General Specifications

EXA TB

Model TB400G
Surface Scattering Light Turbidity Meter

GS 12E04A02-01E

■ General

There have been increasing demands for both industrial use and portable water of good quality because of rapid industrial development and the betterment of consumers' everyday life. A large amount of the waste water from both kinds of uses has been drained or discharged into rivers, causing pollution to worsen year after year.

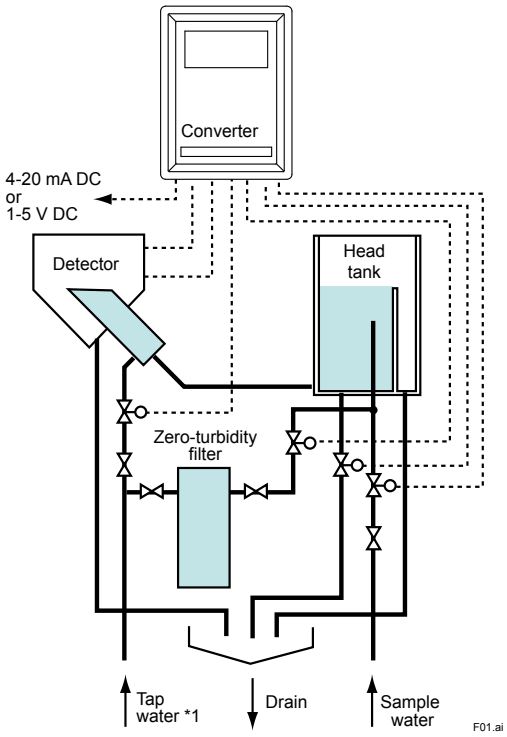
This raises a serious social problem. Therefore, turbidity meters, conventionally used for the operation and control of a water purification plant, are nowadays being required to measure the amount of matter suspended in various sorts of industrial waste water and to detect the turbidity of chemical processes.

Since their sales began in 1959, Yokogawa's process-use turbidity meters, centering on the area of water supply, have achieved a number of records and have provided high reliability to many users.

The TB400G Surface Scattering Light Turbidity Meter has a microprocessor to provide intelligent features for advanced performance and high reliability.

■ System Configuration

For example, the diagram below is a system with automatic cleaning and automatic zero calibration



■ Features

- Equipped with a microprocessor, allowing provision of advanced performance and high reliability.
- Enhanced self-testing functions such as detection of a disconnected lamp, a converter check, and upper and lower limit alarms.
- Provided with multiple functions such as automatic zero calibration.
- Compact and light weight. The system allows access from the front, offering easy maintenance.
- Use of surface scattering-light measuring method eliminates the measurement errors caused by contamination on the cell port.
- Signal smoothing as a measure against air bubbles in sample water.
- pH meter or free available chlorine analyzer can be installed on the TB400G.

*1: Reverse flow of tap water should be prevented using with a check valve on the supply line of tap water.

YOKOGAWA

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GS 12E04A02-01E

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■ Standard Specifications

Measurement: Turbidity of tap water, river water, and water used in general processes
Measurement method: Surface scattering-light measurement
Measuring range: 0-2 to 0-2000 mg/L
Display: Four-digit LED display (resolution; 0.01 mg/L, maximum display value; 2200 mg/L)
Display Units: “mg/L” (standard) or “度” (selectable)

Note: In this GS, the unit “liter” is described as “L”.
Real display unit is “mg/l”.
The unit “度” means degree.

Output Range: 3 range switching
Remote or local (default) range switching, selectable
Auto or manual (default) range,selectable
For auto range, changeover point is user configurable.
3 ranges are user configurable.
The span should be 20% or more of the upper range limit or 2 mg/L (default), whichever is greater.

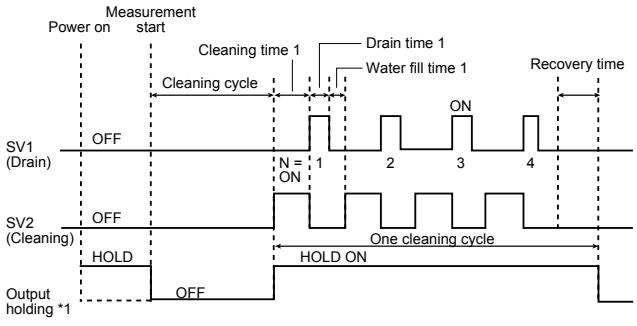
Analog Output Signal: 4 to 20 mA DC (maximum load resistance: 550 Ω) or 1 to 5 V DC (output resistance: 100 Ω or less)
Digital Output Signal: RS-232C (turbidity signal, under-maintenance signal, error signal, calibrating signal, and range signal)
Contact Output: Maintenance output (during maintenance)
Failure output (if an error is detected)
Range output (corresponding to the output range selected) (common to COM)
Configurable contact pair for (a) high and low alarm limits or (b) auto-calibration signal or (c) auto-cleaning signal
Contact status:

Type of contact output	Power off	Power on *1	
		Not in Action	In Action
Maintenance	Closed	Open	Closed
Fail	Open	Closed	Open
High/low alarm	Closed	Closed	Open
Auto zero calibration/cleaning	Closed	Open	Closed

*1: Contact status (open/closed) when power is turned on is user configurable.

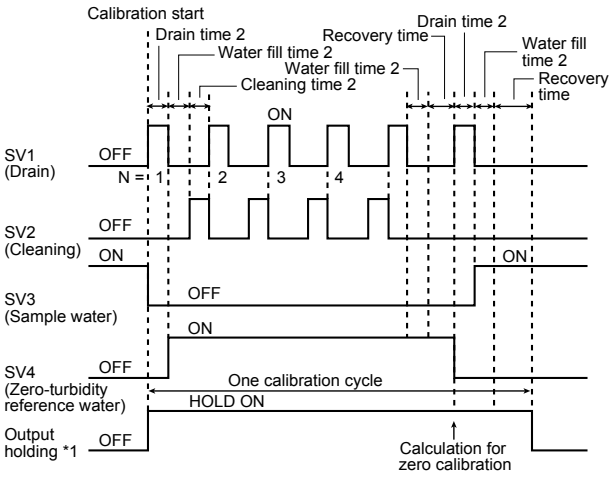
Contact Rating:
Maximum opening/closing voltage:
250 V AC or 220 V DC (resistive load)
Maximum application current:
2 A AC or 2 A DC (resistive load)
Maximum opening/closing rating:
120 VA or 60 W (resistive load)
Contact Input:
Remote range switching (common to COM)
Input resistance when on: 200 Ω or less
Input resistance when off: 100 kΩ or more
Automatic Cleaning: Water jet cleaning (with configurable time cycles)
Automatic Calibration: Zero-point calibration using zero turbidity reference water (for a system with automatic cleaning and calibration)
Error Detection: Turbidity over-range, disconnection of lamp wiring, error in lamp voltage, error in the AD circuit, memory error, CPU error
Check Function: Converter operation check
Manual Calibration:
Zero calibration:
Using zero-turbidity reference water or with light source set to off (selectable)
Span calibration: Using a calibration plate
Other Functions: Breakpoint line-segment output, upper and lower limit alarms
Material:
Detector: Modified black PPE (wetted parts)
Piping: Hard PVC, polyethylene resin, and polypropylene resin (all for wetted parts)
Stanchion: Carbon steel or stainless steel
Converter: Aluminum alloy casting
Paint:
Converter: Baked polyurethane resin finish
color; Munsell 0.6GY3.1/2.0 and Munsell 2.5Y8.4/1.2
Stanchion; Baked polyurethane resin finish
color; Munsell 0.6GY3.1/2.1
Ambient temperature: -5 to 50°C (sample and tap water may need protection against freezing)
Ambient humidity: 5 to 95%RH (non-condensing)
Storage temperature: -30 to 70°C
Installation location: Indoor (weather protection is required for outdoor installation)
Installation:
Separate detector and converter;
Pipe- or rack-mounted
System with sampling system;
Fixed with anchor bolts
Piping Connections:
System with sampling system; VP40 for drain
VP16 for other purposes
System without sampling system;
25 mm ID hose joint
Cable Inlet: 5 cable glands
(on the bottom of the converter)
Outer diameter of applicable wires:
6 to 12 mm
(9 to 11 mm when with arrester option)
Wiring type: Power, analog output, digital output, contact output, contact input (for grounding, GROUND on the connection terminals of the converter or the ground terminal on the outside of the case should be used)
Power supply: 100/110 V AC, 50/60 Hz,
200/220 V AC, 50/60 Hz
Noise filter assembly: (only for TB400G-□-□-KC)
Ambient temperature: -10 to 50°C
(no dew condensation allowed)
Storage temperature: -25 to 70°C
Construction: JIS C 0920 Watertight (IP53)
Power Consumption:
Detector and converter: 50 VA or less, respectively
With sampling system: 200 VA or less
(in full specifications, excluding combination instruments)
Automatic Cleaning Function:
Water jet cleaning. Cleaning time and interval are user configurable. (When auto cleaning is specified)

Automatic Zero Calibration Function: Zero point calibration using zero turbidity water (when auto cleaning/zero calibration is specified)
Weight: Detector; Approx. 3 kg
Converter; Approx. 9 kg
With sampling system; Approx. 50 kg
(in full specifications, excluding combination instruments)
Dimensions:
Detector: 245 (W) x 250 (H) x 200 (D) mm
Converter: 260 (W) x 340 (H) x 150 (D) mm
With stanchion: 530 (W) x 1450 (H) x 550 (D) mm
Sample water:
With sampling system:
Flow rate: 2 to 10 L/min
Pressure: 20 to 500 kPa
Temperature: 0 to 50°C (ambient temperature should not exceed 30°C)
Without sampling system:
Flow rate: 1.5 to 2 L/min
Temperature: 0 to 50°C (Ambient temperature should not exceed 30°C)
Zero turbidity water and cleaning water (tap water):
Turbidity: 2 mg/L or less
Temperature: 0 to 50°C (Ambient temperature should not exceed 30°C)
Pressure: 100 to 500 kPa
Flow rate: Zero turbidity water: 2 to 10 L/min
Cleaning water: 3 to 6 L/min
Consumption: Zero turbidity water:
Approx. 380 L/day
(at a flow rate of 2 L/min)
Cleaning water: Approx. 90 L/min
(at a flow rate of 3 L/min)
(when auto cleaning/zero calibration is enabled and time setting is factory default)
Automatic cleaning time chart when provided with automatic cleaning, but not automatic zero calibration
Example: N (number of cleanings) = 4



*1: During cleaning process, output is always held.
F02.ai

Default Values as shipped from factory:
Cleaning cycle: 2 hours
Cleaning time 1: 30 sec
Drain time 1: 10 sec
Water fill time 1: 100 sec
Recovery time: 150 sec
Automatic zero calibration time chart when provided with automatic cleaning
and automatic zero calibration
Example: N (number of cleanings) = 4



*1: During calibration, output is always held.
F03.ai

Default values as shipped from factory:
Cleaning cycle: 2 hours
Cleaning time 2: 30 sec
Drain time 2: 0 sec
Water fill time 2: 100 sec
Recovery time: 150 sec

■ Characteristics

Linearity (when using kaolin standard):
Upper range limit of 1000 mg/L or less;
±2% of upper range limit
Upper range limit of 2000 mg/L or less;
±5% of upper range limit
Linearity (when using polystyrene latex standard):
Upper range limit of 100 mg/L or less;
±2% of upper range limit
Repeatability:
Standard solution; 2 % of upper range limit
Supply voltage effects: ± 1 % of upper range limit / within ± 10 % of rated voltage
Ambient temperature effects: ± 1 % of upper range limit / 10°C (when using calibration plate)
Response time: 2 minutes or less (90 % response, with a sampling system, flow rate of 3 L/min)
Warm-up time: Approx. 30 minutes

Regulatory Compliance (for TB400G-□-□-KC)
Korea Electromagnetic Conformity Standard Class A
한국 전자파적합성 기준

■ Model and Codes

[Style: S3]

Model	Suffix Code	Option Code	Description
TB400G	.....	.....	Surface Scattering Light Turbidity Meter
Output	-4	.....	4 to 20 mA DC
	-5	.....	1 to 5 V DC
Power supply	-1	.....	100 V AC, 50/60 Hz
	-3	.....	110 V AC, 50/60 Hz
	-6	.....	200 V AC, 50/60 Hz
	-7	.....	220 V AC, 50/60 Hz
Device configuration and Application	-NN	.....	Without sampling system, automatic cleaning, or automatic zero calibration *1
	-A1	.....	With sampling system, but without automatic cleaning or automatic zero calibration
	-A2	.....	With sampling system and automatic cleaning, but without automatic zero calibration
	-A3	.....	With sampling system, automatic cleaning, and automatic zero calibration
	-KC	.....	For Korea. Without sampling system. (without cleaning,without auto.zero calibration) *8
Optional specification	Mounting bracket	/P	Mounting bracket: For pipe mounting *2
		/R	Mounting bracket: For rack mounting *2
	Piping	/B	Tie-in with rear piping *3
	Stanchion material	/S	Stainless steel stanchion *3
	Bubble treatment	/L	Bubble retardant for low range *3 *4
	Tag plate	/SCT	Stainless steel tag plate
	Combination analyzer	/PHN5	With PH450G pH meter (without ultrasonic cleaning) *3 *5
		/PHU5	With PH450G pH meter (with ultrasonic cleaning) *3 *5
		/FC	With non-reagent type free available chlorine analyzer *3 *5
	Arrester	/ARS	With arrester *6
	PSL calibration	/PSL	Calibration using polystyrene latex *7

*1: A de-foaming tank (head tank) is to be provided. It is to be installed to adjust the sample flow to the detector at 1.5 to 2 L/min.
*2: These options are available for the specification of “without sampling system” (suffix code: -NN, -KC).
*3: These options are available for the specification of “with sampling system” (suffix code: -A1, -A2 or -A3).
*4: When measuring range is low (200 mg/L or less) and if air bubbles are likely to be formed on the sample, this option is to be specified.
When measuring range is high (more than 200 mg/L), this option is not to be specified. Because air bubbles in high ranges don’t disturb the measurement, and because clogging or reduction of flow rate may occur at the removal port of air bubbles on the flow line.
*5: A pH meter with necessary units, or non-reagent type free available chlorine analyzer should be purchased separately.
Both of a pH meter and non-reagent type free available chlorine analyzer can not be installed together on the TB400G.
Available model & suffix codes are as follows;
Non-reagent type free available chlorine analyzer (refer to the GS 12F5A1-E)
FC400G-□-□*A/ST (for /FC)
* The power supply of FC400G is to be suitable for the power supply of TB400G.
pH meter (refer to the GS 12B07B02-E, GS 12J05C02-00E and GS 12B07C05-01E)
pH sensor
PH8EFP-03-TN-TT1-N-G*A (for /PHN5 and /PHU5)
pH holder
PH8HF-PP-JPT-T-NN-NN*A (without cleaning) (for /PHN5)
PH8HF-PP-JPT-T-S3-C1*A (with ultrasonic cleaning) (for /PHU5)
pH converter
PH450G-A-J (for /PHN5 and /PHU5)
Ultrasonic oscillator
PUS400G-NN-NN-□-J
* The power supply of PUS400G is to be suitable for the power supply of TB400G.
*6: This option is not available for the options of /PHN5, /PHU5 or /FC.
*7: Polystyrene latex solution of which concentration is 2 degrees is used as a standard solution to calibrate the TB400G.
Without this option, the standard TB400G is calibrated with a Kaolin solution.
*8: No additional specifications other than “/P”,”/R” and “/SCT” can be chosen.

Accessories

Item	Quantity	Description
Standard calibration plate	1	Housed in the converter
Silicone cloth	1	
Lamp	1	As a spare
Fuse	4 each	1 A and 3 A (as spares)
Pipe mounting bracket (optional)	1 set	When specifying option code "/P"
Rack mounting bracket (optional)	1 set	When specifying option code "/R"
Soft PVC tube, 1 m	2	For detector piping (for without sampling system)
Clamp	2	For detector piping (for without sampling system)

Spare Parts

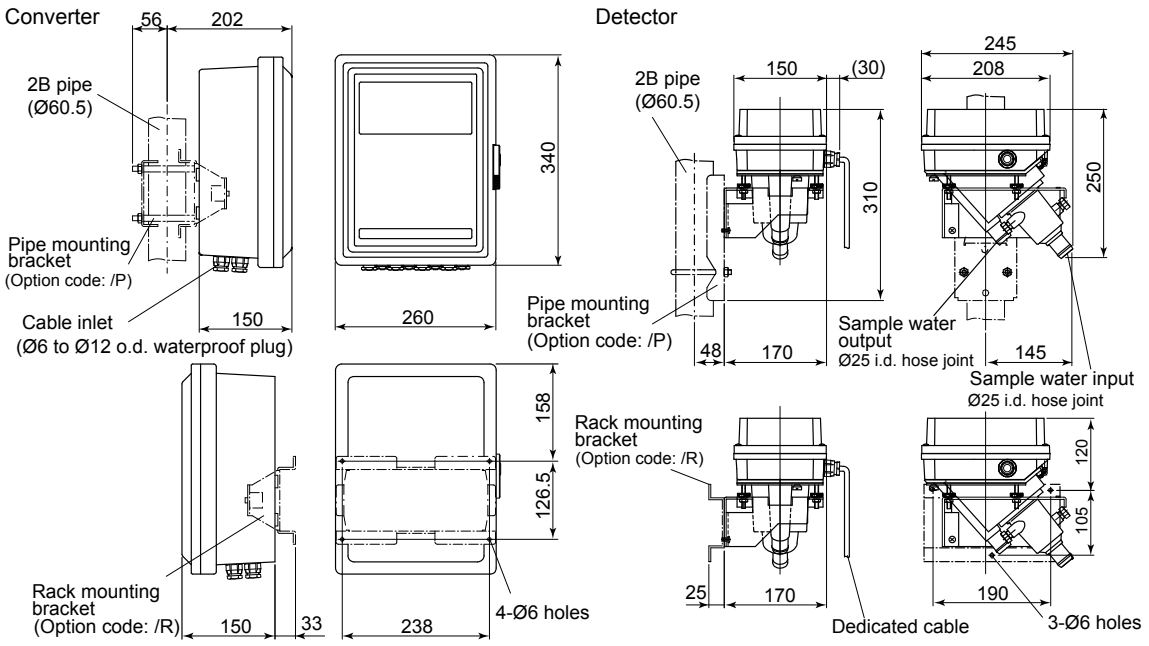
Item	Part Number	Recommended Replacement Interval 1*
Lamp	K9410DA	Yearly
Filter, 1 µm	K9008ZD	Yearly
Filter, 0.2 µm (when specifying option of "/PSL")	K9726EH	Yearly
Fuse, 1 A	A1109EF	Yearly
Fuse, 3 A	A1113EF	Yearly
Drain tube (when specifying suffix of "-A2" or "-A3")	K9411JM	Yearly

1*: Replacement intervals vary depending on the application.

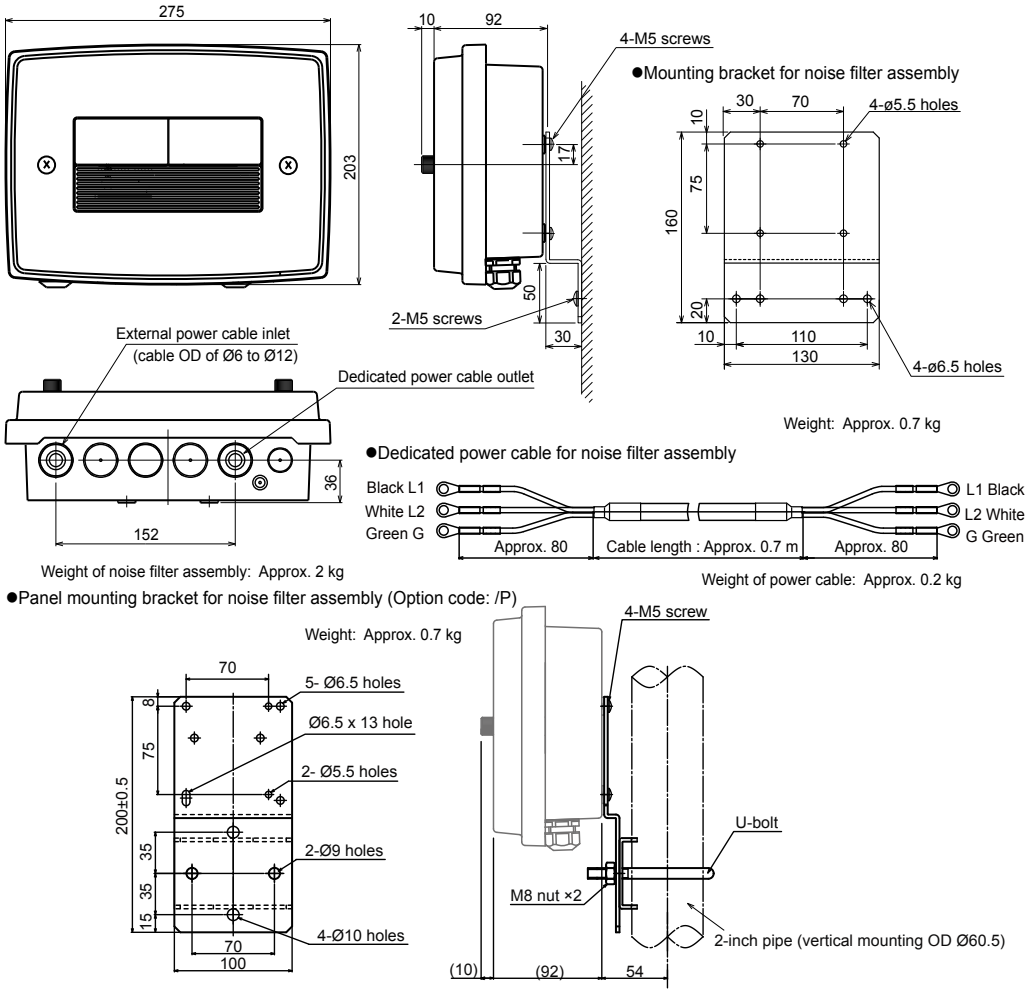
■ External Dimensions

Without sampling system

TB400G - □ - □ - NN, TB400G - □ - □ - KC Unit: mm



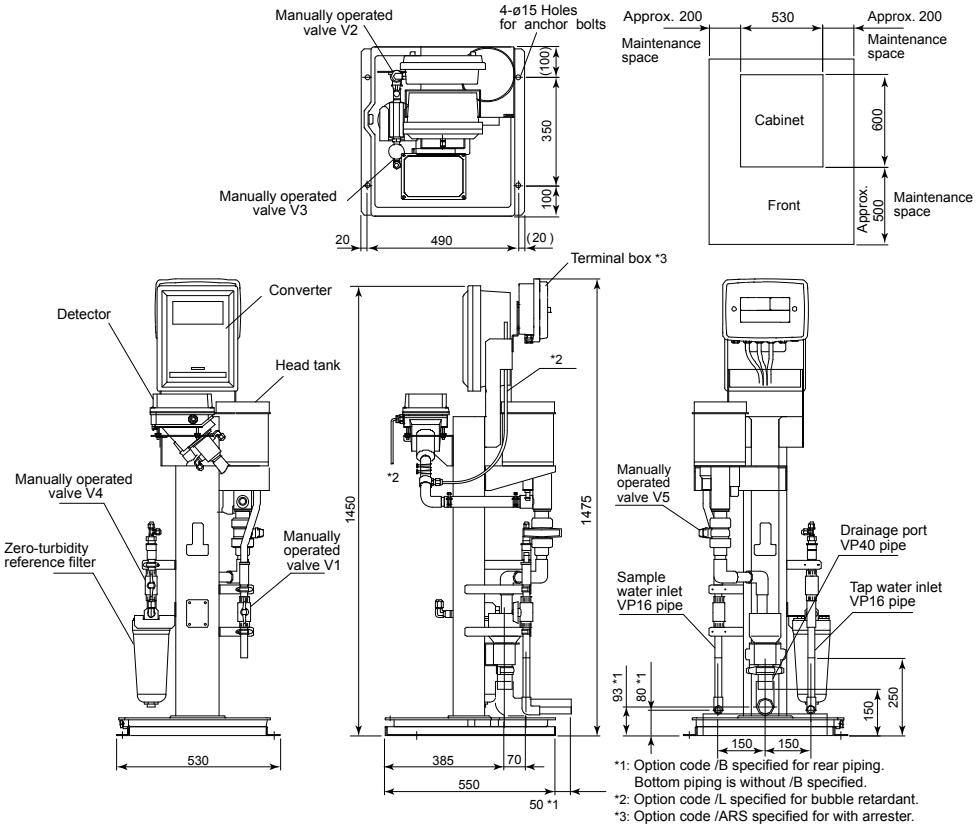
- **Noise filter assembly for TB400G - □ - □ - KC** Unit: mm



With sampling system, but without automatic cleaning or automatic zero calibration

TB400G - □ - □ - A1

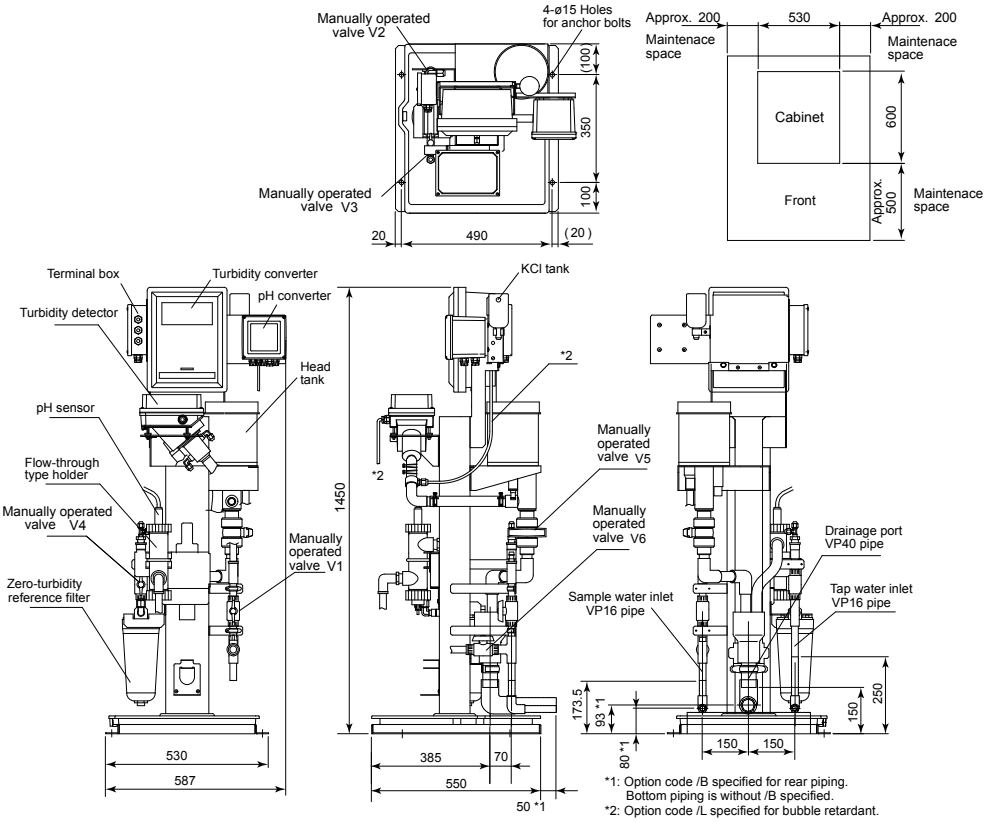
Unit: mm



With sampling system, but without automatic cleaning or automatic zero calibration with pH meter without ultrasonic cleaning

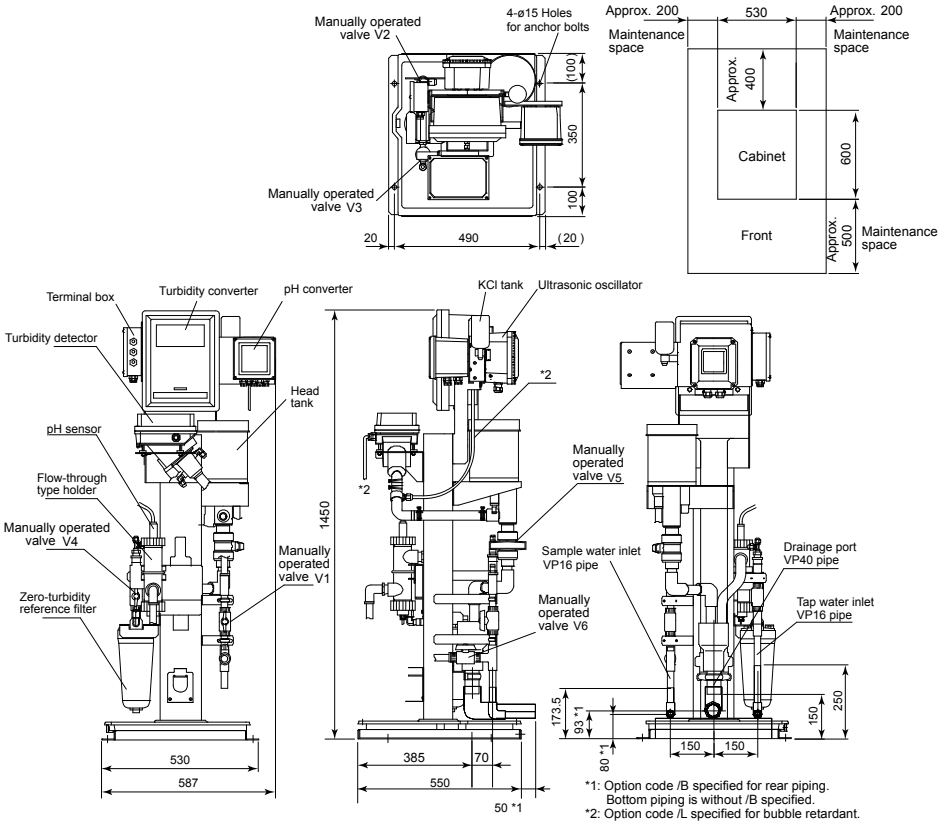
TB400G - □ - □ - A1 / PHN5

Unit: mm



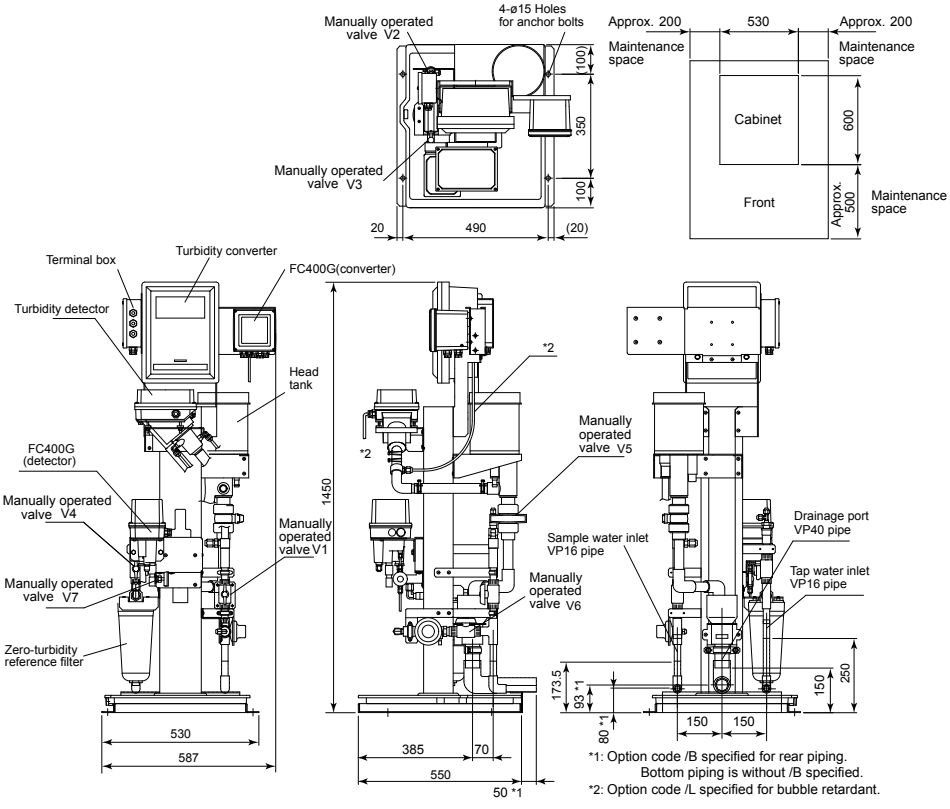
With sampling system, but without automatic cleaning or automatic zero calibration with pH meter with ultrasonic cleaning
TB400G - □ - □ - A1 / PHU5

Unit: mm



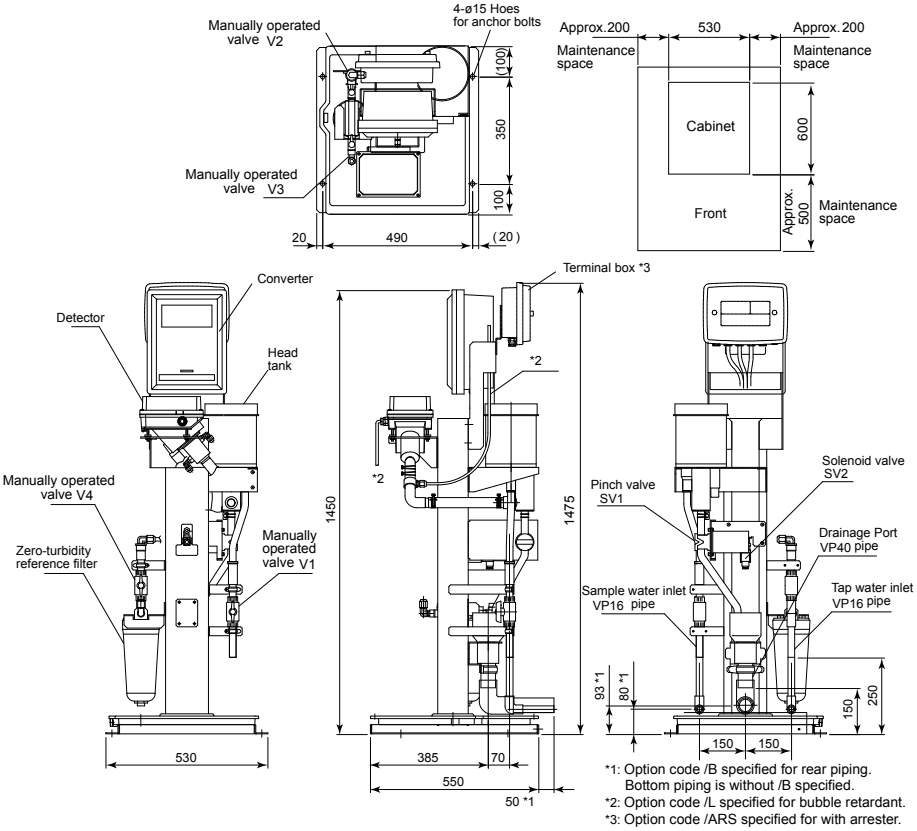
With sampling system, but without automatic cleaning or automatic zero calibration with non-reagent type free available chlorine analyzer
TB400G - □ - □ - A1 / FC

Unit: mm



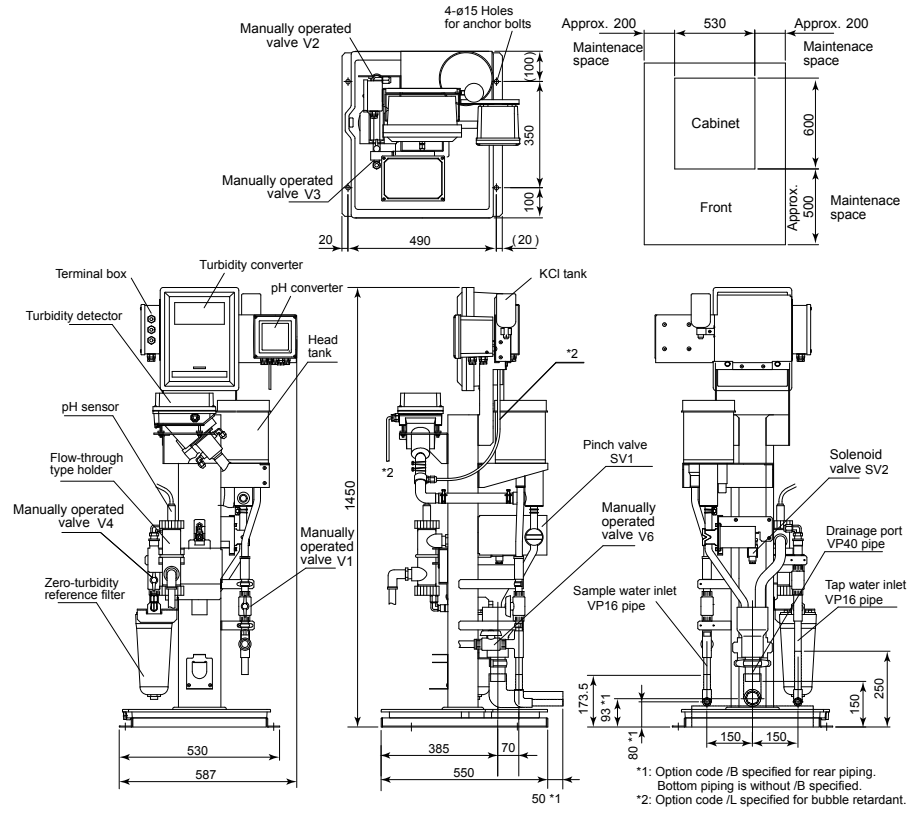
With sampling system and automatic cleaning, but without automatic zero calibration
TB400G - □ - □ - A2

Unit: mm



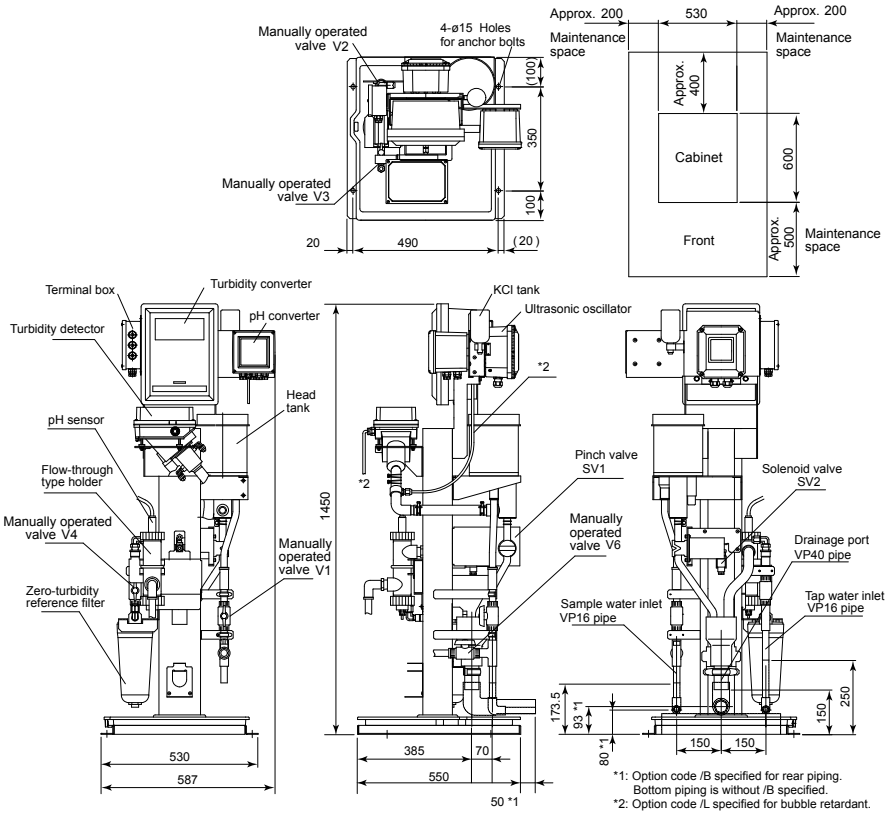
With sampling system and automatic cleaning, but without automatic zero calibration with pH meter without ultrasonic cleaning
TB400G - □ - □ - A2 / PHN5

Unit: mm



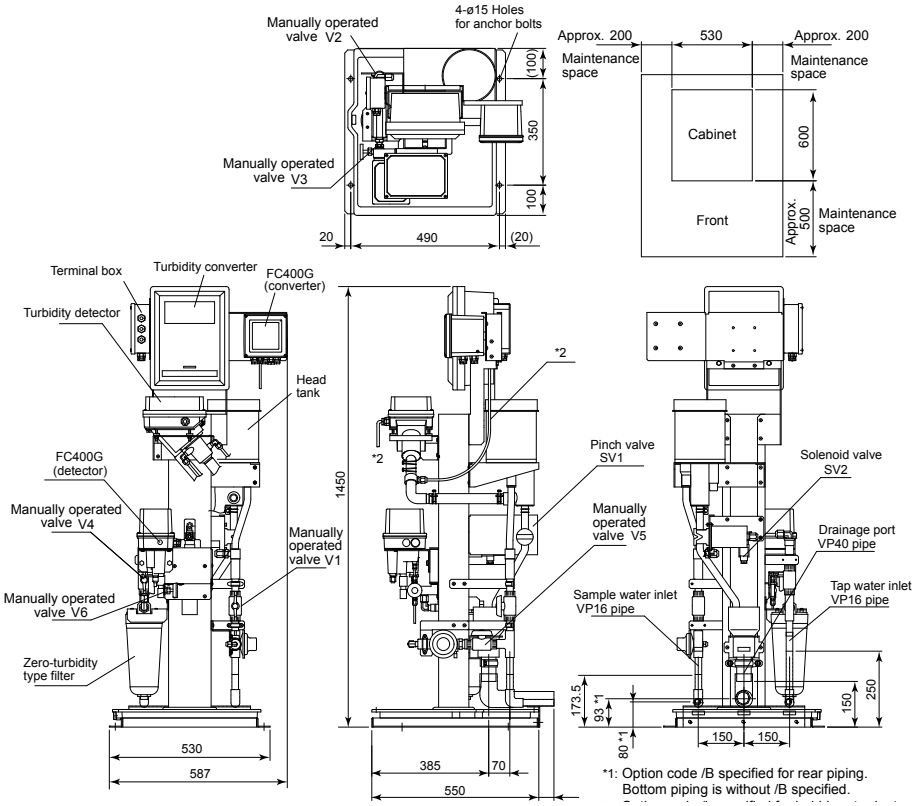
With sampling system and automatic cleaning, but without automatic zero calibration with pH meter with ultrasonic cleaning
TB400G - □ - □ - A2 / PHU5

Unit: mm



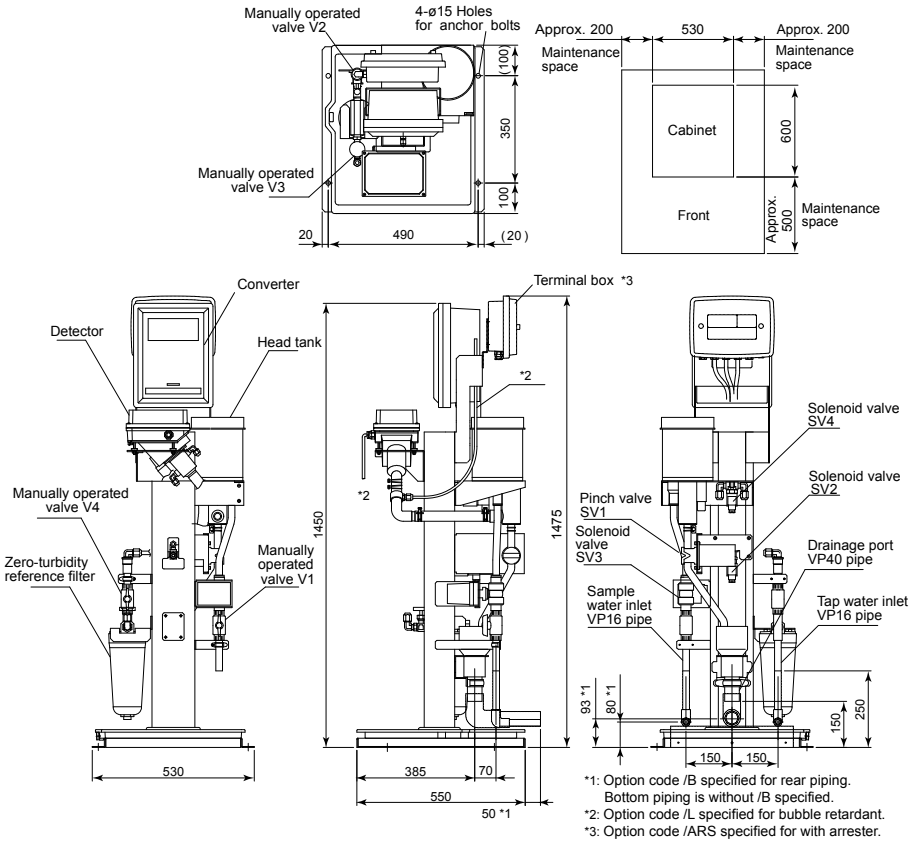
With sampling system and automatic cleaning, but without automatic zero calibration with non-reagent type free available chlorine analyzer
TB400G - □ - □ - A2 / FC

Unit: mm



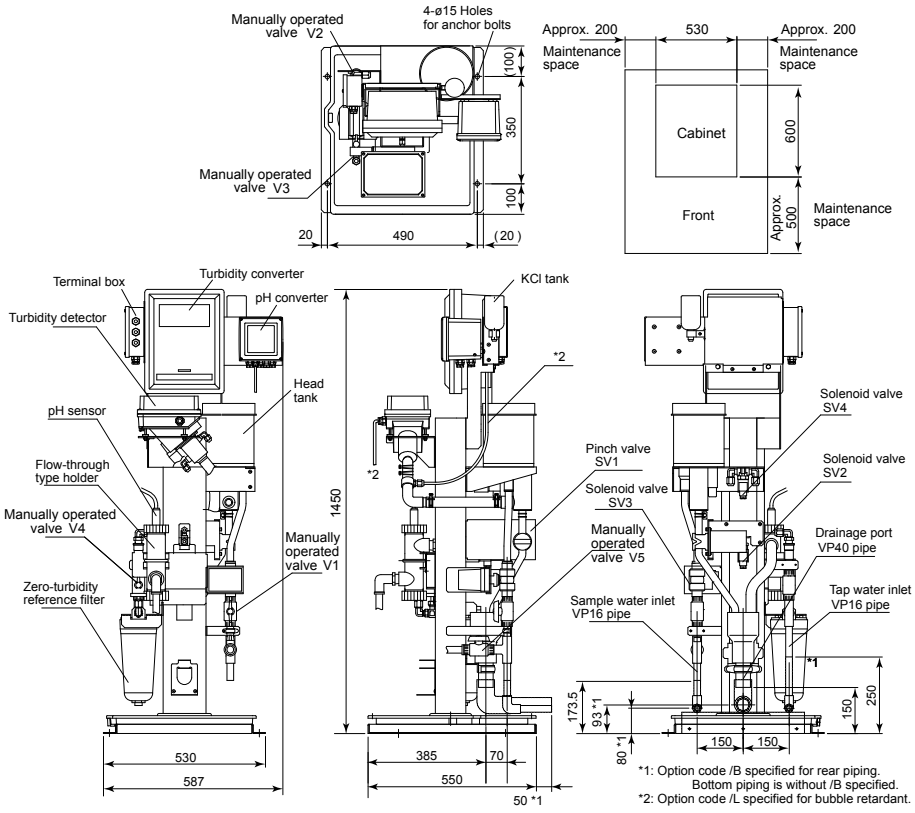
With sampling system, automatic cleaning, and automatic zero calibration
TB400G - □ - □ - A3

Unit: mm



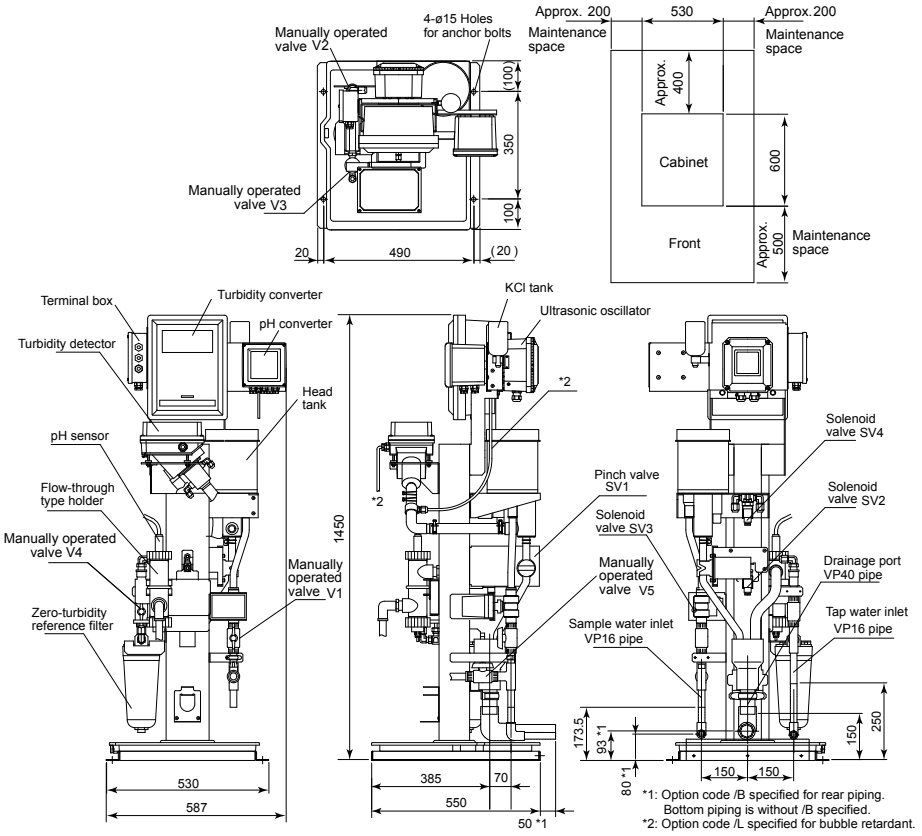
With sampling system, automatic cleaning, and automatic zero calibration with pH meter without ultrasonic cleaning
TB400G - □ - □ - A3 / PHN5

Unit: mm



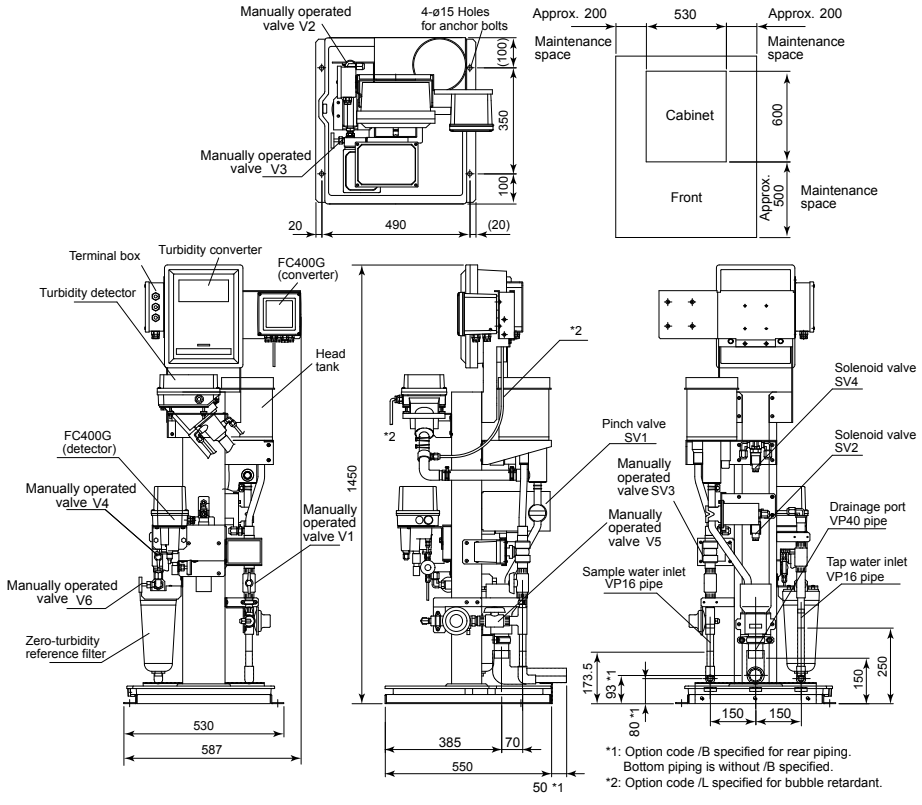
With sampling system, automatic cleaning, and automatic zero calibration with pH meter with ultrasonic cleaning
TB400G - □ - □ - A3 / PHU5

Unit: mm



With sampling system, automatic cleaning, and automatic zero calibration with non-reagent type free available chlorine analyzer
TB400G - □ - □ - A3 / FC

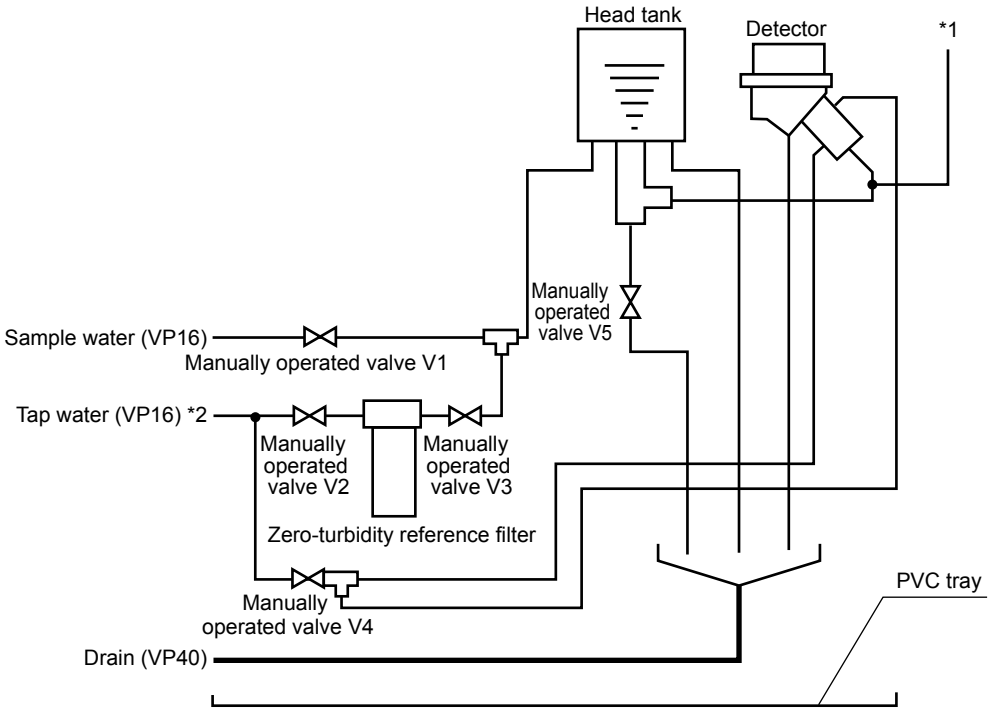
Unit: mm



■ PIPING DIAGRAM

With sampling system, but without automatic cleaning or automatic zero calibration

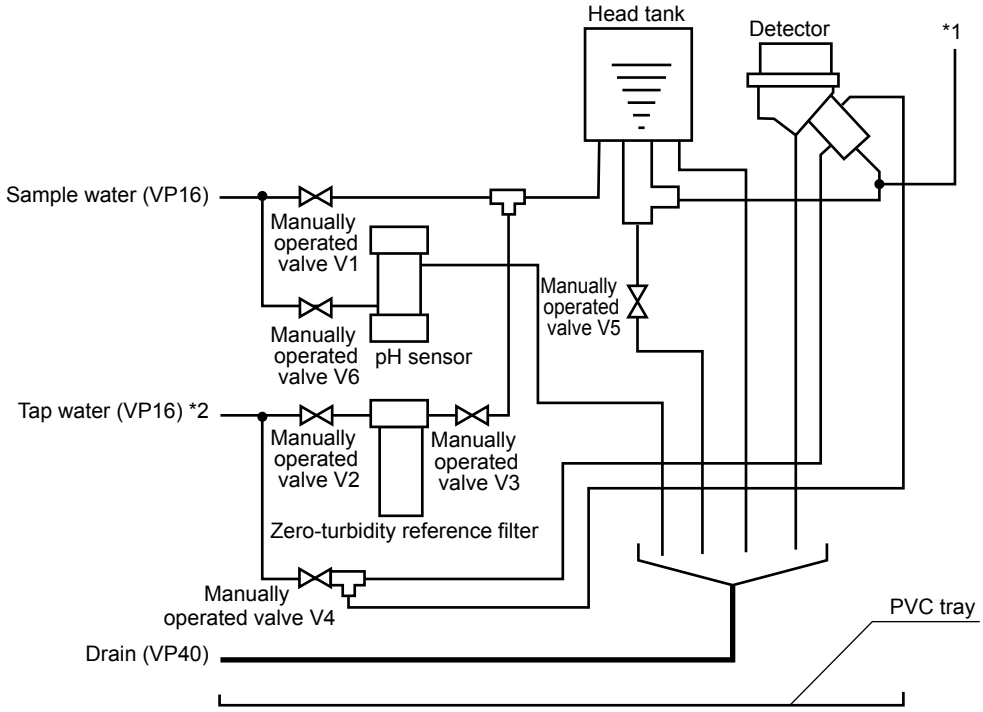
TB400G - □ - □ - A1



*1: Option Code /L (For bubble retardant)
*2: Reverse flow of tap water should be prevented using with a check valve on the supply line of tap water.

With sampling system, but without automatic cleaning or automatic zero calibration, and with pH meter

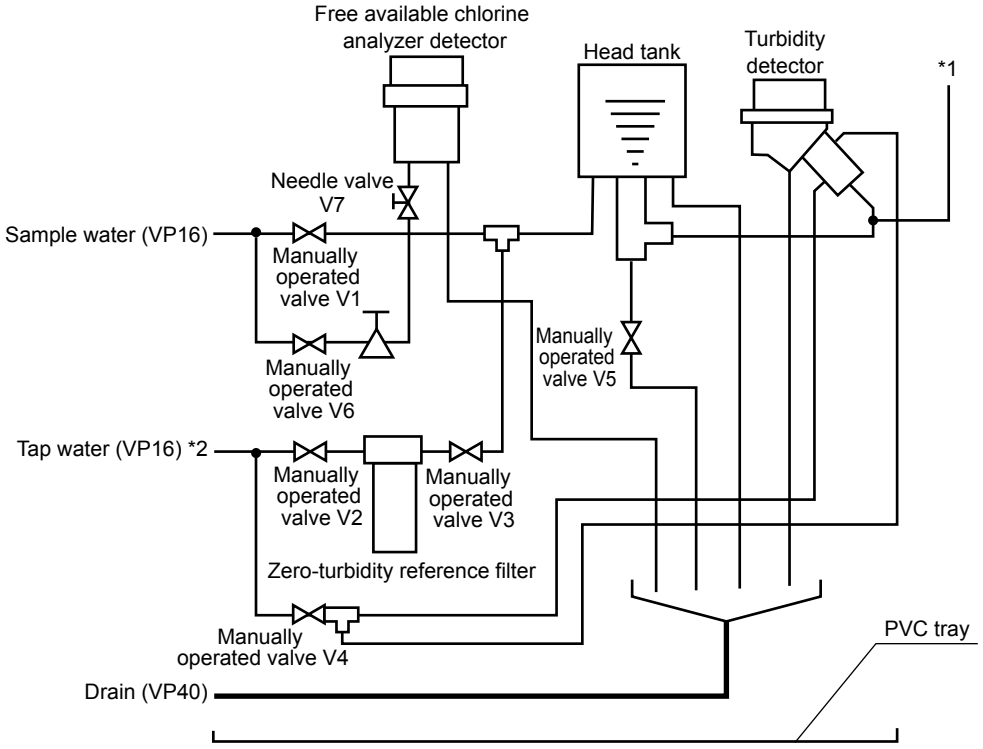
TB400G - □ - □ - A1 / PHN5 or TB400G - □ - □ - A1 / PHU5



*1: Option Code /L (For bubble retardant)
*2: Reverse flow of tap water should be prevented using with a check valve on the supply line of tap water.

With sampling system, but without automatic cleaning or automatic zero calibration, and with non-reagent type free available chlorine analyzer

TB400G - □ - □ - A1 / FC

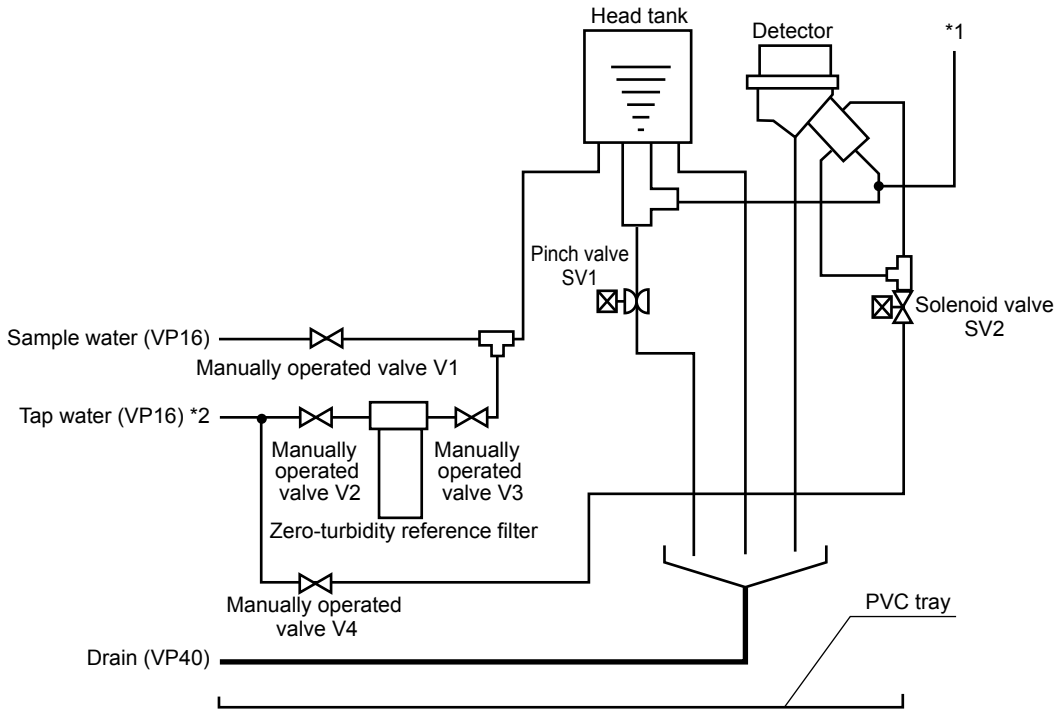


*1: Option Code /L (For bubble retardant)

*2: Reverse flow of tap water should be prevented using with a check valve on the supply line of tap water.

With sampling system and automatic cleaning, but without automatic zero calibration

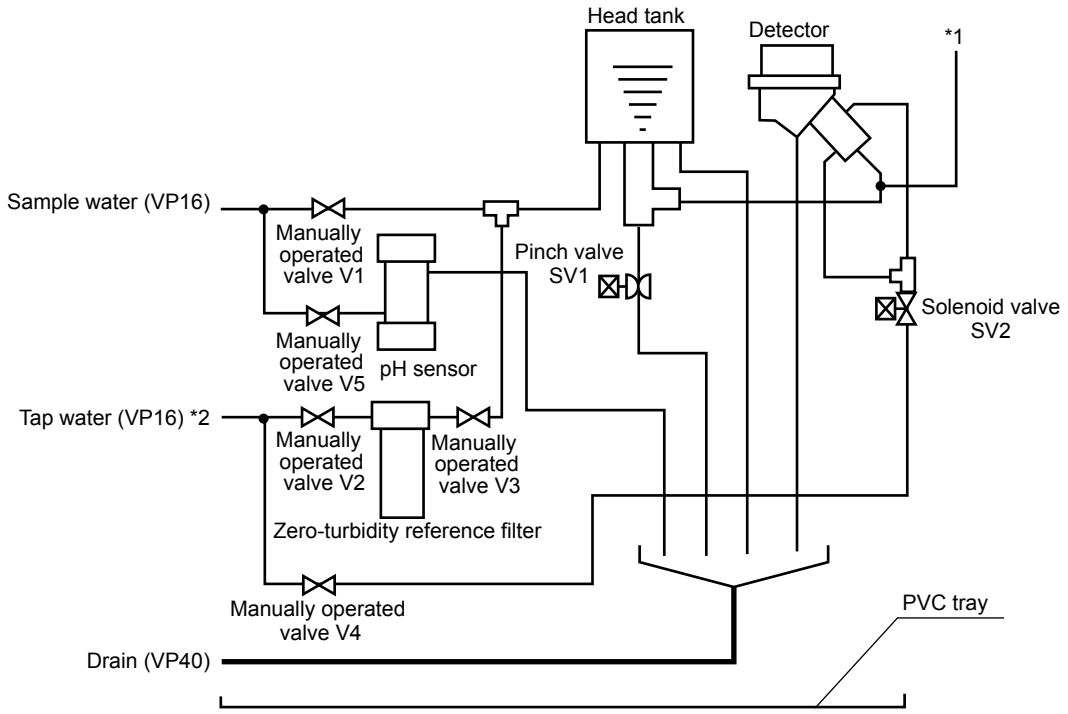
TB400G - □ - □ - A2



*1: Option Code /L (For bubble retardant)

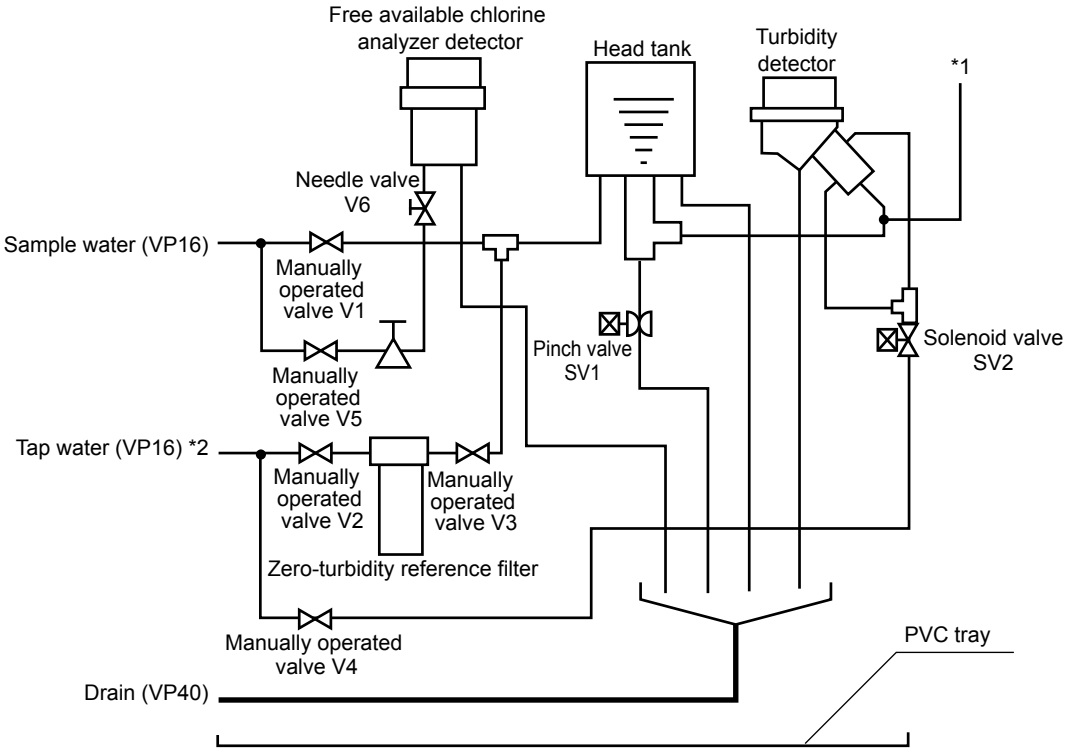
*2: Reverse flow of tap water should be prevented using with a check valve on the supply line of tap water.

With sampling system and automatic cleaning, but without automatic zero calibration, and with pH meter
TB400G - □ - □ - A2 / PHN5 or TB400G - □ - □ - A2 / PHU5



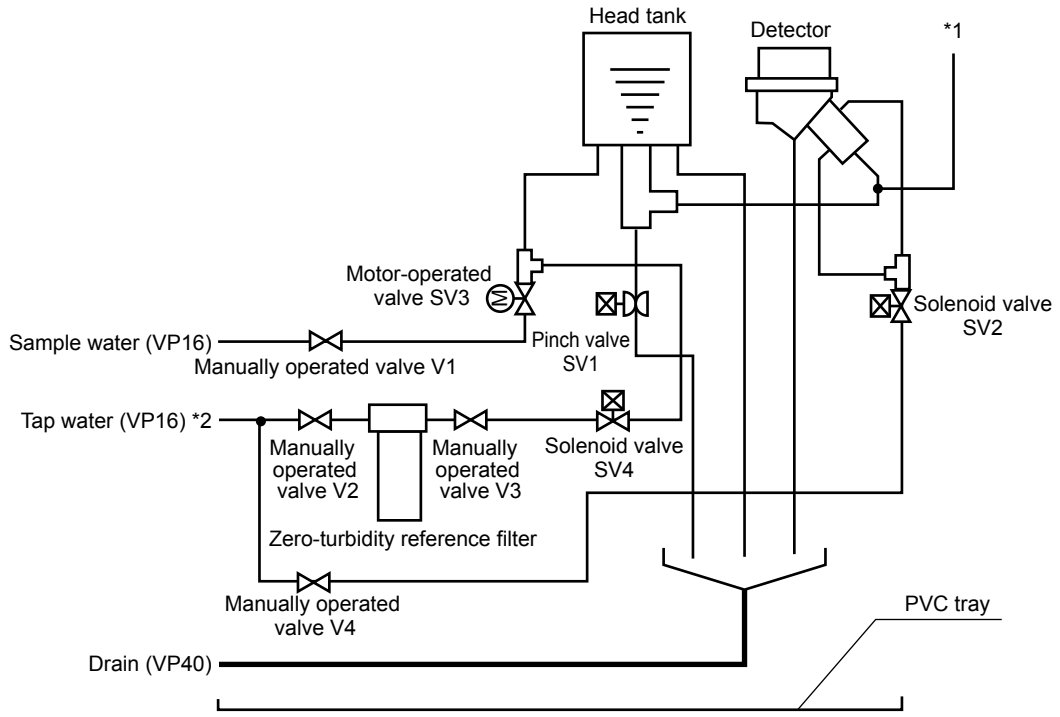
*1: Option Code /L (For bubble retardant)
*2: Reverse flow of tap water should be prevented using with a check valve on the supply line of tap water.

With sampling system and automatic cleaning, but without automatic zero calibration, and with non-reagent type free available chlorine analyzer
TB400G - □ - □ - A2 / FC



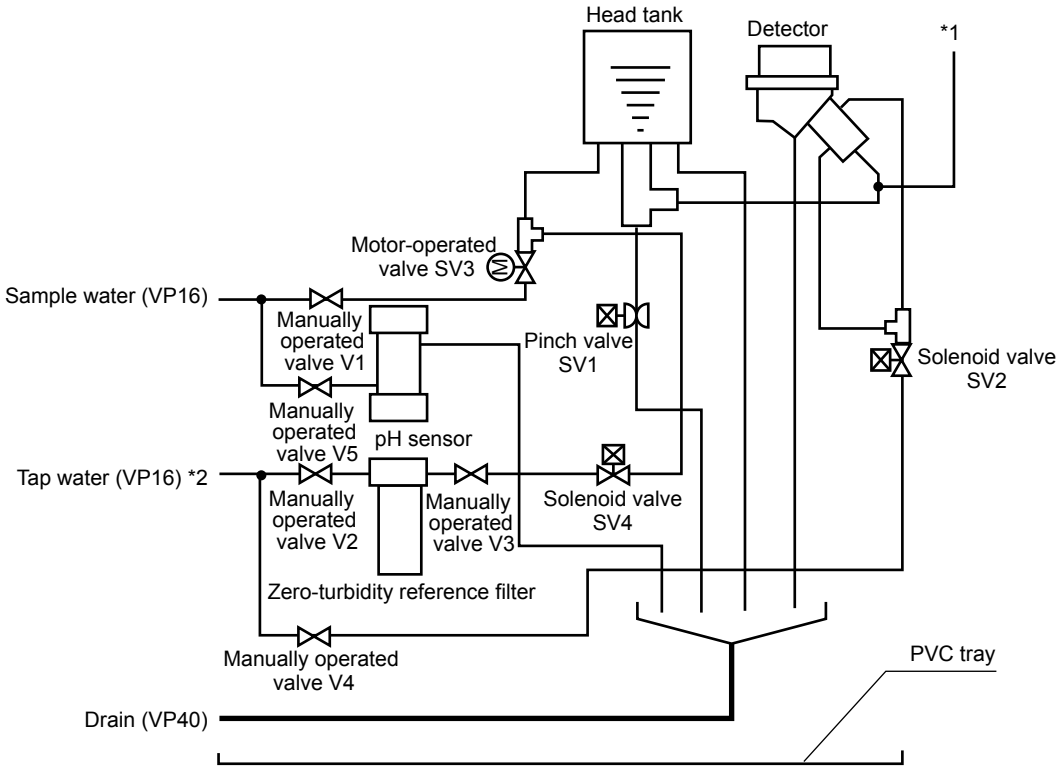
*1: Option Code /L (For bubble retardant)
*2: Reverse flow of tap water should be prevented using with a check valve on the supply line of tap water.

With sampling system, automatic cleaning, and automatic zero calibration
TB400G - □ - □ - A3



*1: Option Code /L (For bubble retardant)
*2: Reverse flow of tap water should be prevented using with a check valve on the supply line of tap water.

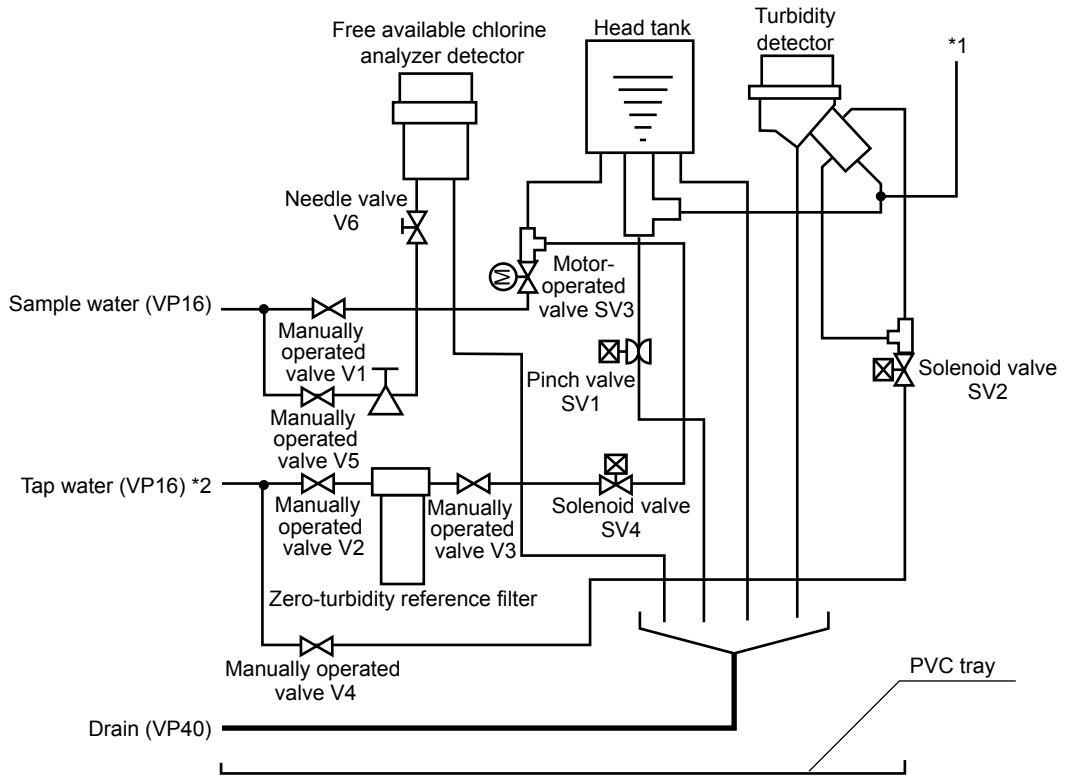
With sampling system, automatic cleaning, automatic zero calibration, and with pH meter
TB400G - □ - □ - A3 / PHN5 or TB400G - □ - □ - A3 / PHU5



*1: Option Code /L (For bubble retardant)
*2: Reverse flow of tap water should be prevented using with a check valve on the supply line of tap water.

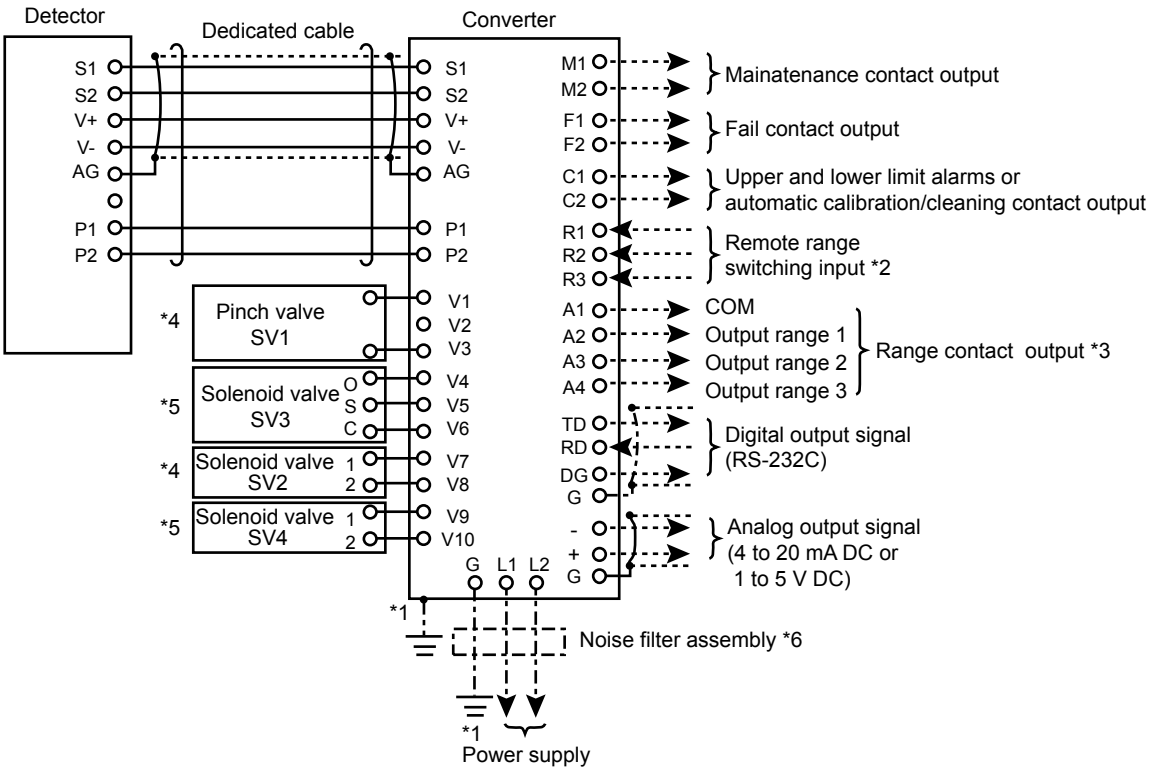
With sampling system, automatic cleaning, automatic zero calibration, and with non-reagent type free available chlorine analyzer

TB400G - □ - □ - A3 / FC



*1: Option Code /L (For bubble retardant)
*2: Reverse flow of tap water should be prevented using with a check valve on the supply line of tap water.

■ Wiring Diagram



*1: Ground terminal ⏚ on the outside of the converter case with a grounding resistance of 100 Ω or less.
Ground the power cord instead only if the above grounding is not feasible.
(Note) Do not use two-point grounding.

*2: Remote range switching method

Output \ Contact	R1 to R2	R1 to R3
Output range 1	OFF	OFF
Output range 2	ON	OFF
Output range 3	OFF	ON

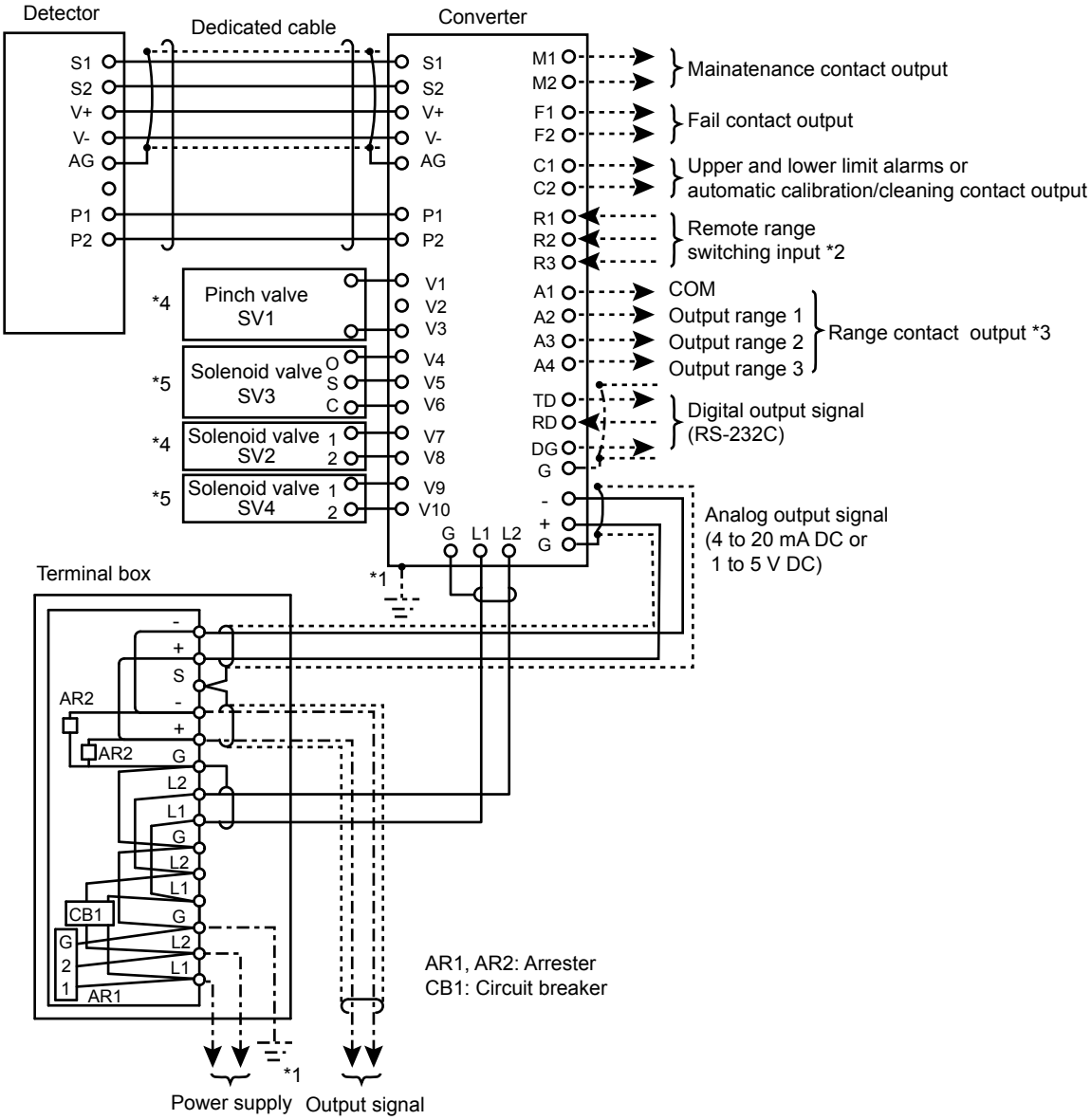
Resistance (ON): 200 Ω or less
(OFF): 100 kΩ or more

*3: Output range switching method

Output \ Contact	A1 to A2	A1 to A3	A1 to A4
Output range 1	Close	Open	Open
Output range 2	Open	Close	Open
Output range 3	Open	Open	Close

*4: In the case of with automatic cleaning (-A2, -A3)
*5: In the case of with automatic zero calibration (-A3)
*6: Only for Korea (-KC)

Option code: /ARS (with arrester)



*1: Ground terminal ⏚ on the outside of the converter case with a grounding resistance of 100 Ω or less.
Ground the power cord instead only if the above grounding is not feasible.
(Note) Do not use two-point grounding.

*2: Remote range switching method

Output \ Contact	R1 to R2	R1 to R3
Output range 1	OFF	OFF
Output range 2	ON	OFF
Output range 3	OFF	ON

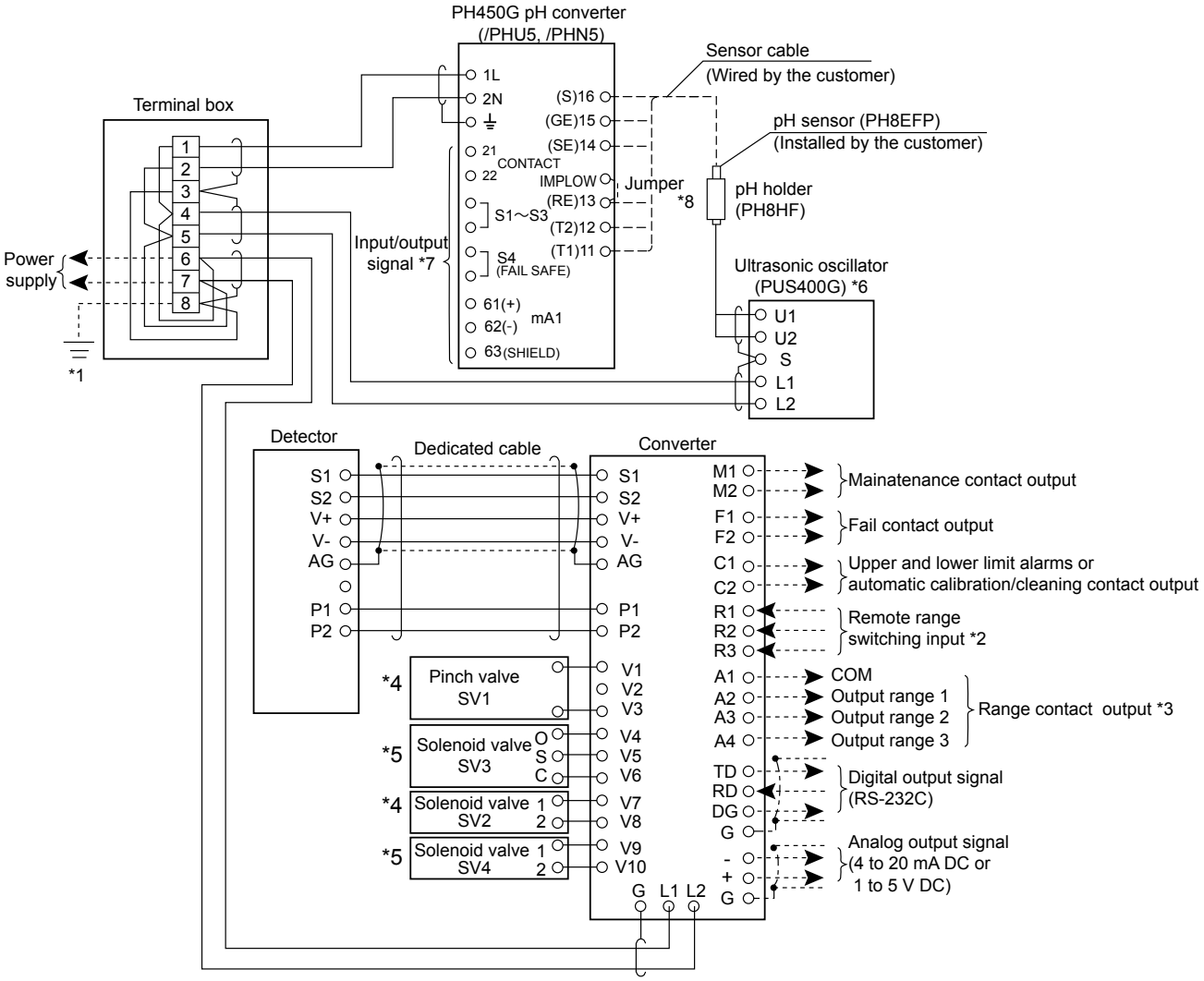
Resistance (ON): 200 Ω or less
(OFF): 100 kΩ or more

*3: Output range switching method

Output \ Contact	A1 to A2	A1 to A3	A1 to A4
Output range 1	Close	Open	Open
Output range 2	Open	Close	Open
Output range 3	Open	Open	Close

*4: In the case of with automatic cleaning (-A2, -A3)
*5: In the case of with automatic zero calibration (-A3)

Option code: /PHN5, /PHU5 (with pH meter)



*1: Ground the power cord (8) with a grounding resistance of 100 Ω or less.

*2: Remote range switching method

Output \ Contact	R1 to R2	R1 to R3
Output range 1	OFF	OFF
Output range 2	ON	OFF
Output range 3	OFF	ON

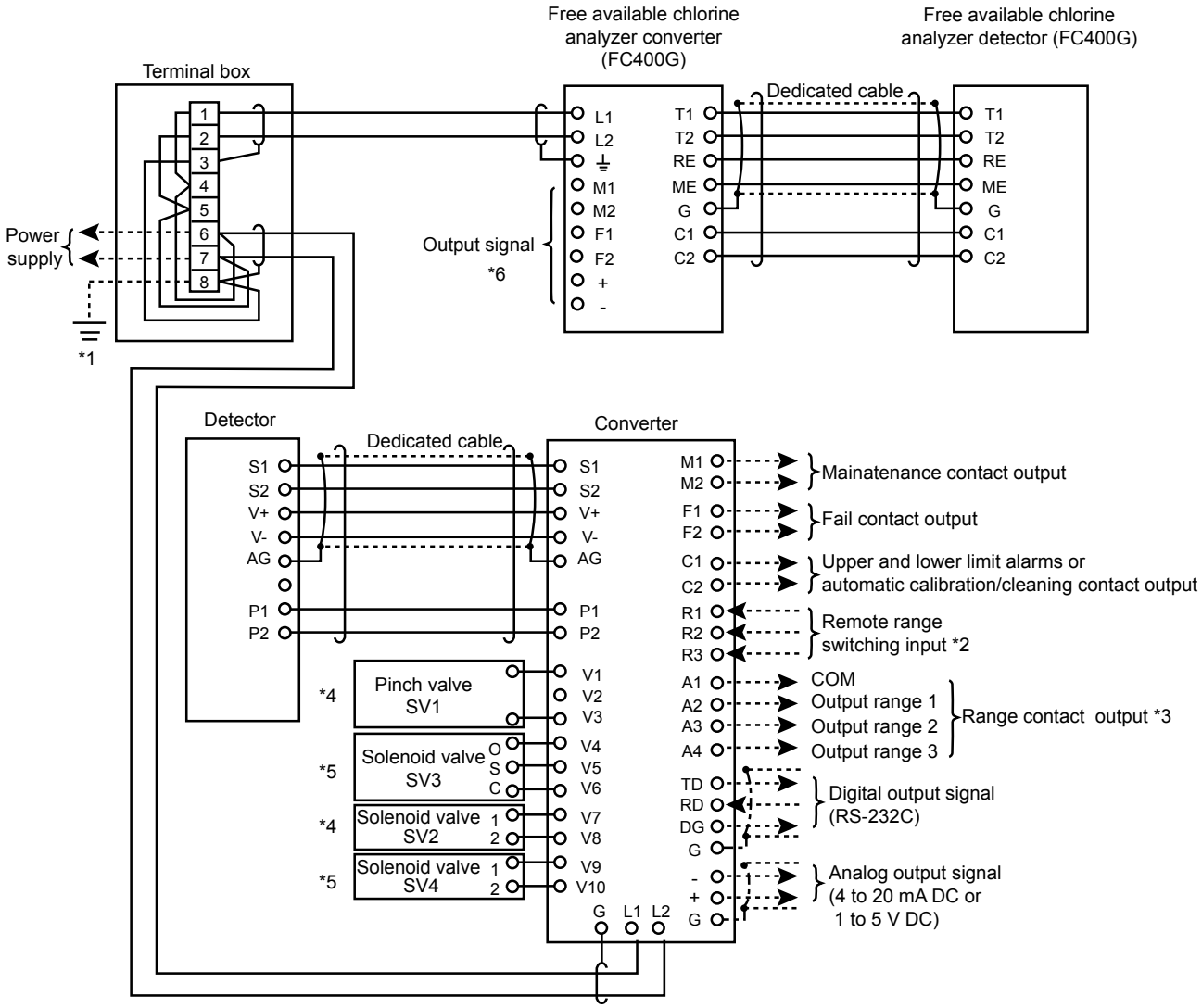
Resistance (ON): 200 Ω or less
(OFF): 100 kΩ or more

*3: Output range switching method

Output \ Contact	A1 to A2	A1 to A3	A1 to A4
Output range 1	Close	Open	Open
Output range 2	Open	Close	Open
Output range 3	Open	Open	Close

*4: In the case of with automatic cleaning (-A2, -A3)
*5: In the case of with automatic zero calibration (-A3)
*6: In the case of with ultrasonic cleaning (/PHU5)
*7: Refer to the User's Manual of the PH450G for details of input/output signals.
*8: Refer to the User's Manual of the PH450G for details of jumper setting.

Option code: /FC (with non-reagent type free available chlorine analyzer)



*1: Ground the power cord (8) with a grounding resistance of 100 Ω or less.

*2: Remote range switching method

Output \ Contact	R1 to R2	R1 to R3
Output range 1	OFF	OFF
Output range 2	ON	OFF
Output range 3	OFF	ON

Resistance (ON): 200 Ω or less
(OFF): 100 kΩ or more

*3: Output range switching method

Output \ Contact	A1 to A2	A1 to A3	A1 to A4
Output range 1	Close	Open	Open
Output range 2	Open	Close	Open
Output range 3	Open	Open	Close

*4: In the case of with automatic cleaning (-A2, -A3)

*5: In the case of with automatic zero calibration (-A3)

*6: Refer to the User's Manual of the FC400G for details of input/output signals.

Enquiry Specifications Sheet for Model TB400G Surface Scattering Light Turbidity Meter

For enquires on the Yokogawa Surface Scattering Light Turbidity Meter, please tick (✓) the appropriate box ☐ and write down the relevant information in the blanks.

1. General Information

Company name; _____

Contact Person; _____ Department; _____ (Phone: _____)

Plant name; _____

Measurement location; _____

Purpose of use; ☐ Indication, ☐ Recording, ☐ Alarm, ☐ Control

Power supply; _____ V AC, _____ Hz

2. Measurement Conditions

(1) Sample water temperature; _____ to _____, Normally _____ [°C]

(2) Sample water pressure; _____ to _____, Normally _____ [kPa]

(3) Sample water flow rate; _____ to _____, Normally _____ [L/min]

(4) Slurry or contaminations; ☐ No, ☐ Yes _____

(5) Names of sample water; _____

(6) Components of sample water; _____

(7) Others; _____

3. Installation Site

(1) Ambient temperature; approx. _____ [°C]

(2) Location; ☐ Indoors _____

(3) Others; _____

4. Requirements

(1) Measuring range; _____ to _____ mg/L

(2) Transmission output; ☐ 4 to 20 mA, ☐ 1 to 5 V DC

(3) System configuration selection; ☐ TB400G turbidity meter, ☐ Sampling system, ☐ pH meter,
☐ PUS400G ultrasonic oscillator, ☐ FC400G free available chlorine analyzer,
☐ Automatic cleaning, ☐ Automatic zero calibration, ☐ Arrester

(4) Others; _____