General Specifications

Model FC400G
Free Available Chlorine Analyzer (Non-reagent Type)

EXA FC

GS 12F5A1-E

GENERAL

Free chlorine contained in tap water from faucets in fresh water distribution is specified to be 0.1mg / l or more by the regulations of the Water Supply Law. However, the presence of excessive free available chlorine results in lack of tap water freshness and even the presence of more than 1 mg / l of free chlorine is reported to be harmful to the human body. Therefore, the measuring and monitoring of the concentration of free chlorine in water supplies, using free chlorine analyzers is increasingly important in recent years.

The FC400G non-reagent free chlorine analyzer adopts the polarographic method using rotating electrode to continuously measure on-line the concentration of free available chlorine.

The FC400G is a microprocessor-based, true intelligent free chlorine analyzer developed based on YOKOGAWA's long experience with residual chlorine analysis.

FEATURES

Intelligent Converter

- One-touch simple calibration
  In calibration, the sensor is automatically analyzed (zero point, slope, and response).
- Output range can be arbitrarily set in the range of from 0-1 mg/l to 0-3 mg/l in the field.
- Line segment output is available for output signals.
- Easy confirmation of inter-electrode applied voltage/ current characteristic (plateau characteristic).
  This allows understanding of the detailed sensor characteristics in the application.
- Enhanced display and contact output functions
- Operation panel with superior operability

Upgraded Detector

- Rotating electrode/ceramic bead cleaning has been improved to realize further effective and continuous automatic cleaning.
- Adoption of reliable-sliding contact for probe
- Easy-to-maintain (-clean) cell construction

Main Differences in Service Condition between Reagent and Non-Reagent Types

Commercialization of the FC400G is based on the main features of maintenance-free and no reagent use. This model has the following usage restrictions in comparison with residual chlorine analyzers (model RC400G) that use reagent.

Service conditions	Non-reagent type free chlorine analyzer (FC400G)	Reagent residual chlorine analyzer (RC400G)
Measured object	Free chlorine	Free chlorine or total chlorine
Sample pH range	pH 6.5 to 7.5	pH 3 to 9
Sample SS (Suspended Solid) range	10 mg/l or less	500 mg/l or less
Sample conductivity range	100 to 300 µS/cm	No particular limit
Effects of combined chlorine in free chlorine measurement	Large effects (Note)	Almost no effects
When measuring high accuracy is required	Not suitable	Suitable
Measuring point	Water purification, water supply, and faucets	Each process from receiving well to water purification, and water supply

Note) Problem does not practically arise since almost no combined chlorine exists in water purification, water supply, and faucets.

YOKOGAWA

Yokogawa Electric Corporation
2-9-32, Nakacho, Musashino-shi, Tokyo, 180-8750 Japan
Tel.: 81-422-52-5617 Fax.: 81-422-52-6792

GS 12F5A1-E

5th Edition Jul. 2011(YK)

STANDARD SPECIFICATIONS

1. Free Chlorine Analyzer (Non-Reagent Type)

Measured Object: Free chlorine in tap water
Measuring System: Polarographic method using rotating electrode
Display Method: Digital (3 1/2 digit LCD) display
Measuring Range: 0 to 3mg / l
Output Range: Can switch between arbitrary ranges (each between 0 to 1 mg/l and 0 to 3 mg/l). Default ranges at shipping time are: Range 1: 0 to 2 mg/l, Range 2: 0 to 3 mg/l
Output Signal: 4 to 20mA DC (load resistance : 550Ω or less) or 1 to 5V DC (output resistance : 300Ω or less) isolated
Contact Output: 2 points, Dry contact
Event of Error; Excessive diffusion current value, sample temperature error, applied voltage error, converter error, and temperature compensation range over
Maintenance; Any modes other than measurement (MEAS) mode
Contact capacity; 250 V AC max., 1 A max., 125 VA max. (resistance load)
220 V DC max., 1 A max., 60 W max. (resistance load)

	Main unit power OFF	Main unit power ON	
	–	During non-operation	In operation
Event of Error	Open	Closed	Open
Maintenance	Closed	Open	Closed

Contact Input: Remote range switching:
Switching between 2 preset ranges (range 1 and range 2)
0VDC or contact open: Range 1
5VDC(input impedance 250 kΩ): Range 2

Sample Conditions:
Temperature; 0 to 50 °C (Temperature compensation range 0 to 40 °C)
pH; 6.5 to 7.5 (see Figure 1)
Flow Rate; 0.1 to 2.5 l/min
Pressure; 1 to 150 kPa
100 to 750 kPa
(for the case where dedicated sampling system ST401G is provided)
Conductivity; 100 to 300 µS/cm (see Figure 2)
SS (Suspended Solid); 10 mg/l or less

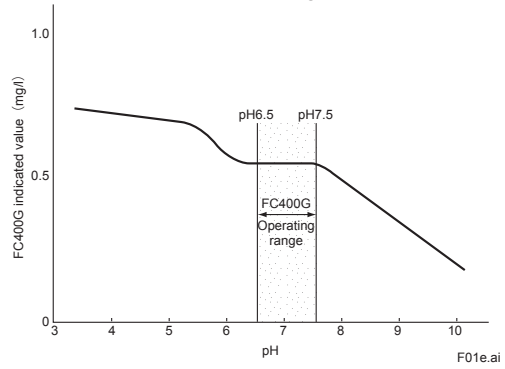


Figure 1 Sensitivity characteristics of diffusion current by pH value

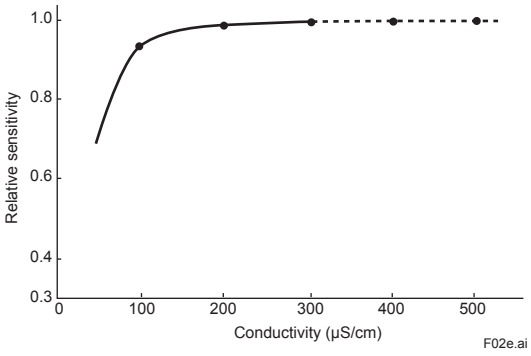


Figure 2 Sensitivity characteristics of diffusion current by conductivity

Note: If conductivity exceeds 300 µS/cm, default value of applied voltage should be changed.

Electrode:
Indicator electrode; Rotating gold electrode
The combined chlorine insensitive version uses a gold alloy indicator electrode.
Counter electrode; Silver chloride electrode (with Pt 1000 RTD installed)
Electrode Cleaning: Ceramic bead cleaning
The combined insensitive version uses glass beads.
Converter Functions:
Display function;
Concentration, sample temperature, applied voltage, diffusion current, output signal %, zero point, slope, error display, interactive message, and key operation request display
Diagnostic function;
Excessive diffusion current value, sample temperature error, applied voltage error, converter error, temperature compensation range over, zero point error, slope abnormality, and response error
Functions settable/executable during operation level; Zero and span calibration, selection of message area display content, hold ON/OFF selection, cell motor ON/OFF selection
Functions settable/executable in setting level; Output range setting, hold parameter setting, wash/auto-calibration parameter setting, plateau characteristic measurement
Service level code entry Functions settable/executable during service level; Switching of °C/°F, temperature compensation range over check ON/OFF, straight line/ two line-segment output selection, applied voltage setting, and applied voltage compensation rate setting

Main Wetted Part Materials:
Measuring tank; Acrylic resin
Piping; Flexible PVC and hard PVC
Color: Munsell 0.6GY3.1 / 2.0 and Munsell 2.5Y8.4 / 1.2
Painting Finish: Baked polyurethane resin coating
Ambient temperature: -10 to 55°C
Ambient humidity: 5 to 95% RH (no dew condensation allowed)
Storage Temperature: -30 to 70°C
Installation: Indoor (Outdoor use separately requires rainproof measures.) (Direct sunlight must be avoided.)
Utility:
Power supply; 100 V AC ±10% 50/60 Hz
110 V AC ±10% 50/60 Hz
200 V AC ±10% 50/60 Hz
220 V AC ±10% 50/60 Hz
Power consumption; Approx. 15 VA
Mounting: 2B pipe mounting or wall mounting
Weight: Approx. 6 kg
EMC Regulatory Arrangement in Australia and New Zealand:
EN 55011 Class A, Group 1
KC Marking: Korea Electromagnetic Conformity Standard

2. ST401G Sampling System for (Non-Reagent Type) Free Chlorine Analyzer

Function: Used for application having high pressure and large flow rate.
Refer to GS 12A00V02-01E.

Characteristics (% display shows value relative to the upper limit of a range.)

Repeatability: 2 %
Linearity: ±5 %
Drift: Zero drift; ±1 % / month
Span drift; -10 % / month
Response time: Approx. 2 min (90% response time)
Temperature compensation error (water temperature): ±3%
(Temperature compensation range : 0 to 40°C)
Ambient temperature effects: ±0.5% / 10°C
Power variation effects: ±0.5% / 10% of rated voltage
Combined chlorine effects of the combined chlorine insensitive version: Approx. 30% of combined chlorine concentration

MODEL AND SUFFIX CODES

(1) Free Chlorine Analyzer (Non-Reagent Type)

Model	Suffix Code	Option Code	Description
FC400G	----------	----------	Free available chlorine analyzer (non-reagent type)
Output signal	-5	----------	1-5 V DC
	-6	----------	4-20 mA DC
Power supply	1	----------	200 V AC±10%, 50 Hz
	2	----------	200 V AC±10%, 60 Hz
	3	----------	220 V AC±10%, 50 Hz
	4	----------	220 V AC±10%, 60 Hz
	5	----------	100 V AC±10%, 50 Hz
	6	----------	100 V AC±10%, 60 Hz
	7	----------	110 V AC±10%, 50 Hz
	8	----------	110 V AC±10%, 60 Hz
—	*A	----------	Style A
Optional specifications		/ PPM	Units in ppm
		/ SCT	With Tag Plate
		/ ST	With ST401G Sampling system (Note 1)
		/ SPS	With Teflon-coated screws for protection from salt corrosion
		/ CC	Combined chlorine insensitive version

(Note 1) Specified /ST to use with sampling system.

ACCESSORIES

Name	Part No.	Q´ty	Remarks
Polishing powder (Alumina)	K9088PE	1 Bottle	For cleaning of rotating gold electrode
Ceramic beads (Note1)	K9332ZP	2	2 bags / 1 Q' ty
Fuse	A1111EF	4	2A (spare)
Allen wrench	L9827AB	1	Nominal size : 1.5 mm
Allen wrench	L9827AT	1	Nominal size : 2 mm

Note1: Glass beads is used in case of combined chlorine insensitive version.

(2) Sampling System for (Non-Reagent Type) Free Chlorine Analyzer (Reference)

Model	Suffix Code	Option Code	Description
ST401G	.....	.....	Sampling system
System instruments	-FC4	.....	With free available chlorine analyzer (FC400G) (note 1)
	-PH4	.....	With pH converter (PH400G) (note 2)
	-PH5	.....	With pH converter (PH450G) (note 2)
	-PF4	.....	With free available chlorine analyzer (FC400G) and pH converter (PH400G) (note 1) (note 2) (note 3)
	-PF5	.....	With free available chlorine analyzer (FC400G) and pH converter (PH450G) (note 1) (note 2) (note 3)
Ultrasonic oscillator (for pH meter)	-N	.....	Not supplied
	-U	.....	Supplied
___	-A	.....	Always -A
Option		/R	Piping connections on the back
		/AN	Without instrument
		/S	With stainless steel stand (note 4)
		/ARS	With arrester (power and signal lines only) (note 5)
		/AZC1	With auto zero calibration for 100 V AC (note 6)
		/AZC2	With auto zero calibration for 110 V AC (note 6)
		/AZC3	With auto zero calibration for 200 V AC (note 6)
		/AZC4	With auto zero calibration for 220 V AC (note 6)
		/RR	With remote range switching (note 7)
		/SCT	With stainless tag plate
		/TT3	With 500 ml KCl reserve tank for pH sensor (note 2)

Model ST401G refers only to a sampling system and does not include a free available chlorine analyzer and/or a pH meter (sensor, holder, converter and ultrasonic oscillator). (Instrument should be purchased separately.)
Note that the ST401G Sampling System accepts the following models of note 1 or note 2 only, and depending on system configuration.

Note 1: Non-reagent type free available chlorine analyzer
When ordering, option code "/ST" (integration into ST401G sampling system) must be specified.

Note 2: 4-wire type pH converter system (refer to GS 12B7C1-E, GS 12B07C05-01E, GS 12B07B02-E, GS 12J05C02-00E)

pH sensor: PH8EFP-03-TN-TT1-N-T*A (when suffix code of "-PH4", "-PF4" specified.)
PH8EFP-03-TN-TT3-N-T*A (when suffix code of "-PH4", "-PF4" and option code of "/TT3" specified.)
PH8EFP-03-TN-TT1-N-G*A (when suffix code of "-PH5", "-PF5" specified.)
PH8EFP-03-TN-TT3-N-G*A (when suffix code of "-PH5", "-PF5" and option code of "/TT3" specified)

pH holders: PH8HF-PP-JPT-T-NN-NN*A (without cleaning system)
PH8HF-S3-JPT-T-NN-NN*A (without cleaning system)
PH8HF-PP-JPT-T-S3-C1*A (with ultrasonic cleaning)
PH8HF-S3-JPT-T-S3-C1*A (with ultrasonic cleaning)

pH converter: PH400G-☐-EA*B (when suffix code of "-PH4", "-PF4" specified.)
PH450G-A-E (when suffix code of "-PH5", "-PF5" specified.)

Ultrasonic oscillator: PUS400G-NN-NN-☐-E (which power supply rating should be same as the pH converter.)

Note 3: Power supply rating of non-reagent type free available chlorine analyzer should be same as the pH converter.

Note 4: Specify if needed, instead of the standard stanchion made of carbon steel.

Note 5: Available only when the suffix code "-FC4", "-PH4" or "-PH5" is specified.

Note 6: Available when free available chlorine analyzer is specified, singly or in combination with pH meter, by suffix code, "-FC4", "-PF4" or "-PF5."

Note 7: Available when free available chlorine analyzer is specified singly by suffix code, "-FC4." An arrester is supplied automatically with this option.

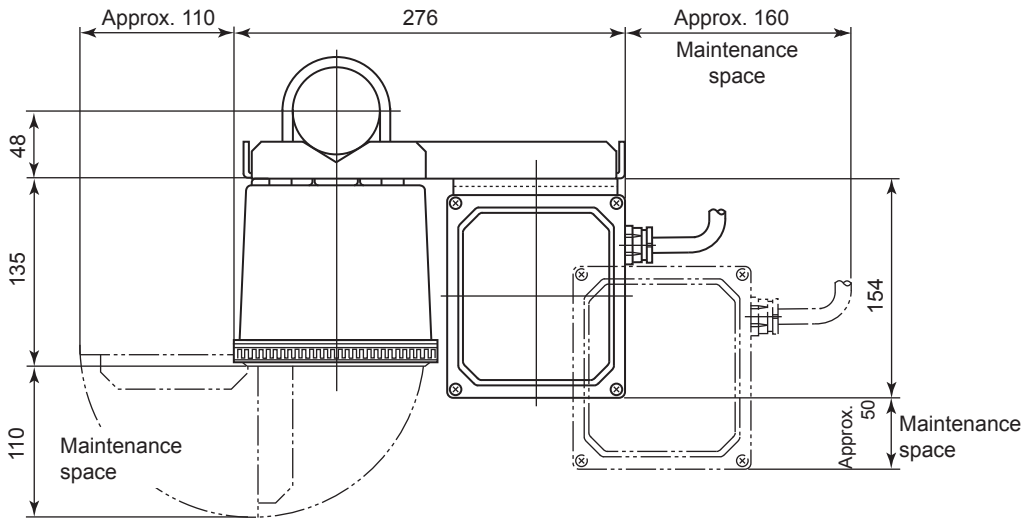
(3) Spare Parts

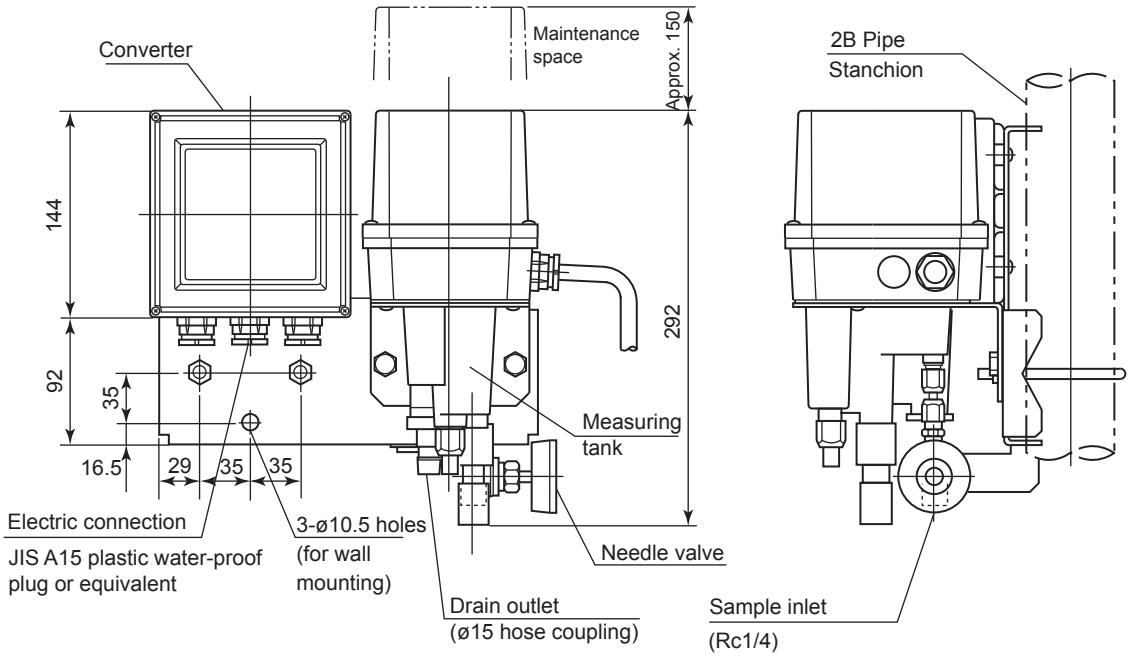
Name	Part No.	Description	Q´ty	Recommended replacement interval (*)
Indicator Electrode (Rotating electrode)	K9332MB	Gold electrode	1	Yearly
Indicator Electrode (Rotating electrode)	K9334JP	Gold alloy indicating electrode	1	Yearly
Counter Electrode	K9332MK	Silver chloride electrode	1	(*1)
Ceramic Beads	K9332ZP	For cleaning general type indicator electrode, 2 bags	1	Yearly
Glass Beads	K9332ZJ	For cleaning anti combined chlorine type indicator electrode, 2 bags / 1Q' ty	1	Yearly
Polishing Powder (Alumina)	K9088PE	For polishing indicator electrode	1	-
Brush	K9332JX	Part for electrode mechanism	1	2 years
Slip Ring	K9332JZ	Part for electrode mechanism	1	2 years
Fuse	A1111EF	2A	1	Yearly (*2)
Driven Shaft Assembly	K9334JV	Part for electrode mechanism	1	3 years
Drive Belt	L9804UK	Part for electrode mechanism	1	3 years
O-Ring	Y9115XB	Part for electrode mechanism	1	3 years
Motor Assembly (100 V)	K9334JY	Part for electrode mechanism	1	3 years
Motor Assembly (110 V)	K9334VQ	Part for electrode mechanism	1	3 years
Motor Assembly (200 V)	K9334VR	Part for electrode mechanism	1	3 years
Motor Assembly (220 V)	K9334VS	Part for electrode mechanism	1	3 years
Gear Head (100 V/110 V)	K9332JP	Part for electrode mechanism	1	3 years
Gear Head (200 V/220 V)	K9334VA	Part for electrode mechanism	1	3 years
Activated Charcoal Filter	L9862AY	For zero calibration	1	Yearly

(*) Replacement intervals vary depending on the application.
(*1) At the time of damage.
(*2) Fuse may be used more than one year, we recommend periodical replace for planning maintenance.

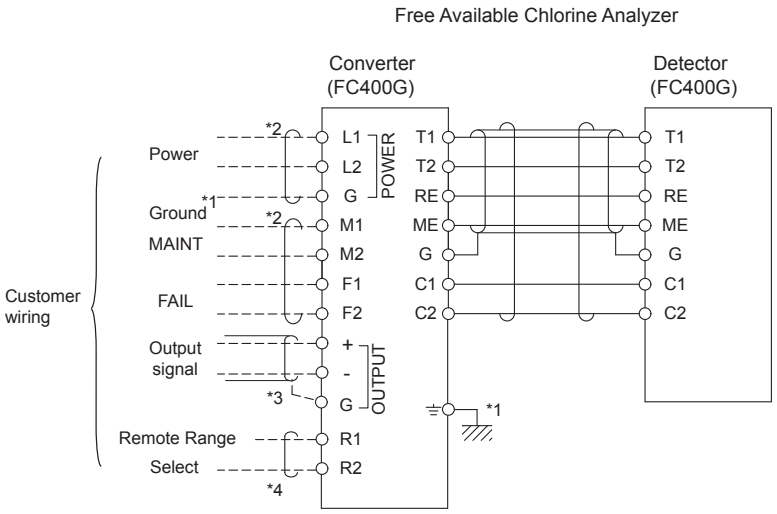
EXTERNAL DIMENSIONS

Unit: mm





WIRING DIAGRAMS

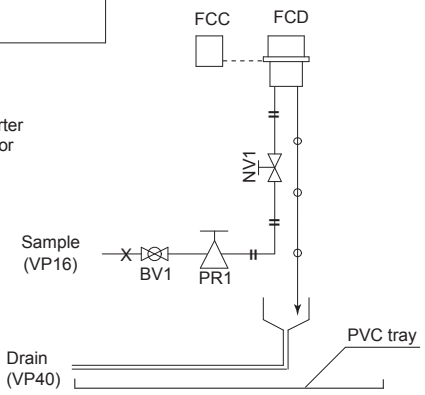


(Note) All are connected to wiring terminals (M3 screw) in the converter.
*1: Be sure to ground the case ground terminal (M4 screw), or if this is not possible then connect to G of power wiring. Avoid two-point ground. (Case is connected to signal ground inside converter).
*2: Use cable with 9 to12 mm OD.
*3: Use two-core shielded cable with 9-12 mm OD. To avoid two-point ground, connect shield to ground at one end only
*4: Contact input to apply the voltage.

Flow of ST401G Sampling System (ST401G - ☐ - ☐ - A) for (Non Reagent Type) Free Chlorine Analyzer (General)

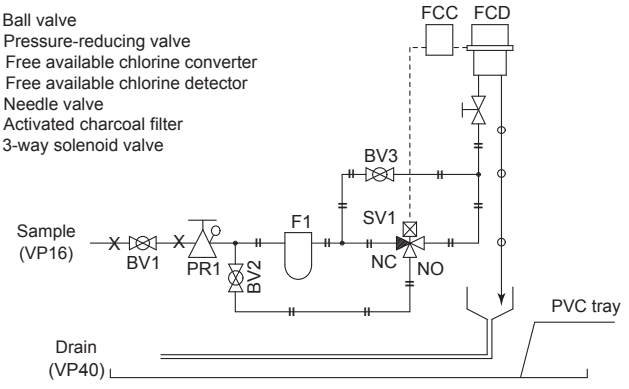
<Tubing materials>
- Ø6 / Ø4 Polyethylene tube
- Ø12 / Ø9 Polyethylene tube
- Ø22 / Ø15 soft tube with net
- VP16 Pipe
- VP40 Pipe

BV1 : Ball valve
PR1 : Pressure-reducing valve
FCC : Free available chlorine converter
FCD : Free available chlorine detector
NV1 : Needle valve



With Auto-zero calibration (ST401G - ☐ - ☐ - A /AZC☐)

BV1, 2, 3 : Ball valve
PR1 : Pressure-reducing valve
FCC : Free available chlorine converter
FCD : Free available chlorine detector
NV1 : Needle valve
F1 : Activated charcoal filter
SV1: 3-way solenoid valve



Inquiry Sheets for Model FC400G Free Available Chlorine Analyzer

1. General Information;

Name of your company; _____
Person in charge; _____ Belongs to: _____(TEL. _____)
Name of plant; _____
Measuring point; _____
Purpose of use; ☐ Indication, ☐ Record, ☐ Alarm, ☐ Control
Power supply; _____V AC, _____Hz

2. Sample Conditions

(1) Liquid temperature; _____ to _____ , Normal _____ [°C]
(2) Liquid pressure; _____ to _____ , Normal _____ [kPa]
(3) Flow rate; _____ to _____ , Normal _____ [l/min]
(4) Ammoniacal contaminants; ☐ No, ☐ Yes
(5) Slurry or soiling components; ☐ No, ☐ Yes
(6) Name of sample liquid; _____
(7) Composition of measured liquid; _____
(8) Other; _____

3. Installation location

(1) Ambient temperature; _____
(2) Installation location; ☐ Indoors _____
(3) Other; _____

4. User requirements

(1) Measuring range; _____to _____mg/l
(2) Transmission output; ☐ 4 to 20mA DC ☐ 1 to 5V DC
(3) Selection of component instruments; ☐ Free Chlorine Analyzer ☐ Sampling system ☐ Accessories
(4) Other ☐ Combined chlorine insensitive version
☐ Remote range control
☐ Auto zero calibration system
☐ _____