Technical Information

TB820D, TB830D Sampling System Selection Manual

TI 12E01B30-01EN

CONTENTS

YOKOGAWA

TI 12E01B30-01EN
©Copyright Oct. 2022
3rd Edition Mar. 2023

Introduction

This manual describes how to select a sampling system when the analyzer combined with the “TB820D Right Angle Scattered Light Turbidity Detector” and “TB830D Surface Scattering Light Turbidity Detector” does not have an assemble stanchion.

If you specify without a sampling device (Suffix code -NN, -A5), you have to select and build system components such as a head tank, solenoid valve, and manual valve. This document describes how to select the solenoid valves and head tanks necessary for configuring a sampling system, as well as piping and wiring diagrams.

Media No. TI 12E01B30-01EN 3rd Edition : Mar. 2023 (YK)

1 Dimensions

1.1 TB820D Dimensions

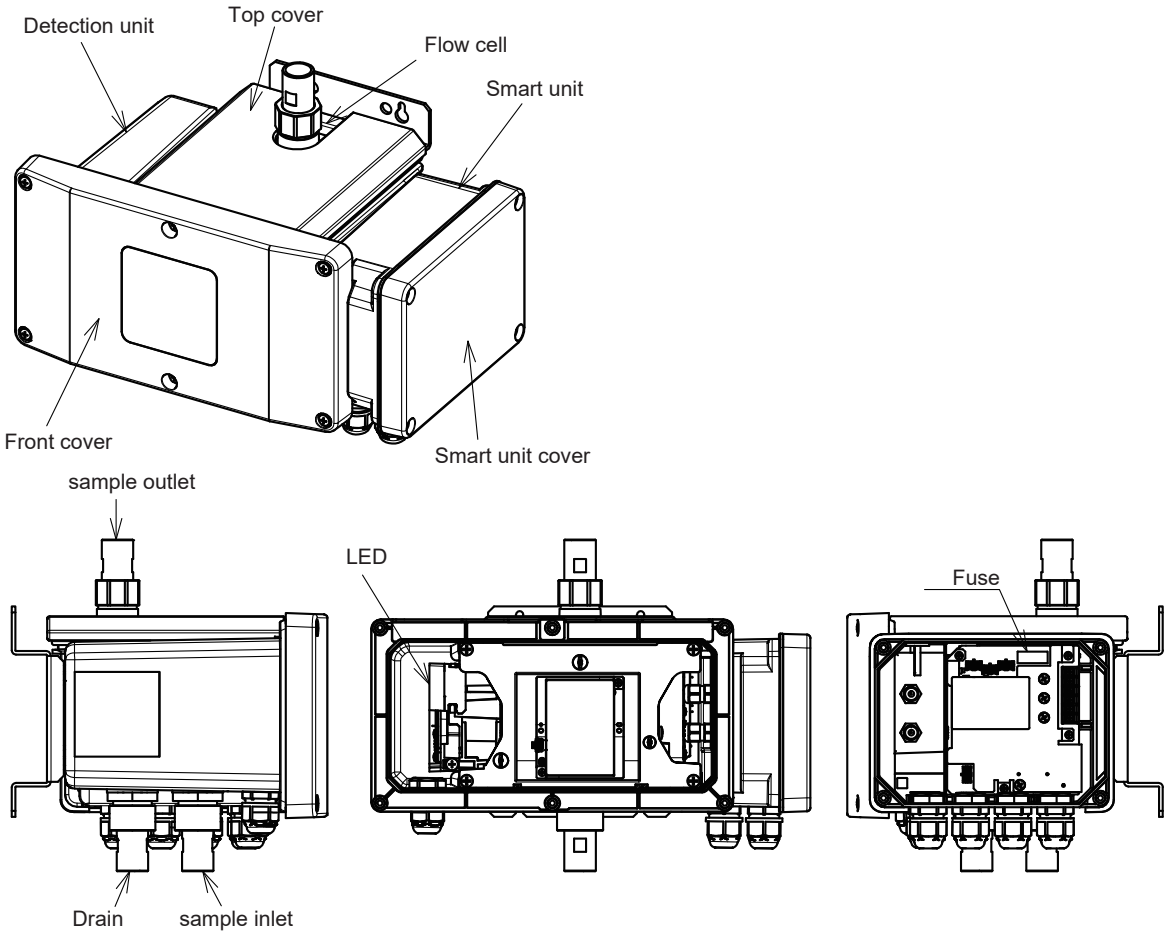


Figure 1 TB820D part name

Unit: mm

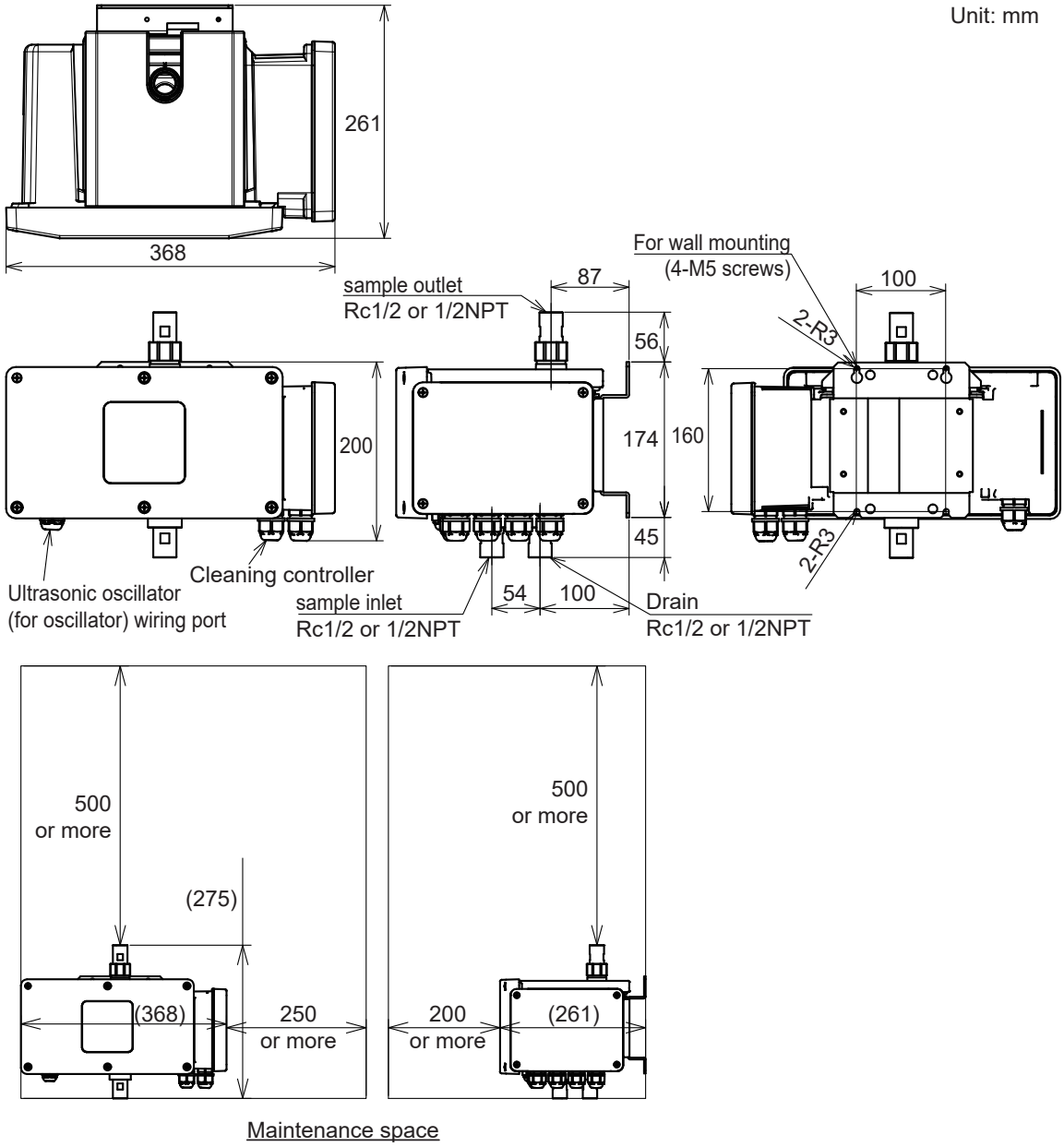


Figure 2 TB820D Dimensions

Installation Dimensions

Install the TB820D's detector unit in pipes or walls using their special mounting brackets, respectively. Note that these mounting brackets are supplied only when specified.

Pipe Mounting (Option Code "/U")

For information on the converter, read FLXA402T IM.

Unit: mm

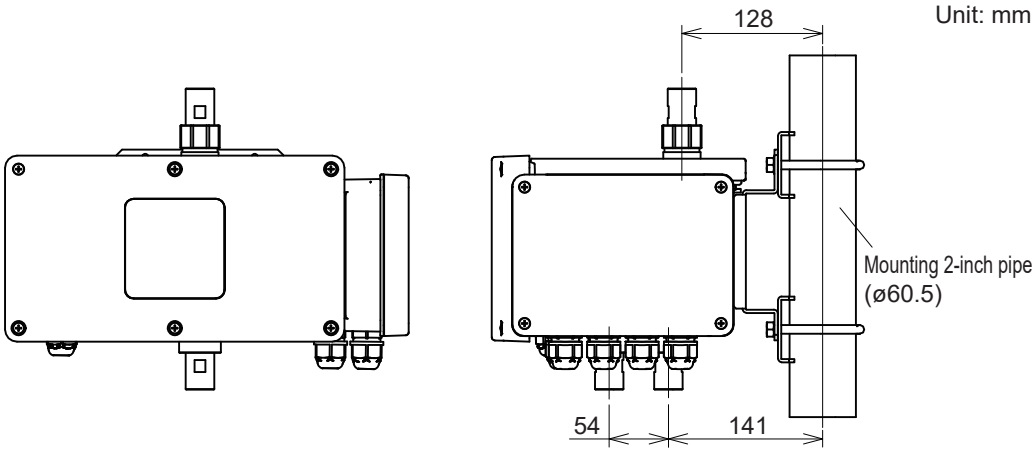


Figure 3 Diagram of TB820D Pipe Mounting

Wall Mounting (Install the detector with four M5 screws)

For information on the converter, read FLXA402T IM.

Unit: mm

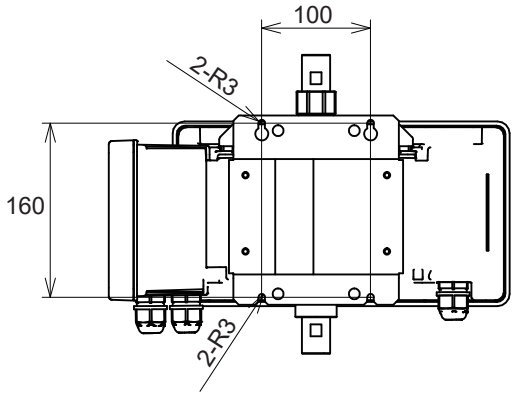


Figure 4 Diagram of TB820D Wall Mounting

Conduit adaptor (/CB3, /CD3, /CF3)

Unit: mm
(inch)

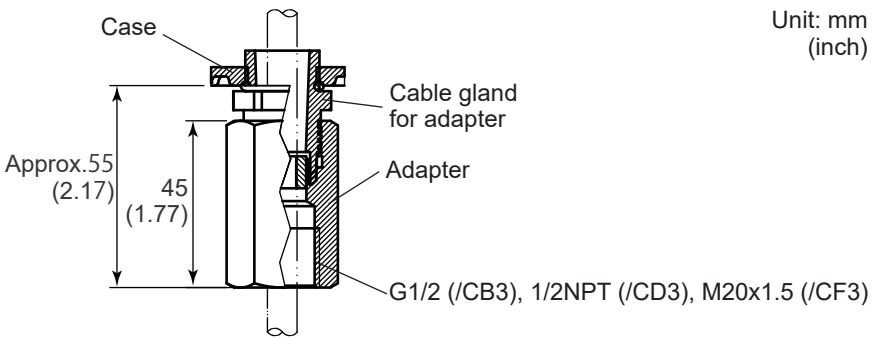


Figure 5 Diagram of TB820D conduit adopter

1.2 TB830D Dimensions

- **Without sampling system (-NN, -A5)** **Unit: mm**

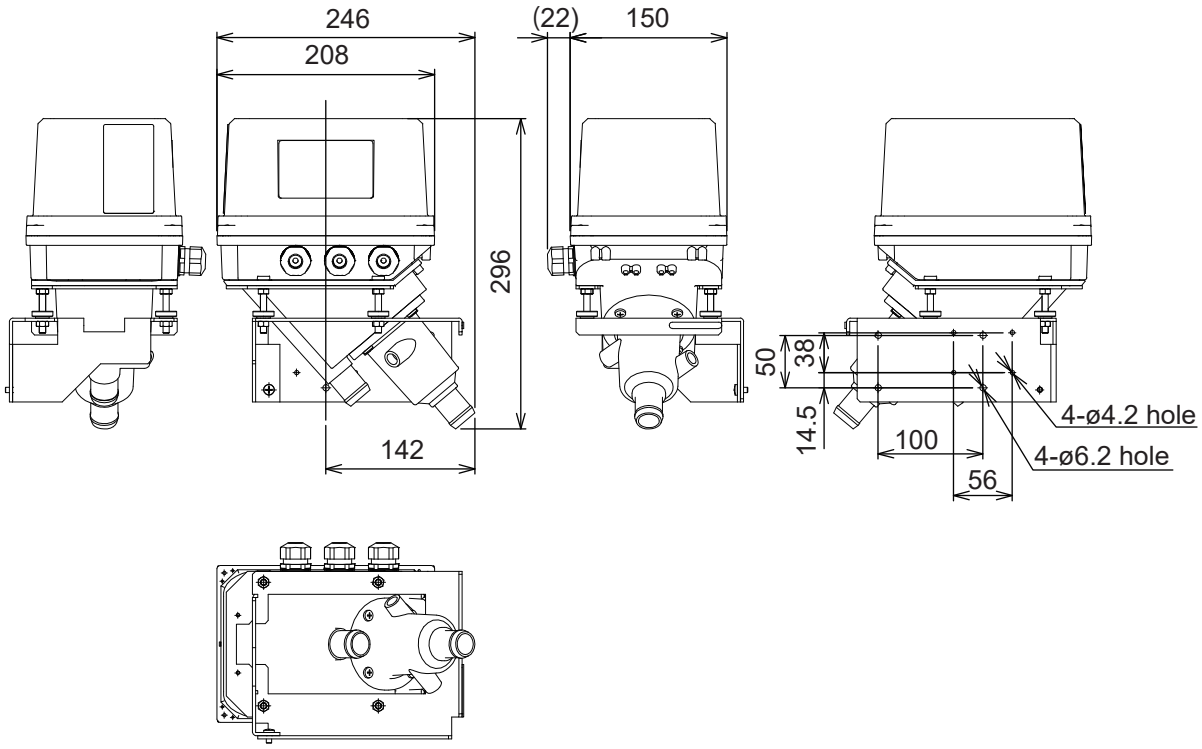


Figure 6 TB830D-NN, -A5 Dimensions

- **Maintenance space**

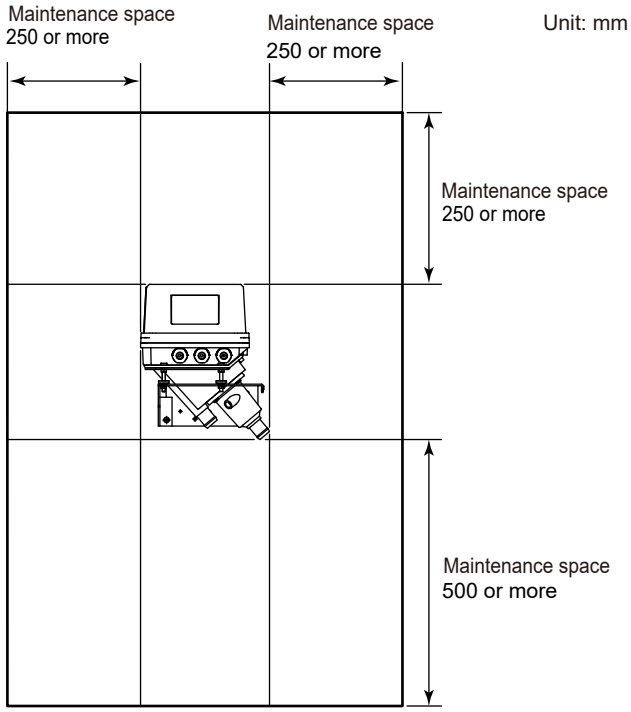


Figure 7 TB830D maintenance space

- **Pipe mounting hardware (/U) for -NN, -A5 Without sampling system** **Unit: mm**

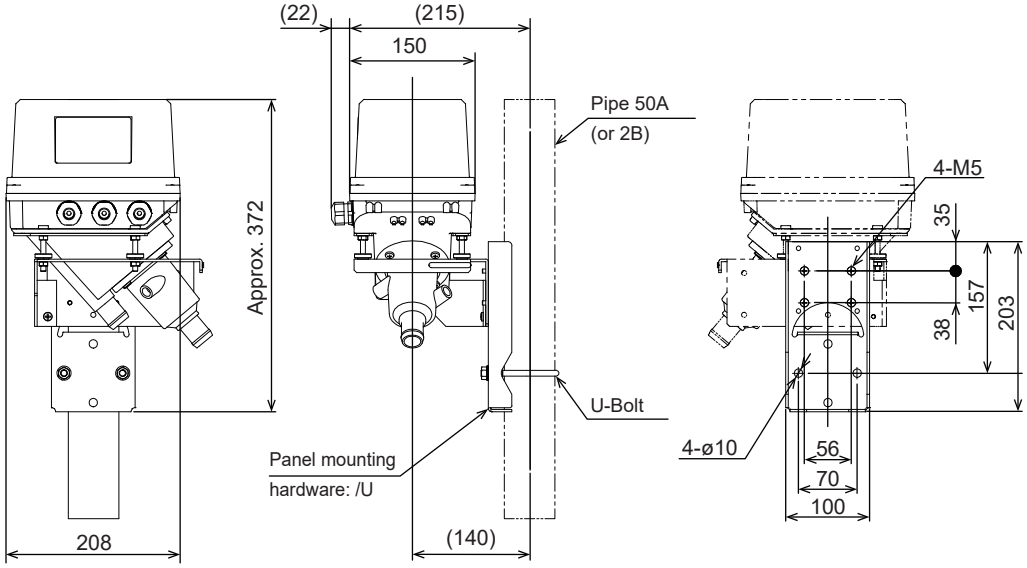


Figure 8 Pipe mounting hardware (/U) for -NN, -A5

- **Rack or wall mounting hardware (/R) for -NN, -A5 Without sampling system** **Unit: mm**

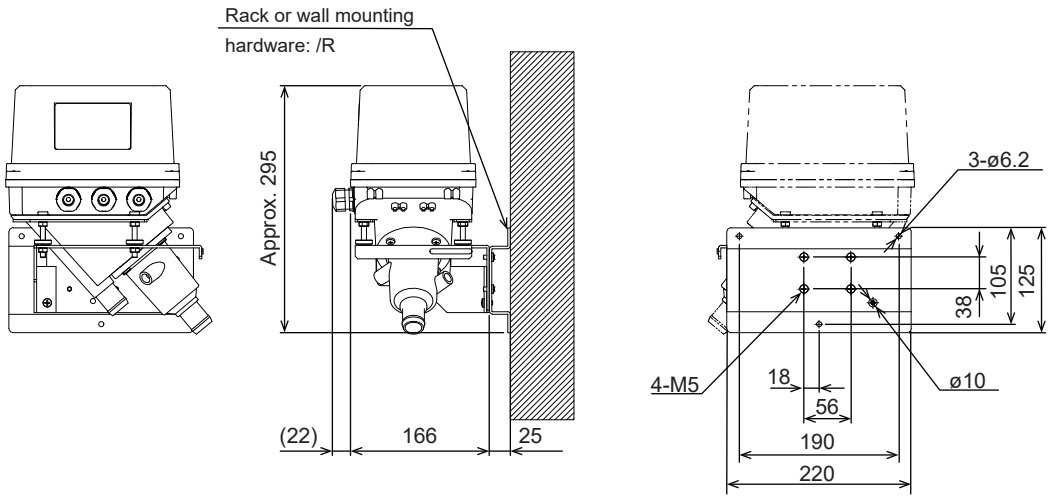


Figure 9 Rack or wall mounting hardware (/R) for -NN, -A5

Other Dimensions

- **Terminal box A** **Unit: mm**

Terminal box A is supplied when "/ARS" option code is specified.

Terminal box A can be connected to the pipe when "/C□" option code is specified.

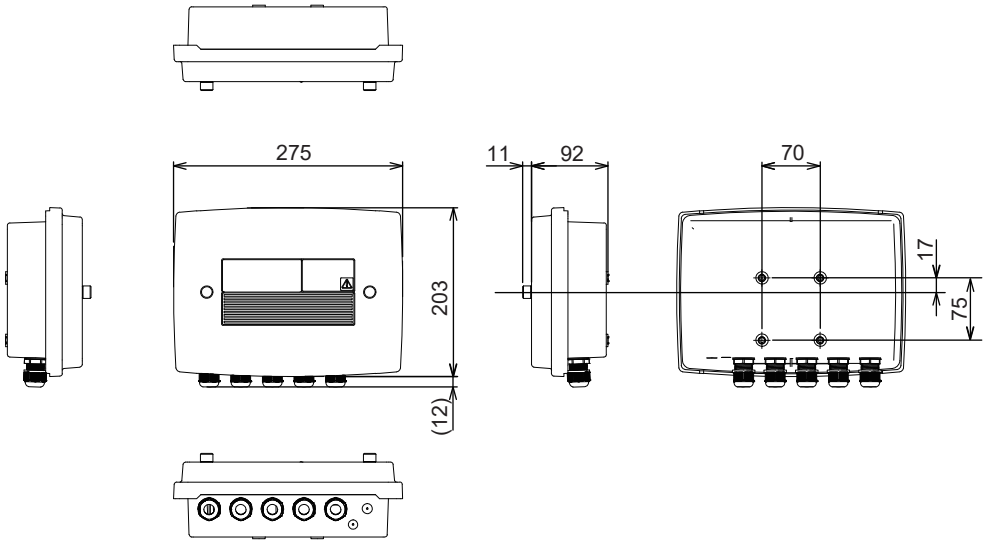


Figure 10 Terminal box A dimensions

- **Installation of pipe mounting hardware (/U) on the terminal box A**

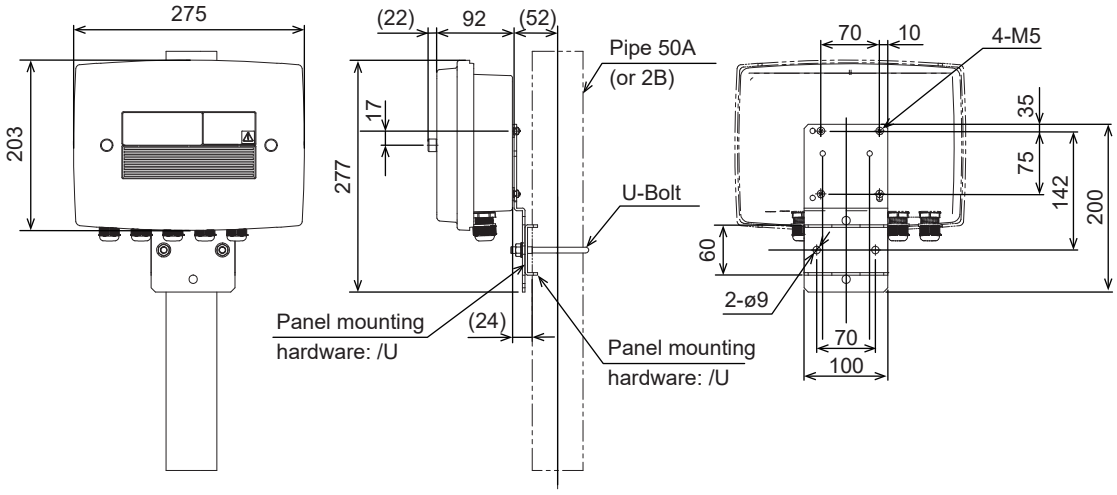


Figure 11 Installation of pipe mounting hardware (/U) on the terminal box A

- **Installation of rack or wall mounting hardware (/R) on the terminal box A**

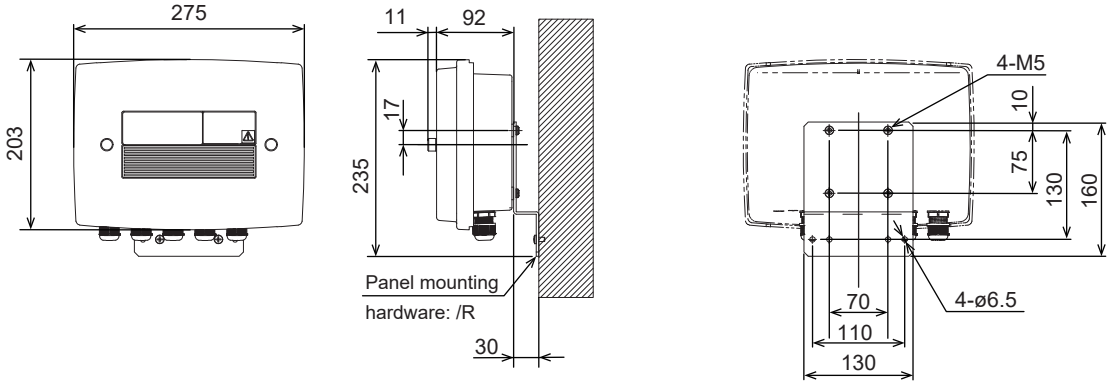


Figure 12 Installation of rack or wall mounting hardware (/R) on the terminal box A

- **Terminal box B** **Unit: mm**

Terminal box B is supplied with the product in the following cases.

- When both Sampling system “-NN” and Option “/C□” (Conduit adapter) are specified, but “/ARS” (with Arrester) is not specified.
- When Sampling system “-A1” is specified but “/ARS” (with Arrester) is not specified.
- When Sampling system “-A2” or “-A3” is specified and Option “/PH□2” or “/PH□7” or “/FC” is specified, but “/ARS” (with Arrester) is not specified.

Terminal box B can be conduit wired.

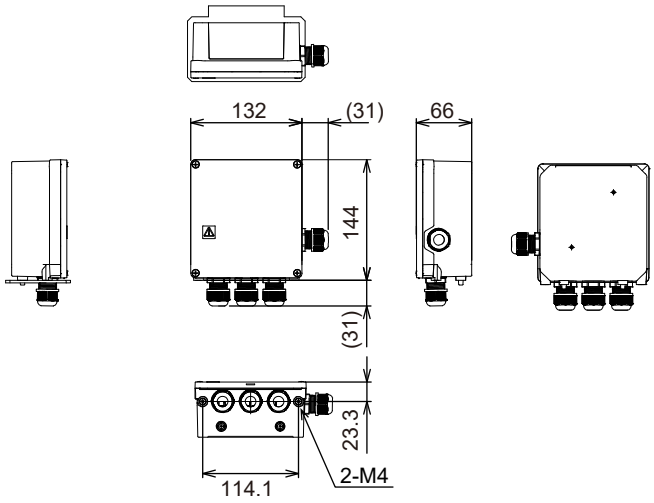


Figure 13 Terminal box B Dimensions

- **Installation of pipe mounting hardware (/U) on the terminal box B**

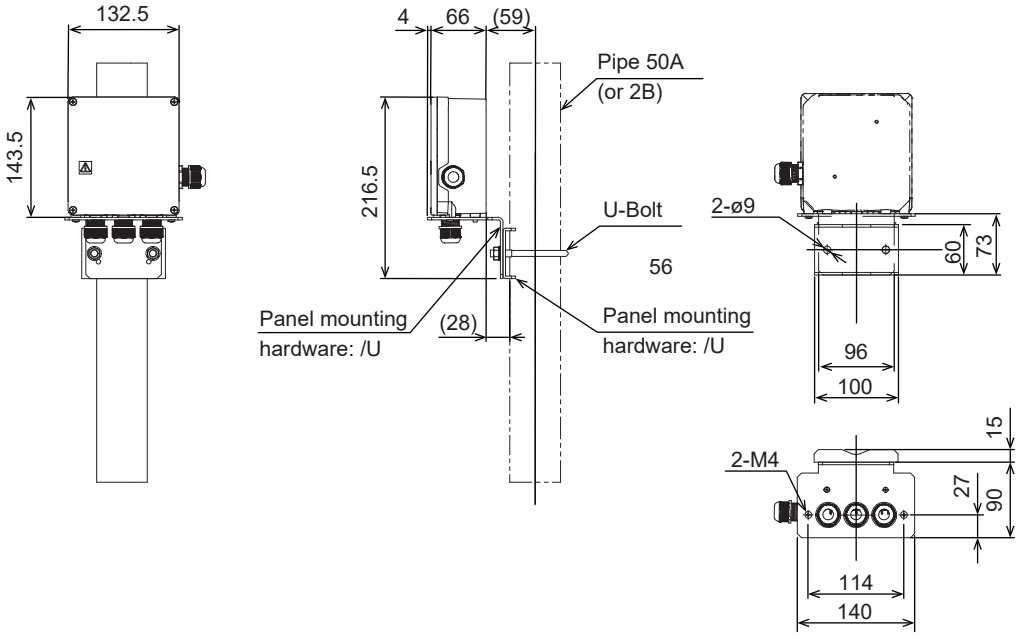


Figure 14 Installation of pipe mounting hardware (/U) on the terminal box B

- **Installation of rack or wall mounting hardware (/R) on the terminal box B** **Unit: mm**

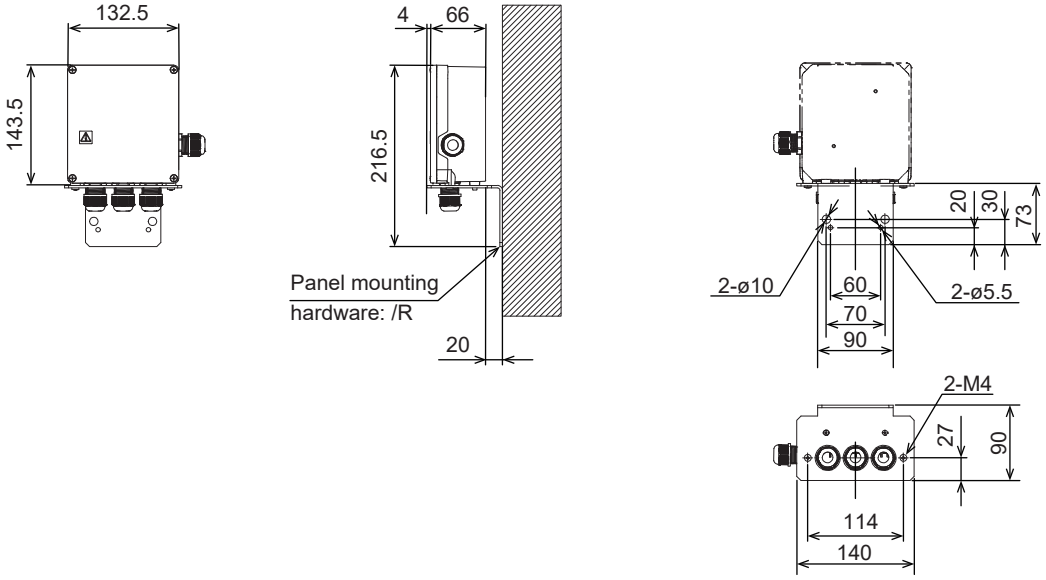


Figure 15 Installation of rack or wall mounting hardware (/R) on the terminal box B

- **Relay box**

A relay box is supplied with the product when “-A2”, “-A3”, or “-A5” is specified. A relay box is used to drive the solenoid valve for automatic cleaning/automatic zero calibration. Select /C□ (conduit adapter) to provide conduit wiring to the relay box.

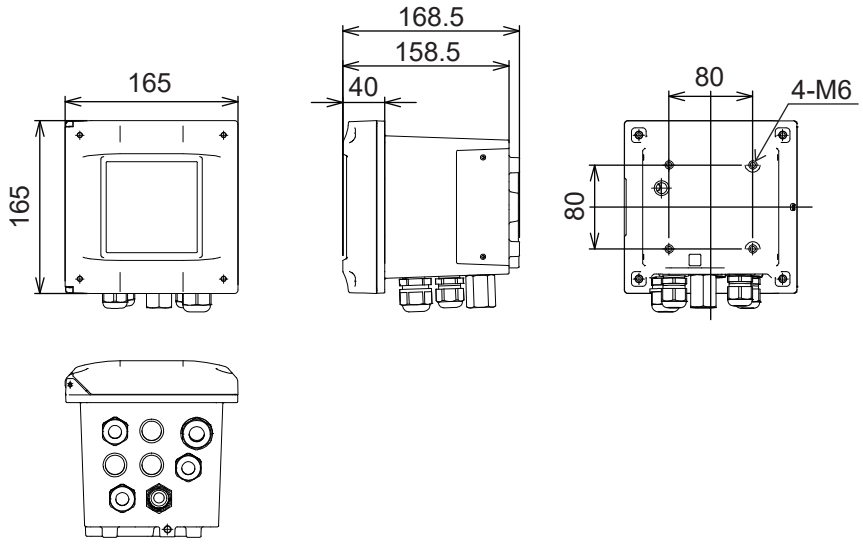


Figure 16 Relay box Dimensions

- **Installation of pipe mounting hardware (/U) on the relay box** **Unit: mm**

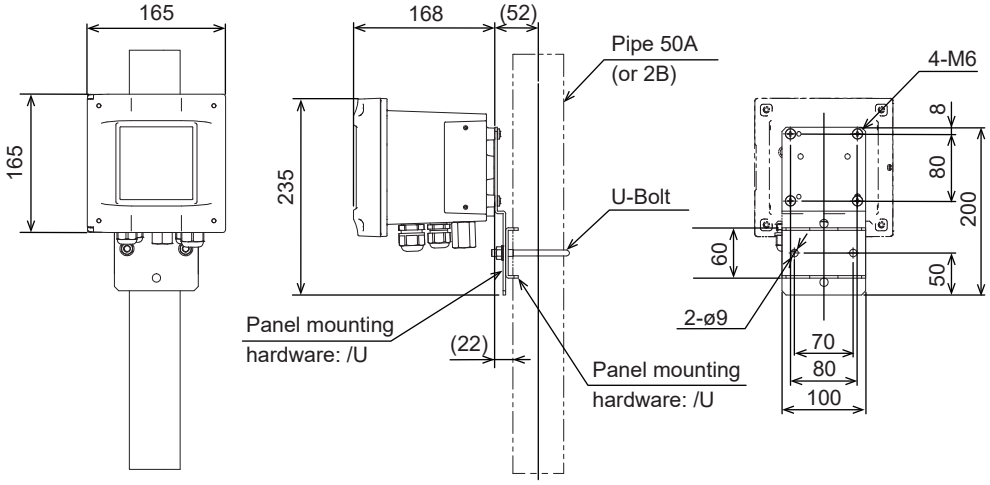


Figure 17 Installation of pipe mounting hardware (/U) on the relay box

- **Installation of rack or wall mounting hardware (/R) on the relay box**

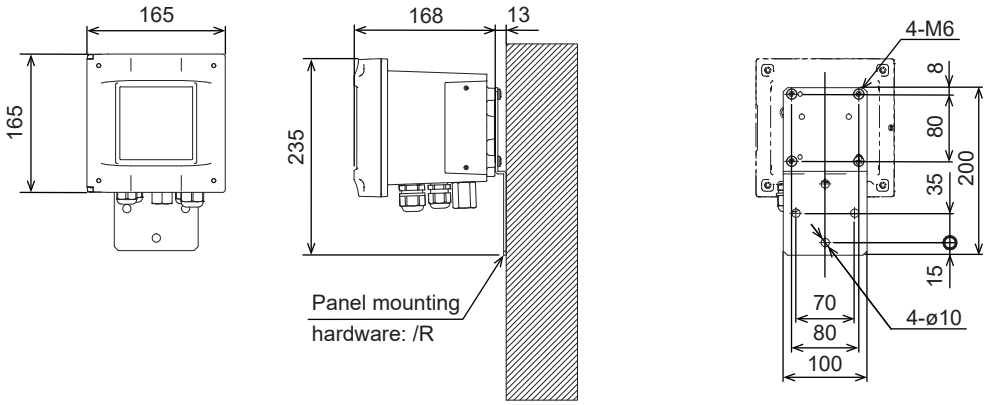


Figure 18 Installation of rack or wall mounting hardware (/R) on the relay box

- **Conduit adaptor (/CB, /CD, /CF)**

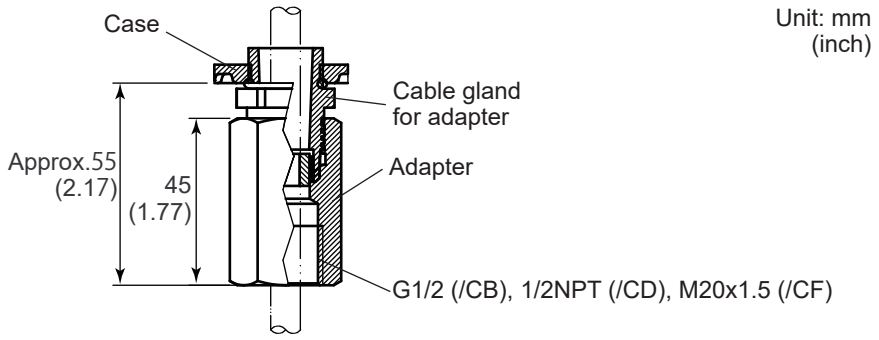


Figure 19 Diagram of TB830D Conduit adaptor (/CB, /CD, /CF)

- **PG400 dimensions and Mounting**

  PG400 will be attached if you choose TB820D-U1.

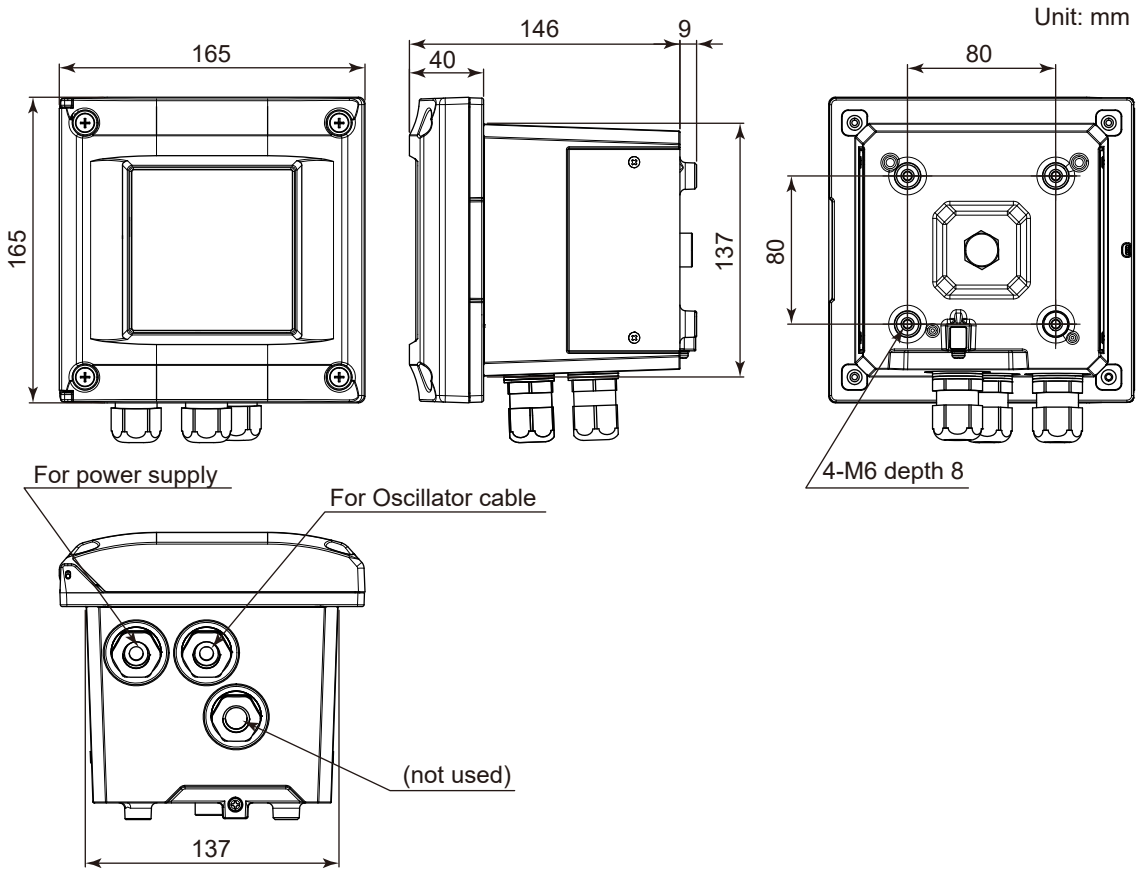


Figure 20 Diagram of PG400

- **PG400 conduit Adapter (Option code: /CB, /CD, /CF)**

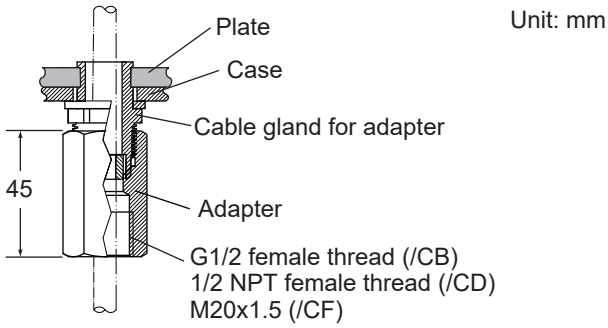
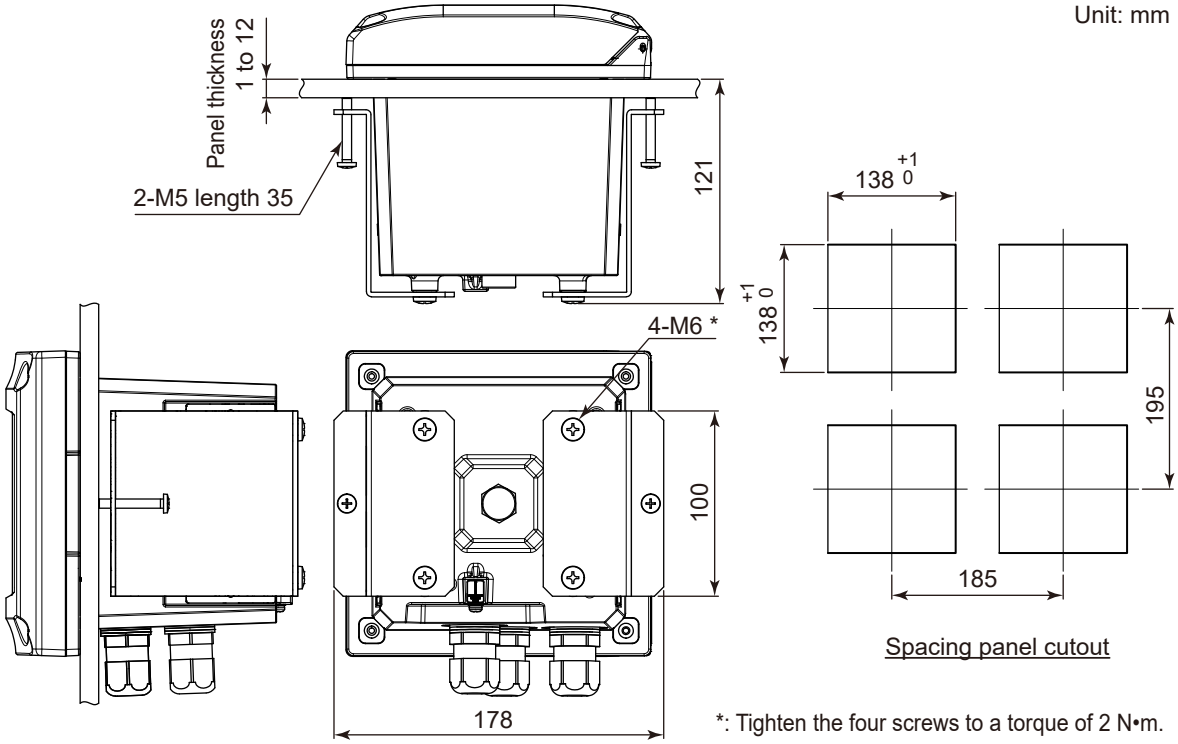


Figure 21 Diagram of PG400 conduit adapter

(Note)The universal mounting kit (/UM) contains the pipe and wall mounting hardware (/U) and the panel mounting hardware (/PM).

- **PG400 panel mounting hardware (Option code: /PM, /UM)**

Unit: mm



*: Tighten the four screws to a torque of 2 N•m.

Figure 22 PG400 panel mounting hardware (/PM, /UM)

- **Panel mounting hardware for replace (from PUS400G/TUS400G) (Option code: /PM1)**

Unit: mm

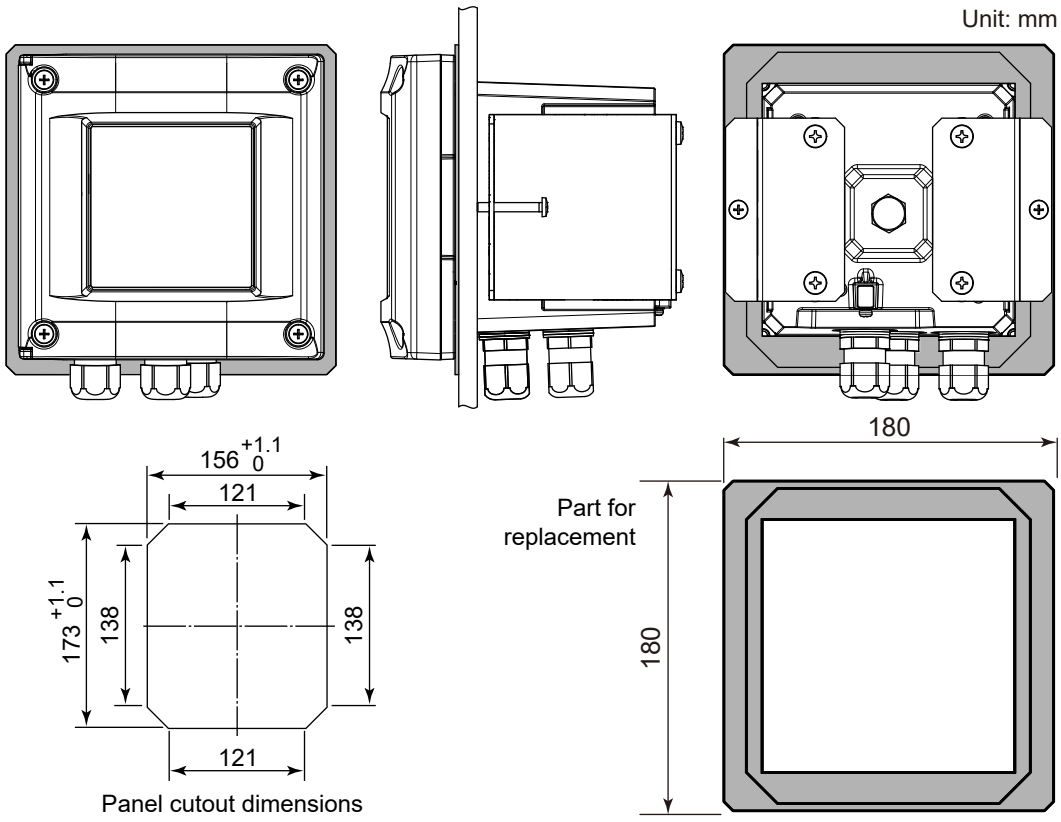
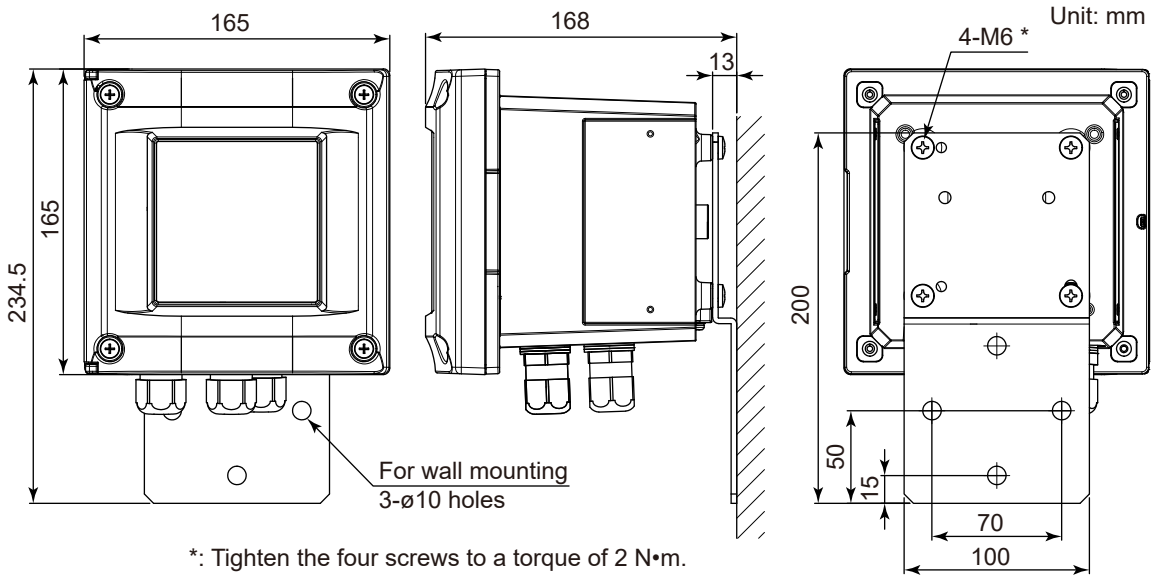


Figure 23 PG400 panel mounting hardware for replace from PUS400G/TUS400G (/PM1)

Note: The wall on which the analyzer is mounted should be strong enough to bear the weight of more than 8 kg.

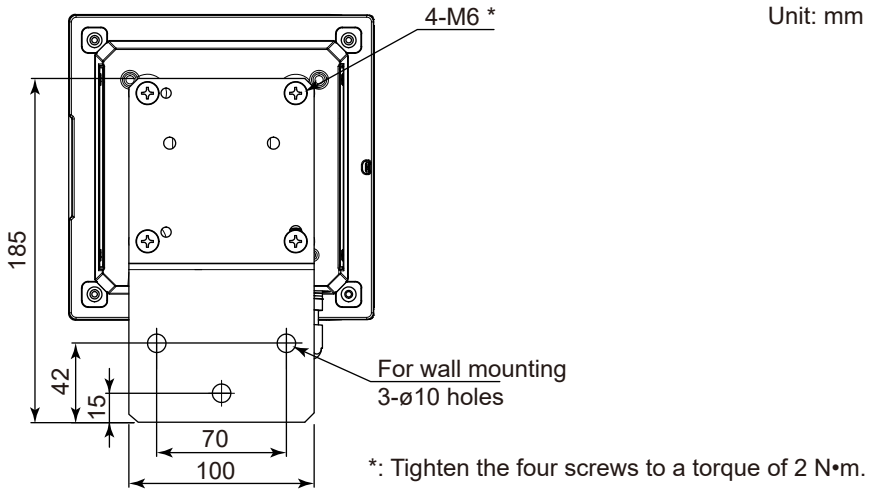
- **PG400 wall mounting hardware (Option code: /U, /UM)**



*: Tighten the four screws to a torque of 2 N•m.

Figure 24 PG400 wall mounting hardware (/U, /UM)

- **PG400 wall mounting hardware (for replacement from PUS400G/TUS400G) (Option code: /U1)**



*: Tighten the four screws to a torque of 2 N•m.

Figure 25 PG400 wall mounting hardware for replacement from PUS400G/TUS400G (/U1)

Note: The wall on which the analyzer is mounted should be strong enough to bear the weight of more than 8 kg.

- **PG400 pipe mounting hardware (Option code: /U, /UM)**

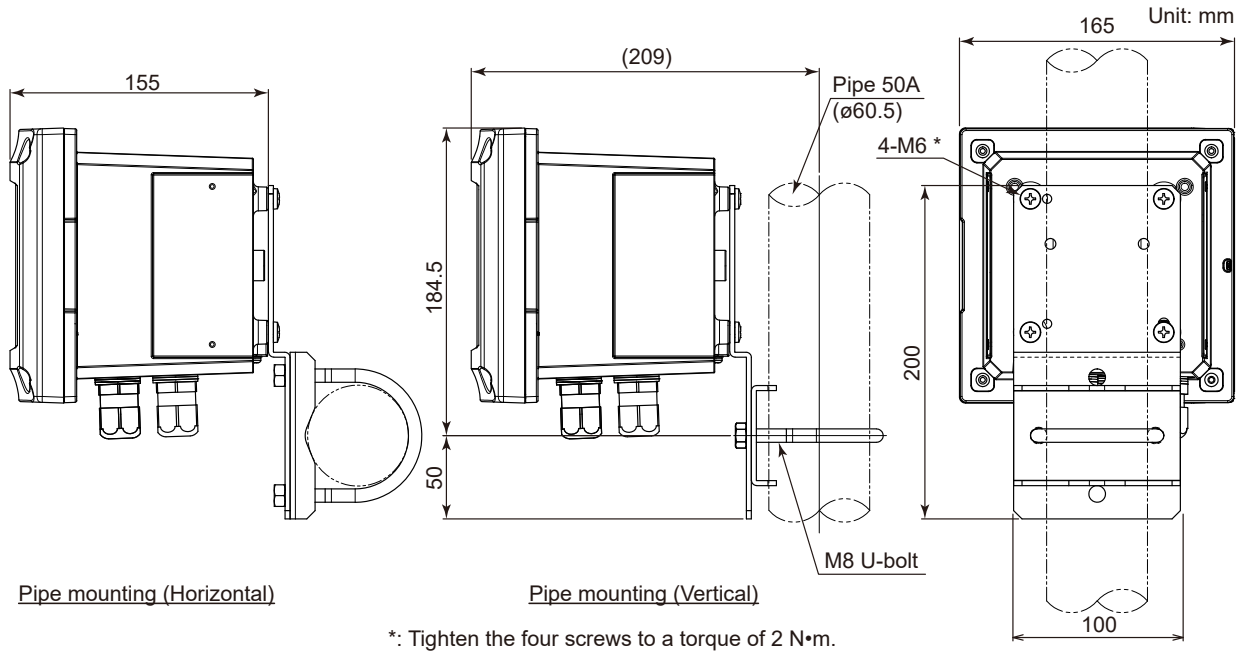


Figure 26 PG400 pipe mounting hardware (/U, /UM)

- **PG400 stainless steel hood (Option code: /H6, /H7)**

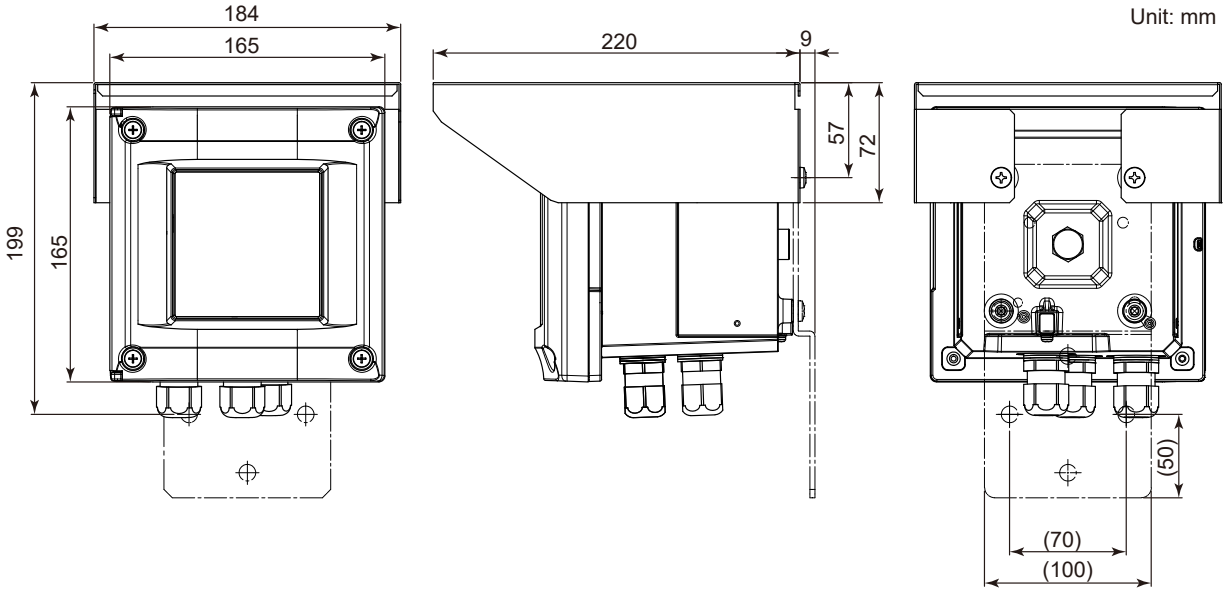


Figure 27 PG400 stainless steel hood (/H6, H7)

2. Installation

The TB820 and 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**

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

3. Piping

3.1 TB820D (-NN, -A5) Piping

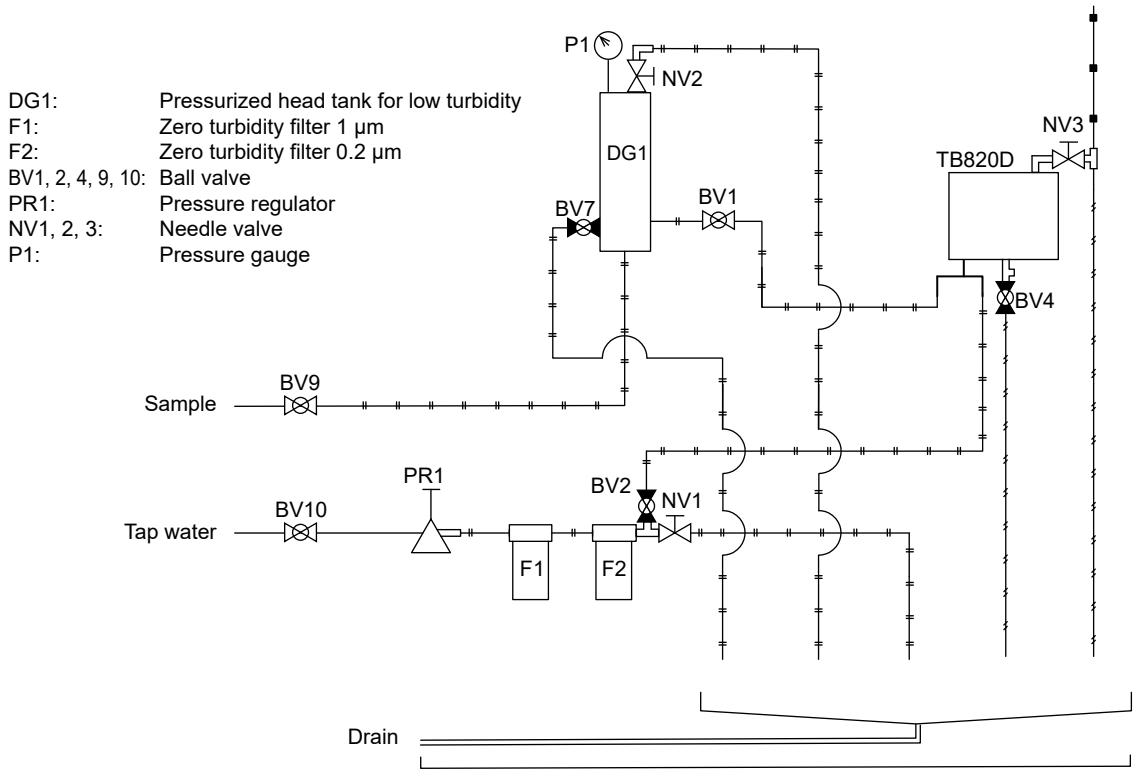
See Section “3.1.1 Head tank and Piping Parts” for head tank types and selection.

Pressurized head tank (/D1)

- **Manual cleaning, manual zero calibration**

  In a system using an open head tank, air bubbles may form from air dissolved in a sample under the reduced pressure in piping and enter into the detector, resulting in an incorrect measurement. For low turbid waters where the effect of air bubbles is a concern, install a pressurized head tank to prevent pressure changes in the piping from the head tank to the detector outlet and thus prevent air bubbles from occurring in the pipe.

  Note: Needle valves are required to adjust the small flow rate by changing the valve opening.



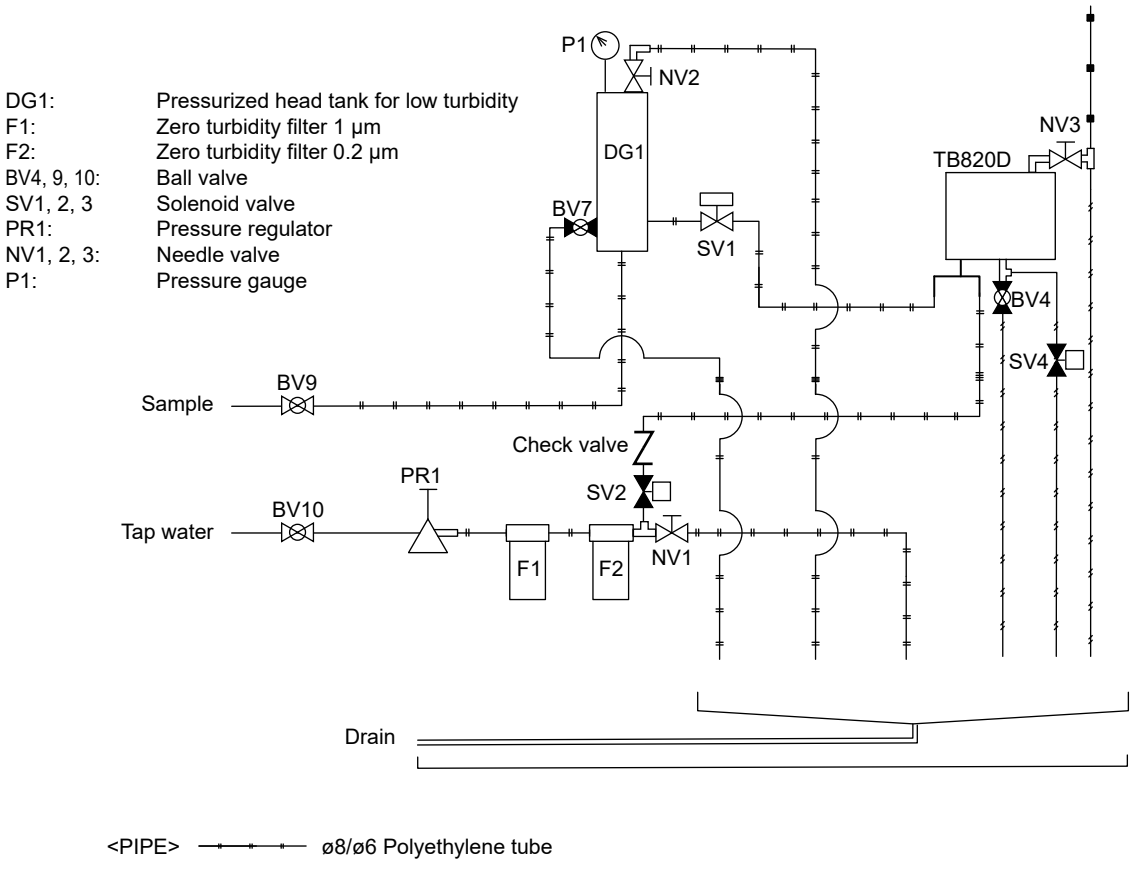
<PIPE> ø8/ø6 Polyethylene tube
ø12/ø9 Polyethylene tube
ø22/ø15 Flexible mesh-reinforced tube
ø26/ø19 Flexible mesh-reinforced tube
ø33/ø25 Flexible mesh-reinforced tube

F2: Use 0.2 µm or 1 µm filter. However, if the sample is more than 2 NTU, only the 1 µm filter may be used.
BV2: Supply Zero water to the detector by operating the ball valve
BV4: Drain dirt and sediment by opening the drain ball valve
NV3: Valve for Flow rate adjustment. Be sure to place it after the detector exit
NV1: Keep a very small amount of water flowing at all times to prevent contamination of the zero filter and prevent freezing in winter.
Atmospheric air open on the outlet side of NV3

Figure 28 Piping diagram for TB820D /D1 without Automatic clean/ Without Automatic zero calibration

- **Automatic cleaning, automatic zero calibration**

  Note: Needle valves are required to adjust the small flow rate by changing the valve opening.



Solenoid valve is installed and set in the cleaning / calibration controller (Relay box)
Atmospheric air open on the outlet side of NV3
F2: Use 0.2 µm or 1 µm filter. However, if the sample is more than 2 NTU, only the 1 µm filter may be used.
NV3: Valve for Flow rate adjustment. Be sure to place it after the detector exit
NV1: Keep a very small amount of water flowing at all times to prevent contamination of the zero filter and prevent freezing in winter.

Figure 29 Piping diagram for TB820D /D1 with Automatic cleaning/ With Automatic zero calibration

(1) Piping of the Sample Line to the Detector

This piping is for introducing a sample into the measurement cell of the detector. Install a pressurized head tank (for low turbidity), valves and pipes by referring to the diagram in Figure 28 and Figure 29.

1. For the piping from a sampling point to a sample valve, use a hose/tube with sufficient diameter that provides adequate flow of sample in order to prevent clogging. The hose/tube also should withstand the sample pressure. The specified sample pressure when using a pressurized head tank is in the range of 20 to 500 kPa. One example is a rigid PVC tube with nominal size of 16 (22 mm OD).
2. For the piping between the valve and the pressurized head tank, use a 8 mm OD x 6 mm ID polyethylene tube and the corresponding fitting.
3. To the sample inlet of the detector, attach a 3-way (tee) or appropriate fitting corresponding to the inlet's connection size (Rc1/2 or 1/2 NPT). This allows switching of the sample flow and the zero water flow.

4. For the piping between the pressurized head tank and the detector, connect a valve to one end of the 3-way tee fitting and connect a 8 mm OD x 6 mm ID polyethylene tube and the corresponding fitting between the valve and the pressurized head tank.
5. To the fitting on the bypass valve (needle valve) at the top of the pressurized head tank, connect a 8 mm OD x 6 mm ID polyethylene tube.
6. To prevent clogging or stagnation of air bubbles in the pipe line, install the pipes so that no bends or stagnation occurs.

(2) Piping of the Sample Line from the Detector

This piping is for draining a sample from the measurement cell of the detector during measurement. As shown in the piping diagram in Figure 28 and Figure 29, connect a needle valve to the sample outlet of the detector. By adjusting the opening of this valve and the bypass valve (needle valve) at the top of the pressurized head tank, the pressure change is controlled in the piping between the head tank and the detector outlet, and thus the generation of air bubbles is prevented.

1. To the sample outlet of the detector, connect a fitting, such as an elbow fitting, corresponding to the connection size (Rc1/2 or 1/2 NPT female) and a needle valve.
2. To the outlet of the needle valve, connect a 8 mm OD x 6 mm ID polyethylene tube using the corresponding fitting to drain the sample to a drain pipe.
3. As shown in Figure 28 and Figure 29, the sample from the detector should be discharged to the atmosphere at a point higher than the measurement cell of the detector. If not, a siphon may be created and the measurement cell may not be filled with a sample. In addition, if the sample inflow stops, the sample will be drawn off and the measurement cell will be emptied, which can cause damage to the Pulse Generator for Clean Unit, if used.

(3) Drain Piping

This piping is for draining a sample from the measurement cell of the detector and a head tank during cleaning, calibration, or other maintenance.

1. The drain of the detector is Rc1/2 (or 1/2 NPT female) thread. Install a fitting corresponding to the thread and connect a hose/tube with sufficient diameter that provides adequate flow of sample, to route the sample from the detector to a drain pipe. Install the pipe so that no stagnation occurs.
2. As shown in Figure 28 and Figure 29, install pipe so that the sample can be drained from the head tank to the drain pipe.

(4) Piping of the Zero Water Line

This piping is for introducing tap water to a zero turbidity filter and then to the detector for zero calibration or measurement cell cleaning.

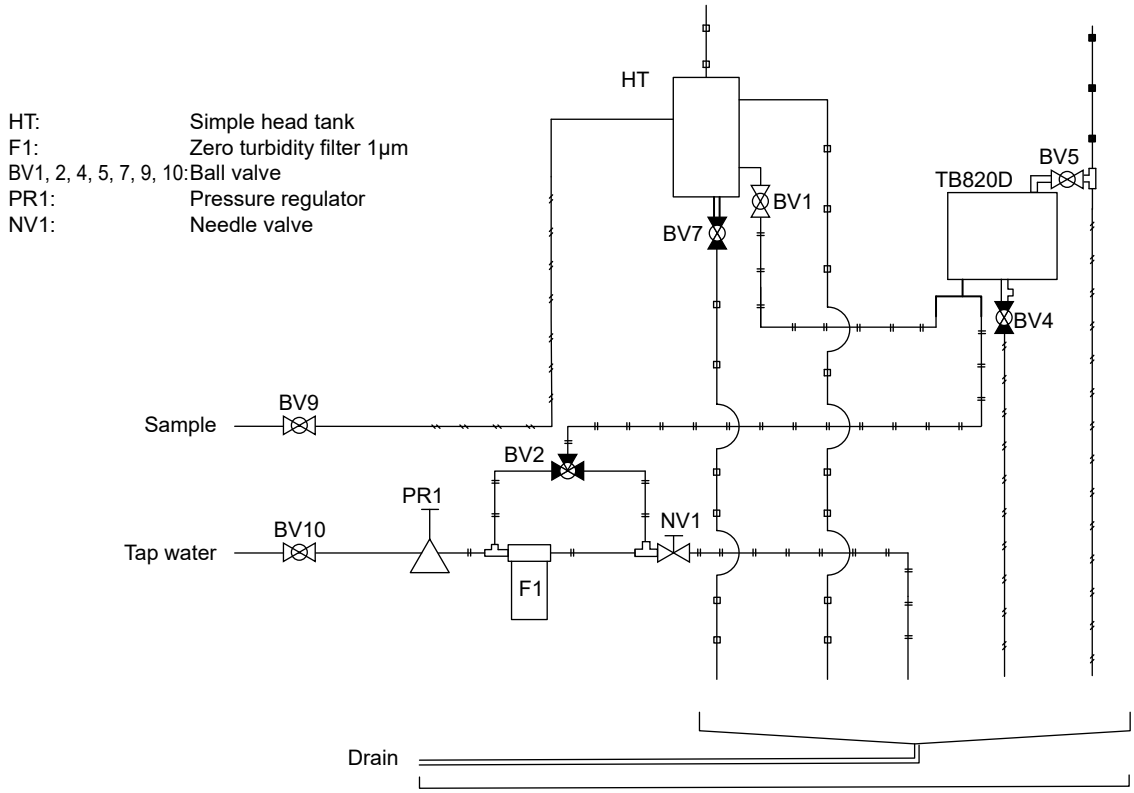
1. As shown in Figure 28 and Figure 29, install a tap water valve and a zero water drain valve.
2. Connect a zero water supply valve to one end of the 3-waytee fitting attached to the sample inlet of the detector.
3. Install a fitting corresponding to the piping connection of the zero turbidity filter and connect an hose/tube that can withstand the pressure of tap water, such as a rigid PVC tube. The flow rate of zero water supply should be in the range of 1 to 3 L/min.
4. For the specifications of the zero turbidity filter, see GS 12E01B30-01EN
5. To prevent corrosion of water inside the zero turbidity filter, allow water to flow through the filter and flow out from the zero water drain valve continuously at a flow rate of approximately 10 mL/min.

Simple head tank (/D2)

- **Manual cleaning, manual zero calibration**

An optional simple head tank with a vent to the atmosphere (option code "/D2"), shown in Figure 38, is available from Yokogawa. The piping diagram of the simple head tank is shown in Figure 30, Figure 31 and Figure 32. The installation of the piping for the simple head tank is described below.

Note: Needle valves are required to adjust the small flow rate by changing the valve opening.



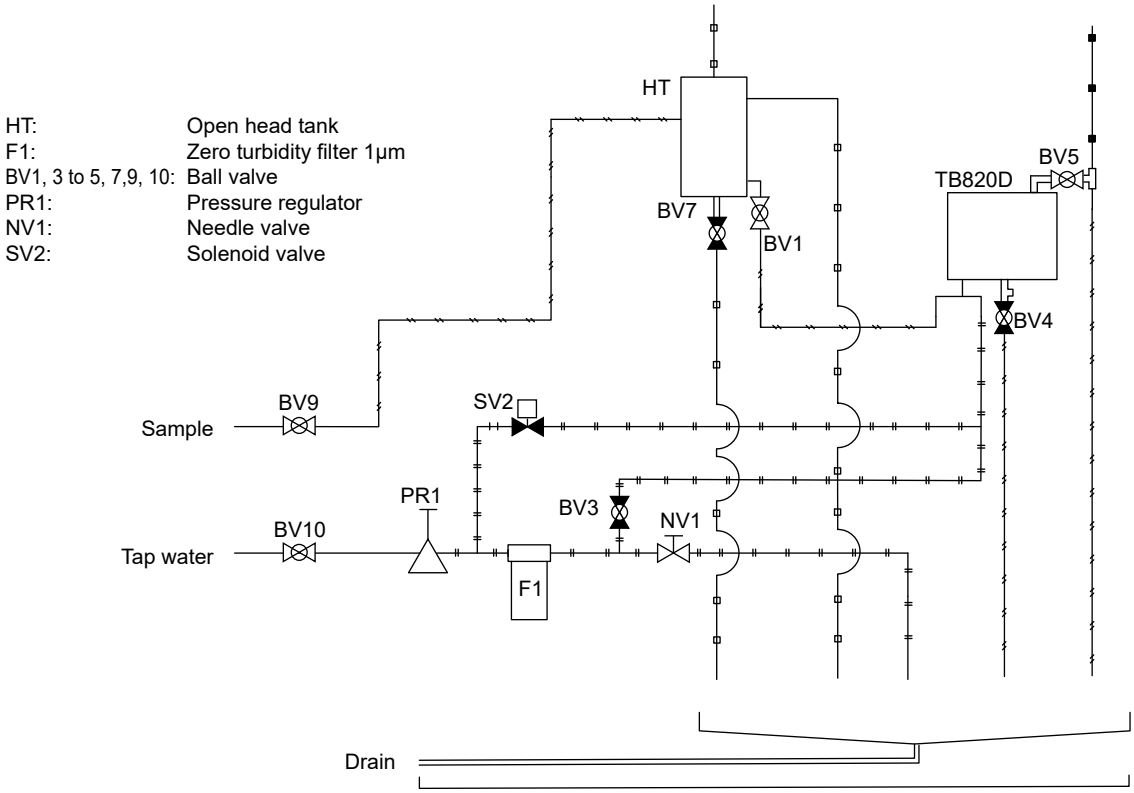
<PIPE> ø8/ø6 Polyethylene tube
ø12/ø9 Polyethylene tube
ø22/ø15 Flexible mesh-reinforced tube
ø26/ø19 Flexible mesh-reinforced tube
ø33/ø25 Flexible mesh-reinforced tube

Atmospheric air open on the outlet side of Needle valve
Needle valve Valve for Flow rate adjustment. Be sure to place it after the detector exit
Ball or Needle valve: without cleaning / calibration or Solenoid valve: with cleaning / calibration
Needle valve: Keep a very small amount of water flowing at all times to prevent contamination of the zero filter and prevent freezing in winter.

Figure 30 Piping diagram for TB820D /D2 without automatic cleaning / without automatic zero calibration

- **Automatic cleaning, manual zero calibration**

  Note: Needle valves are required to adjust the small flow rate by changing the valve opening.



<PIPE> ø8/ø6 Polyethylene tube

ø12/ø9 Polyethylene tube

ø22/ø15 Flexible mesh-reinforced tube

ø26/ø19 Flexible mesh-reinforced tube

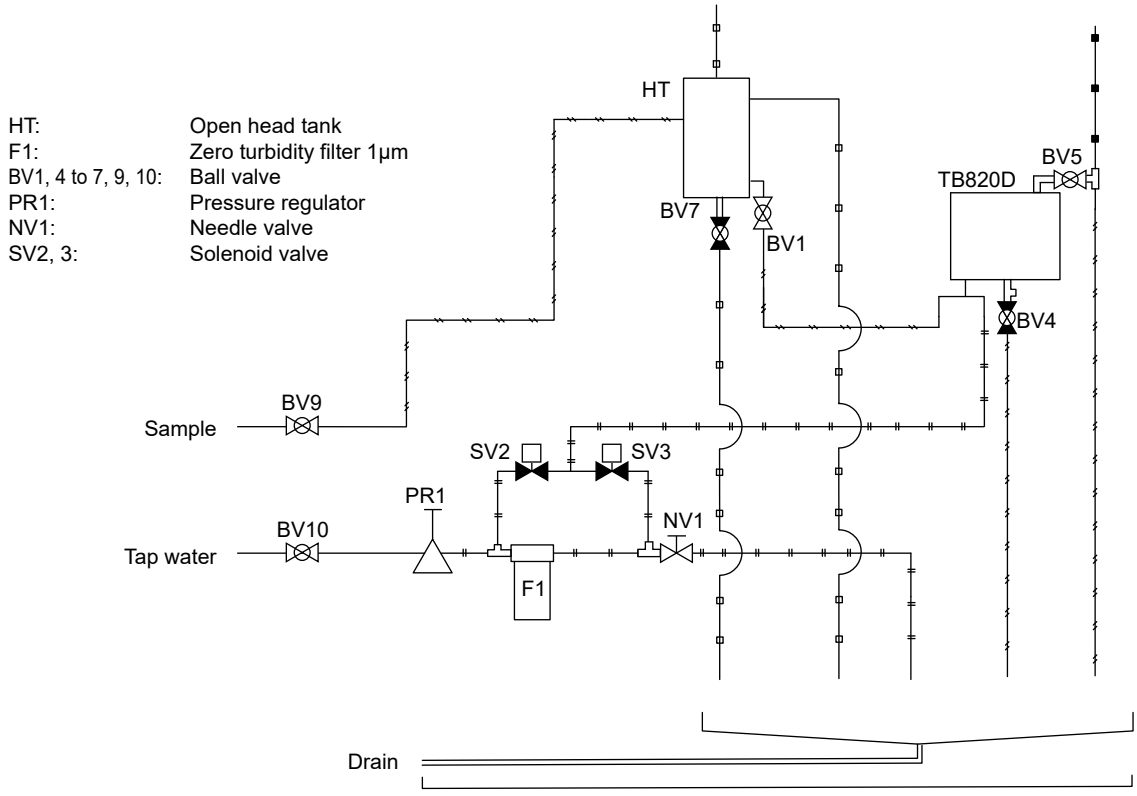
ø33/ø25 Flexible mesh-reinforced tube

Atmospheric air open on the outlet side of Needle valve
Needle valve Valve for Flow rate adjustment. Be sure to place it after the detector exit
Ball or Needle valve: without cleaning / calibration or Solenoid valve: with cleaning / calibration
Needle valve: Keep a very small amount of water flowing at all times to prevent contamination of the zero filter and prevent freezing in winter.

Figure 31 Piping diagram for TB820D /D2 with automatic cleanig / without automatic zero calibration

- **Automatic cleaning, automatic zero calibration**

  Note: Needle valves are required to adjust the small flow rate by changing the valve opening.



<PIPE> ø8/ø6 Polyethylene tube
ø12/ø9 Polyethylene tube
ø22/ø15 Flexible mesh-reinforced tube
ø26/ø19 Flexible mesh-reinforced tube
ø33/ø25 Flexible mesh-reinforced tube

Atmospheric air open on the outlet side of Needle valve
Needle valve Valve for Flow rate adjustment. Be sure to place it after the detector exit
Ball or Needle valve: without cleaning / calibration or Solenoid valve: with cleaning / calibration
Needle valve: Keep a very small amount of water flowing at all times to prevent contamination of the zero filter and prevent freezing in winter.

Figure 32 Piping diagram for TB820D /D2 with automatic cleaning / with automatic zero calibration

[Installation and Piping of the Simple Head Tank]

1. To the sample inlet of the detector, attach a 3-way (tee) or appropriate fitting corresponding to the inlet's connection size (Rc1/2 or 1/2 NPT). This allows switching of the sample flow and the zero water flow.
2. Install the simple head tank with the four M5 bolts (supplied by customer) so that the head tank is positioned higher than the detector.
3. To the sample inlet (Rc3/8) of the simple head tank, connect a fitting corresponding to the connection size and a hose/tube with sufficient diameter that provides adequate flow of sample. If pressure exists in a sample, use an appropriate tube that can withstand the pressure, e.g., a rigid PVC tube.

   If the flow rate of a sample exceeds 10 L/min, install a bypass line before the simple head tank to control the flow rate.

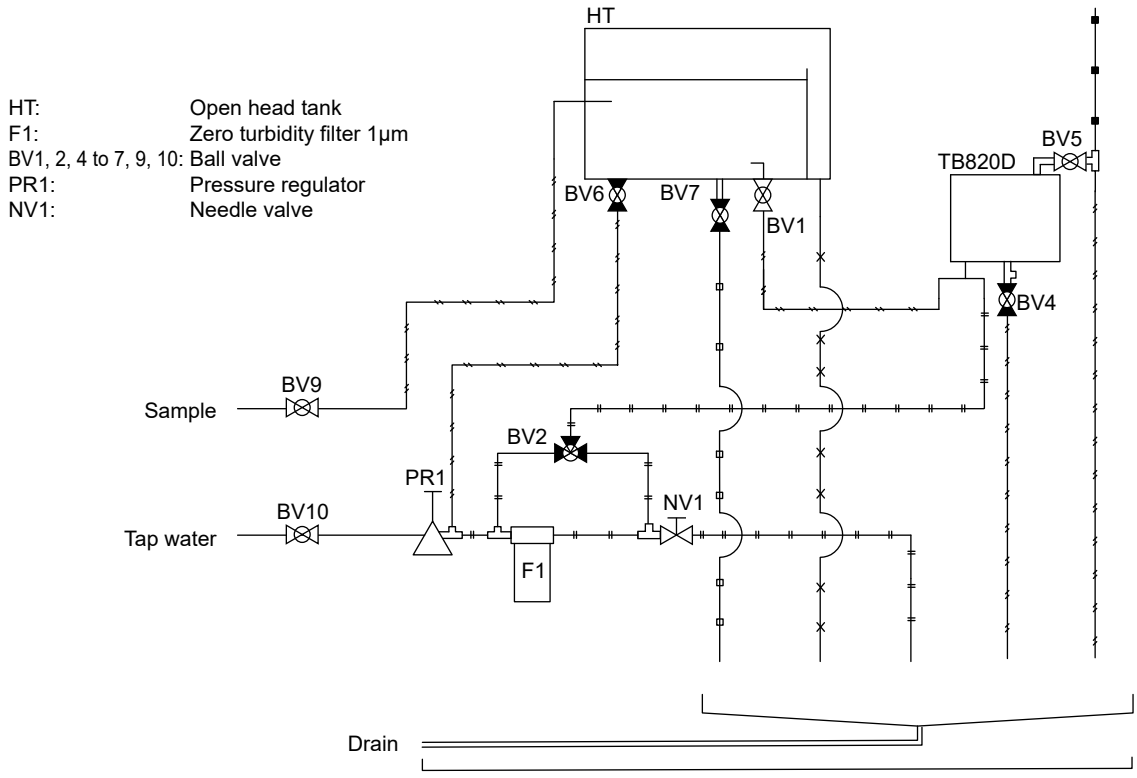
4. Connect a fitting corresponding to the connection size and a hose/tube with sufficient diameter that provides adequate flow of sample between the sample outlet (Rc1/2) of the simple head tank and the sample inlet of the detector.
5. Connect hoses with an inside diameter of 19 mm to the drain and the vent at the top of the head tank to drain the sample to a drain pipe.
6. To the drain at the bottom of the simple head tank, connect a rigid PVC tube corresponding to nominal size 20A (26.2 mm ID) to drain the sample to a drain pipe.
7. To the sample outlet of the detector, connect the drain for controlling the flow rate.

Open head tank (/D3)

- **Manual cleaning, manual zero calibration**

  This is a typical system and the piping diagram is shown in Figure 33, Figure 34, and Figure 35. Air bubbles in a sample are removed by an open head tank and the sample is introduced into the detector at a stable flow rate. Calibration and maintenance such as measurement cell cleaning are efficiently performed by valve operation. An optional Open head tank (option code “/D3”), shown in Figure 40, is available from Yokogawa.

  Note: Needle valves are required to adjust the small flow rate by changing the valve opening.



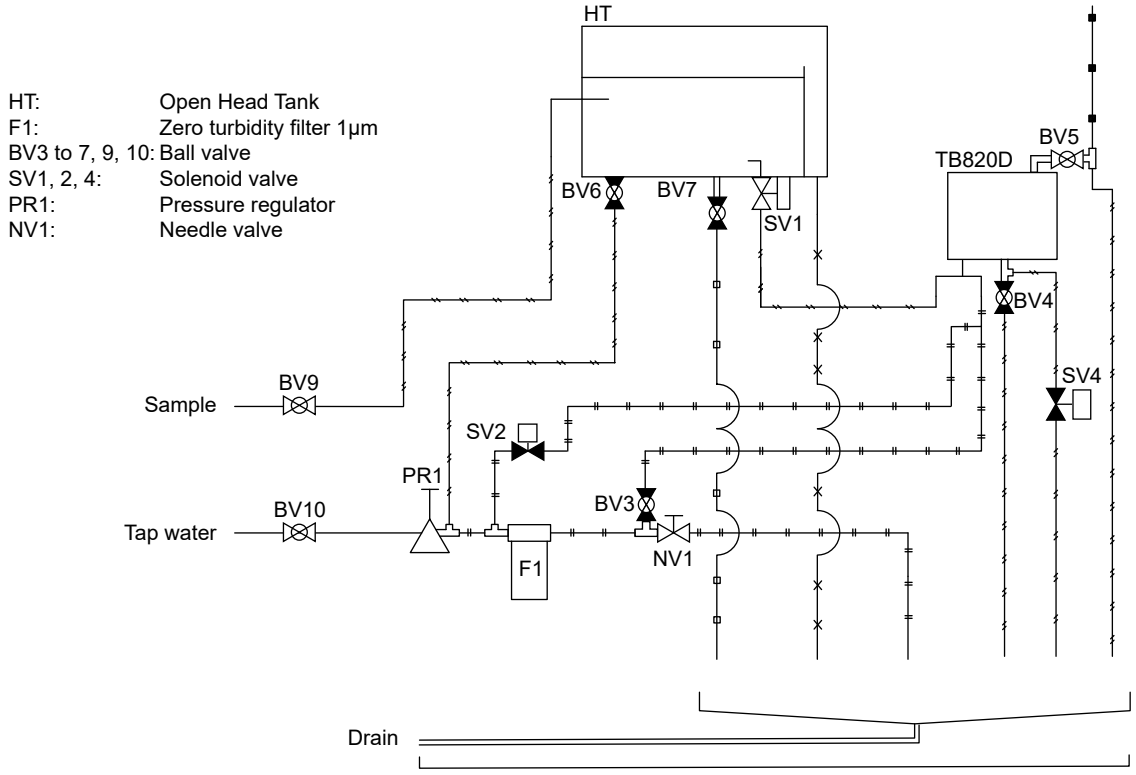
<PIPE> ø8/ø6 Polyethylene tube
ø12/ø9 Polyethylene tube
ø22/ø15 Flexible mesh-reinforced tube
ø26/ø19 Flexible mesh-reinforced tube
ø33/ø25 Flexible mesh-reinforced tube

Atmospheric air open on the outlet side of valve
BV2: Supply Zero water to the detector by operating the ball valve
BV5: Valve for Flow rate adjustment. Be sure to place it after the detector exit (Needle valve is also OK)
NV1: Keep a very small amount of water flowing at all times to prevent contamination of the zero filter and prevent freezing in winter.

Figure 33 Piping diagram for TB820D /D3 without automatic cleaning / without automatic zero calibration

- **Automatic cleaning, manual zero calibration**

  Note: Needle valves are required to adjust the small flow rate by changing the valve opening.



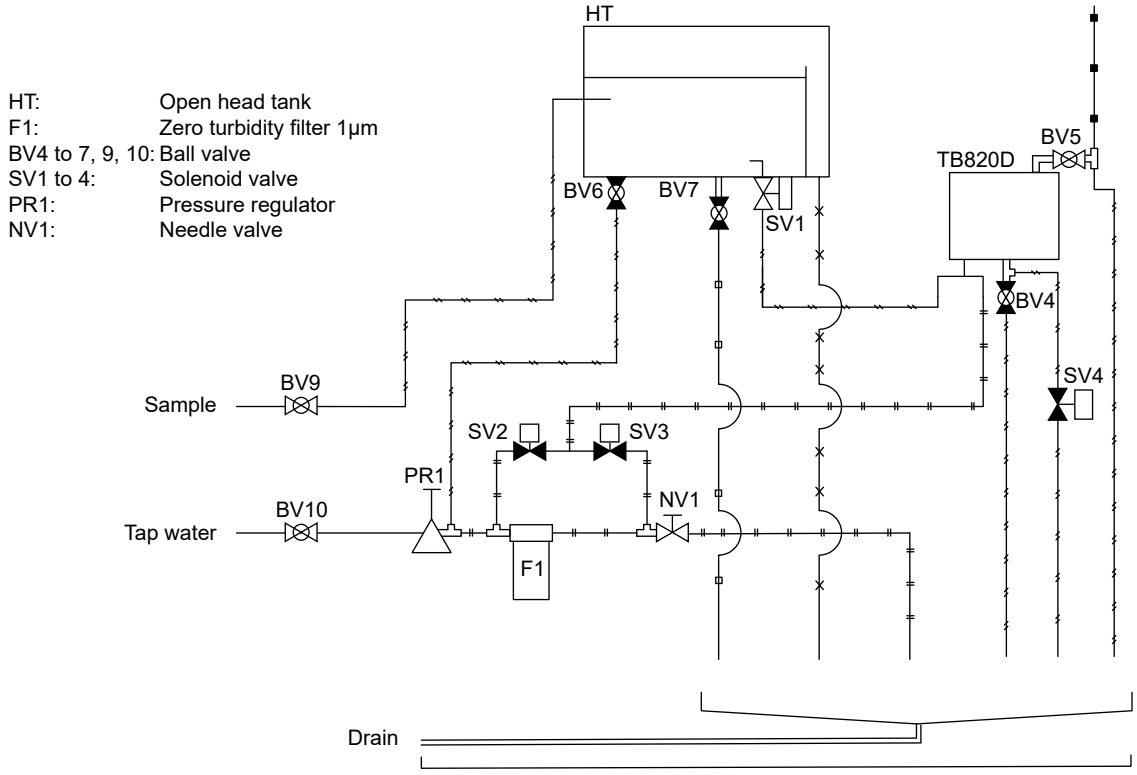
<PIPE> ø8/ø6 Polyethylene tube
ø12/ø9 Polyethylene tube
ø22/ø15 Flexible mesh-reinforced tube
ø26/ø19 Flexible mesh-reinforced tube
ø33/ø25 Flexible mesh-reinforced tube

Note: Regarding requirement of solenoid valve, see “3.1.1 Head tank and Piping Parts”.

Figure 34 Piping diagram for TB820D /D3 with automatic cleaning / without automatic zero calibration

- **Automatic cleaning, automatic zero calibration**

  Note: Needle valves are required to adjust the small flow rate by changing the valve opening.



<PIPE> ø8/ø6 Polyethylene tube
ø12/ø9 Polyethylene tube
ø22/ø15 Flexible mesh-reinforced tube
ø26/ø19 Flexible mesh-reinforced tube
ø33/ø25 Flexible mesh-reinforced tube

Note: Regarding requirement of solenoid valve, see “3.1.1 Head tank and Piping Parts”.

Figure 35 Piping diagram for TB820 /D3 with automatic cleaning / with automatic zero calibration

(1) Piping of the Sample Line to the Detector

This piping is for introducing a sample into the measurement cell of the detector. Install a head tank, valves and pipes by referring to the diagram in Figure 35.

1. For the piping to a head tank, use a hose/tube with sufficient diameter that provides adequate flow of sample in order to prevent clogging. If pressure exists in a sample, use an appropriate tube that can withstand the pressure, e.g., a rigid PVC tube.
2. To the sample inlet of the detector, attach a 3-way (tee) or appropriate fitting corresponding to the inlet’s connection size (Rc1/2 or 1/2 NPT). This allows switching of the sample flow and the zero water flow.
3. Connect a sample supply valve to one end of the 3-way tee fitting, and then connect a hose/tube with sufficient diameter that provides adequate flow of sample between the valve and the head tank.
4. Although the specified flow rate of the detector is in the range of 1 to 10 L/min, the actual flow rate should be at least 2 L/min by adjusting the head difference (H) of the head tank and selecting a hose/tube with appropriate diameter. This is due to the following reasons.
   - To increase the flow rate in the measurement cell of the detector to allow suspended matter to disperse uniformly.

- To prevent suspended matter to accumulate in the measurement cell.
- To dislodge air bubbles from the measurement cell and the measurement window surface.

Depending on the piping method, a flow rate of 5 to 10 L/min is obtained at a head difference (H) of 1 m with piping with nominal diameter of 16A.

5. To prevent clogging or stagnation of air bubbles in the pipeline, install the pipes so that no bends or stagnation occurs.

(2) Piping of the Sample Line from the Detector

This piping is for draining a sample from the measurement cell of the detector during measurement.

1. The sample outlet of the detector is Rc1/2 (or 1/2 NPT female) thread. Install a fitting corresponding to the thread and connect a hose/tube with sufficient diameter that provides adequate flow of sample, to route the sample from the detector to a drain pipe.
2. As shown in Figure 35, the sample from the detector should be discharged to the atmosphere at a point (h) higher than the measurement cell of the detector. If not, a siphon may be created and the measurement cell may not be filled with a sample. In addition, if the sample inflow stops, the sample will be drawn off and the measurement cell will be emptied, which can cause damage to the Pulse Generator for Clean Unit PG400, if used.

(3) Drain Piping

This piping is for draining a sample from the measurement cell of the detector and a head tank during cleaning, calibration, or other maintenance.

1. The drain of the detector is Rc1/2 (or 1/2 NPT female) thread. Install a fitting corresponding to the thread and connect a hose/tube with sufficient diameter that provides adequate flow of sample, to route the sample from the detector to a drain pipe. Install the pipe so that no bends or stagnation occurs.
2. As shown Figure 35, install the pipe so that the sample can be drained from the head tank to the drain pipe during measurement or maintenance.

(4) Piping of the Zero Water Line

This piping is for introducing tap water to a zero turbidity filter and then to the detector for zero calibration or measurement cell cleaning.

1. As shown in Figure 35, install a tap water valve and a zero water drain valve.
2. Connect a zero water supply valve to one end of the 3-way tee fitting attached to the sample inlet of the detector.
3. Install a fitting corresponding to the piping connection of the zero turbidity filter and connect a hose/tube that can withstand the pressure of tap water, such as a rigid PVC tube. The flow rate of zero water supply should be in the range of 1 to 3 L/min.
4. For the specifications of the zero turbidity filter, see GS 12E01B30-01EN.
5. To prevent corrosion of water inside the zero turbidity filter, allow water to flow through the filter and flow out from the zero water drain valve continuously at a flow rate of approximately 10 mL/min.

3.1.1 Head tank and Piping Parts

Sample introduced into TB820D needs to be free from air bubbles by using a Head tank to stabilize the pressure in piping and the flow rate.

Select a head tank that matches the turbidity value of the sample from the following table.

Table 1 Recommended cable for solenoid valve

Name	Part No.	Description
Pressurized head tank for low turbidity	K8003WA	2 NTU or less, same as option code /D1
Simple head tank	K8003YA	over 2 NTU to 10 NTU, same as option code /D2
Open head tank	K9658YR	over 2 NTU, same as option code /D3

Table 2 Specification of a pressure regulator and valves

Name	Part No.	Port size	Max.Pressure
Pressure regulator	K8004QG	Rc 3/4	750 kPa
Check valve	K9658ND	PT 1/4	700 kPa
Needle valve	L9852CB	Rc 1/4	-

■ Pressurized head tank (/D1)

Overflow does not open to the atmosphere. Drain through the needle valve.

Squeeze the needle valve to maintain process pressure. Suppresses the generation of bubbles.

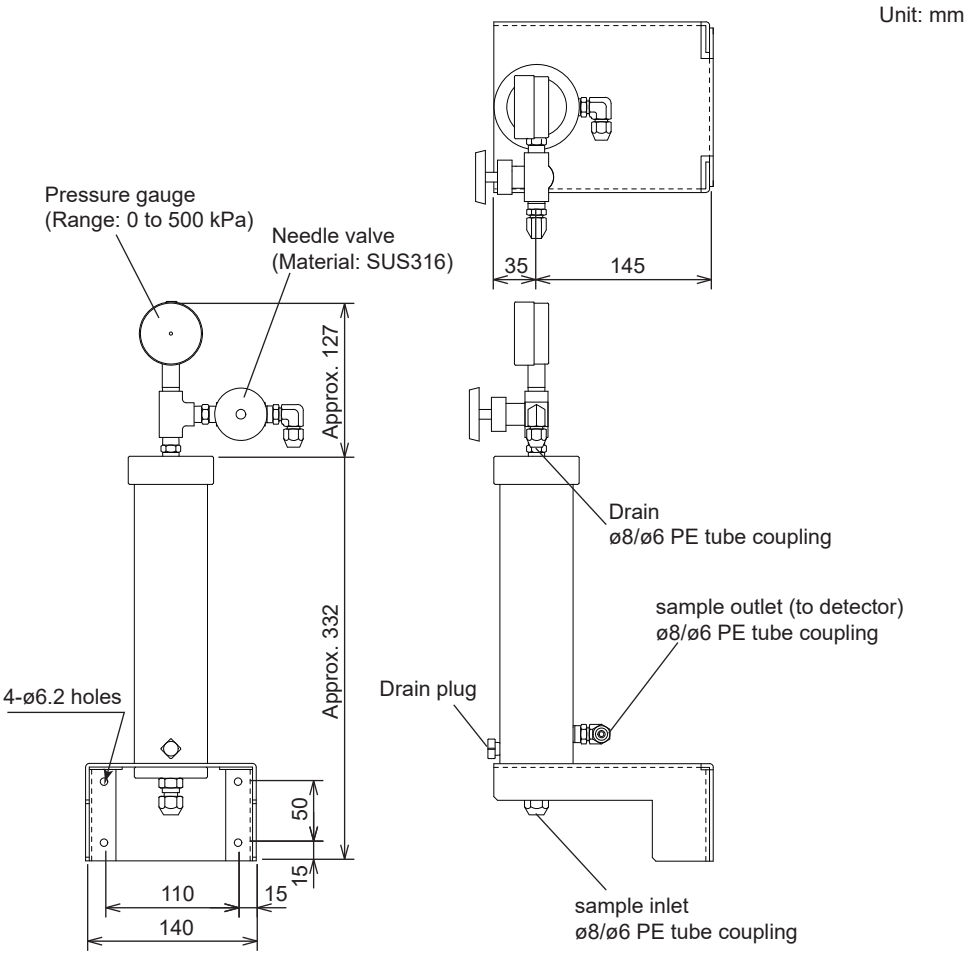


Figure 36 Pressurized Head Tank for Low Turbidity (2 NTU or less)

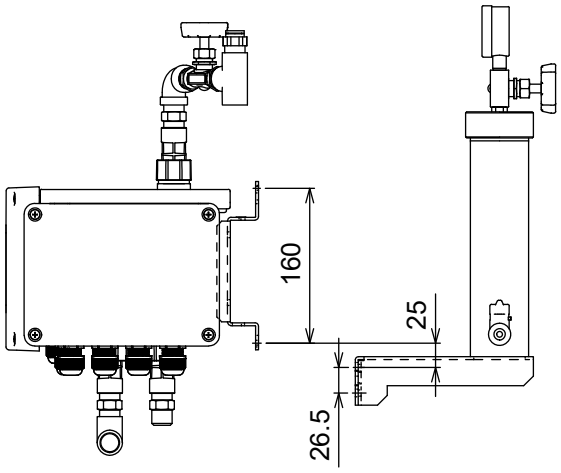


Figure 37 Pressurized head tank mounting position

Install the head tank higher than the detector by exceeding the dimensions shown in the Figure 37.

Simple head tank (/D2)

To meet the requirement of the flow rate , provide a head tank that also works as a deaeration tank (constant-level tank) and connect the measured water supply to the head tank. The head tank needs to be installed at an adequate height so as to regulate the flow rate. Refer to Figure 38 and Figure 40 which show the relationship between the positions of the head tank and detector.

Prevent clogging and bubbles from collecting inside the tube, by cutting the tube to an adequate length to ensure that no bends occur or water or bubbles become trapped.

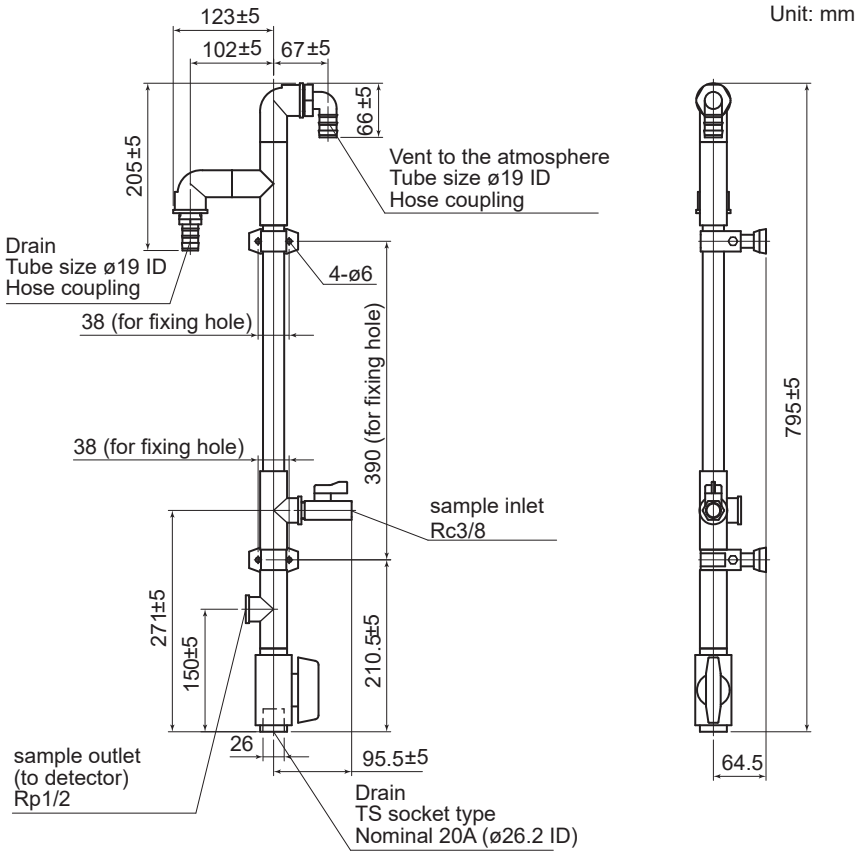


Figure 38 Simple head tank (for 2 NTU to 10.0 NTU) (/D2)

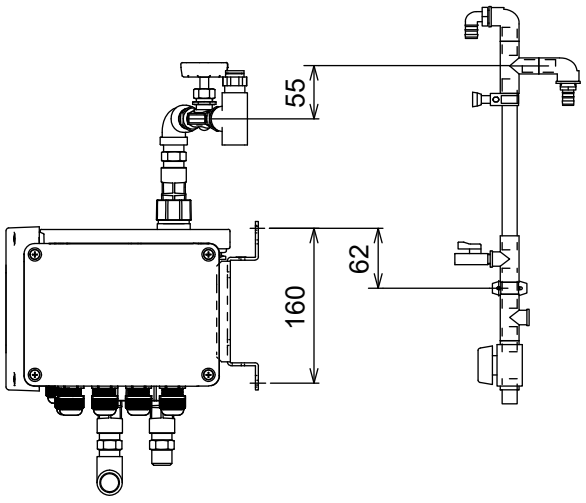


Figure 39 Simplified head tank mounting position

Install the head tank higher than the detector by exceeding the dimensions shown in the Figure 39.

Open head tank (/D3)

Unit: mm

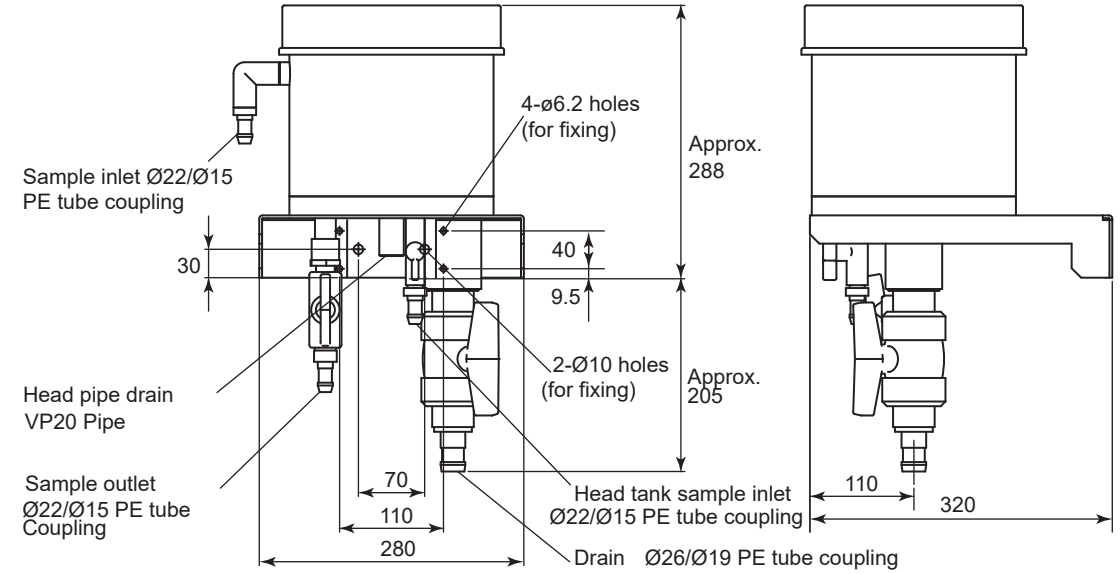


Figure 40 Open Head tank (for over 2 NTU) (/D3)

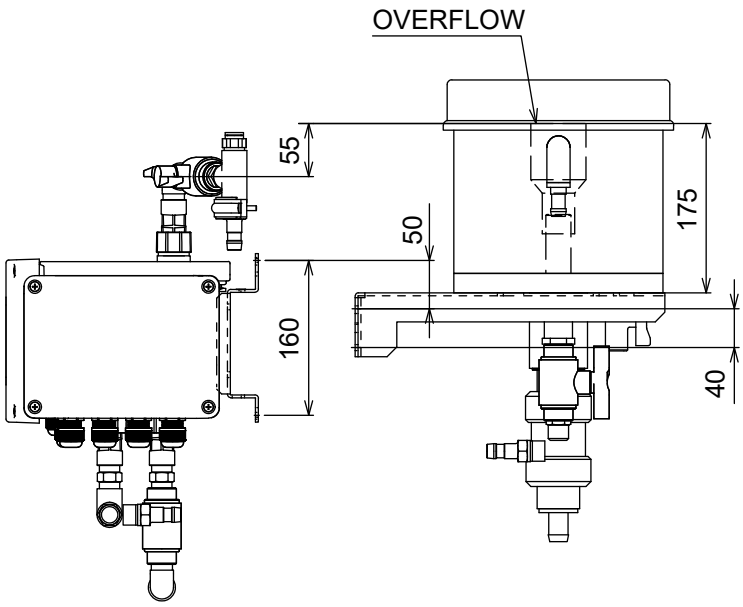


Figure 41 Open head tank mounting position

Install the head tank higher than the detector by exceeding the dimensions shown in the Figure 41.

3.1.2 System without a Head Tank

This is a simple system where a sample is taken from the process and directly introduced into the detector. This system configuration can be used when a sample contains a negligible amount of air bubbles or when the turbidity of a sample is high and the effect of air bubbles is nonsignificant. By installing a throttle at the detector outlet side, it is possible to prevent pressure change and thus air bubbles from occurring in the piping from a sampling point to the detector outlet.

CAUTION

Sample conditions and ambient temperature must meet the specifications: maximum pressure: 500 kPa; sample temperature: 0 to 50°C; ambient temperature: -5 to 55°C. Any failure to meet the specifications may damage the detector or other instruments.

When the sample pressure is reduced by using a pressure regulator or by other means, air bubbles may form in the piping. In that case, consider the use of an open head tank.

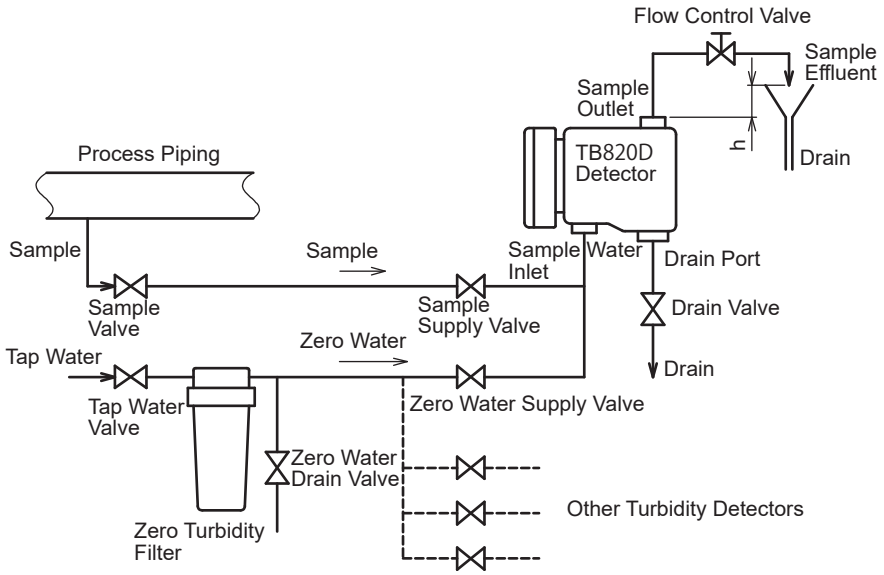
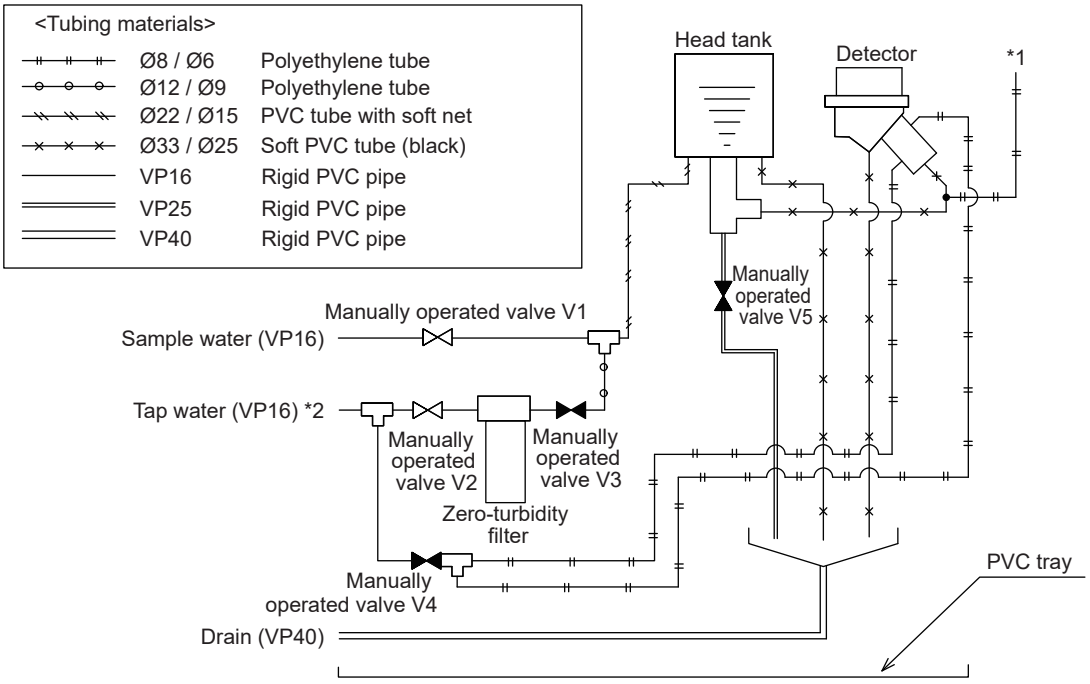


Figure 42 The piping diagram of a system without a head tank

3.2 TB830D (-NN, -A5) Piping

The figure shown is an image. Use this as a reference when configuring your system.

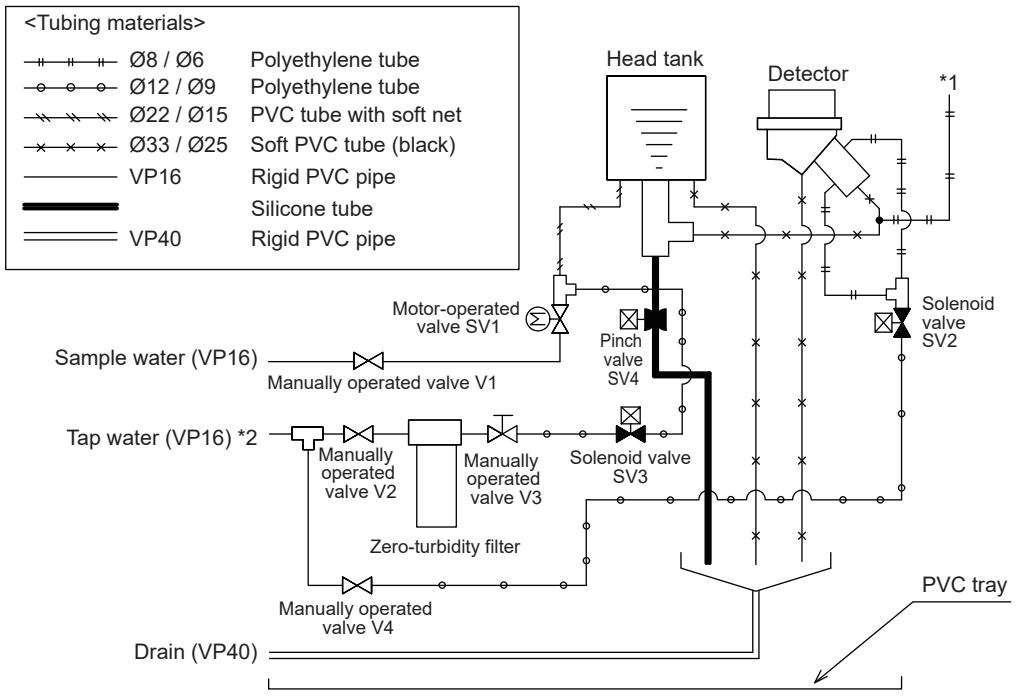
-NN Piping



*1: Option Code /L (Air denoising for Low Range)
*2: You should install a check valve just before the tap water pipe to prevent backflow.

Figure 43 Piping diagram for TB830D-NN

-A5 Piping



*1: Option Code /L (Air denoising for Low Range)
*2: You should install a check valve just before the tap water pipe to prevent backflow.

Figure 44 Piping diagram for TB830D-A5

3.2.1 Piping type

(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 Wash cleaning inlet of the detector is sealed with a blind plug.

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

(4) Zero Water piping

As the zero calibration water, tap water is filtrated and fed to the detector. As with the measured water, the zero calibration water must also be connected to the head tank to meet the requirement of the flow rate of the water fed to the detector. Provide a switching valve on the inlet of the head tank and connect the zero calibration water pipe to the valve so as to allow feed to the head tank to be switched over between the measured water and zero calibration water.

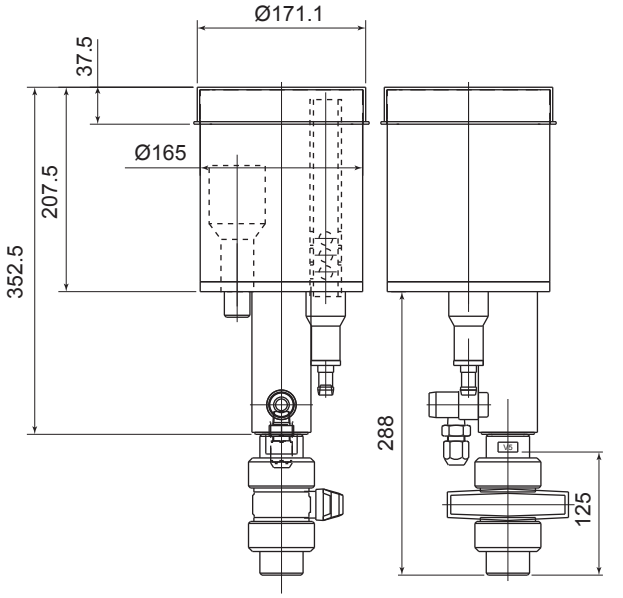
3.2.2 Head tank

Sample introduced into TB830D needs to be free from air bubbles by using a Head tank to stabilize the pressure in piping and the flow rate. Use the head tank of the following table.

Part No.	Description
K9411GC	Usable in all ranges from 0-2000 NTU

To meet the requirement of the flow rate (1.5 to 2.0 L/min), provide a head tank that also works as a deaeration tank (constant-level tank) and connect the measured water supply to the head tank. The head tank needs to be installed at an adequate height so as to regulate the flow rate between 1.5 and 2.0 L/min. Refer to Figure 45 and Figure 46 which show the structure of a head tank and the relationship between the positions of the head tank and detector.

For the piping between the head tank and detector, use the black soft PVC tube (O.D. 33 / I.D. 25 mm) that comes with the TB830D. Prevent clogging and bubbles from collecting inside the tube, by cutting the tube to an adequate length to ensure that no bends occur or water or bubbles become trapped.



Weight: Approx. 2.2 kg

Figure 45 Head tank dimensions

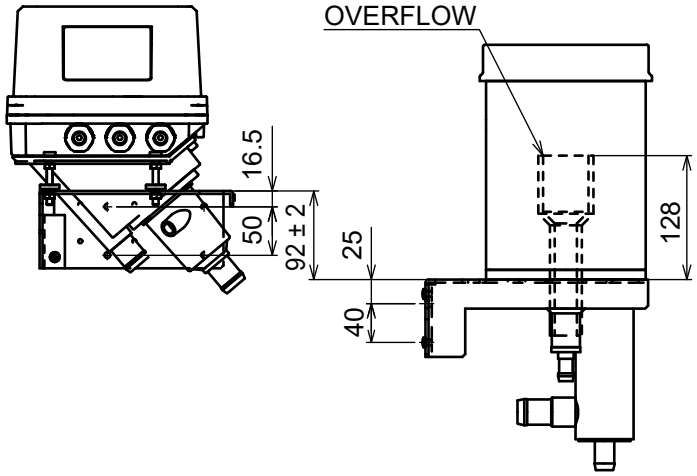


Figure 46 Open tank mounting position

4. Wiring

4.1 TB820D wiring

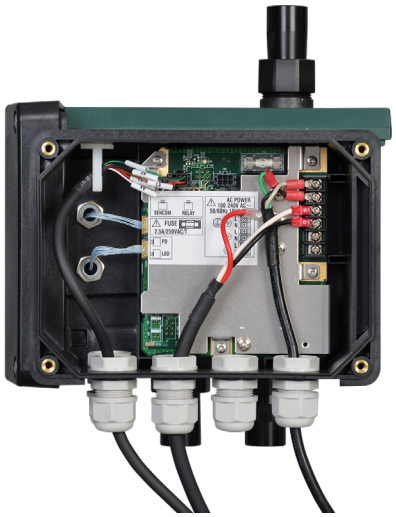
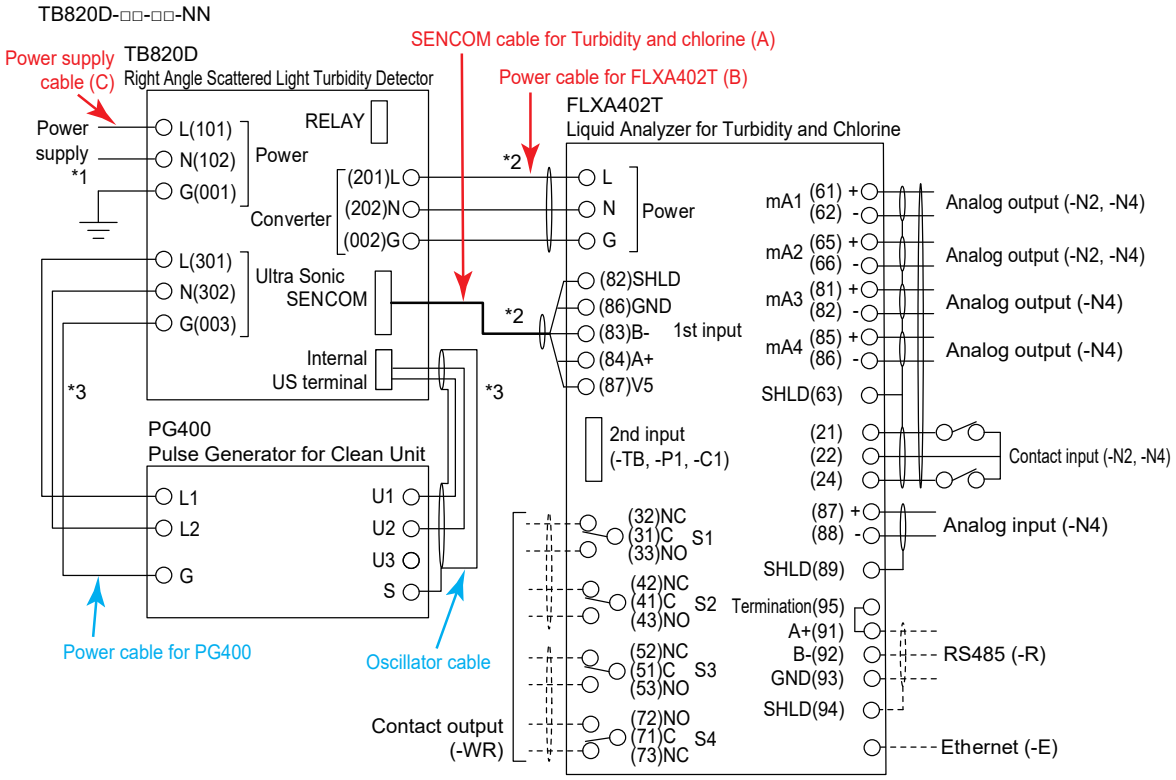


Figure 47 TB820D cover opened

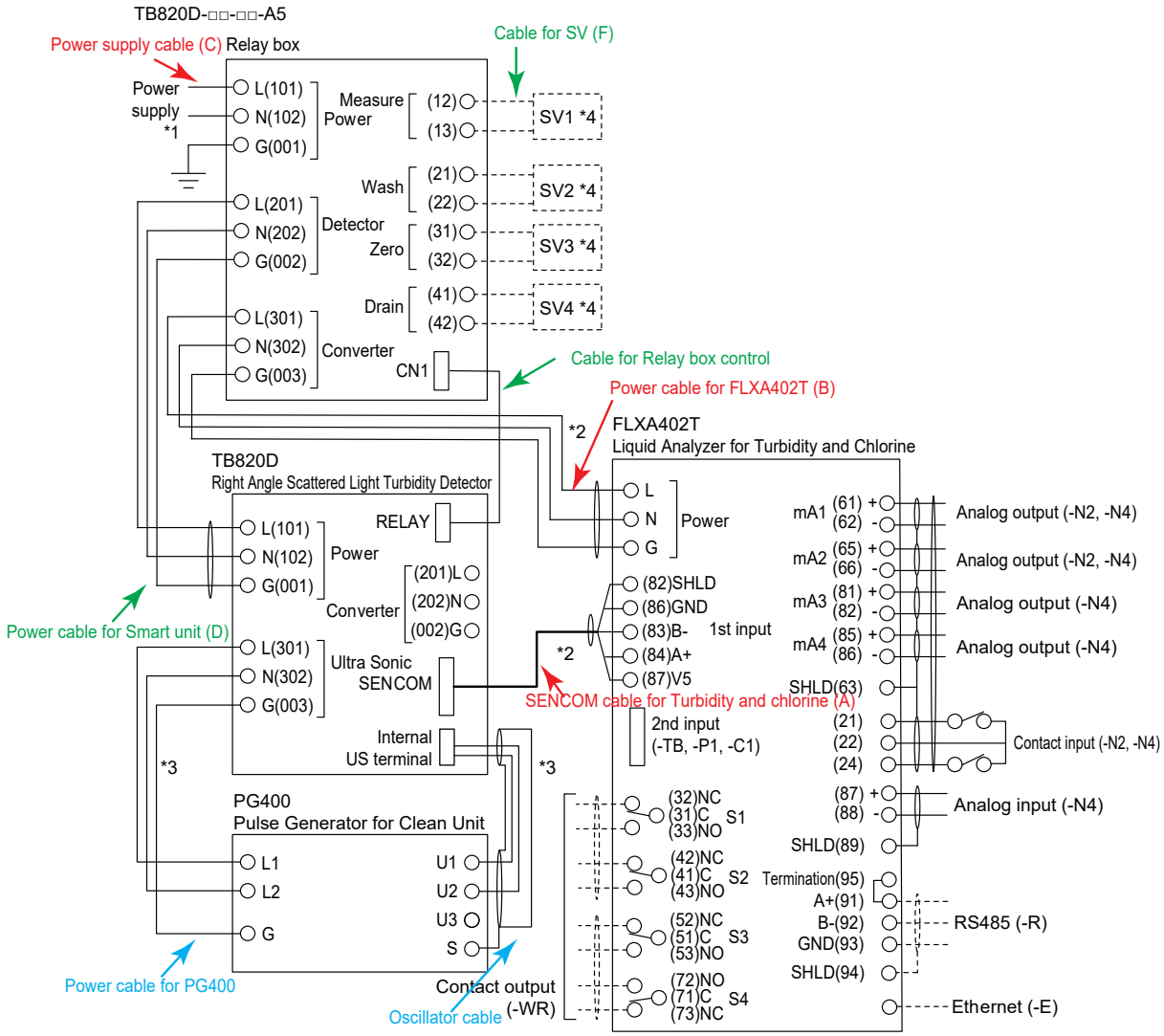
For external wiring of FXLA402, read FLXA402T Operation of Converter IM 12A01G01-02EN section 2.5.



*1: Power terminal "G" on TB820D must be grounded (ground resistance: 100 ohm or less).
In case of selecting -NN as Relay box for solenoid valve, power supply cable connects with L(101), N(102) and G(001) in TB820D.
*2: The connection cables are 1 m in length normally.
They are available with /L02, /L03, /L05, /L10 or /L20 depending on the length you need.
*3: When suffix code -U1 is specified, PG400 should be purchased separately.
Neither Ultrasonic oscillator cables nor power cable are supplied with the product. Purchase them separately.
See GS 19C01B05-01EN.

Figure 48 Wiring TB820D-□□-□□-NN

In case of selecting -A5, purchase the solenoid valve corresponding input power supply and frequency.



*1: Power terminal "G" on Relay box must be grounded (ground resistance: 100 ohm or less).
In case of selecting -A5, power supply cable connects with L(101), N(102) and G(001) in Relay box.
*2: Connection cables are 1 m in length normally.
They are available with /L02, /L03, /L05, /L10 or /L20 depending on the length you need.
*3: When suffix code -U1 is specified, PG400 should be purchased separately.
Neither Ultrasonic oscillator cables nor power cable are supplied with the product.
Purchase them separately. See GS 19C01B05-01EN.
*4: In case of selecting -A5, purchase the solenoid valve corresponding input power supply and frequency.
See ● Solenoid valve (SV1 to SV4).

Figure 49 Wiring TB820D-□□-□□-A5

CAUTION

Turn off power supply to TB820D before wiring. Power rating must comply with TB820D specifications. Power voltage must match with the one indicated on the name plate.

WARNING

- You must install external power supply switch or circuit breaker for power supply.
- The external power supply switch or a circuit breaker must comply with a current rating of 5Aor IEC60947-1 or IEC60947-3
- Yokogawa recommend installing the external power supply switch, circuit breaker and TB820D all in the same location.
- Install the external power supply switch or circuit breaker to the place where operators access easily. To alert users, put a label on the external power switch.
- Fix securely onto constructions or walls all power lines including wire cables of power supply by using stanchion, cable rack, conduit or vinyl band.
  Unplugged cables are dangerous and may cause an electric shock.

CAUTION

- When you open the front cover, make sure the screws are completely out of the screw holes, and then open the front cover slowly in order not to damage the threaded parts on the housing. If the threaded parts are damaged and the screws cannot be tightened, the waterproof performance will deteriorate.
- Don’t lose the four screws of the front cover.

When wiring TB820D, first remove the cover of the smart unit. Provide the wiring with the cover removed. The product is shipped with cable gland attached to the cable entry.

When protecting cables with conduits, use conduit adapters (option code: /CB3, /CD3, /CF3)

For how to provide conduit adapters, see FLXA402T Installation and Wiring IM 12A01G01-02EN section 2.4.

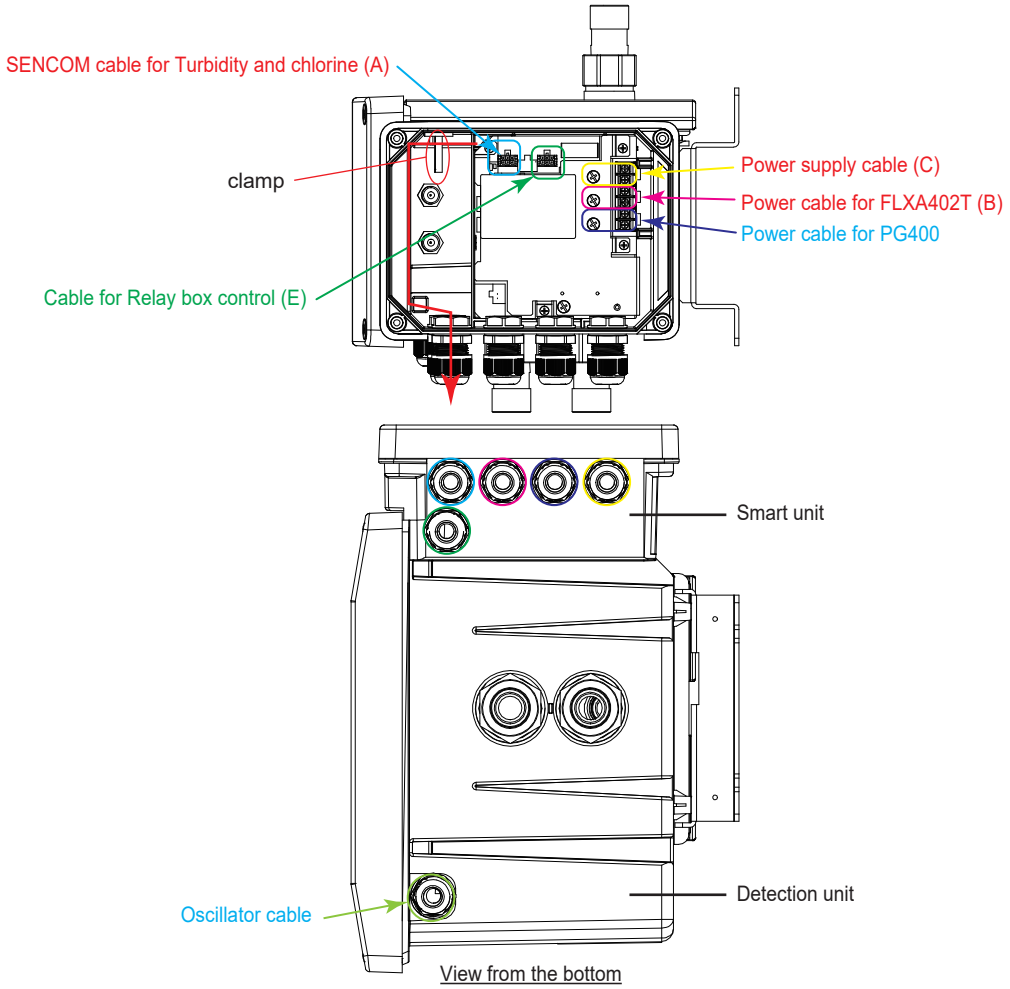


Figure 50 Wiring TB820D Smart unit side

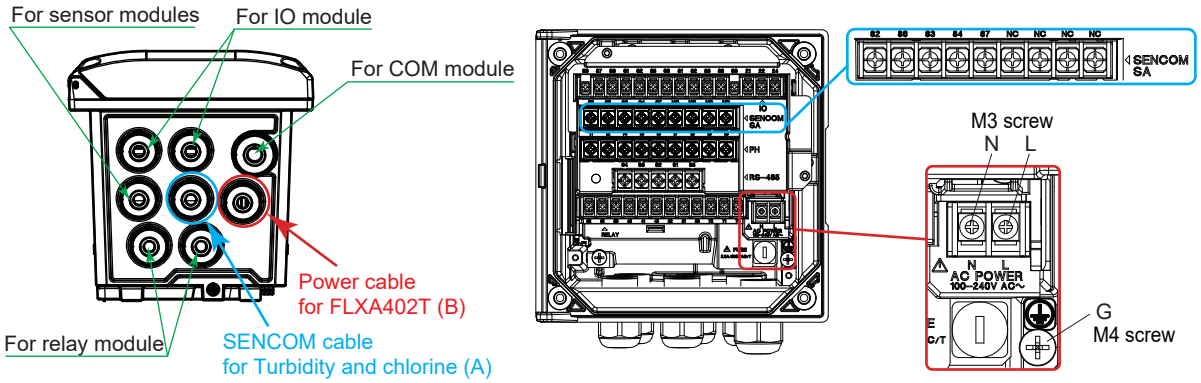


Figure 51 Wiring FLXA402T side

WARNING

Never let the power cable touch SENCOM cable, resulting in failure to comply with safety requirements.

WARNING

- Use wiring cables with heat resistance above 75 °C, waterproof rating IP65 or higher.
- Tightening torque to the four screws of Smart Box cover is 1.4 N·m.
- For power supply, wire cables with a flammability rating of UL 2556 VW-1 or equivalent

CAUTION

- When you open the front cover of FLXA402T, make sure the screws are completely out of the screw holes, and then open the front cover slowly in order not to damage the threaded parts on the housing. If the threaded parts are damaged and the screws cannot be tightened, the waterproof performance will deteriorate.
- Be careful not to lose the four screws on the front cover of the FLXA402T.

4.1.1 SENCOM cable for turbidity and chlorine (A)

Dedicated cable is supplied with the product. For the wiring of FLXA402T, read FLXA402T Installation and Wiring IM 12A01G01-02EN section 2.6.1.

4.1.2 Power cable for FLXA402T (B)

Dedicated cable is supplied with the product.

Both ends are terminated at different lengths. Connect the longer one (approx. 80 mm) to Smart unit side, the shorter one (approx. 50 mm) to FLXA402T side.

Cables have no name on them so wire them by color: L; Black, N; White, G; Red.

Fasten the M3 screw (L, N) (Figure 51) with the tightening torque of 0.6 N·m, M4 screw (G) with 1.4 N·m.

4.1.3 Power supply cable (C)

WARNING

- You must install external power supply switch or circuit breaker for power supply.
- The external power supply switch or a circuit breaker must comply with a current rating of 5Aor IEC60947-1 or IEC60947-3
- Yokogawa recommend installing the external power supply switch, circuit breaker and TB820D converter all in the same location.
- Install the external power supply switch or circuit breaker to the place where operators access easily. To alert users, put a label on the external power switch.
- Fix securely onto constructions or walls all power lines by using cable rack, conduit or vinyl band. Unplugged cables are dangerous and may cause an electric shock.

Provide the smart unit with a power supply whose voltages and frequencies conform to the specifications. Grounding wiring also must be made to prevent electric shock and to prevent the instrument from being affected by noise. Power supply and grounding cable must be provided by customers. The specification of the cables is described in the following table.

Table 3 Specification of power cable

Rated voltage	300V or above
Rated temperature	75°C or above
Number of cores, Wire diameter	3 L, N, G: 0.75 to 2.5 mm2 (AWG18 to14)
Sheath outer diameter	Ø6.5 to Ø12.5 mm
Cable termination	Strip the outer sheath of 80 mm, provide the termination. L, N: M3 round terminal G: M4 round terminal

Connect the power supply cable to the terminal.

This instrument does not have a power supply switch. The power supply line must be equipped with a double switch. Grounding wiring connected to the smart unit shall satisfy Class D (grounding resistance: 100 Ω or less). Fasten the M3 screw (L, N) with the tightening torque of 0.6 N·m, M4 screw (G) with 1.4 N·m. (Figure 51)

4.1.4 Wiring with PG400

When the suffix code -U1 (Oscillator for ultrasonic cleaning) is specified, PG400 Pulse Generator for Clean Unit is supplied with the product.

For PG400, read PG400 User's Manual IM 19C01B05-01EN.

Provide wiring of Oscillator cable and Power cable for PG400, by referring to Figure 48, Figure 49, or Figure 50.

Connect the Cable for PG400 to Detection unit, not to Smart unit of TB820D.

Connect the connector as shown on the left in Figure 52 and thread it through the clamp as shown on the right. Make sure that the connector part is above the clamp. Run the cable along the side of the housing and lay it in the back.

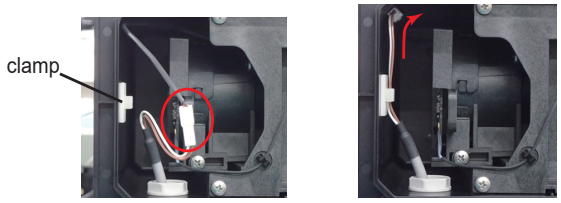


Figure 52 Cable for PG400

4.1.5 When Relay box for solenoid valve is included

When the suffix code -A5 (Relay box for solenoid valve) is specified, a Relay Box is included as shown in the Figure 49. Wire the cables of Power cable for Smart unit (D), Cable for Relay box control (E), and Cable for SV (F).

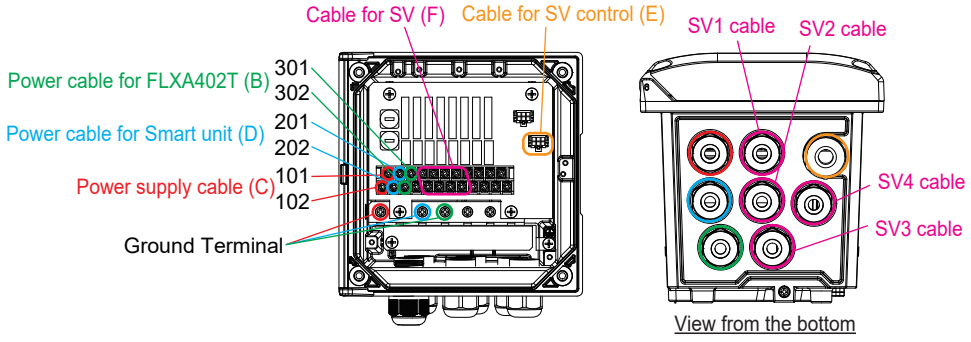


Figure 53 Wiring Relay Box

Power cable for Smart unit (D)

Dedicated cable is supplied with the product.

Table 4 Power cable for Smart unit

Cable color	Relay Box terminal No.	Smart Unit terminal No.
Black (L)	201	101
White (N)	202	102
Red (G)	002	001

Fasten the M3 screw (L, N) with the tightening torque of 0.6 N·m, M4 screw (G) with 1.4 N·m. (Figure 53)

Cable for Relay box control (E)

Dedicated cable is supplied with the product.

Connect to the designated connector by referring to Figure 49, Figure 53.

Cable for SV (F)

Solenoid valve and solenoid valve cable are provided by customers. See Table 5 and Table 8 for the required specifications. Yokogawa also provides these products.

Solenoid valve is not supplied with Relay box for solenoid valve. Purchase separately an appropriate solenoid valve.

Table 5 Requirement for sampling system

	Port size	Valve type	Max. working pressure	Max. Working pressure differential
SV1	Rc 1/2	N.O.(*1)	≥ 1.5 MPa	≥ 0.7 MPa
SV2, 3	Rc 1/4	N.C. (*2)	≥ 5.0 MPa	≥ 0.4 MPa
SV4	Rc 3/8	N.C. (*2)	≥ 2.0 MPa	≥ 1 MPa

*1: Valve closes when energized.
*2: Valve opens when energized.

Table 6 Example

	Voltage	100 V	200 V	220 V
SV1	Part number	B1043ET	B1045ET	B1046ET
	Model code	VXZ2B2GH	VXZ2B2GK	VXZ2B2GZ1G
	Manufacturer	SMC Corporation		
SV2, 3	Part number	B1035ET	B1037ET	B1038ET
	Model code	AB41-02-6-D2GSAC100V-ST	AB41-02-6-D2GSAC200V-ST	AB41-02-6-D2GSAC200V-ST
	Manufacturer	CKD Corporation		
SV4	Part number	B1031ET	B1033ET	B1034ET
	Model code	ADK11-10A-D2GSAC100V-ST	ADK11-10A-D2GSAC200V-ST	ADK11-10A-D2GSAC220V-ST
	Manufacturer	CKD Corporation		

Table 7 Recommended cable for solenoid valve

Part number	K8004TH (for SV1), K8004TJ (for SV2), K8004TK (for SV3), K8004TL (for SV4)
Cable length	1.2 m
Rated voltage	300 V
Specification	AWG20 2-core cable, M3 round terminal

Table 8 Specification of Solenoid valve cable

Cable length (*)	3000 mm or less (*1)
Rated voltage	300V or above
Rated temperature	75°C or above
Specification	AWG 20 2-core cable
Sheath outer diameter	Ø6.5 to Ø12.5 mm
Cable termination	On the terminals of Terminal Box, strip the outer sheath of 80 mm, provide the termination M3 round. On the solenoid valve terminals, the cable termination varies depending on the type of terminal.

(*) The specification shall be satisfied to comply with EMC regulation.

Connect the cable for SV by referring to Figure 49 and Table 8.

- **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 TB820D and FLXA402T, however, be aware of the following.

  (a) 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”.

  (b) When Type of TB820D, FLXA402T is “-AD” (for CSA)

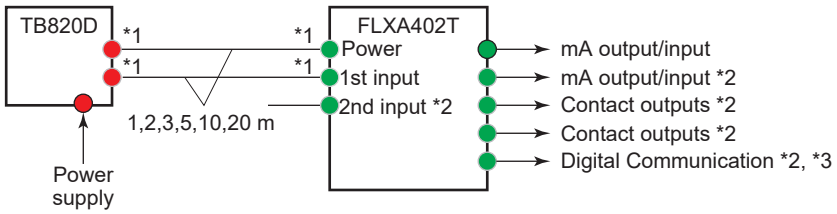
  Order a plate described below to install a conduit adapter for “-AD”, otherwise the CSA safety standards will not be satisfied.

  For “-AD” (for CSA), specify TB820D “/C□3” on TB820D side.

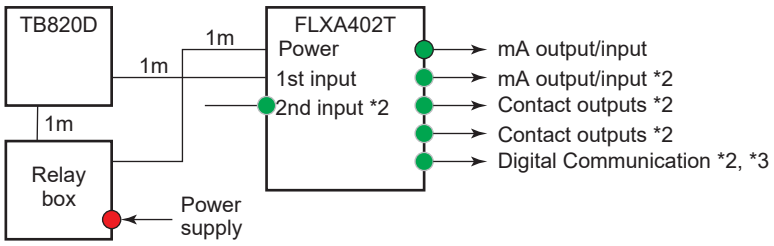
  If “/C□3” is selected, the plate is shipped with the product. Be sure to install the plate on the Smart unit of TB820D.

Next diagram shows the position of each cable entry (●●●) where you can attach conduit adapters for the conduit.

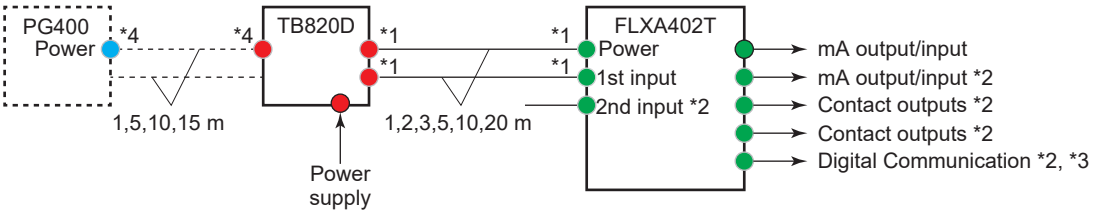
• TB820D-....-NN



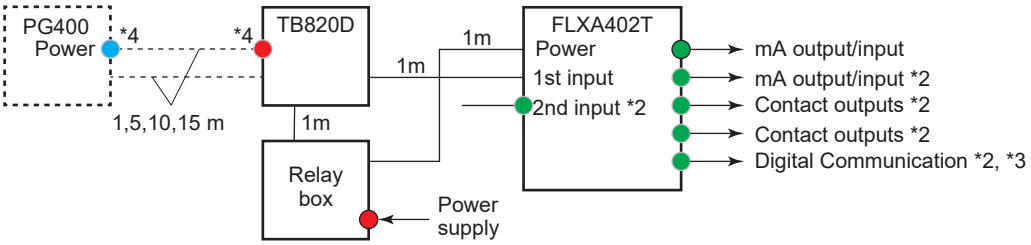
• TB820D-....-A5



• TB820D-....-NN (-U1)....



• TB820D-....-A5 (-U1)....



*1: The standard cable length between FLXA402T and TB820D is 1 m. You can change the cable length by specifying a code from Option code.

*2: The number of cable entry holes to be used are defined by the specification as below.

Spec.	2nd Input		mA output/input		Contact Outputs		Digital Communication		
Code	-NN	the others	-N2	-N4	-WR	-NR	-N	-E	-R
Required No.of cable entry holes	0	1	1	2	2	0	0	1*	1

*: Conduit exclusively for Ethernet

*3: For Ethernet cable, use Ethernet dedicated conduit adapter.

*4: When the cable between PG400 (Pulse generator for clean unit) and TB820D is long, use the conduit adapters on both sides of the cable entry. However, the conduit cannot be used for the oscillator cable.

Figure 54 TB820D system configuration

If you need more conduit adapters to meet the requirement, purchase additionally. See the table below.

Conduit adapter (for additional purchase)

Type	Parts number	Quantity	Remark
G 1/2 (Cable gland for adapter + adapter)	K9703WF	4 set	for Option code /CB□
1/2 NPT (Cable gland for adapter + adapter)	K9703WG	4 set	for Option code /CD□
M 20 x 1.5 (Cable gland for adapter + adapter)	K9703WH	4 set	for Option code /CF□

When you select PG400 "/C□" (conduit adapter), two sets of conduit adapters come with the product. After completing the conduit work on PG400, you can use the unused conduit adapters on TB820/FLXA402T.

4.2 TB830D Wiring

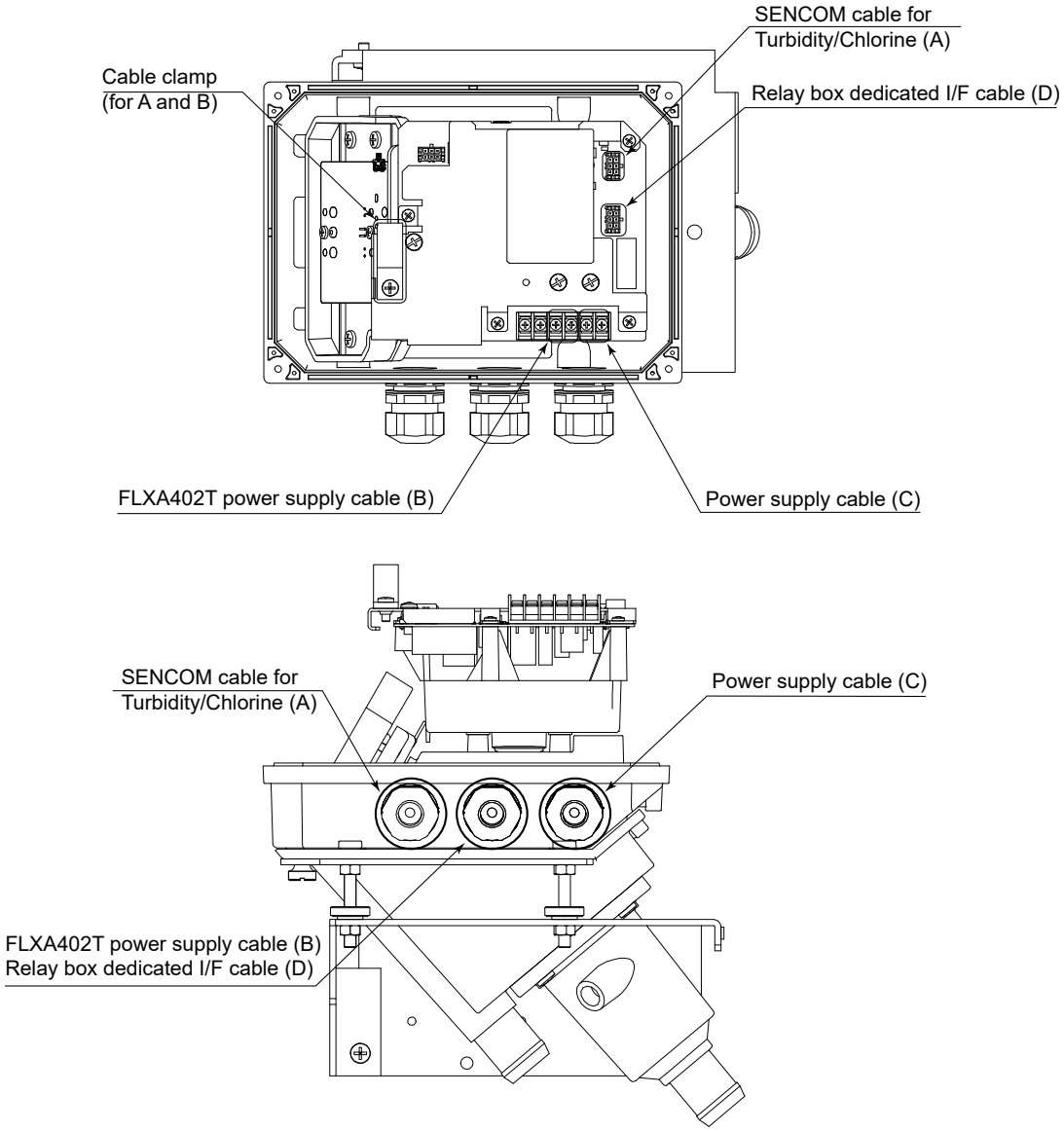


Figure 55 TB830 Side Wiring

For no sampling system (without Relay box for NN solenoid valve).

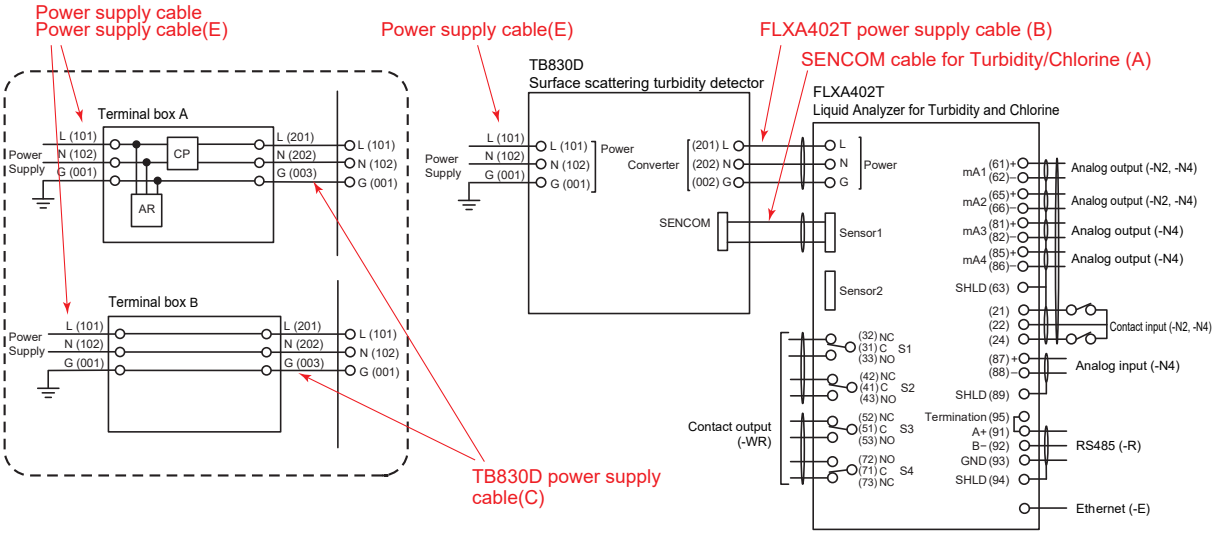
If there is no sampling system (with Relay box for -A5 solenoid valve), refer to “4.2.5 Without a sampling system and with a Relay box for solenoid valve”.

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

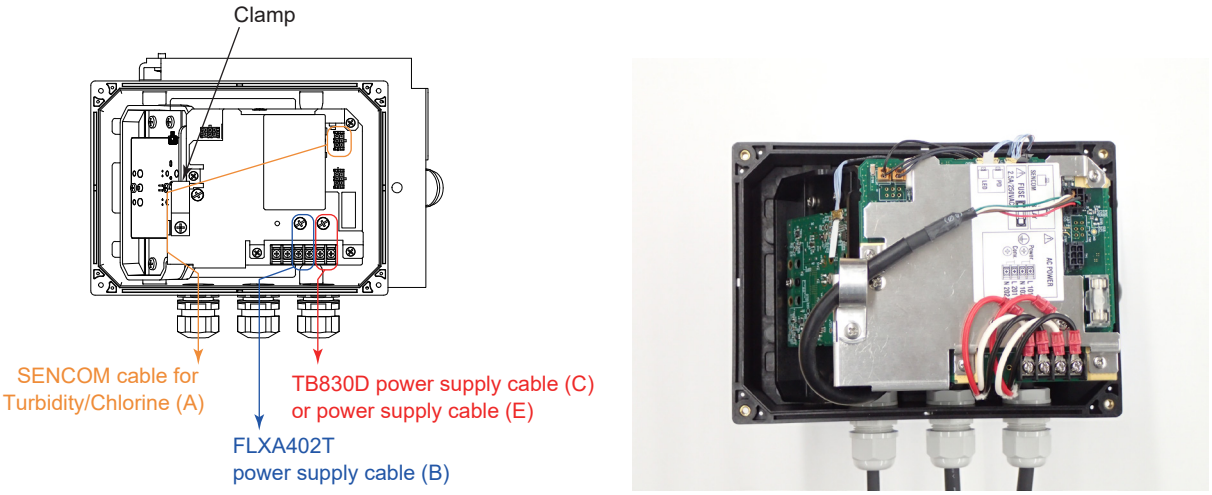
Be sure to shut off the power supply prior to working.

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 56 Wiring diagram without sampling system (without Relay box for NN solenoid valve)



- Open detector cover to wire.
- Wire SENCOM cable for turbidity/chlorine 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. Tightening torque is 1.5 N·m.

Figure 57 TB830D WIRING

WARNING

Wire power supply cable (TB830D power supply cable (C) or power supply cable (E)) in Figure 55 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 tightended to 1.5 N·m.

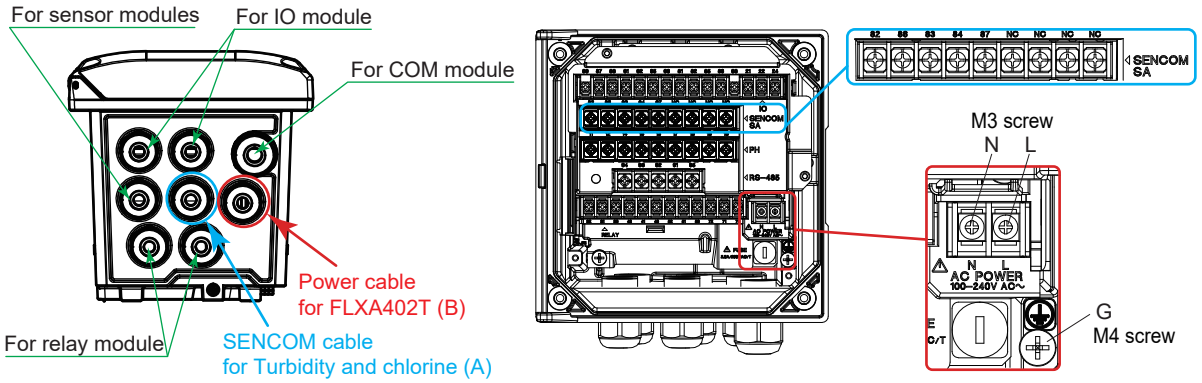


Figure 58 Wire FLXA402T

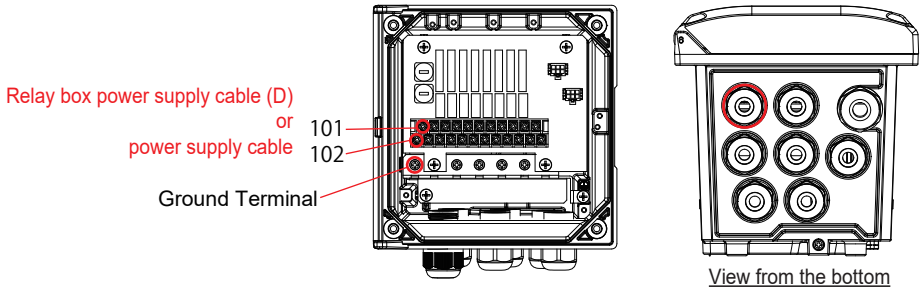


Figure 59 Wire the Relay box

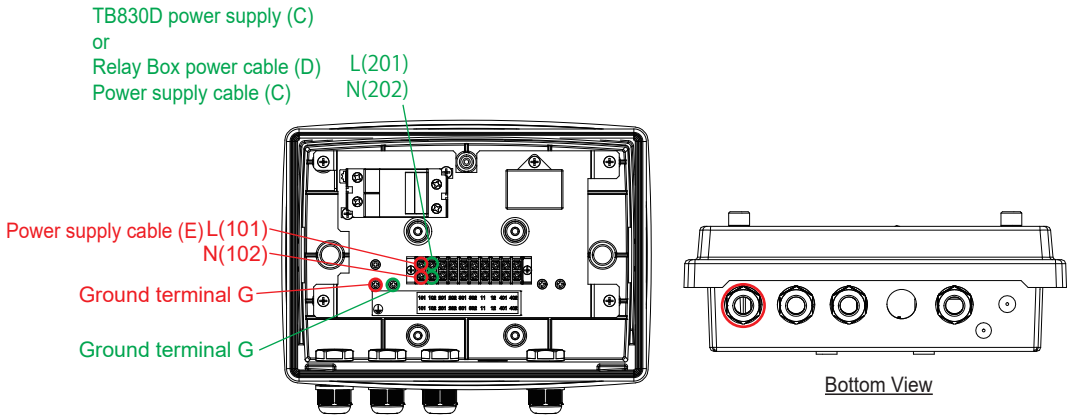


Figure 60 Wiring of Terminal box A

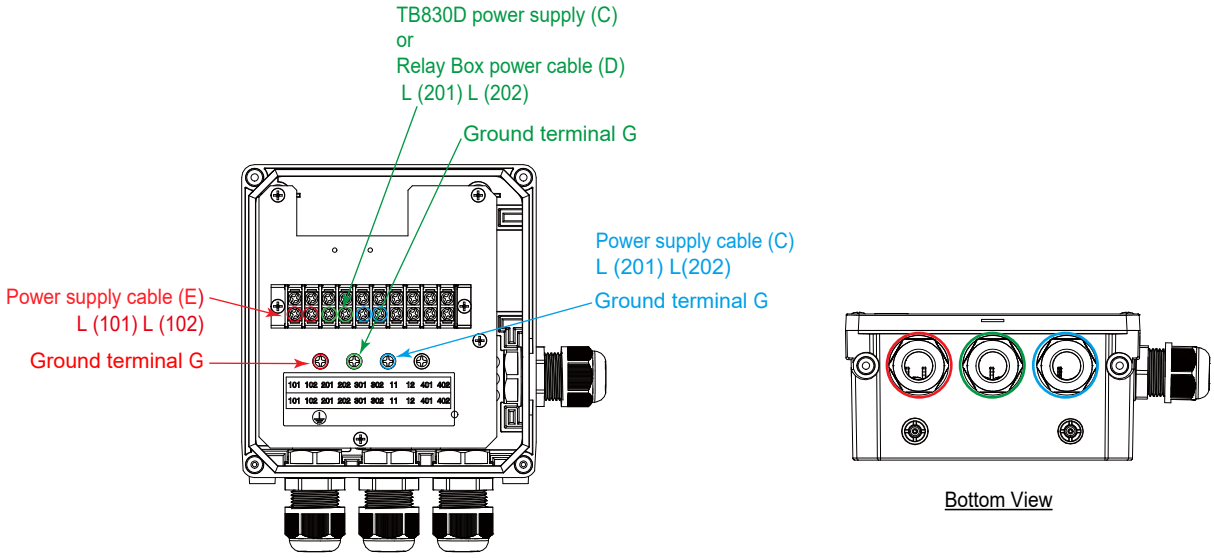


Figure 61 Wiring of Terminal box B

4.2.1 SENCOM cable for Turbidity/Chlorine (A)

Without sampling system (-NN,-A5). For (-A5), refer to “4.2.5 Without a sampling system and with a Relay box for solenoid valve”.

Dedicated cables are included. Refer to Figure 55 and Figure 57 for wiring. Refer to Section 2.6.1 of FLXA402T Installation Manual (IM12A01G01-02EN) for the wiring on FLXA402T.

4.2.2 FLXA402T power supply cable (B)

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

Dedicated cables are included. Refer to Figure 55 and Figure 57 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 .

4.2.3 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 55, Figure 58, Figure 59, and Figure 60 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 .

4.2.4 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 55, Figure 58, Figure 59, and Figure 60 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 9 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.
- Wire the wire so that it meets 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.

- **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.

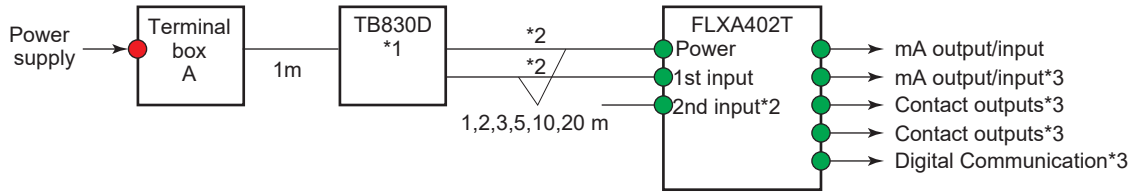
  You can specify the conduit adapter by Option code for both TB830D and FLXA402T, however, be aware of the following.

  - When FLXA402T Digital communication “-E” (Modbus TCP/IP) is selected

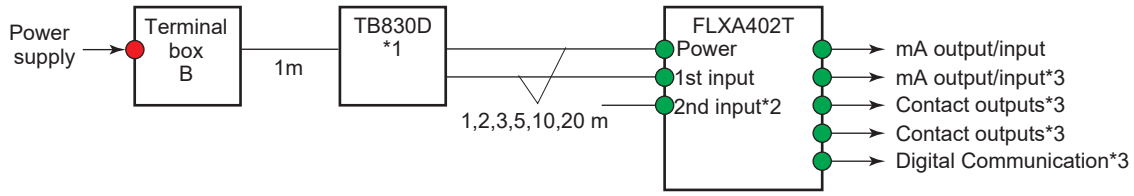
    If you attach a conduit adapter on the Modbus TCP/IP cable entry, you need an Ethernet dedicated conduit adapter. Be sure to specify FLXA402T “/C□6”.

Next diagram shows the position of each cable entry (●●●) where you can attach conduit adapters for the conduit.

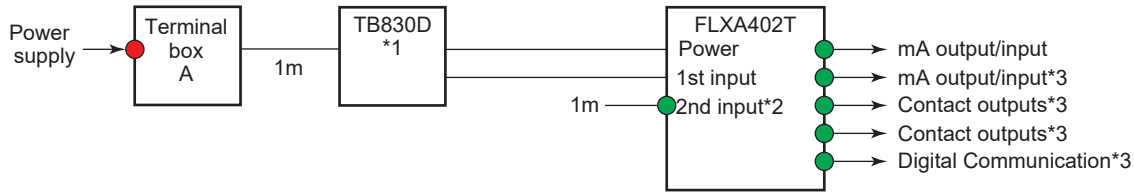
• TB830D-....-NN-□N-NN-NN/ARS/C□



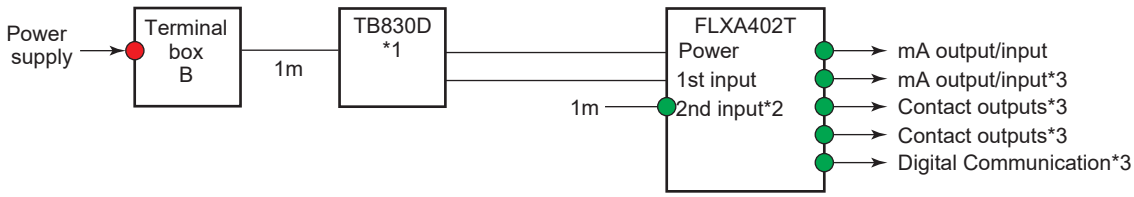
• TB830D-....-NN-□N-NN-NN/C□



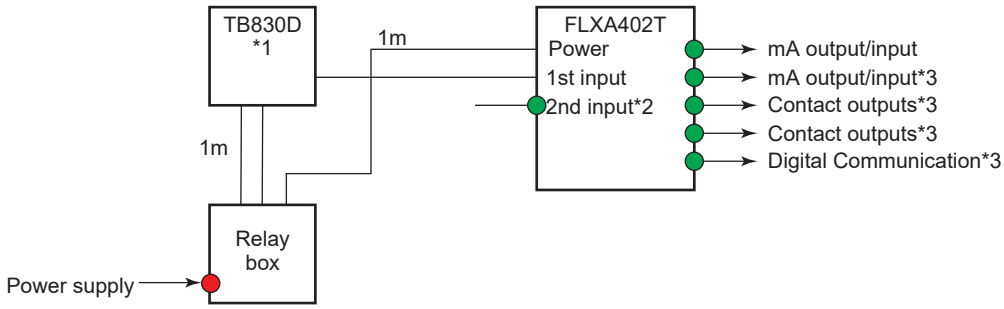
• TB830D-....-A1-NN... /ARS/C□ *4



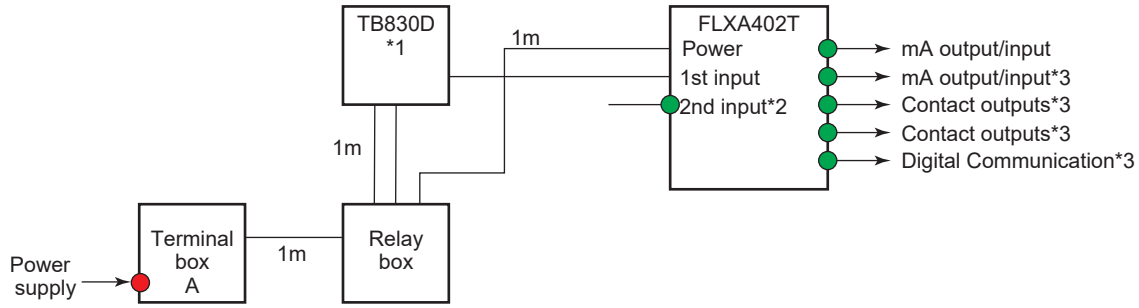
• TB830D-....-A1-NN... /C□ *4



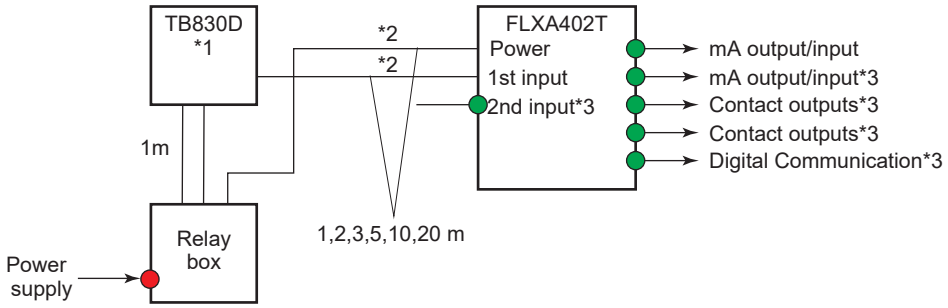
• TB830D-....-A2--NN... /C□ *4
TB830D-....-A3--NN... /C□ *4



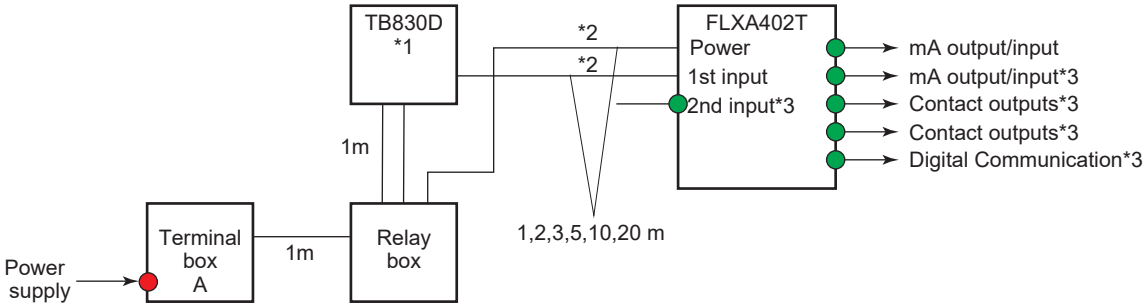
• TB830D-....-A2--NN... /ARS/C□ *4
TB830D-....-A3--NN... /ARS/C□ *4



• TB830D-....-A5--NN... /C□ *4



• TB830D-....-A5--NN... /ARS/C□



*1: Conduit piping is not allowed to TB830D because the wiring inlet is on the moving part.
*2: The standard cable length between FLXA402T and TB830D is 1 m. You can change the cable length by specifying a code from Option code.
*3: The number of cable entry holes to be used are defined by the specification as below.

Spec.	2nd Input		mA output/input		Contact Outputs		Digital Communication		
Code	-NN	the others	-N2	-N4	-WR	-NR	-N	-E	-R
Required No.of cable entry holes	0	1	1	2	2	0	0	1*	1

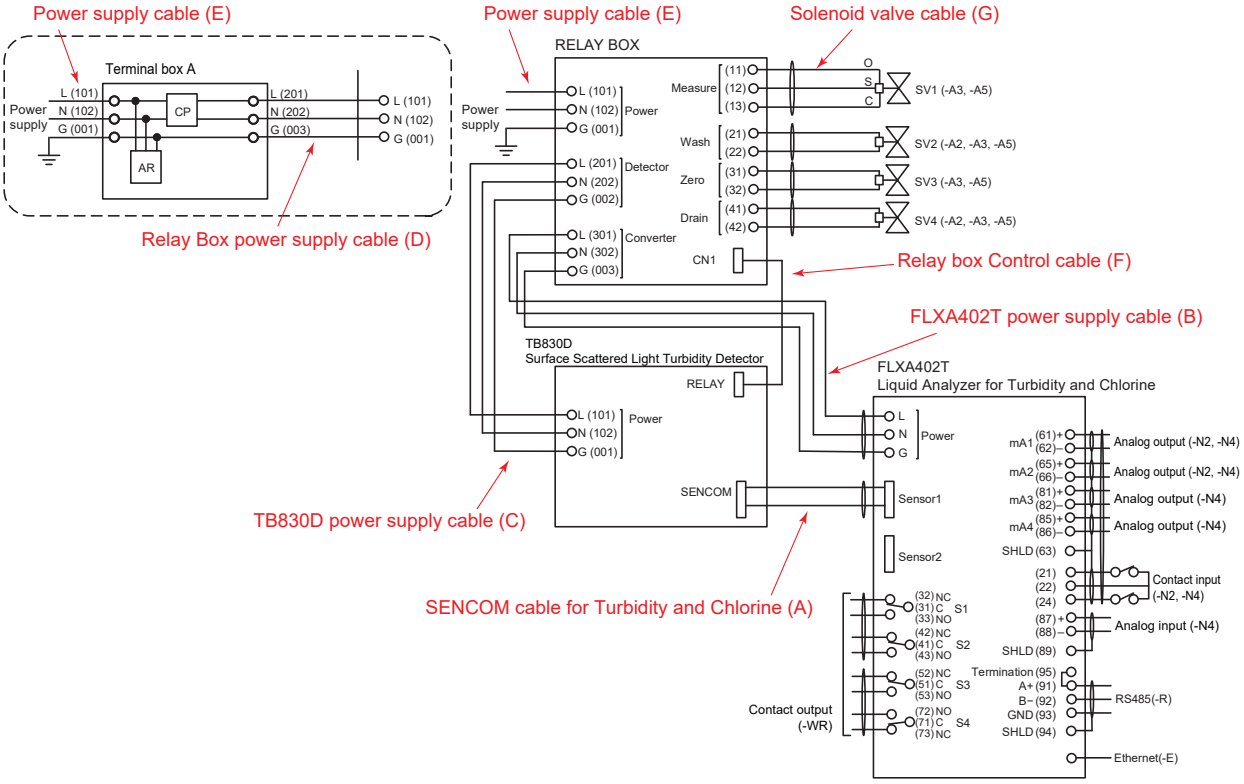
*: Conduit exclusively for Ethernet

*4: When /PH□2, /PH□7, or /FC is specified, FLXA402 or FLXA402T can be connected. Conduit can be provided to these products' mA I/O, contact output, digital communication wiring.

4.2.5 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 62 Wiring diagram without sampling system (with relay-box)

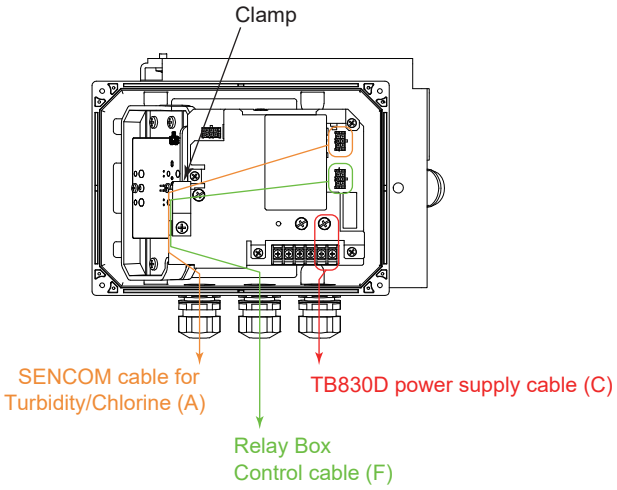


Figure 63 Wire TB830D (for-A5)

WARNING

Never let the power cables of TB830D (Figure 63) touch the Cable for Relay box control (F), SENCOM cable for turbidity/chlorine (A), resulting in failure to comply with the safety requirements.

WARNING

Wire the wire so that it meets the IP65 or higher. The four screws of detector cover are tightened to 1.5 N·m.

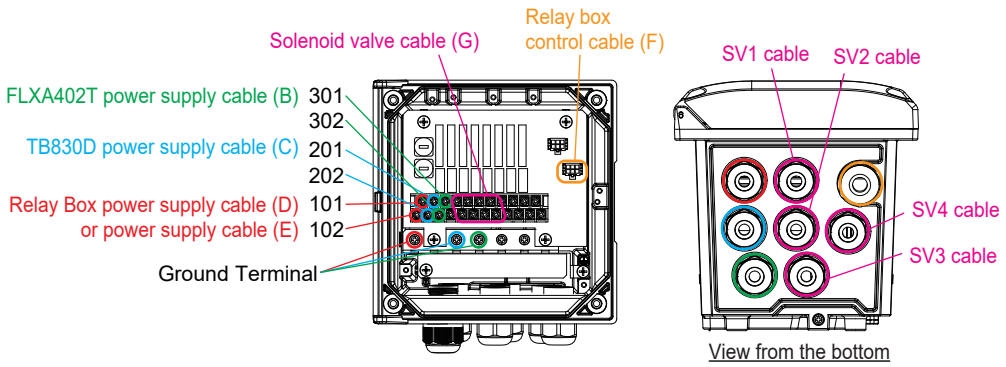


Figure 64 Wiring of Relay box (for-A5)

SENCOM cable for Turbidity/Chlorine (A)

Dedicated cables are included. Refer to Figure 62 and Figure 63 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 62 and Figure 64 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. Tightening torque of M3 screws (L and N) is 0.6 N·m. The tightening torque 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 62, Figure 63, and Figure 64 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 an power supply cable that connects the Relay box to the Relay box when a Relay box is attached.

Dedicated cables are included. Refer to Figure 62 and Figure 64 for wiring. Cables have no terminal names on them. Wire them by color. L:Black, N: White, G: Red. The tightening torque for M3 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 62 for wiring. Cables for power supply and grounding must be provided by the customer. Refer to “4.2.4 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 62, Figure 63, and Figure 64.

Cable for solenoid valve and solenoid valve (G)

Solenoid valve and solenoid valve cabling must be provided by the customer. Refer to Table 10 and Table 11 for required specifications. Wire solenoid valve cabling referring to Figure 62 and Figure 64.

Table 10 Solenoid valve Requirements

	Port	Valve type	Max. working pressure	Max. working pressure difference	Part No.
SV1 (Measure)	15A	Motor Valve 3 Terminals (Open, Shut, Common)	1 MPa	1 MPa	K9411DT (100V, 110V) K9411DU (200V, 220V)
SV2 (Wash)	RC3/8	Solenoid valve NOOC. (*1)	1.5 MPa	0.5 MPa	A1014MZ (100V) A1016MZ (110V) A1015MZ (200V) A1017MZ (220V)
SV3 (Zero)	RC3/8	Solenoid valve NOOC. (*1)	1.5 MPa	0.5 MPa	A1014MZ (100V) A1016MZ (110V) A1015MZ (200V) A1017MZ (220V)
SV4 (Drain)	Ø21 × Ø18 Silicone tube	Pinch valve N.C. (*1)	—	—	K9411JG (100V, 110V) K9411JH (200V, 220V)

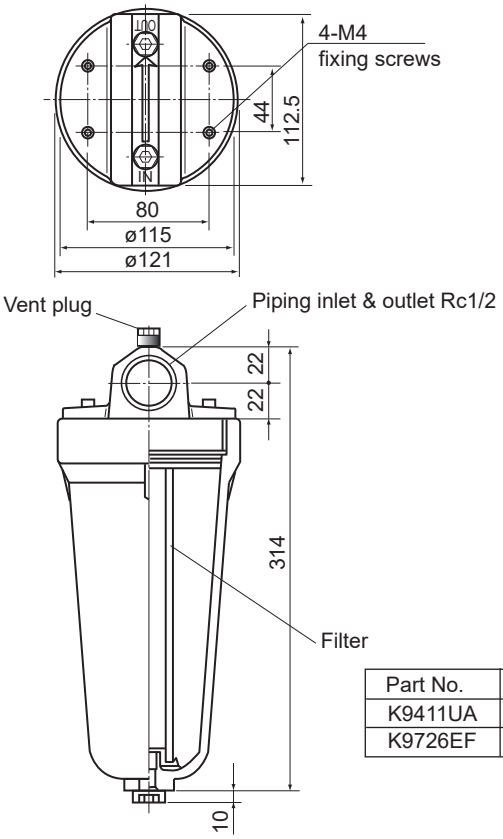
*1: The valve opens when energized.

Table 11 Solenoid valve Cable Requirements (Recommended Cables)

Cable length		1.2 m
Nominal 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

5 Zero Turbidity Filter

Unit: mm



Part No.	Filtering size
K9411UA	1 µm
K9726EF	0.2 µm

Figure 65 Zero turbidity filter

For TB820D

Use 0.2 µm and 1 µm filter. However, if the sample is more than 2 NTU, only the 1 µm filter may be used.

For TB830D

1 µm filter can be used because the measuring range is over 2 NTU. 0.2 µm filter is also available.

6 Operation

6.1 TB820D Supplying a Sample and Adjusting the Flow Rate

Supply a sample to the detector and adjust its flow rate.

System Using an Open Head Tank (Option code /D3) (See Piping Diagram in Figure 40)

1. Open the sample valve to supply a sample to the head tank.
2. Completely open the sample supply valve to allow the sample to flow into the detector.
3. Check that the sample is drained from the detector drain. Then, close the drain valve.
4. Adjust the opening of the valve at the sample out of the detector so that the sample overflows and is surely drained from the head tank.
5. Measure the drainage volume at the sample outlet of the detector using a beaker or relevant measure. The rate of flow to the detector must be in the range of 1 to 10 L/min.

System Using a Simple Head Tank (Option code /D2) (See Piping Diagram in Figure 38)

1. With the outlet valve after the detector open completely, open the valve at the inlet of the simple head tank gradually and completely.
2. By gradually closing the valve at the sample out of the detector, adjust the flow rate so the sample is thoroughly drained from the drain of the simple head tank.
3. Close the sample supply valve while checking the turbidity reading until the influence of air bubbles disappears. Check that the sample is overflowing from the drain of the simple head tank.

System Using a Pressurized Head Tank (Option code /D1) (See Piping Diagram in Figure 36)

1. Completely open the bypass valve at the top of the head tank, the sample supply valve, and the needle valve at the sample outlet of the detector.
2. Open the sample valve to supply a sample to the head tank.
3. Gradually close the bypass valve at the top of the head tank until the rate of flow from the sample outlet of the detector is in the range of 0.05 to 10 L/min. The rate of drainage from the bypass valve should be secured to the extent that air bubbles are removed.
4. Pressure changes in the line between the sampling point and the detector outlet should be controlled to prevent air bubbles from occurring. For this, gradually close the valve at the sample outlet of the detector until the pressure gauge at the tops of the pressurized head tank approximates the pressure of the sample and until the rate of flow from the sample outlet of the detector is in the range of 0.05 to 10 L/min. Check the pressure gauge at the top of the pressurized head tank. The gauge must read under 500 kPa.

System without a Head Tank (See Flow Diagram in Figure 42)

1. With the valve at the sample outlet of the detector opened completely, open the sample valve (immediately after the sampling point) in the sample line.
2. Open the sample supply valve to supply a sample to the detector.
3. Adjust the opening of the valve at the sample out of the detector until the rate of flow from the sample outlet of the detector is in the range of 0.05 to 20 L/min.
4. Pressure changes in the line between the sampling point and the detector outlet should be controlled to prevent air bubbles from occurring. For this, gradually close the valve at the sample outlet of the detector until the rate of flow from the sample outlet of the detector is in the range of 0.05 to 20 L/min. Before taking this procedure, make sure that the sample pressure of the process is under 500 kPa.

6.2 TB830D Preparation for Operation

Leveling detector (flow rate Adjustment)

The measurement surface is rippled.

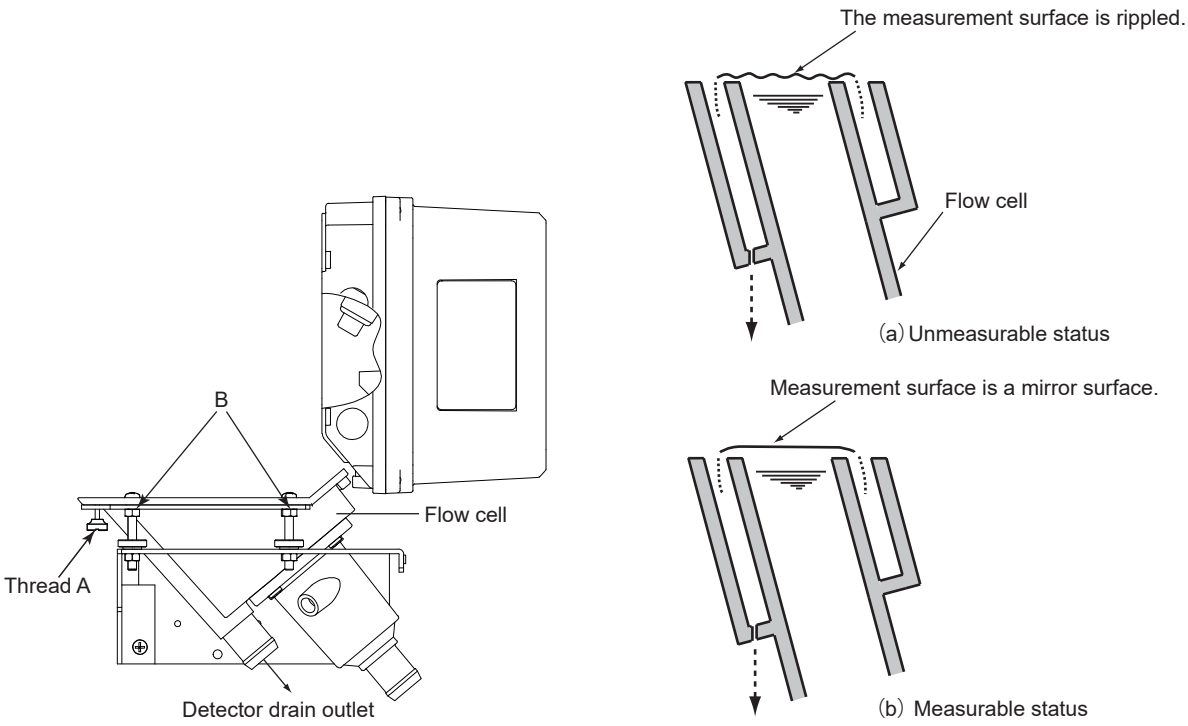


Figure 66 (A) Detector (B) The liquid level of the detector

1. Models with a sampling system, it is factory-adjusted, so there is usually no need for leveling. When adjusting without a sampling system or with a sampling system, place a level on the Flow cell with no water flowing, and adjust at B (4 locations) shown in Figure 66 (A) so that the level shows horizontal at two points at right angles (see Figure 67). 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 66 (B)-(b)).
2. After leveling, measure the volume of water drained from the detector drain port (see Figure 66 (A)) 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 66 (A).

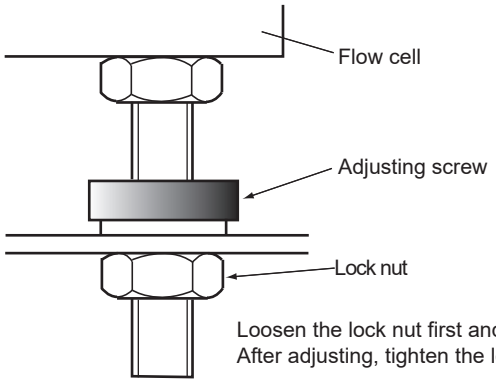


Figure 67 Enlarged view of B shown in Figure 66 (A)

Supplying Sample and Adjustment flow rate

1. Turn Off converter maintenance mode.
2. Set the manual valve to the measurement state.
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 "■ 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 "3.2 TB830D (-NN, -A5) Piping" and adjust to the following flow rate by operating the appropriate valve.

- 3 to 11 L/min for pH meter Flow-through Type Holder
- 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.

7. Automatic cleaning/Automatic zero calibration Sequence

7.1 TB820D Sequence

The next diagrams show how the solenoid valve works during TB820D automatic cleaning / automatic zero calibration.

During Automatic cleaning

The parameters on valve working during automatic cleaning are as follows.

- Drainage time
- Cleaning time
- Repeat count of wash
- Recovery time

◆ Automatic cleaning

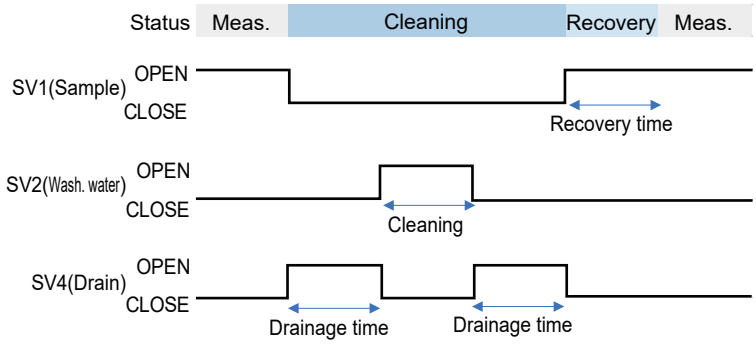


Figure 68 Sequence of during automatic cleaning (TB820D)

1. When automatic cleaning starts, SV1 (valve for sample) closes and shut the sample feeding. At the same time, SV4 (valve for drain) opens and starts draining the sample out of the flow cell.
2. After the “drainage time” elapses, SV4 closes and SV2 (valve for washing water) opens and TB820D starts feeding washing water.
3. During the “washing time”, SV2 stays open, SV4 stays closed.
4. After the washing time elapses, SV4 opens and TB820D starts draining the washing water out of the flow cell.
5. If “Repeat count of wash” is set to over 1, valve working1 to 4 is repeated.
6. Once the draining for washing completes, SV4 closes, SV1 opens, and TB820D starts feeding a sample and go to “Recovery time”.
7. After the sample feeding starts when the Recovery time elapses, the automatic cleaning sequence ends and a measurement starts.

■ During Automatic zero calibration

The parameters on Valve working during automatic zero calibration are as follows.

- Drainage time
- Flow waiting time
- Recovery time

“Calibration time” refers to the period from Stability check to an execution of Calibration and a completion of parameter update.

◆ Automatic zero calibration

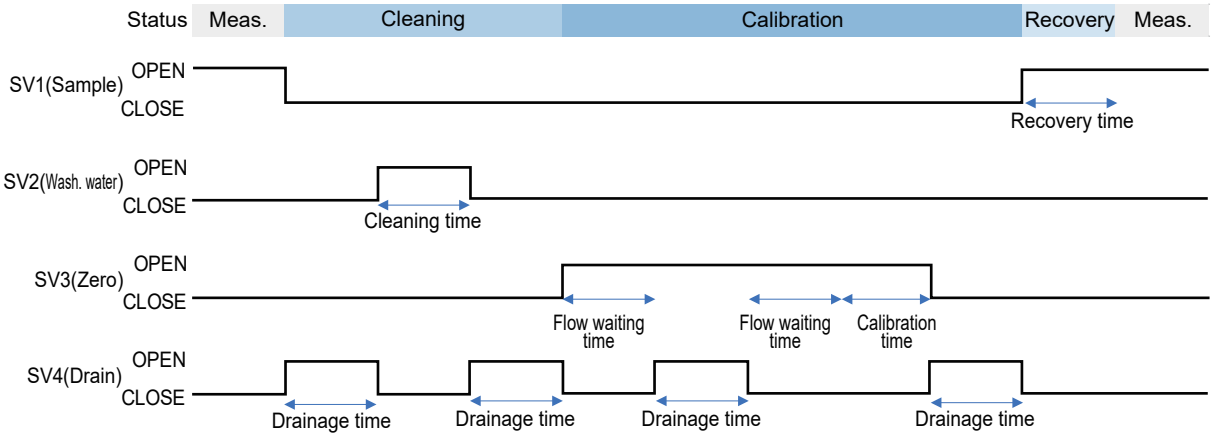


Figure 69 Sequence of during automatic zero calibration (TB820D)

1. When sequence starts, Automatic cleaning works first. See 1 to 5 in “■ During Automatic cleaning”.
2. Automatic zero calibration starts without a recovery time after automatic cleaning.
3. When automatic zero calibration starts, SV4 closes, SV3 (valve for zero water) opens and a zero water starts filling the flow cell.
4. After the calibration preparation time has elapsed, SV4 opens and the zero water in the Flow cell is drained once. After the drainage is completed, pass the zero water for the calibration preparation time again and the calibration starts.
5. After the calibration time elapses, SV3 closes, SV4 opens, and TB820D starts draining the zero water out of the flow cell.
6. After the draining finishes, SV4 closes, SV1 opens, and TB820D starts feeding a sample into the flow cell.
7. After the sample feeding when the Recovery time elapses, automatic zero calibration sequence ends and a measurement starts.

7.2 TB830D Sequence

Automatic cleaning (without automatic zero calibration)

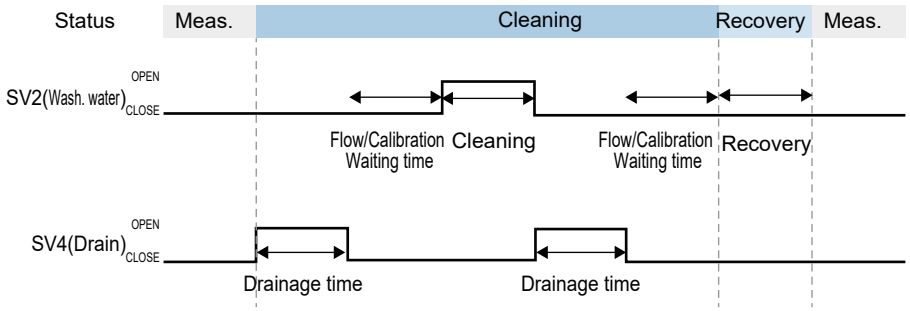


Figure 70 Sequence of during automatic cleaning (TB830D-A2, -A5)

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 water) opens. Wash 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 washing 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 washing completes, SV4 closes, and TB830D starts feeding a sample.
7. After Flow/Calibration Waiting time” elapses, the detector becomes Recovery time.
8. After the Recovery time elapses, a measurement starts.

Automatic cleaning (with automatic zero calibration)

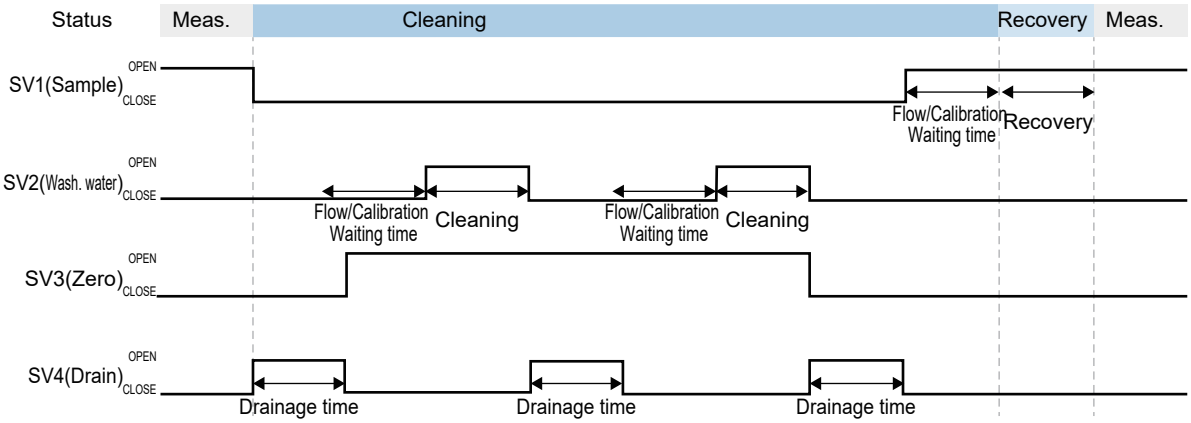


Figure 71 Sequence of during automatic cleaning (TB830D-A3 -A5)

1. When automatic cleaning starts, SV1 (Sample) 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 water) opens. Wash 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 washing 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 washing completes, SV4 closes, SV1 opens, and TB830D starts feeding a sample.
7. After Flow/Calibration Waiting time” elapses, the detector becomes Recovery time.
8. After the Recovery time elapses, a measurement starts.

Automatic zero calibration (-A5)

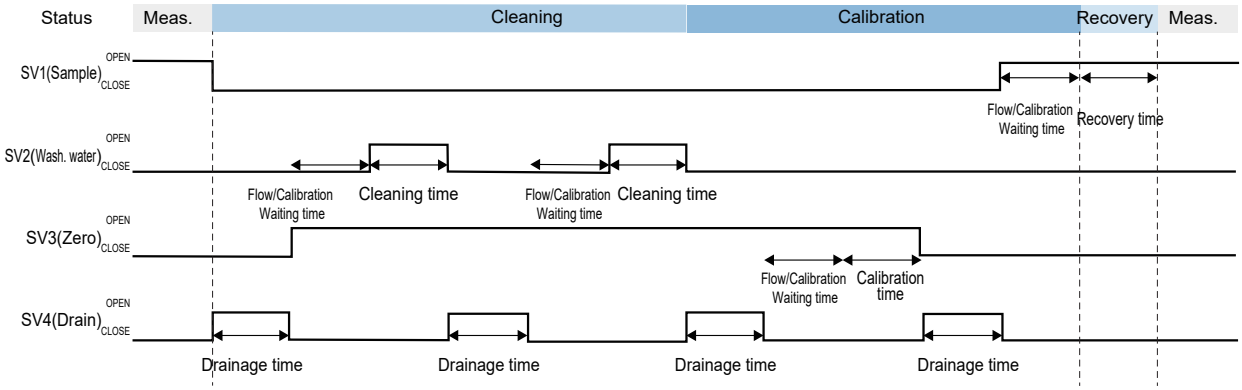


Figure 72 Sequence of during automatic zero calibration (TB830D-A3, -A5)

1. When sequence starts, automatic cleaning works first. After the automatic cleaning, an automatic zero 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 Washing 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.

Revision Information

Title : TB820D and TB830D Sampling System Selection Manual
Manual number : TI 12E01B30-01EN

Mar. 2023/3rd Edition
Changed explanation (page 9). Changed part number (page 53) and figures (page 32).

Jan. 2023/2nd Edition
Added TB830D

Oct. 2022/1st Edition
Newly published

Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, Tokyo 180-8750, JAPAN
http://www.yokogawa.com/