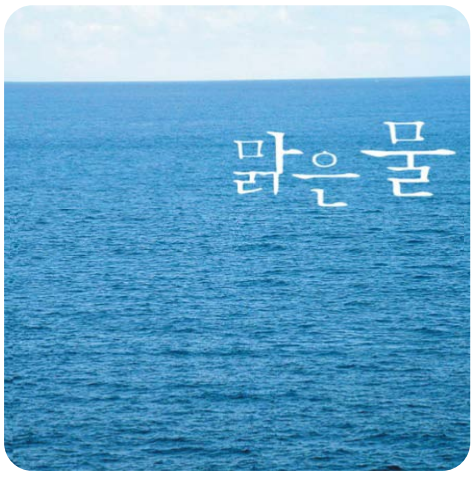
COD ANALYZER

Introduction Manual



KDT-3951
KDT-3952
KDT-3953
KD-2951
KD-2951H
KD-2952
KD-2953

KDTMS

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PREFACE

As this User Manualincludes matters required for accurate and safe use of the measuring device,please read carefully and exhibit 100% of its performance for long time. Contact the seller in case of failure, abnormality or unclear matter.

NOTICE

1. When installing this measuring device,prepare power with earth to protect the device from electric shock or lightning.
2. Remove connection of terminals in the power box to perform insulation resistance test and withstanding voltage test.Conducting test tests under connection can operate surge voltage absorption,causing short circuit and damaging of thedevice.
3. This measuring device can result in failure when conditions of use are inappropriate. Failure caused by natural disasters may turn matters of free warranty into charging of a fee. Read this document carefully before operating the device.

1. OVERVIEW

A. Overview

This automatic COD measuring deviceautomatically measures and records COD concentration according to total emission regulation in the Clean Water Act. It uses testing method of Korea to internalize the sequence of factory drain test and execute it using computer. The results of continuous measurement are recorded in the form of hourly and daily reports.

Note	* COD (Chemical Oxygen Demand) measurement methods (methods applied by our company) in official test method for water pollution 1. Acidic potassium permanganate method: oxygen consumption by acidic $KMnO_4$at 100℃ 2. Alkaline potassium permanganate method: oxygen consumption by basic $KMnO_4$at 100℃ 3. Potassium dichromate method: chemical oxygen consumption by dichromate * Classification of products according to measurement method 1. Acidic potassium permanganate method • KDT-3951(amount of reagent:10 ㎖, measurement range: 0~100 ㎎/L) • KD-2951(amount of reagent: 5 ㎖, measurement range: 0~100 ㎎/L) • KD-2951H(amount of reagent: 5 ㎖, measurement range: 0~200 ㎎/L) 2. Alkaline potassium permanganate method • KDT-3952(amount of reagent: 10 ㎖, measurement range:0~100 ㎎/L) • KD-2952(amount of reagent: 5 ㎖, measurement range:0~100 ㎎/L) 3. Potassium dichromate method • KD-2953(amount of reagent5 ㎖, measurement range:0~100 ㎎/L)

※ Definition of names

This Manual defines names for models of automatic COD measuring device of KDTMS as follows.

☐ KDT-3951, 3952, models with sample amount of 10㎖ are indicated as **3 Series**.

☐ KD-2951, 2951H, 2952 and 2953, models with sample amount of5㎖,are indicated as **2 Series**.

☐ Acidic potassium permanganate method is indicated as **manganese method**.

☐ Alkaline potassium permanganate method is indicated as **alkali method**.

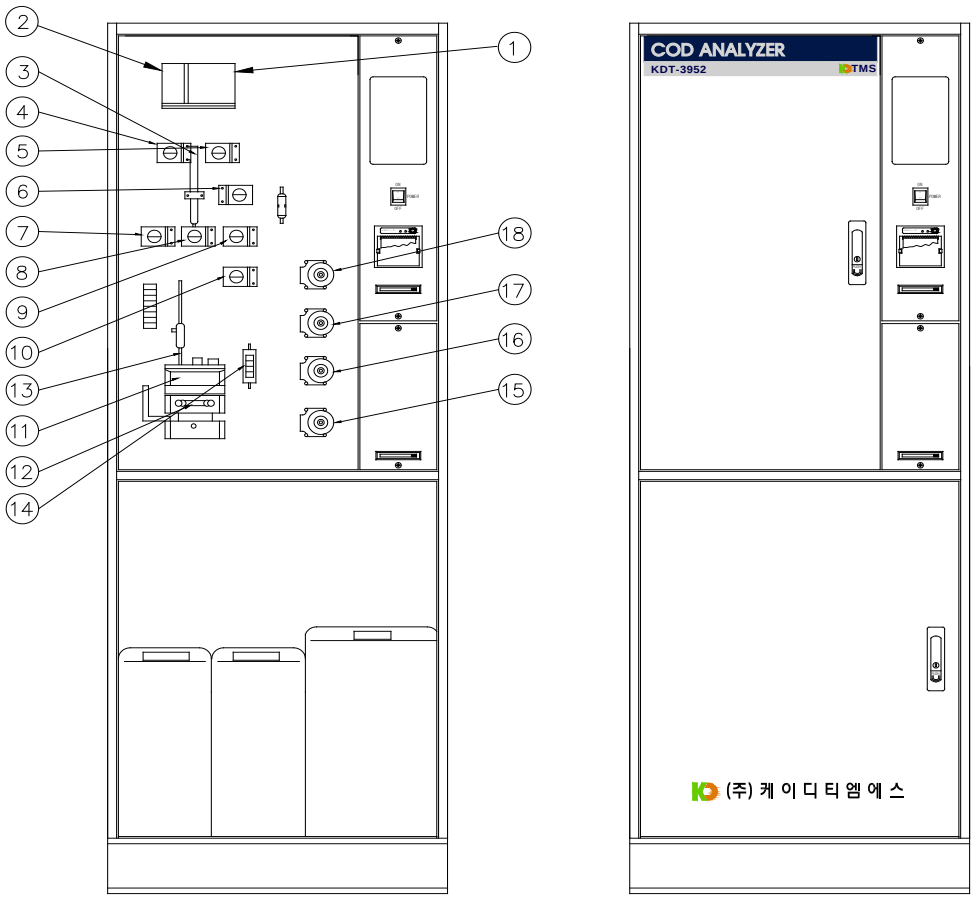
☐ Potassium dichromate method is indicated as **chromium method**.

B. Characteristics

1) Since preliminary measurement is performed every time to decide optimal amount of reagent (10-step),precise measurement can be done with large fluctuation in COD concentration.
2) Endpoint of titration is detected by oxidation reduction potential difference method.
As endpoint potential is calculated every time by remembering potential in oxidation state (manganese method, alkali method : excess $KMnO_4$/ chromium method: excess dichromate) and potential in reduction state(manganese methodand alkali method: excess sodium oxalate / chromium method: excess FAS solution),there is no effect from change in oxidation reduction potential by reagent.
3) Potassium permanganate(manganese method and alkali method) and FAS(chromium method) solution pumps control appropriate amount by finding the number of rotations using photoelectric detector. Also, precision of titration can be easily maintained by frequently calibrating the number of rotations based on 10 ㎖(3Series) or 5 ㎖(2Series) measurement at a time.
4) Diluted water and tap water can be used to frequently perform measurement of diluted water COD, blank value, factor of potassium permanganate (manganese method and alkali method), and factor of FAS solution (chromium method) based on computer control. In addition, the effect of degenerated reagent can be removed.
5) Summarization of measurement data is easy because the COD concentration values are printed as hourly and daily reports.
6) Abnormalities can be accurately handled by printing out a message that sends out an alarm in case of defective operation or abnormal measurement.
7) (Manganese method and alkali method) Concentration of chloride ion in the reagent is measured every time using chloride ion concentration measurer, and amount of solution is found to add nitrate for chloride ion. (OPTION)
When measurement is done without adding nitrate, the effect of chloride ion is frequently corrected.
(However, measuring device using manganese method enters chloride ion concentration into internal memory and corrects this data.)
8) (Manganese method and alkali method) Based on partial adjustment of the program (setting of initial values),measurement of acidic and alkaline potassium permanganate can be randomly selected.

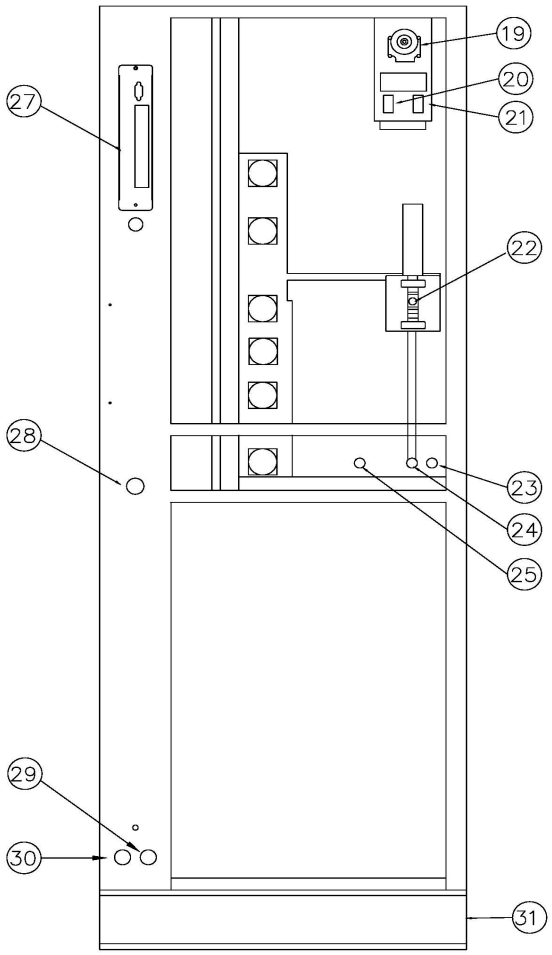
2. Composition of Device

A. Overall Diagram



<Front view>

* SIZE : 600mm(W) x 640mm(D) x 1590mm(H)



<Rear view>

B. Components of Analysis Part

1) Front side of analysis part

(1) Reagent tank	:	Reagent is pulled up using reagent pump inside.Amount of reagent is 400 ㎖ and any excess is overflown and drained. Reagent is agitated by cleaning reagent stirrer using tap water for each measurement
(2) Diluted water tank	:	Tank fordiluted and cleaning water that can deliver 250㎖ of tap water through diluted tank valve. Any excess is overflownand drained
(3) Gauge glass	:	(Manganese) measures reagent, diluted water, KMnO4 and Na2C2O4. (Alkali) measures reagent, diluted water,NaOH, KMnO4 and Na2C2O4. (Chromium) measures reagent, diluted water, K2Cr2O7 and FAS. (3 Series) amount is10 ㎖, and each solution is measured by electrode (2 Series) amount is 5 ㎖, and each solution is measured by electrode
(4) Dilution valve	:	Solenoid valve that introduces diluted water to gauge glass (closed)
(5) Reagent valve	:	Solenoid valve that introduces reagent to gauge glass (closed)
(6) Reagent drain valve	:	Solenoid valve that drains reagent tank while cleaning (open)
(7) Airtightvalve	:	Valve that seals inside of reaction unit when draining solution(open)
(8) Glass gauge valve	:	Solenoid valve that introduces solution measured by gauge glass to reaction unit (closed)
(9) Metering valve	:	(Manganese and alkali) valve that introduces $KMnO_4$ solution to gauge glass(open) (Chromium) valve that introduces FASsolution to gauge glass (open)
(10)Titration valve	:	(Manganeseand alkali)solenoid valve that introduces $KMnO_4$solution to reaction unit during titration(closed) (Chromium)solenoid valve that introduces FAS solution to reaction unit during titration (closed)
(11) Reaction unit	:	This is a unit made of PILEXES GLASS for heating and reacting reagent, and drainage of solution is done by blowing air. Agitation is done using stirrer motor at the bottom of oil bath. A thermometer is attached to control temperature depending on the measurement status.
(12)Oil bath	:	Silicon oil is used as heating medium.A thermometer is attached to control temperature depending on the measurement status.400W (AC 100V) heater is divided into two semicircles attached with a temperature sensor to prevent heating.
(13) ORP indicator electrode	:	Platinum plate is deposited onto glass tube to measure oxidation reduction potential inside reaction unit
(14) ORP reference electrode	:	Reference electrode made of ceramic and brass wire
(15) $AgNO_3$ pump	:	(Chromium) delivery pump that introduces 20W/V% $AgNO_3$solution to reaction unit, but manganese method is optional

(15) NaOH pump : (Alkali) delivery pump that introduces 1N NaOH solution to reaction unit

(16) H_2SO_4 pump : (Manganese and alkali) delivery pump that introduces (1+2)H_2SO_4solution to reaction unit

(16) $H_2SO_4 \cdot Ag_2SO_4$ pump : (Chromium) delivery pump that introduces $H_2SO_4 \cdot Ag_2SO_4$solution to reaction unit

(17) $Na_2C_2O_4$ pump : (Manganese and alkali) delivery pump that introduces N/40 $Na_2C_2O_4$solution to gauge glass

(17) $K_2Cr_2O_7$ pump : (Chromium) delivery pump that introduces K2Cr2O7solutionto gauge glass

(18) $KMnO_4$ pump : (Manganese and alkali) delivery pump that introduces N/40 $KMnO_4$solution to gauge glass. It rotates at low rate to introduce solution to reaction unit during titration.Photoelectric detector is attached to the joint to divide each rotation into 32 parts for detection.

(18)FAS pump : (Chromium) delivery pump that introduces FASsolution to gauge glass. It rotates at low rate to introduce solution to reaction unit during titration. Photoelectric detector is attached to the joint to divide each rotation into 32 parts for detection.

2) Rear side of analysis part

(19) Reagent pump : Delivery pump for reagent collection. It pulls reagent into reagent tank when collecting reagent and sends tap water out when cleaning the collection line.

(20) Cleaning tank valve : Solenoid valve that introduces tap water when cleaning reagent tank

(21)Diluted water tank valve : Solenoid valve that introduces tap water to diluted water tank

(22) Tap water needle valve : Needle valve that controls flow of diluted water and cleaning water

(23) Reagent hole : Entrance of reagent(outer diameter Ø6)

(24) Tap water hole : Entrance of tap water (hard vinyl chloride pipeØ6)

(25) Drain hole : Drain hole for overflown reagent, overflown diluted water, cleaning water and reaction solution of reagent tank, and cleaning solution of reaction unit(12mm braid hose)

(27)Telemeterterminal : Concentration and alarm output terminal (RS-232C communication)

(28) Power input : Power input part

(29) Earth terminal : Equipment earth connection part

(30) Signal and power input work(15A)

3. Installation

A. Surrounding Facilities

Surrounding facilities will be briefly explained.

1) Conditions of installation

(1) This device should be installed inside a measuring room.

(2) Maintain temperature around the device at2℃ ~ 40℃. (There is concern for degeneration of reagent)

(3) Avoid direct light.

(4) Avoid places where drops of corrosive liquids and floating scraps contact the mainbody.

(5) Avoid places with explosive gas or corrosive gas.

(6) Avoid places where temperature goes below zero. Heat such places with a heater when the device needs to be installed.

(7) Avoid places with large vibrations.

(8) Choose places with small amount of dust.

(9) Avoid earth work in a place with substantially large terrestrial current.

(10) Accurately perform earth work. Earth terminal is the metal terminal on the rear panel of the measuring device.

2) Collection of reagent

In general, reagent is directly collected from drain.However, when pulling height exceeds 3m, a separate auxiliary tank is installed to pump up drainwater. Water collection facility needs to satisfy the following conditions of operation.

(1) To be able to collect reagent to be measured

(2) To be able to collect water analysis reagent with ease

(3) To show ease of cleaning auxiliary tank

(4) To not receive influence of sunlight or rainwater

3) Tap water

Tap water is used for diluted water and cleaning.

4) Treatment of drain

Drain water includes drain (cleaning water, overflown water) that can be directly discharged and drain (reactant solution and cleaning water of reaction unit) that cannot be directly discharged.Amount of drain that must be treated isabout 30ℓ per day. Neutralize this drain using a neutralizing agent before discharging.

5) TELEMETER INTERFACE momo (OPTION)

When performing central management from a remote place, a special telemeter interface is used for transmission of data. There are two types including BIT SERIAL (RS-232C)

andBAND SERIAL (1 of DATA 8 and STATUSeach). Choose as appropriate for the receiving side.

6) Dilution device(OPTION)

When COD concentration of reagent is expected to exceed100ppm,use a dilution device to dilute the reagent before introducing it to reagent tank.

B. Piping

1) Rear pipes

Piping for each pipe on the rear side of this device shall be done as below.

Reagent hole : ---------- 6φ one-touch

Tap water : ---------- 6φ one-touch

Drain water : ---------- 12mm braid hose

Drain : ---------- 6φ Teflon

Drain of reaction unit ---------- 5φ x 7φ Tygon tube

2) Reagent tank

Be careful about incorrectly connecting reagent container and tube in reagent tank tube.

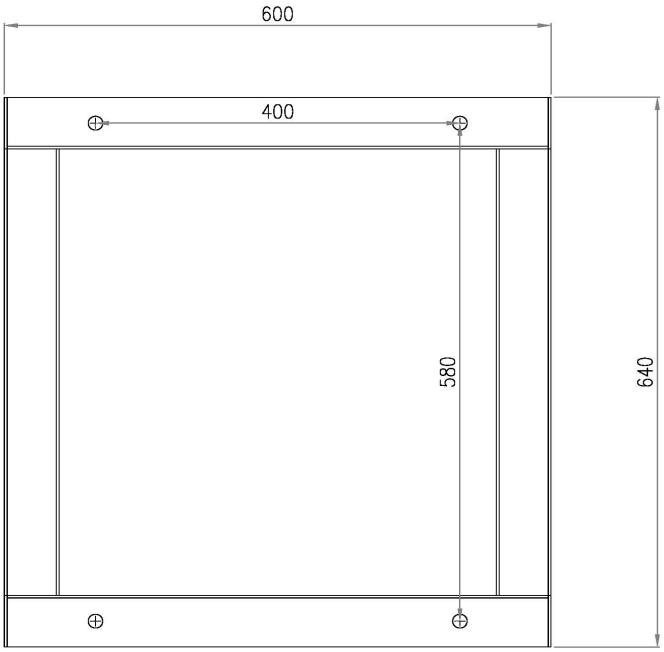
Measurement method	Name of reagent	TUBE SIZE	TANK	
			3 Series	2 Series
Manganese method / Alkali method	N/40 potassium permanganate	2X4 ㎜ ø TEFLON TUBE	10 ℓ	5 ℓ
	N/40 sodium oxalate	2X4 ㎜ ø TEFLON TUBE	20 ℓ	10 ℓ
	(1+2) sulfate	2X4 ㎜ ø TEFLON TUBE	10 ℓ	5 ℓ
Alkali method	1N sodium hydroxide	2X4㎜ø TEFLON TUBE	10 ℓ	5 ℓ
Manganese/ Chromium	20% $AgNO_3$	1.8X3.2 ㎜ ø TEFLON TUBE	500 ㎖ brown	250 ㎖ brown
	Potassium dichromate solution	2X4 ㎜ ø TEFLON TUBE	10 ℓ	5 ℓ
Chromium	FAS solution	2X4㎜ø TEFLON TUBE	10 ℓ	5 ℓ
	Sulfate-silver sulfatesolution	2X4㎜ø TEFLON TUBE	10 ℓ	5 ℓ

3) Power facility

This device uses single-phase AC60 ㎐ 110V. Maximum power consumption is800VA and allowable voltage fluctuation is±10%. Surge voltage must be protected, and computer can protect itself using protection program. However, please add an isolate trans to protect the digital circuit for lines with large amount of noise.

Caution !!	1. Earthed consent is used for power wiring, and it should allow for protective earth simply by inserting a plug, or protective earth terminal must be separately earthed. 2. Be careful in earth work of flowmeter so that earth potential of flowmeter is identical to earth potential of this device.

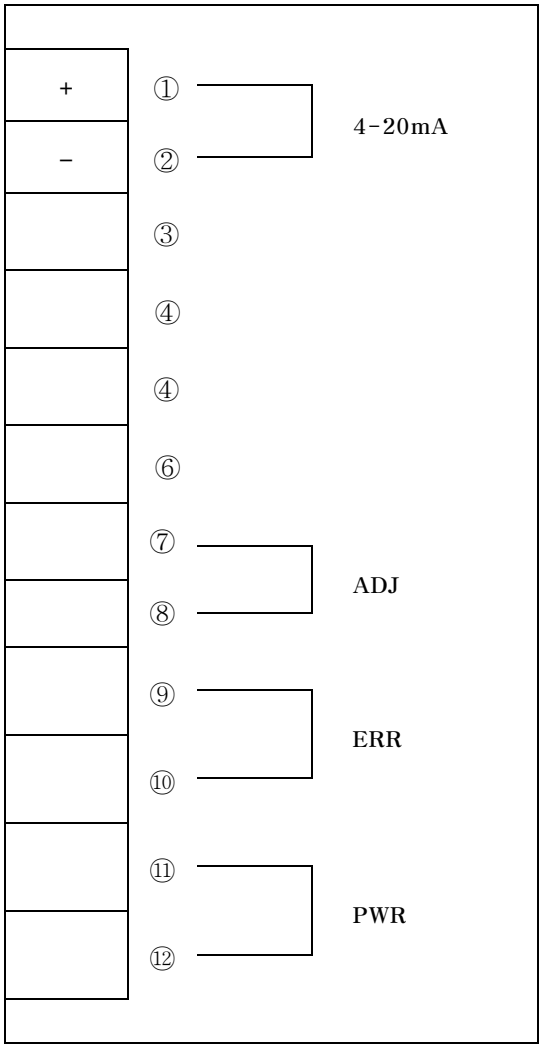
4) Base installation



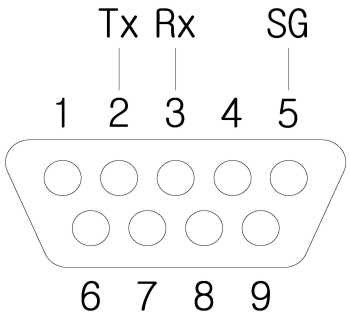
Size of anchor bolt hole: 16Ø

C. Connection of Signals

1) Telemeter output signals



2) PIN MAP



2) Output of CODconcentration

RS232or DC 4-20 ㎃ is displayed proportional to measured concentration.

FULL SCALE(29 CH) can be arbitrarily configured.

Output impedance500Ω or below

3) Power unit signal(PWR)

Power unit signal is displayed when power of this device is disconnected.

Contact voltage	Zero voltage
Contact rating	60VA
Maximum switching voltage	DC 24V
Maximum switching current	1A

4) Adjustment signal(ADJ)

When making adjustment on this device such as repair, inspection or correction, adjustment signal is displayed by placing control panel key switch on adjustment.

However, adjustment signal is displayed after completion of measurement when it is done during measurement.

Contact voltage	Zero voltage
Contact rating	10VA
Maximum switching voltage	DC 100V
Maximum switching current	0.25A

5) Operation error signal(ERR)

Operation error signal is displayed when an error occurs in the measurement sequence during measurement.

D. Preparation of Reagents

1) N/40 potassium permanganate solution(N/40 $KMnO_4$)-manganeseand alkali methods

Dissolve 8g of potassium permanganate in 10L of distilled water and boil for 1 - 2 hours before leaving intact in a dark place overnight.Filter very clean solution as 3 G 4 using glass filter (PUHUNA nude type). Place the filtered solution in a coloring bottle steam washed for 30 minutes and preserve in a dark place.

[Standardization]

Take 100 ㎖ of distilled water in a300 ㎖ Erlenmeyer flask and add 10 ㎖ of sulfate(1+2).Add 10 ㎖ of N/40 sodium oxalate solution(for titration) and titrate using N/40 $KMnO_4$ solution at 60 ~ 80℃.

$$f = \frac{10}{X} \times \text{N/40 sodium oxalate solution(for standardization) FACTOR}$$

Adjust factor of N/40 $KMnO_4$ solutions that it has finer scale (0.02 - 0.04) compared to factor of N/40 $Na_2C_2O_4$ solution.

Caution !!	When $KMnO_4$solution is neglected for long time, inner surface of tank is contaminated by manganese dioxide to facilitate deposition. Replace the entire tank when replacing solution.

2) N/40 sodium oxalate solution(N/40 $Na_2C_2O_4$)-manganese and alkali methods

Heat sodium oxalate (standard reagent for dosage analysis)to150 - 200℃ in advance for 40 - 60 minutes and cold release it in sulfate desiccator. Accurately weigh 33.50g of 100% Na2C2O4 and dissolve it in distilled water.Add 30 ㎖ of (1+2)sulfate solution and accurately dilute to 20L ± 30 ㎖. (Sulfate is added to clean the gauge glass, and it does not affect the measurement data.) Factor (F) of N/40 sodium oxalate solution is computed according to the following equation.

$$f = \frac{\text{Clear}Na_2C_2O_4\ (g)}{33.50} \times \frac{20\ \ell}{\text{Total amount prepared}\ (\ell)}$$

3) (1+2)sulfate solution ((1+2)H_2SO_4)-manganese and alkali methods

Slowly add 1 unit of sulfate into 2 units of distilled water while stirring, and continue to add N/40 potassium permanganate solution for 60 seconds until light red color appears.

Caution !!	① Adding water to concentrated sulfate is extremely dangerous. Slowly add concentrated sulfate into water while agitating.(Here, do not inhale mist of sulfateformed.) ② When hand or clothing is stained with sulfate, immediately wash using tap water. ③ When sulfate is spilled on a metal or desk, neutralize it with limewater, magnesia water or soda water and wipe out.

4) Silver nitrate solution(20W/V% $AgNO_3$)-manganese and chromium methods
Dissolve 50g of nitratein distilled waterto make 250 ㎖.
Preserve it in a brown bottle.

5) 1N sodium hydroxide solution(1N NaOH) -alkali method
Dissolve 400g of sodium hydroxide in distilled water to make10 ℓ .

6) N/40 ferrous ammonium sulfate: FAS[$Fe(NH_4)_2 \cdot (SO_4)_2 \cdot 6H_2O$] -chromium method
Dissolve 9.8g of ferrous ammonium sulfate FAS[$Fe(NH_4)_2 \cdot (SO_4)_2 \cdot 6H_2O$] in water and add 20 ㎖ of concentrated sulfate (c-H_2SO_4). Cool it down and dilute to 1L.Since this solution is unstable, it must be standardized at every time of use.

[Standardization]
Add 10.mL of standard potassium dichromate solution in a 250mLErlenmeyer flask. Here, add about 100mL of distilled water.
Add 30mL of concentrated sulfate while mixing for cold release. Then add 2~3 drops of ferroin indicator and titrate using ferrous ammonium sulfate (FAS) solution. Endpoint of titration is the point at which color of the solution changes from orange to green and then to reddish brown.
Concentration factor (f) is computed according to the following equation based on mL (x) of 0.025N ferrous ammonium sulfate solution required for titration.

$$f = (10/x)$$

Caution !!	Factor of FAS solution is adjusted to be finer (0.02~0.04) than factor of potassium dichromate solution.

7) Standard N/40 potassium dichromate solution(N/40 $K_2Cr_2O_7$)-chromium method
Dissolve 1.226g of dried potassium dichromate (K_2Cr_2O7) in water to make 1L

8) Sulfate-silver sulfate solution(H_2SO_4 -Ag_2SO_4)-chromium method
Dissolve 11.0g of silver sulfate (Ag2SO4) in 1L of sulfate. It takes 1~2 days to completely dissolve.(Heat the solution if necessary)

Caution !!	① Adding water to concentrated sulfate is extremely dangerous. Slowly add concentrated sulfate into water while agitating.(Here, do not inhale mist of sulfateformed.) ② When hand or clothing is stained with sulfate, immediately wash using tap water. ③ When sulfate is spilled on a metal or desk, neutralize it with limewater, magnesia water or soda water and wipe out.

9) Consumption of reagent

These are the standard consumptions of reagents used.

There is a slight difference in consumption depending on the setting of measurement mode.

NO	Measurement method	Name of reagent	Reagent consumption	
			3 Series	2 Series
1	Manganese and alkali methods	N/40 potassium permanganatesolution	10ℓ / 2 weeks	5ℓ / 2 weeks
2	Manganese and alkali methods	N/40 sodium oxalatesolution	20ℓ / 2 weeks	10ℓ / 2 weeks
3	Manganese and alkali methods	(1+2) sulfate solution	10ℓ / 2 weeks	5ℓ / 2 weeks
4	Manganese and chromium methods	Silver nitrate solution (20W/V%)	70~80 ㎖ / 1week	35~40 ㎖ / 1 week
5	Alkali method	1N NaOH solution	10ℓ / 2 weeks	5ℓ / 2 weeks
6	Chromium method	N/40 potassium dichromate solution	10ℓ / 2 weeks	5ℓ / 2 weeks
7	Chromium method	N/40 FAS solution	10ℓ / 2 weeks	5ℓ / 2 weeks
8	Chromium method	Sulfate-silver sulfatesolution	20ℓ / 2 weeks	10ℓ / 2 weeks

10) Amount of drain- 3 Series

Drain water: overflown reagent, overflown diluted water, cleaning water of reagent tank, etc. -about200ℓ/ day

Drain: reactant solution and cleaning water of reaction unit·····30ℓ / day

11) Amount of drain - 2 Series

Drain water: overflown reagent, overflown diluted water, cleaning water of reagent tank, etc. -about 100ℓ / day

Drain: reactant solution and cleaning water of reaction unit····· 15ℓ / day

12) How to prepare standard solution -chromium method

(1) Standard potassium hydrogen phthalate solution (for 2,000ppm, 1L)

Dry potassium hydrogen phthalate at 105~120℃for about 4 hours before cold release.

Accurately weigh2.215g and dissolve it in distilled water to make 1L.

(2) Standard potassium hydrogen phthalate solution (for 90ppm, 1L)

2,000ppm : XL = 90ppm : 1L

Here, X=0.045L(45mL)

Measure 45mL of standard potassium hydrogen phthalate solution, add to 1L container, and fill with pure water to 1L mark.

(3) Standard potassium hydrogen phthalate solution (for 45ppm, 1L)

2,000ppm : XL = 45ppm : 1L

Here, X=0.0225L(22.5mL)

Measure 22.5mL of standard potassium hydrogen phthalate solution, add to 1L container, and fill with pure water to 1L mark.

(4) Standard potassium hydrogen phthalate solution (for 5ppm, 1L)

2,000ppm : XL = 5ppm : 1L

Here, X=0.0025L(2.5mL)

Measure 2.5mL of standard potassium hydrogen phthalate solution, add to 1L container, and fill with pure water to 1L mark.

4. Operation of Device

A. Confirmation Before Power Input

Operation of the device begins with power input. However, poor maintenance of the device can result in malfunctioning, misjudgment and leakage of reagent.Check the following before power input.

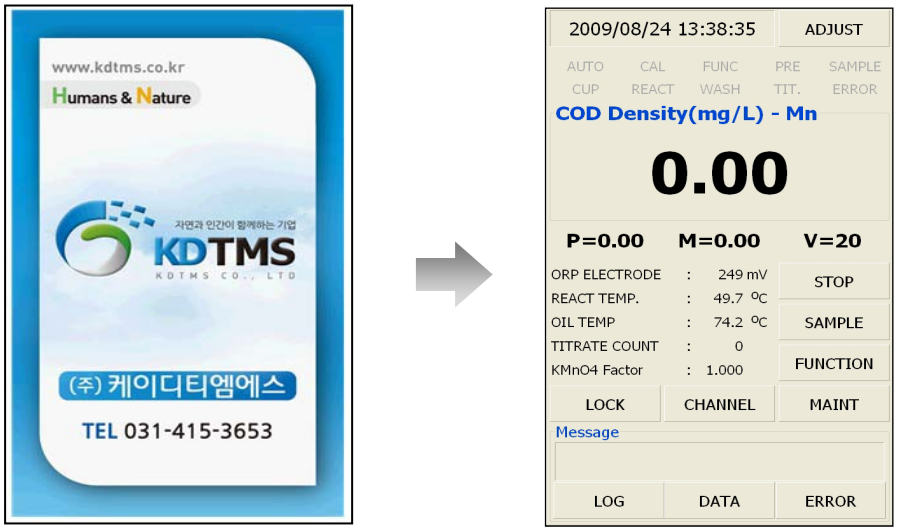
1) There must be no problem in reagent pipe and drain pipe
2) Status of reagent in the reagent tank and tube insertion must be proper
3) Pressure of tap water must be controlled to0.5 - 1.5 ㎏/㎠
4) Connection of protective earth terminal in the power earth part(earth leakage breaker)and status of power wiring protective conductor and voltage must be normal
5) Connection part and connector of the device must be firmly bonded
6) There must be no loosening of joints or problem in pump, gauge glass, tube and reaction unit

B. Insertion of Printer Paper

Pull the paper stopper to push printer paper into the insertion part and turn the handle.
Use standard printer paper.

C. Preparation for Operation

Once the inspection in the previous section is completed, turn ON the earth leakage breaker on the rear side.This will turn ON display LED, and the printer prints the following screen.



▷ Upon initial power ON,LCD shows the booting screen with company logo, followed by the main screen.

▷ After power is turned ON,the main control screen appears with the following print.

```
· · · · · · · ADJ MODE · · · · · · ·

* POWER ON 2 0 0 9 / 0 9 3 0 / 10 : 30
.
.
```

Or depending on the case,

```
* Setting standard value intomemory! !
```

When the above appears, internal memory is deleted and standard value is set up for channel needed for measurement.Change the memory if necessary and perform correction. Also, adjust time if modification of time is necessary.

When the internal memory is deleted immediatelyafter installation of the device,it is necessary to set the memory needed for display of results by performing continuous operation.

To check the channel setting or change the method of 「DATA OUT」and channel,refer to the method of 「DATA IN」and change the setting channel.

1) Setting for COD measurement

(1) Set printing of the measurement result.

Setting	Hourly report	Daily report
0	Time + concentration + measurement data	Daily contamination report
1	Time + concentration	Daily contamination report

○ **Time print**

11 : 0 Measurement data

Time

○ **Concentration print**

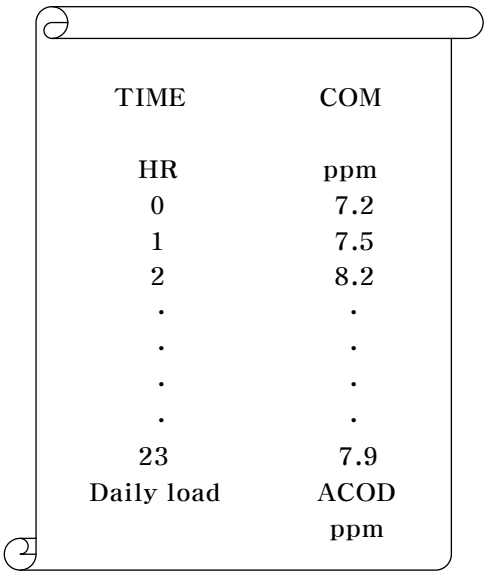
7.2PPM

CODconc.

○ **Measurement data print**

P = 0.65	M = 3.85	V = 100
Preliminary measurement of titration(㎖)	Main measurement of titration (㎖)	Amount of reagent collected (㎖)

○ **Daily contamination report print**



(4) Selection of measurement mode·····6CH

Set measurement mode for continuous operation.

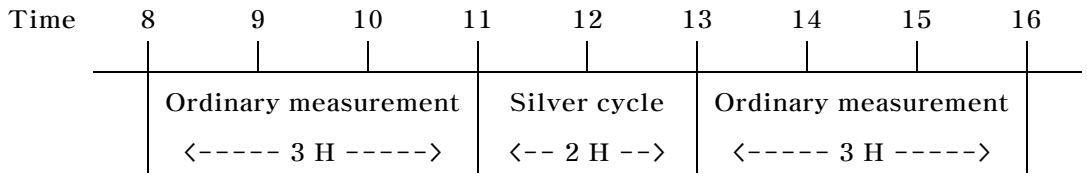
Setting	Details
0	Ordinary measurement(preliminary + main measurements)
1	Ordinary measurement without preliminary measurement
2	Cycle measurement with silver(preliminary + main + silver+ $KMnO_4$ solution, standardization of factor (manganese and alkali methods)/ FAS factor (chromium method) ▷ 2-hourcycle
3	Measurement of diluted water(main + standardization of $KMnO_4$ factor)
4	Blank test (preliminary + main + silver factor + standardization of $KMnO_4$ factor(manganese and alkali methods)/ FAS factor (chromium method) ▷ 2-hourcycle

(3) Setting of cycle measurement with silver(manganese and chromium methods)·· 7CH, 8CH

▷ 7CH : setting of one cycle

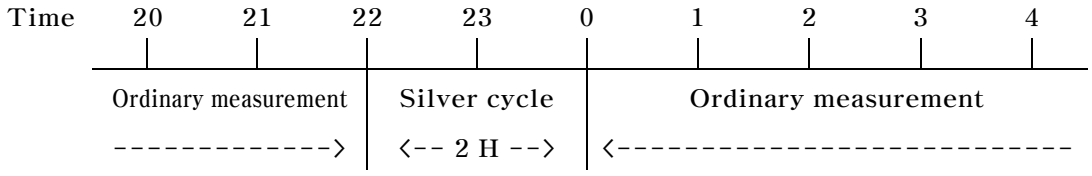
▷ 0 : silver addition cycle is performed at the cycle according to the number of measurements. The number of measurements is configured with8CH.

▷ Ex) When 7CH = 0, 8CH = 3.. → silver addition cycle is performed after 3 measurements.



▷ N: silver addition cycle is performed at every N cycles. Measurement time is configured with8CH.

▷ Ex) When 7CH = 1, 8CH = 22.. → silver addition cycle is performed once at 22:00.

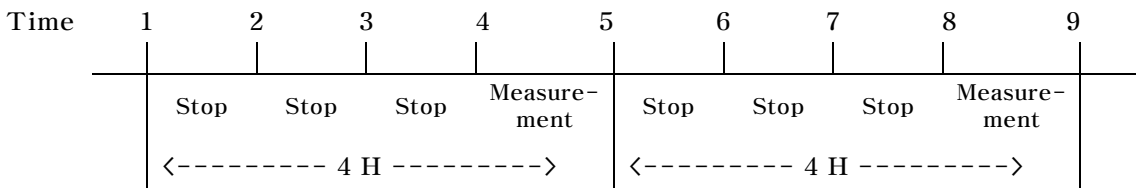


(4) Setting of measurement cycle·····9CH

▷ Set measurement time interval.

▷ Measurement is done once at the setting time.

▷ Ex) When 9CH = 3.. → measurement is done after waiting for 3 hours.(4-hourcycle)



(5) $Na_2C_2O_4$ factor (manganese method)·····12CH

▷ Set factor ofN/40 $Na_2C_2O_4$.

$K_2Cr_2O_7$factor (chromium method)·····12CH

▷ Set factor of $K_2Cr_2O_7$.

(6) Select $AgNO_3$(manganese and chromium methods)·····17 CH

Select whether to add $AgNO_3$ solution in this measurement.

▷ 0: do not add silver nitrate(ordinary main measurement) → effect of chloride ion is automatically corrected.

▷ 1: add silver nitrate(silver added main measurement) → amount of solution is corrected by concentration of chloride ion.

(7) COD concentration of tap water····· 21 CH

As COD concentration of tap water used in diluted water, it is used to correct COD concentration of diluted water in the blank test.

(However, COD concentration of diluted water is entered by setting measurement mode (6CH) to 3.)

3) Setting of telemeter output

(1) Alarm of COD concentration ····· 28 CH

▷ Set COD concentration (ppm) at which alarm is sent out.

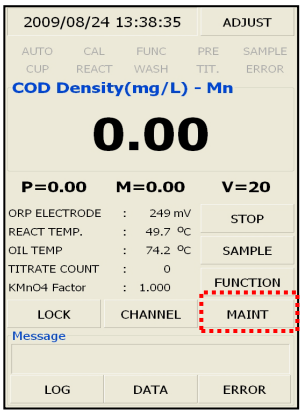
D. Tap Water Needle Valve Setting and Diluted Water Flow Setting

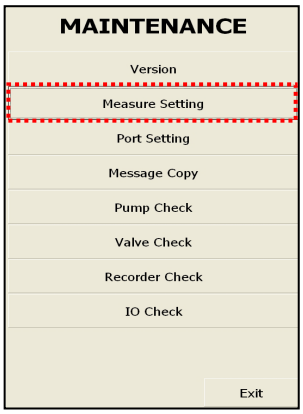
1) Adjustment of tap water needle valve

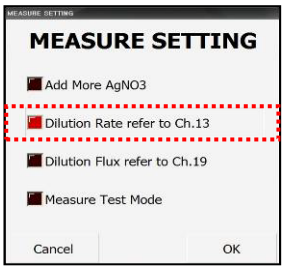
Immediately after setting, when operation is stopped for long time, or when tap water needle valve is closed, adjust the amount of tap water in the following order.

(1) Open the rear panel and check whether tap water needle valve is closed. Then open the tap water faucet to check for water leak from the entrance of the device.

(2) When dilution device is used(to dilute the reagent)







▷ Explanation on measurement setting (explanation on the item when each solution is diluted using dilution device)

■ Add More $AgNO_3$: when silver nitrate is used

■ Dilution Rate refer Ch.13 : when diluted water is used

■ Dilution Flux refer Ch.19 : when distilled water is used

■ Measure Test Mode: auto test mode(continuous computation of standard solution data)

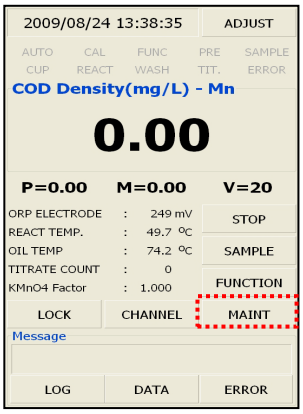
2) Setting of diluted water flow

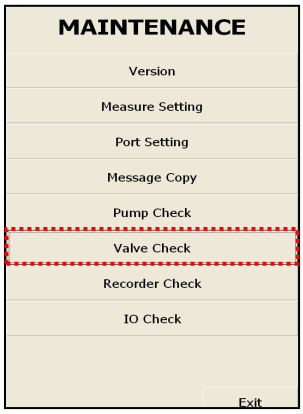
Enter flow of diluted water (㎖/min)flowing into reaction unit when gauge glass valve and dilution valve are opened into 19CH memory.

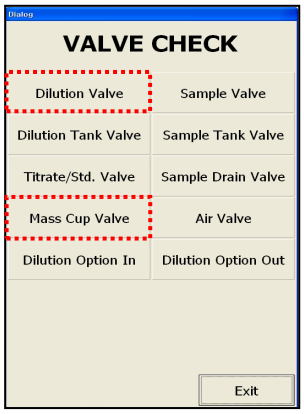
3) Measurement of flow

(1) Remove pipe between gauge glass valve of the analysis part and reaction unit and inserta mass cylinder (about 250 ㎜).

(2)





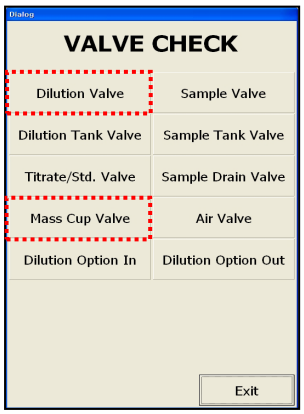


* Measurement of flowON

VALVE CHECK > Dilution Valve> ① ON

VALVE CHECK > Mass Cup Valve > ② ON

(3) After measurement, retouch each menu to turn them OFF.



VALVE CHECK > Dilution Valve> ① OFF

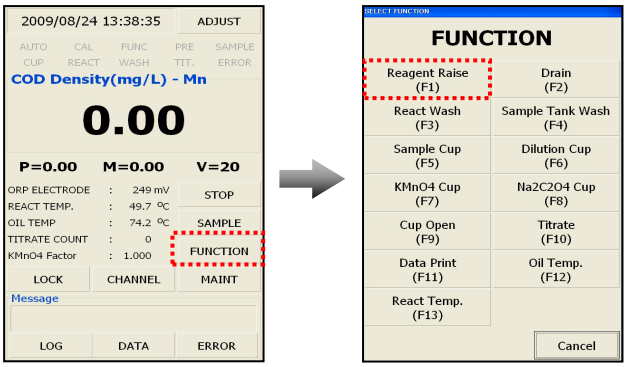
VALVE CHECK > Mass Cup Valve > ② OFF

$$\text{Flow (mℓ/min)} = 200 \times \frac{60}{\text{Measurement time}}$$

Use the above equation to find flow and enter into 19CH.

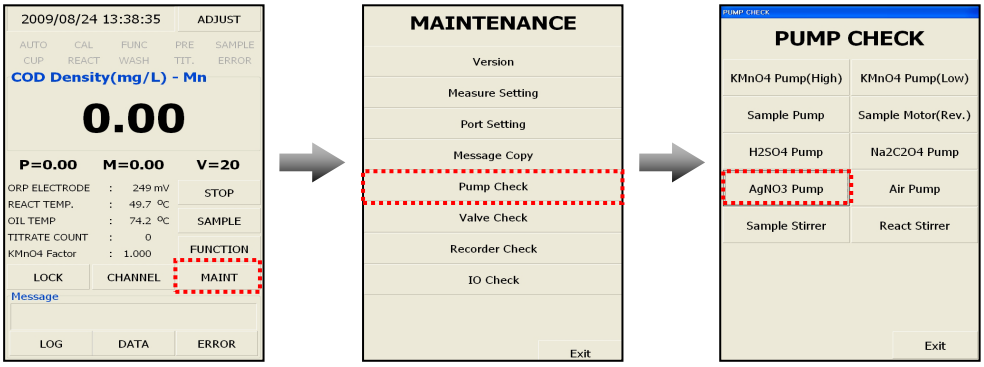
E. Filling of Reagent

When the reagent pipe is not filled with reagent or when replacing reagent, insert the reagent tube into the reagent container



and touch FUNCTION > Reagent Raise(F1)to fill reagent into each pipe. However, since silver nitrate solution is not operated, manually fill it into the reagent pipe if necessary.

* Filling silver nitrate solution into the reagent pipe (manually)–manganese and chromium methods



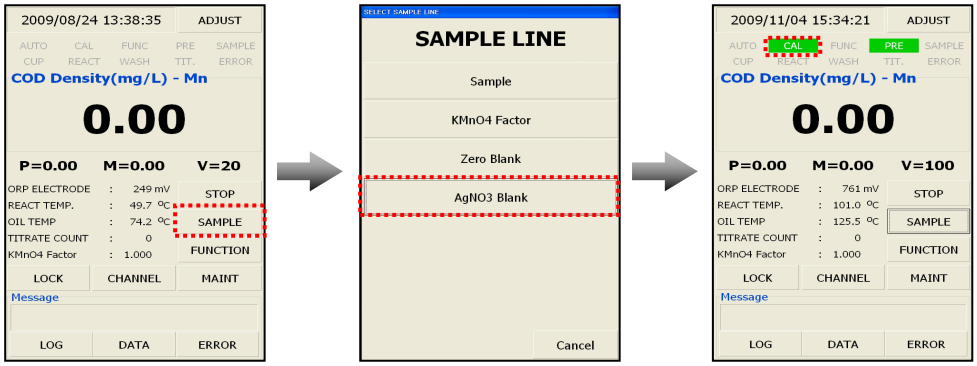
▷ Control (touch) sequence: MAIN > MAINT > PUMP CHECK > $AgNO_3$

Control in the above sequenceto start operating $AgNO_3$pump. When nitrate solution arrives at the entrance of reaction unit,touch MAIN > MAINT > PUMP CHECK > $AgNO_3$ once again to turn it OFF.

F. Measurement of COD Concentration for Diluted Water(Tap Water)

This device needs to measure COD concentration of diluted water (tap water) to perform blank correction by diluted water upon installation and dilution correction by diluted water during COD measurement. Follow the sequence below for measurement.

1) Set factor of sodium oxalate solution(manganese and alkali methods)/potassium dichromate solution(chromium method) with 12CH.
2) When reagent is not filled into pipe,fill it by executing MAIN > FUNCTION > Reagent Raise(F1).
3) Open the top cover of the device and add distilled water to the reagent tank. (However, add a drop of concentrated sulfate to pure water to protect the leveler.)
4) (Manganese and chromium methods) Touch SAMPLE >AgNO3 Blank to display 『CAL』 sign on the main screen. Distilled water in the reagent tank is measured and blank standardization (zero) of preliminary measurement, main measurement and silver added measurement and standardization (SPAN) of KMnO4(manganese and alkali methods)factor / FAS factor are performed.



The measurement result is printed as follows. (Examples)

(1) Manganese method

$KMnO_4$factor	1.005	
+Ag blank value	0.43 ㎖	(32CH)
MEAS blank value	0.35 ㎖	(31CH)
PRE blank value	0.21 ㎖	(30CH)

(2) Alkali method

$KMnO_4$ factor	1.005	
NaOH blank value	0.45 ㎖	(32CH)
MEAS blank value	0.35 ㎖	(31CH)
PRE blank value	0.28 ㎖	(30CH)

(3) Chromium method

FAS factor	1.005	
+Ag blank value	0.43 ㎖	(32CH)
MEAS blank value	0.35 ㎖	(31CH)
PRE blank value	0.21 ㎖	(30CH)

5) When 『3』 is entered into 6CH(measurement mode),concentration of diluted water is measured and recorded in 21CH.
The measurement result is printed as follows.

$KMnO_4$(or FAS) factor	1.001
COD	0.8ppm(concentration of diluted water)

Caution !!	For measurement of COD concentration of diluted water, there is no need to perform blank correction by diluted water to correctly measure COD concentration when quality of diluted water is contaminated. However, omit the above operation and directly enter COD concentration into 21CH if COD of diluted water is already known.

G. Blank Correction, KMnO4 (or FAS) Factor Standardization

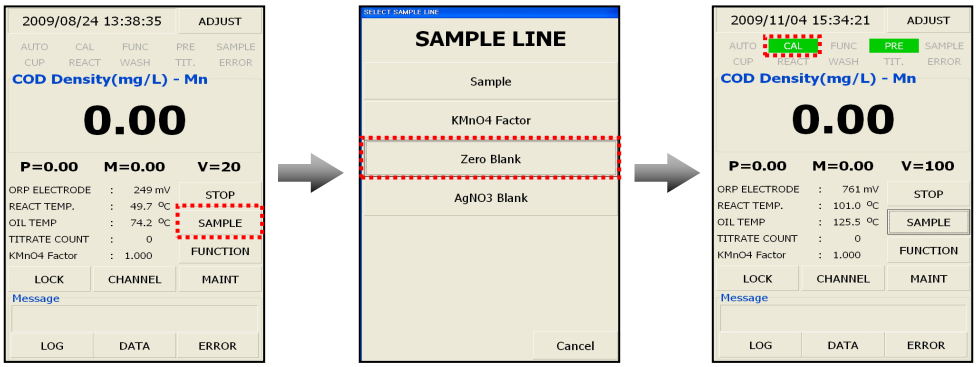
Correction of blank value and standardization of $KMnO_4$ (or FAS) factor are necessary when the device is stopped for long time or reagent is replaced.
This device can perform blank correction by distilled water and blank correction by diluted water (correction of COD concentration of diluted water).

1) Blank test correction by distilled water
(1) Open the top cover of the measuring device and add distilled water to the reagent tank. (However, add a drop of concentrated sulfate to pure water to protect the leveler.)
(2) (Manganese and chromium methods) Touch SAMPLE >$AgNO_3$ Blankto display 『CAL』 sign on the main screen. Distilled water in the reagent tank is measured and blank standardization (zero) of preliminary measurement, main measurement and silver added measurement is performed. Then standardization (SPAN) of KMnO4(manganese and alkali methods) factor / FAS factor is performed.

The measurement result is printed as follows.

$KMnO_4$(or FAS) factor	1.005	
+Ag blank value	0.43 ㎖	(32CH)
NaOH blank value (alkali)	0.43 ㎖	(32CH)
MEAS blank value	0.35 ㎖	(31CH)
PRE blank value	0.28 ㎖	(30CH)

2) Blank test correction by diluted water
(1) TouchSAMPLE > Zero Blankto display 『CAL』 sign. Measure diluted water (tap water) in the dilution tank to perform standardization of preliminary measurement, main measurement and silver added measurement (SPAN correction).
Then standardization of $KMnO_4$factor (or FAS factor)(SPAN correction).
Blank correction is done by COD concentration (21CH) of diluted water.



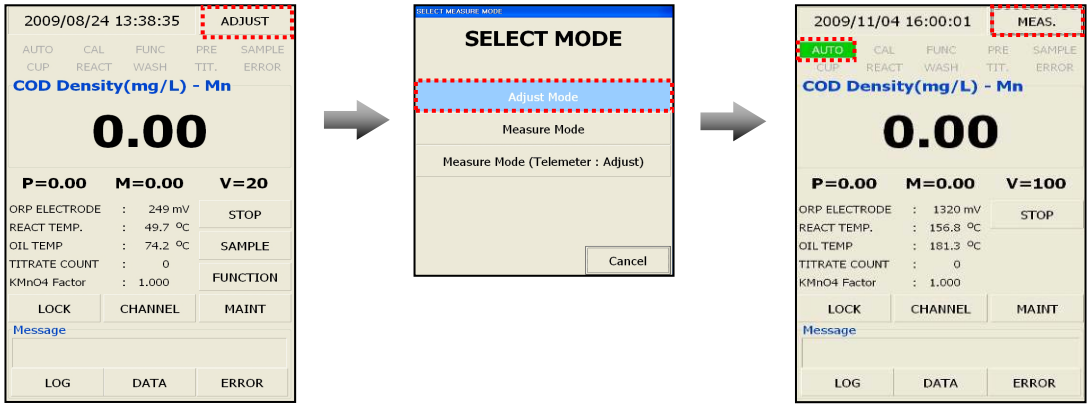
The measurement result is printed as follows.

$KMnO_4$ (or FAS) factor	0.998	
MEAS blank value	0.37 ㎖	(31CH)
PRE blank value	0.25 ㎖	(30CH)

H. Continuous Operation

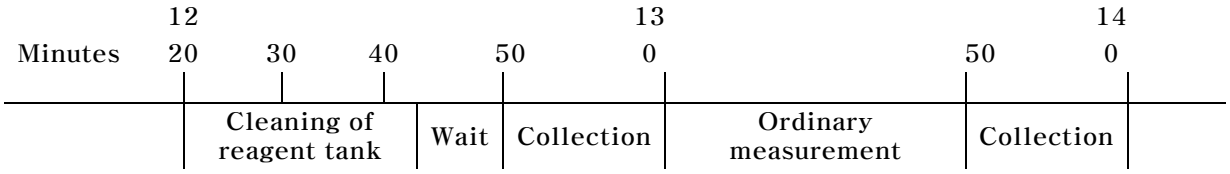
When measure mode is touched after preparing for the previous section in adjust mode on the main screen, “AUTO” sign is turned ON and “MEAS MODE" is printed to enter measurement mode.

In measurement mode, cleaning of the reagent tank, cleaning of water collection line and cleaning of reaction unit(about 20 minutes) are performed before waiting until reagent collection time(every 50 minutes). After collection of reagent, reagent is continuously measured at every hour.

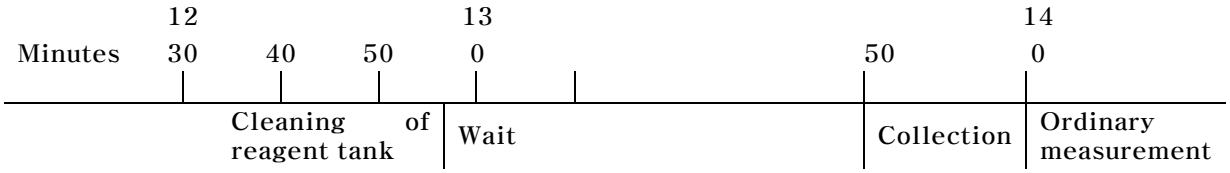


Caution !!	Measurement is started at the hour when measurement mode is entered before 30 minutes. If measurement mode is entered after 30 minutes, measurement does not begin until the next hour.

(Ex) When adjust mode is entered at 12:25, reagent is collected at 12:50 and measurement is started at 13:00.



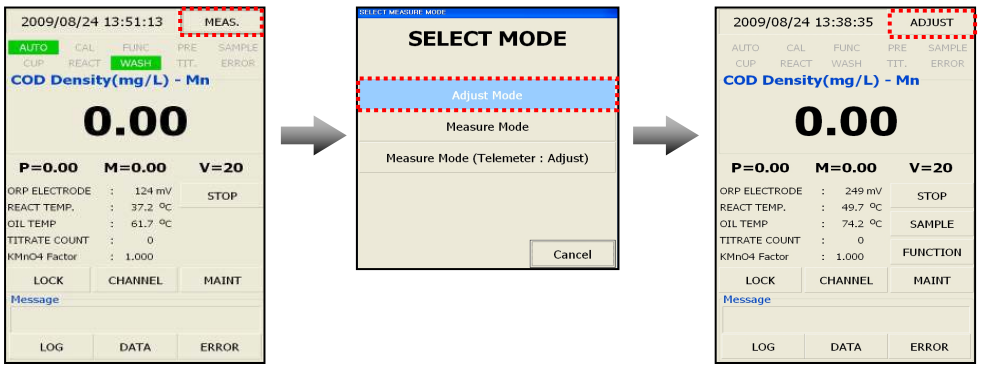
When measurement mode is entered at 12:35, reagent is collected at 13:50 and measurement is started at 14:00.



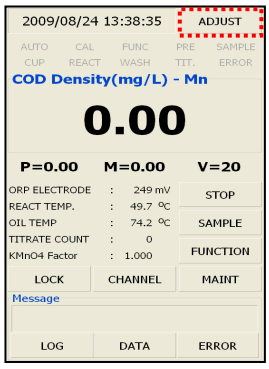
I. Replacement of Reagent

Each reagent can be operated for 2 weeks. If there is small amount of reagent remaining, quickly replace it. Replacement is done in the following sequence.

1) Touch adjust mode (auto measurement) in measurement mode to move to the main screen.

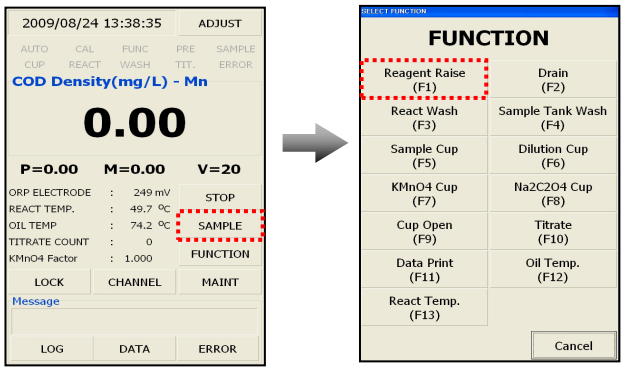


2) Touch MAIN > STOP to stop auto measurement.



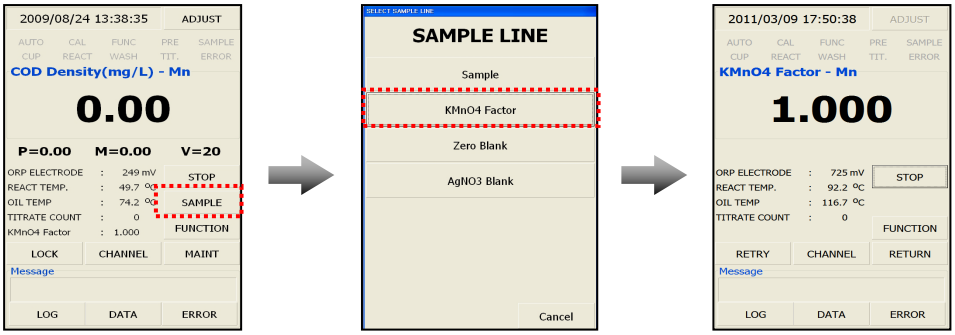
3) Separate $KMnO_4$(or FAS solution) tube line connected to gauge glass and reaction unitto clean.

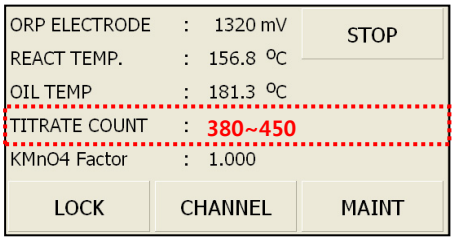
4) Replace to a new reagent and execute<u>FUNCTION > ReagentRaise(F1)</u> to raise reagent.



* Replace permanganate tube before executing F1.

5) When <u>SAMPLE > $KMnO_4$ (or FAS) Factor</u>is run,5 ㎖ of $KMnO_4$ (or FAS) is measured and titrate count on the main screen is checked to see whether it lies between 380~450. Data is more accurate at titrate count is closer to 400. When titrate count exceeds 430, reagent pump tube must be replaced.





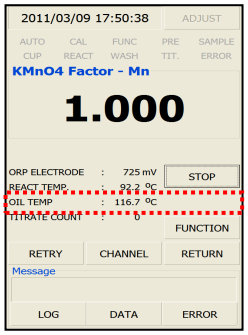
▶ Normal range for titrate count is 380~450.

6) Factor is automatically executed according to sequential operation.

* Operation sequence

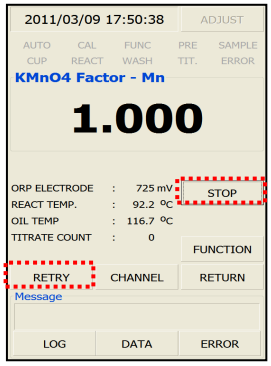
▶ Execute F7: measurement of potassium permanganate(or FAS)

▶ CH39 oxidation potential is automatically changed to 1,200



* Automatically executed when oil temperature exceeds 100℃
(If temperature is below 100℃, it is executed after reaching 100℃)

7) An error occurs when potential of reaction unit is 500mV or below.
Touch STOP > Retry to rerun the factorproperly.

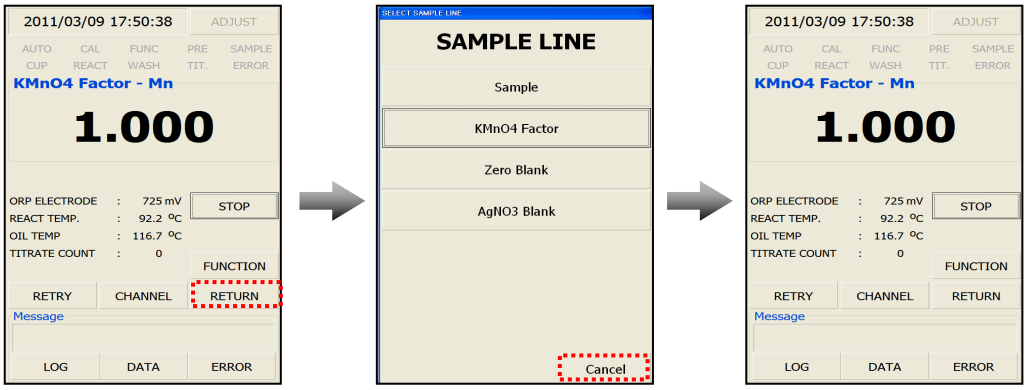


8) Check whether $KMnO_4$ (or FAS) factor displayed is within 0.95~1.02(optimal: 0.97~1.05).

9) After confirming that factor value is minimal, touch Retry for 2~3 consecutive measurements.
Exit the factor when $KMnO_4$(or FAS) factor lies within0.95~1.02(optimal: 0.97~1.05).

* Sequence of exit is as follows.

RETURN > SAMPLE LINE Cancel > Main Screen



10) If the displayed factor value is lower than 0.95,dilute $Na_2C_2O_4$ (or K2Cr2O7)with distilled water and execute MAIN > FUNCTION >Reagent Raise(F1)before repeating steps 5) ~ 7).

11) If the displayed$KMnO_4$(or FAS) factor value is higher than 1.02,dilute $KMnO_4$ (or FAS) with distilled water and execute MAIN > FUNCTION >Reagent Raise(F1)before repeatingsteps 5)~7).

* Calculation of the amount of distilled water used for dilution

$$\text{Amount of distilled water} = \text{Current reagent} - \left(\frac{\text{Current reagent}}{\text{Factor value}}\right)$$

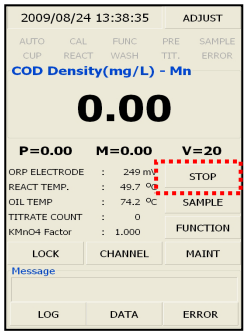
12) Execute steps 10~11. If $KMnO_4$(or FAS) factor is normal($KMnO_4$ factor is0.95~1.05 (optimal:0.97~1.02)),change adjust mode on the main screen to measure mode.

5. Routine Maintenance

A. Stopping of Device

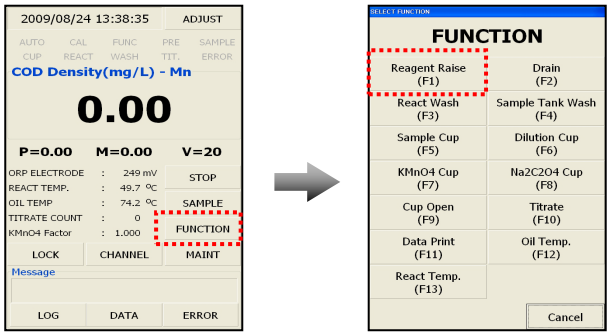
The device is stopped in the following order for cleaning and movement.

1) When measure mode on the main screen is changed to adjust mode, adjust sign appears.

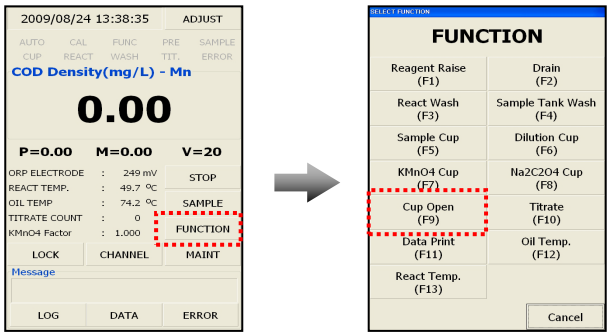
2) 

Touch MAIN->STOP to stop all operations of the device. Here, when temporarily stopping the device for cleaning,replacement of reagent, or replacement of some parts, turn the power OFF.

3) When stopping the device for long time,remove reagent tube in the reagent tank and touch MAIN > FUNCTION >REAGENT RAISE(F1)to pull out reagent form the tube



One the tube is emptied, touch MAIN > FUNCTION >React Wash(F3)to wash reaction unit and turn the power OFF.



Caution !!	When MAIN > CHANNEL > Ch. above the tableis pressed, all channels are selected. Touch print at the bottom to print data of all channels. Print and store channel data table, and enter necessary channel data based on this table when the memory is deleted upon recovery of power.

B. Routine Inspection

Appropriate routine maintenance and inspection are important for maintaining correct measurement values.
Since inspection cycle of routine inspection differs according to componentand status of reagent, it should be determined separately.
Basic cycle is to inspect the device every 2 weeks when supplementing reagent.Perform inspection based on the following details.

1) Routine inspection table

(1) Inspection of sampling part

Item		Inspection	Details	Note
SAMPLING PART	Water collection route	Inspection of water collection route	No clogging or contamination of each part Normal flow	Route is regularly cleaned according to degree of contamination.
		Inspection of reagent collection pump	Normal rotation No water leak, groove or tear of pump tube	In principle, tube is replaced once in 3months.
		Inspection of reagent tank	No internal contamination Normal overflow Normal rotation of stirrer	Clean using brush.
	Diluted water route	Inspection of diluted watertank	No internal contamination Normal overflow	Clean using brush.
		Inspection of pipe route	No water leak, groove, tear or deformation	
	Gauge glass	Inspection of measurement leveler	Normal measurement	
		Inspection ofgauge glass	No contamination No clogging of reagent injection hole	Wash with sodium oxalate. Clean using brush.

(2) Inspection of reagent part and reaction part

Item		Inspection	Details	Note
Reagent Part	Amount of reagent	Inspection of remaining reagent	Certain amount is to be consumed	In principle, reagent is supplemented once in 2 weeks.
		Filling of reagent	Fill each reagent in the prescribed tank ($KMnO_4$(or FAS)solution is replaced for each tank)	
	Reagent route	Inspection of reagentpump	Normal rotation and no water leak, groove or tear in the pump tube	In principle, tube is replaced once in 6 months.
		Pinch valve inspection	Normal switching operation No clogging, groove or tear in the tube	In principle, tube is replaced once in 6 months.
		Pipe route inspection	No loosening ofconnection No water leak, groove, tear or deformation	
Reaction Part	Reaction unit	Reaction unit inspection	No damage and clean	Potassium permanganate is cleaned bysulfate (1+2).
		Reaction unit coverinspection	No loosening ofconnection No water leak such as chemical	
		Reaction unit stirrercheck	Normal rotation	
		Dischargecheck	Normal liquid discharge operation	
	Electrode part	ORPelectrodeinspection	Electrode surface is clean	Clean with distilled water.
		ORP reference electrodeinspection	Electrode is made of copper Copper wire in the front part of H_2SO_4injection pipe	In principle, it is replacedonce a year.
	Heating unit	Check oil in oil bath	Need standard amount of oil	Supplement or replacein a timely manner
		Temperature control	To be controlled properly Regulated voltage (AC 100V) supplied to the heater	
Measurement Part	Titration	Inspection of titration	To be properly titrated in reaction unit	
		Check titration potential	Reduction potential (37CH)≒700 ㎷ Titration-end potential (38CH)≒800 ㎷ Oxidation potential (39CH)≒1200 ㎷	Potential is changed by water quality
	Correction	Zero correction	Measurement is done with zerocorrection solution	
		Span correction	Factor correction is done	
Record Part	Recording device	Paper transport	Paper transport must be smooth	
		Record status	Print must be clear	
		Remainingpaper	Check remaining paper	
I/O Part	Input signal	Flowmeter signal	No loosening of terminal or disconnection of wire	
	Output signal	Telemeteroutput signal	No loosening of terminal or disconnection of wire	

C. Troubleshooting with Message

This device prints messages about expected failure or status on the printer.
Most problems can be handled by responding to the printed message.

1) **Check reagent line!!**
   - ▷ This message is printed when reagent measurement is defective.(For 10 seconds)
   - ▷ Possible causes are shortage of reagent, defective collection line, defective reagent pump and defective measurement circuit.

2) **Check dilution line!!**
   - ▷ This message is printed when diluted water measurement is defective. (For 10seconds)
   - ▷ Possible causes are shortage of tap water, defective dilution tank valve and defective measurement circuit.

3) **Temperature does not increase!!**
   - ※ Example ofdisplay: BATH TEMP ERRORW 25℃(reaction unit) 0 27℃(oil bath)
   - ▷ This message is printed when regulated temperature (4CH) is not reached within prescribed time after measurement of reagent. (For 6 minutes of waiting time)
   - ▷ Possible causes are defective heater in heating unit, defective water bath temperature sensor, defective oil bath temperature sensor, disconnection of temperature controller and defective temperature control.

4) **Check $KMnO_4$ (or FAS)line!!**
   - ▷ This message is printed when $KMnO_4$(or FAS)measurement is defective.(For 1 minute)
   - ▷ Possible causes are defective $KMnO_4$(or FAS)pipe, defective transfer of $KMnO_4$(or FAS)pump and defective measurement circuit.

5) **LEVERER COUNT = 25**
   - ▷ This message is printed when measurement count is below appropriate value (350).
   - ▷ Possible causes are defective measurement circuit, defective gauge glass valve and defective$KMnO_4$counter.

6) **Check $KMnO_4$ (or dichromate)tube!!**
   - ▷ This message is printed when $KMnO_4$(or FAS)count is above regulated value (550).
   - ▷ Possible causes are reduced capability of $KMnO_4$(or FAS)pump tubeand defective $KMnO_4$(or FAS)pipe.

7) **Check oxalate line!!**
   - ▷ This message is printed when $Na_2C_2O_4$(or K2Cr2O7)measurement is defective.(For 1 minute)
   - ▷ Possible causes are defective $Na_2C_2O_4$(or K2Cr2O7)pipe, defective transfer of $Na_2C_2O_4$(or K2Cr2O7) pump and defective measurement circuit.

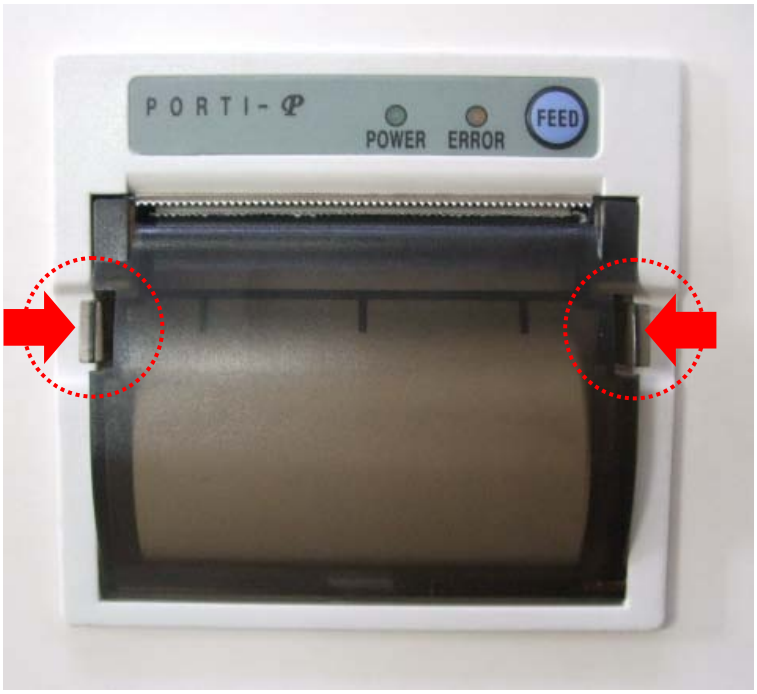
8) **Potential error-1,263MV(oxidation potential) 1,208MV(reduction potential)**
   - ▷ This message is printed when oxidation potential is above regulated value(1,700㎷), reduction potential is below regulated value(100㎷) or difference between oxidation potential and reduction potential is below regulated value(100㎷). Possible causes are defective ORP measurement electrode, defective H_2SO_4solution, defective ORP reference electrode, defective rotation of reaction unit stirrer and defective AMP circuit. This message is also printed when factor of$KMnO_4$(or FAS)solution is higher than factor of $Na_2C_2O_4$(or K2Cr2O7) solution and when COD concentration exceeds the measurement range.

9) **Titrate over count!!**
   This message is printed when titration is not completed within prescribed time. (For 5 minutes of titration) Possible causes are defective transfer of $KMnO_4$(or FAS)pump defective titration valve, defective titration pipe, defective ORP measurement electrode, defective H_2SO_4(or H2SO4-Ag2SO4) solution, defective ORP reference electrode, defective rotation of reaction unit stirrer and defective AMP circuit.

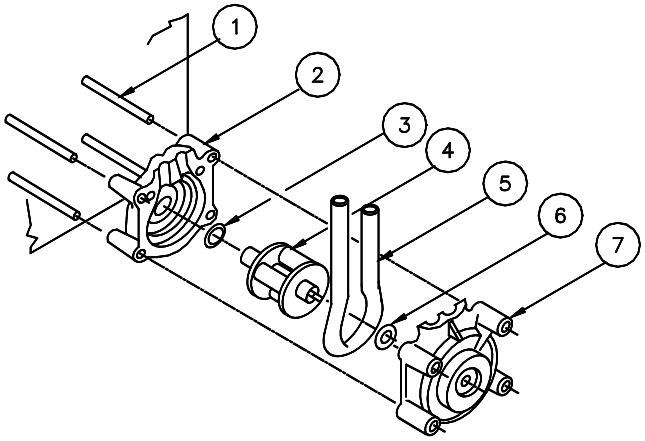
D. Maintenance of Device

1) Maintenance of printer

When the print head is stopped as printer paper gets stuck, the computer may stop without functioning properly. When the printer head rips printer paper or paper gets stuck while printing, move the handle of the paper cover inward to open the cover and pull paper with hands in any directions to remove it.



2) Replacement pf pump tube



▷ Exploded view of pump tube

① Fixing shaft

②,⑦ Pump head

④ Roller

⑤ Pump tube

③,⑥Washer

▷ How to attach tube

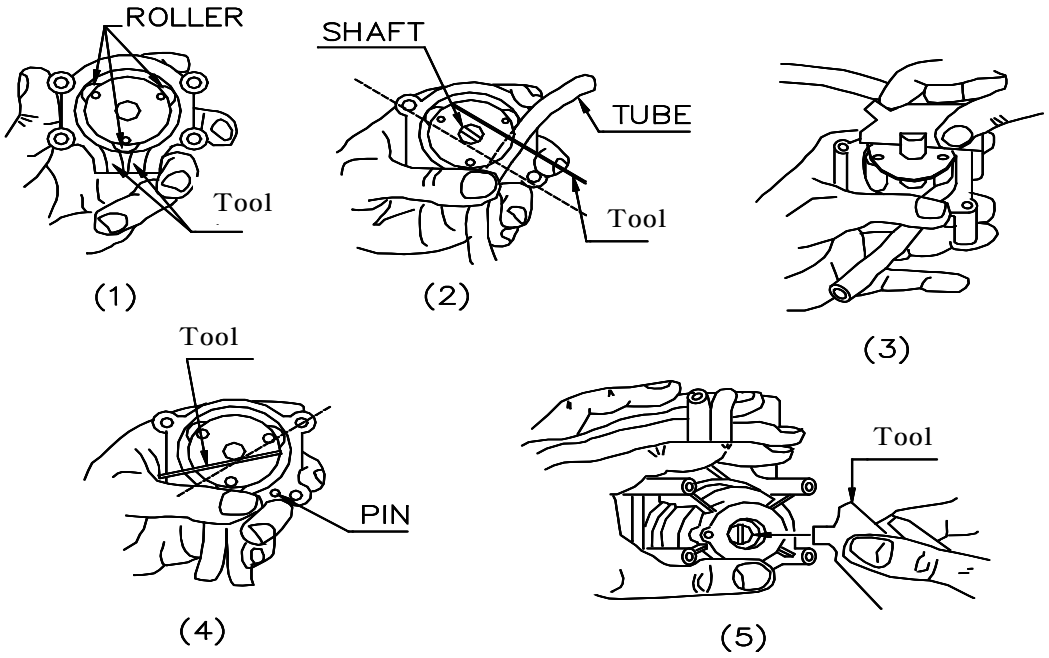
① Hold the pump head as shown in the figure below and set the roller in the direction of 2, 6 and 10 o'clock.

② Insert tube into the groove on the right side and press with a thumb to insert the tube pump tool between shaft and roller as in the figure.

③ Insert the tool in the direction of shaft and rotate it counterclockwise.

④ After one rotation, press the tube into the groove on the left side to detach the tool. Also, set position of pump head pin on one side to be perfectly accurate.

⑤ Insert the assembled pump into fixing shaft and rotate the shaft using the tool to align with the motor shaft. Fix using a butterfly screw.

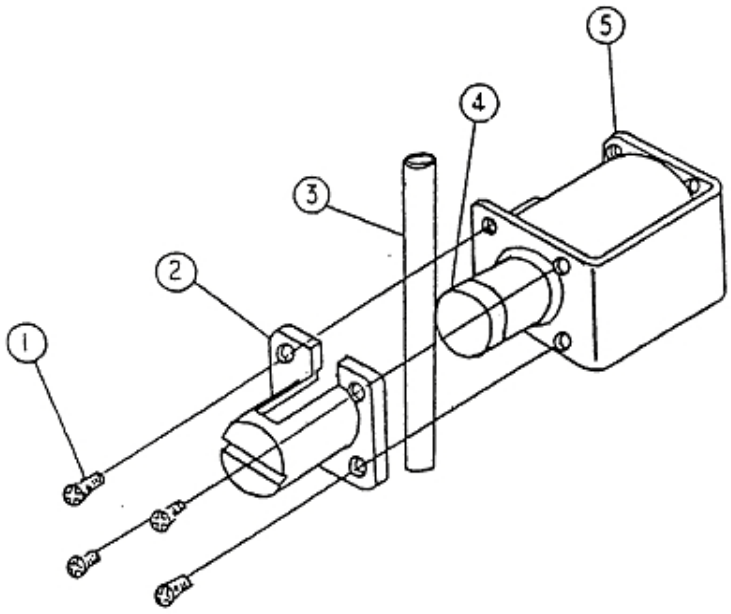


3) Replacement of solenoid valve tube

Replace silicon tube of solenoid valve after loosening 4 bracket fixing screws and detaching the bracket. There are 2 types of silicon tube. Do not incorrectly replace it.

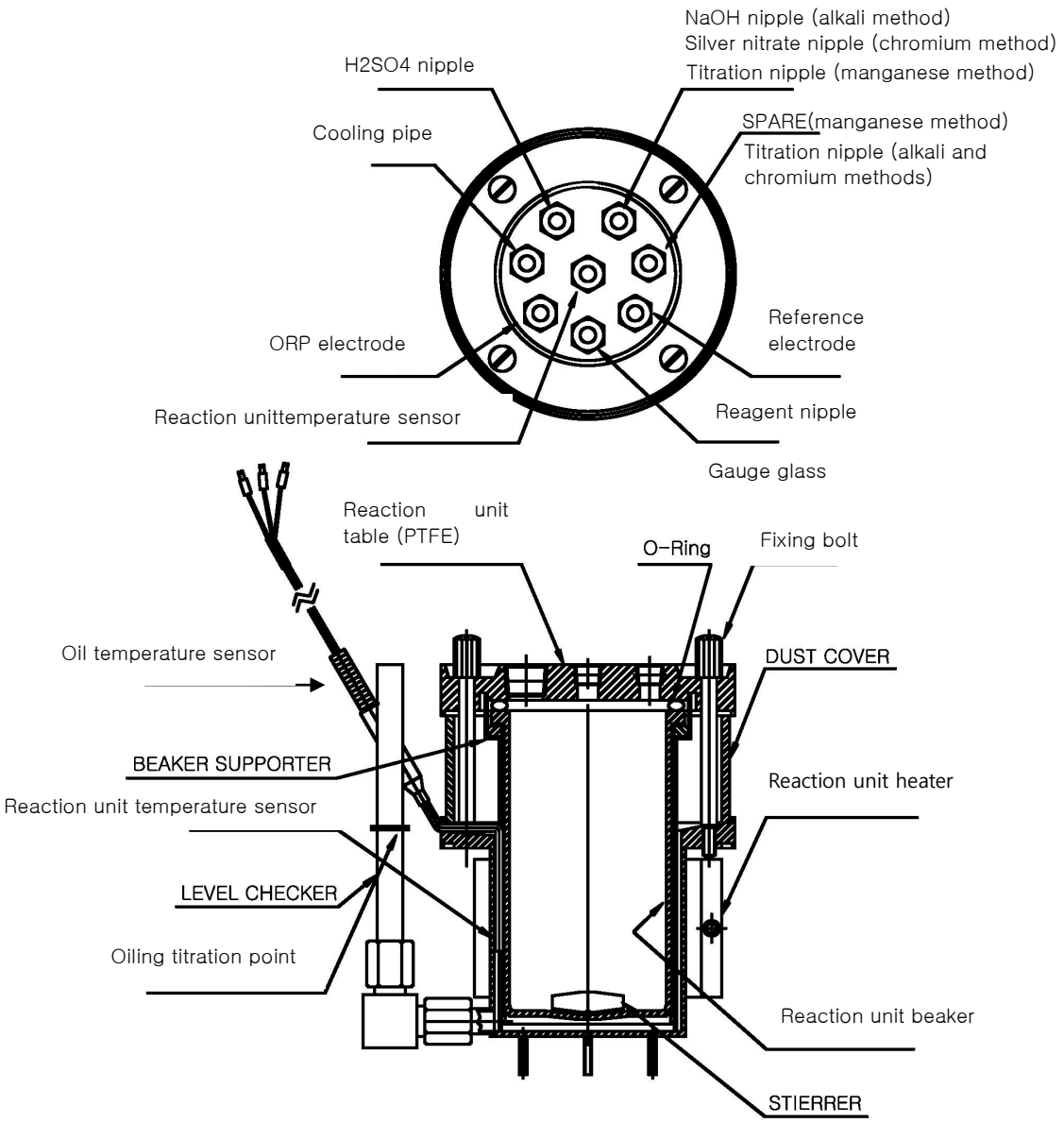
Name	Specification	Product Model
Reagent valve	3 x 5 mm Φ	SI-0305
Dilution valve	3 x 5 mm Φ	SI-0305
Reagent drain valve	5 x 7 mm Φ	SI-0507
Gauge glass valve	3 x 5 mm Φ	SI-0305
Air drain valve	5 x 7 mm Φ	SI-0507
Precision valve	3 x 5 mm Φ	SI-0305
Titration valve	3 x 5 mm Φ	SI-0305

① VOLT
② BLAKET
③ SILICON TUBE
④ PISTON
⑤ SOLENOID VALVE



4) Replacement of reaction unit beaker

Loosen electrode or pipe connected to reaction unit to detach reaction unit beaker. Be careful when loosening it. After loosening 4 reaction unit fixing screws, remove the cover of reaction unit and O-ring and detach reaction unit beaker.Since silicon oil of oil bath is attached nearby reaction unit beaker,separate while being careful not to spill it nearby.Put stirrer in a new beaker, add to oil bath, and insert O-ring.
Cover the reaction unit cover immediately on top.Simultaneously tighten 2 diagonal reaction unit fixing screws. If water cannot be drained because of air leak, wipe water out of the edges of beaker and O-ring before repeating the work.



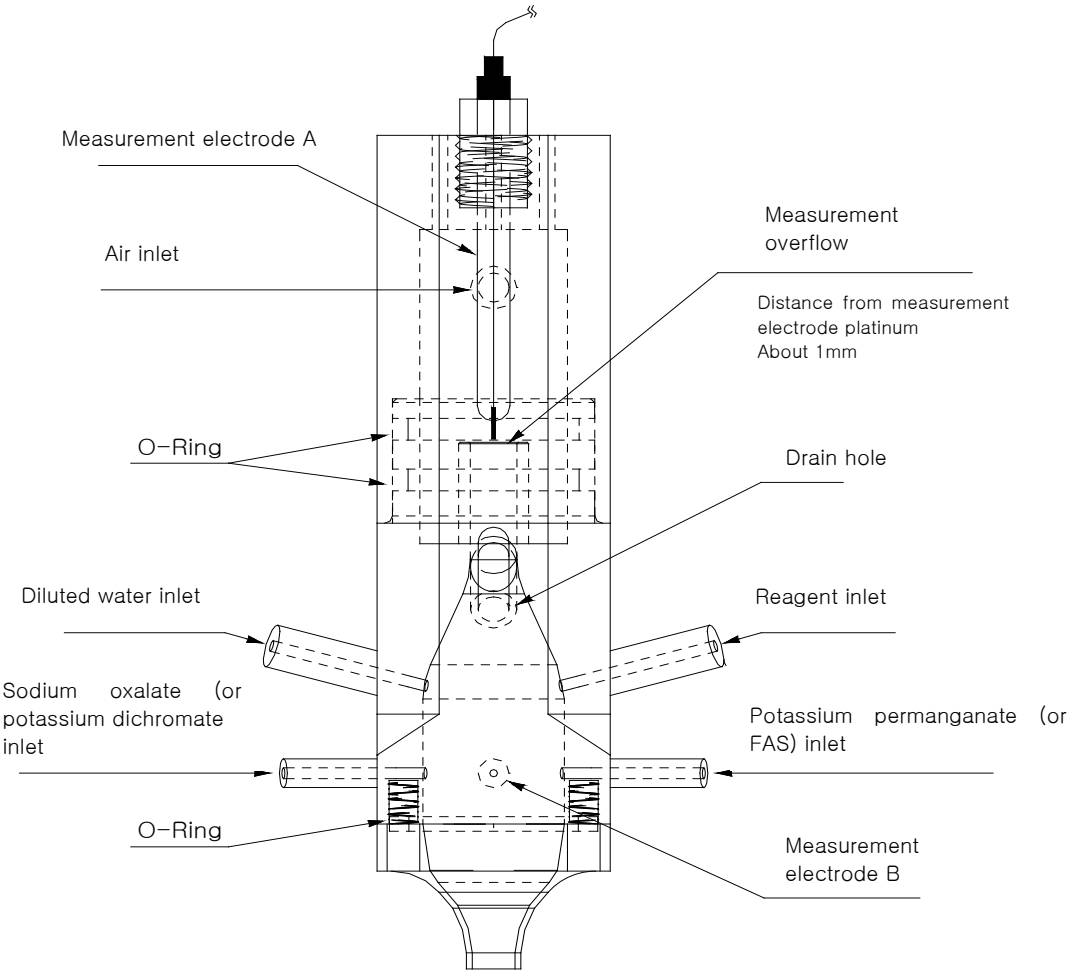
5) Cleaning of gauge glass

Loosen the anchor block of measurement electrode A and add (1+2) sulfur into the loosened opening. Neglect for a moment before cleaning.

▷ Adjustment of position of measurement electrodeA

▷ Position can be adjusted by rotating measurement electrode A while holding its anchor block.

▷ Adjust 0-1 ㎜ above the entrance of measurement overflow.

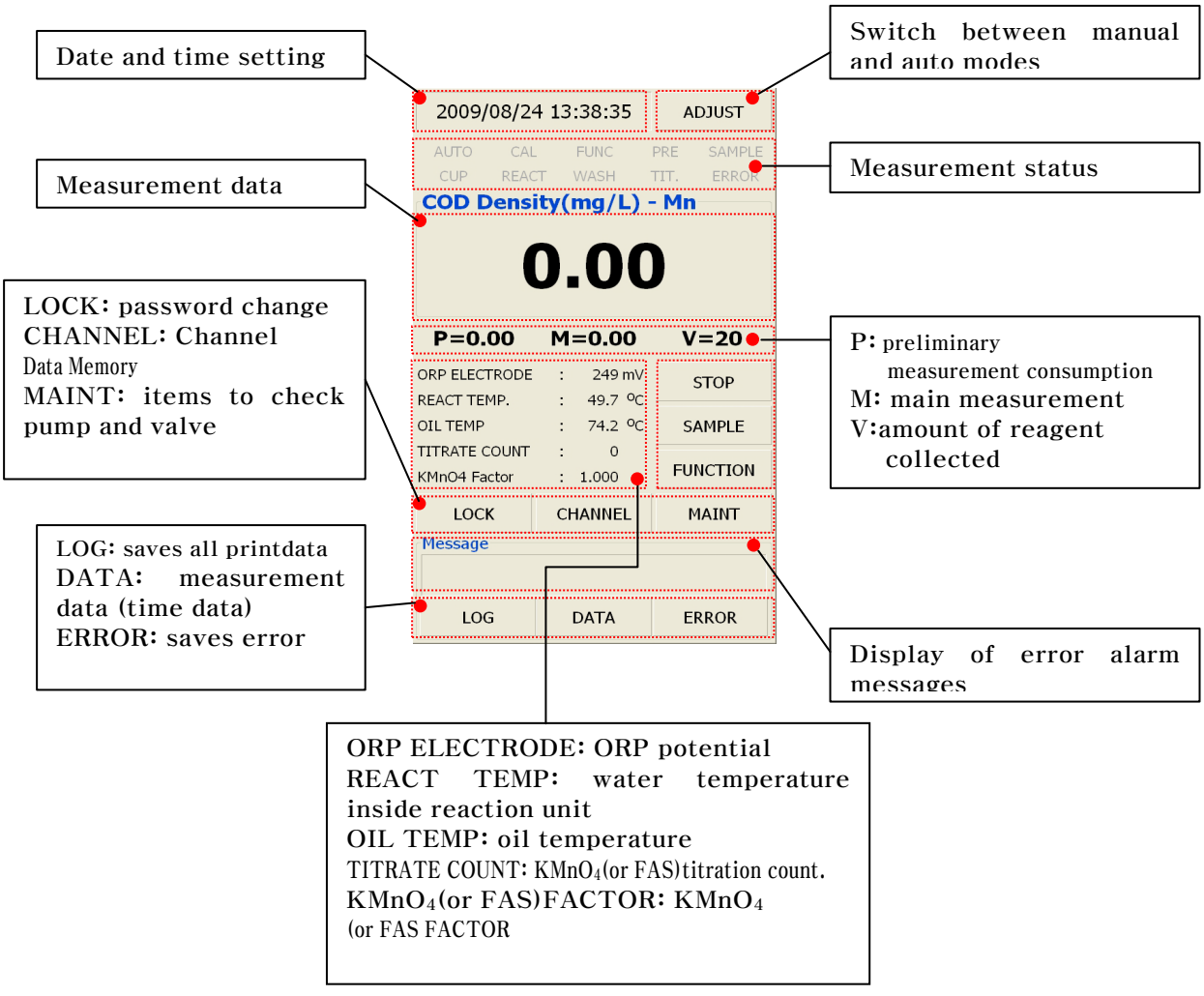


New glass gauge

6. FunctionControl (Touch Screen Type)

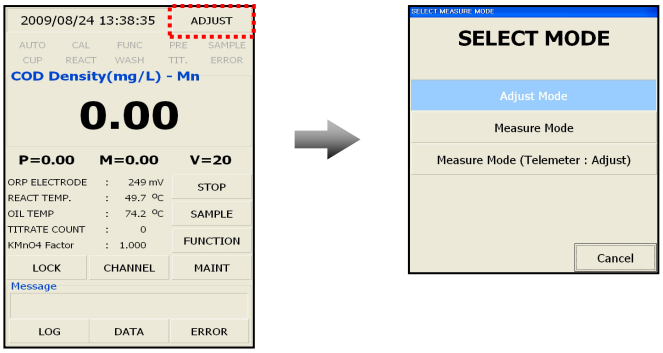
Chapter 6 explains specific method of using each function menu. Read and understand the following explanation to accurately use functions without error.

※ **Main control screen**



A. Measurement Mode

Measurement mode can be selected between manual and auto modes, and operation of each mode is as follows.



MODE	Explanation of Mode
ADJUST	This mode is used for inspection or clock adjustment. When set to this position, "ADJ"is turned on and adjustment signal is sent out to telemeter.
MEASURE	This mode is used to set auto measurement or change data. "MEAS" is turned ON by setting to this position.
MEASURE (Telemeter:Adjust)	Adjust mode signal is printed during measure mode (auto measurement).

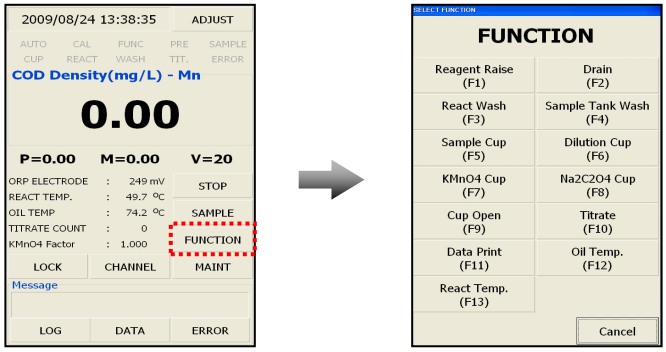
※ Refer to the table below for operation according to position of each unit.

ITEM \ MODE	ADJUST	MEASURE	MEASURE (Telemeter:ADJUST)
DATA IN(CHANNEL DATA)	○	○	○
DATA OUT(CHANNEL DATA)	○	○	○
Each operation sequence	Manual / auto	Auto	
Switch to display mode	○	○	○
Factor correction	○		
Time correction	○		
Sample check	Manual	Auto	
$AgNO_3$	Manual	Auto	

B. Method of Using Function(Method of Using Touch Screen Menu)

1) Method of using operation (function) menu

Each operation sequence can be performed once by the following control in adjustmode.

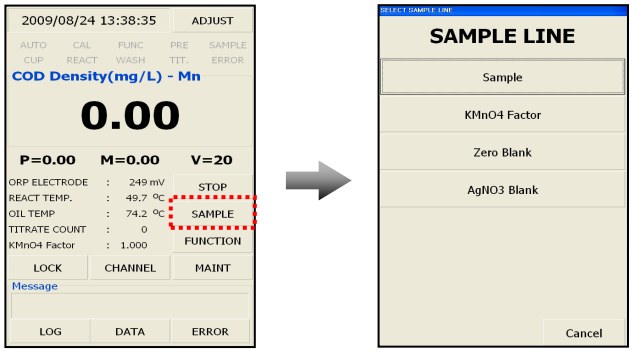


※ The following operations can be done depending on the type of Fn.

Fn	Item	Execution
F1	Reagent Raise	· Reagent is raised ▷ $KMnO_4$(or FAS) PUMP, $Na_2C_2O_4$(or K2Cr2O7) PUMP, and H_2SO_4(or $H_2SO_4 \cdot Ag_2SO_4$) PUMP are rotated for about 40 secondsto supply each reagent in thepipe.
F2	Drain	· Drain ▷ Air drain valve is closed and air pump is operated to drain reagent and diluted water in reaction unit.
F3	React Wash	· Cleaning of reaction unit ▷ Cleaning water is introduced to reaction unit to repeat drain operation 3 times.
F4	Sample Tank Wash	· Cleaning of sample tank ▷ Clean sample tank, gauge glass and sample pipe.
F5	Sample Cup	· Measurement of sample count ▷ Open sample valve and measure sample count. After measurement, open gauge glass valve and add diluted water. "Check sample line!!" is printed in case of measurement defect.
F6	Dilution Cup	· Measurement of diluted water ▷ Open dilution valve and measure diluted water. After measurement, open gauge glass valve and add diluted water into reaction unit. "Check dilution line!!" is printed in case ofmeasurement defect.
F7	$KMnO_4$ Cup (or FAS)	· Measurement of $KMnO_4$(or FAS)solution ▷$KMnO_4$(or FAS) pump is operated to measure FAS solution. After measurement,$KMnO_4$(or FAS)solution is counted and recorded in 24CH. Here, "Check $KMnO_4$line!!" is printed when count lies outside the regulated range(350-550).
F8	$Na_2C_2O_4$ Cup (or $K_2Cr_2O_7$)	· Measurement of sodium oxalate (or potassium dichromate) solution ▷ $Na_2C_2O_4$ (or $K_2Cr_2O_7$)pump is operated to measure sodium oxalate solution. After measurement, gauge glass valve is opened and sodium oxalate solution is added into reaction unit."Check $Na_2C_2O_4$ line!!" is printed in case of measurement defect.
F9	Cup Open	· Switching of gauge glass valve ▷ Gauge glass valve is opened for about 5 second sand air pump is operated to add solution in gauge glass into reaction unit.

F10	Titrate	・Titration ▷ After titration valve is opened(precision valve is closed), FAS pump perform titration by operating FAS pump at low rate.
F11	Data Print	・Data factor ▷ COD concentration is printed from internal data.
F12	Oil Temp.	・Temperature of oil bath (standby state) ▷ Heater is installed to adjust temperature of oil bath to setting temperature (2CH).
F13	React Temp.	・Temperature of reaction unit (heated reaction state) ▷ Temperature of reaction unit is adjusted to setting temperature (2CH).

2)Method of using sample



This control is used to check correction and measurement sequence.

When SAMPLE of SAMPLE > SAMPLE LINE is touched on the main screen, the screen moves to main to run measurement for 1 hour.

Check whether the main screen turns to adjust mode and execute the next operation.

Here, wait until all current measurements are completed.

(1) Explanation on SAMPLE -> SAMPLE LINE

ZERO BLANK : Blank test measurement by diluted water
After measuring diluted water and correcting blank (zero) of preliminary, main and silver added measurements,factor of $KMnO_4$ (or FAS)is standardized (span correction). Blank value is corrected from COD concentration of tap water.

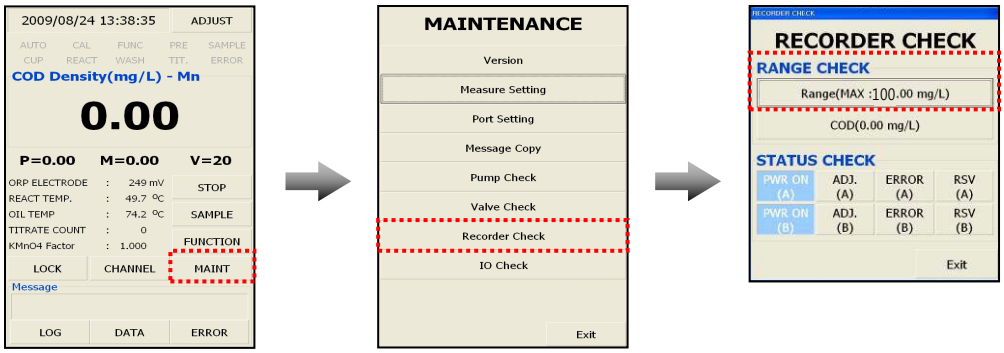
$KMnO_4$ FACTOR (or FAS) : Standardization of potassium permanganate(or FAS)solution factor
Factor of potassium permanganate (or FAS)solution is standardized.

SAMPLE : Ordinary measurement
Measurement is done once according to measurement mode configured in the measurement mode selector(6CH). However, sample is not collected.Add sample to be measured into sample tank in advance.

$AgNO_3$ BLANK : Blank test measurement by distilled water
Measure distilled water in the sample tank and perform blank correction ofpreliminary, main and silver added measurementsto standardize permanganate factor.
Add distilled water in the sample tank in advance.
Titrated value is entered as blank value.

(2) Telemeter analog output (0-range value)

When the following control is done in MAIN > MAINT > Recorder Check > RANGE CHECK of ADJUST MODE, analog output and 0~range value for telemeter are printed. (Range is identical to 29CH. 4~20mA is printed depending on the range.)



Ex) Check data output on recorder check (4~20mA)

* If range is 100mg/L and 0ppm is entered asCOD data,4mA is printed.
* If range is 100mg/L and 50ppm is entered as COD data, 12mA is printed.
* If range is 100mg/L and 100ppm is entered as COD data, 20mA is printed.

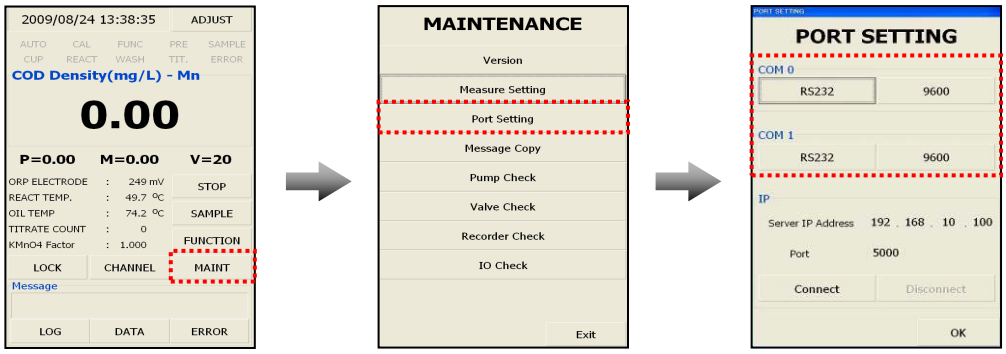
(3) Output voltage(4-20mA)

Voltage (current) configured in the output terminal of telemeter(current: 5, 6, 17, 18) is printed as below.

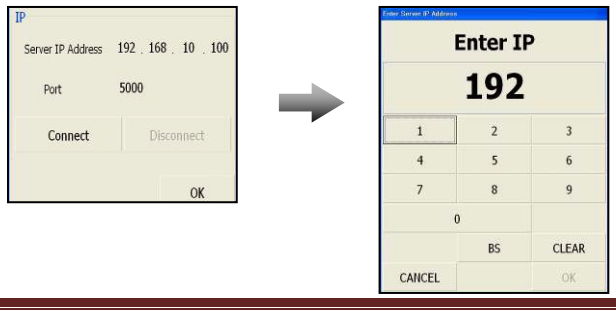
* D/A output check500MV!!!(Output voltage)

(4) RS-232C/422/485 output

COM PORT is touched in MAIN > MAINT > Port Setting to change RS-232C/422/485.



* COM 0, COM 1 PORT is changed in the order of RS-232 > 422 > 485 when itemis touched.
* For IP andport setting, touch the corresponding item and enter the number on the key screen and touch OK.

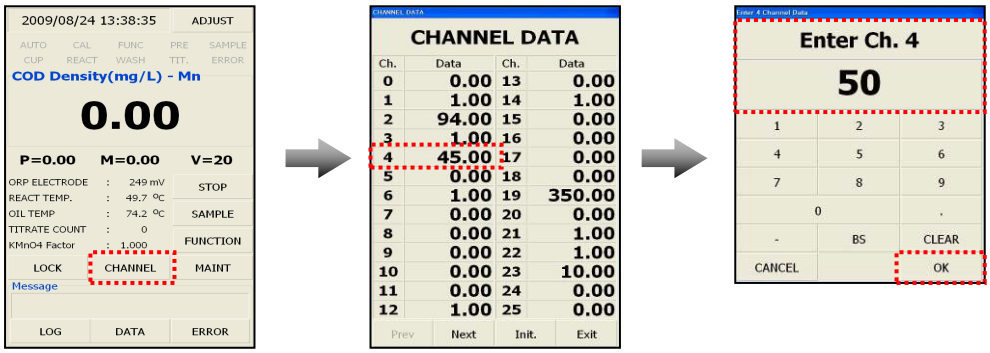


3) Adjustment of channel data

(1) When entering channel data

MAIN > CHANNEL >touch channel data to be changed-> CHANNELDATA KEY SCREEN> change number> OK

Ex) When data of Ch.4 is changed from 45 to 50

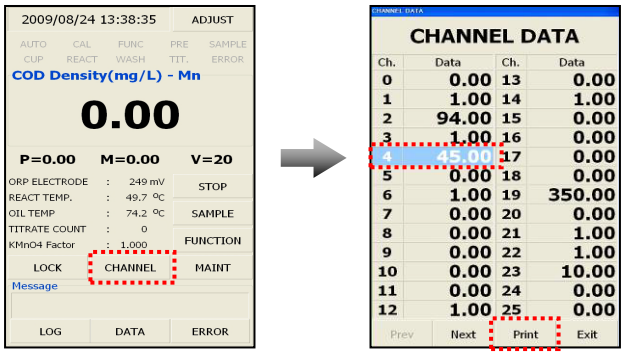


(2) When printing channel data

MAIN > CHANNEL > touch correspondingCh. NO >touch PRINT

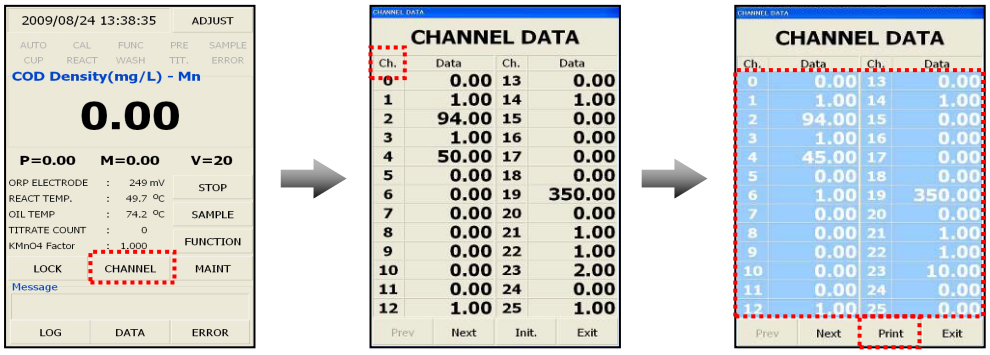
Ex) When printing data of Ch.4 (Ch.4 : 45)

* When the correspondingCh. NO is touched, color is revered to select the corresponding item. Among 4 menus at the bottom, Init menu is changed to Print.



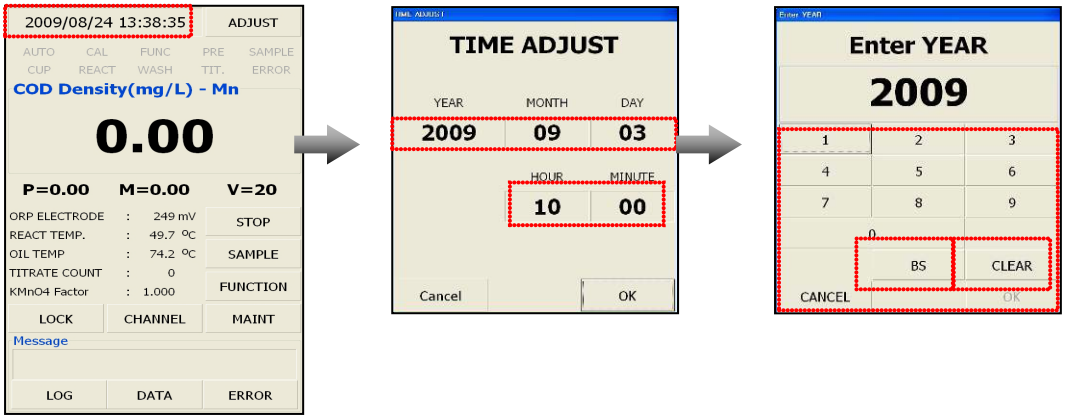
(3) When printing all channel data

MAIN > CHANNEL >touch Ch. in the channel table(select all) > PRINT



4) Adjust time

Time can be simply adjusted by several touches.



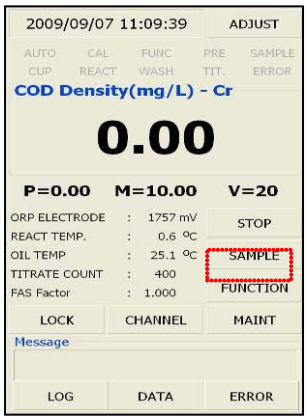
▷ Touch time on the top leftside of time

▷ Touch the field to be adjusted in time adjust

▷ BS: clear sequentially
CLEAR: clear all
Touch number to be adjusted

5) Adjustment stop

Perform the following control to forcibly stop the measurement operation.



▷ If this control is done during reaction in measure mode,it enters standby state with reactant solution remaining.
Since this contaminates reaction unit, do not use this function unless urgently necessary.

This function cannot be used when input is disabled.

7. Measuring

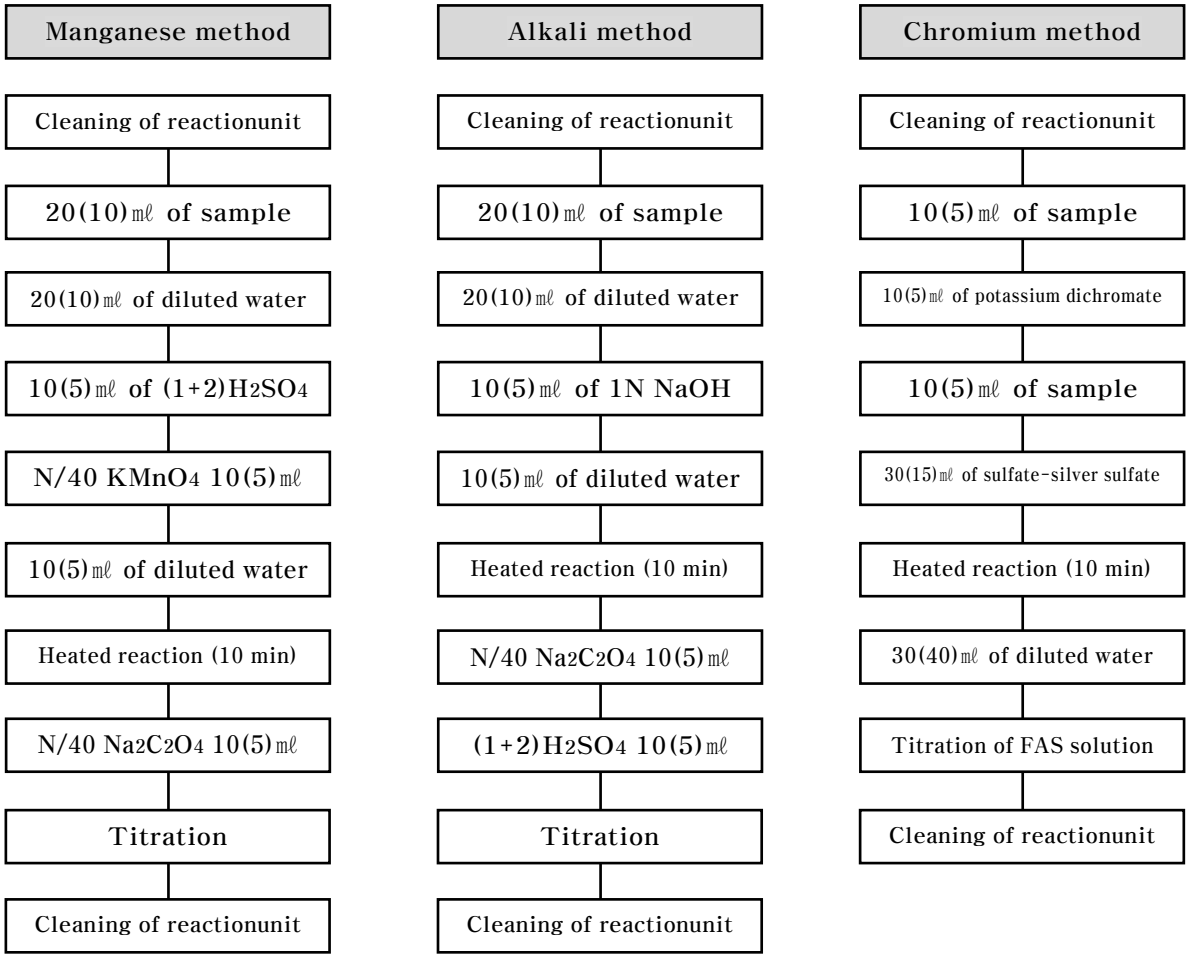
A. Preliminary Measurement

**( )is for 2 Series

Manganese method: this measurement is used to determine the amount of sample to be collected for main measurement.20(10)㎖ of sample and 30(15)㎖ of diluted water are measured, and 10(5)㎖ of (1+2) sulfate and10(5)㎖ N/40 potassium permanganateare injected into reaction unit.After 10 minutes of heated reaction, stop the reaction using10(5)㎖ of N/40 sodium oxalate and titrate using N/40 potassium permanganate to find COD concentration of sample and determine the amount of sample for main measurement.

Alkali method: this measurement is used to determine the amount of sample for main measurement.20(10)㎖ of sample and 30(15)㎖ of diluted water are measured, and 10(5)㎖ of 1N NaOH and 10(5)㎖ of N/40 potassium permanganate are injected into reaction unit.After 10 minutes of heated reaction, stop the reaction using 10(5)㎖ of N/40 sodium oxalate and 10(5)㎖ of (1+2)H_2SO_4 and titrate using N/40 potassium permanganate to find COD concentration of sample and determine the amount of sample for main measurement.

Chromium method:this measurement is used to determine the amount of sample for main measurement.20(10)㎖ of sample is measured and 30(15)㎖ of sulfate-silver sulfate and10(5)㎖ potassium dichromate are injected into reaction unit. After 10 minutes of heated reaction, 30(40)㎖ of diluted water is added and titrated using FAS solution to find COD concentration of sample and determine the amount of sample for main measurement.



B. Main Measurement

**( ) for 2 Series

This measurement is used to find COD concentration of sample. Measurement is based on pollution process test method and factory drain water test method(oxygen consumption by KMnO4(or FAS).

1) Main measurement without addition of silver

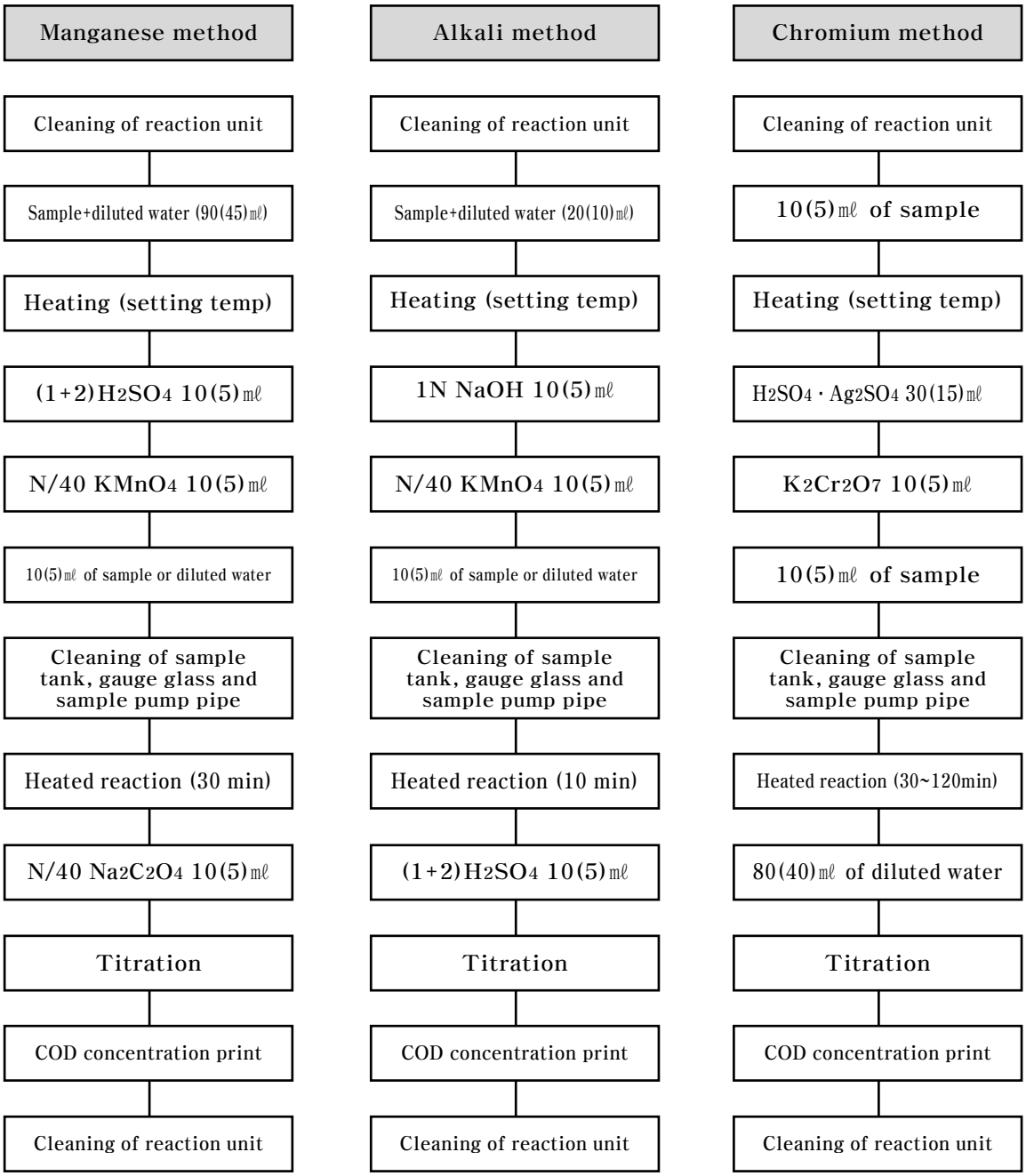
Manganese method: measurement is done without adding silver sulfate.Measure 100(50)㎖ of sample and diluted water according to the amount of sample calculated by preliminary measurement. The solution is heated until it reaches setting temperature(4CH), and 10(5)㎖ of sulfate and 10(5)㎖ of N/40 potassium permanganate are injected into reaction unit.After 30 minutes of heated reaction, stop the reaction with 10(5)㎖ of N/40 sodium oxalateand titrate using N/40 potassium permanganateto find COD concentration of sample.

Alkali method: Measurement is done without adding silver nitrate.Measure 100(50)㎖ of sample and diluted water according to the amount of sample calculated by preliminary measurement. The solution is heated until it reaches setting temperature(4CH), and 10(5)㎖ of 1N sodium hydroxide and 10(5)㎖ of N/40 potassium permanganate are injected into reaction unit.After 30 minutes (or 2 hours) of heated reaction, stop the reaction using 10(5)㎖ N/40 of sodium oxalate and 10(5)㎖ of (1+2) sulfate and titrate using $KMnO_4$solution to find COD concentration of sample.

Chromium method: Add silver nitrate solution equivalent to chloride ion concentration and add10(5)㎖ to hide chloride ion.Measure 20(10)㎖ of sample according to the amount of sample calculated by preliminary measurementand add silver acetic acid (equivalent amount +10(5)㎖). The solution is heated until it reaches setting temperature(4CH), and30(15)㎖ of sulfate-silver sulfate and10(5)㎖ of potassium dichromateare injected into reaction unit.Stop the reaction using 80(40)㎖ diluted water heated for 30 minutes (or 2 hours) and titrate using FAS solution to find COD concentration of sample.

$$COD(mg/L) = \frac{1000}{V} \times f \times 0.2 \times (a - b - w)$$

V : Amount of sample····· 23CH × 10
f : $KMnO_4$(or FAS)solution factor ·····22CH
a : Amount used for main measurement·····34CH
b : Blank value of measurement····· 31CH
w : correction of COD concentration for diluted water when diluted


Manganese method
Cleaning of reaction unit
Sample+diluted water (90(45)㎖)
Heating (setting temp)
(1+2)H2SO4 10(5)㎖
N/40 KMnO4 10(5)㎖
10(5)㎖ of sample or diluted water
Cleaning of sample tank, gauge glass and sample pump pipe
Heated reaction (30 min)
N/40 Na2C2O4 10(5)㎖
Titration
COD concentration print
Cleaning of reaction unit
Alkali method
Cleaning of reaction unit
Sample+diluted water (20(10)㎖)
Heating (setting temp)
1N NaOH 10(5)㎖
N/40 KMnO4 10(5)㎖
10(5)㎖ of sample or diluted water
Cleaning of sample tank, gauge glass and sample pump pipe
Heated reaction (10 min)
(1+2)H2SO4 10(5)㎖
Titration
COD concentration print
Cleaning of reaction unit
Chromium method
Cleaning of reaction unit
10(5)㎖ of sample
Heating (setting temp)
H2SO4 · Ag2SO4 30(15)㎖
K2Cr2O7 10(5)㎖
10(5)㎖ of sample
Cleaning of sample tank, gauge glass and sample pump pipe
Heated reaction (30~120min)
80(40)㎖ of diluted water
Titration
COD concentration print
Cleaning of reaction unit

2) Main measurement with addition of silver

**( )is for 2 Series

Manganese method: Silver nitrate is added as equivalent to chloride ion concentration plus5(2.5)㎖ to hide chloride ion. 1000(500)㎖ of sample and diluted water is measured according to the amount of sample calculated in preliminary measurement, and silver acetic acid(equivalent amount + 5(2.5)㎖) is added.The solution is heated to setting temperature (4CH), and 10(5)㎖ of sulfate and10(5)㎖ of N/40 potassium permanganate are injected into reaction unit. The reaction is stopped using 10(5)㎖ of N/40 sodium oxalate heated for 30 minutes and titrated with N/40 potassium permanganate to find COD concentration of sample.

Chromium method: Silver nitrate solution is added as equivalent to chloride ion concentration plus 10(5)㎖ to hide chloride ion.20(10)㎖ of sample is measured according to the amount of sample calculated in preliminary measurement, and silver sulfate (equivalent amount +10(5)㎖) is added.The solution is heated to setting temperature (4CH), and 30(15)㎖ of sulfate-silver sulfate and10(5)㎖ of potassium dichromate are injected into reaction unit. The reaction is stopped using 80(40)㎖ of diluted water heated for 30 minutes (or 2 hours) and titrated with FAS solution to find COD concentration of sample.

$$\text{COD(mg/L)} = \frac{1000}{V} \times f \times 0.2 \times (a - b - w)$$

V : Amount of sample····· 23CH × 10
f : N/40 potassium permanganate (or FAS) factor·····22CH
a : Amount used for main measurement·····34CH
b : Blank value for main measurement····· 31CH
w : correction of COD concentration for diluted water when diluted

Manganese method

- Cleaning of reaction unit
- Sample+diluted water(90(45)㎖)
- 20W/V% AgNO3 (equivalent+5(2.5)㎖)
- Heating (setting temp)
- (1+2)H_2SO_4 10(5)㎖
- N/40 $KMnO_4$ 10(5)㎖
- Cleaning of sample tank, gauge glass and sample pump pipe
- 10(5)㎖ of sample or diluted water
- Heated reaction (30 min)
- N/40 $Na_2C_2O_4$ 10(5)㎖
- Titration
- CODconcentration print
- Cleaning of reaction unit

Chromium method

- Cleaning of reaction unit
- 10(5)㎖ of sample
- 20W/V% AgNO3 (eqivalent+10(5)㎖)
- Heating (setting temp)
- H_2SO_4 · Ag_2NO_3 30(15)㎖
- $K_2Cr_2O_7$ 10(5)㎖
- 10(5)㎖ of sample
- Cleaning of sample tank, gauge glass and sample pump pipe
- Heated reaction (30~120 min)
- 80(40)㎖ of diluted water
- Titration
- CODconcentration print
- Cleaning of reaction unit

Caution !!	※ For 100㎖ of chloride ion, equivalent amount of 20W/V% AgNO3is 2.4㎖.

3)Standardization of factor

Manganese and alkali methods: potassium permanganatesolution **( ) is for 2 Series
Measure 100(50)㎖ of diluted water and add10(5)㎖ of (1+2)sulfate. Then add 10(5)㎖ of N/40 sodium oxalate.
Heat until temperature of reaction unit reaches70℃ and titrate using N/40 potassium permanganate to find the factor.

$$F\ (KMnO_4) = \frac{10}{X} \times f\ (Na_2C_2O_4)$$

F(KMnO4) : N/40 permanganate factor ····· 22CH

X : amount needed for standardization of factor ·····34CH

f(Na2C2O4): N/40 sodium oxalate factor ·····12CH

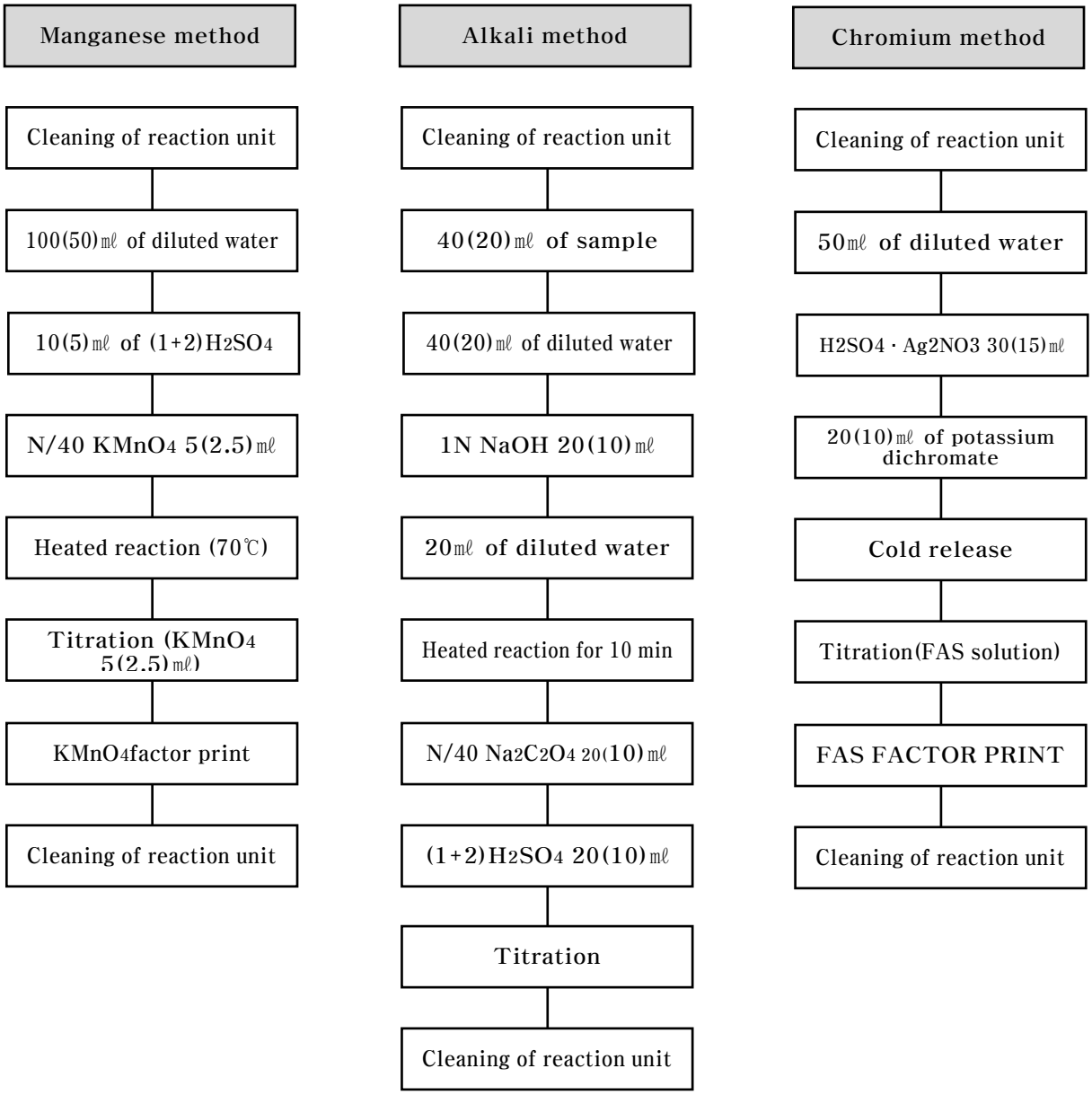
Chromium method: FAS solution
Measure100(50)㎖ of diluted water and add 30(15)㎖ of sulfate-silver sulfate. Then add 10(5)㎖ of potassium dichromate.
After cold releasing for a few seconds, titrate using FAS solution to find the factor.

$$F\ (FAS) = \frac{10}{X} \times f\ (K_2Cr_2O_7)$$

F(FAS) : FASsolution factor····· 22CH

X : amount needed for standardization of factor ·····34CH

f K2Cr2O7) : Potassium dichromate factor·····12CH



C.Titration

Titration is done by remembering oxidation reduction potential before stopping of the reaction(excess potassium permanganateor excess potassium dichromate)and oxidation reduction potential after stopping of the reaction(excess sodium oxalate or excess FAS solution) using the intermediate potential as the endpoint.

Titration is done with $KMnO_4$(or FAS)pumpand N/40 $KMnO_4$(or FAS)solution at low rate until the endpoint of oxidation reduction potential is reached.

8. EquipmentSpecification

A. Equipment Specification

Measurement method	:	Manganese - 100℃ acidic potassium permanganate (according to pollution process test method) Alkali - 100℃ alkaline potassium permanganate (according to pollution process test method) Chromium-potassium dichromate (according to water quality test)
Measurement range	:	0~100 mg/L(0~200 mg/L : KDT-2951H)
Degree of measurement	:	Manganese and alkali - ±0.5ppm of N/800 $Na_2C_2O_4$ solution Chromium±5ppm F · S of KHP solution
Reproducibility	:	Manganese and alkali- ±0.5ppm of N/800 $Na_2C_2O_4$ solution Chromium - ±5ppm F · S of KHP solution
Quantity of sample	:	(Manganese and alkali)3 Series:10~100ml, in case of dilution (sample +diluted water=100 ㎖) (Optimal amount is determined by preliminary measurement.) (Manganese and alkali)2 Series:5~50ml, in case of dilution (sample +diluted water=50 ㎖) (Optimal amount is determined by preliminarymeasurement.) Chromium: 20(10)㎖
Heating method	:	Temperature control according to designated measurementby oil bath
Endpoint detection	:	Detection of endpoint potential using oxidation reduction potential difference of platinum electrode
Measurement time	:	Manganese and alkali: 1 hour for 1measurement Chromium: 1 hour for 1measurement (30 minutes of reaction), 3 hours for 1measurement (2 hours of reaction)
Input setting	:	TOUCH SCREEN
Print output	:	Hourly report, daily report, correction result and error messages are printed by thermo-sensitive print method Hourly report-time, COD concentration, measurement data Daily report -date, COD concentration
Concentration output	:	DC 4-20mA
Alarm output	:	Power unit, adjustment, defect,contact signal(zero voltagecontact)
Communication	:	RS-232C
Computation of reagent	:	Manganese: N/40 potassium permanganate…… 5(2.5) ℓ/week N/40 sodium oxalate …… 8(4) ℓ/week (1+2) sulfate…… 4(2) ℓ/week Silver acetic acid(option)…… 70-80(35-40)㎖/week Alkali: N/40 potassium permanganate …… 5(2.5) ℓ/week N/40sodium oxalate …… 8(4) ℓ/week

	(1+2)sulfate ·····	4(2) ℓ/week
	1N NaOH solution ·····	4(2) ℓ/week
	Chromium: FAS solution ·····	5(2.5) ℓ/week
	H_2SO_4 · Ag_2NO_3solution ·····	8(4) ℓ/week
	$K_2Cr_2O_7$ solution ·····	4(2) ℓ/week
	Ag_2NO_3solution (option)·····	80(40)㎖/week
Power supply	:	Single-phase AC60㎐ 100V ±10%
Power consumption	:	800VA(maximum)
Temperature of use	:	2-40℃
Humidity of use	:	85% RH or below
Dimensions	:	600(W) × 640(D) × 1590(H) ㎜
Weight	:	About 130㎏

B. Components

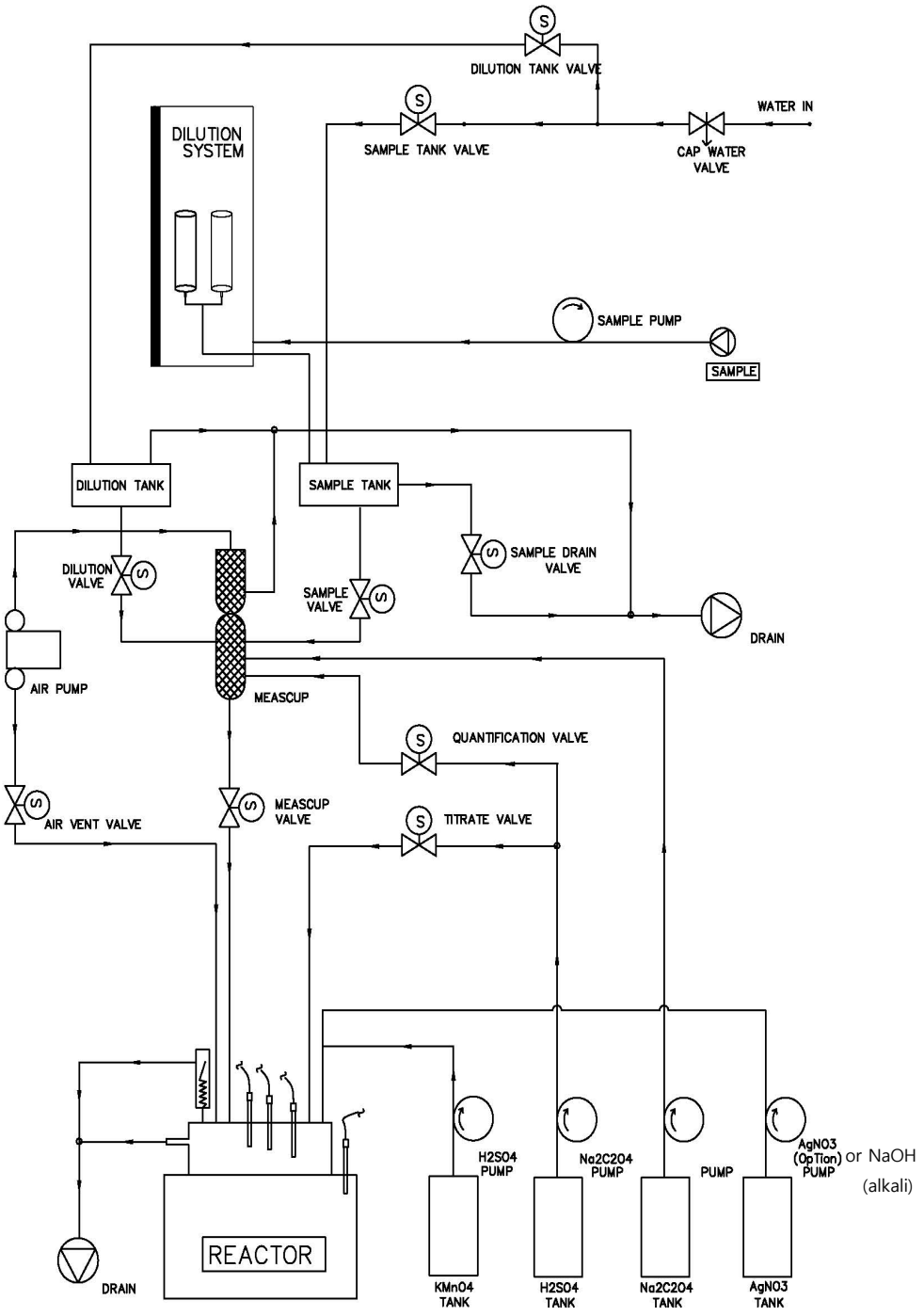
**( ) for 2 Series

Item	Specification		Quantity	Note
	Measurement	Tank Specification		
Reagent tank	Manganese method	20(10) ℓ POLY TANK 10(5) ℓ POLY TANK 10(5) ℓ POLY TANK	1 ea. 2 ea. 1 ea.	$Na_2C_2O_4$ solution $KMnO_4$,H_2SO_4solution $AgNO_3$solution (option)
	Alkali method	20(10) ℓ POLY TANK 10(5) ℓ POLY TANK 10(5) ℓ POLY TANK	1 ea. 2 ea. 1 ea.	$Na_2C_2O_4$solution $KMnO_4$,H_2SO_4solution NaOH solution
	Chromium method	20(10) ℓ POLY TANK 10(5) ℓ POLY TANK 10(5) ℓ POLY TANK	1 ea. 2 ea. 1 ea.	H_2SO_4 · $AgNO_3$ solution $K_2Cr_2O_7$, FASsolution $AgNO_3$solution (option)
Fuse	Common	5 A	2 ea.	
Printerpaper		Record sheet	3 ea.	
Preliminary tube		TUBE SET	1 SET	For titration valve and precise valve
Oil bath oil		SILICON OIL(TSF-433)	200 ㎖	
Mesh net		100meshes	1 ea.	
User Manual			1 book	

■ COD Auto Measurer Drawing-Manganese and Alkali Methods

KDTMS

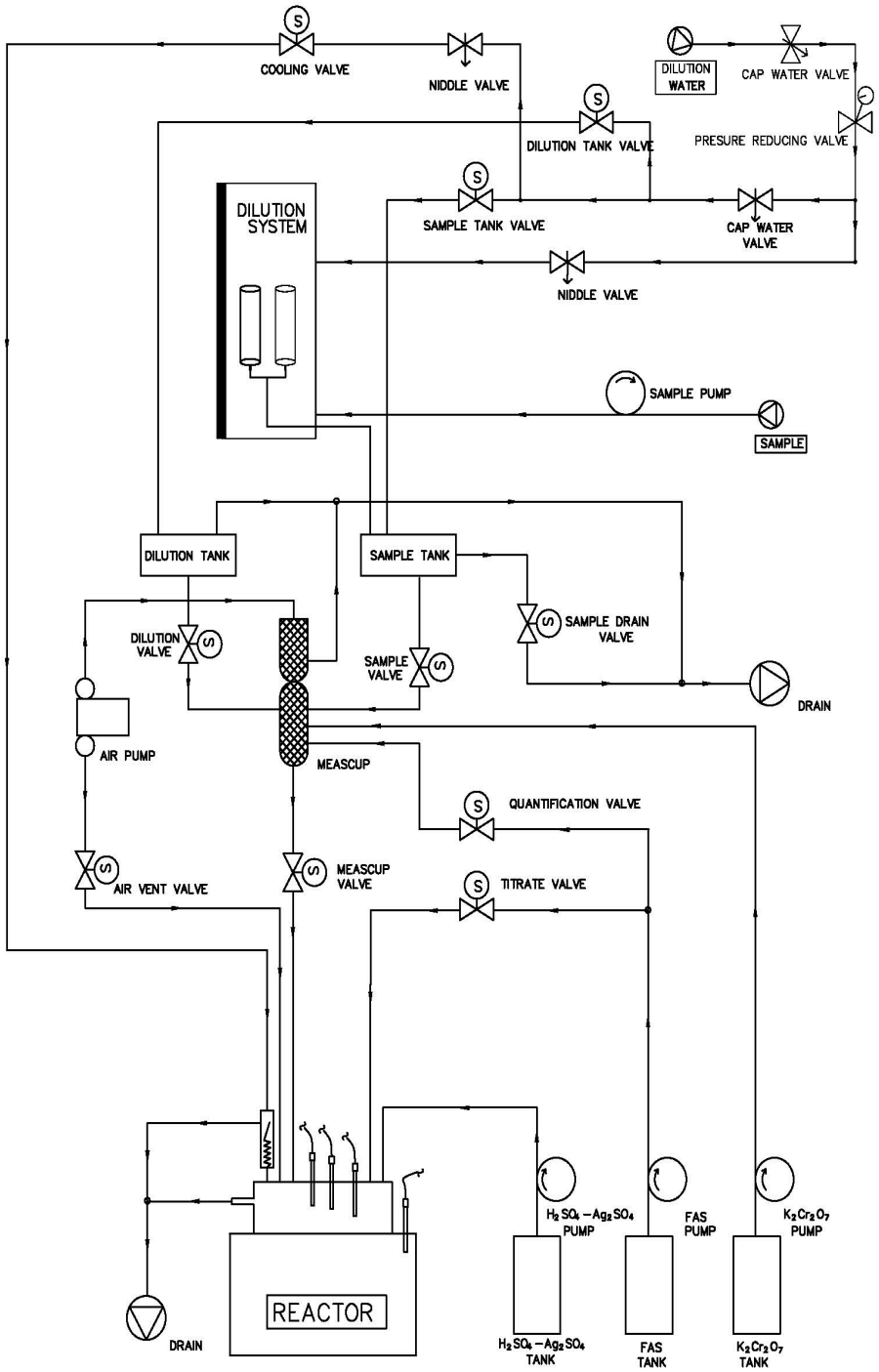
■ COD Auto MeasurerDrawing



■ COD Auto Measurer Drawing-Chromium Method

KDTMS

■ COD Auto MeasurerDrawing



■ Replacement cycle of parts

List of Parts		Model / Specification	Replacement Cycle
Item	Name of Part		
Electrode	ORP electrode	KDT-01-01	6M/1Y
	Reference electrode	KDT-01-02	1 Y
	Reference electrodedetection line	KDT-01-07	2M
	Thermometer of water bath	KDT-01-03	6M/1Y
	Thermometer of oil bath	KDT-01-04	2Y
	Measurement sensor A	KDT-01-05	2Y
	Measurement sensor B	KDT-01-06	2Y
Reaction unit	Reaction unit beaker	KDT-02-01	6M/1Y
	Reaction unit support	KDT-02-02	When damaged
	Round stealer	KDT-02-03	1Y
	Round band heater	KDT-02-04	1Y
	Reaction unit cover	KDT-02-05	When damaged
	Reaction unitdust cover	KDT-02-06	When damaged
	Reaction unit drain nipple	KDT-02-07	When damaged
	Reaction unitnipple (Ø4)	KDT-02-08	6M
	Reaction unit nipple (Ø6)	KDT-02-09	6M
	Temperature controller	KDT-02-10	When damaged
	Reaction unit O-ring	KDT-02-11	When damaged
Valve	Precise valve	KDT-03-01	3Y
	Titration valve	KDT-03-02	3Y
	Airtight valve	KDT-03-03	3Y
	Dilution/sample/measurement/sample drain valve	KDT-03-04	3Y
	Dilution tank /cleaning tankvalve	KDT-03-05	3Y
Glass pipe	Gauge glass	KDT-04-01	When contaminated
	Gauge glass O-ring	KDT-04-02	1Y
	T shapedglass pipe	KDT-04-03	1Y
	Cooling pipe	KDT-04-04	When damaged
	上 shapedglass pipe	KDT-04-05	1Y
	L shapedglass pipe	KDT-04-06	1Y

Gear	Sulfate / sodium oxalate gear	KDT-05-01	2Y
	Potassium permanganate gear	KDT-05-02	2Y
	Sample gear	KDT-05-03	1Y
Motor	Sulfate / sodium oxalate gear	KDT-06-01	2Y
	Potassium permanganate gear	KDT-06-02	2Y
	Sample motor	KDT-06-03	1Y
	Reaction/ sample unit motor	KDT-06-06	2Y
Pump	Sample pump	KDT-07-01	3Y
	Reagent pump	KDT-07-02	3Y
	Air pump	KDT-07-03	3Y
Printer	Printer	KDT-09-01	Failure
	Record sheet	KDT-09-02	Supplement
Tube	Sample tube	KDT-08-01	6M
	Reagenttube	KDT-08-02	6M
	Solenoid valvetube A	KDT-08-03	6M
	Solenoid valvetube B	KDT-08-04	2Y
	Teflontube A	KDT-08-05	When contaminated
	Teflon tube A	KDT-08-06	When contaminated
	Air tube	KDT-08-07	When contaminated
	Diluted watertube	KDT-08-08	When contaminated
	Pipe connectiontube A	KDT-08-09	When contaminated
	Pipe connectiontube B	KDT-08-10	When contaminated
Others	Sample unitstealer	KDT-10-01	3Y
	Sample tank	KDT-10-02	When damaged
	Photo-sensor	KDT-10-03	When damaged
	Drain pipe (assembly)	KDT-10-04	When damaged
	Silicon oil	KDT-10-05	Supplement
	Photoelectric disk	KDT-10-06	When damaged

■ Troubleshooting with Message

Message	Cause	Measure
Potential Error 600mV **600mV** (Oxidation reduction potential isbelow 600mv)	·Too much sample included at high Concentration(Set dilution ratio according to concentration)	·6CH=0 inpreliminary measurement *3CH is slightly increased to increase concentration during preliminary measurement 6CH=1 when only main measurement is run *Adjust 23CH If 10ppm, 23=10 If 20ppm,23=5 If 50ppm,23=2 If 100ppm,23=1
Potential Error 1000mV **1000mV** (Oxidation reduction potential is below 1,000mv)	·When $KMnO_4$(or FAS) factor is high	·After standardizing the factor, check whether it is between 0.97~1.00and correct the factor if it lies outside the range.
	·Contamination of reaction unit In ADJ mode, reaction unit is cleaned by running 1 check 2 end and func3 ent. Here, reaction unit is contaminated when potential is over 800mV with water filled in reaction unit	·Clean reaction unit beaker ·Replace reaction unit beaker
Potential Error 0mV **600mV** (Oxidation reduction potential is below 800mV)	·When reagent tube is not inserted in correct position of reagentcontainer	·Insert reagent tube in correct position ofcontainer
	·When $H_2SO_4$is not injected	·Inject H_2SO_4
	·When reference electrode detection line is disconnected	·Replace reference electrodedetection line
	·When reference electrode detection line is contaminated	·Replace reference electrode detection line
	·Cooling pipe is blocked by boiling of measurement sample due to high auto drain water bath temperature	·Lower 2CH

Message	Cause	Symptom	Measure
Check Sample Line	No sample in the tank	Reverse rotation of sample motor (clockwise)	Press Main>Pump check> Sample motor(REV.) and replace relay in power box
		Sample in auxiliary tank is not maintained	Check pump
		Air leaks from sample collection line	Replace sample collection line
	There is sample in the tank	Measurement defect(electrode) - Cannot be measured in 10 seconds	Press Main>Function>Sample Cup.(F5) and check measurement -Electrode is to be replaced
Check Sample Line	No diluted water in the tank	Shortage of tap water	Check tap water line
		Weak pressure of tap water	Press Main>Valve Check> Dilution Valveand add tap water
	There is diluted water in the tank	Measurement defect (electrode) - Cannot be measured in 10 seconds	Press Main>Function>Dilution Cup.(F6) and check measurement - Replace electrode
Bath Temp Error	Bad temperature on display	·Thermal protector defect · Heaterdefect ·2CH check ·Temperature sensor defect ·Insufficient silicon oil	·Replace thermal protector · Replace heater ·Enter 2CH=94 ·Replace temperature sensor ·Supplement silicon oil
	200℃ or 0℃ displayed	Temperature sensor defect	Replacetemperature sensor
Check KMnO4 (or FAS) Line	KMnO4(or FAS)cannot be measured	·Measurement electrodedefect ·No KMnO4(or FAS) reagent ·Connection of reagent container and tube ·KMnO4(or FAS) pump defect ·KMnO4(or FAS)reagent leak	·Replacemeasurement electrode ·Replace reagent ·Connect reagent container with tube ·Replace KMnO4(or FAS)motor ·Replace tube
Check KMnO4 (or FAS) Tube	2CH=550 or higher	·Measurement defect ·KMnO4(or FAS) reagent leak	·Replace measurement electrode ·Replace tube
Check Oxalate Line	Na2C2O4(or $K_2Cr_2O_7$)cannot be measured	·Measurement electrodedefect ·No Na2C2O4(or $K_2Cr_2O_7$) reagent ·Connection of reagent container and tube · Na2C2O4(or $K_2Cr_2O_7$) pump defect · Na2C2O4(or $K_2Cr_2O_7$) reagent leak	·Replace measurement electrode ·Replace reagent ·Connect reagent container with tube ·ReplaceNa2C2O4(or $K_2Cr_2O_7$)motor ·Replace tube
Level Count Error	KMnO(or FAS)count is below appropriate value (printed at 350or below)	·Photodiodedefect ·Water leaking from dilution and sample valve tube togauge glass	·Replace photodiode ·Inspect and replace dilution valve and sample valve

Message	Cause	Symptom	Measure
Over Titrate	Titration is continued without stopping at prescribed time	·KMnO4(or FAS) factor is low ·Defective rotation of reaction unit stealer and motor	·Correct factor (refer to page 27) Disassemble reaction unit to check rotation and replace motor
Check Flow Signal	Error messageis displayed (no problem in measurement)	Flow signal is not entered	Change 51=0,53=1,61=0,63=1

KDTMS

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