User's Manual

TB830D
Surface Scattering Light Turbidity Detector

IM 12E04B40-02EN

YOKOGAWA
Yokogawa Electric Corporation

IM 12E04B40-02EN
2nd Edition

INTRODUCTION

Thank you for purchasing TB830D Surface Scattering Light Turbidity Detector.
This User's Manual contains all essential information for the user to make full use of TB830D.
Please read the following respective documents before installing and using the instrument.
The related documents are listed as follows.

General Specifications

Contents	Document number	Note
TB830D, FLXA402T Surface Scattering Light Turbidity Detector	GS 12E04B40-01EN	Online manual

"EN" in the document number is the language code.

User's Manual

Contents	Document number	Note
TB830D Surface Scattering Light Turbidity Detector Start-up and Safety Precautions	IM 12E04B40-01EN	Attached to the product (printed manual) (This manual)
TB830D Surface Scattering Light Turbidity Detector	IM 12E04B40-02EN	Online manual
FLXA402T Liquid Analyzer for Turbidity and Chlorine Start-up and Safety Precautions	IM 12A01G01-01EN	Attached to the product (printed manual)
FLXA402T Liquid Analyzer for Turbidity and Chlorine Installation and Wiring	IM 12A01G01-02EN	Online manual
FLXA402T Liquid Analyzer for Turbidity and Chlorine Operation of Converter	IM 12A01G01-03EN	Online manual
FLXA402T Liquid Analyzer for Turbidity and Chlorine Operation of pH	IM 12A01G02-01EN	Online manual
FLXA402T Liquid Analyzer for Turbidity and Chlorine Operation of SC	IM 12A01G03-01EN	Online manual

"EN" in the document number is the language code.

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

Technical Information

Contents	Document number	Note
FLXA402T Liquid Analyzer for Turbidity and Chlorine MODBUS Communication	TI 12A01G01-62EN	Online manual

"EN" in the document number is the language code.

You can download the latest documents from our website. Scan QR code.
http://www.yokogawa.com/an/flxa402t/download/

Refer to each corresponding manual for other related products.

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.
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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.

Terminology

- Turbidity meter, Turbidity analyzer: TB830D + FLXA402T
- Detector, Detection unit: TB830D detector, TB830D Detection unit
- Converter or liquid analyzer: FLXA402T

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TB830D
Surface Scattering Light Turbidity Detector

IM 12E04B40-02EN 2nd Edition

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1. OVERVIEW

Surface Scattering Light Turbidity Detector, composed of Turbidity Detector TB830D and Liquid Analyzer FLXA402T, is a next-generation analyzer, developed based on years of experience, combining the reliable measurement principle with our latest digital sensor technology realizing high efficiency in facility operations. The product has successfully extended its life by employing LED as the light source.

1.1 Measurement system and structure

TB830D is used with FLXA402T Liquid Analyzer for Turbidity and Chlorine. TB830D also can be used with a sampling system to control the pressure or flow rate of samples.

● TB830D Surface Scattering Light Turbidity Detector

TB830D measures turbidity. The Detection unit consists of the following three parts.

- Flow cell: A sample flows through it. A light beam is emitted from the light source onto the sample solution.
- Detection unit: An optical system incorporating a Light source, Receiver, and lenses. Desiccant equipped helps the dryness inside.
- Smart unit: Memory of parameters, the control unit

● FLXA402T Liquid Analyzer for Turbidity and Chlorine (converter)

Displays/Outputs measurement or status of connected detectors or controls detectors.

Refer to IM 12A01G01-03EN for the setup of the display, input/output, or communication.

● Sampling System

The Head tank enables the pressure of a sample and the flow rate to stabilize. The Head tank also reduces the effect of air bubbles.

For Automatic cleaning/Automatic zero calibration, a Relay box and/or solenoid valve is mounted.

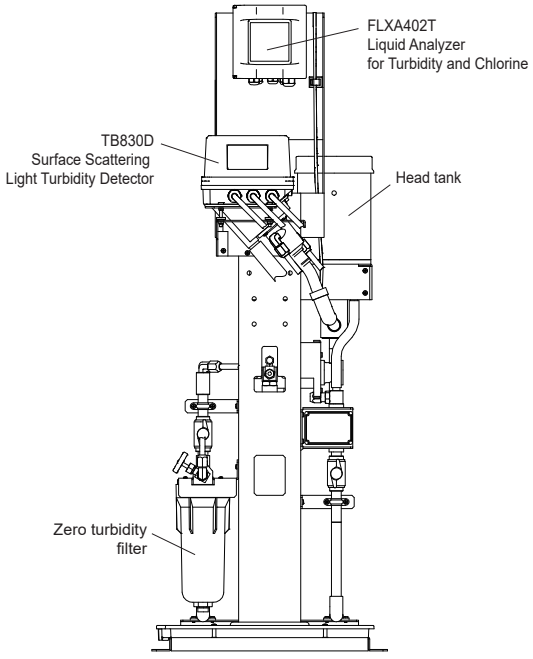


Figure 1.1 Example “With sampling system” (-A3)

1.2 Part Name and Functions

Refer to IM 12A01G01-03EN for FLXA402T Liquid Analyzer for Turbidity and Chlorine Operation of Converter.

TB830D Turbidity detector

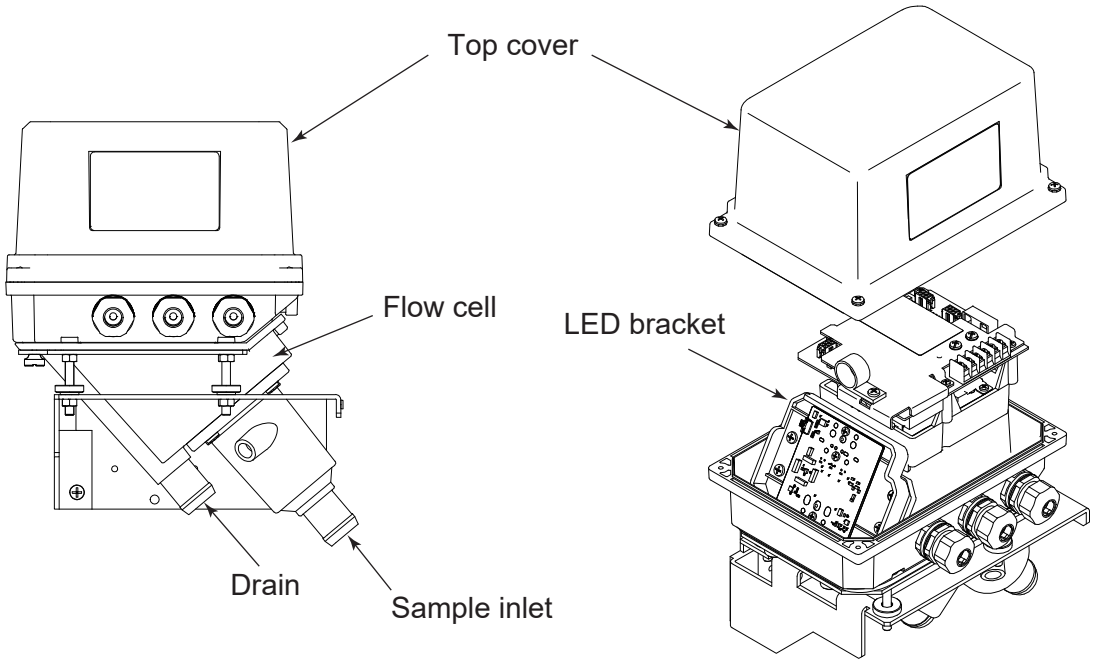


Figure 1.2 Part name

1.3 Specifications

See TB830D General Specification GS 12E01B40-01EN.

1.4 Model and Codes

■ Model and Suffix Codes

Model	Suffix code	Option code	Description
TB830D	·····	·····	Surface Scattering Light Turbidity Detector
Light source and Turbidity standard	**-F8**	·····	White LED, Formazin, 0-2 NTU to 0-2000 NTU
	-FS	·····	860 nm, Formazin, 0-2 FNU/NTU to 0-2000 FNU/NTU
Type	**-AB**	·····	General purpose for CE, RCM, China standard
	-AD	·····	General purpose for CSA
	-AG	·····	General purpose for KC
	-AJ	·····	General purpose (*1)
Sampling system	**-NN**	·····	Without sampling system (*2)
	-A1	·····	With sampling system (without automatic cleaning, without automatic zero calibration) (*3) (*4) (*13)
	-A2	·····	With sampling system (with automatic cleaning, without automatic zero calibration) (*3) (*14)
	-A3	·····	With sampling system (with automatic cleaning, with automatic zero calibration) (*3) (*14)
	-A5	·····	Without sampling system, with relay box (*2)
Material and Connection of Sampling system	**-AN**	·····	Without sampling system (Detector mounting bracket Carbon steel) (*5)
	-SN	·····	Without sampling system (Detector mounting bracket Stainless steel) (*5)
	-AD	·····	Carbon steel stanchion, base mounting
	-AB	·····	Carbon steel stanchion, rear mounting
	-SD	·····	Stainless steel stanchion, base mounting
	-SB	·····	Stainless steel stanchion, rear mounting
Solenoid valve for Sampling system	**-NN**	·····	Without Solenoid valve (*15)
	-10	·····	100 V AC
	-12	·····	110 V AC
	-20	·····	200 V AC
	-22	·····	220 V AC
—	**-NN**	·····	Always -NN
—	**-NN**	·····	Always -NN
Option		**/L02**	Connection cable for analyzer 2 m (*6)
		/L03	Connection cable for analyzer 3 m (*6)
		/L05	Connection cable for analyzer 5 m (*6)
		/L10	Connection cable for analyzer 10 m (*6)
		/L20	Connection cable for analyzer 20 m (*6)
		/SCT	Stainless steel tag plate
		/U	Pipe mounting hardware (SUS)
		/R	Rack or wall mounting hardware (SUS)
		/CB	Conduit adapter G1/2×1 pcs
		/CD	Conduit adapter 1/2NPT× 1 pcs
		/CF	Conduit adapter M20×1.5×1 pcs
		/ARS	With arrester (*7)
		/PHN7	With pH (Using FLXA402) (without ultrasonic cleaning) (*8) (*10) (*13) (*14)
		/PHU7	With pH (Using FLXA402) (with ultrasonic cleaning) (*8) (*10) (*13) (*14)
		/TT3	With 500ml KCl reserve tank for pH (*10) (*11)
		/FC	With Free Available Chlorine Analyzer (*8) (*9) (*13) (*14)
		/PHN2	With pH (Using FLXA402T 2nd input) (without ultrasonic cleaning) (*8) (*11) (*13) (*14)
		/PHU2	With pH (Using FLXA402T 2nd input) (with ultrasonic cleaning) (*8) (*11) (*13) (*14)
		/L	Air denoising for Low Range (*12)

*1: "-AJ" is no standard.
*2: Install the head tank so that the flow rate of the detector is the specified flow rate (1.5 to 2 L/min). Customers have to arrange a head tank.
*3: 1 µm zero turbidity filter is supplied with the product.
*4: Cleaning, zero calibration, span calibration are enabled manually.
*5: This is selectable only when Sampling system "-NN" or "-A5" is specified.
*6: This is not selectable when Sampling system "-A1", "-A2", "-A3" is specified. 1 m cable is supplied with the product. Select this code for other cable length to change if necessary.
*7: This is not selectable when Type -AD is specified.
*8: This is selectable only when "-A1", "-A2", "-A3" for Sampling system is specified.
*9: For TB830D equipped with Non-reagent type Free Available Chlorine Analyzer. You need one converter just for the chlorine analyzer. Selectable only when "-AJ" (no standard) is specified.
The TB830D cannot be equipped with both a pH sensor and a Non-reagent type Free Available Chlorine Analyzer.
Prepare the following products separately. Refer to GS 12F05B10-01EN for FC800D Non-reagent type Free Available Chlorine Analyzer.
Sensor: FC800D-□□-AJ-NN-NN/L02/ST
Converter: FLXA402T-A-B-AJ-CL-NN-N□-WR-N-□-J-ST-NN

*10: For TB830D equipped with pH sensor. You need one converter just for the pH sensor. Selectable only when “-AJ” (no standard) is specified.
Prepare the following products separately. Refer to GS 12B07B02-E, GS 12J05C02-00E, GS 12A01F01-01EN, GS 19C01B05-01EN.
pH sensor: PH8EFP-03-TN-TT1-N-G*A (/PHN7 or /PHU7 and without /TT3)
PH8EFP-03-TN-TT3-N-G*A (/PHN7 or PHU7 and with /TT3)
pH holder: PH8HF-PP-JPT-T-NN-NN*A (/PHN7 without ultrasonic cleaning)
PH8HF-PP-JPT-T-S3-C1*A (/PHU7 with ultrasonic cleaning)
pH converter: FLXA402-A-B-AJ-P1-NN-A□-□□-N-□-J-NN (/PHN7 or /PHU7)
Pulse generator for clean unit: PG400-A-B-AJ-PU-00-J-ST (/PHU7 with ultrasonic cleaning)

*11: For TB830D equipped with pH sensor. One converter can be shared with the scattered light turbidity detector.
Analog pH sensors can be used.
For the 2nd Input of the converter, specify “-P1” (pH) to connect an analog pH sensor
Prepare the following products separately. Refer to GS 12B07B02-00E, GS 12J05C02-00E, GS 19C01B05-01EN.
pH sensor: PH8EFP-03-TN-TT1-N-G*A (/PHN2 or /PHU2 and without /TT3)
PH8EFP-03-TN-TT3-N-G*A (/PHN2 or /PHU2 and with /TT3)
pH holder: PH8HF-PP-JPT-T-NN-NN*A (/PHN2 without ultrasonic cleaning)
PH8HF-PP-JPT-T-S3-C1*A (/PHU2 with ultrasonic cleaning)
Pulse generator for clean unit: PG400-A-B-□-PU-00-□-ST

*12: For low turbidity (200 NTU or less) measurement range and the application which may generate bubbles, select this code for head tank.
Do not select this code for high turbidity (above 200 NTU) measurement range because the influence of air bubbles is small, and the turbidity in the sample may block the air bubble removal piping or reduce the flow rate.

*13: When the Sampling system “-A1” is specified, the sampling system does not support CE or Chinese standards. The product cannot be sold to the area to which these regulations apply.

*14: When the Sampling system “-A2” or “-A3” is specified, the sampling system does not support CE, RCM, CSA, Chinese standards. The product cannot be sold to the area to which these regulations apply.

*15: This is selectable only when Sampling system “-NN” or “-A1” or “-A5” is specified.

Accessories

Name	Q´ty	Remarks
Silicone cloth	1	Part number: K9210KS
Check tool	1	—
Desiccant	1	For spare. 4 pcs/Q'ty (Part number: K9657RJ)
Desiccant	1	For operation. 4 pcs/Q'ty (Part number: K9657RJ) (When the code for “Without sampling” is specified)
Pipe mounting hardware (Option)	1	For “/P” (Option)
Rack mounting hardware (Option)	1	For “/R” (Option)
Soft vinyl chloride tube (Ø33 × Ø25 Black)	1 set (1 m x 2)	For piping detector (when the code for “Without sampling” is specified)
Clamp	1	For piping detector (when the code for “Without sampling” is specified

Spare Parts

Name	Part No.	Description	Frequency of Replacement
LED ASSY (white)	K8004BD	When “-F8” is selected.	3 years
LED ASSY (IR)	K8004BE	When “-FS” is selected.	3 years
Desiccant (4 pcs/Q'ty)*	K9657RJ	—	Yearly
Drain tube	K9411JM	—	Yearly
Fuse	A1633EF	—	—
Fuse	A1624EF	for Sampling system “-A2” “-A3”. The relay box uses two fuses.	—
1 µm filter	K9008ZD	—	Yearly

*: Use within a year after purchasing.

Mounting Hardware (Option)

Select each corresponding hardware based on the table below.

Model	Mounting type		
	Wall	Pipe	Panel
TB830D	/R	/U (Pipe mounting)	NA
FLXA402T	/UM* or /U	/UM* or /U	/UM* or /PM

*: Universal mounting kit (/UM) contains pipe, wall mounting hardware (/U) and panel mounting hardware (/PM).

Parts for Sampling system

Name	Part No.
Pinch valve for drain (100V, 110V)	K9411JG
Pinch valve for drain (200V, 220V)	K9411JH
Solenoid valve for cleaning water or zero water (100V)	A1014MZ
Solenoid valve for cleaning water or zero water (110V)	A1016MZ
Solenoid valve for cleaning water or zero water (200V)	A1015MZ
Solenoid valve for cleaning water or zero water (220V)	A1017MZ
Solenoid valve for sample (100V, 110V)	K9411DT
Solenoid valve for sample (200V, 220V)	K9411DU
Head tank (with manual valve)	K9411GC
Head tank (with pinch valve 100V, 110V)	K8004FB
Head tank (with pinch valve 200V, 220V)	K8004FC
Head tank mounting hardware	K8004LD
Zero turbidity filter (1 µm)	K9411UA

Required Number of Conduit Adapters

If you need to provide conduit work with cables, specify the conduit adapter by Option code.

Conduit adapters and dedicated cable glands, which are used in place of the standard cable gland for cable entry holes, are supplied with the product.

You can specify the conduit adapter by Option code for both TB830D and FLXA402T, however, be aware of the following.

- When FLXA402T Digital communication “-E” (Modbus TCP/IP) is selected
  If you attach a conduit adapter on the Modbus TCP/IP cable entry, you need an Ethernet dedicated conduit adapter. Be sure to specify FLXA402T “/C□6”.

1.5 External Dimensions

See TB830D General Specification GS 12E04B40-01EN.

1.6 Measurement principle

TB830D is a surface scattering turbidity detector.

It is comprised of a Flow cell, Detection unit, and Smart unit.

The sample flowing in from the lower side of the Flow cell overflows at the upper part of the Flow cell.

At the same time, the LED light source of the sealed Detection unit irradiates the light beam to the sample surface through the plural lenses.

The irradiated light is divided into transmitted light, reflected light, and scattered light at the liquid surface.

Transmitted and reflected light disappears in a dark room equivalent to a blackbody.

The intensity of the scattered light (L) is proportional to the turbidity as shown in the following equation.

$Ls = K \cdot Q \cdot S$

Where:

- K: Constant due to turbidity
- Q: LED light intensity
- S: Turbidity

The scattered light is converged by the lens inside the Detection unit to be detected by a light-receiving element (silicon photodiode).

The Detection unit incorporates a comparator to detect LED light intensity.

The lens of the Detection unit has a built-in transparent heater to prevent the effect of condensation.

The Smart unit controls the light source drive circuit based on the signal from the comparator so that LED light intensity (Q) keeps constant.

Turbidity is calculated by performing arithmetic on the basis of the turbidity signal from the light-receiving element (silicon photodiode).

The Smart unit also functions as a power supply for measurement, memory storage of parameters such as calibration parameters, and a communication device between the detector and the converter.

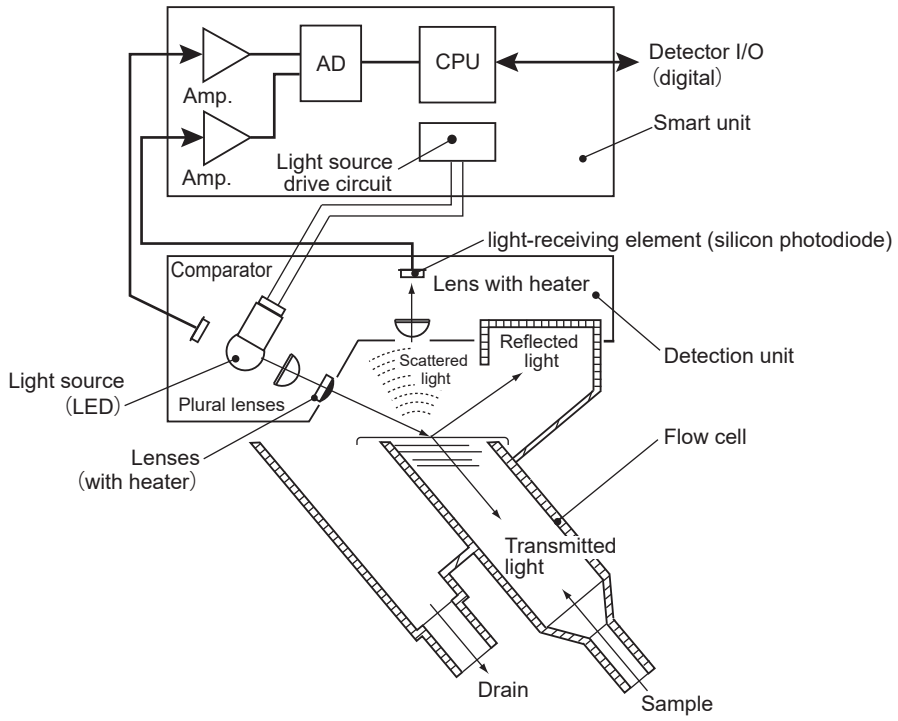


Figure 1.3 Measurement principle

2. INSTALLATION, PIPING, AND WIRING

The “TB830D Surface Scattering Turbidity Detector” is shipped after being fully packaged so that it will not be damaged during transportation. Unpack carefully near the installation location.

The TB830D may also be shipped embedded in a Sampling system.

Installation Location

The TB830D should be installed in a location:

- **In a building or a cabinet where no direct sunlight or rainwater can get inside.**

  Direct sunlight may cause an abnormal rise in the temperature inside the instrument and discoloration or deterioration of resin parts. Also, removing the cover for maintenance during rain may damage the electrical parts inside the instrument.

  Install the instrument in a building or cabinet away from direct sunlight and rainwater.

- **With little vibration**

  Vibration may result in incomplete connections such as external wiring.

- **Where corrosive gases are not present.**

  Corrosive gas can damage electrical component inside the instrument.

- **Where humidity of 0 to 90% RH is maintained (No condensation)**

  No installing in a place with high humidity.

- **With little temperature change, close to normal temperature**

  The ambient temperature must not exceed the range of -5 to 55°C.

  If the temperature of the sample is lower than the ambient temperature, it may cause condensation.

  Take protective measures to prevent a sample and the tap water from freezing, if necessary.

- **With adequate maintenance space and easy access for maintenance work.**

  Secure sufficient maintenance space for maintenance such as replacement, cleaning, and calibration.

- **Where the drain is provided**

  The sample needs to be drained during cleaning and calibration, so install it in a place where drainage is possible.

- **Near the place where the converter is installed (without sampling system)**

  Consider the length of the connection cable to the converter when installing.

Installation

See GS12E04B40-01EN for the dimensions of detectors and mounting brackets. For the converter, see the user's manual of FLXA402T IM 12A01G01-02EN.

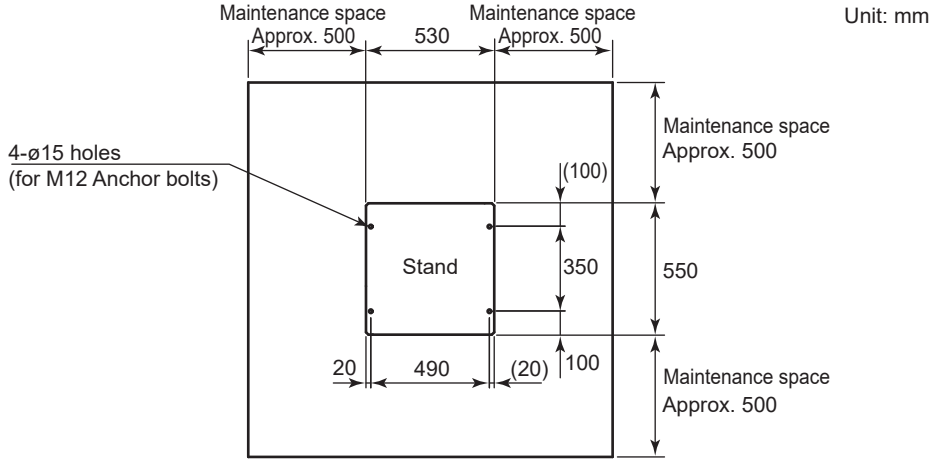
It the sampling system is not provided, it can be wall mounted or pipe mounted.

For wall mounting (Option: / R), mount with 4 M5 screws (not included).

For pipe mounting (Option code: / U), mounting bracket for replacement is available.

See GS 12E04B40-01EN for details.

If the sampling device is provided, fix it to a well-drained concrete foundation with anchor bolts (M12).



2.1 Piping

2.1.1 For TB830D-□-□-NN, -A5 (without sampling system)

(1) Sample piping

If the flow rate of the sample is 1.5 to 2 L/min, the sample can be introduced to the detector as is. Connect the supplied ø33 × ø25 mm black soft vinyl chloride tube to the sample inlet.

However, if the flow rate of the sample exceeds the range of 1.5 to 2 L/min, install a head tank (constant water level tank) that also serves as a defoaming tank to meet flow rate requirements. Connect the ø33 × ø25 mm black soft vinyl chloride tube to the pipe between the head tank and detector.

(2) Drain piping

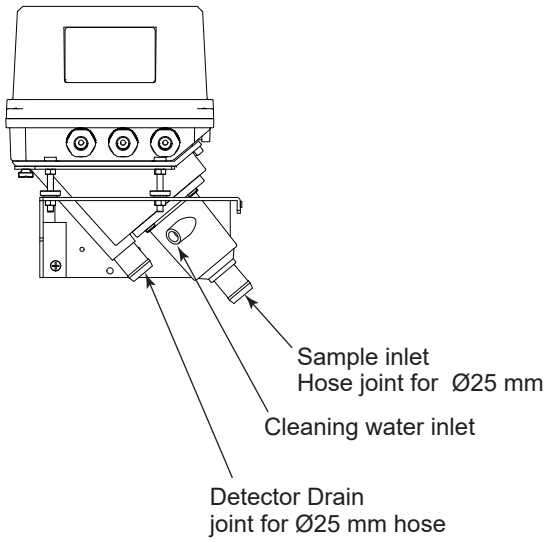
Connect the supplied ø33 × ø25 mm black soft vinyl chloride tube to the drain port of the detector.

At this time, install piping with care to prevent accumulation in the tube. Accumulated water in the drainage pipes may cause problems such as overflow from the detector.

(3) Cleaning water piping

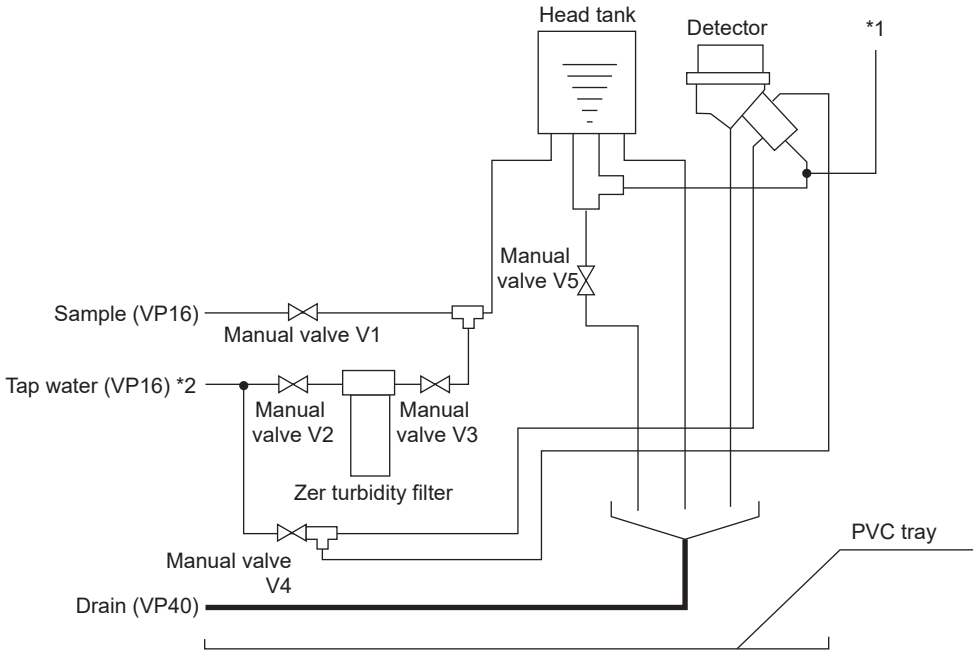
The cleaning water inlet of the detector is sealed with a blind plug.

(Note) When measuring low turbidity (200 NTU or less), prepare a sampling system capable of supplying zero water (filtered tap water with a zero turbidity filter).



2.1.2 TB830D-□-AJ-A1,-A2,-A3 (with sampling system)

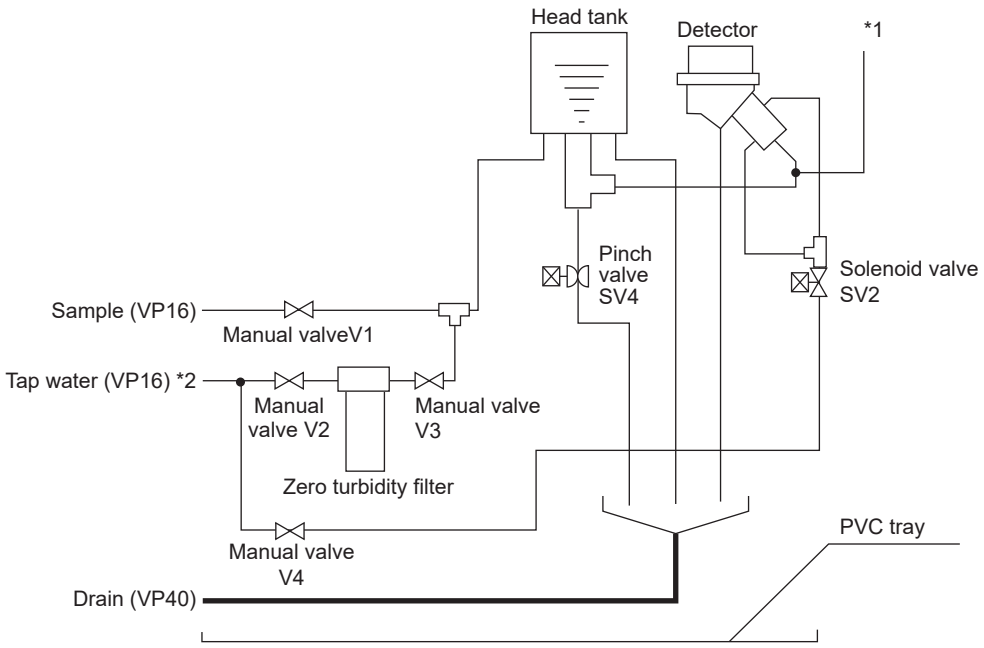
Refer to Figure 2.1 to Figure 2.3 for piping. Refer to Figure 2.4 for piping location. Refer to GS 12E04B40-01EN for the piping diagram of the combination equipment (/FC, /PH□2, /PH□7).



*1: Option /L (Air denoising for Low Range)

*2: You should install a check valve just before the tap water pipe to prevent backflow.

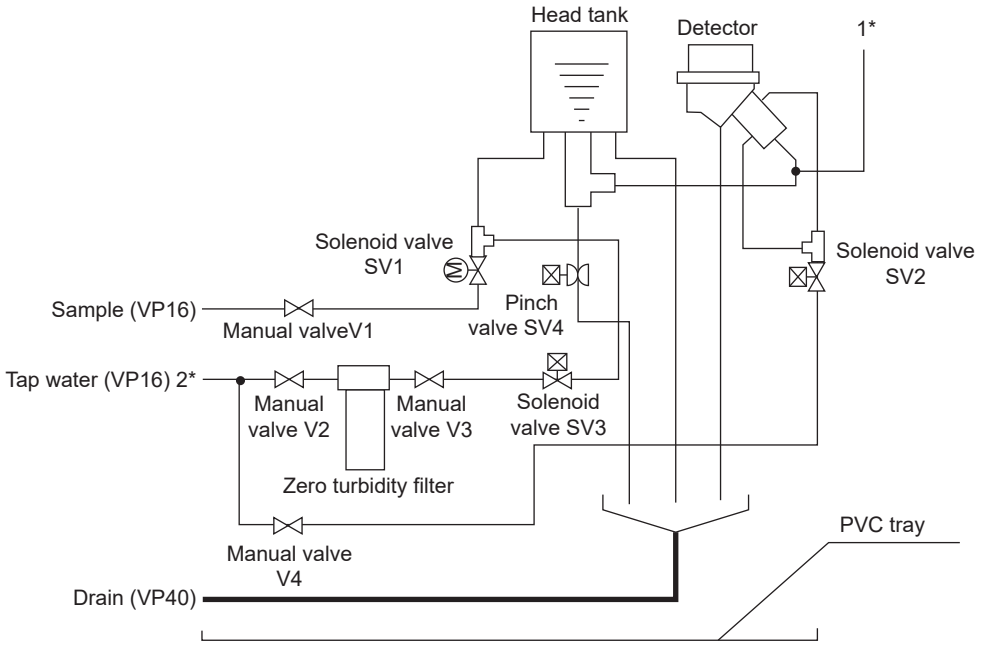
Figure 2.1 -A1 With sampling system (without auto cleaning, without auto zero calibration)



*1: Option /L (Air denoising for Low Range)

*2: You should install a check valve before the tap water pipe to prevent backflow.

Figure 2.2 -A2 With sampling system (with auto cleaning, without auto zero calibration)



1*: Option /L (Air denoising for Low Range)

2*: You should install a check valve just before the tap water pipe to prevent backflow

Figure 2.3 -A3 With sampling system (with auto cleaning, with auto zero calibration)

(1) Sample piping

This piping is used to feed the sample to the detector.

The pressure condition of the sample is 20 to 500 kPa, and the flow rate is 2 to 10 L/min .

The pipe joints are rigid PVC pipes with a nominal diameter VP16 (O.D. ø22mm). Before piping, install any fittings that match the pipe diameter, such as unions or flanges.

(2) Tap-water piping

This is a piping for supplying detector with cleaning water and zero water. Use tap water or other water with a turbidity of 2 NTU or less. The pressure of the water to be used is 100 to 500 kPa . The pipe joints are rigid PVC pipes with a nominal diameter VP16 (O.D. ø22mm). Before piping, install any fittings that conform to the pipe diameter in the same way as the sample piping.

You should install a check valve before the tap water pipe to prevent backflow.

(3) Drain piping

This piping is for discharging the sample and tap water supplied to detector into drains, or the like. The pipe joints are rigid PVC pipes with a nominal diameter of VP40.

Connect a rigid PVC pipe with a VP40 or higher capacity, and connect the pipe so that sediment does not accumulate or drain stagnations in the pipe.

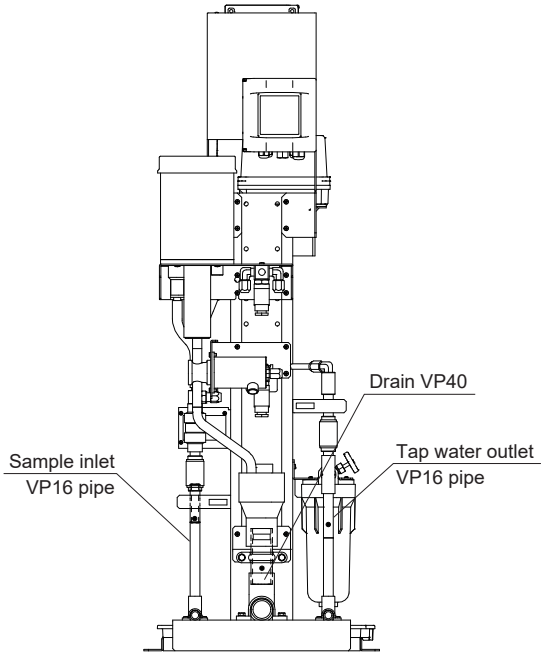


Figure 2.4 Pipe position (with sampling)

2.2 Wiring

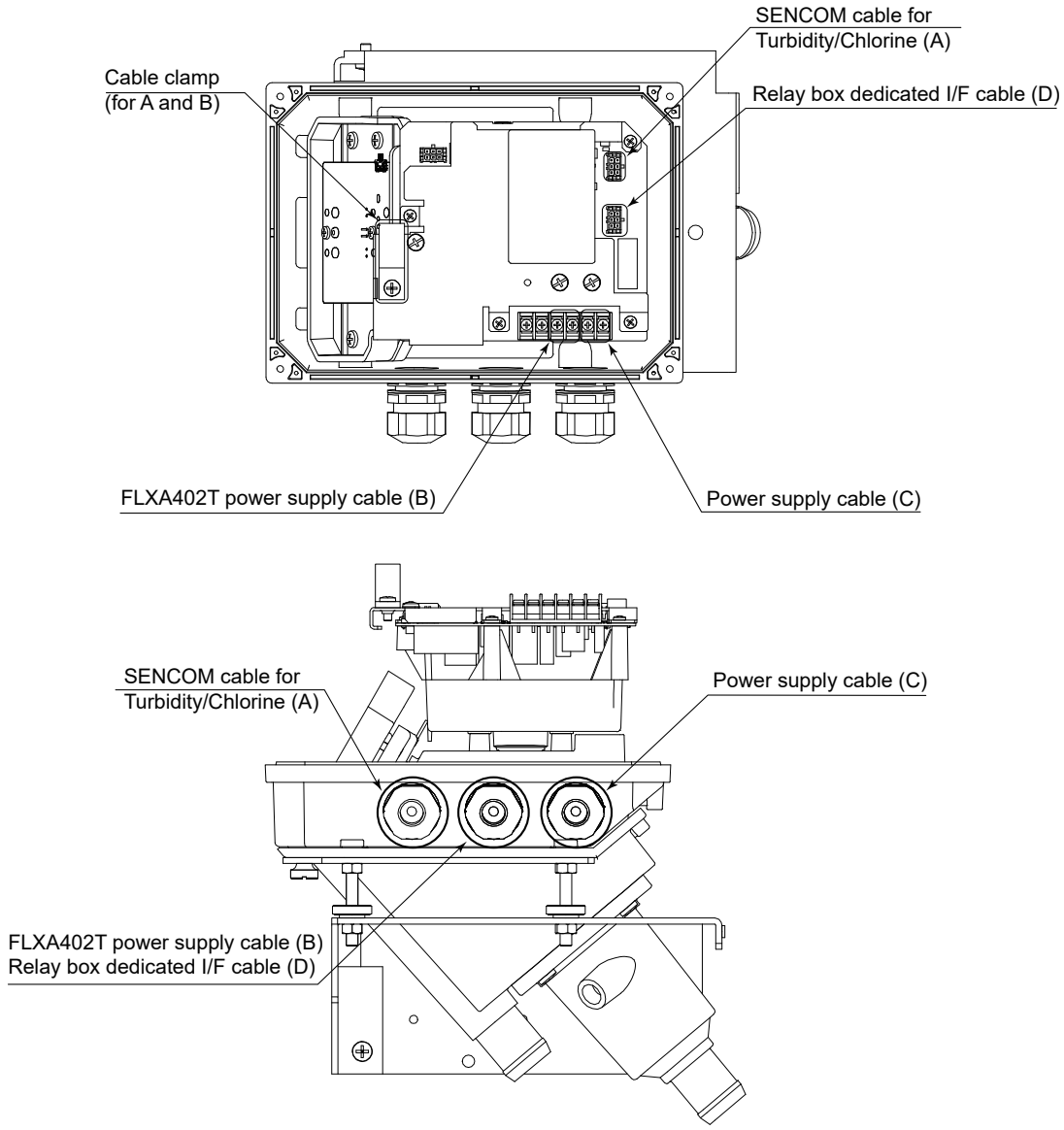


Figure 2.5 Wiring TB830D side

For Sampling system -NN (Without sampling system), see Figure 2.6. For Sampling system -A1, -A2, -A3 (With sampling system), see Figure 2.7 and Figure 2.8. Sections 2.2.1 to 2.2.5 show how to wire each cable.

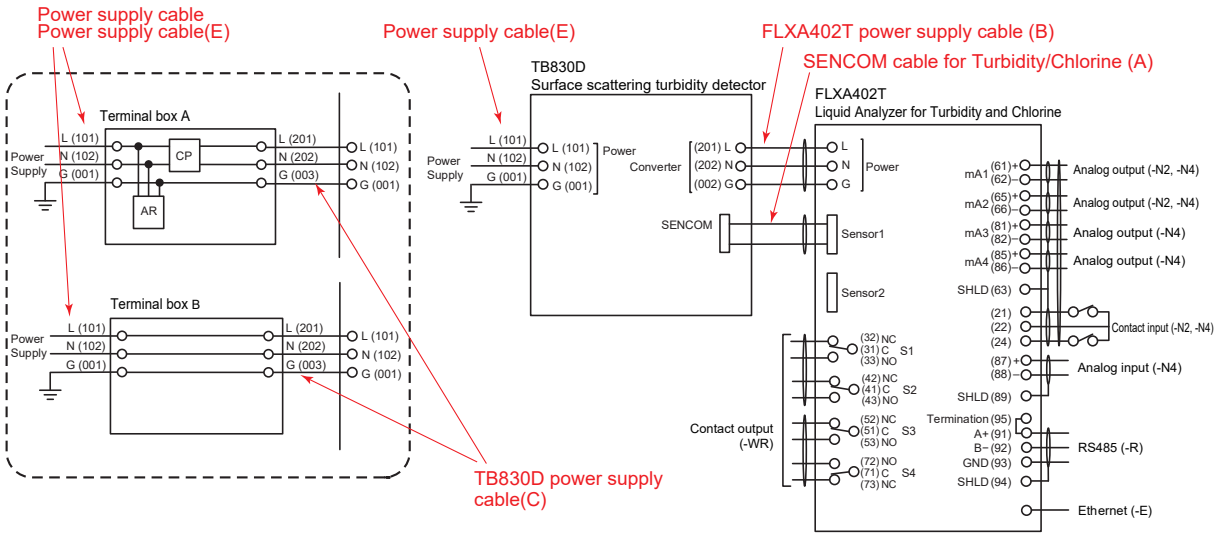
For Sampling system -A5 (Without sampling system, with relay box), refer to “2.2.5 Without a sampling system and with a Relay box for solenoid valve”.

Wire the external wires (contact input/output, mA input/output, and digital communication) of FLXA402T as required. Refer to Section 2.5 of FLXA402T Installation Instructions (IM 12A01G01-02EN) for how to wire.

CAUTION

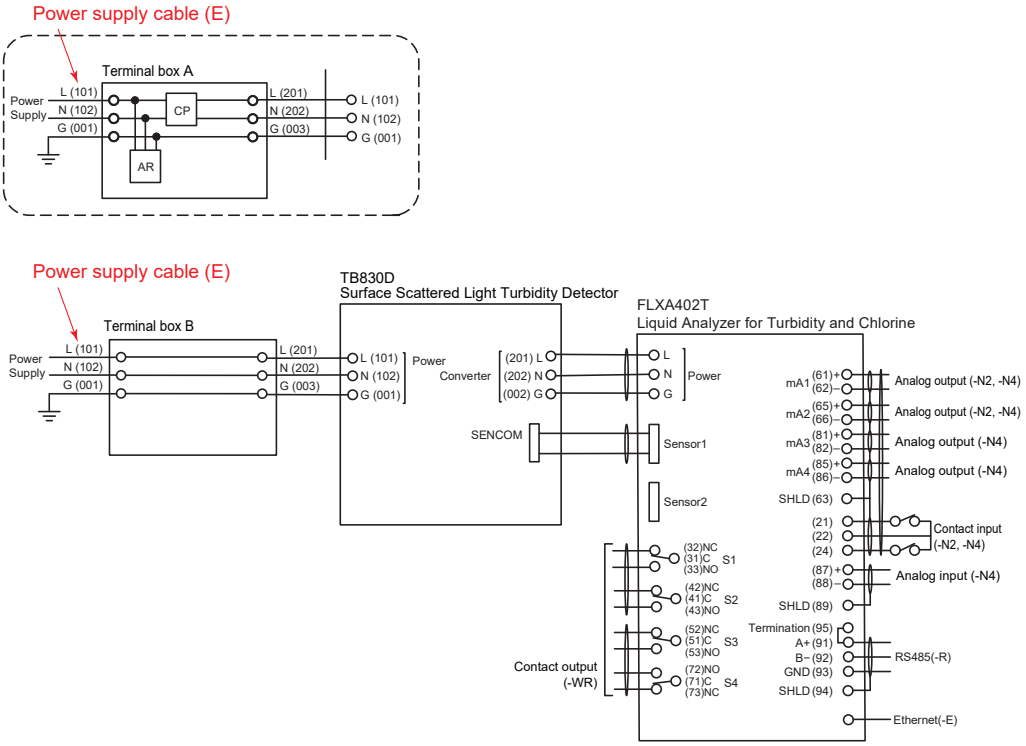
Be sure to shut off the power supply prior to working.

Make sure that the supplied power supply meets the specifications of the TB830D and the voltages listed on the nameplate.



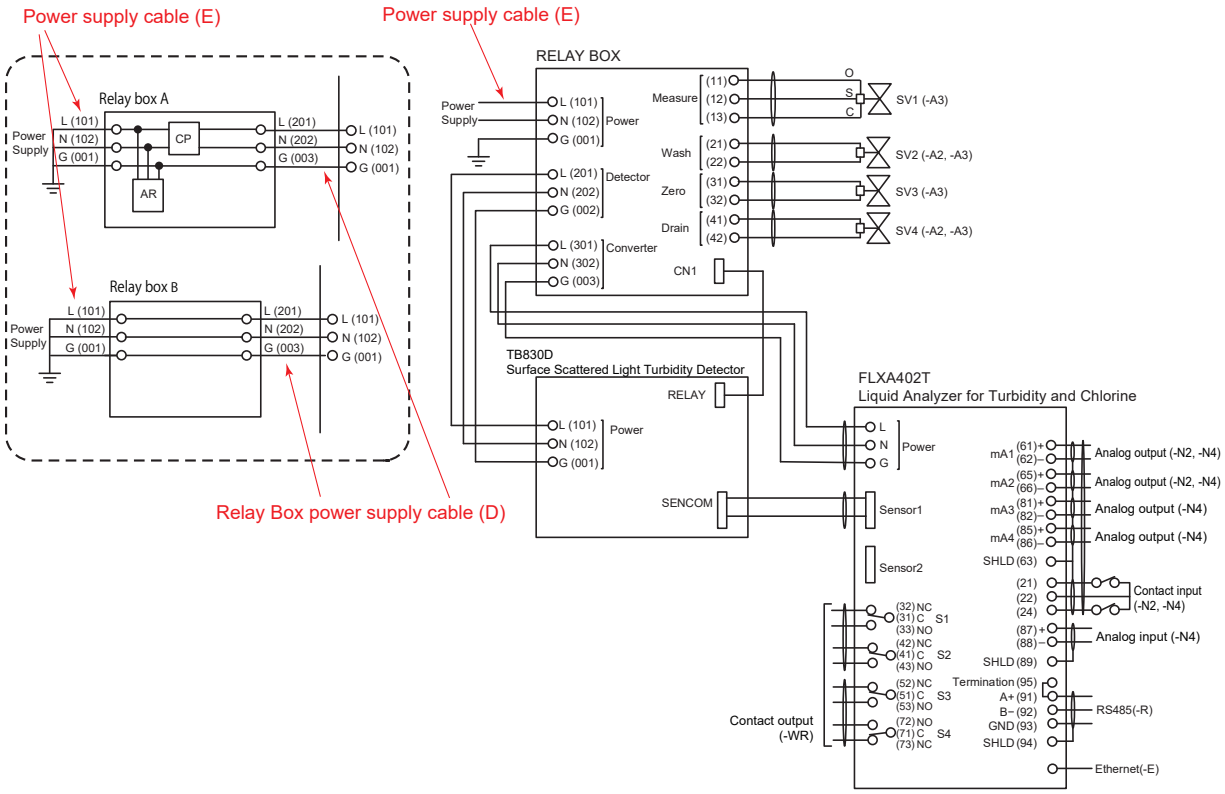
- If a Relay box is not provided, wire power cable (E) to TB830D.
- If Terminal box A or B is included, wire the power supply cable (E) to the Terminal box.
- wire TB830D power supply cabling (C) between the junction box and TB830D.

Figure 2.6 Wiring TB830D-□-□-NN (without sampling system)



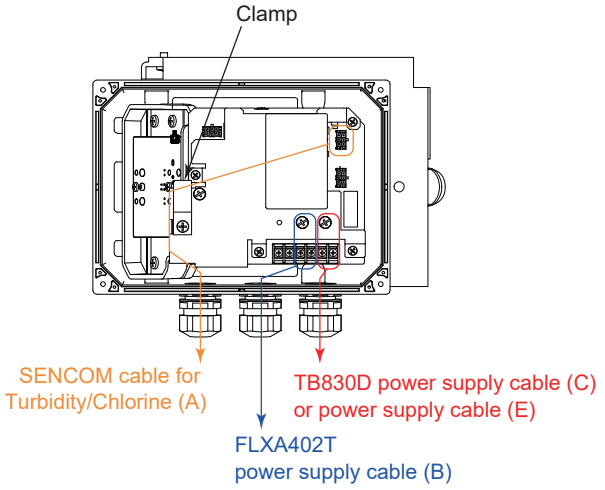
- Relay box A or B is included.
- wire power supply cable (E) to the junction box.

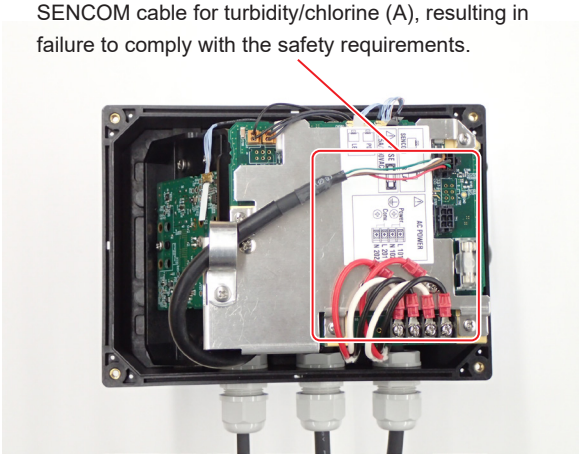
Figure 2.7 Wiring diagram with sampling system (for-A1)



- If a Terminal box is not included, wire power supply cable (E) to the Relay box.
- If Terminal box A or B is included, wire the power supply cable (E) to the Terminal box.
- Wire the Relay box power cable (D) between the Terminal box and the Relay box

Figure 2.8 Wiring TB830D-□-□□A2, -A3





- Open detector cover to wire.
- Wire SENCOM cable for turbidity/residual salt through the clamps in the figure. Never let the power cables of TB830D touch the SENCOM cable for turbidity/chlorine (A), resulting in failure to comply with the safety requirements.
- A cable gland is attached to the wiring port. Securely tighten the wires so that they meet the IP65 or higher.
- After wiring is complete, securely tighten the four screws on the detector cover. The tightening torque of the screw is 1.5 N·m.

Figure 2.9 TB830D WIRING

WARNING

Wire power supply cable (TB830D power supply cable (C) or power supply cable (E)) in Figure 2.5 so that it does not come into contact with the SENCOM cable. Otherwise, it results in failure to comply with the safety requirements.

WARNING

The wiring must meet the IP65 or higher. The four screws of the detector cover are tightened to 1.5 N·m

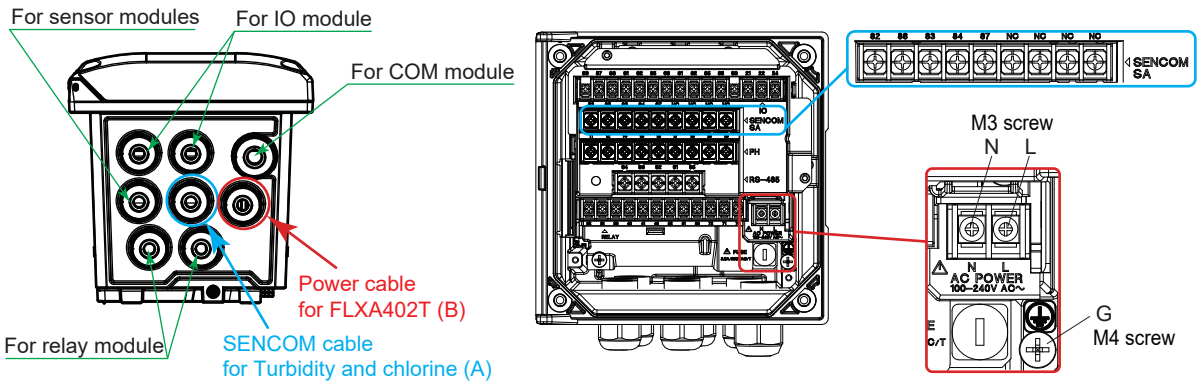


Figure 2.10 Wiring FLXA402T

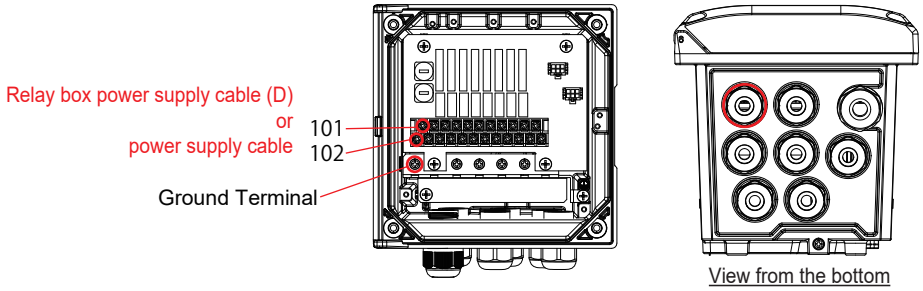


Figure 2.11 Wiring the Relay box

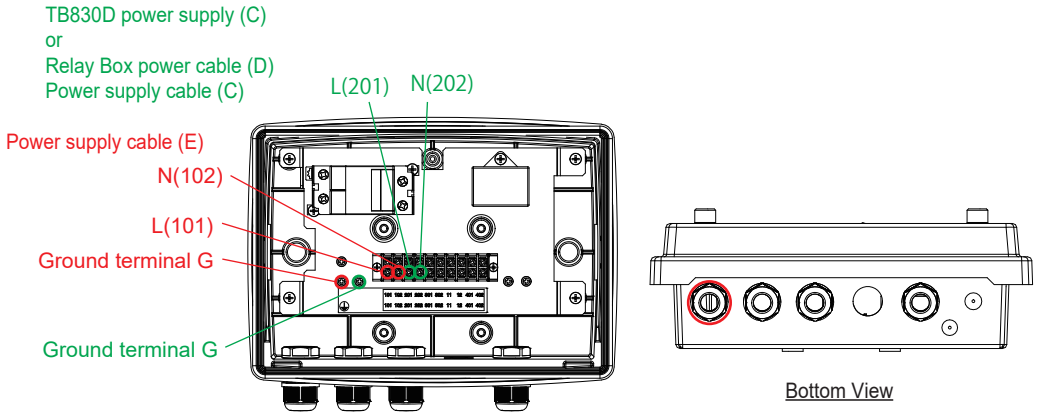


Figure 2.12 Wiring Terminal box A

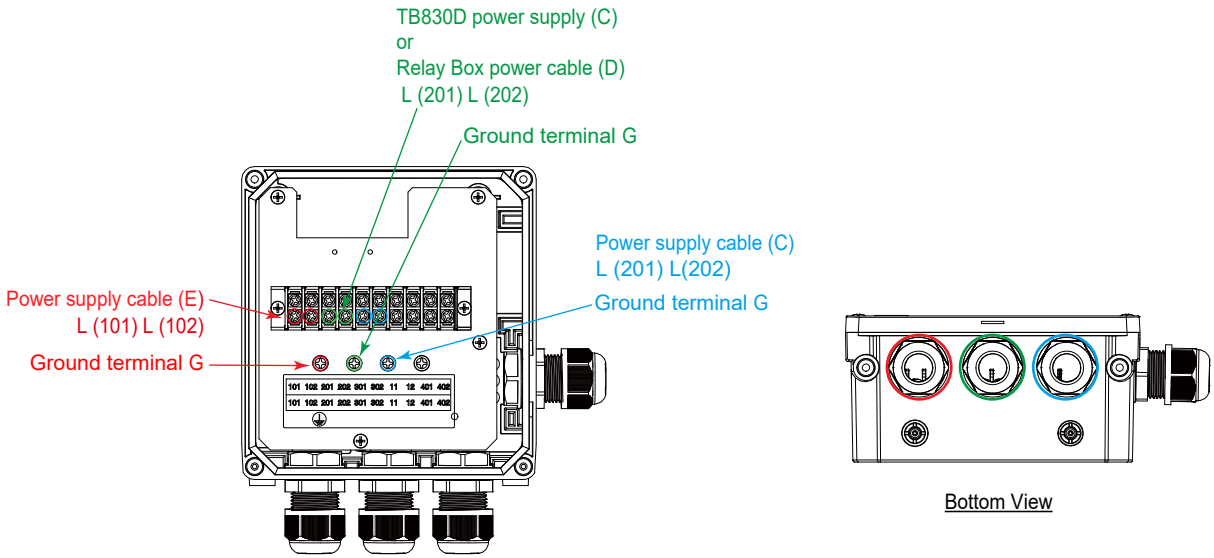


Figure 2.13 Wiring Terminal box B

2.2.1 SENCOM cable for Turbidity/Chlorine (A)

Without sampling system (-NN,-A5). For (-A5), refer to “2.2.5 Without a sampling system and with a Relay box for solenoid valve”.

Dedicated cables are included. Refer to Figure 2.6, Figure 2.9, and Figure 2.10 for wiring. Refer to Section 2.6.1 of FLXA402T Installation Manual (IM12A01G01-02EN) for the wiring on FLXA402T.

2.2.2 FLXA402T power supply cable (B)

Without sampling system (-NN,-A5). For (-A5), refer to “2.2.5 Without a sampling system and with a Relay box for solenoid valve”.

Dedicated cables are included. Refer to Figure 2.6, Figure 2.9, and Figure 2.10 for wiring. The lengths of the terminal processes at both ends are different. Connect the longer side (approx. 80 mm) to TB830D side and the shorter side (approx. 50 mm) to FLXA402T side. Cables have no terminal names on them. Wire them by color. L:Black, N: White, G: Red. M3 The tightening torque for screws (L and N) is 0.6 N·m, and that for M4 screws (G) is 1.4 N·m.

2.2.3 TB830D power supply cable (C), Relay box power supply cable (D)

When a Terminal box A or Terminal box B is included, use this power cable to connect between the Terminal box and TB830D, or the Terminal box and a Relay box.

Dedicated cables are included. See Figure 2.6, Figure 2.11, Figure 2.12, and Figure 2.13 for wiring. Cables have no terminal names on them. Wire them by color. L:Black, N: White, G: Red. M3 The tightening torque for screws (L and N) is 0.6 N·m, and that for M4 screws (G) is 1.4 N·m.

2.2.4 Power supply cable (E)

If Terminal box A or Terminal box B is included, wire it to the Terminal box. If there is no Terminal box but a Relay box is attached, wire to the Relay box. Otherwise, wire to TB830D.

Refer to Figure 2.6, Figure 2.7, Figure 2.8, and Figure 2.9, Figure 2.11, Figure 2.12, and Figure 2.13 for wiring.

Supply a power whose voltages and frequencies conform to the specifications. In addition, grounding wiring must be made to prevent electric shock and to prevent the device from being affected by noise. Cables for power supply and grounding must be provided by the customer.

Table 2.1 Power supply cable Specifications

Nominal Voltage	300 V or more
Nominal temperature	75°C or higher
Number of cores, wire diameter	3 L, N, G:0.75 – 2.5 mm^2 (AWG18 – 14)
Outer diameter of sheath	Ø6.5 – Ø12.5
Cable termination	Strip the outer sheath of 80 mm, and provide the termination. L, N: M3 Round terminal G: M4 Round terminal

The tester does not have a power supply switch. The power supply line must be equipped with a double switch. Grounding wiring shall satisfy Class D (grounding resistance: 100 Ω or less). M3 the tightening torque for screws (L and N) is 0.6 N·m, and that for M4 screws (G) is 1.4 N·m.

WARNING

- Install an external switch or breaker on the power supply of TB830D.
- Use external switches or breakers that conform to nominal 5A, IEC 60947-1 or IEC 60947-3.
- Yokogawa recommends installing the external power supply switch, circuit breaker, and TB830D all in the same location.
- The external switch or breaker should be installed within reach of the operator and marked so that the operator can easily find the power-supply switch of TB830D.
- Fix securely onto constructions or walls the wire cables of the power supply by using a cable rack, conduit, or vinyl band. If the cable is pulled out of the terminal, an electric shock may result.

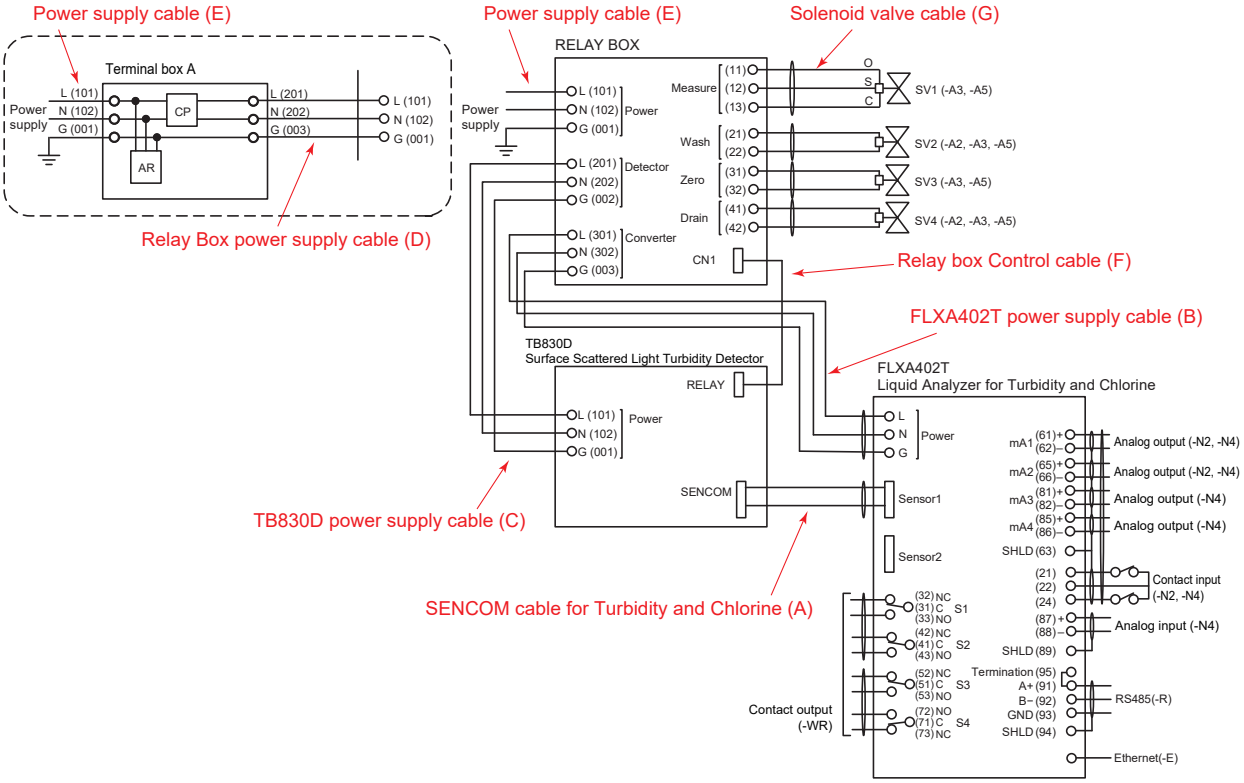
WARNING

- Use cables with heat resistance of 75°C or higher for wiring.
- The wiring must meet the IP65 or higher. The four screws of the detector cover are tightened to 1.5 N·m.
- Use a cable that conforms to the UL2556VW-1 or equivalent standards for the power supply cable.

2.2.5 Without a sampling system and with a Relay box for solenoid valve

When the suffix code-A5 (without sampling system and with Relay box for solenoid valve) is specified, a Relay box is included.

Wire SENCOM cable for turbidity/chlorine (A), FLXA402T power cable (B), TB830D power cable (C), Relay box power cable (D), power supply cable (E), Relay box control cable (F), and cable for solenoid valve (G).



- If a Relay box is not included, wire the power cable (E) to the Relay box.
- If Terminal box A is included, wire the power cable (E) to the Relay box.
- Wire the power supply cable (D) between the Terminal box and the Relay box.

Figure 2.14 Wiring diagram without sampling system (with relay-box)

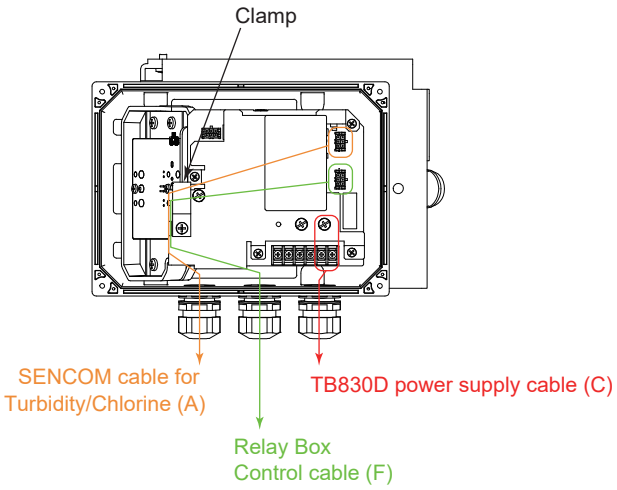


Figure 2.15 Wire TB830D (for-A5)

WARNING

Never let the power cables of TB830D (Figure 2.15) touch the Cable for Relay box control (F), SENCOM cable for turbidity/chlorine (A), resulting in failure to comply with the safety requirements.

WARNING

The wiring must meet the IP65 or higher. The four screws of detector cover are tightened to 1.5 N·m.

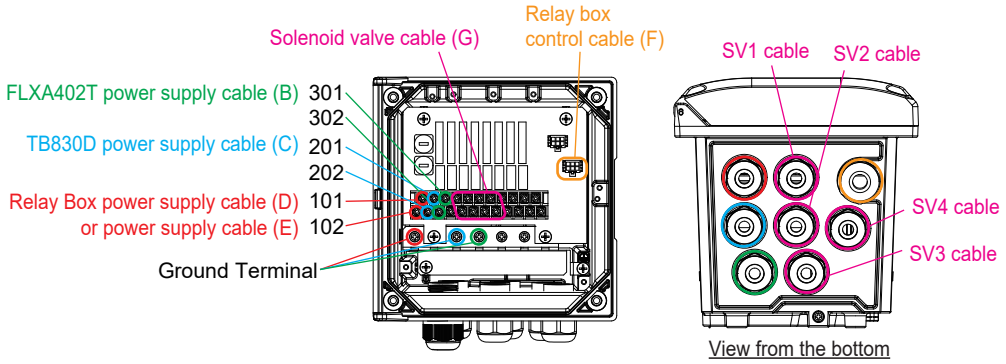


Figure 2.16 Wiring of Relay box (for-A5)

SENCOM cable for Turbidity/Chlorine (A)

Dedicated cables are included. Refer to Figure 2.14 and Figure 2.15 for wiring. Refer to Section 2.6.1 of FLXA402T Installation Manual (IM12A01G01-02EN) for the wiring on FLXA402T.

FLXA402T power supply cable (B)

Dedicated cables are included. Refer to Figure 2.14 and Figure 2.16 for wiring. The lengths of the terminal processes at both ends are different. Connect the longer side (approx. 80 mm) to TB830D side and the shorter side (approx. 50 mm) to FLXA402T side. Cables have no terminal names on them. Wire them by color. L:Black, N: White, G: Red. The tightening torque of M3 screws (L and N) is 0.6 N·m, and that for M4 screws (G) is 1.4 N·m.

TB830D power supply cable (C)

power supply cabling that connects the Relay box to TB830D.

Dedicated cables are included. Refer to Figure 2.14, Figure 2.15, and Figure 2.16 for wiring. Cables have no terminal names on them. Wire them by color. L:Black, N: White, G: Red. M3 The tightening torque for screws (L and N) is 0.6 N·m, and that for M4 screws (G) is 1.4 N·m.

Relay Box power supply cable (D)

This is a power supply cable that connects a Relay box to another Relay box when a Relay box is attached.

Dedicated cables are included. Refer to Figure 2.14 and Figure 2.16 for wiring. Cables have no terminal names on them. Wire them by color. L:Black, N: White, G: Red. M3 The tightening torque for screws (L and N) is 0.6 N·m, and that for M4 screws (G) is 1.4 N·m.

Power supply cable (E)

If a Terminal box is included, wire it to the Terminal box If there is no Relay box, wire it to the Relay box.

Refer to Figure 2.14 for wiring. Cables for power supply and grounding must be provided by the customer. Refer to “2.2.4 Power supply cable (E)” for the specifications of the cable and the requirements for power supply and grounding wiring.

Relay box control cable (F)

Dedicated cables are included. Connect to the specified connectors referring to Figure 2.14, Figure 2.15, and Figure 2.16.

Solenoid valve cable (G)

Solenoid valve and its valve cabling must be provided by the customer. Refer to Table 2.2 and Table 2.3 for required specifications. Wire solenoid valve cabling referring to Figure 2.14 and Figure 2.16. Use a solenoid valve that matches the required power supply voltage.

Table 2.2 Solenoid valve Requirements

	Port	Valve type	Max. working pressure	Max. working pressure difference
SV1 (Measure)	15A	Motor Valve 3 Terminals (Open, Shut, Common)	1 MPa	1 MPa
SV2 (Wash)	RC3/8	Solenoid valve NOOC. (*1)	1.5 MPa	0.5 MPa
SV3 (Zero)	RC3/8	Solenoid valve NOOC. (*1)	1.5 MPa	0.5 MPa
SV4 (Drain)	Ø21 × Ø18 Silicone tube	Pinch valve N.C. (*1)	—	—

*1: The valve opens when energized.

Table 2.3 Solenoid valve Cable Requirements (Recommended Cables)

Cable length		1.2 m
Rated voltage		300 V AC
Specifications	**SV1**	AWG 17 3 core cable, M3 round terminal
	SV2, SV3, SV4	AWG 20 2 core cable, M3 round terminal

2.3 Desiccant mounting

High humidity in detector internal storage may affect the measurement. Desiccants must be installed on detector internal storage for correct readings.

With sampling system (-A1, -A2, -A3)

The desiccant is shipped pre-installed on detector internal storage, so you do not need to install the desiccant when starting operation.

Without sampling system (-NN, -A5)

Desiccant must be attached to detector internal storage. Perform mounting of the desiccant according to the following.

To prevent electric shock, turn off the power supply of the detector before turning mounting the desiccant.

CAUTION

Be sure to shut off the power supply prior to working.

(1) Loosen the four static screws and remove the detector Top window.

(2) Mount one each of the supplied desiccants on the top and sides of the top cover. Mount the desiccant so that the printed side is facing the cover. Mount the top desiccant toward the right side (see Figure 2.18).

(3) Tighten the four screws to attach the top cover. The tightening torque of the screw is 1.5 N·m.

(4) This completes the replacement.

After mounting the desiccant, warm up the dryer for at least an hour to ensure that the desiccant absorbs moisture in the detector before starting the measurement.

The side with no print is the moisture-absorbing surface.

Figure 2.17 Moisture absorption surface of the desiccant

Mount the desiccant on the top side to the right.

Figure 2.18 Mounting Desiccant to Top cover

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3. PREPARATION for OPERATION

After completing piping and wiring, confirm the operation mode and prepare for operation according to the contents of this chapter.

Type of operation mode

There are two operation modes of the instrument: measurement mode and maintenance mode.

Measurement mode

This mode is for steady operation.

Maintenance mode

This mode is used to perform maintenance work, etc. Always place the instrument in maintenance mode prior to performing any maintenance tasks such as calibration or maintenance. From the main screen, set to x to enter maintenance mode.

(The mode can also be switched in detector Menu → Maintenance → Maintenance mode.)

Operation in Maintenance Mode

Table 3.1 Operation of Items in Maintenance Mode

Item	Operation
Measured value	Maint. damping time constant applies
mA Output	Hold or output by following the automatic hold setting Converter menu > Converter setting> mA output setting >Output channels > Auto hold setting
Contact output	When maintenance is set up, the contact is On. Other contact outputs remain the previous value gained right before the Maintenance turned on. Other contact outputs remain the previous value gained right before the Maintenance turned on.
Manual operation	Solenoid manual operation is enabled. detector menu > Maintenance > Valve. Pump To initialize Valve, turn off the maintenance mode. You can also operate the Solenoid valve from the main screen. When the maintenance mode is turned Off, the light source/bulb status returns to the default status.
Automatic cleaning, Automatic zero calibration	Not available

3.1 Piping and Wiring Check

Confirm that the piping and wiring have been completed correctly before supplying water or power.

Refer to “2.1 Piping” and “2.2Wiring”.

If a sampling system is available, attach the filter element when using the zero-turbidity filter. Refer to “8.7 Replacing the zero turbidity filter element” for the mounting method.

3.2 Confirming detector condition

Open the cover and set a new desiccant. Close the cover firmly. See “2.3 Desiccant mounting” for instructions on how to attach the desiccant.

Check those unused cable entries are plugged with inserts.

3.3 Supplying Power and switching operation modes

Supply power when the pipes and wires are in normal condition. The detector is activated in a measuring mode.

Set the maintenance mode to On until the operation preparation is completed. Press x on the main screen of the converter to enter maintenance mode.

3.4 Valve operation

With the maintenance mode on, open and close the solenoid valve (SV1 to SV4) from the maintenance menu (solenoid valve/wiper operation) on the converter. Or with the cleaning box enabled, you can operate with the manual switch icon (MAN.SW) at the bottom of the main screen.

When automatic cleaning or automatic zero calibration is specified, the solenoid valve is opened and closed by automatic control.

Table 3.2 shows the open/close status of the valves at measuring, draining, and zero calibration for the respective sampling specifications.

Refer to “4.5 Automatic cleaning/Automatic zero calibration setting” for the operation when automatic cleaning and automatic zero calibration are selected.

Table 3.2 Status of valves in each action in the table

Sampling system Code	Operating status	Manual valve					Solenoid valve			
		V1	V2	V3	V4	V5	SV1	SV2	SV3	SV4
-A1	Measuring	○	○	×	×	×	–			
	Drain	×		×	×	○				
	Zero calibration (zero water)	×		○	×	×				
	Manual cleaning (Sample)	○		×	○	×				
	Manual cleaning (zero water)	×		○	○	×				
-A2	Measuring	○	○	×	○	–	–	×	–	×
	Drain	×		×				×		○
	Zero calibration (zero water)	×		○				×		×
	Manual cleaning (Sample)	○		×				○		×
	Manual cleaning (zero water)	×		○				○		×
-A3	Measuring	○	○	○	○		○	×	×	×
	Drain	×					×	×	×	○
	Zero calibration (zero water)	○					×	×	○	×
	Manual cleaning (Sample)	○					○	○	×	×
	Manual cleaning (zero water)	○					×	○	○	×

○: Open, ×: Closed, -: No specification

V6 and V7 are manual valves for supplying sample with /PH□2, /PH□7 and /FC. Operate referring to the piping diagram.

CAUTION

The pinch valve (SV4) is hot when energized, so it is setup to turn Off automatically after 10 minutes or more.

3.5 Supply of zero water

If the turbidity to be measured is greater than 200 NTU, remove the element of the zero turbidity filter.

(1) Supply the specified tap water to the mounting port of tap water.

(2) Close all valves except V2 and SV3 (for Sampling system: -A3).

(3) Loosen the knob of the air vent at the top of the zero-turbidity filter and vent the air until tap water leaks out. After venting, tighten the knob firmly.

(4) Loosen screw A (see Figure 3.1) at the bottom of the detector and open the top of the detector.

(5) Slowly open valve V3 to adjust the level so that it overflows from the overflow port in the head tank, and check that the liquid level becomes the mirror surface as shown in (b) in Table 3.2.

3.6 Leveling detector (flow rate adjustment)

The measurement surface is rippled.

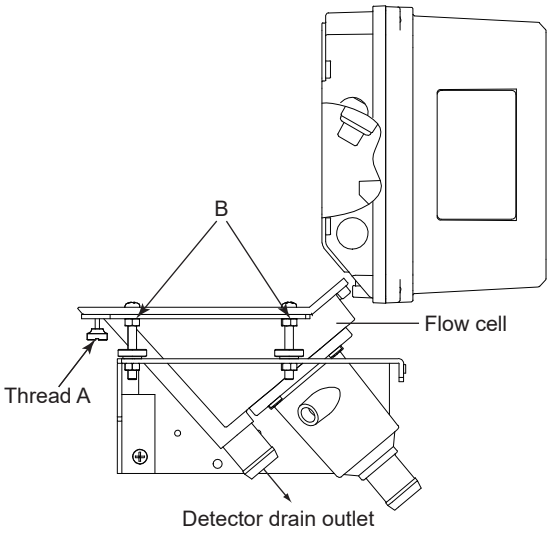

Figure 3.1 Detector

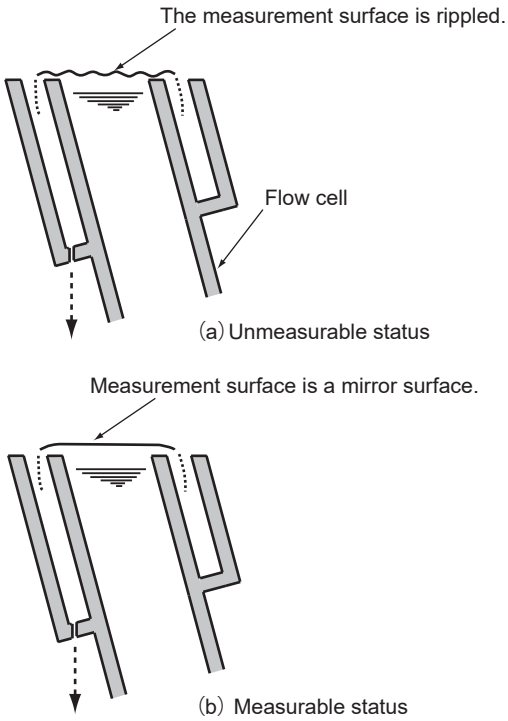

Figure 3.2 The liquid level of the detector

(1) Models with a sampling system usually do not need leveling because they are factory adjusted. (“3.12 Supplying Sample and Adjustment flow rate” is required). When leveling with or without a sampling system, place a level on the Flow cell with no water flowing, and adjust at B (4 locations) shown in Figure 3.1 so that the level shows horizontal at two points at right angles (see Figure 3.3). If there is no level gauge, it can be adjusted visually. In this case, adjust so that water overflows almost uniformly from the Flow cell (see Figure 3.2 (b)).

(2) After leveling, measure the volume of water drained from the detector drain port (see Figure 3.1) using a graduated cylinder, etc., and confirm that the volume is within 1.5 L ± 0.1 L per minute. If the flow rate is large, adjust it again in the direction of raising the Flow cell. If it is small, adjust it again in the direction of lowering the Flow cell using B (4 positions) shown in Figure 3.1.

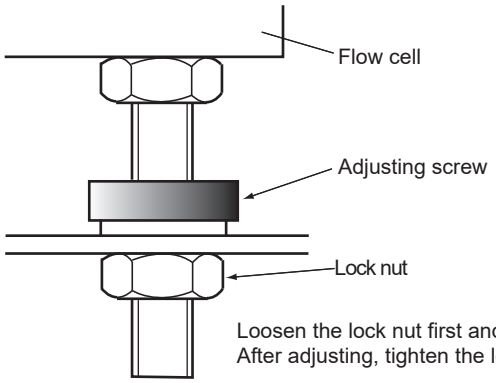

Figure 3.3 Enlarged view of B shown in Figure 3.1

3.7 Supply of Cleaning water

Check that the flow rate of the cleaning water is correct with Zero water flowing.

(1) Open solenoid valve SV2 via converter “solenoid valve/WIPER OPERATION” menu.

(Note 1) For sampling system codes:-NN and-A1, there is no solenoid valve SV2.

(2) Slowly open valve V4 to allow it to flow so that water does not splash.

(3) Close solenoid valve SV2.

(4) Close detector.

(Note 2) For sampling system cords:-NN and A1, close valve V4 and open each time wash is performed.

3.8 Running-in operation

The operation is conducted for at least one hour while zero water is flowing.

3.9 Setup of operating parameters

TB830D starts operating according to the factory-set operation parameters (default settings).

Before starting measurement, check that the initial data conforms to the operating conditions. If needed, set up again to perform the desired operation. See “4. SETTING PARAMETERS” and “5. FLXA402T sensor menu” for the setup. If the operating parameters were setup again, it is recommended to note the changed data.

(1) Converter’s Display Out setup

* Refer to Section 4 of FLXA402T converter Operator’s Manual (IM 12A01G01-03JA).

(2) Refer to the detector parameter setup “4. SETTING PARAMETERS”.

(3) Setup for Auto cleaning and Auto calibration

The sequence operation is set in the converter setting. See “4.5 Automatic cleaning/ Automatic zero calibration setting”.

3.10 Calibration

Allow TB830D to run for approximately one hour before starting calibration. For calibration, refer to “7. CALIBRATION”.

3.11 Zero calibration & slope calibration

After performing the running-in and the display becomes stable, perform zero calibration using zero water and span calibration using a calibration plate.

Refer to “7. CALIBRATION” for calibration procedure.

It is recommended to perform calibration approximately once a month. Calibration must be performed when the product has been out of operation for a long time or after inspection or maintenance.

3.12 Supplying Sample and Adjustment flow rate

(1) Turn Off converter maintenance mode.

(2) Set the manual valve to the measurement state (see “3.4 Valve operation” and Table 3.2).

(3) Supply the specified flow rate (2-10 L/min) of the sample.

(4) Measure the displacement of the detector drain with a graduated cylinder, etc., and confirm that the displacement is within 1.5 L ± 0.1 L per minute. If the flow rate is out of range, perform horizontal adjustment, or flow rate adjustment) of the detector referring to “3.6 Leveling detector (flow rate adjustment)”.

(Note 2) For the specification without a sampling system (sampling system code:-NN,-A5), make sure that the flow rate of the sample flowing into the detector is 1.5 to 2 L/min .

CAUTION

Precautions for products when option /PH□2, /PH□7, or /FC is specified.

The pH sensor of the pH meter and the ceramic beads of the Free Chlorine Meter detector are shipped in separate packages. Refer to the user’s manual of each instrument and install it correctly as a preparation for operation.

Failure to do so may cause measurement failure or equipment failure.

The operation of the instrument begins with supplying the required process fluid to the respective device. Refer to the piping diagram in “2.1 Piping”and adjust to the following flow rate by operating the appropriate valve.

(1) 3 to 11 L/min for pH meter Flow-through Type Holder

(2) Apply 0.1 to 2.5 L/min to the non-reagent type free chlorine detector.

For the operation of each device, refer to the respective instruction manuals.

3.13 Switch to measurement mode

After operation preparation is completed, turn Off the maintenance mode and set it to measurement mode. Check that no error occurs.

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4. SETTING PARAMETERS

This section describes how to set up turbidity meter-specific parameters.

Table 4.1 lists the parameters that can be set up from the sensor menu. Table 4.2 lists the parameters of “Automatic cleaning/Automatic zero calibration setup” among the parameters that can be set up from the converter menu. For further converter menu setup parameters, refer to FLXA402T user’s manual (converter operation).

To go to the Sensor setting menu, refer to “5.5 Setting”. To go to the converter menu, refer to section 3.4 in FLXA402T Operation of Converter IM 12A01G01-03EN.

Table 4.1 Sensor setting

Menu				Parameter	Default	Reference
Measure setting				Negative value non output	Disable	4.1.1
				Turbidity unit select	mg/L	4.1.2
				User-defined unit	(blank)	
				Meas. damping time constant	20.0 sec	4.1.3
				Turbidity warning High limit	9999 (*1)	4.1.4
				Turbidity warning Low limit	-10.0 (*1)	
	Air denoising setting			Air denoising function	Disable	4.1.5
				Air noise detection value	999.9 (*1)	
				Air denoising hold time	30 [sec]	
				Denoising release time	30 [sec]	
Cal./Maint. settings				Turbidity value of check tool	90.0 (*1)(*3)	4.2.1
				Maint. damping time constant	6 [seconds]	4.1.3
				Zero shift value	0.0	4.2.2
				Correction factor	1.0	
				Stability check allowable width	(*2)	4.2.3
				Stability checking time	10 [sec]	
				Stability check limit time	1.0 [minutes]	
				Wash/Cal. box	Disable (*3)	4.2.4
	Calibration setting others			Zero	(*2)	4.2.5
				Slope	100.0[%]	
				Sens.factor	(*2)	
		Linearize table	point 1.	X value	(*2)	
				Y value	(*2)	
			point 2.	X value	(*2)	
				Y value	(*2)	
			point 3.	X value	(*2)	
				Y value	(*2)	
			point 4.	X value	(*2)	
				Y value	(*2)	
			point 5.	X value	(*2)	
				Y value	(*2)	
			point 6.	X value	(*2)	
				Y value	(*2)	

*1: Depend on the configured unit of turbidity
*2: Value is preset factory default. After initialization, set each value to default.
*3: The factory default setting and default may differ. Check the factory default setting.

Menu	Parameter	Default	Reference
Diagnosis setting	Light source diagnosis	Enable	4.3.2
	Dried condition diagnosis	Enable	
	Light source operating days	Enable	
	Wiper operating days	Enable (*3)	
Communication setting	Sensor connection address	1	4.3.3

*1: Depend on the configured unit of turbidity
*2: Value is preset factory default. After initialization, set each value to default.
*3: The factory default setting and default may differ. Check the factory default setting.

Table 4.2 Converter setting

Menu		Parameter	Default	Reference
Auto wash/cal. settings		Auto sequence for wash/cal.	Disabled	4.5.1
		First start Year YY	00 [Year] *	4.5.2
		First start Month MM	1 [Month]	
		First start date DD	1 [days]	
		First start hour hh	0 [h]	
		First start minute mm	0 [minutes]	
		Auto update of start date	Disable	
	TB setting	Auto wash function	Enable	4.5.3
		Wash type	Water flow	
		Auto calibration function	Disable	
		Washing interval	6.0 hour	4.5.4
		Repeat count of wash	1 Times	
		Calibration frequency	0 Times	
		Drainage time	20 sec	
		Washing time	65 sec	
		Wiper driving time	10 sec	
		Flow waiting time	50 sec	
		Recovery time	150 sec	

*: Specify the last two digits of the year (20xx)

4.1 Measure setting

4.1.1 Negative value non output

When “Negative value non output” is set to Enable, a negative measurement result is displayed as “0” and mA output shows “0”.

When “Negative value non output” is set to Disable, a negative measurement result is displayed as a negative value and mA output shows negative, too.

4.1.2 Turbidity unit select

Select turbidity unit, mg/L, TU, NTU, FTU, FNU, or user defined unit. If you select a user defined unit, the unit is displayed in text. You can enter up to 6 character of user-defined units.

4.1.3 Meas. damping time constant, Maint. damping time constant

Performing time constant processing smooths the fluctuation of measured turbidity. 63% Response time is set as a time constant.

The larger the time constant is, the more stable the value of turbidity becomes, but the slower the response is.

In a measurement mode, the measurement damping time constant is applied. Maintenance time constant is used under the following conditions:

- Maintenance mode
- During Calibration
- Automatic cleaning/Automatic zero calibration

To make the response faster under the above period, set the maintenance damping time constant to a smaller value than the measurement damping time constant.

4.1.4 Turbidity warning High/Low limit

Set the High or Low limit of the turbidity value.

If the value exceeds the limit, a warning appears. A “Turbidity warning High limit” is generated when the setup upper limit is exceeded, and a “Turbidity warning Low limit” is generated when the lower limit is exceeded.

4.1.5 Air denoising setting

■ Overview

Air bubbles or dust in a sample may cause fluctuation in turbidity readings; generally, a sudden rise in reading occurs. The fluctuation is dependent on the size of air bubbles or dust and their behavior.

It is recommended that a head tank for removing air bubbles be installed. (A TB830D with a sampling system is equipped with a head tank.). A head tank prevents air bubbles from reaching the detector. In rare cases, however, air bubbles occur and grow in the pipe between the head tank and the detector, and rise to the measuring cell, resulting in reading fluctuation.

The air denoising function is to detect and suppress a sudden change due to air bubbles or dust. The detector has a time constant processing (measurement time constant) for turbidity signal. The time constant can be varied. Increasing the measurement time constant can handle the indicated changes caused by small bubbles and debris to some extent. However, when the measurement time constant is too large, setup with a very large time constant is not practical because the response of the turbidity signal itself is slow according to the measurement time constant. Therefore, TB830D detects only sudden changes caused by bubbles and dust, and suppresses sudden changes caused so as not to be output to the display and power outputs.

[Function]

To suppress a sudden fluctuation due to air bubbles or dust, the TB830D:

(1) Checks a turbidity signal before averaging;

(2) Calculates the difference between the current signal and the previous signal;

(3) Compares the difference with the Air noise detection value;

(4) If it is less than the Air noise detection value, proceeds to average and gives the turbidity reading;

(5) If it is greater than the Air noise detection value, holds the output for a specified Air denoising hold time period; During this time, CHECK is displayed to the main screen. No contact output occurs by the Air denoising hold time period.

(6) During the hold, Air noise detection value is not checked. However, if a value greater than “Air noise detection value” is continued for 5 seconds, the process moves to the same process as “Denoising release time” in (7) without waiting for the Air denoising hold time.

(7) When the hold period is completed, the “Denoising release time” is checked unconditionally and the turbidity is Denoising release time without checking the “output and displayed”.

(8) After the Denoising release time has elapsed, performs the Air noise detection value check again.

[Notes on air denoising function]

The air denoising function is effective in processes where turbidity changes are relatively small under normal conditions, but it may not be suitable for processes where sudden changes often occur. Even if sudden changes do not usually occur, this function may be activated and may cause a delay in the response of the reading or output if stepwise turbidity changes occur occasionally.

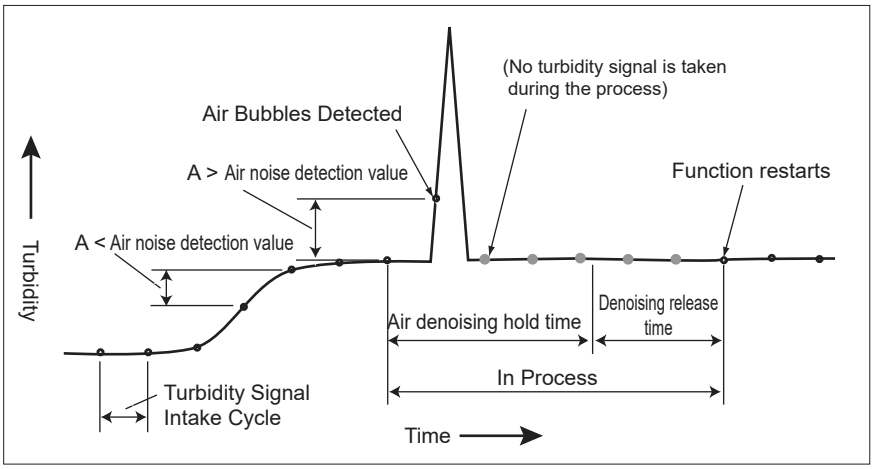
Therefore, before using this function carefully consider the process conditions, and in order to use it properly, determine optimum setpoints for the operating conditions while changing them little by little. When using the function, pay attention to the following.

(1) Adjust the Air noise detection value according to the degree of reading change due to air bubbles or dust.

(2) If an excessively long Air denoising hold time is set, the turbidimeter may not be able to detect a change in reading that may have occurred and should have been recognized as real change.

(3) If the turbidity reading responses slowly due to the operation of this function, try turning setup the “Bubble suppression release time” longer without changing the “Bubble suppression hold time”.

(4) When an abnormal turbidity reading is suspected, turn off the function once and wait for a while and see. The function may have prevented the turbidimeter from giving readings properly.



A: Difference between the current signal and the previous signal

A:Difference between the current signal and the previous signal

Figure 4.1 Air bubble suppression function

How to Set Each Parameter

a. Air denoising function

You can set up enable or disable Air denoising function. To use Air denoising function, set the function to enable.

b. Air noise detection value

Air noise detection value is used to determine whether a reading is a spike due to air bubbles or dust. Setup is defined as a turbidity value in NTU

For the Air noise detection value check, a pre-averaging turbidity value is used. To determine the Air noise detection value, it may be needed to know the degree of fluctuation in pre-averaging turbidity signals. Set the value to a larger degree than the fluctuation. To know the pre-averaging fluctuation, setup the measurement time constant (maintenance time constant in maintenance mode) to 0. The measured turbidity value at this time is a value that is not processed by the time constant.

c. Air denoising hold time

Times hold Display power when bubbles or dust are detected.

Take into account how long air bubbles and dust stay on the scatter surface and setup them longer. Normally, air bubbles and dust will run off the Flow cell or disappear within a short time (in a few seconds). In practice, first set the Air denoising hold time to a shorter time, and then increase it if the function does not work satisfactorily.

d. Denoising release time

After the Air denoising hold time has elapsed, the turbidimeter gives readings without any processing to verify that no fluctuation occurs in turbidity readings. The time count starts at the end of Air denoising hold time.

It is unlikely that air bubbles or dust occur consecutively. Therefore, the Denoising release time may not need to be too short. If the Denoising release time is set too short, the response is delayed when a sudden change in turbidity actually occurs. First set the Denoising release time slightly longer. If something is wrong with the behavior, shorten the time.

[Instructions for Use]

Be careful when using the function since the following restrictions apply.

(1) The function works only in measurement mode. As soon as the mode is changed, the Hold or Denoising release timer is reset and the function stops.

(2) During an Air denoising hold time period, both turbidity readings (including communication data) and analog outputs are held. During the hold time, CHECK is displayed on the HMI. Contact output doesn't work by this function.

(3) The function does not run for approximately 5 seconds right after the turbidimeter is turned.

(4) If the turbidimeter is turned off and then on again while the function is running, the timer is reset.

4.2 Cal./Maint. Settings

4.2.1 Turbidity value of check tool

Set up the turbidity of the check tool used for slope calibration. The value is set at the factory.

CAUTION

When the initialization is executed, setup data at the factory is deleted. After initialization, re-enter the turbidity value of the check tool.

4.2.2 Zero shift value, Correction factor

These parameters are related to zero shift correction and sensitivity correction in the calibration menu. Normally zero shift value is 0, and the correction factor is 1. See “7. CALIBRATION”.

4.2.3 Stability check

You can configure the following parameters to evaluate the measurement stability in a calibration.

- Stability check allowable width
- Stability checking time
- Stability check limit time

The measurement stability is verified, when the measurement stays within the range of “Stability check allowable width” without exceeding the range for longer than the set period of” Stability checking time”. If the measurement does not become stable before “Stability check limit time” is up, a confirmation dialog appears to abort the calibration.

4.2.4 Wash/Cal. box

Select whether or not to use Wash Box (Relay box for solenoid valve). While using the Relay box, make the Wash box Enabled.

If Wash Box is disabled, you cannot implement automatic cleaning/automatic zero calibration.

If you enable this function when Wash Box is not connected, an alarm occurs to notice the Wash Box error.

4.2.5 Calibration setting others

Zero, slope, Sens.factor Linearize table changed manually. Go to the sensor detail screen to check the setting as a reference. These parameters are important for the turbidity linearity.

Do not change those setting except for resetting values.

4.3 Diagnosis setting

4.3.1 Light source diagnosis

Select Light source diagnosis On/Off. See 5.3 for details.

4.3.2 Dried condition diagnosis

Select Dried condition diagnosis On/Off. See 5.3 for details.

4.3.3 Operating days

Set each counts of parameter enabled/disabled

If you want to confirm the value of operation days, enable the function. However, even if you set it disabled, the operating day counts internally. TB830D does not use the Wiper operating days.

4.4 Communication setting

■ Sensor connection address

You can change Modbus address. Normally, you do not need to change setup. After changing Modbus address, you need to change the configuration of the converter that connects to the system. To change the converter setting, Converter menu > Setting > Converter setting > Advanced settings > MODBUS setting >Sensor Address setting (S) Refer FLXA402T Operation of Converter (IM 12A01G01-03EN).

CAUTION

The change in sensor addressing setup is reflected by turning OFF/ON Power Supply.

4.5 Automatic cleaning/Automatic zero calibration setting

This setup is a converter setup.

4.5.1 Auto sequence for wash/cal.

Enable this function to use Automatic cleaning/Automatic zero calibration.

If this function is disabled, automatic cleaning/automatic zero calibration is never implemented even if other setting is active.

4.5.2 Start date

First set the date and time to activate automatic cleaning/automatic zero calibration. As the first time automatic cleaning/automatic zero calibration, enter a future date/time but not the current one.

If you want to perform the next and subsequent automatic cleaning/automatic zero calibration automatically, turn ON Auto update of start date. The next date of automatic cleaning/automatic zero calibration is determined according to the washing interval.

4.5.3 Automatic cleaning/Automatic zero calibration function and wash type

You can set Automatic cleaning function and Automatic zero calibration function respectively to Enable/Disable. When you use Auto calibration, always set Automatic cleaning to Enable Always select water flow as wash type.

4.5.4 Auto sequence setting

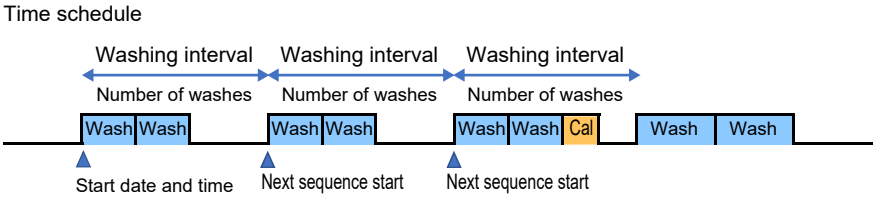
Configure the following parameters to setup the schedule for Automatic cleaning and Automatic zero calibration.

- Cleaning interval
- Repeat count of wash
- Calibration frequency

The auto-sequence starts at the setup hour of the start time at the washing interval cycle.

See how many times the automatic cleaning repeats in a sequence by setting “Repeat count of wash”. When Auto calibration function” is ON, Auto sequence starts at an interval determined calibration frequency. When automatic cleaning ends, automatic zero calibration operates one time. When Calibration frequency is set to “0”, no Auto calibration operates.

The next figure shows the example when. Repeat count of wash is 2. Calibration frequency is 3.



Automatic calibration takes place one time after the auto sequence repeats as many calibration frequencies.

Other parameters are for setting details about one count of automatic cleaning/automatic zero calibration. For further information on the auto sequence, read “Appendix Automatic cleaning/ Automatic zero calibration Sequence”.

CAUTION

The settings changed in the wash interval will be reflected in the second “start date and time” that follows.

5. FLXA402T sensor menu

Start up> Main screen MENU

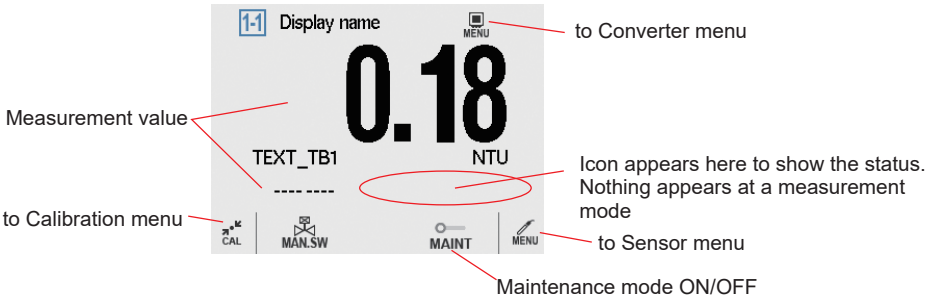


Figure 5.1 Main screen

On Main screen the shortcut menus

MAINT Maintenance mode dialog

To go to Sensor menu,

Start up> Main screen MENU > Sensor menu

The following operation are available.

- Auto wash
- Calibration (sensor calibration)
- Setting (sensor setting)
- Sensor maintenance
- etc.

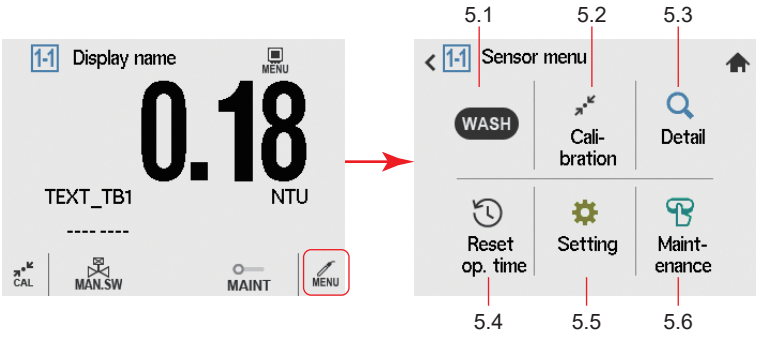


Figure 5.2 Sensor menu

5.1 WASH

On Sensor menu, tap WASH > a dialog to start automatic washing manually

Tap “Start” then Auto Wash. runs only one time. This operation does not affect any automatic sequence schedule.

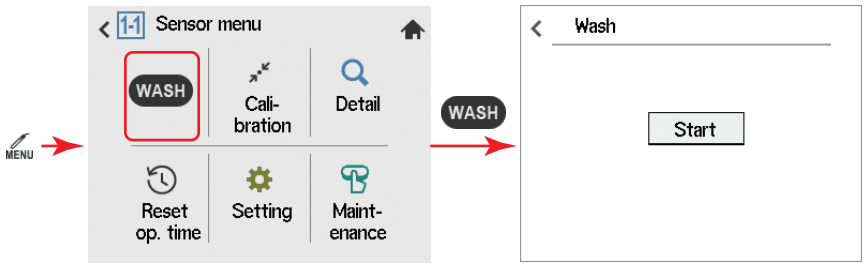


Figure 5.3

When you have a password, a password verification appears. Upon successful confirmation, Wash screen appears.

For further information on the password setting, see FLXA402T Operation of Converter IM 12A01G01-03EN 5.4 Password.

5.2 Calibration

On Sensor menu, tap “Calibration” > Calibration menu

Or on Main screen, tap CAL “Calibration” > Calibration menu

For further information about Calibration, see “7. CALIBRATION”

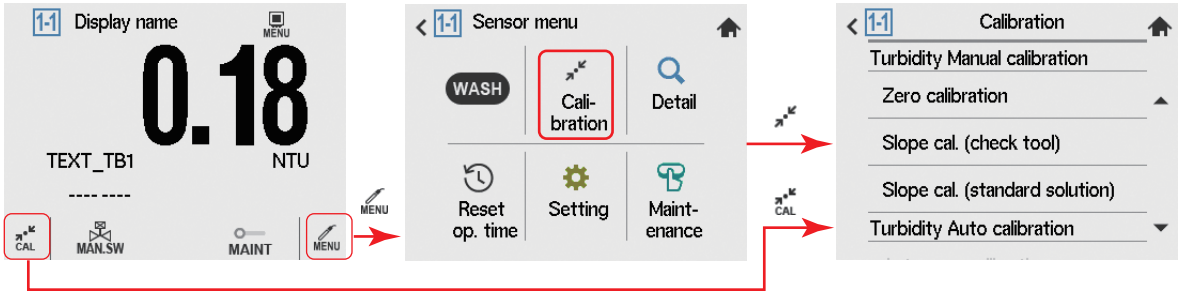


Figure 5.4

When you have a password, a password verification appears. Upon successful confirmation, Calibration screen appears.

For further information on the password setting, see FLXA402T Operation of Converter IM 12A01G01-03EN 5.4 Password.

5.3 Detail

On Sensor menu, tap “Detail” > to check details (setup, sensor diagnosis, calibration, and module production number).

In case of trouble, when you contact Yokogawa service, please inform us of the module and FLXA402T software revision displayed on the Detail under converter menu and sensor menu and module production number, style number indicated on the nameplate attached to the instrument

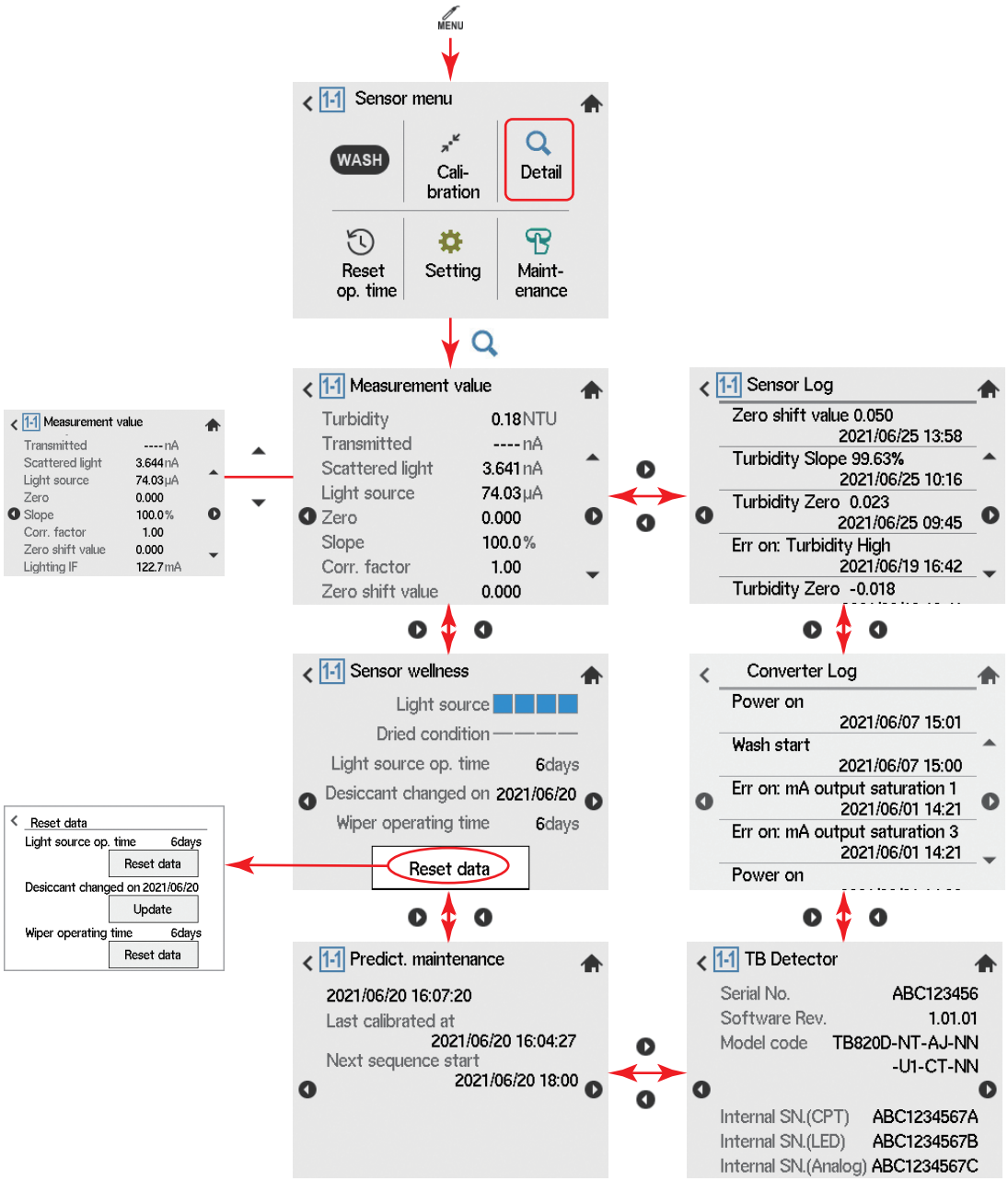


Figure 5.5 Sensor menu flow chart

Measurement value

Turbidity

Shows the turbidity on Main screen.

Current value

Shows input current value of Transmitted, Scattered light, Light source.

TB820D does not support “Transmitted”, which displays “----”.

Zero, Slope, Corr. factor, Zero shift value

It is recommended that you note the values of these items prior to performing calibration. When calibration is executed, the data is overwritten.

Lightening IF

Shows a driving current value of the light source.

Sensor wellness

Light source diagnosis

The result shows how much the Light source condition has changed since the factory preset. The more ■ appears in each gauge, the more sound the Light source is. A gauge is indicated only when the setting of Sensor wellness for Light source is enabled. If the sensor wellness setting is “disabled, a bar (----) is displayed.

Dried condition diagnosis

Shows the dryness inside the detection unit.

The more ■ appears, the more sound the dryness condition is. If no ■is displayed, replace the desiccant. The gauge is displayed only when the setting of the dried condition is valid. When not, a bar (----) is displayed.

Replacement/Operating days

Manages desiccant replacement day or operating days of Light source and wiper.

To reset each data, go to dialog of Sensor wellness reset. Press reset, then the number of operating days is reset to 0 but the replacement date is updated. See 5.4.

Only when the wellness setting is enabled, the result is displayed.

Predict. maintenance

Last calibrated at

Displays a date when the last auto calibration took place and the last calibration menu was implemented.

Next sequence start

When next auto wash, next auto calibration are scheduled, the next date on schedule is displayed.
If you set a date/time for the first-time operation, the date and time for the first time operation is displayed. When you set Next auto calibration date to be updated automatically, the next date of auto calibration date is automatically updated.

TB detector

Displays Serial number (Serial No.) of a connected Turbidity detection unit, software version (Software Rev.), Model code (Model code), internal serial number of CPT board, LED board and analog board (Internal SN.(CPT), Internal SN.(LED), Internal SN.(Analog)).

Converter log, Sensor log

Same display as on the converter “Detail”.

See FLXA402T Operation of Converter IM 12A01G01-03EN

5.4 Reset op. time

To reset wellness data of each sensor
Sensor menu > Reset op. time > Sensor wellness , tap “Reset data” > Reset data

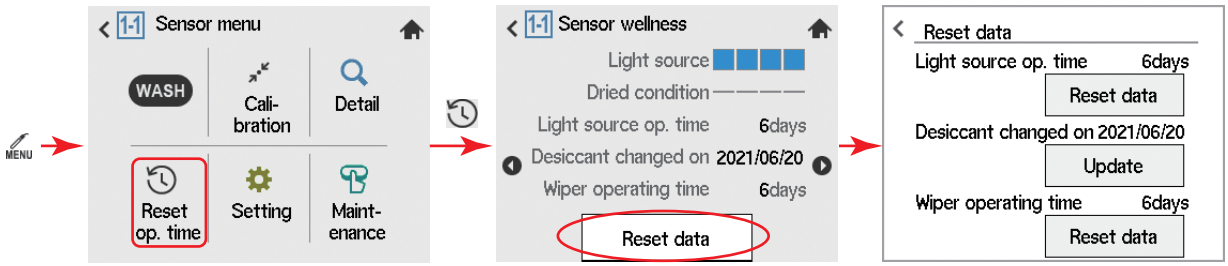


Figure 5.6

You can reset each data from the dialog of Sensor wellness. If you reset, the operating days are reset to “0” but the replacement date is updated.

When you have a password, the password verification appears. Upon successful confirmation, Reset confirmation screen appears.

For further information on the password setting, see FLXA402T Operation of Converter IM 12A01G01-03EN 5.4 Password.

5.5 Setting

Sensor menu > Setting .

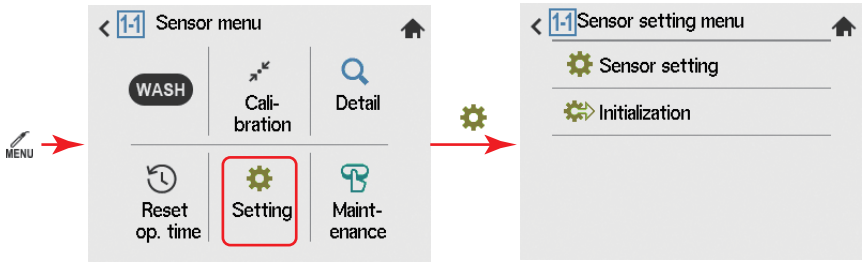


Figure 5.7

When you have a password, the password verification appears. Upon successful confirmation, Sensor Setting screen appears.

For further information on the password setting, see FLXA402T Operation of Converter IM 12A01G01-03EN 5.4 Password.

If you go to Sensor setting, the mA output becomes HOLD when automatic hold function is enabled, and contact output keeps the current status.

Sensor setting

Set sensors. See “4. SETTING PARAMETERS”

Initialization

Initialize sensor parameters.

If you tap “Execute”, the loading starts. When the loading ends, you will return to Sensor menu.

Confirm the items before tapping Execute. If you initialize the calibration value of Zero, Sens. factor, linearize table etc., they return to the factory default. Some factory default are different from the initial value. See the Table 4.1.

5.6 Maintenance

Sensor menu > Maintenance

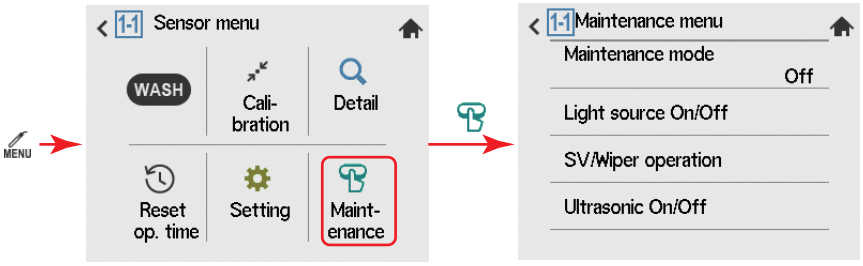


Figure 5.8

When you have a password, the password verification appears. Upon successful confirmation, Maintenance screen appears.

For further information on the password setting, see FLXA402T Operation of Converter IM 12A01G01-03EN 5.4 Password.

5.6.1 Maintenance mode

Switches the mode between the measurement and the maintenance. For Maintenance mode, See “3. PREPARATION for OPERATION”.

5.6.2 Light source On/Off

Switches On/Off Light source. This function is enabled only when Maintenance mode is On.

5.6.3 SV/Wiper operation

SV/Wiper operation

TB830D does not use wipers. The function controls the solenoid valve connected to Relay box. You can go to the same screen when tapping (MAN SW MAN.SW of Main menu. This function is enabled only when Maintenance mode is On.

CAUTION

SV4 (pinch valve) is set to automatically turn off after 10 minutes of operation to prevent overheating due to energization.

6. OPERATION

6.1 Turbidity measurement

When Power Supply is set to ON with a sample passing through the Flow cell, the turbidity detector is activated in a measurement mode, and turbidity is continuously measured.

Regular maintenance enables the measurement to be performed stably. For details about maintenance and troubleshooting, see “8. MAINTENANCE” and “9. TROUBLESHOOTING”.

6.2 Air denoising

If the Air denoising is set to ON, the protrusion of the measured value caused by the bubble is deleted. “Check” status icon appears on the main screen during air denoising hold time Contact output doesn’t work by this function. Refer to “4.1.5 Air denoising setting” for more information on Air denoising operation and parameter setup.

6.3 When Water Supply is Cut Off

If the sample or tap water (cleaning water or zero water) stops, normal measurement cannot be performed. Since the TB830D cannot detect whether the water supply is stopped or not, a check water supply lines periodically.

6.4 Automatic cleaning/Automatic zero calibration Operation

When the sampling system is properly installed and Automatic cleaning/Automatic zero calibration is properly set up on the converter setting, Automatic cleaning/Automatic zero calibration starts at a scheduled time during a regular operation in a measurement mode For more information on operation scheduling, see “4.5 Automatic cleaning/Automatic zero calibration setting” and “Appendix Automatic cleaning/Automatic zero calibration Sequence”.

You can see when the next automated wash or automated calibration starts from the sensor detail screen. If the scheduled auto sequence date has already passed or is a past date, Automatic cleaning/Automatic zero calibration does not operate.

Refer to FLXA402T converter Operators (IM 12A01G01-03JA) for converter display and mA-output display when Automatic cleaning and Automatic zero calibration are running.

During Automatic cleaning/Automatic zero calibration, you cannot turn on the maintenance mode. You cannot enter the calibration menu or the setting menu, either.

6.5 Stop and restarting operation

To stop operation, stop supplying Power. If the instrument out of operation for a long period, stop supplying sample and wash the Flow cell and keep it empty or keep zero water running.

When restarting operation after long-term shutdown, perform maintenance referring to “8. MAINTENANCE” and then prepare for operation described in “3. PREPARATION for OPERATION”.

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7. CALIBRATION

This chapter describes types of calibration enabled with TB830D. Periodical calibration and an optimization of calibration parameters for Zero or Slope ensure accurate measurement. The sensitivity correction can also correct the standard and grab sample sensitivity. Clean the Flow cell before calibration. Perform calibration with the detectors or the Flow cells free from contamination when the reading is stable.

7.1 Turbidity calculation and calibration menu

Zero, Slope are adjusted based on a standard solution as a reference. (Equation 7.1)

If the turbidity measured by the instrument may differ from the one measured manually in a lab due to the difference of properties of the sample and/or of turbidity measurement methods, the instrument can be adjusted so that it reads the same value as the one measured in a lab by performing the zero shift correction or sensitivity correction.

In this case, the instrument determines zero and sensitivity correction factors in addition to the calibration factor determined based on the calibration using standards. (See Equation 7.2.)

Normally T2 represents a turbidity, but when Zero calibration, Slope calibration (check tool, standard solution), Auto Zero Calibration, Sensitivity correction calibration is being progressed, T1 is used.

$T1 = [100/SL/S_0]*[V-A]$ .....Equation 7.1

T2 = K*T1 + B.....Equation 7.2

Where:

- T1: Turbidity based on turbidity standards
- S0: Sensitivity factor
  Calculated reference sensitivity calibration. This calibration is performed at the factory before shipment.
- SL: Slope
  Calibrated by slope calibration. SL(%) value means how different sensitivity is from factory sensitivity.
- A: Zero
  Calculated in zero calibration using zero water.
- V: Measuring signal
  This signal is calculated by ratio of scattered light current and light source monitoring current.
- T2: Turbidity after zero and sensitivity corrections
- K: Correction factor
  Determined in sensitivity corrections or 2-point sensitivity corrections.
- B: Zero shift value
  Determined in zero shift corrections or 2-point sensitivity corrections.

Turbidity manual calibration

Zero calibration (“7.4 Zero Calibration”)

Adjust the reading to zero point. Update the Zero of calibration parameter.(A in Equation 7.1) Zero

Slope calibration (Check tool) (“7.6 Slope calibration (Check tool)”)

Update the Slope of calibration parameter (SL in Equation 7.1) by using Check tool.
Adjust the reading to pre-defined turbidity value of Check tool.
Be sure to perform after Zero calibration.

Slope calibration (Standard solution) (“7.7 Slope calibration (Standard solution)”)

Adjust the reading to arbitrary concentration value.
Update the Slope of calibration parameter (SL in Equation 7.1).
Be sure to do this after Zero calibration.

Turbidity auto calibration

Auto zero calibration (“7.8 Auto zero calibration”)

Zero calibration by feeding Zero water automatically.

Enable only when the converter setting of Automatic cleaning/Automatic zero calibration is correct and the sampling system runs normally.

Calibration others

Zero shift correction (“7.9 Zero shift correction”)

Update the Zero correction factor (B in Equation 7.2) using Zero water.

Sensitivity correction (“7.10 Sensitivity correction”)

Update the basic Sensitivity correction factor (K in Equation 7.2) by correcting to an arbitrary sample value. Be sure to do this after Zero shift correction.

2 Points correction (“7.11 2 points correction”)

Update the Zero correction factor (B in Equation7.2) and Sensitivity correction factor (K in Equation 7.2) all together, by using samples of two different concentration except for zero.

Reference sensitivity calibration (“7.12 Basic (reference) sensitivity calibration”)

Update the Reference sensitivity (S0 in Equation 7.1) which is an important parameter for concentration calculation. Slope is initialized to 100 %. Usually this calibration is performed only prior to factory shipment.

[Calibration status and calibration recovery status]

If you enter calibration’s screen from calibration menu without turning on the maintenance mode, the turbidity meter enters calibration status and enters the maintenance contact and auto hold target status. When calibration is finished or interrupted and the unit returns to the main screen, contact status and mA hold status remain unchanged, and the CAL flashes.

After confirming that the reading is normal, press the flashing CAL to cancel calibration recovery and return to measurement mode. When 1 hour has elapsed with calibration recovery state, the measuring mode is automatically returned.

7.2 Turbidity standards

The turbidity standards are used as reference for adjusting a zero or span point of a turbidity detector.

Zero Standard

Zero Turbidity Standard Solution

Filtered tap water is used as a zero turbidity standard solution for TB830D turbidity detector.

For zero calibration, it's filterd through a 1 µm filter.

Zero Turbidity Filter

The specifications of the zero turbidity filter that can be purchased from Yokogawa is as follows.

Item	1 µm Zero Turbidity Filter	0.2 µm Zero Turbidity Filter
Part number	K9411UA	K9726EF
Piping connection	Rc1/2	Rc1/2
Maximum pressure	500 kPa	500 kPa
Cartridge material	Polypropylene	Polypropylene
Filter size	1 µm	0.2 µm
Accessory	Air vent plug	Air vent plug

Turbidity Standards

Turbidity Standard Solution

A formazin, Kaolin, PSL is used as a turbidity standard solution for TB830D turbidity detector.

Check Tool

A check tool used for slope calibration or the sensitivity checks is supplied with the turbidity detector.

The check tool has been pre-calibrated for span point using a standard solution above at the factory before shipment. Normally the check tool is used as span.

Drain the water inside the FLow cell and wipe the edge of the Flow cell before setting the check tool.

NOTE

The turbidity value indicated on the check tool has been determined for the turbidity detector of interest based on zero and span calibrations at the factory; it is a unique value, specific to the turbidity detector.

When using multiple turbidity meters, there is no compatibility between the check tools of each turbidity meter.

Be sure to use the check tool that comes with each turbidity meter.

Also, special care should be taken when handling a check tool. Scratches or dirt on the surface of a check tool may affect the turbidity value.

How to install the check tool

- Loosen the screw A at the bottom of the detector and open the top detector. (Figure 7.2)
- Set the check tool as shown in Figure 7.2.

Figure 7.1 Check tool

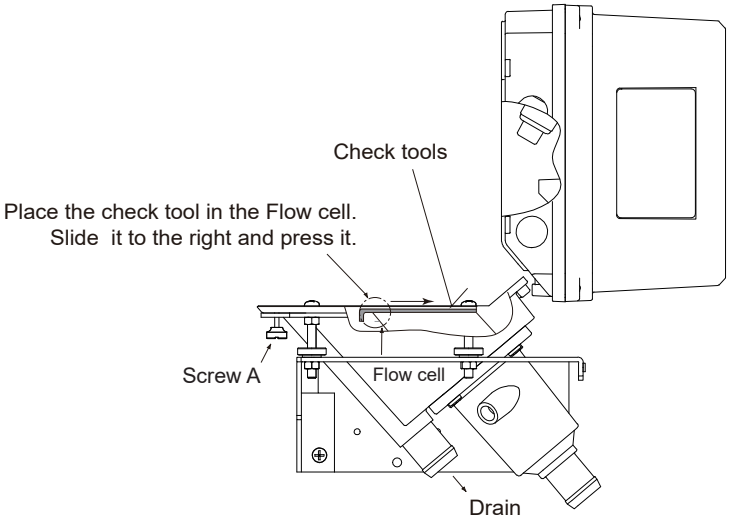


Figure 7.2 How to install a check tool

CAUTION

Do not lose the check tool supplied with the turbidity detector. The check tool has a turbidity value unique to the turbidity detector of interest. Therefore, the same check tool cannot be purchased again. If it is lost, contact Yokogawa. We may provide another check tool prepared in advance.

<How to clean the check tool>

Clean the dust and contaminants on the surface of the check tool.

(1) Cleaning with the attached silicone cloth or washing

If the surface is dusty, use the included silicone cloth to gently wipe it off and remove the dust. At this time, do not rub hard the surface.
If the dust and contaminants cannot be removed by just wiping it, wash it with tap water. After cleaning, drain the water well and absorb the remaining water with tissue paper. At this time, do not rub the surface.

(2) Cleaning with detergent

Touch the surface with your hands. If your hands still get dirty, or if the stain does not come off even after cleaning (1), clean it with the neutral detergent.
Take the following steps below for cleaning.

a. Dissolve an appropriate amount of detergent in tap water and soak the check tool.

b. Shake the check tool in the detergent solution to clean the surface.

c. If the stain is tough and does not come off by just shaking it, rub gently the surface in the detergent solution.

d. After the stain comes off, rinse off the cleaning solution with the tap water and drain the water droplets on the surface.

e. Wipe off the residual solution on the surface with tissue paper, but do not rub hard the surface.

CAUTION

- Avoid rubbing hardly regardless of the material of the cloth.
- Do not use agents other than mild detergent for wash; avoid ethanol, acetone, and other solvents.
- Do not use fingers to wash off the stain on the surface.
- Handle with care. Scratches on the surface may interfere with accurate measurement.

7.3 Formazin Standard Solution

A turbidity standard calibration solution should be prepared by diluting a 400 NTU formazin standard stock solution. This section describes the procedures for preparing a standard stock solution and a diluted solution for calibration.

7.3.1 Preparing a 4000 NTU Formazin Standard Stock Solution

(1) Reagents Required

- Hydrazine sulfate, $(NH_2)_2 \cdot H_2SO_4$
- Hexamethylene tetramine, $(CH_2)_6 \cdot N_4$

(2) Equipment Required

- Measuring flask, 1 x 2000 mL
- Beaker, 2 x 1000 mL

(3) Precautions

- Use clean, high quality laboratory glassware and measure the volume needed accurately.
- To dilute the formazin standard stock solution, use deionized water or water filtered through a 1.0 µm zero turbidity filter.

(4) Procedure

a. Weigh out 10.00 g ±0.01 g of hydrazine sulfate with a balance, place it in a 1000-mL beaker, and add deionized water 700 mL (solution A).

b. Weigh out 100.00 g ±0.01 g of hexamethylene tetramine with a balance, place it in another 1000-mL beaker, and add deionized water 700 mL (solution B).

c. Make sure that both reagents have been completely dissolved in solutions A and B, respectively. Pour all of the both solutions (A and B) into a measuring flask (2000 mL) and mix them together, rinsing the beakers with the deionized water so that no solution is left in the beakers.

d. Add deionized water up to the marked line of the measuring flask to make the total volume 2000 mL and stir the mixture throughly.

e. Allow the mixed solution to stand for 24 hours at 25 ±3°C.

f. When you find white turbidity or the white precipitation of the mixed solution, stir the mixture well to use.

The shelf life of 4000 NTU formazine standard solution is one month.

7.3.2 Preparing a 400 NTU Formazin Calibration Standard Solution

(1) Reagents Required

- Hydrazine sulfate, $(NH_2)_2 \cdot H_2SO_4$
- Hexamethylene tetramine, $(CH_2)_6 \cdot N_4$

(2) Equipment Required

- Measuring flask, 2 x 100 mL
- Measuring flask, 1000 mL
- Volumetric pipette, 50 mL
- Analytical balance

(3) Procedure

a. Weigh out 1.000 g ±0.001 g of hydrazine sulfate with a balance, place it in a 100-mL measuring flask, and add deionized water to make 100 mL (solution A).

b. Weigh out 10.00 g ±0.01 g of hexamethylene tetramine with a balance, place it in another 100-mL measuring flask, and add deionized water to make 100 mL (solution B).

c. Make sure that both reagents have been completely dissolved in solutions A and B, respectively. Pipette 50 mL each of solutions A and B into a 1000-mL measuring flask and mix well.

d. Allow the mixed solution to stand for 24 hours at 25 ±3°C.

e. Bring the total volume to 1000 mL with deionized water.

This is a 400 NTU formazin standard stock solution and its storage life is one month. To make a standard solution of the desired turbidity, dilute this stock solution with deionized water.

7.4 Zero Calibration

Supply Zero water or turn off the light source to perform Zero calibration. See "■ Zero Standard" (7.2) to confirm about zero water.

[How to perform Zero calibration]

(1) Turn on the maintenance mode.

(2) Prepare to supply zero water.

<When using zero filter water>

- Open the valve for zero water and let the zero filter water flow.

<For zero calibration by turning off the light source>

This can be selected only when the measured turbidity exceeds 200 NTU.

- Turn off the LED from the maintenance menu.

(3) Press on Main screen and go to the calibration menu.

(4) On the calibration menu, select Zero calibration.

(5) Confirm the reading is stable. Press [check stability].

(6) After the message pops saying the reading is stable, confirm that the calibration value is zero. Then press [Next].

(7) Check the result of calibration and press [Accept] to update the Zero of the calibration parameter.

(8) If Light source has been turned off, turn on the light source.

To shift to the slope calibration, proceed to the steps of “7.6 Slope calibration (Check tool)” or “7.7 Slope calibration (Standard solution)”. If you finish the operation, fix the clear cover and feed the sample with the top cover on. Turn off the maintenance mode to end the calibration.

7.5 For zero calibration by turning off the light source

This can be selected only when the measured turbidity exceeds 200 NTU.

Refer to “7.4 Zero Calibration” for step.

7.6 Slope calibration (Check tool)

When you calibrate both zero point and slope, first calibrate the zero point and then the slope. See “● Check Tool” to confirm about check tool.

[How to perform Slope calibration-Check tool]

(1) Turn on the maintenance mode. Drain all the sample inside the Flow cell. Mount the check tool referring to “7.2 Turbidity standards”.

(2) Press on CAL Main screen and go to the calibration menu.

(3) On the calibration menu, select [Slope calibration (Check tool)] of turbidity manual calibration.

(4) Confirm the reading is stable. Press [check stability].

(5) After the message pops saying the reading is stable, confirm that a value of the check tool is correctly displayed. Then press [Next].

(6) Check the result of calibration and press [Accept] to update the Slope of the calibration parameter.

(7) Remove the check tool. If you finish the calibration, run the sample and turn off the maintenance mode.

7.7 Slope calibration (Standard solution)

Normally slope calibration is performed with a check tool. If you perform with a standard solution, follow the steps as below. If you do both Zero and Slope calibration, perform Zero calibration first then do Span calibration. Prepare a standard solution referring to “■ Turbidity Standards”

(1) Make 20 L or more of turbidity standard solution for slope calibration. (see 7.3 to 7.5)

Dilute the turbidity standard solution as necessary.

(2) Turn on the maintenance mode.

(3) Press on CAL Main screen and go to the calibration menu.

(4) Select [Slope calibration (standard solution)] on the calibration menu.

(5) Stop supplying the sample and drain all the sample in the detector. (Turn ON [Maint.] on the main menu. Switch On [SV4] from [SV].

(6) Drain several times while supplying the zero water and remove all the contaminants left in the head tank or the detector. After the cleaning, stop the zero water and drain all the water left in the detector or the head tank.

(7) Connect the standard-solution tank to the sample inlet and feed the standard solution at a rate of 2 L/min using a pump. Supply the standard solution agitating it with a magnetic stirrer.

(8) When the standard solution begins to overflow the Flow cell, stop supplying the standard solution by turning off the pump, and drain it off by opening the drain value. Then close the drain valve and again supply the standard solution.

(9) Allow the standard solution to flow for 4 minutes or more and after the reading stabilizes, carry out span calibration.

(10) Confirm the reading is stable. Press [check stability].

(11) After the message pops saying the reading is stable, enter the calibration value. Then press [Next].

(12) Check the result of calibration and press [Accept] to update the Slope of the calibration parameter.

(13) Drain the standard solution and clean the Flow cell with zero turbidity water. If you finish the calibration, run the sample and turn off the maintenance mode after the reading becomes stable.

7.8 Auto zero calibration

Automatic cleaning and Automatic zero calibration run one time. Execute this operation in a measurement mode. Maintenance mode cannot carry out this operation. This operation does not affect any automatic sequence schedule.

If Auto zero calibration cannot be selected, check the following two points.

- Activate the Wash box. (See “4.2.4 Wash/Cal. box”)
- Activate the Automatic cleaning/Automatic zero calibration function. (See “4.5 Automatic cleaning/Automatic zero calibration setting”)

7.9 Zero shift correction

Perform this calibration when you need to adjust the Zero value after both Zero and Slope calibration are conducted correctly.

(1) Turn on the maintenance mode.

(2) Press CAL on Main screen and go to the calibration menu.

(3) On the calibration menu, select [Zero shift correction] in the menu list of Calibration others.

(4) Run or feed from top of the detector a sample to use the Zero shift correction

(5) Confirm the reading is stable. Press [check stability].

(6) After the message pops saying the reading is stable, enter the value in [Cal.point]. Then press [Next].

(7) Check the result of calibration and press [Accept] to update the Zero shift value of the calibration parameter.

(8) Place the clear cover and the top cover on top of the detector. If you finish the calibration, run the sample and turn off the maintenance mode.

7.10 Sensitivity correction

Use Sensitivity correction to adjust a difference sensitivity between a standard solution and a grab sample after both Zero calibration and Slope calibration are conducted correctly. Calculate the sample turbidity manually and use the value as a calibration value.

(1) Turn on the maintenance mode.

(2) Press CAL on Main screen and go to the calibration menu.

(3) On the calibration menu, select [Sensitivity correction] in the menu list of Calibration others.

(4) Run or feed from top of the detector a sample to use for the Sensitivity correction.

(5) Confirm the reading stable. Press [check stability].

(6) After the message pops saying the reading is stable, enter the calibration value (turbidity value to adjust). Then press [Next].

(7) Check the result of calibration and press [Accept] to update the Sensitivity correction factor of the calibration parameter.

(8) Drain the sample and clean the Flow cell with zero turbidity water. Place the clear cover and the top cover on top of the detector. If you finish the calibration, run the sample and turn off the maintenance mode.

7.11 2 points correction

The Zero point and Sensitivity correction factor are adjusted. Use two arbitrary known turbidity solution. Take two measurements and record the low concentration as low point, the high concentration as high point. Be sure to take low point first, then do the measurement of the high point.

[How to perform a two point calibration]

(1) Turn on the maintenance mode.

(2) Feed the solution for Low point measurement into the Flow cell.

(3) Press CAL on Main screen to go to the calibration.

(4) Select [2point calibration] in the menu list of Calibration others.

(5) Confirm the reading stable. Press [check stability].

(6) When a message pops saying that the reading is now stable, enter the calibration value. Press [Next].

(7) Feed the solution for High point measurement into the Flow cell. Wait until the reading becomes stable. After it becomes stable, press [check stability].

(8) When a message pops saying the reading is now stable, enter the calibration value. Press [Next].

(9) Confirm the result of calibration. Press [Accept] to update the parameter for Zero shift value and sensitivity correction factor.

(10) Drain the sample and clean the Flow cell with zero turbidity water. Place the clear cover and the top cover on top of the detector. If you finish the calibration, run the sample and turn off the maintenance mode.

7.12 Basic (reference) sensitivity calibration

Sensitivity factor(S0) is updated The slope is 100 %. Be sure to perform this calibration after implementing the Zero calibration.

No error check is conducted at the calibration, therefore, perform calibration properly. For information on preparation of calibration solution, see “n Formazin Standard Solution”

[How to perform basic (basic (reference)) sensitivity calibration]

(1) Turn on the maintenance mode.

(2) Press on CAL Main screen to enter the calibration menu.

(3) Select [basic sensitivity calibration] in the menu list of Calibration others.

When a message appears, press [Next]. Enter the concentration of the standard solution and press [Next].

(4) Check the reading becomes stable. Press [Accept].

(5) Check the calibration result and the concentration of the standard solution, press [Accept] to update a basic (basic (reference)). Slope is updated to 100%.

(6) To exit the calibration, turn off the maintenance mode after feeding the sample and confirming that the reading becomes stable.

7.13 Calibration Error

When executing calibration items except for Basic sensitivity calibration, if a calibration result is abnormal, the calibration error is displayed, and the calibration result is discarded. The Acceptable range as follows:

Zero:	Acceptable range is wide and hardly error occurs.
Slope:	25 ~ 200%
Zero shift value:	-10 ~ 10 NTU
Correction factor:	0.25 ~ 4 times

8. MAINTENANCE

This chapter describes the inspection and maintenance required to keep the instrument in good operating condition.

Inspection/Maintenance Items and Intervals

The main inspection/maintenance items and their recommended intervals to keep the instrument in good operating condition are provided in Table 8.1.

Since the frequency of inspection/maintenance depends on the operating conditions, use the recommended intervals shown in Table 8.1 as a reference and perform inspection/maintenance at appropriate intervals.

Table 8.1 Inspection/Maintenance Items and Recommended Intervals

Inspection/Maintenance Item	Recommended Interval	Reference section
Cleaning with tap water	As needed	8.1
Cleaning of Flow cell	Weekly	8.2
Cleaning of head tank	Monthly	8.3
Checking and replacing desiccants	6 months	8.4
Pipe cleaning	6 months	8.5
Lens cleaning	6 months	8.9
Inspection solenoid valve	6 months	8.6
Replacement of zero turbidity filter element	Yearly *1	8.7
LED replacement	3 Years	8.8
Fuse replacement	As needed	8.10
Replacement of the Silicone Tube *2	Yearly	8.11
Checking flow rate (liquid level)	Monthly	8.12
Zero calibration	Monthly	7.4, 7.5
Slope calibration	Monthly	7.6, 7.7

*1: This is an interval estimated if tap water used has average turbidity of 0.4 dgrees and runs at a flow rate of 2 L/min.
*2: With sampling system (-A1, -A2, -A3)

8.1 Cleaning with cleaning water

When Without automatic cleaning (Sampling system:-NN,-A1) is selected, the valve is manually opened/closed and cleaning is performed.

Wash while running the zero water to avoid splashing the cleaning water.

(1) Set converter maintenance mode to On.
(2) Loosen screw A at the bottom of the detector and open the top of the detector.
(3) Close the valve V1 and open V3 to allow zero water flow.
Open valve V4 gradually to prevent splashing of cleaning water from the Flow cell. With the valve V4 open, wash for approximately 30 seconds.
(4) Close the valve V4 and open the valve V5 for about 10 seconds to drain the water.
(5) Repeat steps (3) and (4) several times, depending on stain severity.
(6) Close the valve V5.
(7) Close the upper part of the detector and tighten the screw A.
Set the valve to the state at the time of measurement and turn Off the maintenance mode.

Automatic cleaning is performed periodically when With sampling system (Sampling system:-A2, -A3) is specified. See “4.5 Automatic cleaning/Automatic zero calibration setting” for automatic cleaning/automatic zero calibration.

When (Sampling system :-A1) is specified: Cleaning is performed by manually operating the valve V4 for a wash.

(1) Set converter maintenance mode to On.
(2) Open valve V4 and perform wash for approximately 30 seconds. (Refer to Table 3.2 for the status of the valves in wash.)
Wash while running sample or zero water to avoid splashing With sampling system.
(3) Close valve V4 and open valve V5 for approximately 10 seconds to drain.
(4) Repeat steps (2) and (3) several times according to the degree of contamination.
(5) Close valve V5.
(6) End.

8.2 Cleaning of Flow cell

Wash the inside of the detector with a brush, etc.

(1) Turn on the maintenance mode.
(2) Select the draining status. (Table 3.2 for the status of each valve when draining).
(3) Loosen screw A at the bottom of the detector and open the top of the detector. (Table 8.1).
(4) When the water in the detector is drained, polish the Flow cell with a soft brush, sponge, etc. At this time, do not scratch the inside of the detector. Do not splash water on the lens on the light source section and the light receiving section.
(5) Open Valve V4 and solenoid valve SV2 to feed water and discharge floating dust. At this time, gradually open valve V4 so that water does not splash water on the lens on the light source section and the light receiving section.
(6) After the wash is completed, tighten screw A firmly to execute the Zero calibration and Slope calibration.
(7) End.

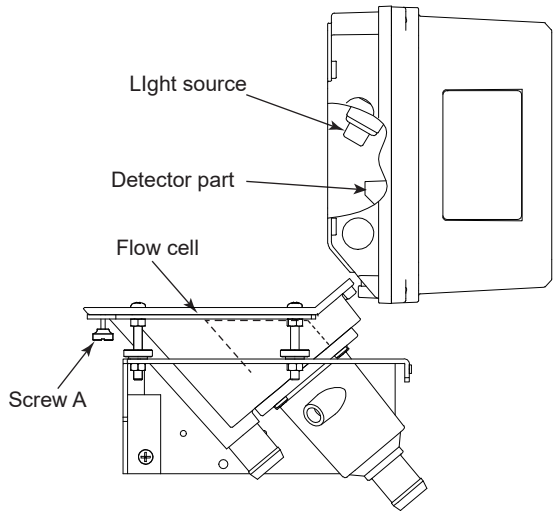


Figure 8.1

8.3 Cleaning of Head tank

This section describes the cleaning of the head tank.

(1) Set converter maintenance mode to On.
(2) Open the valves so they are set to drain the tank. Refer to Table 3.2 for the status of each valve during drainage.
(3) After the water in the head tank is drained off, open the upper cover and wipe the inside of the tank with a soft brush, sponge, or the like.

(4) After cleaning is completed, discharge any remaining contaminants by supplying tap water or repeat filling the tank two or three times with zero water and then draining it until all of the contaminants in the head tank is discharged with the water.

(5) End.

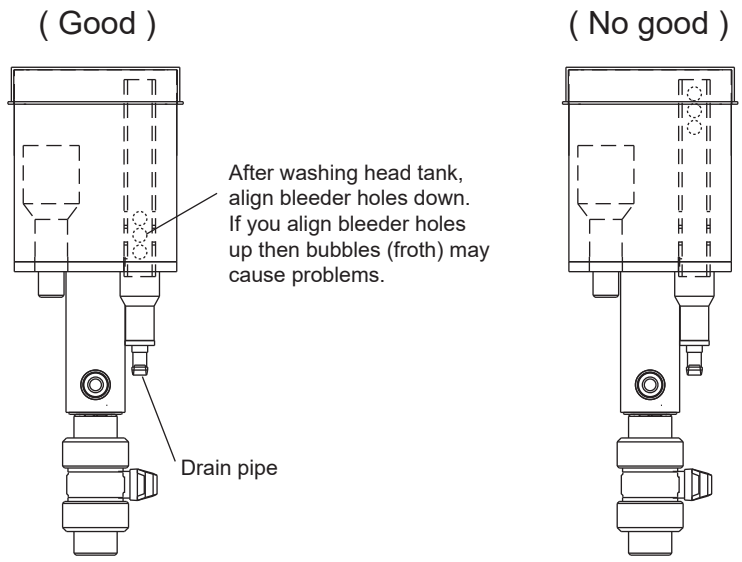


Figure 8.2

CAUTION

After cleaning the head tank, be sure to align the holes down. If you align bleeder holes up, bubbles (froth) may cause problems.

8.4 Checking and Replacing Desiccants

CAUTION

Stop supplying power to TB830D prior to opening the detector top cover. Make sure that the power supply of TB830D is not turned on. Do not touch the terminals while the power supply of TB830D is on.

Inspect the desiccant once every six months, and replace the desiccant if necessary. Regardless of the inspection results, replace the desiccant once a year.

Keep the internal storage circuitry of the detector unit dry to ensure correct readings. Remove the desiccants and check for softness with the hand. Desiccants soft textured in gel form should be replaced.

(1) Stops supplying Power Supply to TB830D.

(2) Loosen the four (4) fixing screws and remove the front cover of the detector unit.

(3) Remove the desiccants and check for softness with the hand. Desiccants soft textured in gel form should be replaced.

(4) Install the desiccant. Mount the desiccant so that the printed side is facing the cover. (See Figure 8.3.)

(5) Attach the front cover by fastening the four (4) screws. The tightening torque of the screw is 1.5 N·m.

(6) This completes the replacement.

After checking or replacing desiccants, allow the instrument to warm up for at least one hour before measurement so that desiccants can absorb the moisture inside the detector.

The desiccants absorb moisture from the side on which no letter is printed.

Figure 8.3 Installing 4 desiccants to the front cover

Arrange the desiccant as follows:

Table 8.2 Table 8.2 Desiccants

Part No.	Product name	Remark
K9657RJ	Desiccant	4 pcs/Q'ty

8.5 Pipe Cleaning

Remove the pipes between the detector and the head tank, and clean them.

(1) Set converter maintenance mode to On.
(2) Select the draining status. (Table 3.2 for the state of the valve when draining).
(3) After checking that the head tank has run out of water, remove the pipes between the detector and the head tank. Use an elongated brush to remove any contaminants from the inside, and finally wash with tap water.
(4) If Air denoising is provided, also clean the pipe ASSY internal storage for Air denoising. Disconnect the PVC pipe by loosening the clamps at the detector side.
(5) Attach the piping again in the reverse order of removal.
(6) End.

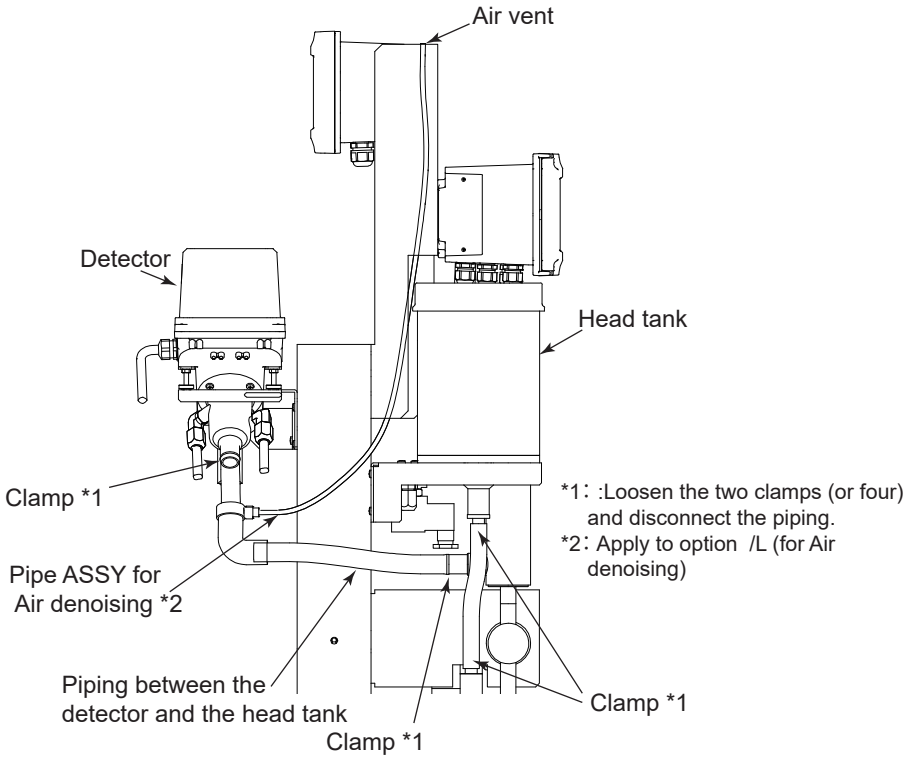


Figure 8.4

8.6 Inspection solenoid valve

The solenoid valve has moving parts and has a limited service life. Check and inspect the operation of solenoid valve as shown below. If any error is found, replace it with a new one.

How to Inspect solenoid valve

(1) Set converter maintenance mode to On.
(2) Turn On/Off solenoid valve (SVs) in the converter "solenoid valve/WIPER OPERATION" menu to confirm the operation.
(3) To exit solenoid valve operation check, turn Off converter maintenance mode.

Solenoid valve to be inspected include the following: See Figure 2.1 or Table 2.3 for the position of these solenoid valves.

- SV1 (Measure): sample inlet
- SV2 (Wash): Cleaning water inlet
- SV3 (Zero): Zero water inlet
- SV4 (Drain): Detector drainage

These solenoid valves are required for the Automatic cleaning/Automatic zero calibration. Inspect them about every six months.

Operate solenoid valves (SVs) to check that the fluid flows normally when the solenoid valve is opened and that there is no leakage when the solenoid valve is closed. Solenoid valve must be replaced if any error is found during the inspection. In principle, contact YOKOGAWA if the replacement of the solenoid valve is required.

8.7 Replacing the Zero Turbidity Filter Element

The zero turbidity filter element should be replaced at regular intervals. Refer to Figure 2.1 to Figure 2.3.

(1) Make sure that the valve2 and the valveV3 are closed.
(2) Close the valve2 and stop supplying tap water.
(3) Turn and remove the filter case. Be careful not to allow internal water to run over.
(4) If the inside of the case is dirty, clean it with a brush or relevant tool.
(5) Replace the filter element with a new one.
(6) Reassemble the filter in reverse order. At this time, be sure to install the O-ring correctly to prevent water leakage.
(7) Open the valve (V2) for tap water control, installed before the zero turbidity filter, and (SV3) after the filter. Open the valve (V3) (when “-A3” is selected) installed after the zero turbidity filter gradually to feed the tap water. Run the zero water and check for any water leakage.
(8) Loosen the knob of the air vent at the top of the zero-turbidity filter and bleed the air until tap water leaks out. After venting, tighten the valve securely.
(9) Allow the water to flow for at least 20 minutes to wet the filter element.
(10) Close the zero water drain valve after the zero turbidity filter.
(11) This completes the replacement.

Note

- If the zero turbidity filter is not to be used for a prolonged time, remove, dry, and store the filter element in a dry place.
- Pass enough water through the filter element to wet it. Otherwise, air bubbles may enter and affect the zero calibration.

CAUTION

Do not mix up two different sizes (1 µm and 0.2 µm) of the zero turbidity filter element if you install two zero turbidity filters.

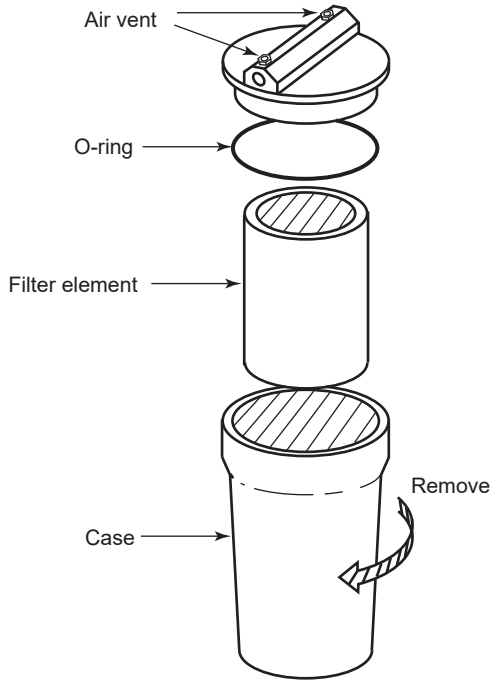


Figure 8.5 Zero Turbidity Filter Element Replacement

Table 8.3 Filter element

Part No.	Name
K9008ZD	1 µm filter element
K9726EH	0.2 µm filter element
K9411UD	O-ring

8.8 LED Replacement

CAUTION

- Turn off the power of TB830D before replacing the LED.
- LED may be damaged by static electricity. When replacing the LED be sure to take measures against static electricity, such as wearing a grounded wristband.

LED light source usually lasts more than 3 years. However, it is recommended to replace it every 3 years for preventive maintenance.

This section explains how to replace the LED.

(1) Stops supplying Power Supply to TB830D.
(2) Remove the top cover of the detection unit by loosening the four (4) setscrews.
(3) Loosen the four (4) setscrews on LED ASSY.
(4) Remove the cable connector from LED ASSY (Figure 8.7).
(5) Replace LED ASSY with a new one.
(6) Attach the cable connector to the new LED ASSY (Figure 8.8).

(7) Fasten the four (4) setscrews and fix the LED ASSY. The tightening torque of the screw is 1.5 N·m.
(8) Attach the cover. The tightening torque of the screw is 1.5 N·m.

CAUTION

After turning on the power of the instrument, warm it up for at least 30 minutes before starting the measurement.

Arrange the LED as follows.

Table 8.4 LED

Part No.	Product name
K8004BD	LED ASSY (white)
K8004BE	LED ASSY (infrared)

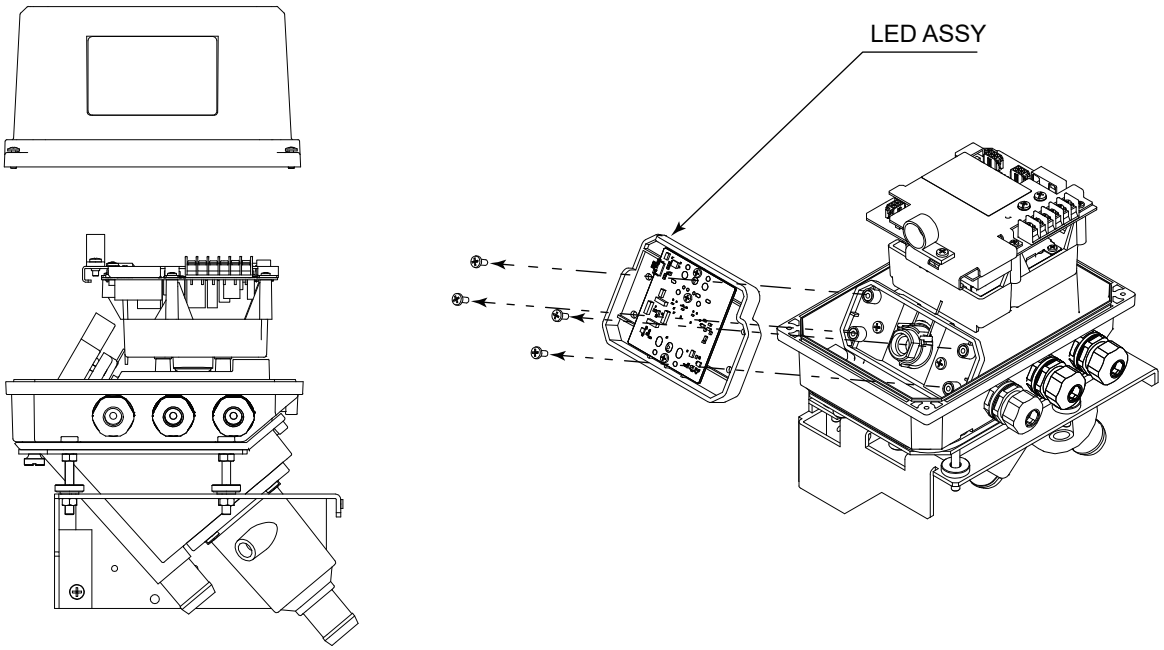
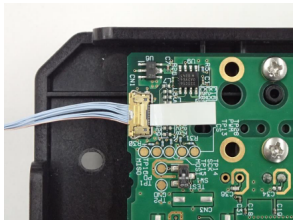
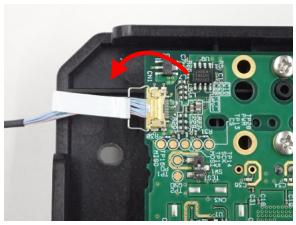
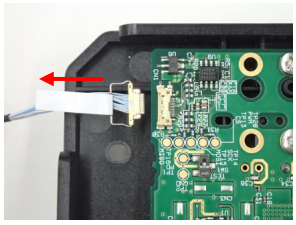


Figure 8.6 LED Replacement



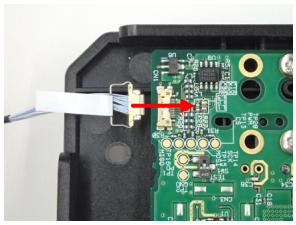


Pinch the strap to
release the lock lever



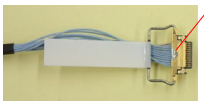
Pull out the connector

Figure 8.7 Disconnecting cables

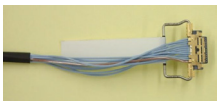


Plug in the connector

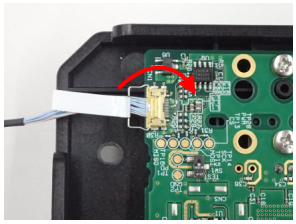
The side with the solder part faces up.



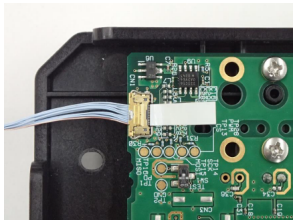
<Right>



<Wrong>



Pinch the strap and push down the lock lever.



Fix the lock lever.

When properly fixed, it clicks.

Figure 8.8 Connecting cables

8.9 Lens cleaning

(1) Stops supplying power to TB830D.
(2) Loosen screw A under the detector and open the top cover (Figure 8.9).
(3) Check whether or not the lenses in the detector are dirty. If they are, wipe them with cotton swabs. At this time, if the cotton swab is soaked with alcohol, it will become cleaner.
(4) After cleaning the lenses, carry out zero and span calibrations.
(5) End.

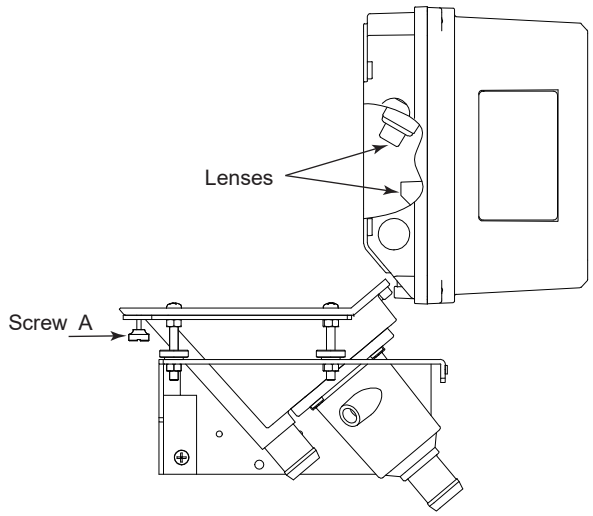


Figure 8.9 Lens positions

8.10 Fuse replacement

If a blown fuse occurs, replace the fuse.

There is one fuse in the converter and one fuse in TB830D. When sampling system -A2, -A3, or -A5 (with auto cleaning) is selected, there are another two fuses in the relay box.

See (IM 12A01G01-02EN) for how to replace the converter fuse. This section explains the procedures for replacing fuses of the relay box.

CAUTION

Always disconnect the instrument from Power Supply prior to beginning to replacing the fuse.

CAUTION

Stop supplying power to TB830D before opening the detector top cover. Make sure that the Power Supply of TB830D is not turned on. Do not touch the terminals while Power Supply of TB830D is on.

Replacement of Fuses

Be sure to use a A1633EF for the fuse of TB830D.

(1) Loosen the four (4) setscrews to open the detector top cover.
(2) Take out the fuse. (Figure 8.10).
(3) Replace the fuse with a new one.
(4) Put the top cover back in place.

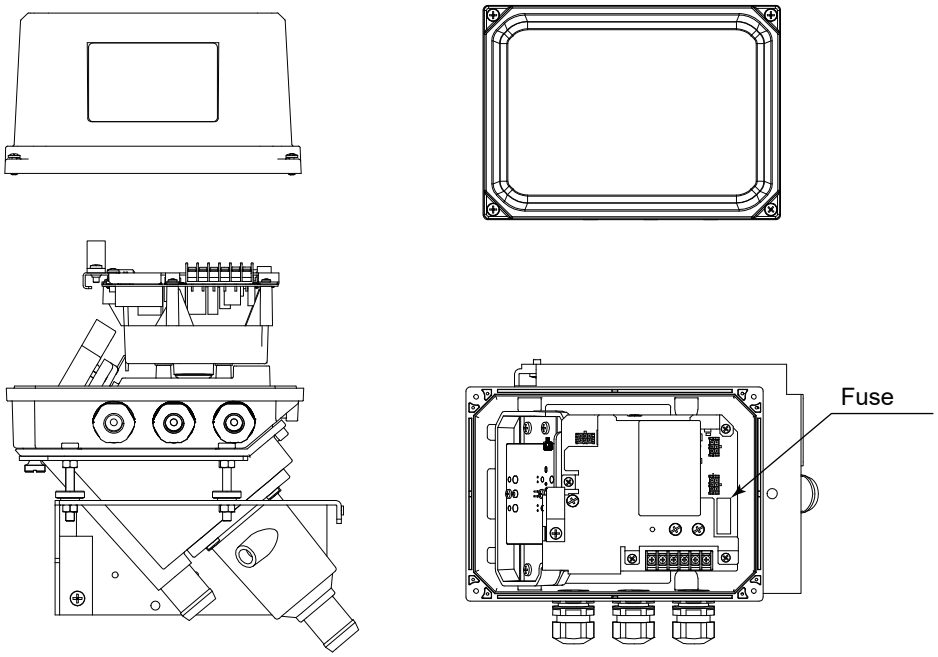


Figure 8.10 Fuse replacement

Replacing the fuse in the relay box (when -A2, -A3, or -A5 is selected)

When Sampling system: -A2, -A3, or-A5 (with auto cleaning) is specified, a relay box is included.
Be sure to use A1624EF for the fuse of the relay box.

(1) Loosen the four (4) screws and open the relay-box window.
(2) Remove the fuse holders (2 pcs.) (Figure 8.11).
(3) Replace the fuse with a new one and install the fuse holder.
(4) Close window of the relay box.

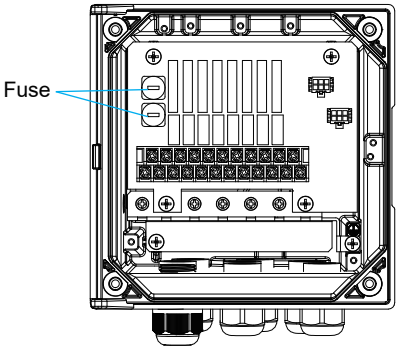


Figure 8.11 Fuse replacement (relay box)

CAUTION

After turning on the power, warm up the instrument for at least 30 minutes before starting the run.

Arrange the following fuses.

Table 8.5 Fuse

Part Number	Product name	Remark
A1633EF	Fuse	Fuse for TB830D x 1
A1624EF	Fuse	1 fuse for relay box (*)

(*) Two are required for the relay box.

8.11 Replacement of the Silicone Tube

(1) Set converter maintenance mode to On and unclamp the silicone tube.
(2) Open the pinch valve (SV4: solenoid valve).
(3) Remove the silicone tube and thread the new silicone tube through the hole in the pinch valve (SV4).
(4) Pass the clamp through the silicone tube and insert the upper side into the lower side of the head tank (it will be easier to insert if it is wet).
(5) Make sure that the drain pipe is visible from the top of the head tank.
(6) Close the clamp.
(7) Place the end of the tube into the drain pipe.

Table 8.6 Silicone tube

Part No.	Product name	Note
K9411JM	Silicone tube	for SV4

CAUTION

- The pinch valves become hot when energized. The pinch valves are setup to Off automatically after 10 minutes or more.
- The valve may not open if no tube is inserted or if the tube is crushed and stuck. If this happens, assist by hand.

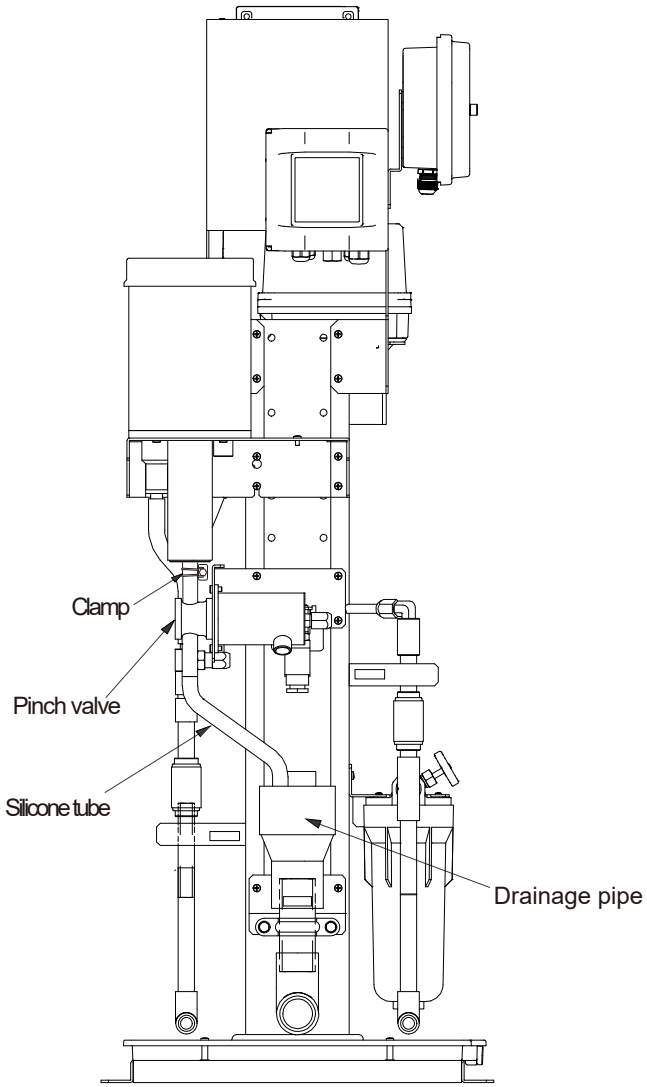


Figure 8.12 Replacement of Silicone Tube for Pinch Valve

8.12 Checking flow rate (liquid level)

Feed sample or zero water to check the liquid level in the FLow cell.

(1) Set converter maintenance mode to On. Remove screw A on the bottom of the detector, and open the top of the detector (Figure 8.1). Set the status of the valves to a measurement mode or the zero calibration status (Table 3.1).

(2) Make sure the sample surface is mirror-like as shown in Figure 8.13. When it is undulating, adjust flow rate of the sample or zero water (see Section 3.5, "Supplying Zero Water", "Leveling and Adjusting flow rate on detector 3.6", "Supplying sample and Adjusting the 3.12").

(3) Check that the amount of overflowing sample is almost uniformly overflowing around the entire circumference of the measuring tank. If there is a large deviation, perform leveling (flow rate adjustment) of the detector in section 3.6, "Leveling and Adjusting flow rate."

(4) Check the contamination of the detector's internal storage and clean it if it is dirty. Be sure to perform zero calibration and slope calibration after cleaning.

(5) Close detector.

(6) End.

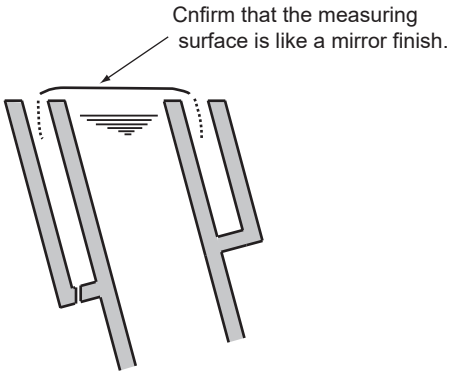


Figure 8.13 Sample surface

8.13 When Sample Water Supply is Cut Off

If the sample or tap water (cleaning water or zero water) stops, normal measurement cannot be performed. Since the TB830D cannot detect whether the supply of sample, tap water (cleaning water, zero water) is stopped or not, a periodical check of the line is needed.

Also, when the sample or tap water (cleaning water or zero water) is stopped, an error/alarm may be detected. Check the supply of sample and tap water when an error/alarm is detected.

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9. TROUBLESHOOTING

9.1 When an error occurs

Figure 9.1 TB830D Error List

Alarm Number	Name	Explanation	Remedy	NE107 Default (*1)	NE107 Changed
X500	EEPROM error	The TB830D has become defective. Contact Yokogawa service.		F	Disable
X501	User param. read error			F	Disable
X502	Factory param. read error			F	Disable
X503	AD converter failure			F	Disable
X504	RAM failure			F	Disable
X505	Flash Memory failure			F	Disable
X50A	Sensor communication error	No sensor is detected.	Check the power supply connection. Check the connection between the detection unit and the converter.	F	Enable
X520	Wash/Cal. box error	Cleaning box does not work.	Check the connection of Relay box or configuration (Enable/ Disable.) of the cleaning box.	S	Disable
X521	Humidity sensor failure	Humidity sensor does not work.	After turning ON/OFF the power, if the problem still remains, check the cable connection on the detector board. If the cable is correctly connected, replace the detector board. When you replace the detector board, you need to perform turbidity calibration.	S	Enable
X522	Lens heater failure	Lens heater shows abnormal resistivity.	Check the condition of the anti-fog lens heater. Check for water leaks to the lens and disconnection of the lens heater drive cable. If there are no abnormalities in these, the lens heater may have reached the end of its life. Contact Yokogawa.	S	
X540	Turbidity High	Turbidity value is exceeded high limit setpoint.	Check measurement value. Confirm Turbidity warning high limit on sensor setting.	S	Enable
X541	Turbidity Low	Turbidity value is less than low limit setpoint.	Check measurement value. Confirm Turbidity warning low limit on Sensor setting.	S	Enable
X542	Light detection error	Photodetector current is out of range.	Check the scattered light current. Identify where the error occurs : Flow cell, light source board, detector board. After then, bring it back to a normal state.	S	Enable
X543	Light source failure	Light source intensity is abnormal.	Check light source monitoring current and Lightning IF. If value is abnormal, open the front cover and check the cable connection or assemble condition. If the cause is not found, please replace the Light source part.	S	Enable

Note : X of Alarm Number denotes Channel of the measurement detection unit.
1: sensor connection number 1-1
5: sensor connection number 2-1
6: sensor connection number 2-2 (not required on the first FD)
(*1): F: Failure, C: Function Check, S: Out of Specification, M: Maintenance required, N: Off

Alarm Number	Name	Explanation	Remedy	NE107 Default (*1)	NE107 Changed
X54E	Auto Zero cal result error	Result of auto zero calibration is out of range.	Confirm the solenoid valve runs correctly by manual operation. Check if the zero water flows normally. If no error is found in the sampling, check whether no condensation is found on Measurement window.	S	Enable
X54F	Auto Cal stability time limit	Detection value is not stable during auto calibration.		S	Enable

Note : X of Alarm Number denotes Channel of the measurement detection unit.
1: sensor connection number 1-1
5: sensor connection number 2-1
6: sensor connection number 2-2 (not required on the first FD)
(*1): F: Failure, C: Function Check, S: Out of Specification, M: Maintenance required, N: Off

Figure 9.2 TB830D Analyzer Error Message List (Wash)

Alarm Number	Name	Explanation	Remedy	NE107 Default (*1)	Error config. (HMI)
009E	Auto wash config. error	Automatic cleaning is not properly set.	Check automatic cleaning setting. Converter setting > Auto wash > Auto calib. setting	C	Enable
009F	Disable auto update of next start	Automatic cleaning/ Automatic zero calibration is overdue.	Set the first calibration start time. Converter setting > Auto wash> Auto calib. setting	C	Enable

(*1): F: Failure, C: Function Check, S: Out of Specification, M: Maintenance required, N: Off

9.2 When No Error Indication Appears

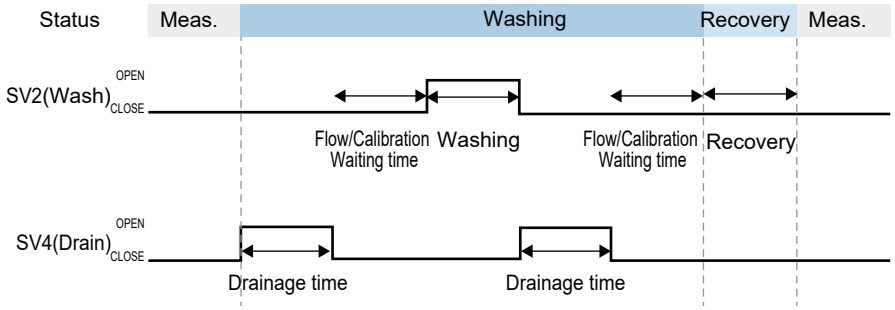
There is a possibility that measurement has abnormalities without any error occurrence. Next table shows some possible causes. Solve the problems referring to the next table.

Figure 9.3 Abnormalities, Their Possible Causes, and Remedies

Abnormalities	Possible Causes	Remedies
Measured value fluctuates largely.	● Sample air bubble or contamination stays in Flow cell. ● The measured value fluctuates according to the sample turbidity.	● Clean the Flow cell. ● Check the head tank before the sample inlet of the detector. ● Check if the turbidity reading is stable by using Zero water or Check tool. If the reading is not stable, identify where the error occurs in Flow cell, Light source, or Detector board. After then, bring it to a normal state. ● If no error is found in the instrument or sample flow, set larger value of measurement time constant.
Measured value increased over time	● Inside of the Flow cell is contaminated. ● Water droplets or contamination is adhering to the lenses of the light source or detection unit.	● Check the condition of Flow cell, head tank, piping, lenses. If they are contaminated, clean them. ● Check the condition of desiccant attached inner the cover. Replace it with new one if deterioration is found.
Measured value abruptly increases but plunged in a short time	● Air bubbles or contamination pass through the Flow cell.	● Check the condition of Flow cell, head tank, piping, lenses. If they are contaminated, clean them. ● Turn ON the Air denoising function. ● Optimize the air denoising parameter.

Appendix Automatic cleaning/Automatic zero calibration Sequence

Automatic cleaning (-A2, -A5)



1: When Automatic cleaning starts, SV4 (Drain) opens and starts draining the sample out of the Flow cell.

2: After the “Drainage time” elapses, SV4 closes and sample starts flowing into the detector.

3: After the “Flow/Calibration Waiting time” elapses, SV2 (Wash) opens. Cleaning water (tap water) starts purging from two water ports on the side of the Flow cell to wash the side or edge of the Flow cell

4: After the cleaning time elapses, SV4 opens during the Drainage time to wash the Flow cell, head tank, and the pipes between head tank and the detector.

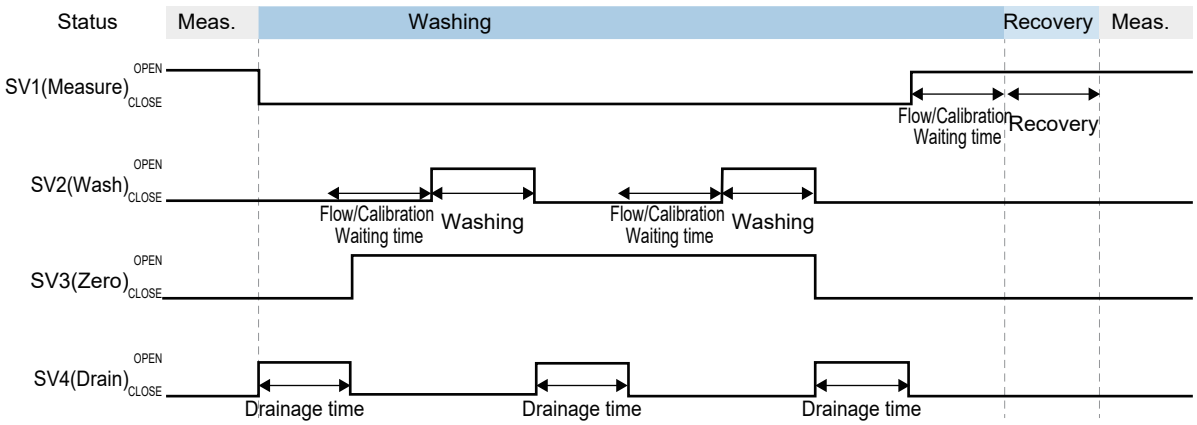
5: If “Repeat count of wash” is set to over 2, valve working 2 to 4 is repeated.

6: Once the draining for cleaning completes, SV4 closes, and TB830D starts feeding a sample.

7: After Flow/Calibration Waiting time” elapses, the detector becomes Recovery time.

8: Afthe the Recovery time elapses, a measurement starts.

Automatic cleaning (-A3, -A5)



1: When Automatic cleaning starts, SV1 (Measure) closes and SV4 (Drain) opens to start draining the sample out of the Flow cell.

2: After the “Drainage time” elapses, SV4 closes and SV3 (Zero) opens to feed the zero water into the detector.

3: After the “Flow/Calibration Waiting time” elapses, SV2 (wash) opens. Cleaning water (tap water) starts purging from two water ports on the side of the Flow cell to wash the side or edge of the Flow cell.

4: After the cleaning time elapses, SV4 opens during the Drainage time to wash the Flow cell, head tank, and the pipes between head tank and the detector.

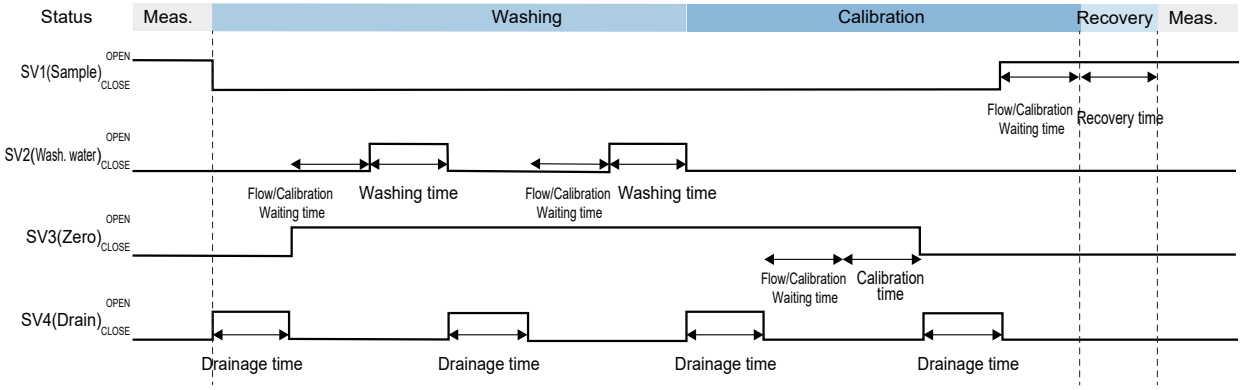
5: If “Repeat count of wash” is set to over 2, valve working 2 to 4 is repeated. Right before the last draining, SV3 closes and the zero water stops.

6: Once the draining for cleaning completes, SV4 closes, SV1 opens, and TB830D starts feeding a sample.

7: After Flow/Calibration Waiting time” elapses, the detector becomes Recovery time.

8: Afthe the Recovery time elapses, a measurement starts.

Automatic calibration (-A3, -A5)



1: When sequence starts, Automatic cleaning works first. After the Automatic cleaning, an automatic calibration starts without a recovery time. Therefore, the steps from 1 to 5 for “Automatic cleaning (-A3)” are common. When a Drainage time starts after the last Cleaning time, the screen shows a calibration. This time, SV3 (Zero) stays open.

2: After the Drainage time elapses, SV4 closes and a zero water starts flowing into the detector.

3: After “Flow/Calibration Waiting time” elapses, a zero calibration starts. The calibration time in the figure shows the total amount of time of an Auto stabilization check and a zero calibration which is carried out after the Auto stabilization check (the reading becomes stable).

4: After the calibration, SV4 opens and the zero water in the Flow cell is drained.

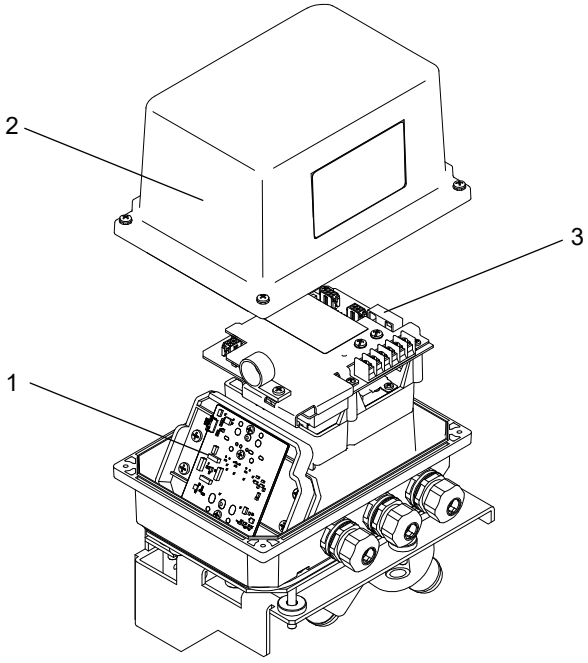
5: After the Drainage time elapses, SV4 closes, SV1 opens, and a sample starts flowing into the detector.

6: After Flow/Calibration Waiting time elapses, TB830D starts the Recovery time.

7: After the Recovery time elapses, a measurement starts.

Customer Maintenance Parts List

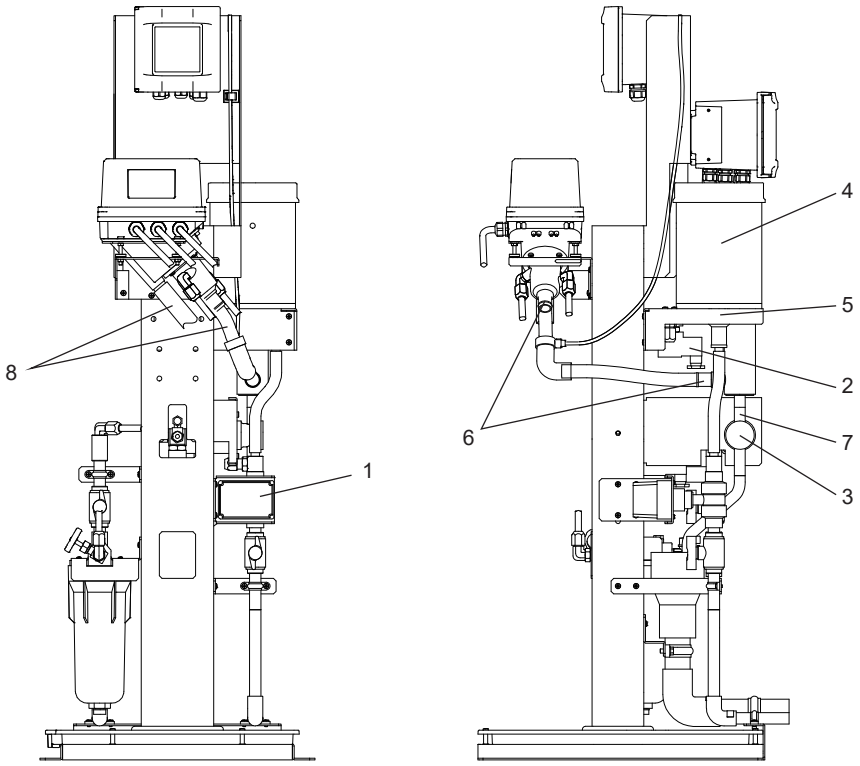
TB830D
Surface Scattering Light Turbidity Detector



Item	Part No.	Qty	Description
1	K8004BD	1	LED Assy (white)
	K8004BE	1	LED Assy (Infrared)
2	K9657RJ	1	Desiccant
3	A1633EF	1	Fuse (for TB830D)

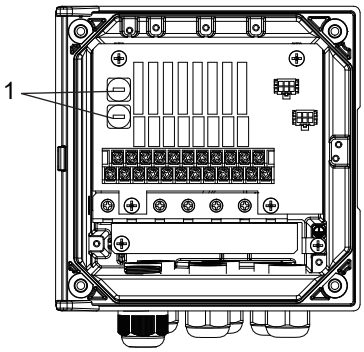
CMPL 12E04B40-01EN
1st Edition: Mar. 2023 (YK)

With Sampling System (for -A1, -A2, -A3)



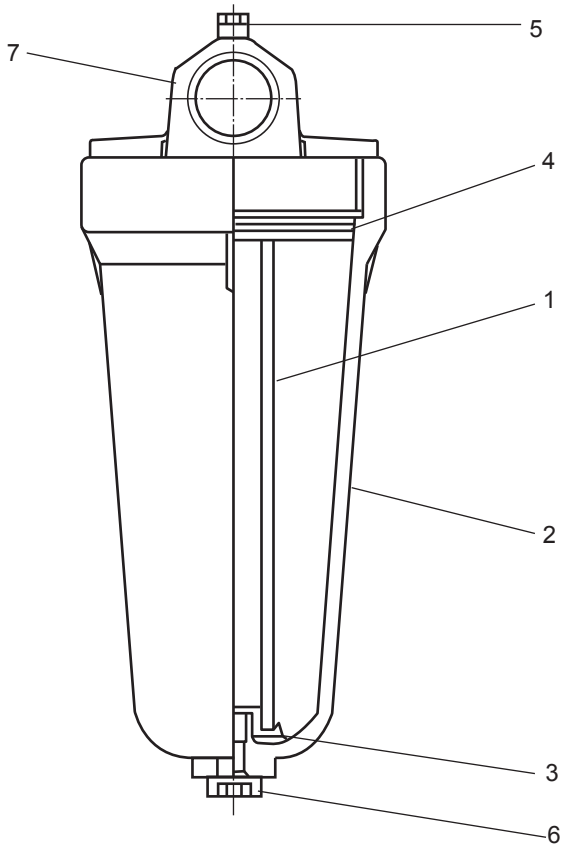
Item	Part No.	Qty	Description
1	K9411DT	1	Motor Valve for SV1 (100V/110V)
	K9411DU	1	Motor Valve for SV1 (200V/220V)
2	A1014MZ	1	Solenoid Valve for SV2, SV3 (100V)
	A1016MZ	1	Solenoid Valve for SV2, SV3 (110V)
	A1015MZ	1	Solenoid Valve for SV2, SV3 (200V)
	A1017MZ	1	Solenoid Valve for SV2, SV3 (220V)
3	K9411JG	1	Pinch Valve for SV4 (100V/110V)
	K9411JH	1	Pinch Valve for SV4 (200V/220V)
4	K9411GC	1	Tank Assembly without Pinch Valve
	K8004FB	1	Tank Assembly with Pinch Valve for 100V/110V
	K8004FC	1	Tank Assembly with Pinch Valve for 200V/220V
5	K8004LD	1	Tank Assembly mounting bracket
6	L9813XP	1	Clamp
7	K9411JM	1	Tank drainage tube (for Pinch Valve)
8	K9411ZF	1	Tube (Black, 2 m)

Relay box (for -A2, -A3)



Item	Part No.	Qty	Description
1	A1624EF	2	Fuse

K9411UA ZERO TURBIDITY FILTER ASSEMBLY (1 micron filter)
K9726EF ZERO TURBIDITY FILTER ASSEMBLY (0.2 micron filter)



Item	Part No.	Qty	Description
1	K9008ZD	1	Filter Element (1 micron)
	K9726EH	1	Filter Element (0.2 micron)
2	K9411UB	1	Case
3	K9008ZE	1	Plate
4	K9411UD	1	O-Ring
5	K9411UC	1	O-Ring
6	K9411UE	1	O-Ring
7	K9411UF	1	Head

Revision Information

- Title: TB830D Surface Scattering Light Turbidity Detector
- Manual No.: IM 12E04B40-02EN

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Corrected Figure 2.12.
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