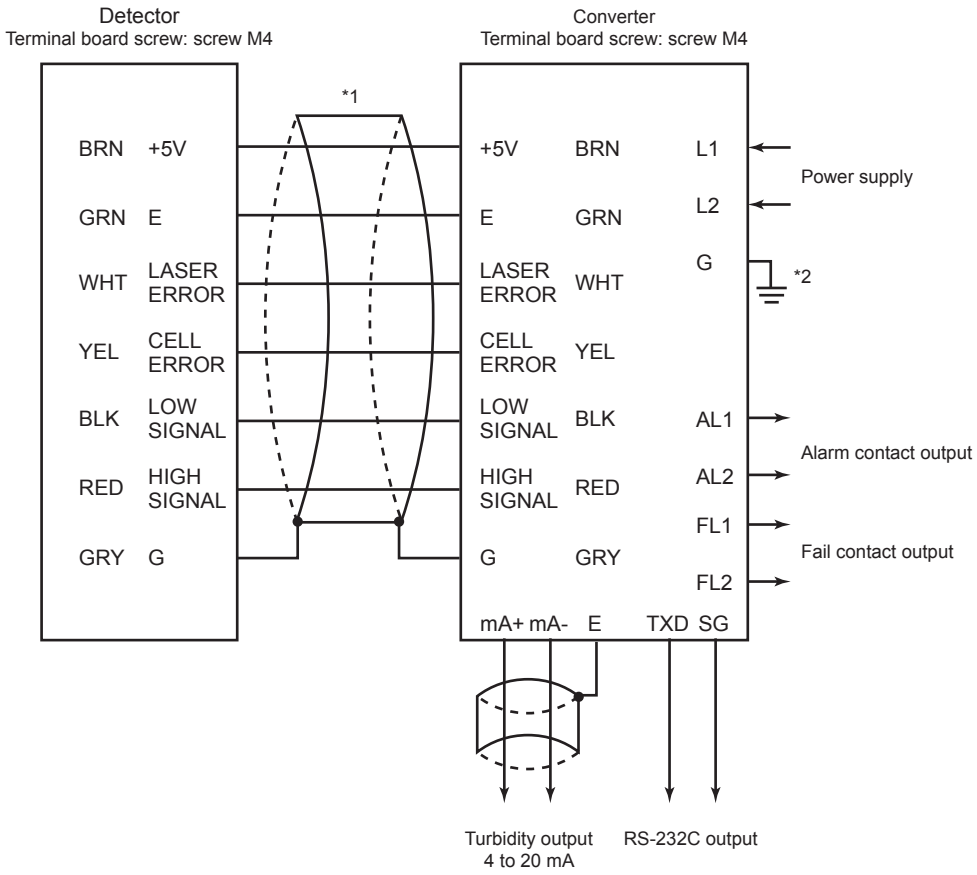


Figure 2.2 External Wiring Diagram

Note 1: A dedicated cable (1 m) is used between the detector and the converter
Note 2: The earth terminal must be grounded (JIS Grade 3 grounding)

2.3.1 Power and Ground Wiring

Power wiring

This wiring is for supplying the power, which voltage and frequency conform to the specification of the instrument, to the converter. Connect the power supply to the terminals “L1” and “L2” on the converter 2.

Use a two-core cable with a finished OD of ø6 to ø12mm for the power wiring.

A cable termination of the end to be connected to the converter is instructed below.

(1) Strip about 80 mm of the insulation covering from the cable end.

(2) Terminate an exposed core end by mounting a crimp terminal, fitting to the screw M4, onto it.

Ground wiring

A grounding terminal, located on outside of the converter case and designed for the screw M5, is used for ground wiring. Connect an appropriately terminated grounding wire (having enough conductivity) to the grounding terminal for grounding (JIS Grade 3 grounding, grounding resistance of 100 Ω or less.)

Note: If the grounding terminal on the converter cannot be used for grounding, connect the grounding wire to the grounding terminal (screw M4) inside the conductor and ground the wire on the power supply side. In this case, use 3-core or 2-core shielded cables for the power and ground wiring.

2.3.2 Analog Output Wiring

This wiring is for transmitting analog output signals of 4-20 mA DC to a receiver such as a recorder.

Use a 2-core shielded cable with a finished OD of ø6 to ø12 mm for wiring.

(1) Strip about 40 mm of the insulation covering and the shield from the cable end. Solder a lead wire on the root of the exposed shield. And protect the soldered part by winding an insulation tape on it or by relevant measures.

(2) Cut the lead wire at the same length as cores have. And mount crimp terminals, fitting to the screw M4, onto the ends of this lead wire and each core.

(3) Connect the cable to terminals mA+, mA-, and E on the converter: connect the core's plus-pole end of the cable to the output signal terminal " mA+", the core's minus-pole end to the terminal " mA-", and the lead wire of the shield to the terminal "E". (Do not ground the shield on the receiver side.)

2.3.3 Digital Output Wiring

This wiring is for transmitting digital output signals of the RS-232-C to an external device such as a PC.

Use a 2-core cable with a finished OD of ø6 to ø12 mm for wiring.

(1) Strip about 40 mm of the insulation covering and the shield from the cable end.

(2) Mount crimp terminals, fitting to the screw M4, onto ends of each core.

(3) Connect the cores of the cable to terminals TXD and SG on the converter.

2.3.4 Contact Output Wiring

The converter outputs a contact signal of "alarm." Contact output wiring is conducted when using this function.

Use a 2-core cable with a finished OD of ø6 to ø12 mm for wiring.

(1) Strip about 40 mm of the insulation covering from the cable end.

(2) Mount crimp terminals, fitting to the screw M4, onto the ends of each core.

(3) Connect the cable to the alarm contact output terminal on the converter: connect the cores of the cable to terminals "AL1" and "AL2".

Contact capacity of the contact output is 250V AC, 1A, 250 VA.

2.3.5 Wiring between the Detector and the Converter

This wiring is for a connection between the detector and the converter of the unit without a sampling system. (It is unnecessary for the unit with a sampling system, with which this wiring has been completed.)

(1) Put a free cable with a crimp terminal from the converter, into the detector and mount the waterproof plug on the end of the cable to the detector.

(2) Connect the cable to the detector referring to Figure 2.2, External Wiring Diagram.

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3. Operation

CAUTION

After completing piping and wiring, make sure that your power supply specification is in conformity with the instrument's counterpart and that wiring and piping are properly conducted before applying the power. making a mistake in order of opening valves may cause piping disconnection or water leakage, resulting in injury and failures.

3.1 Preparation

Take the following procedures in order before operating the instrument.

3.1.1 Setting Desiccant

To prevent the detector inside from condensation, put a set of desiccant (2 sachets/set, accessory) into the detector.

(1) Open the cover of the detector.

CAUTION

Screws fixing the cover are tapping screws. Do not strongly turn them to avoid destroying the thread of screws.

(2) Take new 2 sachets of desiccant out from a vinyl bag.

(3) Put them into the detector. (Place one distant from the other)

(4) After making sure that sealing sections are not covered with desiccant sachets, close the cover.

3.1.2 Adjusting Flow Rate of Water Sample

The TB600G's detector requires a flow rate of 50 ml/min.

WARNING

Keep the flow rate of the detector constant, because it affects the total performance of the TB600G.

With the unit without a sampling system, adjust the valve so that the detector has a flow rate of 50 ml/min ±10%.

With the unit with a sampling system, adjust the flow rate as instructed below while referring to Figure 1.3, External Dimensions of TB600G with Sampling System and Figure 2.1, Flow Chart of TB600G with Sampling System.

(1) Confirm that all valves, NV1, BV1, BV2, and FM1, are closed.

(2) Open valves NV1 and FM1 completely.

(3) Open valves BV1 completely.

(4) When the flow rate of the valve FM1 is less than 50 ml/min, close valve NV1 gradually and adjust it until the flow rate stays at 50 ml/min ±10%.

(5) When the flow rate of the valve FM1 is greater than 50 ml/min, close valve FM1 and adjust it until the flow rate stays at 50 ml/min ±10%.

3.1.3 Applying the Power

When the liquid cell of the detector is filled with the water sample, switch the power on.

(1) Open the cover of the converter and turn the power switch ON.

(2) Confirm that the power has been applied by checking the digital display meter being turned on.

3.2 Running-in

Before operating the instrument for measurement, allow it to run for more than 30 minutes for running-in.

3.3 Simple Calibration

The Laser Turbidity Meter TB600G is calibrated with for mazine or kaolin standard solutions specified by Yokogawa. Since for mazine and kaolin standard solutions somewhat differ in quality depending on their production place and manufacturing lot, there may be discrepancies between values the TB600G has and those calculated manually. In this case TB600G's values can be adjusted to manually calculated values by changing internal coefficients as following the procedure below.

(1) Take a note of currently displayed turbidity reading.

(2) Press the "DISPLAY" and "AVERAGE" keys simultaneously for a few seconds and confirm that the last digit of displayed reading flashes and the LED of the mode "CLOCK" is turned on.

(3) Four internal coefficients are set. The coefficient indication changes in turn: first coefficient, second coefficient, third coefficient, fourth coefficient, and back to the first coefficient, by pressing the "MODE" key. At the same time the LED changes: "CLOCK" --> "ALARM" --> "PRT.INT" --> "OUTPUT SPAN" --> "CLOCK", accordingly. So the coefficient can be confirmed by the LED.

(4) Initial values in the internal coefficients are set at 1.4500 in the first, 1.4500 in the second, 1.0000 in the third, and 1.0000 in the fourth. Change the first and the second coefficients for the kaolin standard, and the third and the forth coefficients for for mazine standard, to values calculated by the following equation. Change the digit of the value using the ">", "^", and "v" keys and lastly press "ENT" key.

Note: The same figure must be inputted in the first and the second coefficients, and the same one in the third and the forth coefficients.

Coefficient to be inputted
= Current coefficient x (manually calculated value/currently displayed value)

(5) After completing inputting figures, press the "CANCEL" key to return to the measuring mode and confirm readings.

4. Functions

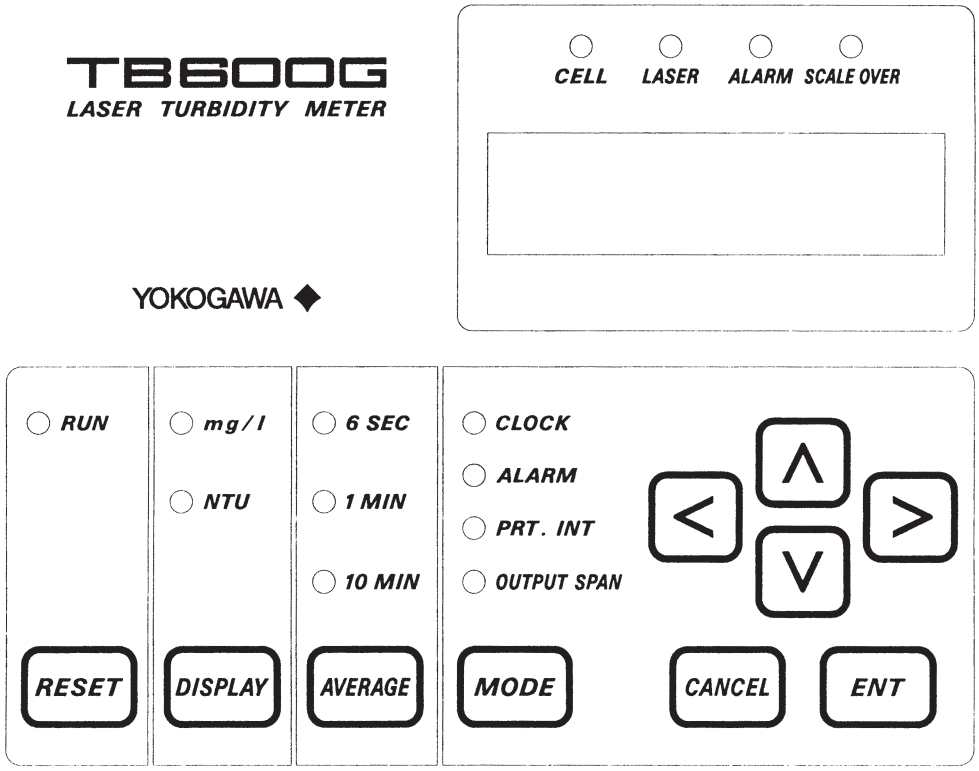

Figure 4.1 Key Layout

4.1 Key Functions

4.1.1 "RESET" Key

The "RESET" key is used for discarding all past data and starting a new measurement.

When a measuring time of 1 minute or 10 minutes is selected, an average value for 6 seconds will be displayed until the specified time elapses after the "RESET" key is pressed.

4.1.2 "DISPLAY" Key

The "DISPLAY" key is used for changing a measuring unit.

mg/l: should be selected for measuring turbidity based on kaolin conversion

NTU: should be selected for measuring turbidity based on for mazine conversion

4.1.3 "AVERAGE" Key

The Laser Turbidity Meter TB600G displays and outputs the average value for the specified time as a measured value. This key is to change the specified time. Pressing the key changes the specified time in turn: [6SEC] --> [1MIN] --> [10MIN] --> [6SEC].

[6SEC]: displays average values for 6-second measurement

[1MIN]: displays average values for 1-minute measurement

[10MIN]: displays average values for 10-minute measurement.

Readings in any specified time above are updated every 6 seconds.

When a measuring time of 1 minute or 10 minutes is selected, an average value for 6 seconds will be displayed until the specified time elapses and data needed to calculate the average are collected.

4.1.4 “MODE” Key

The key is used to switch the each mode and to change the setting. Pressing the key changes the mode in order: [CLOCK] --> [ALARM] --> [PRT.INT] --> [OUTPUT SPAN] --> [CLOCK]. Refer to Section 4.2, Mode Functions for their functions.

4.1.5 “<”, “>”, “^”, “v”, “CANCEL”, “ENT” Keys

These keys are used to set values in each mode.

The “<” and “>” keys are to change the digit.
The “v” and “^” keys are to increase and decrease the digit

The “ENT” key is to accept the changed value.

The “CANCEL” key is to finish the setting mode and return to the turbidity display.

4.2 Mode Functions

4.2.1 “CLOCK”

This is a mode for displaying and setting the current time.

To change the time, use the “<”, “>”, “^”, and “v” keys and then press the “ENT” key to accept the change.

4.2.2 “ALARM”

This is a mode for setting the alarm value of the contact output.

When an average measured value exceeds the value set here, the alarm indication LED will be turned on and at the same time the contact output will be ON.

The initial value is set at 2.0000.

Use the “<”, “>”, “^”, and “v” keys to change the set value and then press the “ENT” key to accept the change.

4.2.3 “PRT.INT”

This is a mode for setting the time that is output in the RS232C.

The time set in this mode will be output. Pressing the “<” and “>” keys changes the mode in order: [1] --> [10] --> [60] --> [9999] --> [1]. Press the “ENT” key to accept the change.

The initial value is set at [1].

[1]: output every minute
[10]: output every 10 minutes
[60]: output every 60 minutes
[9999]: output when the alarm is activated

4.2.4 “OUTPUT SPAN”

This is a mode for setting a range of the analog output.

A turbidity value corresponding to 20 mA output is set here. (The value of 0 is fixed for 4 mA)

To change the set value, use the “<”, “>”, “^”, and “v” keys and then press the “ENT” key to accept the change.

A setting range is 0.1000 to 2.0000.

The value [2.0000] is set as an initial value.

CAUTION

Do not set a value less than 0.1000, while it is possible to be input.

4.3 LED Indication

4.3.1 “CELL”

The “CELL” LED will be turned on when the laser beam cannot reach the detector because of troubles such as dirt on, and condensation in, the sample cell. If the cell becomes dirty, clean the cell referring to Section 5.2. If condensation occurs in the cell, a service person is required to open the cell. Contact the Yokogawa Service Station.

The “CELL” LED may also be turned on when large air bubbles pass through the cell for a moment.

4.3.2 “LASER”

The “LASER” LED will be turned on when a laser beam output decreases. Replacing the laser on site is not available, so contact the Yokogawa Service Station for service.

Note that the LED may also be turned on when the laser beam cannot reach the detector because of troubles such as dirt on and condensation in the sample cell. Therefore when the “LASER” LED is turned on, first clean the cell and try an operation again. If this does not have the LED turned off, contact the Yokogawa Service Station.

4.3.3 “ALARM”

The “ALARM” LED will be turned on when an average measured value exceeds the set alarm value. At the same time the contact output will be ON, too.

4.3.4 “SCALE OVER”

The “SCALE OVER” LED will be turned on when a measured value exceeds 2 mg/l of 2NTU.

Note: that all the LED will be turned off after the condition is recovered.

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5. Check and maintenance

This chapter explains the inspection and maintenance implemented to keep the Laser Turbidity Meter TB600G in good operating condition.

5.1 Check and maintenance Items and Their Periods

Major inspection and maintenance items and their recommended periods to keep the instrument in good operating condition, are shown below. As inspection and maintenance periods vary depending on each operating condition, conduct the inspection and maintenance at suitable period for your operating condition.

Inspection/maintenance Item	Period
Checking and cleaning sample cell	One time/3 months
Replacing desiccant	One time/3 months
Calibration	One time/year
Replacing laser	One time/year
Replacing fuse	One time/year
Replacing lithium battery for backup	One time/2 years

5.2 Cleaning Sample Cell

While some dirt on the sample cell does not affect measurements in terms of the measurement principle, it is recommended that periodic cleaning be conducted to maintain a good operating condition.

(1) Stop supplying water samples to the detector. With the unit with a sampling system, close valve BV1 completely.

(2) Remove couples from the SAMPLE IN and the SAMPLE OUT.

(3) Insert a brush (accessory) into the pipe and move it up and down to clean off adhered dirt or films on the cell

Note: Do not move the brush strongly, otherwise it may damage the cell.

(4) Cleaning the cell using acid solutions such as diluted hydrochloric acid solution does not give any damage on the cell. Take extra care to handle acid solutions.

(5) After finishing cleaning, mount couplings back to the detector. Allow the instrument to run at the specified flow rate (50 ml/min ± 10%) for 30 minutes for running-in.

5.3 Replacing Desiccant

A desiccant is installed in the detector to prevent the sample call or the printed board from condensation.

Replace the desiccant with a new one every three months or when opening the detector's cover for cleaning the cell.

The desiccant consists of 2 sachets. Make sure that 2 sachets be replaced at the same time when replacing the desiccant.

5.4 Calibration

The Laser Turbidity Meter TB600G should be calibrated once a year.

On-site calibration is not available, so a Yokogawa service person withdraws the instrument from your field to a Yokogawa plant for calibration, which requires 2 or 3 weeks. Consult with the service person about a substitute during the calibration.

5.5 Replacing Laser

For a safety reason it is recommended that the laser be replaced with a new one at the same time when you ask Yokogawa for calibration, although a laser's life is more than 2 years . On-site laser replacement is not available, so as instructed in Section 5.4, a Yokogawa service person withdraws the instrument from your field for the laser replacement.

5.6 Replacing Fuse

For preventive maintenance, it is recommended that the fuse be replaced once a year.

The fuse is used in the converter.

5.7 Replacing Lithium Battery for Backup

To reserve memories set, a lithium battery is loaded in the converter. The battery should be replaced every two years. In replacing the battery, it is required to reset setpoints. Contact a Yokogawa service person for it.

6. Troubleshooting

Causes of operation failures and their remedies are listed below.

When the LED is turned on, refer to Section 4.3 for the remedy.

Symptom	Probable cause	Remedy
No readings displayed or off scale	Connection between detector and converter	Check their terminals
	Deteriorated laser	Replace laser
Unstable readings	Air bubbles contamination	Check piping of sampling
	Improper sampling	Adjust flow rate
Readings increase after turning on (Fluctuation for relatively short time)	Water drop condensing on sample cell due to desiccant malfunction	Regenerate desiccant
Readings fluctuation (for long time)	Dirt on sample cell	Clean
Readings drift	Dirt on sample cell	Clean
	Deteriorated laser light	Calibrate
Immediate failure even after regenerating desiccant	Leakage of liquid cell	Contact Yokogawa Service Station

When the keys does not work due to disturbance or when setpoints of each mode are rewritten, four internal coefficients may also be rewritten. Confirm them taking the following procedure.

(1) Turn the switch off once, and turn it on again.

(2) Check if setpoints of each mode have been changed. If so, reset the figures referring to Section 4.2 on page 19.

(3) Press the “DISPLAY” and “AVERAGE” keys at the same time for a few seconds until the last digit of a displayed value flashes and the “CLOCK” LED in the MODE is turned on. This value is the first internal coefficient.

(4) Four internal coefficients are set in the Laser Turbidity Meter TB600G. The coefficient display changes in turn: “Second internal coefficient” --> “Third internal coefficient” --> “Forth internal coefficient” --> “First internal coefficient.” As the coefficient changes, the LED changes: “ALARM” --> “PRT.INT” --> “OUTPUT SPAN” --> “CLOCK”, accordingly. So the coefficient can be confirmed by the LED.

(5) Check that each internal coefficient are [First: 1.4500], [Second: 1.4500], [Third: 1.9999], [Fourth: 1.0000]. If any of figures is different from the above, change it to the above figures by using the “>”, “^”, and “v” keys and confirm the change by pressing the “ENT” key. Pressing the “ENT” key leads to next internal coefficient without pressing the “MODE” key.

(6) After completing setting figures, press the “CANCEL” key to return a measuring mode. A displayed figure does not longer flash and the MODE LED is turned off, whereby you can confirm that the instrument goes back to the measuring mode.

CAUTION

Do not change these internal coefficients unless above-mentioned troubles happen, since they are very important in terms of maintaining reliability of the instrument.

Consult Yokogawa service personnel for changing the internal coefficients.

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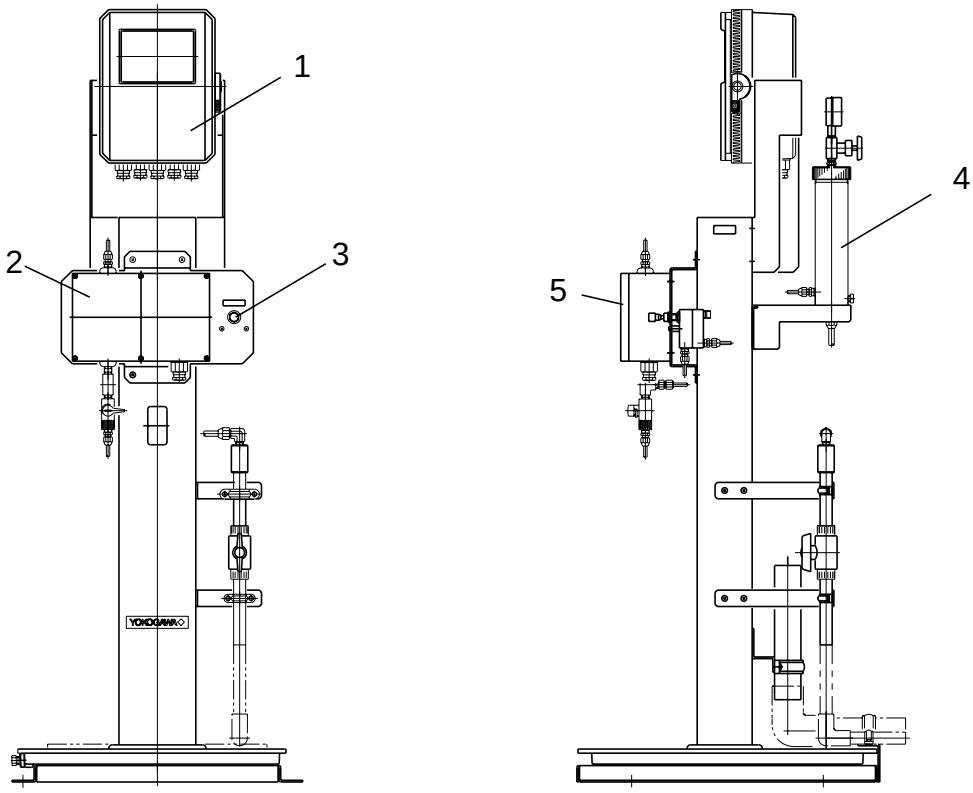
Customer Maintenance Parts List

TB600G
Laser Type Turbidity Meter



Item	Parts No.	Qty	Description
1	K9058PA	1	Converter Assy
2	K9058QA	1	Detector Assy
3	B1000EU	1	Flow Control Valve
4	K9725WA	1	Over Flow Tank Assy for TB600G-AD or -AB
5	K9058RW	1	Cover for Detector Assy

YOKOGAWA
Yokogawa Electric Corporation

CMPL 12E7A1-02E
3rd Edition : Nov. 2005 (YK)

Revision Information

- Title: Model TB600G Laser Turbidity Meter
- Manual No.: IM 12E7A1-01E

Apr. 2017/2nd Edition

Revised overall inculuding addition of Product Dispolsal (p.i), partial change in the maintenance parts list and figures.(formatting into InDesign)

Sep. 1999/1st Edition

Newly published

■: http://www.yokogawa.com/an/
■ Published by Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, Tokyo 180-8750, JAPAN
■ Printed by KOHOKU PUBLISHING & PRINTING INC.

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