Automatic Potentiometric Titrator

AT-610

Operation Manual

Please read this manual thoroughly in advance for the best performance of the equipment.

Ver.11
A/N 69-000-6801-48

Table of contents Page

1. Introduction

1-1. Overview of the instrument

We thank you for your continued patronage of KEM products. The AT-610 Automatic Potentiometric Titrator you have purchased is the latest titration system to determine concentration of target substance in liquids or solids, operated easily and resulting quickly with high precision and accuracy. By changing the electrode and preamplifier, those titrations like acid base, redox and photometric can be equally performed as well.

[Features]

1) **Two (2) measuring units can be connected (simultaneous measurements in parallel)**
   Addition of another AT-610 as option to this unit allows you to make two measurements simultaneously. In addition, this unit can be also used in combination with MKA-610 (Volumetric KF titrator) or MKC-610 (Coulometric KF titrator).

2) **A Large color LCD with two languages selective on display**
   A large 8-inch color LCD provides easy view and operation with language selection of either English or Japanese on display.

3) **Real time titration curve and two potentials are displayed and recorded simultaneously**
   Titration in progress can be seen in real time, and two potentials of titration and temperature, pH and transmittance as well as pH and conductivity can now be recorded at the same time, which used to be unavailable with the existing titration devices. Measurement of transmittance or conductivity requires optional parts.

4) **Operating panel is Touch-on type LCD**
   You just touch on the display panel following the guiding messages to complete a series of measurements. The panel is covered with a protection film which is replaceable with a new one whenever you want a better view in the course of time.

5) **Operating unit and measuring unit can be separated**
   The measuring unit can be detached depending on sample type when so necessary.

6) **Data Storage on Compact Flash (CF) Card:**
   Allow an operator to store Measuring conditions (Method Parameter) and Titration results on CF cards (option).

7) **GLP/GMP conformed**
   Up to 50 operators names can be registered. Also, check results with standard substances and calibration records for electrodes can be recorded. Recorded results can be displayed as history. Further, AT-610 features reminders of the day for replacing reagent and piston.

8) **Platinum thermal resistor Pt100 sensor ensures precise measurement of temperature**
   Pt100 platinum resistance element is quipped for sensing correct measuring temperature.

1-2. About the manual

Please keep this manual near your system so that you can easily access to the necessary information you are looking for while operating or preparing for measurement.

The below three boxed messages show the basis symbols of warning, caution and note that you will see in this manual from time to time:

1. Where there exists a danger of physical injury or even possible death:

> **Warning!**
> **There exists the danger of physical injury or even possible death if the instruction is disregarded.**

2. Where there exists a danger of property damage:

> **Caution!**
> **There exists the danger of property damage if the instruction is ignored.**

3. When there exists a possibility of failure of instrument performance:

> **Note:**
> **There exists the possibility of failure of instrument performance. If ignored, warranty may not be covered.**

- It is prohibited to copy a part or all of this manual without authorization by copyright.
- If you should find any part in this manual not clear to understand or missing article, contact your local dealer or sales representative.
- Manufacturer will not be liable for any loss or damage directly or indirectly caused by use of the instrument or its consequences.
- This Manual is based on the apparatus of standard specification. For details of those of special specification, see its manual.

1-3. ⚠ Safety symbols

Always observe these signs and instructions.

You must observe cautionary messages and warnings in order to protect yourself as well as prevent others from physical injury or property damages.

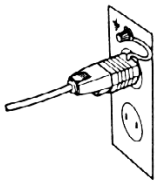
⚠ **Warning** This symbol means "Danger of severe injury or possible death".	This symbol means prohibition of an act.
⚠ **Caution** This symbol means "Danger of injury or property damage".	This symbol means mandatory.

⚠ WARNING!

You must ground earth wire of power cable.

Ground the green wire of adapter if power tap is 2-pin outlet.

3-pin plug has earth line to ground by itself when plugged in.



Danger of electric shock if not grounded to earth.

⚠ WARNING!

Use the same type and rating of fuse. Be sure to plug out power cord before replace the fuse.

Danger of fire if a wrong fuse is loaded.

⚠ WARNING!

Do not use volatile chemical or work in flammable gas.

Danger of explosion inside the instrument.

⚠ WARNING!

Wear safety glasses, gloves or protective mask if necessary,and well ventilate the room.

Danger of injury on your skin or in the eyes by splashing chemical.
Also your windpipe may get hurt if toxic gas is breathed in.

⚠ CAUTION!

Unplug the power cord when the unit can be troubled or exposed to a lightning.

Failure to observe this caution may result in a damage to the instrument.

⚠ CAUTION!

Do not operate in a way other than specified in the manual.

Danger of fire, electric shock or damage to the instrument.

⚠ CAUTION!

Do not open housing case or overhaul the unit for repair except by an authorized service person.

Danger of fire, shock or malfunctioning of the unit.

About place for installation

Avoid the use of this instrument under the environment described below.
(Failure can lead to the degradation of performance and reliability of the system.)

- Operation of devices with strong electric motors using common power source
- Near strong magnetic/electric field
- Use of power source with too variable load
- Location of strong vibration
- Exposure to direct sunlight
- Location with large temperature difference
- Exposure to corrosive gas
- Exposure to extreme heat (Operation temperature: 5 to 35°C (41 to 95°F))
- Exposure to high humidity (Over 85%RH)

About power source

- Power for this instrument is AC100-120/200-240V ±10%and 50/60Hz.
- Supply power direct from the outlet, and do not share power from a tap.
- Do not put any obstacle around power outlet just case of need for plugging out power cord to avoid the possible danger of the whole system in trouble.

About place for storage

- If the unit is not used for an extended period of time, first clean the electrode and place it for storage. Also discard the regent in the burette, and clean it with pure water or methanol before storage. It is recommended to pack the main unit in the carton box in which the instrument was first delivered.
- Avoid the places for storage under inadequate ambient conditions such as extremely high/low temperature, high humidity or heavily dusty atmosphere.

About use

- Karl Fischer reagents are toxic chemicals. Therefore, please handle in a well ventilated room and be aware of its danger.
- When a reagent etc. is spilt to Main unit or the connectors of magnetic stirrer, there is a possibility of malfunction.
- When using the touch panel, just lightly touch it with a finger. Do not touch it with a sharp edge such as pen tip; otherwise the touch panel can be incapable of normal operations.

About reagents

- The liquid contact part on burette and reagent bottle is made of materials such as glass, ceramics or PTFE. Refrain from using reagents containing solid medium that may be incompatible with these materials.

Other caution

- Do not use such a solvent as alcohol, acetone, thinner or the like for cleaning this instrument. Doing so may adversely affect the instrument, e.g. deformation, discoloration or cracks. When cleaning this instrument, wipe it with a soft cloth or tissue paper, after applying detergent diluted with water to the soft cloth or tissue paper and adequately wringing out excess water in order not to allow water drops to fall.
- Waste liquid should be drained out before the Drain pot is filled with it. Otherwise, waste liquid may overflow into the stirrer unit, causing its breakdown.

Environmental condition

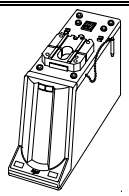
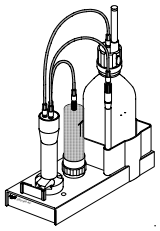
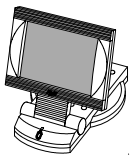
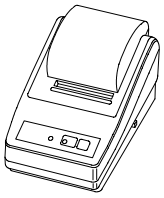
- This instrument is designed for the indoor use under the environmental conditions specified in the Section 1.4 of CE marking (LVD, 73/23/EEC, EN61010-1) and the use of the Category II of Overvoltage and the Pollution Level 2.

2. Preparations for measurement

2-1. Supplied parts

Check the supplied parts referring to the following parts list for MKA-610, Reagent Replacement Unit and MCU-610. If you should find any missing or broken parts including the main unit, accessories or manual, contact your sales representative or local dealer.

— Automatic Potentiometric Titrator AT-610 —

Part name	Part code	Qty	Sketch
Automatic Potentiometric unit*1	AT-610	1 unit	
Burette unit*2 (Standard unit: EBU-610-20B)	EBU-610-50B EBU-610-20B EBU-610-10B EBU-610-05B EBU-610-01B	1 unit	
Touch-on panel main control unit*3	MCU-610	1 unit	
Impact dot printer*4 (AC 100V) (AC 120V) (AC 230V)	IDP-100-10 -11 -12	1 unit	

Note:

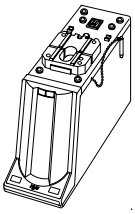
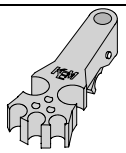
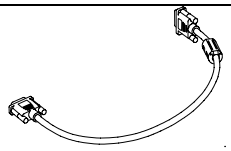
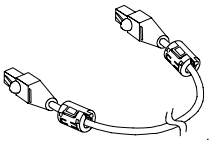
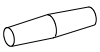
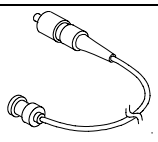
The details of components for above 1, 2 and 3 are shown on the following pages.

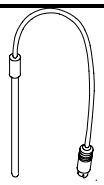
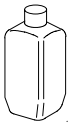
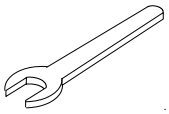
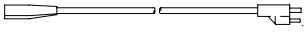
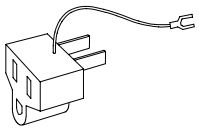
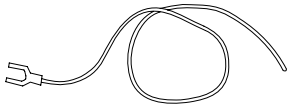
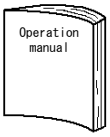
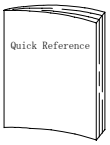
Above 3 and 4 are not attached for AT-610-S/2ND , AT-610-T/2ND , AT-610-P/2ND , AT-610-O/2ND and AT-610-C/2ND.

*5 Please see the following table about the relation between the device model and the next page built-in preamplifier.

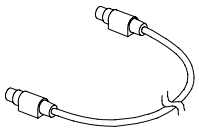
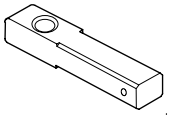
Device model	Preamplifier
Standard (AT-610-ST,AT-610-S/2ND)	STD-610
Photometric (AT-610-PT,AT-610-P/2ND)	PTA-610
Polarization (AT-610-OT,AT-610-O/2ND)	POT-610
Conductmetric (AT-610-CT,AT-610-C/2ND)	CMT-610
pH dual input (AT-610-TT,AT-610-T/2ND)	TET-610

— Components of AT-610 (*1) —

Part name	Part code	Qty	Sketch
Main unit	—	1 unit	
Magnetic stirrer (With a built-in preamplifier*5)	(12-001-0401-48)	1 unit	
Stand bar	98-550-0041	1 pce	
Electrode holder	69-004-0900-48	1 pce	
Stirrer cable	98-428-0031	1 pce	
Connecting cable	32-001-1400-48	1 pce	
Terminator	98-429-0026	1 pce	
Stirrer rotor	(98-500-3141)	1 pce	 (L=25mm)
Combined glass electrode	98-100-C171	1 pce	
Connecting cable	98-429-0012	1 pce	

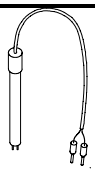
Part name	Part code	Qty	Sketch
Temperature compensation electrode	98-100-T171	1 pce	
Internal solution for reference electrode (3.33M-KC1)	98-811-5001	1 pce	
Piston extraction rod	98-551-5002	1 pce	
Wrench 8mm	98-514-3339	1 pce	
Power cord with earth wire (AC 100/110/120V area) (AC 220/230/240V area) (for UK) (for China)	 98-320-3198 98-320-3461 98-320-4199 64-000-1800-48	1 pce	
Adapter for power connector (AC 100/110V only)	98-320-3199	1 pce	
Ground wire (AC 100V only)	98-433-3331	1 pce	
Seal	(98-594-0010)	1 pce	
Operation manual	69-000-6801-48	1 copy	
Quick reference (Basic)	69-000-6805-48	1 copy	
Quick reference (Advanced)	69-000-6807-48	1 copy	

When the photometric titration kit (AT-610-PT,AT-610-P/2ND) is purchased, the following parts are also included in the kit.

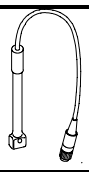
Part name	Part code	Qty	Sketch
Photometric sensor	12-001-1000-48	1 set	
Connecting cable	98-428-0030	1 pce	
Interference filter (530nm)*	12-001-1200-48	1 pce	
Interference filter (630nm)	12-001-1201-48	1 pce	
Shutter	98-550-5502	1 pce	

- Attached to the photometric sensor.

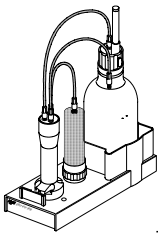
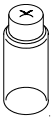
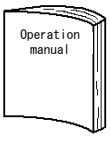
When the polarization titration kit (AT-610-OT,AT-610-O/2ND) is purchased, the following part is also included in the kit.

Part name	Part code	Qty	Sketch
Twin platinum electrode	98-100-M511	1 pce	

When the conductometric titration kit (AT-610-CT,AT-610-C/2ND) is purchased, the following part is also included in the kit.

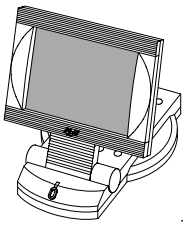
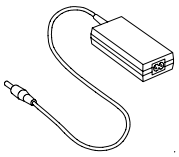
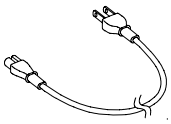
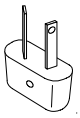
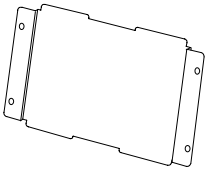
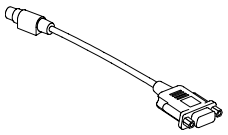
Part name	Part code	Qty	Sketch
Conductivity cell	98-101-K321	1 pce	

— Components of EBU-610-01B, 05B, 10B, 20B, and 50B (*2) —

Part name	Part code	Qty	Sketch
Burette unit*	—	1 set	
Zeolite tube	98-430-0053	1 pce	
Nozzle pocket	(20-040-5200-48)	1 pce	
Diffusion proof nozzle / STD (For EBU-610-01B, 05B, 10B, and 20B only)	12-001-6902-48	1 pce	
Titration nozzle / 50mL (For EBU-610-50B only)	12-001-6901-48	1 pce	
Titration nozzle tip	20-040-5000-48	1 pce	
Degas vial (with septum)	98-722-0003	1 pce	
Seal	(98-594-0010)	1 pce	
Operation manual	69-000-6800-48	1 copy	

* The burette unit comes with a reagent bottle cap (with a rubber plug)(98-430-0052) and a polyethylene bottle (69-000-2800-48).

— Component of MCU-610 (*3) —

Part name	Part code	Qty	Sketch
Main control unit	—	1 unit	
AC adapter	98-403-0052	1 pce	
Power cable (AC 100/110/120V area) (AC 220/230/240V area) (for UK) (for China)	 98-429-0035 98-429-0034 98-429-0036 64-000-3500-48	1 pce	
Adapter (for China)	64-000-3600-48	1 pce	
Protection film	(98-560-0093)	2 pce	
Connecting cable (Mini DIN-D Sub)	98-428-0032	1 pce	

Note:

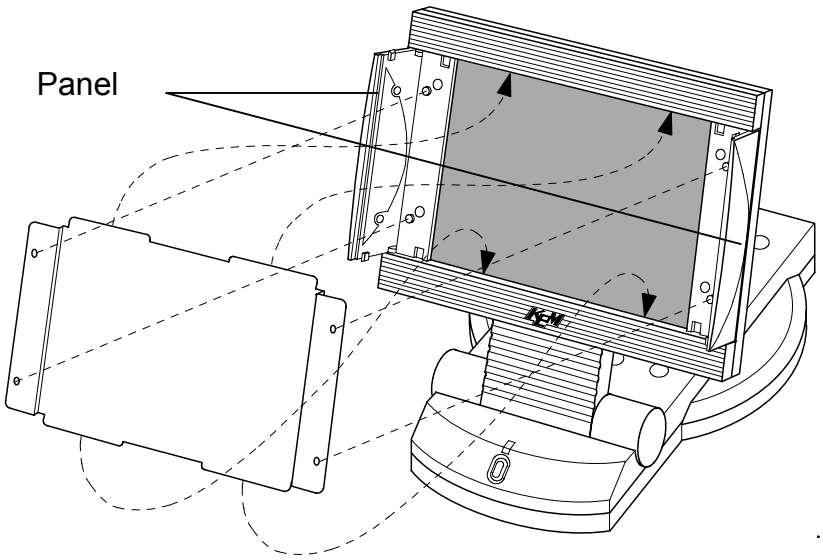
Parts with parenthesized part code have unique order units or packing forms different from others. Therefore, please refer to the section "7-1. Part list" when ordering these parts.

2-2. Installation and start-up

2-2-1. Protection film

Attach the protection film on the display panel of Main control unit (MCU-610):

1) Make sure the power of Main control unit is turned off.
2) Open the control panel.
3) Attach the supplied film as follows: Insert the film into the vertical gap, and match the film holes and raised portions on panel.
4) Close the panel.

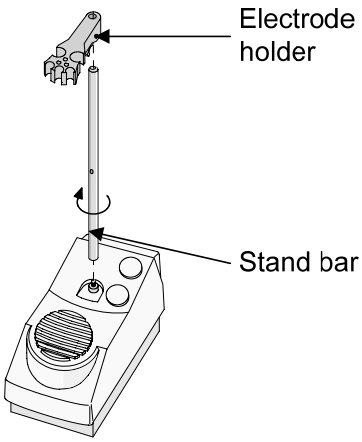


Note:

When using the optional glazed protection film (P/N: 20-024-5400-48), apply the protection film to the surface of the touch panel.

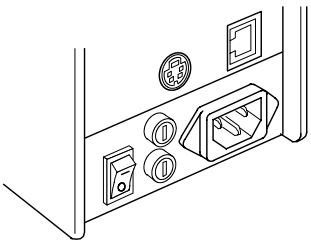
2-2-2. Assembly of magnetic stirrer

1) Squeeze the stand bar into the designated position on the stirrer as shown in the figure.
2) Install the electrode holder on the top of the stand bar. The height of electrode holder can be adjusted with the clip under the electrode holder.

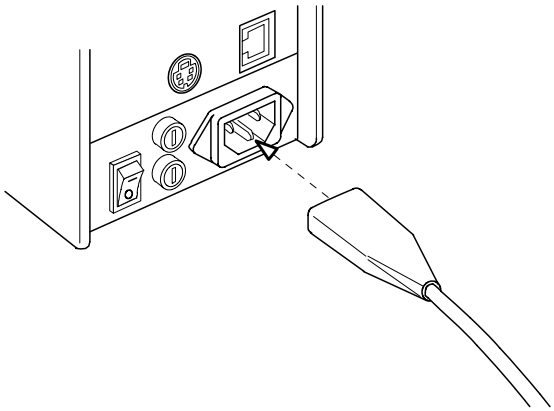


2-2-3. Power cable

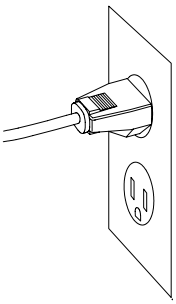
1) Make sure the power switch is in Off position.



2) Plug in the supplied power cable on the back of unit.

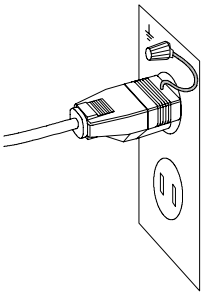


3) Connect the power cable to the power outlet.



< 3-pin plug >

The 3 pins plug has an earth terminal and grounds to the earth by itself.



< 2-pin plug >

Attach an adapter for power connector to the plug and ground the green wire to the earth terminal.

⚠ Warning!

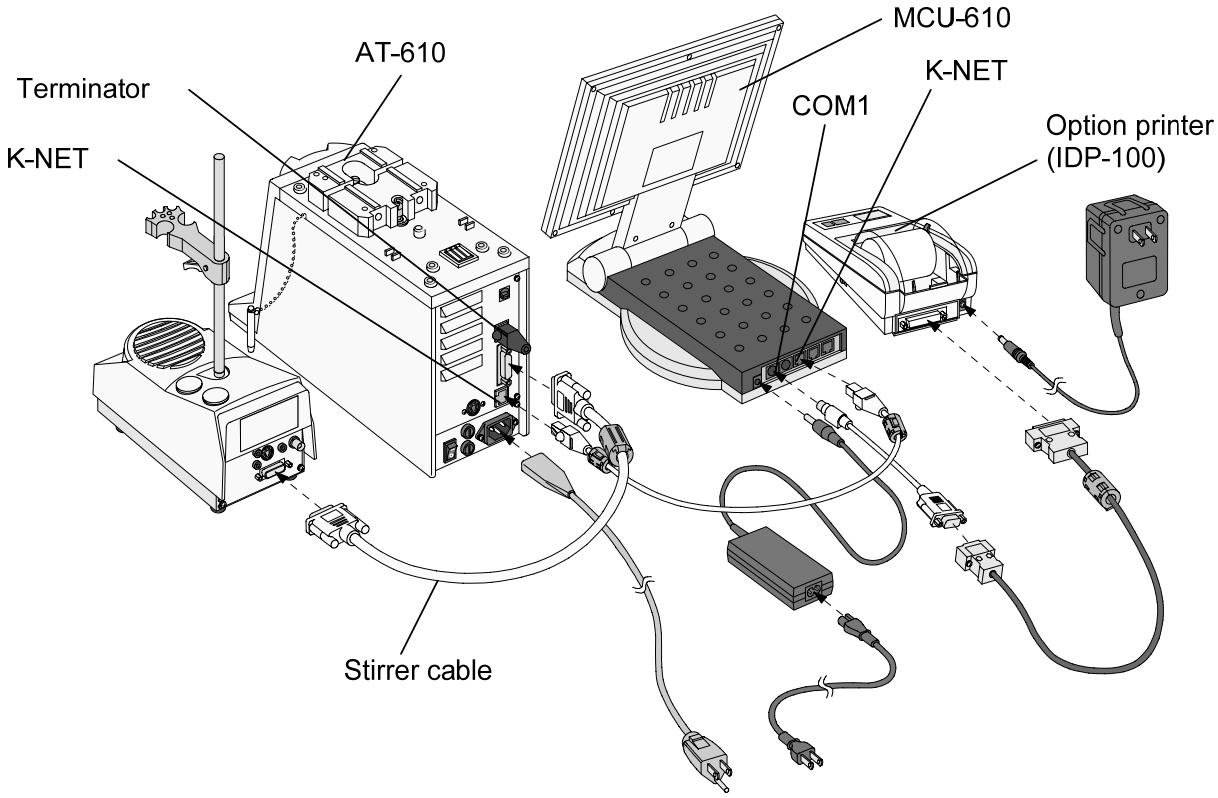
The earth wire must be grounded. If not, there exists a danger of electric shock.

2-2-4. Connecting cables

Connect the cables as shown below.

Connect MCU-610 and AT-610 with connecting cable via K-NET port on the back.

Connect MCU-610 and Printer with the cable via COM1 or COM2 port on the back of MCU-610 and the printer port.



Note:

Turn on the power only after all of the cables are connected. Work on the stirrer cable only when the main power switch is off in order to avoid malfunction of the main unit.

⚠ Warning!

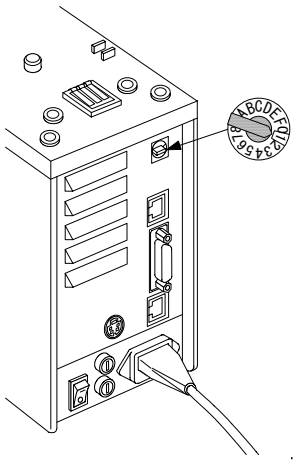
Use an AC adapter appropriate to the power line voltage. Make sure of the rating of the AC adapter before plug it in to avoid malfunction of the unit or breakout of a fire.

⚠ Caution!

Operating the unit without plugging Terminator may cause a communication error (halt) due to susceptibility to noise.

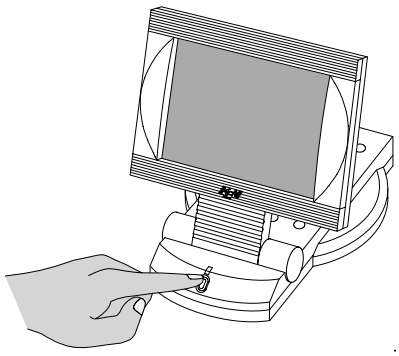
2-2-5. Set up the address for measuring unit

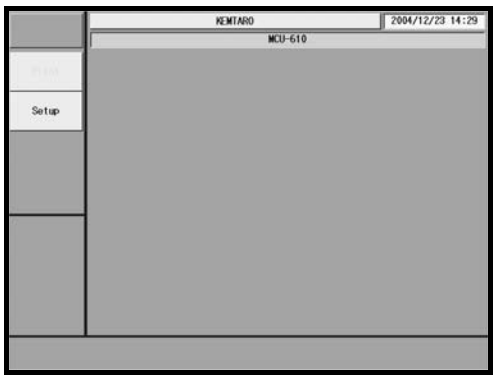
Set MCU No. switch on the back of measuring unit to “1” position.



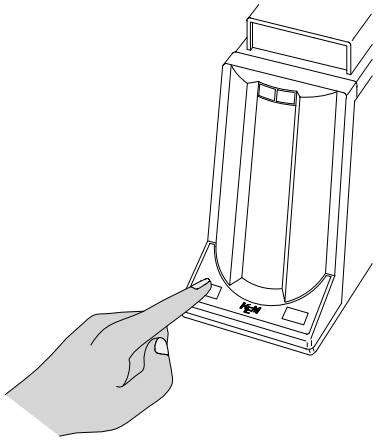
2-2-6. Start-up

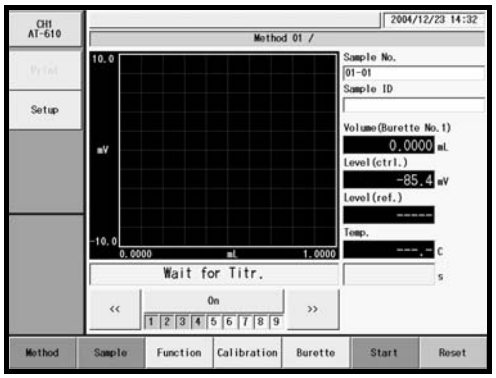
1) Make sure the power of measuring unit is off, and then turn on the power of Main control unit. The screen will show the initial display when first power is turned on after the unit is delivered and unpacked.





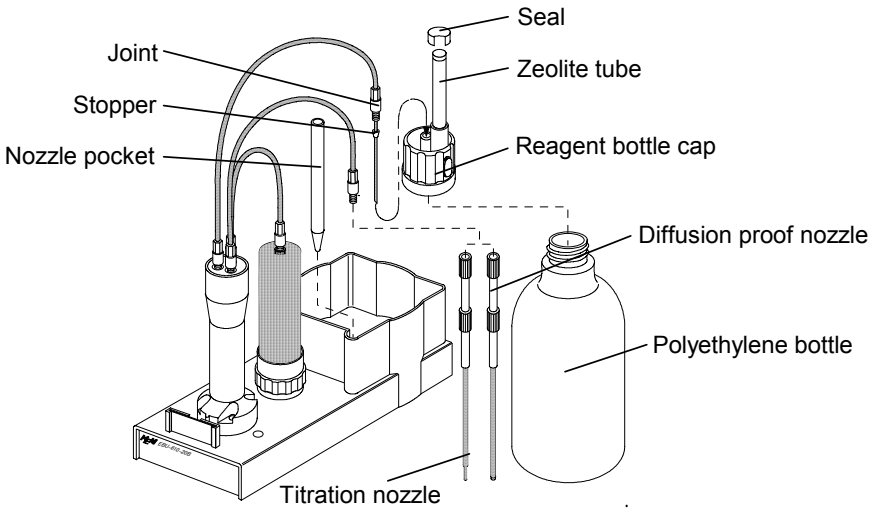
2) Turn on the power of measuring unit by turning on “Power” switch on the back of unit, and then, press [Power] button in front. The screen of Main control unit will show the below display, which will first appear from the next time on.





2-2-7. Installation of burette unit

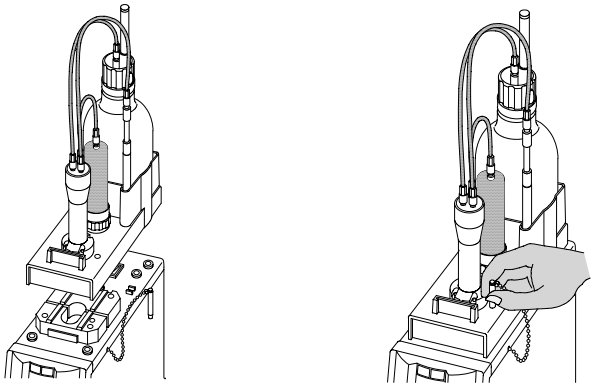
1) Insert the tube from burette unit through the reagent bottle cap, and settle the bottle it in place as shown below. (Please check that the joint and the stopper are attached to the tube.)
2) Peel off the seal on Zeolite tube, and install it onto the reagent bottle cap.
3) Put the nozzle pocket on burette unit.
4) Connect the diffusion proof nozzle with the tube as shown below.
   When using the titration nozzle in order to perform constant dose, change the tip of diffusion proof nozzle (P/N: 12-001-6902-48; with defoaming feature) to the titration nozzle tip before connecting it with the tube. (See Section 5-2-5. "Replace titration nozzle".)



Note:

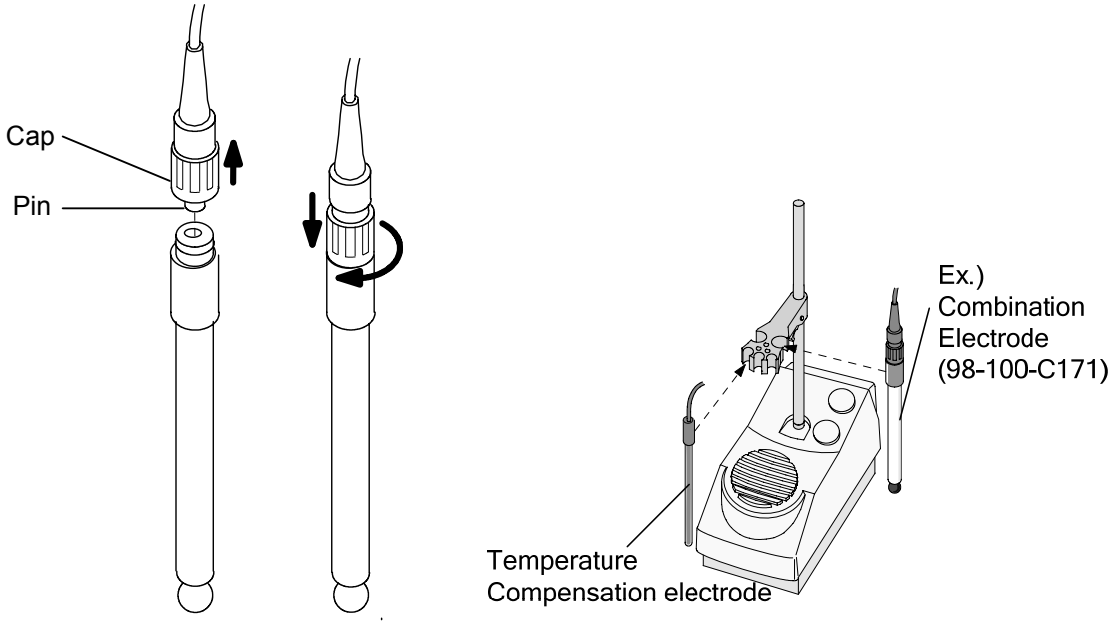
Remove the seal on the Zeolite tube first.
When a bottle other than supplied one is used and its outside diameter is smaller than that of the burette unit, use the optional bottle holder.
When using the titration nozzle tip (P/N 20-040-5000-48) with the 50mL burette unit, set the dispensing speed low. The solution of the set volume will not be dispensed if the dispensing speed is set too fast.

5) Place the burette unit onto the main unit, and push it towards you to set it in.
6) Insert the lock pin into the unit until it reaches the bottom.



2-2-8. Installation of electrode

1) Connect the cable with an electrode. While watching the tip of electrode cable (pin as shown in the figure), insert it into the connector until it clicks in it. Then, tighten the cap. An electrode with the lead already connected does not require this step. Fix the electrode to the holder as shown.



Note:

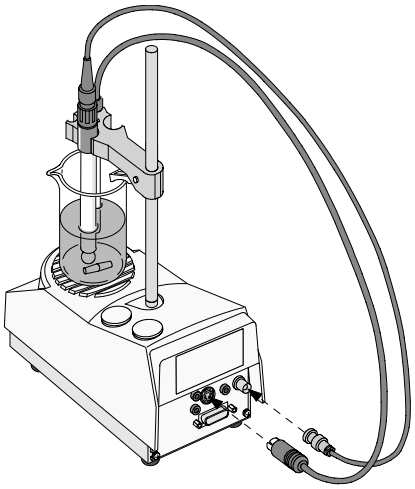
The electrode cable must be securely connected to the electrode connector until it clicks in, and then tighten the cap. Loose connection may result in abnormal signal detection.

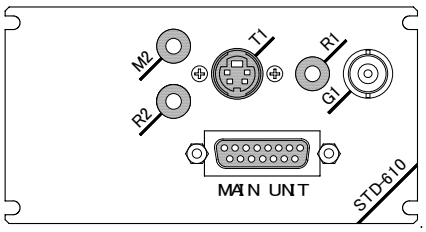
⚠Caution!

When installing an electrode onto the holder, set an electrode from the side. To remove, hold the connector section (such as black and red parts). Do not hold the body as doing so may break the electrode.

2) Ensure that the power switch is in OFF position.

3) Connect the electrode lead with the preamplifier. Connect one for temperature compensation with T1 jack and the combination glass electrode (98-100-C171) lead with G1 jack.





< pH glass electrode (98-100-H1xx) or Ion electrode (98-100-1xxx) >
Connect the lead from an electrode with G1 jack and the clear cable (98-429-0014 or 98-429-0017) for reference electrode (98-100-Rxxx) with R1.

< Metal electrode (98-100-M2xx or 98-100-M3xx) >
When connecting an electrode with detector 1, insert the electrode cable to G1, and for reference electrode (98-100-Rxxx) plug the clear connecting end of the electrode cable (98-429-0014 or 98-429-0017) in R1.
When connecting an electrode with detector 2, plug the clear connecting end of the electrode cable (98-429-0014 or 98-429-0017) in M2, and for reference electrode (98-100-Rxxx) plug the clear connecting end of the electrode cable (98-429-0014 or 98-429-0017) in R2.

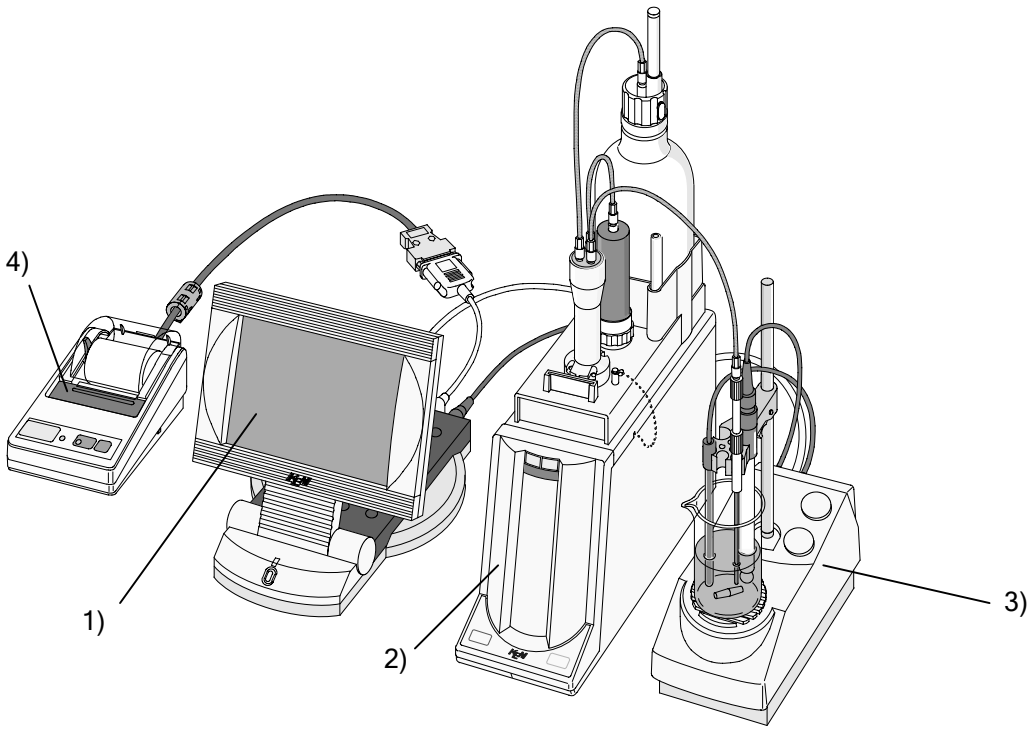
< Combination electrode (98-100-C2xx, 98-100-C7xx or 98-100-C8xx) >
When connecting the electrode with detector 1, connect it with G1 jack.
When connecting the electrode with detector 2, plug the clear connecting end of the electrode cable (98-429-0014 or 98-429-0017) in M2 jack and the black end in R2 jack.

⚠Caution!

The electrode is made of glass. If given excessive force, it may break and hurt your hand. Care should be taken when handle the electrode.

2-3. Parts configuration and each function

2-3-1. Automatic Potentiometric Titrator



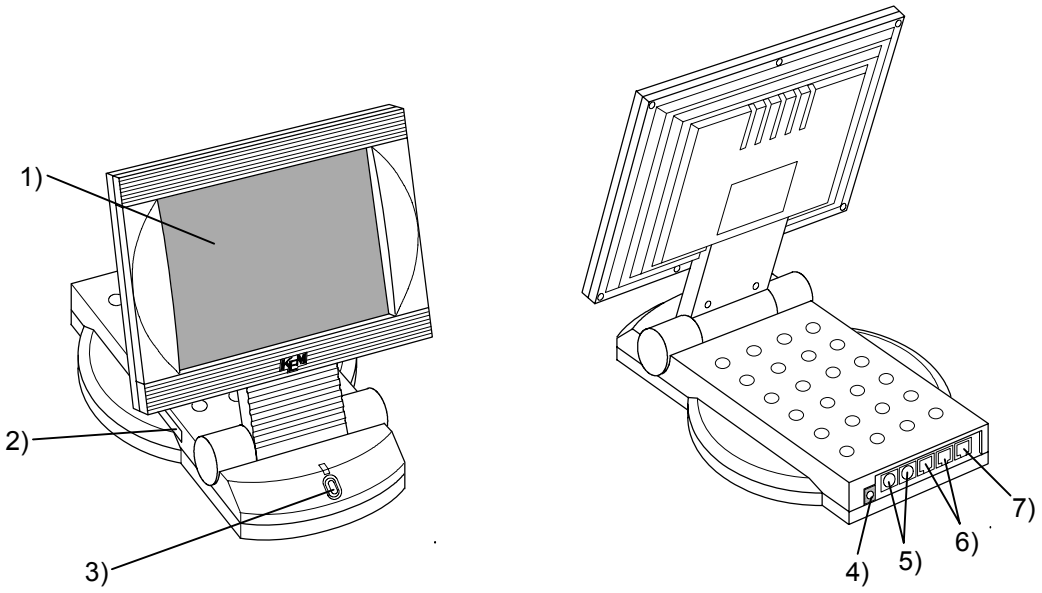
1) Main control unit (MCU-610)
   Operating unit Automatic Potentiometric Titrator.

2) Measuring unit (AT-610)
   Control unit for Automatic Potentiometric Titrator.

3) Stirrer
   Measuring unit for Automatic Potentiometric Titrator. Magnetic stirrer and Preamplifier are integrated.

4) Impact dot printer (IDP-100)
   Print out measurement results and parameters.

2-3-2. Main control unit (MCU-610)



1) Touch-on panel display
   This panel displays operating buttons and measurement results as well as configured parameters. With these buttons on screen, you can maneuver the sequence for measurement by just touching on the necessary buttons on display.

2) Card slot
   Insert the CF card (option).

3) Power switch
   This switch turns on or off the power of Main control unit. It should be noted the power must be turned on again at least 10 seconds interval.

4) ~ LINE
   Connector for power cord.

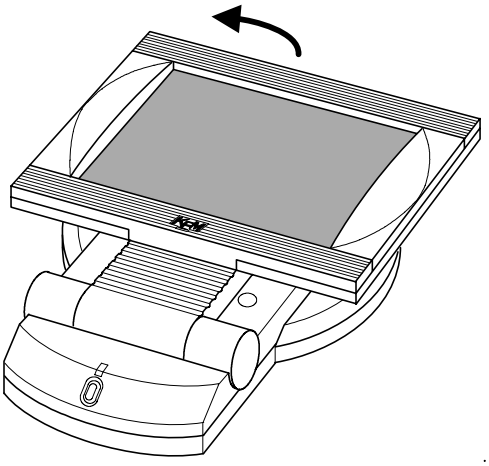
5) COM1 and COM2 port
   These ports are for connections to Printer, Balance or Personal computer. The printer prints out measurement results as well as selected parameters. When an electronic balance is connected, the sample weight is automatically input for measurement. Personal computer is connected to this port for data acquisition using the optional software.

6) K-NET connector
   Connecting port for measuring unit.

7) PC connector
   This connector is not used in this system.

< Adjust the Touchpanel >

Lift the Touchpanel slowly as shown below until you hear it click and stop. Then tilt and sit it to the point where you can see the monitor well. When lifting it up too much, once lift it to the upright position according to the instructions in < How to tilt the Touchpanel of MCU-610 >, followed by folding the panel. Then tilt it again to adjust the angle.

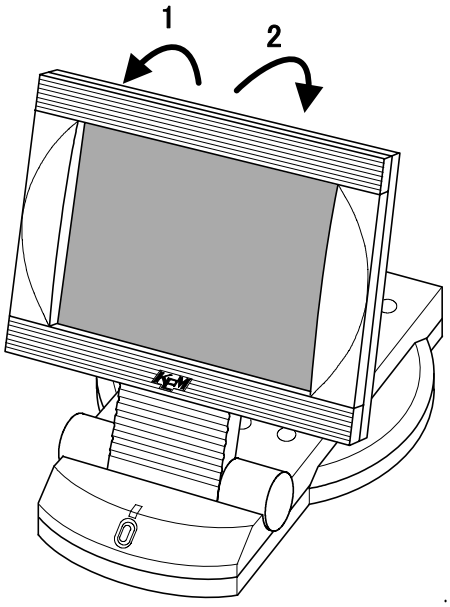


⚠ Caution:

Do not force the Touchpanel when tilting it.
Failure may break the joint for tilting the Touchpanel.

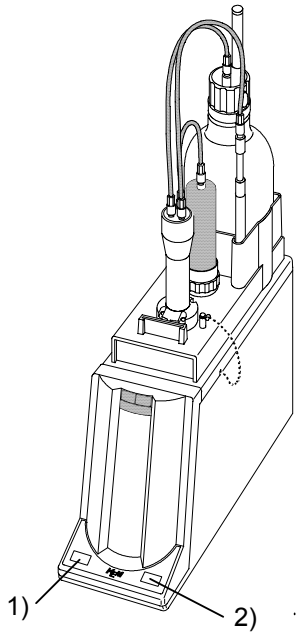
< How to tilt the Touchpanel of MCU-610 >

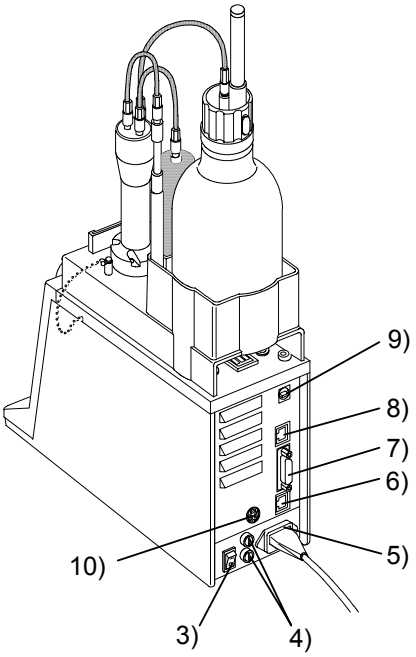
Once lift the Touchpanel to the upright position as shown below.
Then tilt the panel backward.



2-3-3. Measuring unit (AT-610)

< Main unit >





1) [Power] button
It turns on or off the power. The power is turned off when pressed for more than 5 seconds. This button works only when the power switch on the rear panel of measuring unit is in On position.

2) [Reset] button
On-going measurement can be aborted with this button, and the unit sets in standby mode.

3) Power switch on rear
This switch turns on or off the measuring unit. This is the main switch for measuring unit, and [Power] switch in front works only when this switch is in On position.

4) Fuse box
Power fuse rated for T3.15A/T250V is housed here.

5) Power connector
Connecting port for power cable.

6) K-NET connector
Connecting port for communication with Main control unit.

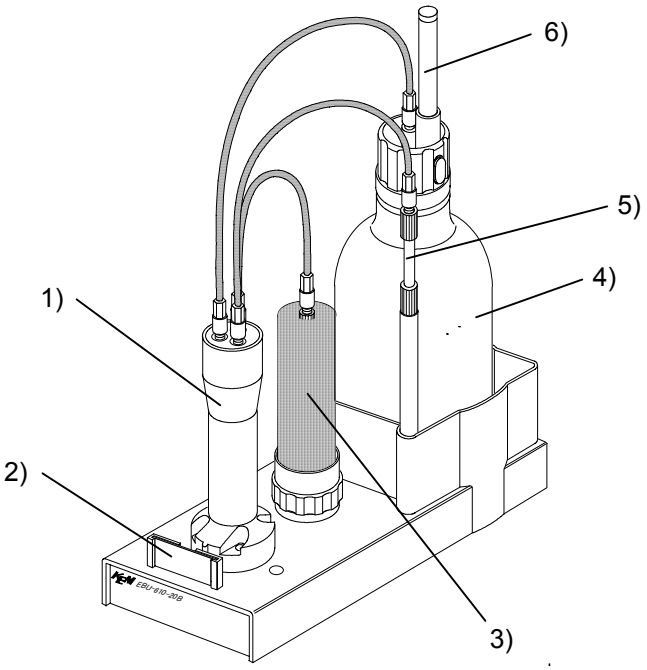
7) Stirrer port
Magnetic stirrer is connected to this port.

8) S-Bus port
Connector designated for connecting with the optional External burette unit (APB-600, APB-610 or APB-620) or Multiple sample changer (CHA-600).

9) MCU No. switch
The main unit group number (MCU No.) connected to measuring unit is selected here.

10) Temp. Comp. connector
Connector designated for connecting with the optional titrant temperature compensation sensor.

< Burette unit: EBU-610-20B >



1) Switching valve
   This is the cock switching the line between cylinder ↔ reagent bottle and cylinder ↔ titration nozzle.

2) Name plate
   As a reminder, write the reagent name in use with a marker or pen.

3) Cylinder
   The glass cylinder contains Karl Fischer reagent supplied in it.

4) Reagent bottle
   It contains reagent for titration.

5) Nozzle
   The nozzle delivers reagent for titration.

6) Zeolite tube
   This tube with molecular sieves (5A) reduces dissolved gas like carbon dioxide that affects titrant.

< Stirrer unit >

‼ EMBED Visio.Drawing.11 ¶ ┌ ┴

1) Stirrer bar

   The stirrer bar spins to stir sample liquid.

2) Titration nozzle

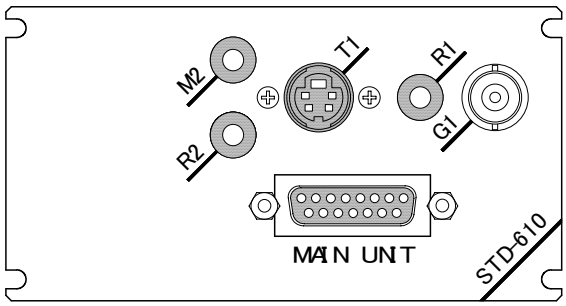
   The titration liquid is discharged into the titration vessel through this nozzle.

3) Preamplifier

   This is the detector to detect potential of sample liquid. Select an appropriate one to the titration.

   This has a port to connect the cable from Main to stirrer.

   (Example: STD-610)



Detector 1

G1: For connecting with the glass electrode

R1: For connecting with the reference electrode

T1: For connecting with the compensation electrode

Detector 2

M2: For connecting with the metal electrode

R2: For connecting with the reference electrode

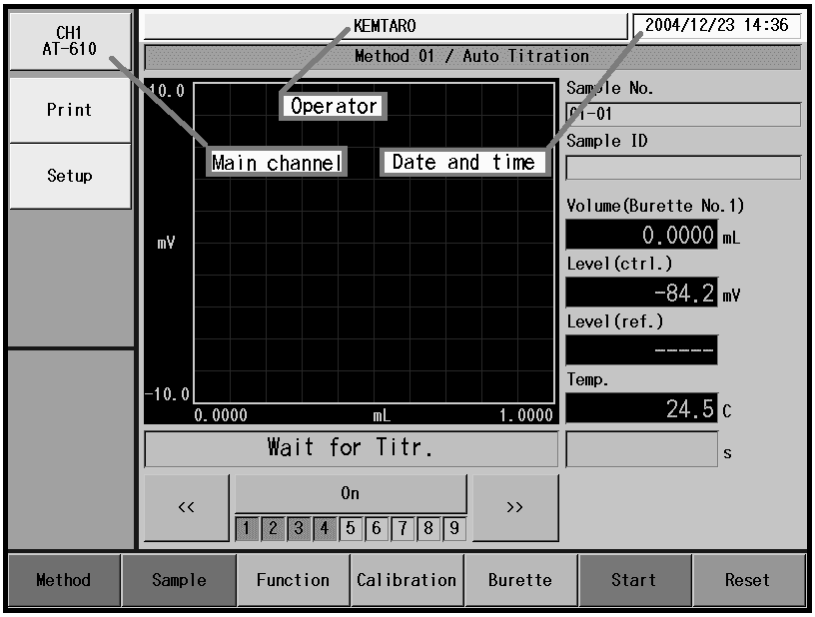
4) Main connector

   Port for connectings the cable from stirrer to Main unit

2-4. Displays and operating buttons

2-4-1. Description of system area and operating buttons

Here major buttons are arranged on display for configuration of the system in general.



[Main channel]

Main channel system is shown here.

[Print] button

This button is for printing the parameters shown on main channel area.

[Setup] button

Setup functions are selected as follows:

- Regist operator
- International
- Interface
- LCD Backlight
- Beep
- Maintenance

[Operator] button

Operators name or code is changed here with the button showing currently active operator in charge.

Note:

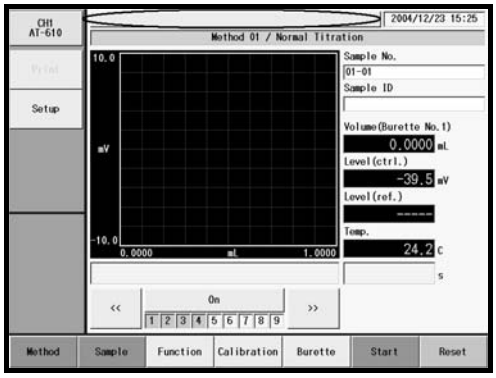
Refer to the section "2-4-1-1. Register operators" for setting operator's name.

[Date and time]

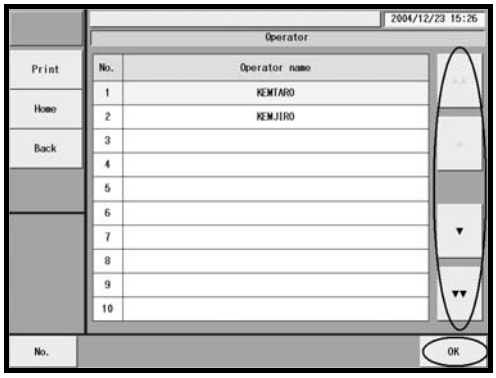
The built-in clock shows the present time and date here.

2-4-1-1. Registration of operators

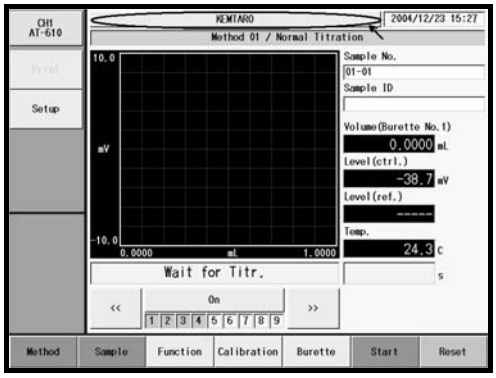
The operator's name or code once registered appears on printout together with titration results.



1) Press [Reset] button.
2) Wait for the message "Wait for Titr.".
3) Enter the operators name or code on 3-4-1.[Operator registration].
4) Press the button for [Select operator].



5) "Operator" screen appears.
   Select the operator with [▲][▼], [▲▲] or [▼▼]. (the operator can be registered and selected by numbering with [Number] button)
6) Press [OK] button.



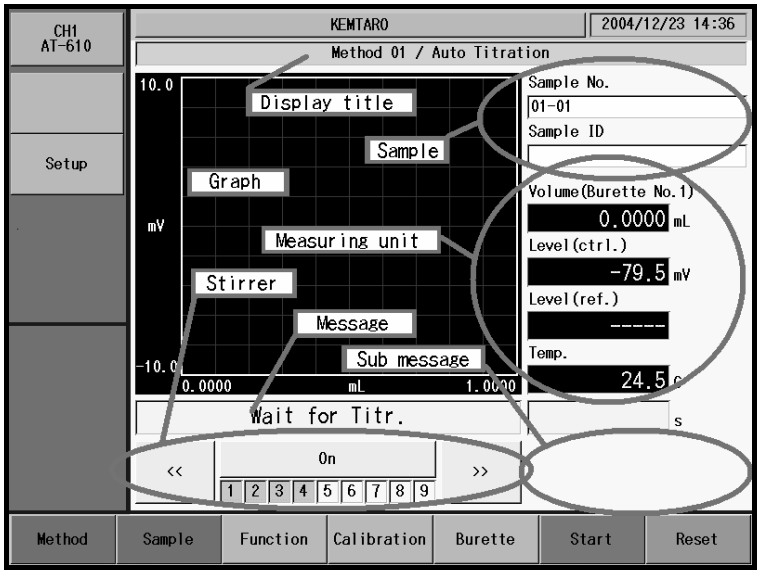
The selected operator appears and the screen returns to Main display (standby mode).
The active operator is shown on display.

Note:

The operator cannot be changed during titration.
To change it, press [Reset] button to turn it to "Wait for Titr." state.

2-4-2. Main channel display area and operating buttons

The potential level of measuring unit and drift level connected to main channel are shown here.



[Display title]

The title of currently displayed screen is shown here. It shows currently significant Method number and its name.

[Message]

This shows the status of measuring unit connected to main channel.

- Wait for Titr.
- Titrating

[Stirrer]

This button controls stirrer speed of the stirrer connected to the measuring unit.

- [〈〈] : Speed slows down by one step.
- [〉〉] : Speed goes up by one step.
- [On] : Turn on stirrer.
- [Off] : Turns off stirrer.

[Graph]

The graphic curve is plotted in real time during titration. This setting is made on graph setup on Function.

[Sample]

Sample number and its ID preset on sample setup are shown here.

[Measuring unit]

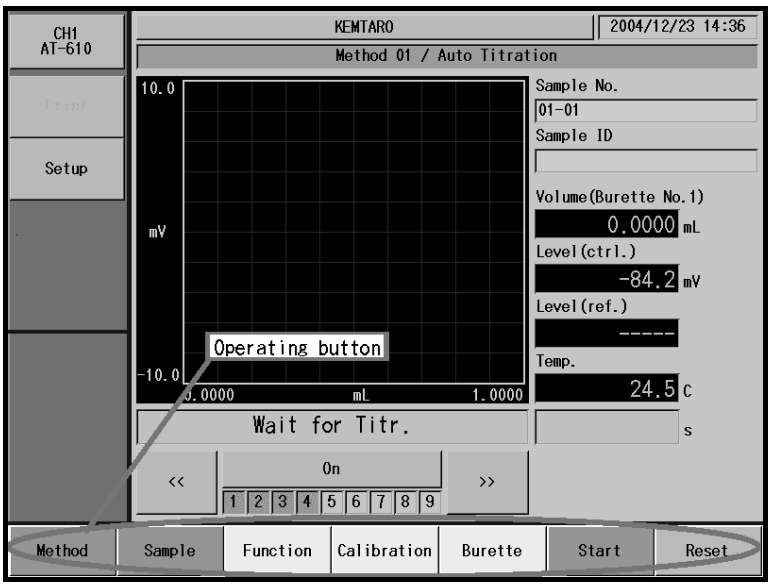
This box shows the drift level, potential and water content relayed from the measuring unit.

[Submessage box]

Supplemental information is provided when an error message such as “Parameter error” is displayed.

2-4-3. Main channel operating buttons

Here arranged are the buttons for operating the measuring unit connected to main channel.



[Method] button ⇆ [Max. Volume]

Here you work on Method like create, edit or copy a method, and can change Method. During titration, it turns to [Max. Volume] and can change maximum volume of titration by the method.

[Sample] button

Here you define and configure the sample to be titrated.

[Function] button

Function provides the following settings:

- Reagent information
- Method edit
- Results list
- Sample mode
- Blank list
- GLP management
- Auto statistics
- Decimal edit
- Graph setting
- Other settings
- System information
- Memory clear
- Operation of CF card

[Calibration] button

Here you edit calibration condition for the electrode and preamplifier, change calibration method and calibrate.

[Burette] button

The burette activates with this button.

[Start] button ⇆ [Pause On] ⇆ [Pause Off]

Titration starts with [Start] button. When “Wait time” for titration is set up, pressing [Start] button again after starting titration will lead to skipping the execution of “Wait time”. During titration, it turns to [Pause On] to halt titration. While pausing, it turns to [Pause Off] button to resume titration.

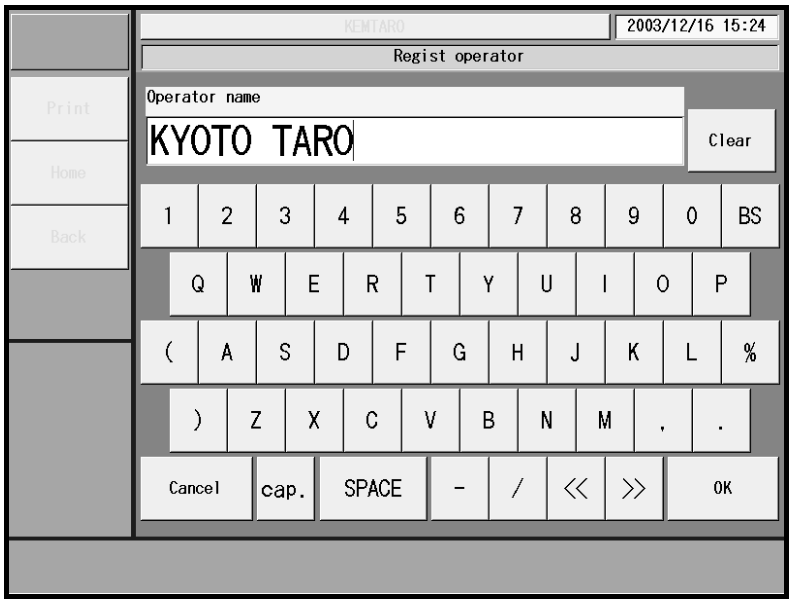
[Reset] button

This button stops aborts measurement underway.

2-4-4. Description of how to input characters and numbers

The operators name or reagent name are selected and entered here.

(Example: Regist operator)



[1] ~ [0] button

These are numeric buttons

[A] ~ [Z] or [a] ~ [z] button

Capital or small letters are selected here. [CAP.] stands for capital letter and [cap.] for small.

[( ], [,], [ )], [,], [%] button

These are symbols.

[BS] button

This button erases the preceding one character.

[Cancel] button

The entered characters can be canceled with this button.

[cap.] or [CAP.] button

This button switches capital letter or small and [–], [/] or [+], [*] button.

[Space] button

Space is inserted with this button.

[–], [/] or [+], [*] button

These symbols can be selected with [cap.] or [CAP.] button

[〈], [〉] button

This button moves the cursor position o display.

[OK] button

This button confirms the input that you have entered on key board display.

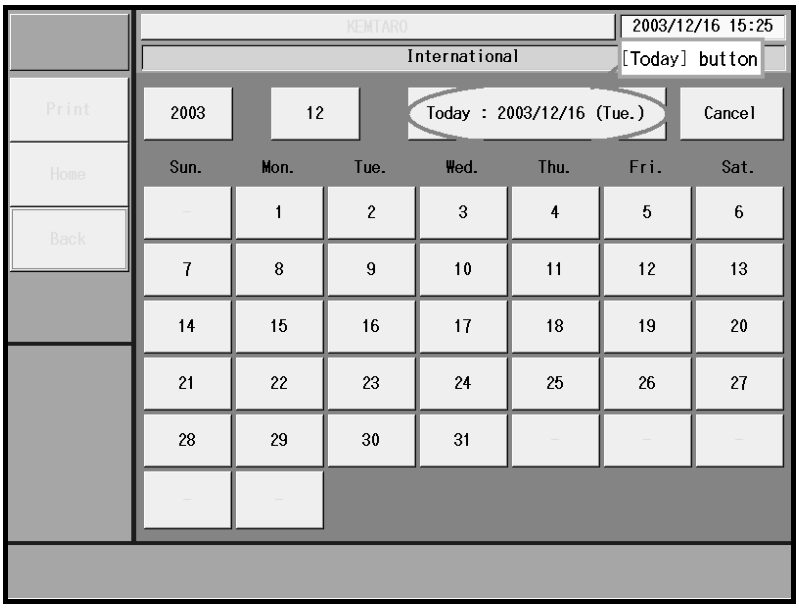
[Clear] button

This button clears key entries. When pressed again, the display returns to the screen before cleared.

2-4-5. Description of date entry

The below display appears for date entry.

(Example: setup of international)



[Today] button

This button updates the date to the present day as of today.

Year button

Display where you enter the year.

- 2001 ~ 2099 year

Month button

Display where you enter the month

- 1 (January) ~ 12 (December)

[1] ~ [31] button

This button enters the day of the month. This date will be displayed as calendar by inputting a year and a month.

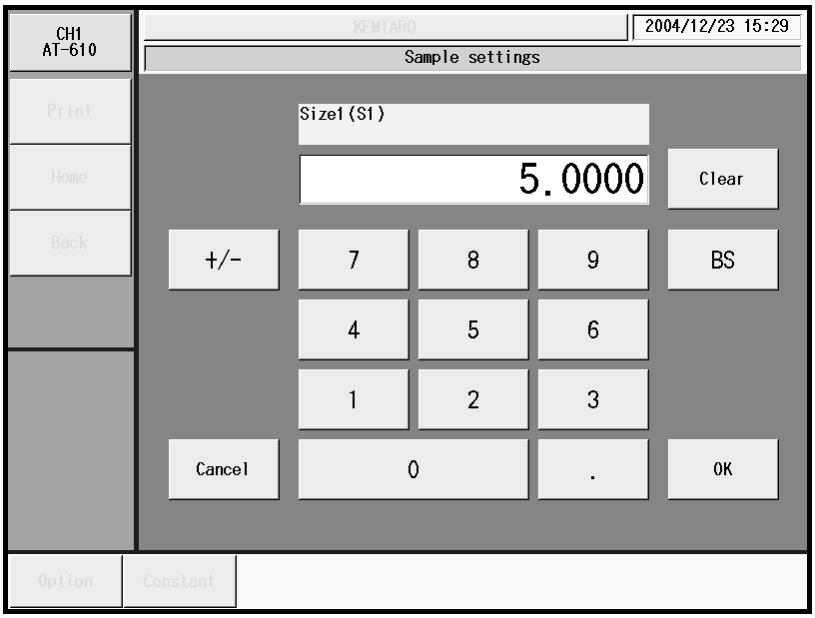
[Cancel] button

This button cancels already entered configuration.

2-4-6. Description of numeric entry

The below display appears for numeric entry.

(Example: Display of sample size (Size 1))



[1] ~ [0] button

This button enters numerals.

[.] button

This button enters decimal point, only significant when so necessary.

[OK] button

This button confirms the input that you have entered on key board display.

[BS] button

This button erases preceding one character.

[Clear] button

This button clears all of the entered configurations. When pressed again, it returns to the previous display before cleared.

[Cancel] button

This button cancels the entry.

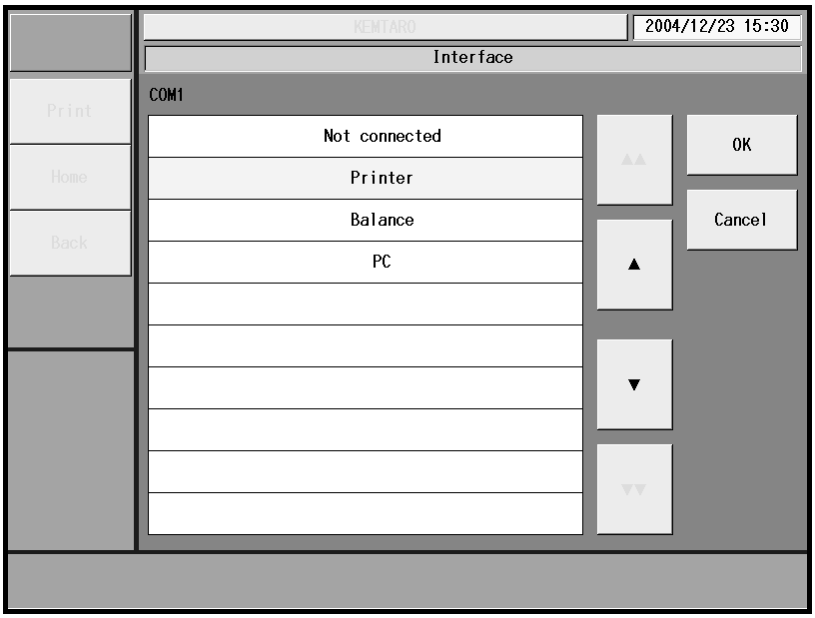
[+/–] button

This button switches plus and minus, only significant when minus can be entered.

2-4-7. Description on display for selection

This screen appears for selection of configurations.

(Example: Setting Interface)



[▲], [▼]

Move cursor on the selected screen display.

Note:
The desired item can be selected by touching the panel.

[▲▲], [▼▼]

These buttons are effective when selected items exist on previous or next page. It breaks a page.

The cursor moves to the top on a new page.

[OK] button

Pressing this button leads to the confirmation of key entry.

[Cancel] button

Pressing this button allows an operator to cancel key entry.

3. Basic procedure

3-1. Basic procedures before starting titration:

The electrode and preamplifier must be selected appropriate for the titration. Here is an example of basic flow of preparation for an acid base (neutralization) titration using a pH electrode.

1. Preparation of electrodes

Install a combination glass electrode and temperature compensation electrode.

* Prepare an electrode or sensor and preamplifier appropriate for the titration.

↓

2. Calibrate the electrode or sensor

Calibrate the electrode and preamplifier with pH standard liquid (pH7/pH4).

* Calibration method differs depending on preamplifier type and the electrode or sensor.

↓

3. Filling titration liquid

Fill the burette with 0.1 mol/L-hydrochloric acid.

* For filling procedure, refer to 3-6. Burette.

↓

4. Check titration condition

Here you confirm preset conditions.

* Once titration methods are preset for individual samples, all you have to do is to change the method, and can start titration right away. The method is protected with lock function.

↓

5. Preparation of a sample

Prepare the sample for titration.

* Sample conditions can be stored in memory card as a sample file. Once stored in advance, all you need to enter is the sample size.

↓

6. Start titration

Dip the electrode in the sample in vessel, and press [Start] button.

↓

7. After titration

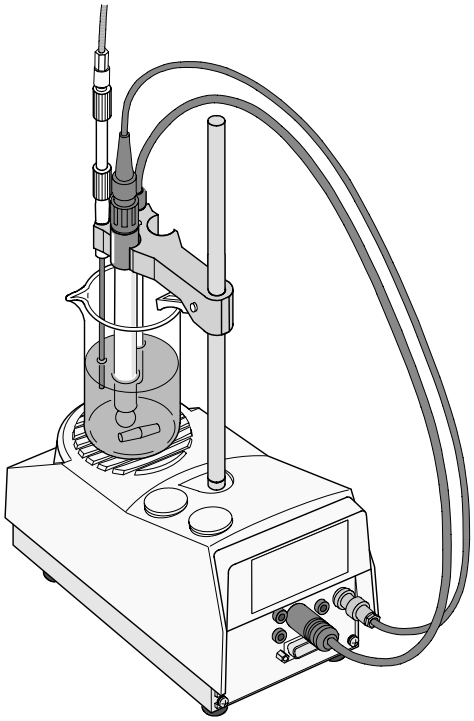
Clean the electrode and keep it in pure water dipped.

Note:

The steps within the dotted line box are daily procedures.
Other steps are optional when necessary.

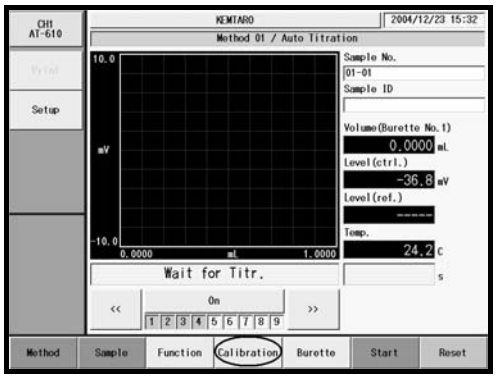
3-1-1. Connecting the electrode

1) Connect the cable to the combination glass electrode and plug its connector into G1 jack.
2) Connect the temperature compensation electrode to T1 jack.
3) Install the electrodes and burette nozzle to the electrode holder as shown below.
4) Keep each electrode and burette nozzle in a beaker filled with pure water.

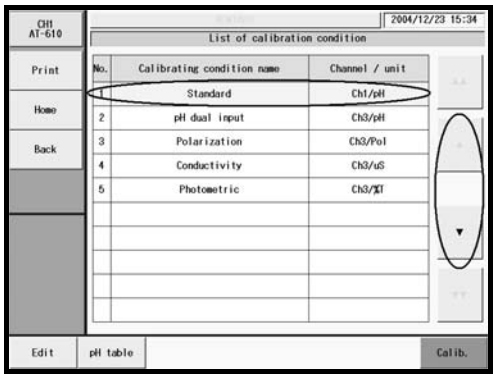


3-1-2. Calibration of detectors (preamplifiers) and electrodes

It is necessary to calibrate the detector and electrode in order to perform precision measurement.
Below description explains how to perform pH calibration that is the basic for titration.



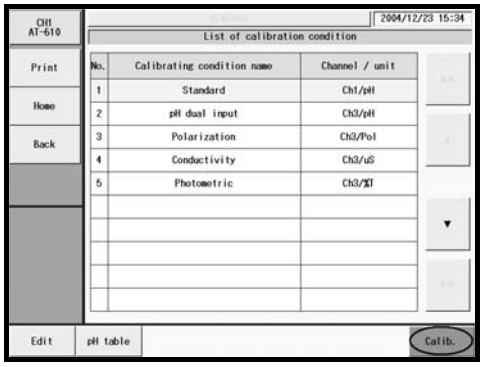
1) Press [Reset] button.
2) Ensure the message “Wait for Titr.” on display.
3) Press [Calibration] button.



4) Now you see “List of calibration condition” on display. Choose the method for calibration with [▲], [▼] key. Ensure “Channel/Unit” is either “Ch1/pH” or “Ch3/pH” (when TET-610 preamplifier for pH dual input is connected and calibrate with detector 3).

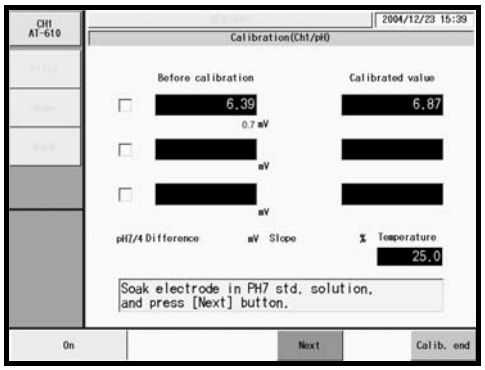
Note:

For setting up calibration condition, refer to 3-7. Calibration.
Calibration of pH electrode is necessary for acid base titration using any kind of preamplifier No.1 of 2-way pH input type preamplifier No.3.
For calibration of preamplifier No.3 of other types, refer to “4-1. Preamplifier other than STD-610”.



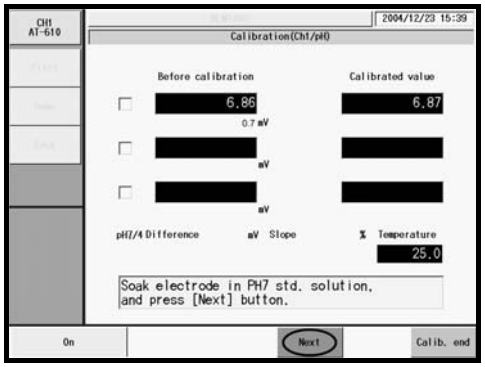
< When “Calibration mode” for calibration method is in “Auto” >

1) Press [Calib.] button.

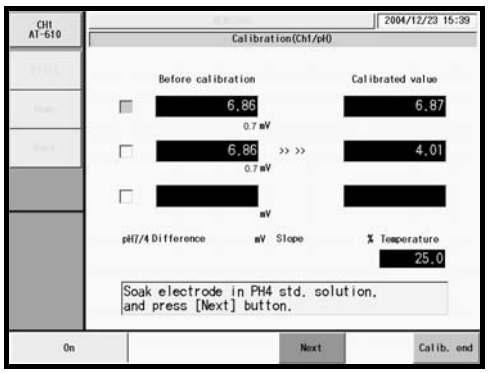


Example: when “Calibration point” for calibration method is “pH7/4”

2) Now the screen for pH7 calibration appears on display.



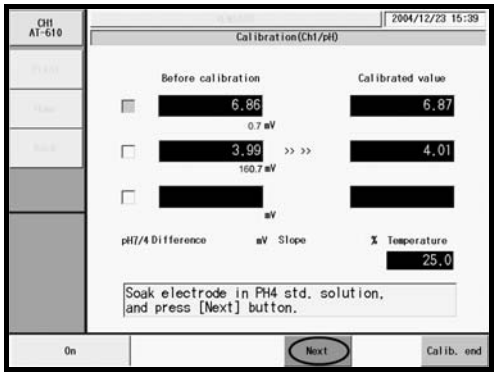
3) Dip the electrode in pH7 standard liquid. Then, press [Next] button.
You will see the electrode reading on the left, and calibration value on the right.
The potential value (mV) of the electrode is shown under the electrode reading on the left.
Shown in the lower right is the temperature of the calibration solution measured with the temperature compensation electrode.
(The temperature of the calibration condition is shown when a temperature compensation electrode is not used.)



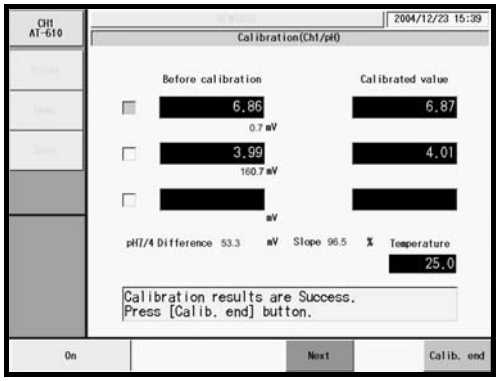
4) After pH7 calibration is over, the screen changes to display pH4 calibration. Rinse the electrode with pure water, and blot it with tissue.

Note:

Be sure to clean the electrode with pure water and blot it with tissue paper or the like before dipping it in another standard solution. Otherwise, calibration value may be deviated causing failure in measurement.

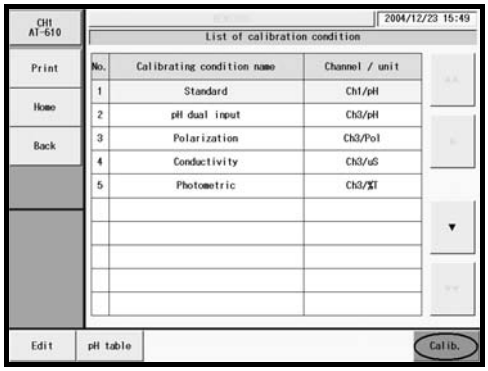


5) Dip the electrode in pH4 standard. Then, press [Next] button. The screen will show the display under the calibration condition as preset, then, you can go on to the next calibration.



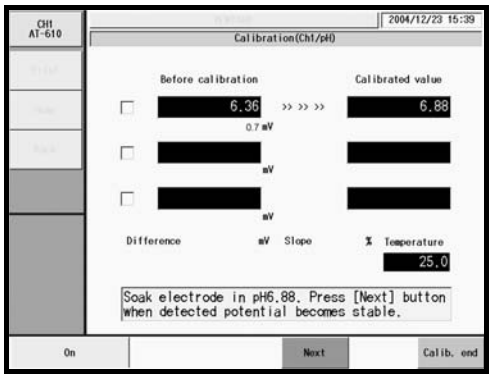
6) As shown on the left, a potential difference and a slope value per pH are displayed once a calibration is done.
When a calibration fails, the display shows "Calibration results are Failure."

7) Press [Calib. end] button. You can check calibration record by selecting "Function" – "GLP management" – "CAL. record".

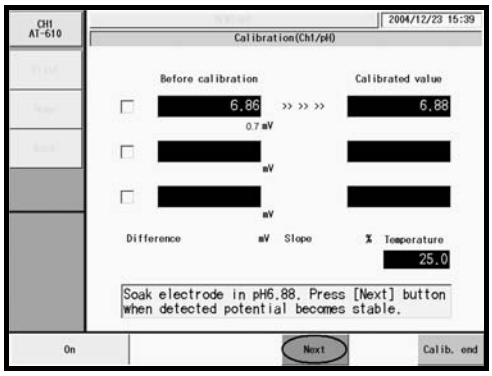


< When "Cal. mode" for calibration method is in "Manual" >

1) Press [Calib.] button.



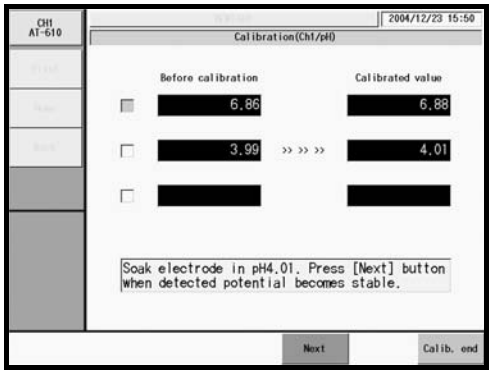
2) Now the display for "1st calibration" appears on the screen.



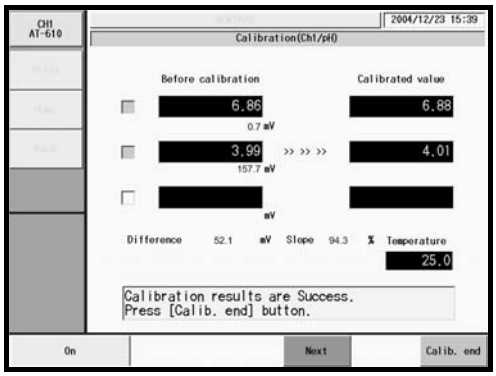
3) Dip the electrode in the standard liquid as indicated on display. When both values on the left and right are stable, then press [Next] button. You will see the electrode reading on the left, and calibration value on the right.
The potential value (mV) of the electrode is shown under the electrode reading on the left.
Shown in the lower right is the temperature of the calibration solution measured with the temperature compensation electrode.
(The temperature of the calibration condition is shown when a temperature compensation electrode is not used.)

Note:

Be sure to rinse the electrode with pure water and blot it with tissue paper or the like before dipping it in another standard solution. Otherwise, calibration value may be deviated, causing failure in measurement.



4) After the first calibration pH is over, the screen changes to display the second calibration. Rinse the electrode with pure water, and blot it with tissue paper. Continue to calibrate one after another as the display shows the preset conditions for each standard.



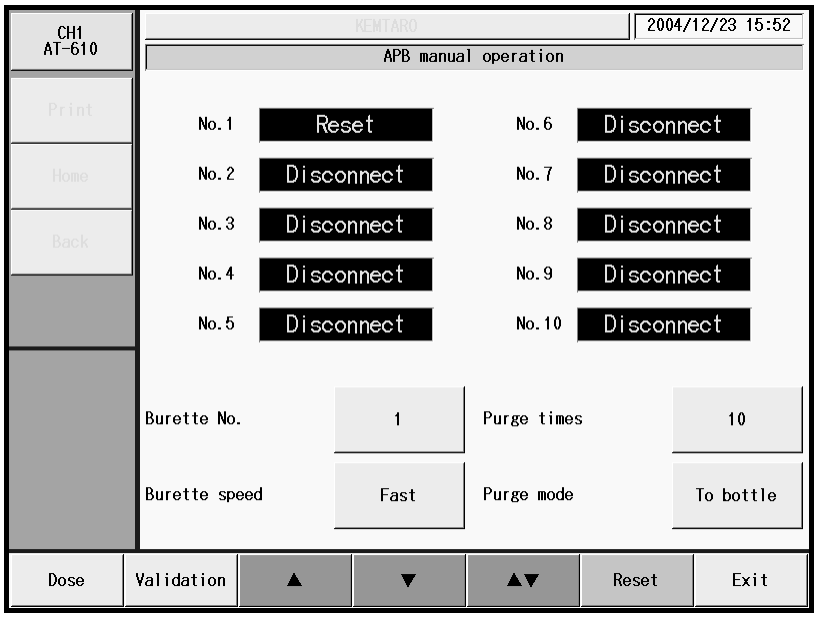
5) As shown on the left, a potential difference and a slope value per pH are displayed once a calibration is done.
6) Press [Calib. end] button.
You can check calibration record by selecting "Function" – "GLP management" – "CAL. record".

Note:

When the calibration mode is in "Manual", it will not evaluate the results on the pass/fail basis. Calibration records indicate OK for all calibrations. Use "Auto" mode for the good or NG evaluation on electrode performance.

3-1-3. Operational procedures

1) Fill the reagent bottle with the titrant used for titration.
2) Press [Burette] button on Main display.
3) “APB manual operation” appears on display.



4) Select a burette number (Burette No.) to use.
5) Set “Burette speed” to “Slow”.
6) Set purge mode to “To nozzle”.
7) Allow the tip of the titration nozzle to move into a beaker or the like.
8) Press [▲▼] button.

⚠ Caution!
Move the tip of the titration nozzle into a vessel like a beaker to prevent reagent from dispersing.

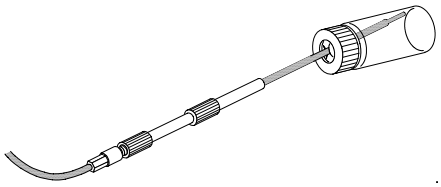
9) When the air inside the burette is pushed out to a beaker and the reagent starts dripping from nozzle tip, press [▲▼] button to stop piston movement.

⚠ Caution!
Wear a protective pair of glass in order to avoid splashing reagent in case the tube joint is loosened or disconnected.

3-1-4. Purge the burette

Purging is necessary to eliminate the difference in concentration between the reagent in burette and in reagent bottle:

1) Press [Burette] button on Main display. "APB manual operation" will appear on display.
2) Select the burette number and the purge times you want to set.
3) Set the purge mode to "To bottle".
4) Press [▲▼] button to start purging. After purging for the preset number of cycles, it stops into standby mode.
5) Remove the titration nozzle from the holder, and insert its tip into the supplied defoaming bottle.
6) Hold the bottle and nozzle slightly upward as shown, and press [▲] button. After air bubbles in the nozzle are removed, press [Reset] button and remove the defoaming bottle.

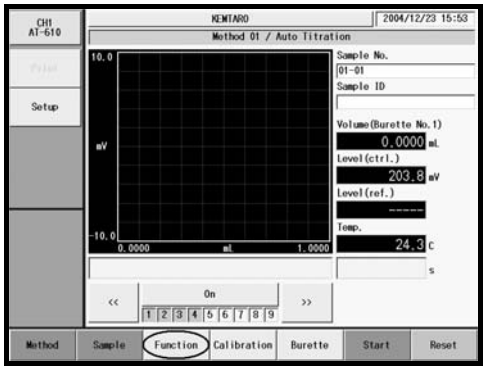


7) Install the titration nozzle onto the holder.

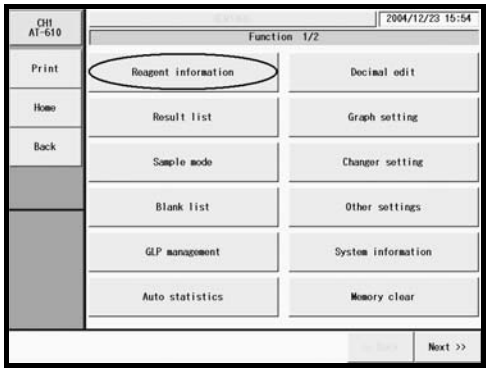
⚠ Caution!

Be sure to wear a pair of protective glasses.
Your eyes may be hurt if the tube lines are suddenly disconnected splashing reagent.

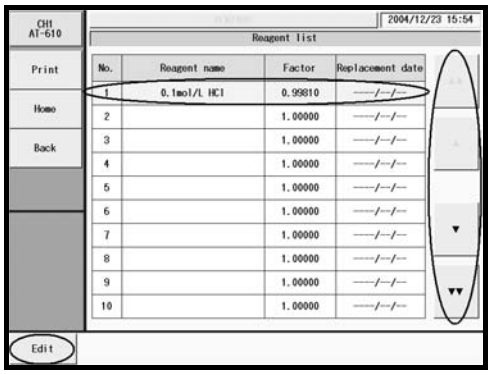
3-1-5. Setting information on reagent



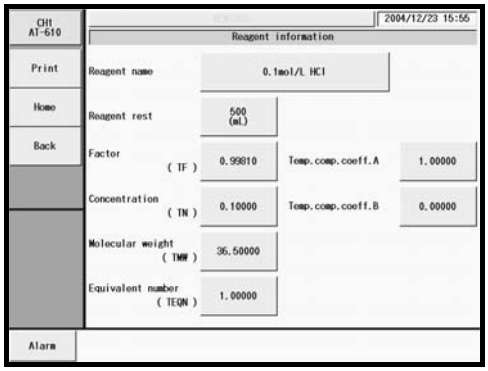
1) Press [Function] button.



2) Press [Reagent information] button.



3) "Reagent list" appears on display. Choose No.1 with [▲], [▼] button.
4) Press [Edit] button.

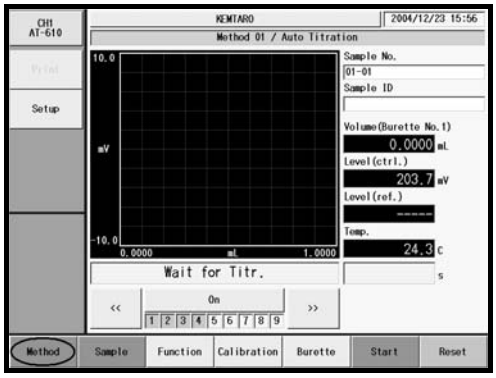


5) "Reagent information" appears on display. Here you enter the reagent name, factor value, concentration, molecular weight, equivalent number. (For 0.1mol/L-HCl, enter "0.1" for concentration (TN), "36.5" for molecular weight (TMW) and "1" for equivalent number (TEQN).)
6) Press [Home] button.

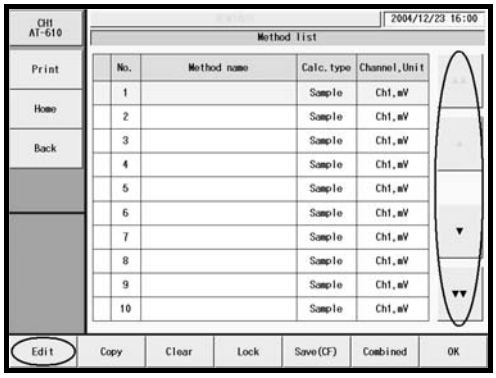
Note:

Regarding setting information on reagent, refer to "3-5-1. [Reagent information]".

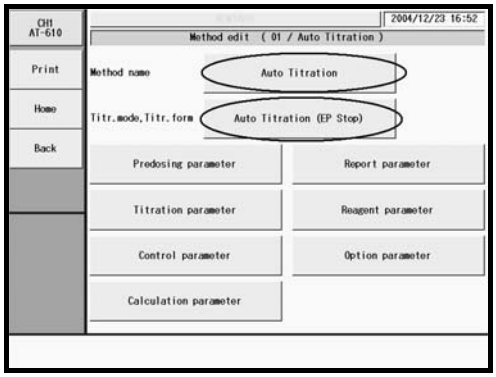
3-1-6. Setting Method (measuring conditions)



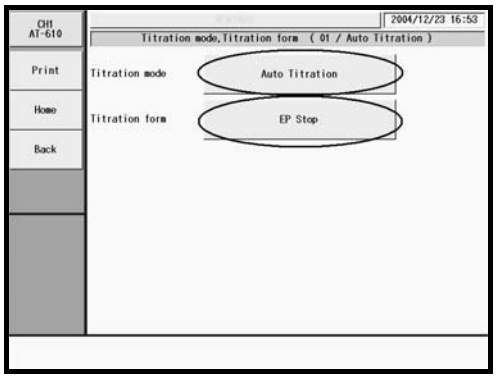
1) Press [Reset] button.
2) Ensure the display shows “Waiting for Titr.”.
3) Press [Method] button.



4) “Method list” appears on display. Choose the method for titration you intend with [▲] [▼], [▲▲], [▼▼] buttons.
5) Press [Edit] button.

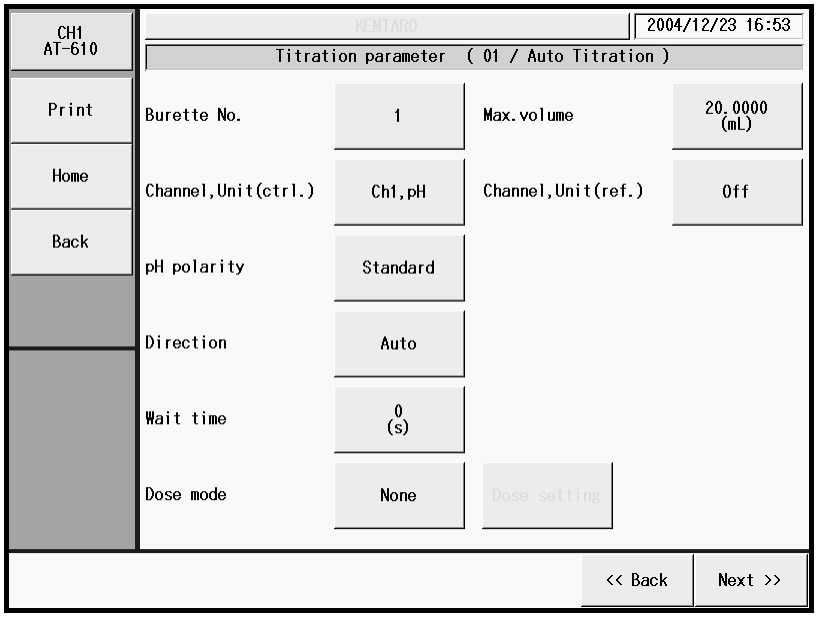


6) Press Method name button and enter the name.
7) Press Titr. mode, Titr. form button.

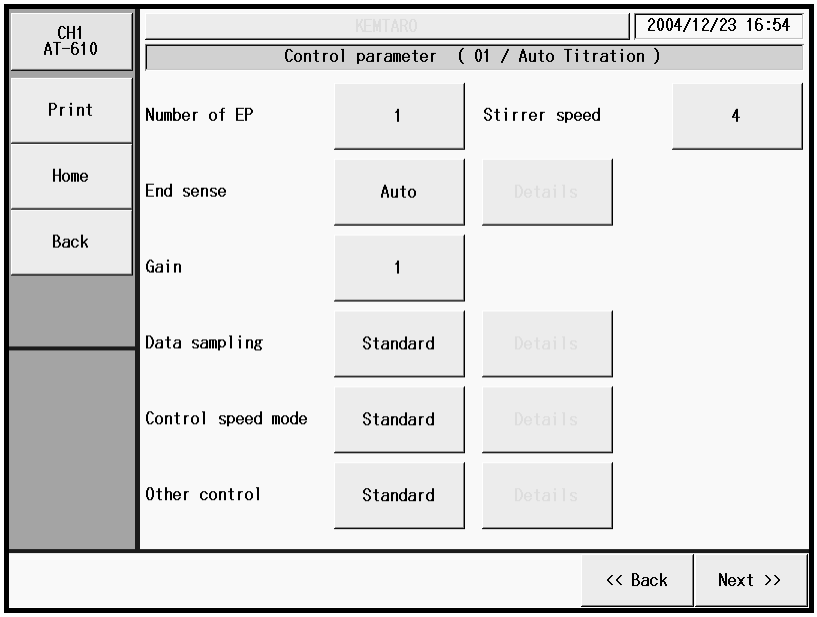


8) “Titration mode, Titration form” appears on display.
   Set “Titration mode” to “Auto titration” and “Titration form” to “EP stop”.
9) Press [Back] button.

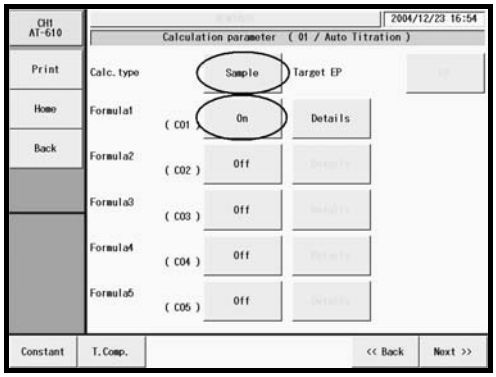
10) Press [Titration parameter] button.
Configure titration parameters as shown below, and you can change the settings if you will.



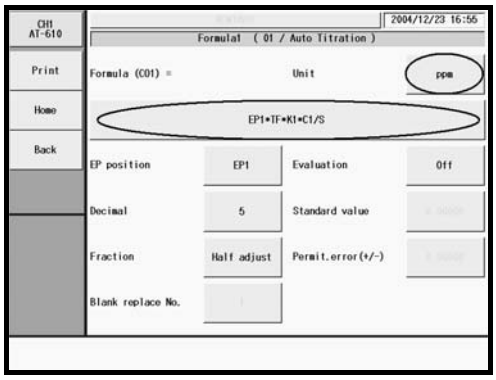
11) Press [Next] button. Configure control parameters as shown below.
Change the settings as shown below when otherwise set.



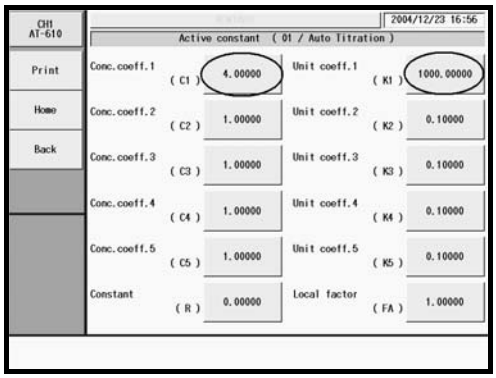
Note:
For the settings of Method, refer to "3-8. Method".



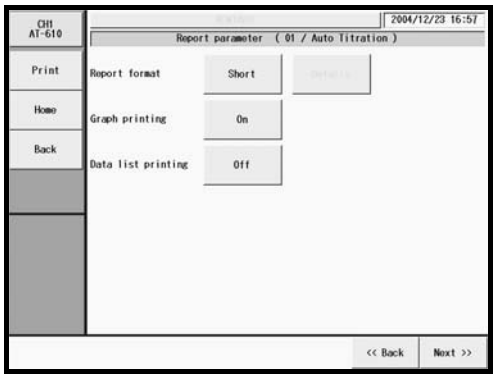
12) Press [Next] button to show Calculation parameter. Select “Sample” for “Calc. type”, and “On” for Formula 1 (CO1).
13) Press [Details] button on Formula 1 (CO1).



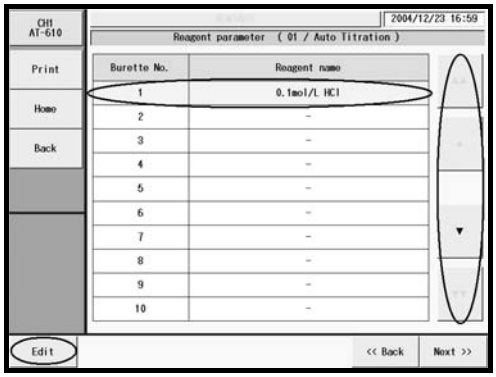
14) “Formula 1” appears on the screen display. Enter “ppm” for unit, and “EP1*TF*K1*C1/S” for Formula (CO1). Set EP position to “EP1”.
15) Press [Back] button.



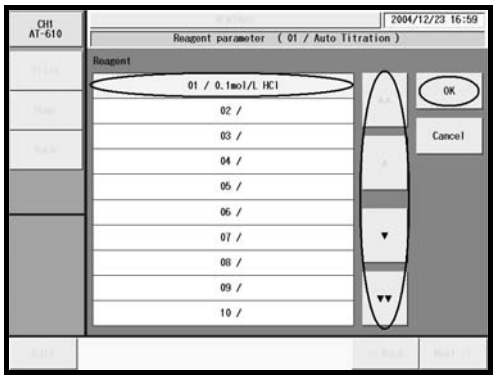
16) Press [Constant] button to show “Active constant” on display. Enter Conc. coeff. 1(C1) and Unit coeff. 1(K1). (When titrating sodium hydroxide with 0.1mol/L, enter “4.00” for C1, and “1000” for K1 when concentration is expressed in ppm.
17) Press [Back] button.
18) Press [Next] button.



19) The display shows “Report parameter”. Select “Short” for “Report format”, “On” for “Graph printing” and “Off” for “Data list printing”.
20) Press [Next] button.

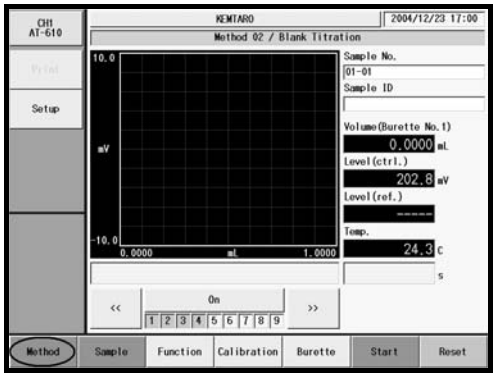


21) Now, the display shows “Reagent parameter”. Select the burette number you are going to use with [▲] or [▼] button. (Select No.1 for the built-in burette)
22) Press [Edit] button.

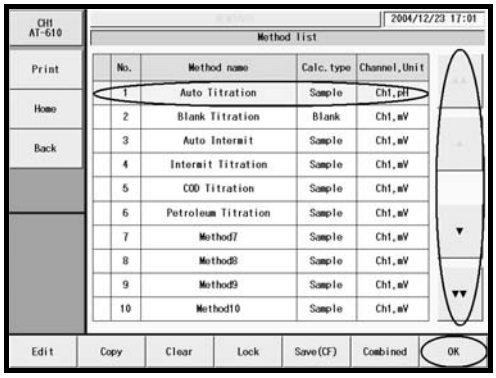


23) Choose the reagent you have selected on the Section “3-1-5”, and press [OK] button.
24) Press [Home] button.

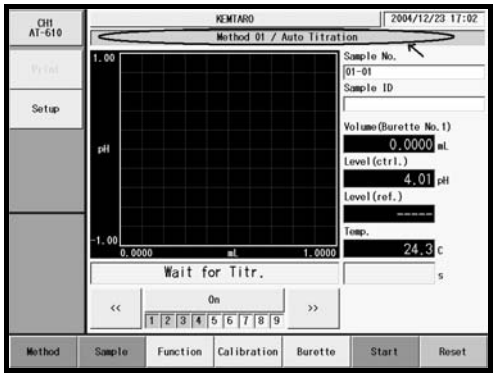
3-1-7. Selection of Method (measurement parameters and conditions)



1) Press [Reset] button.
2) Make sure the message “Wait for Titr.” appears.
3) Press [Method] button.



4) When “Method list” dialog box appears select your desired Method for measurement with [▲] [▼], [▲▲] [▼▼] buttons. You can choose a Method directly with numeric buttons.
5) Press [OK] button. You can choose a Method directly with numeric buttons.



The Method display changes to Main display (standby mode), where currently active Method is shown on the screen.

Note:

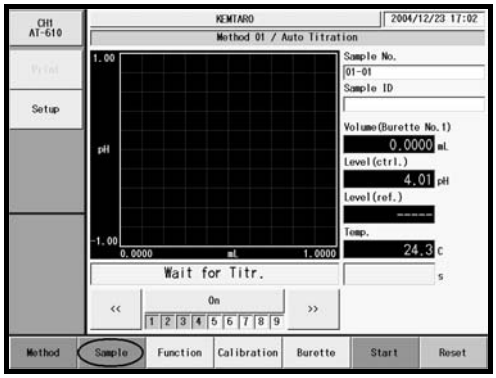
Method cannot be changed during measurement in progress.
To change Method, press [Reset] button to set in “Wait for Titr.” mode.

3-1-8. Preparing a sample for measurement

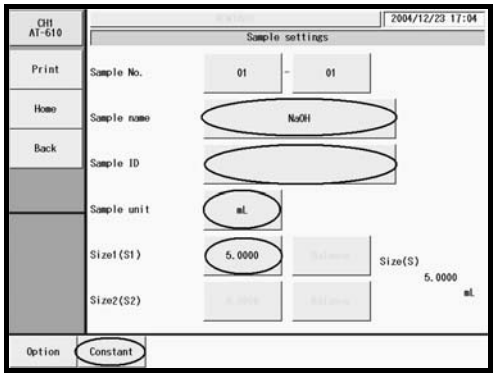
3-1-8-1. Preparation of the sample

1) Attach a pipeter to a 5mL transfer pipette.
2) Take a small amount of 0.1mol/L-NaOH and self-clean the inside wall of pipette.
3) Take 5mL of 0.1mol/L-NaOH and put it in 200mL beaker.
4) Put the supplied stirrer bar in the beaker and add 100mL of pure water.
5) Rinse clean the electrode with water, and blot it with tissue.
6) Place the beaker with sample liquid in it onto the stirrer, and dip the electrode in the sample.

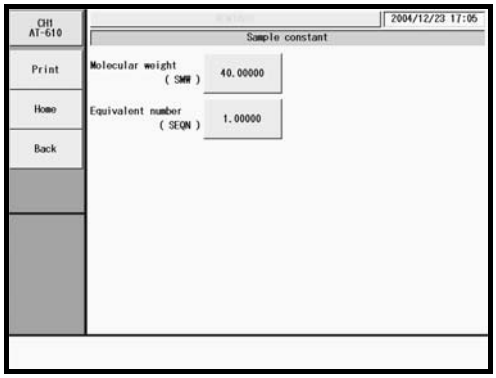
3-1-8-2. Setting sample parameters



1) Press [Sample] button.

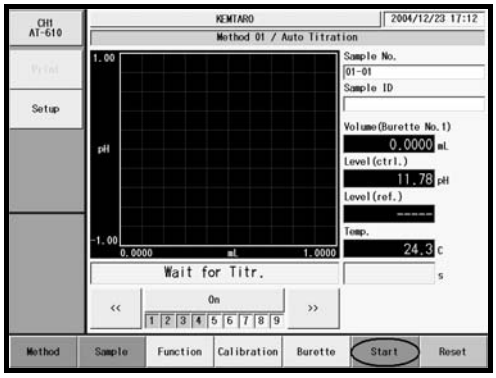


2) The display shows “Sample settings”. (When “Sample file” selected by [Function] – [Sample mode] is set to “Off”)
3) Enter the sample name and ID.
4) Enter “mL” for “Sample unit”.
5) Press Size 1 button for sample size.
   With numeric characters displayed, enter the sample volume put in the Step 3-1-8-1.
   The sample size (Size) equals to | [Size 1] – [Size 2] |.
6) Press [Constant] button.

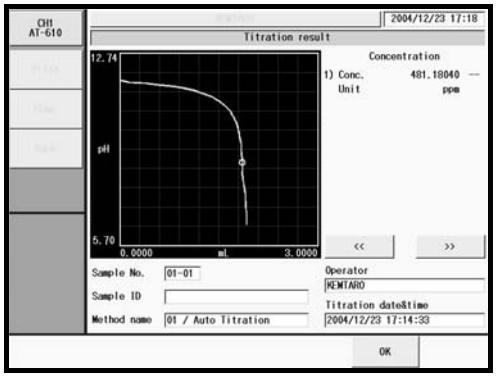


7) When “Sample constant” appears, enter the reagent's Molecular Weight (MW) and reagent Equivalent Number (EQN). (On NaOH, enter “40.0” for “SMW” and “1” for “SEQN”.)
8) Pressing [Home] button will turn the screen display to the Main screen.

3-1-9. Starting titration



1) Press [Start] button. Titration will start and plot a titration curve. Press [Reset] button if you want to about the titration.



2) When the titration is completed, the results are calculated with the preset sample size on 'Size 1' and displayed. When the printer is connected with AT-610, the results are printed out according to the print parameter preset on Method.
3) Press [OK] button to return to the Main screen display. When the time limit for resulting display preset in [Function] – [Other settings], the display will automatically returns to the Main screen display when the preset time elapses.

Note:

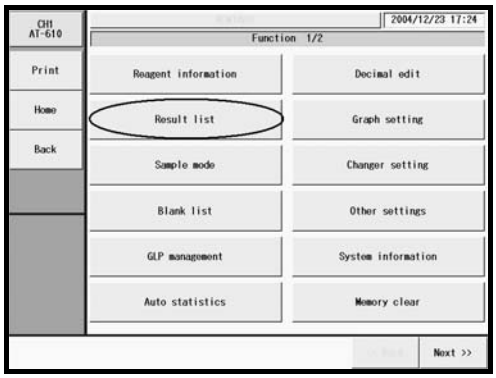
When "Before entry" in [Function] – [Sample mode] is set to "On", the display for Sample mode will appear with [Start] button.
When the screen display shows "Sample settings", titration will not start.

3-1-10. After-titration care

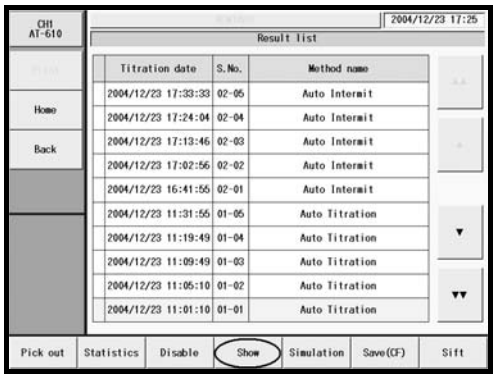
1) Detach the beaker with sample from the stirrer. Place an empty beaker below the electrode, and rinse it with pure water contained in a rinse bottle.
2) Blot the electrode with tissue paper to wipe it off water.
3) Store the electrode by dipping it in clean pure water.

3-2. Usage of titration data

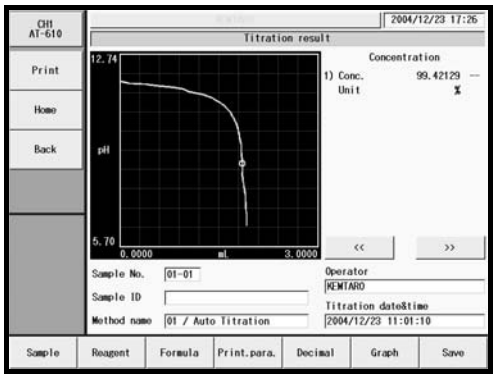
3-2-1. Re-calculate titration data



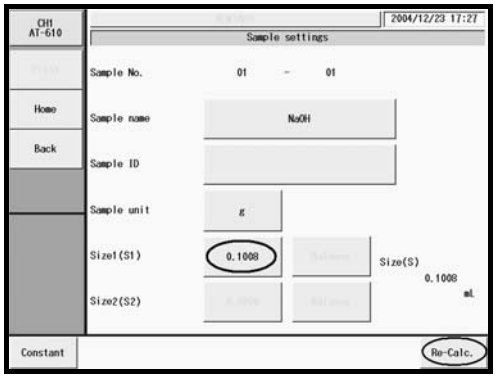
1) Press [Function] button on Main display.
2) Press [Results list] button.



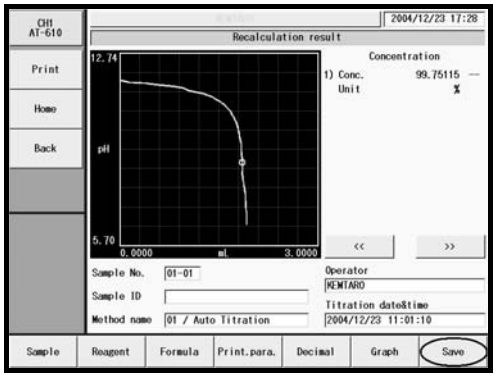
3) When "Results list" appears, point the cursor on the results data for recalculation.
   Use [▲][▼], [▲▲][▼▼] buttons to move the cursor or you can choose the desired data directly by pressing the data on list.
4) Press [Show] button.



5) The results of measurements will appear, and press the items for recalculation accordingly.
   Example: Press [Sample] button.

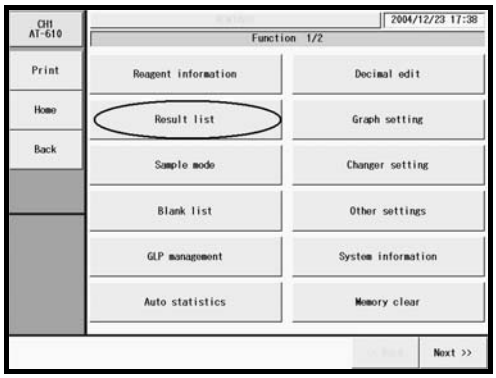


6) When "Sample settings" is displayed, press [Size 1] button. Enter the amount in volume or weight.
7) Press [Re-Calc.] button.

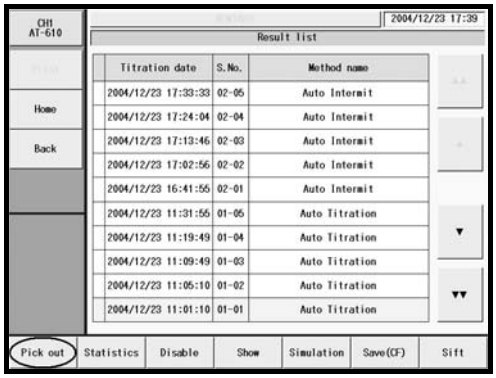


8) The screen display will turn “Recalculation result” dialog box. Then, press [Save] button.
9) The screen display will turn to the confirmation screen. Then, press [Yes] button.

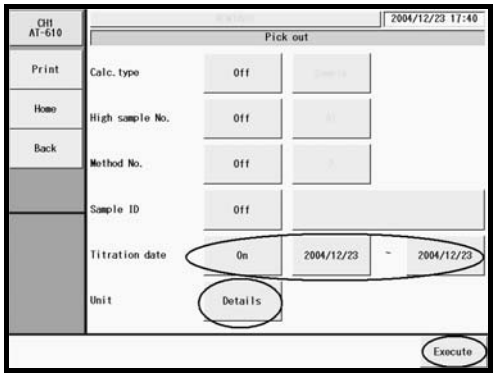
3-2-2. Batch processing of titration data



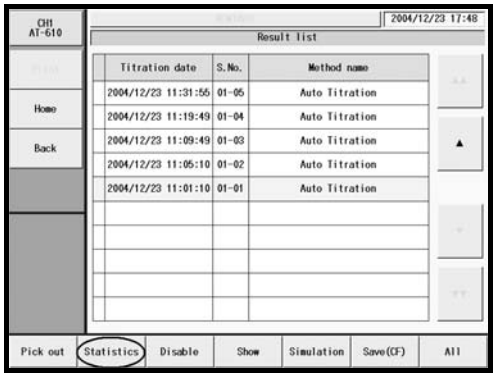
1) Press [Function] button on Main display.
2) Press [Result list] button.



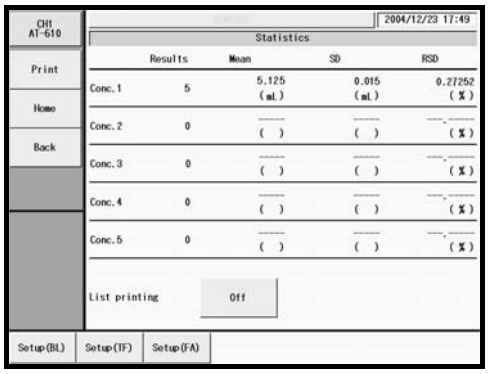
3) Press [Pick out] button. Here you sort out the data for batch calculation.



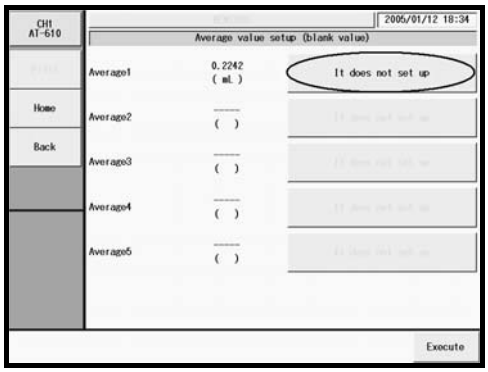
4) When “Pickout” display appears, configure parameters for selection of data, and press [Execute] button.
Example: Take data using “Unit” and “Titration date” as key parameter. Press [Details] button, make “Unit 1” active (“On”) and select “mL” or the like in the Unit setting. Make “Titration date” active (“On”), followed by setting the date.



5) Only those data thus selected appear on the results list, and then, execute batch processing by pressing [Statistics] button. If you want to view all of the results, press [All] button.

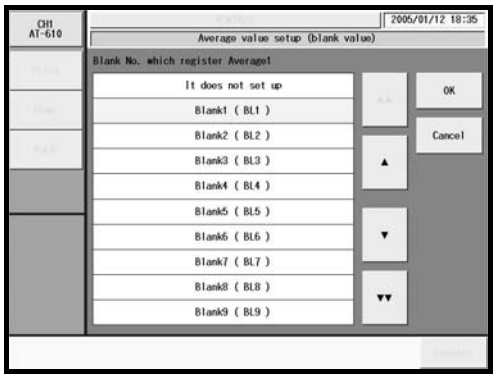


6) The screen on the left will appear. The batch calculated results will be printed out when [Print] button is pressed.
7) To return to Main display, press [Home] button.

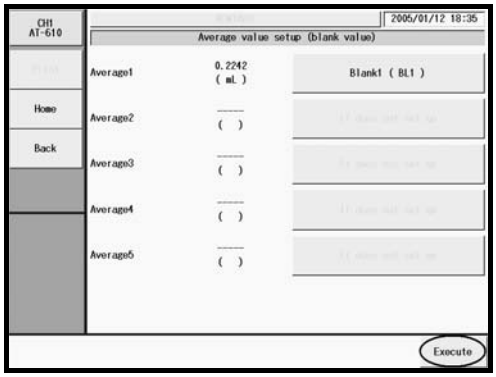


< When statistical calculation results
are registered as Blank values >

1) When you want to set the average of statistical calculation results 1 of bath calculation as Blank level, press [Setup (BL)] button on the "Statistics" screen display. Then, when "Average value setup (blank value)" screen appears, press [Average 1] button.



2) Point the cursor on "Blank 1 (BL1)" with [▲], [▼], [▲▲] or [▼▼] button or directly press a blank value No. in the menu list.
3) Press [OK] button.



4) Press [Execute] button.

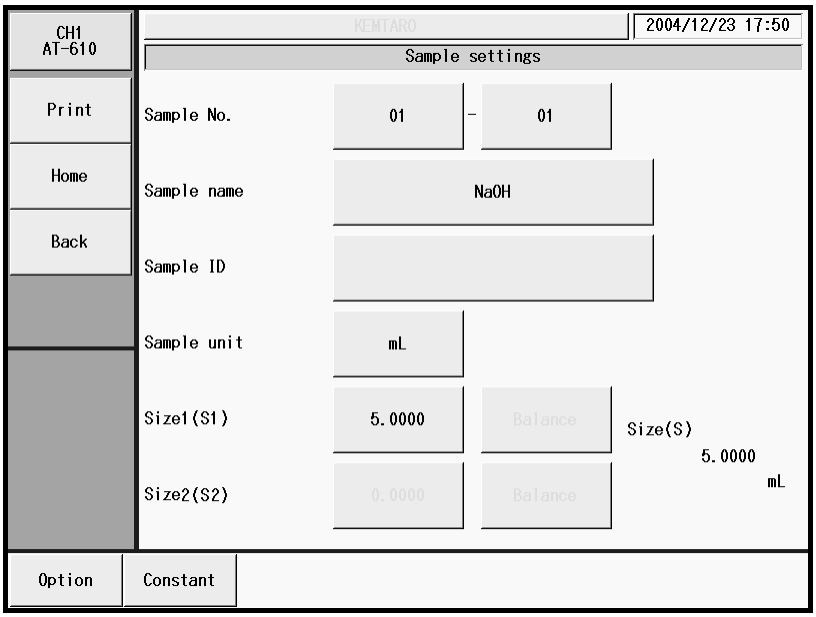
5) The average value "Average 1" will be registered as Blank 1 on "Function"–"Blank list".

Note:
For details of batch calculation, refer to "3-5-2-2. [Statistics]".

3-3. Sample settings

Here you set up parameters for the sample to be measured.

Press [Sample] on Main display to show the below screen. Select the buttons for the items you want to preset.



[Sample No.]

Here you select sample numbers. The sample number consists of a high order and low order number. The high order number is a group number for batch calculation. The low order number counts up after each measurement.

- 00 ~ 99

[Sample name]

Here each sample can be named with characters up to 20 letters.

[Sample ID]

The samples can be identified with ID or Lot number with up to 20 characters.

[Sample unit]

Here enter the unit of sample weight. Up to 10 characters can be entered.

[Size 1]

Input “Tare + Sample weight”.

- -99999.99999999 ~ 99999.99999999

[Size 2]

Input Tare weight after injecting a sample.

- -99999.99999999 ~ 99999.99999999

Note:

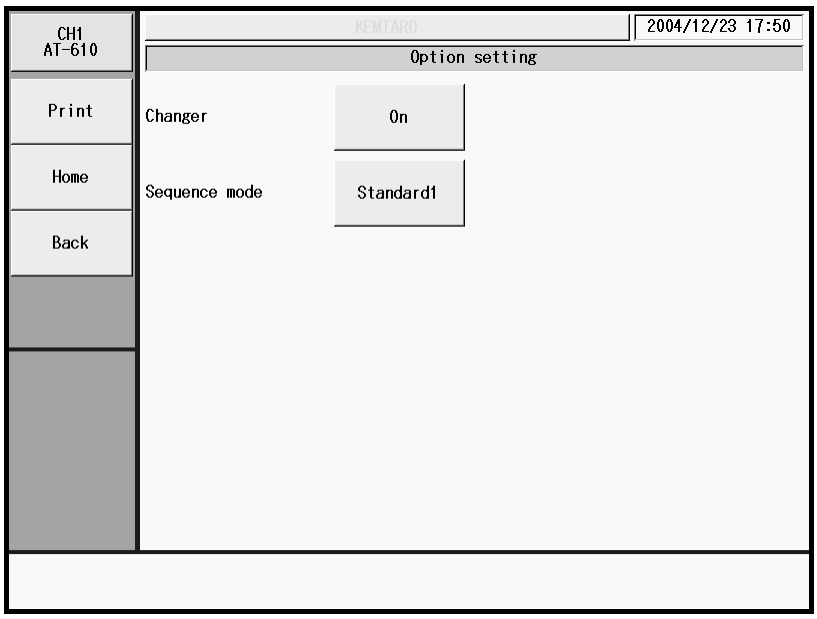
The number of digits for SIZE differs depending on the sample size preset on [Function] – [Decimal edit].

[Balance]

Screen for Balance input will be displayed. Press this button when inputting weight on the balance.

[Option]

Here set up the optional sample changer on display as shown below.

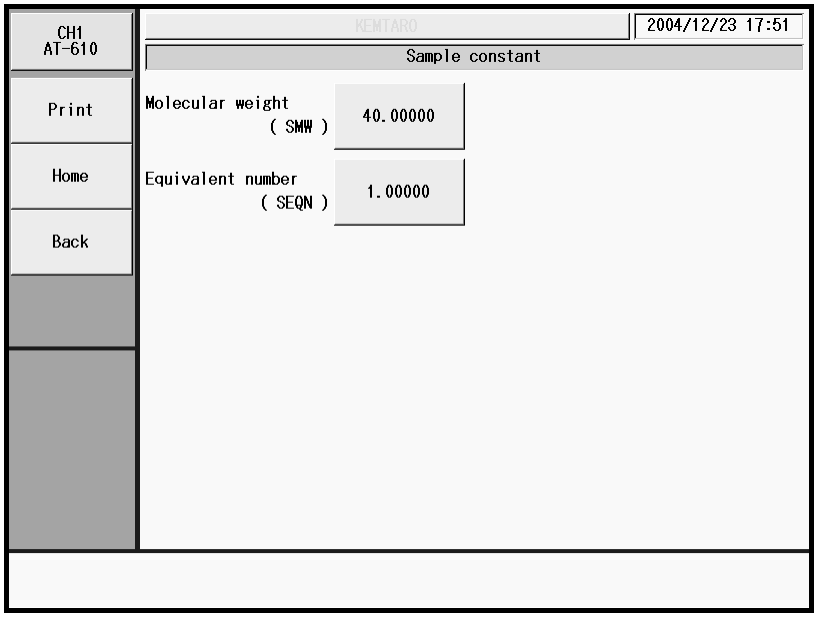


Note:

For Option display, refer to the Section “3-5-9. [Changer setting]”.

[Constant]

Here see the display for sample constant where you configure those constants like reagent molecular weight and equivalent number particular to the sample. Those constant numbers can be used for SMW and SEQN constants as calculation parameter in Method.

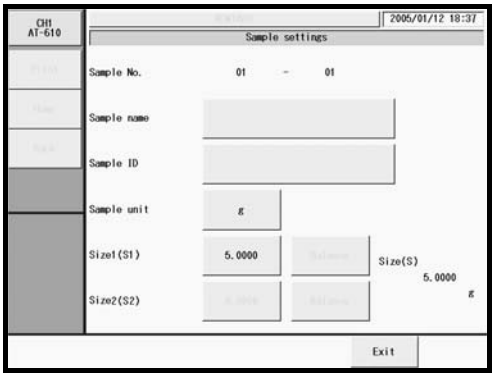


Note:

For details of sample constant, refer to the Section "3-8-7. [Calculation parameter]".

< Sample setup after titration starts >

While titrating, press [Sample] button to display the screen display as shown below and make the entry of sample setup. After entering necessary setup parameters, press [Exit] button.



3-3-1. Sample File Mode

This mode is useful when multiple sample changer is connected and when you wish to preset sample parameters in advance. To use this mode, select "Yes" for sample file on Sample Setup in Function.

3-3-1-1. Outline of Sample File

The sample file consists of the following elements shown in the below chart.

Example: When you set the number of samples to 99, and 5 for the next measurement number:

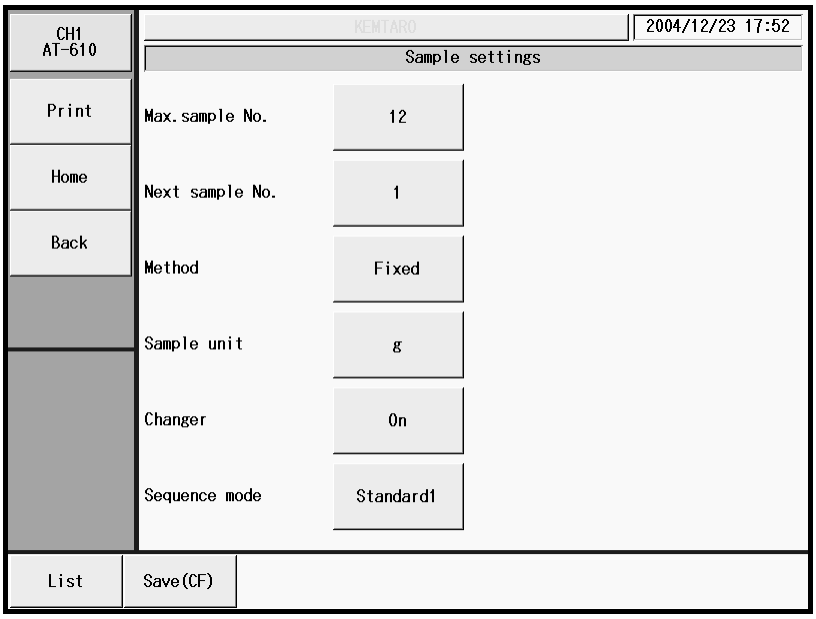
		Sample parameter						
	No.	Sample No.		Sample name	Sample ID	·····	Size 1	Size 2
	1	01	01	Blank		·····	0.0000	0.0000
	2	01	02	Blank		·····	0.0000	0.0000
Max sample No.	3	01	03	Blank		·····	0.0000	0.0000
	4	12	01	Sample A	20030501	·····	5.5213	4.5123
Next sample No.->	5	12	02	Sample A	20030501	·····	5.5312	4.5111
	:	:	:	:	:	·····	:	:
	:	:	:	:	:	·····	:	:
	95	21	02	Sample A	20030506	·····	5.5216	4.5122
Measured samples	96	21	03	Sample A	20030506	·····	5.5315	4.5121
	97	33	01	Standard B	990123	·····	1.0201	0.0000
	98	33	02	Standard B	990123	·····	1.0121	0.0000
	99	33	03	Standard B	990123	·····	1.0341	0.0000

When measurement is started, it begins with sample parameters of No. 5, and continues the series of measurements up to No. 99 under the conditions preset in advance.

Note:
For switching to Sample File Mode, refer to "3-5-4. [Sample mode]".

3-3-1-2. Sample file parameter

Press [Sample] button on Main display to show “Sample settings”.



[Max. sample No.]

Here you enter the largest number of samples for Sample File.

- 1 ~ 100

[Next sample No.]

The number for the next measurement is selected here.

- 1 ~ 100

[Method]

Here you select the mode for measurement method.

- Fixed : Measure with preset Method.
- Variable : You can define individual Method for each sample. This is useful for continuous measurement of blank and sample.

[Sample unit]

Here enter the unit of sample weight. Up to 10 characters can be entered.

[Changer]

Select “On” when using the optional sample changer.

- Off : Changer is not used.
- On : Changer is used.

[Sequence mode]

Here you select a sequence for cleaning the optional sample changer.

- Standard 1 : This standard 1 sequence shower cleans the sampler after each measurement.
- Standard 2 : This sequence dip cleans the sampler after each measurement.
- Standard 3 : This sequence shower cleans and dips the electrode in given solvent after measurement.
- Standard 4 : This sequence shower cleans and dip cleans, and separates the drains.
- User : This sequence is a sequence defined by user for desired maneuver of the sampler.

Note:

For details of sequence, refer to the instruction manual for your sample changer.

[List]

Here the list for sample parameters appears where you select sample conditions for each sample.

[Save (CF)]

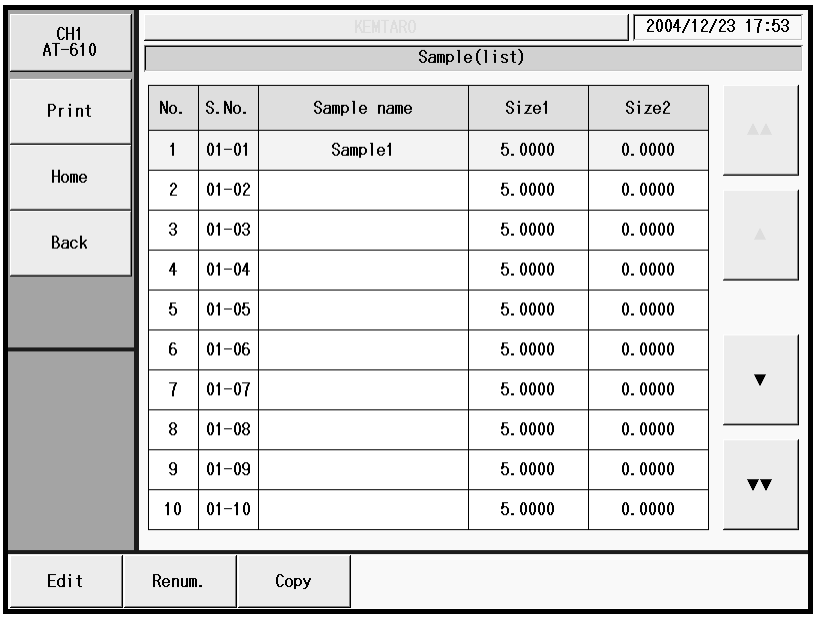
The sample files can be stored in an optional memory card.

Note:

For details of saving sample settings in a CF card, refer to “3-3-1-5. Save CF (sample settings)”.

3-3-1-3. Sample (list)

The below display appears when you press [List] button on “Sample settings” in sample file mode.



[▲], [▼]

Use these keys to move the cursor on the list.

[▲▲], [▼▼]

These keys begin a new page of the list. The cursor moves to the top number on the list after page break.

[Edit]

Here you can edit sample parameters. Point the cursor on the number where you want to edit the list. The display will change to “Sample” with this button.

[Renum.]

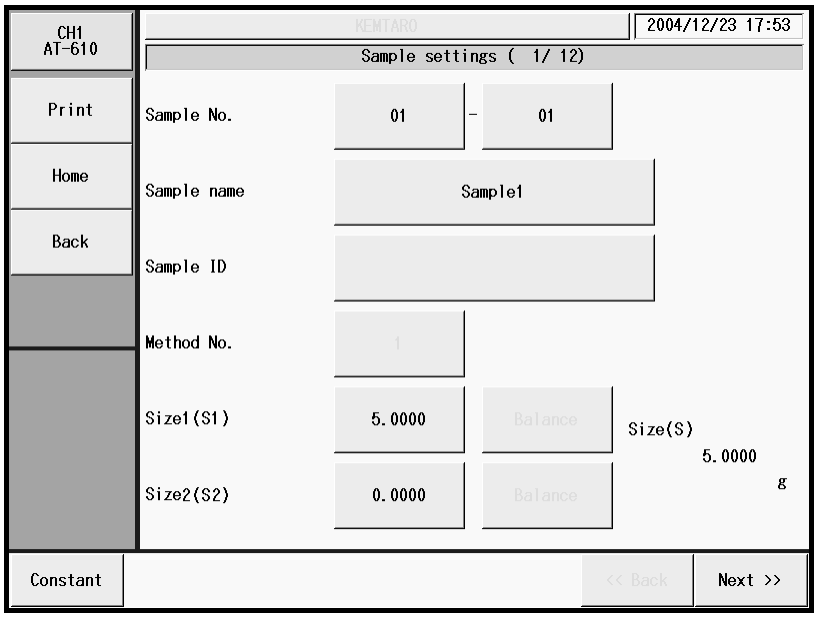
You can batch edit sample numbers (S.No.).

The batch edit begins with the sample number on the list with cursor on and selects numbers in series down to the sample of lower in number.

[Copy]

This key allows the user to apply the sample conditions for the number that the cursor lies in the list to the sample conditions for the rest samples from it.

3-3-1-4. Sample (sample file mode)



[Sample No.]

Here you select sample number. The sample number consists of a high order and low order number. The high order number is a group number for batch calculation. The low order number counts up after each measurement.

- 00 ~ 99

[Sample name]

You can name a sample with characters up to 20 letters.

[Sample ID]

Samples can be identified with individual ID code or Lot number with characters up to 20 letters.

[Method No.]

Here you select Method number, which becomes significant only when “Variable” is chosen for method on sample file parameter.

- 01 ~ 50, 61 ~ 70

[Size 1]

Input “Tare + Sample weight”.

- -99999.99999999 ~ 99999.99999999

[Size 2]

Input Tare weight after injecting a sample.

- -99999.99999999 ~ 99999.99999999

Note:

The number of digits for SIZE differs depending on the sample size preset on [Function] – [Decimal edit].

[Balance]

Screen for Balance input will be displayed. Press this button when inputting weight on the balance.

[Constant]

Here see the display for sample constant where you configure those constants like reagent molecular weight and equivalent number particular to the sample. Those constant numbers can be used for SMW and SEQN constants as calculation parameter in Method.

Note:

For details of sample constant, refer to the Section "3-8-7. [Calculation parameter]".

[Next >>]

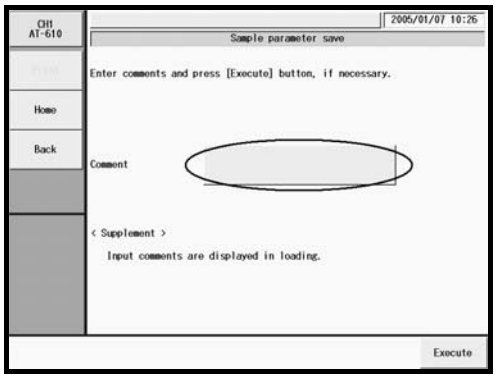
The next of sample setup display appears with this button.

[<< Back]

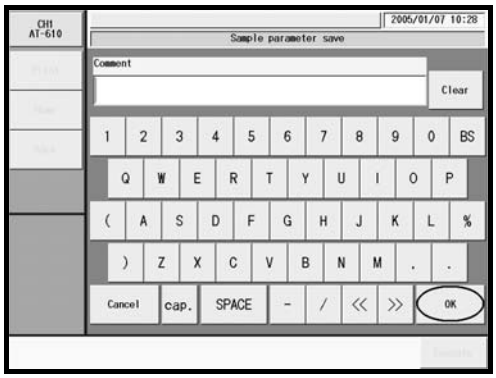
The preceding page appears with this button when pressed.

3-3-1-5. [Save CF] (sample settings)

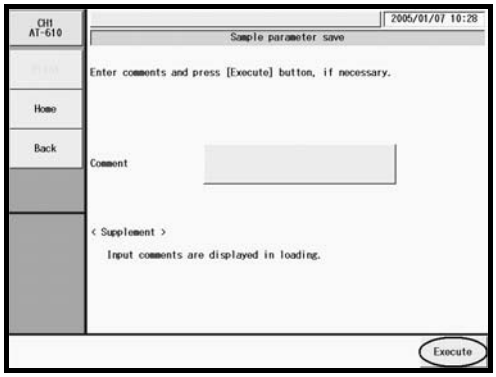
The files of sample settings are saved in CF card.



1) Press [Save (CF)] button on “Sample settings”. The display “Sample parameter save” appears as shown on the left. If you want to enter your comment regarding the sample setting to be stored, press the comment column on display.



2) The display shows the left screen, and then, press [OK].



3) On “Sample parameter save”, press [Execute] button. When the display prompts your confirmation, press [Yes] button.

4) The sample settings will be stored in CF card, and the display returns to “Sample settings”.

Note:

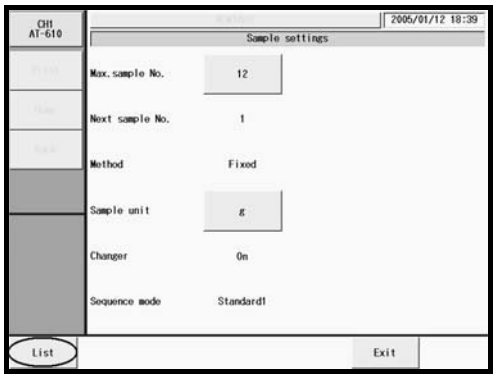
When CF card saves sample settings, the number of bytes of memory will become approximately 13K bytes. Up to 100 files can be stored in CF card. If CF card stores method conditions and measurement results, the remaining capacity of memory will be limited accordingly.

Note:

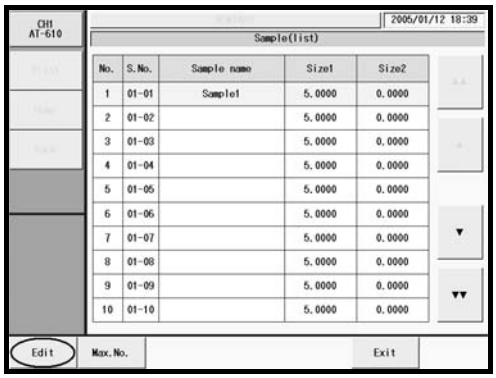
To display sample settings stored in CF card on the measuring unit, refer to the Section “3-5-13-3. [Load/ Delete sample settings]”.

3-3-1-6. Sample setup after starting titration

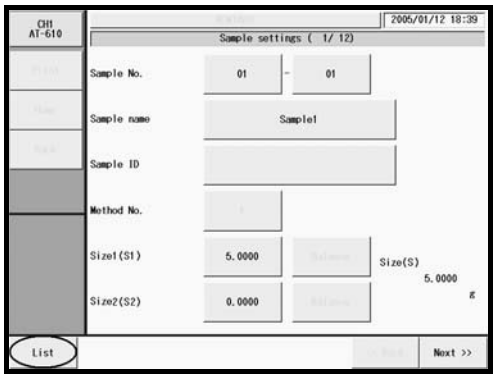
With a sample file in use, configure sample setup and add samples with [Sample] button after starting a titration.



1) After starting a titration, pressing [Sample] button will lead to the ”Sample settings” screen display, where you can change “Max. sample No.”.
2) Press [List] button.



3) When the “Sample (list)” screen appears, point the cursor on the sample setup to edit.
   Use [▲], [▼], [▲▲] or [▼▼] button to move the cursor or you can select a sample setup directly on the list.
4) Press [Edit] button. (When changing the max sample number, press [Max No.] button to return to the above Step 1.)



5) Enter setup parameters.
6) Press [Next] button for sample setup in the same manner as Step 5.
7) Press [List] button to return to Step 3.

8) Press [Exit] button.

Note:

Sample No. and Method No. for currently ongoing measurement cannot be modified.

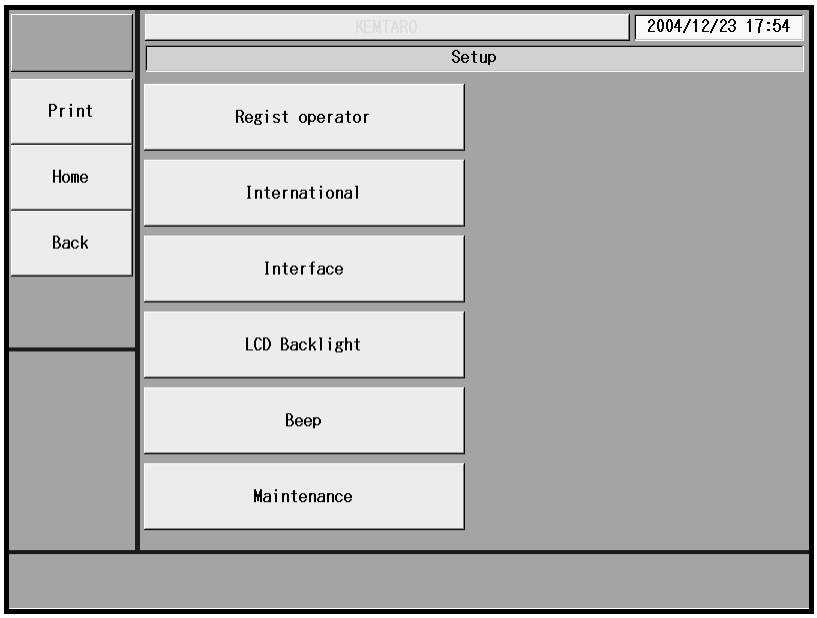
Note:

Those samples added during ongoing measurement cannot undergo pre-treatment process. Also, for the samples added during the last measurement underway, pre-dosing of the following added sample alone won’t be performed.

3-4. About Setup

You can configure system setup using the function of Setup.

Press [Setup] on Main display to show the below screen where you can select desired functions.



[Regist operator]

Here the operator is defined for identification.

[International]

Languages, date and clock time can be set.

[Interface]

Here you configure settings for your printer, the balance and output to a personal computer.

[LCD Backlight]

Here the backlight of LCD can be adjusted.

[Beep]

Beep tone for alarm can be selected on this display.

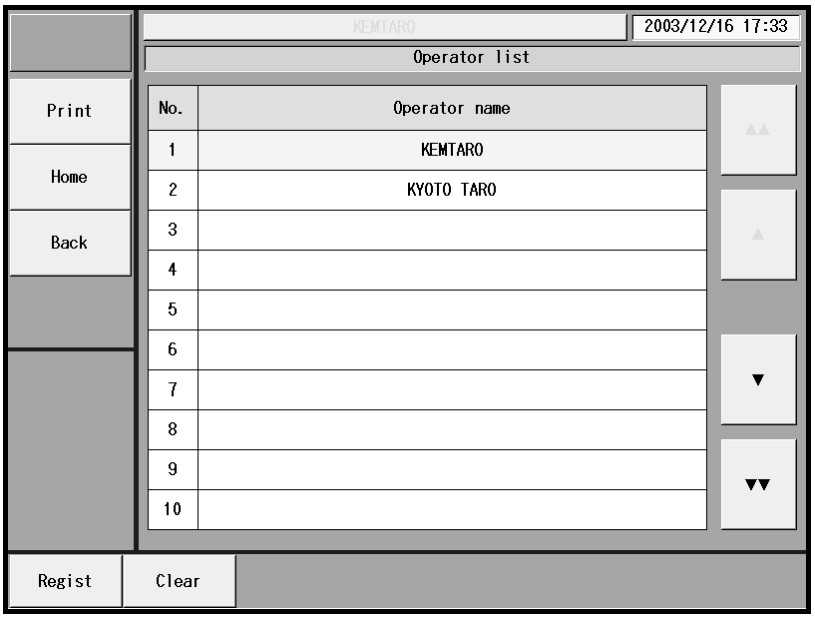
[Maintenance]

Here you can delete the information on devices that are connected to CH1 and/or CH2, and clear the memory.

3-4-1. [Regist operator]

Up to 50 operators can be registered with individual names. The registered name will be automatically printed out together with measurement results. (Characters: alphanumeric including capital and small letters)

Press [Regist operator] button on “Setup” to show the list of operators.



[▲], [▼]

Moves the cursor on the list page.

[▲▲], [▼▼]

The list page turns with these buttons. The cursor moves to the top number after page break.

[Regist]

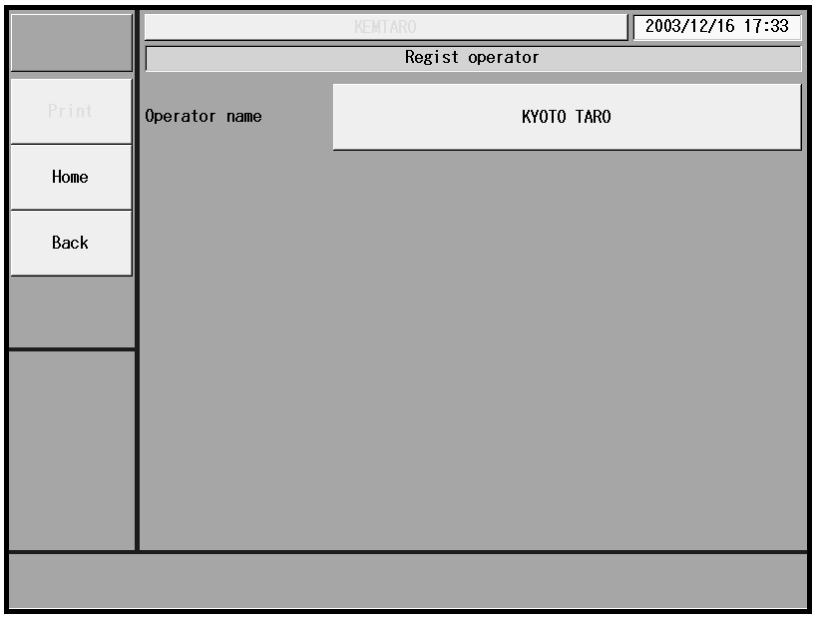
Here the operator is registered. The display for “Regist operator” will appear with this button after pointing the cursor on the operator’s number on the list.

[Clear]

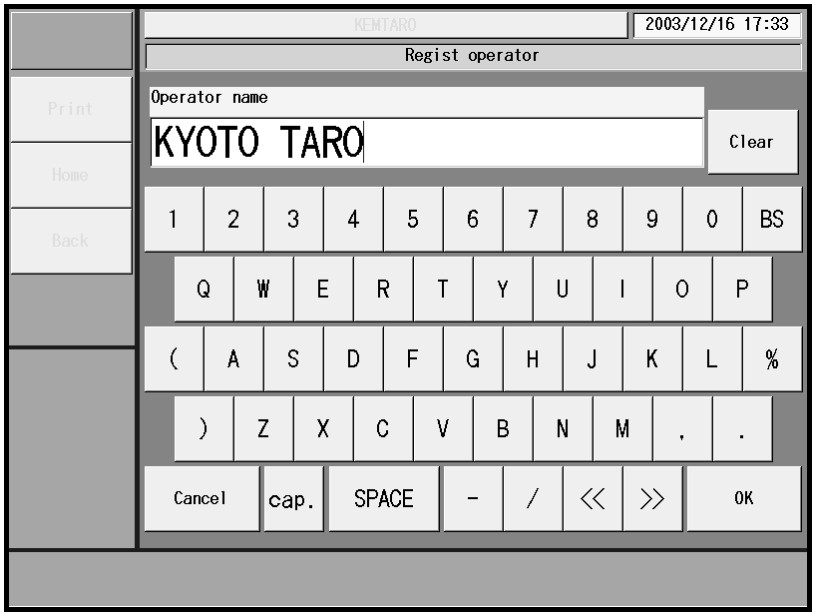
With the cursor pointed on the number you wish to clear, the display will appear to prompt your confirmation.

3-4-1-1. [Regist] button

Press this button on “Operator list” to display “Regist operator” dialog box.



Press the area of operator name. Enter the operator’s name in below display, and press [OK] button.
Press [CAP.] button to use capital letter and [cap.] button for small letter.



3-4-2. [International]

Languages, date and clock time can be set.

Press [International] button on “Setup”.

[Language]

Choose a language either English or Japanese you wish to view and use in operation, and press [OK] button. **The language you have selected will appear after the power is turned off and on again**.

- English
- Japanese

[Date format]

Here you select and update the date of year, month and day. Press [OK] button.

- YYYY/MM/DD : Christian year/month in number/day of the month
- MM/DD/YYYY : month in number/day of the month/Christian year
- DD/MM/YYYY : day of the month/month in number/Christian year

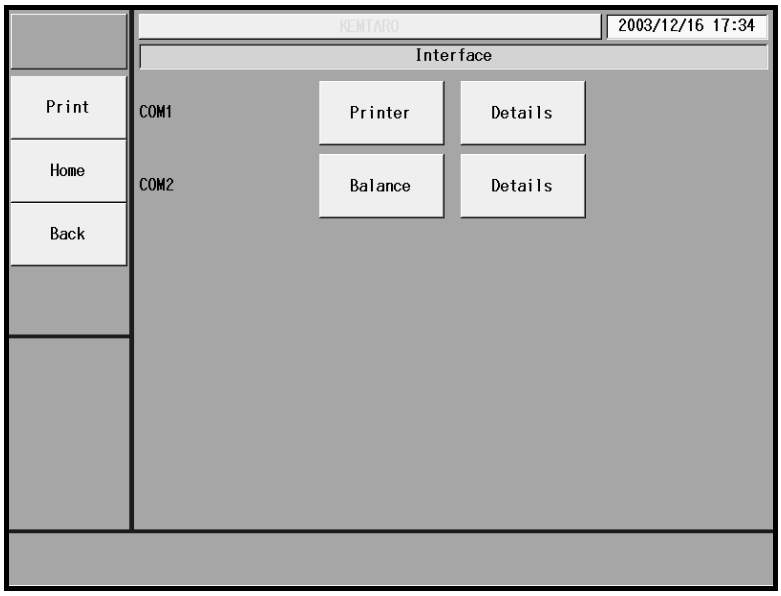
[Date&Time]

Here the date and time are updated. Press the date button for calendar and select the present date and time. The hour and minute can be entered with numerals which appear on display. Then, press [OK] button.

- Date : 2001/01/01 ~ 2099/12/31
- Time : 00:00 ~ 23:59

3-4-3. [Interface]

Here you set up the use of printers, balance and/or Personal computers. Press [Interface] button on "Setup".



[COM1], [COM2]

The COM ports are for the output to a printer, data transfer from an electronic balance and/or the output of measurement results to a personal computer. There are two COM ports available; data can be output to the printer through either COM port. Only one electronic balance can be connected. Pressing [Details] button will turn the screen display to the Option screen display, where the properties of COM port can be set.

Selection:

- Not connected
- Printer
- Balance
- PC

[Details]

Whether COM1 or COM2 is chosen, either "Printer setting" or "Balance setting" appears depending on your choice.

Note:

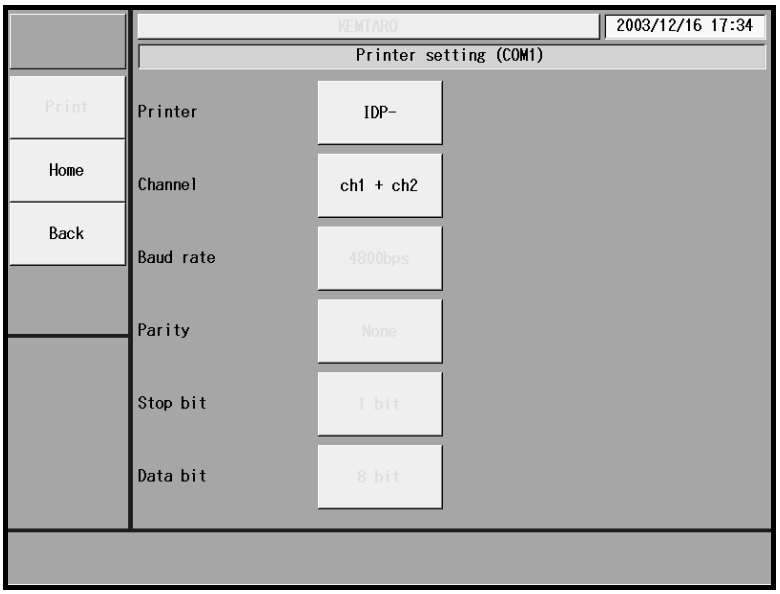
For details on printer or balance setting, refer to "3-4-3-1. Printer setting" or "3-4-3-2. Balance setting".

Note:

When you want to transfer the output data to a personal computer, you need to purchase our optional Data Capture Software (SOFT-CAPE). But you have to check the version of the Data Capture Software because some software cannot be compatible with the titrator. For more information, please contact your sales representative nearest to or local dealer.

3-4-3-1. Printer setting

Choose either COM1 or COM2 on “Interface”, and press [Details] button to show below display.



[Printer]

Select a type of printer you are going to use:

- IDP- : KEM’s impact dot printer model IDP-100
- DP- : KEM’s thermal printer model DPU-414
- Other : Other printer than the above

Note:

For printer type and configurations, refer to the Table 3-4-3. The communication protocol between your printer and titration unit must match. Otherwise, printing may fail and halt halfway. For digital configurations for your printer, refer to the operation manual for the printer.

[Channel]

Two channels can be selected in three ways as follows:

- ch1 : The data from the unit connected to channel 1 are printed out.
- ch2 : The data from the unit connected to channel 2 are printed out.
- ch1+ch2 : The data from the unit connected to channel 1 and 2 are printed out.

[Baud rate]

If you use other printer as defined on “Printer”, you have to select baud rate for your printer:

- 600bps
- 1200bps
- 2400bps
- 4800bps
- 9600bps

[Parity]

If you use other printer as defined on “Printer”, you have to select parity for your printer:

- None
- Even
- Odd

[Stop bit]

If you use other printer as defined on “Printer”, you have to select parity for your printer:

- 1 bit
- 1.5 bit
- 2 bit

[Data bit]

If you use other printer as defined on “Printer”, you have to select data bit for your printer:

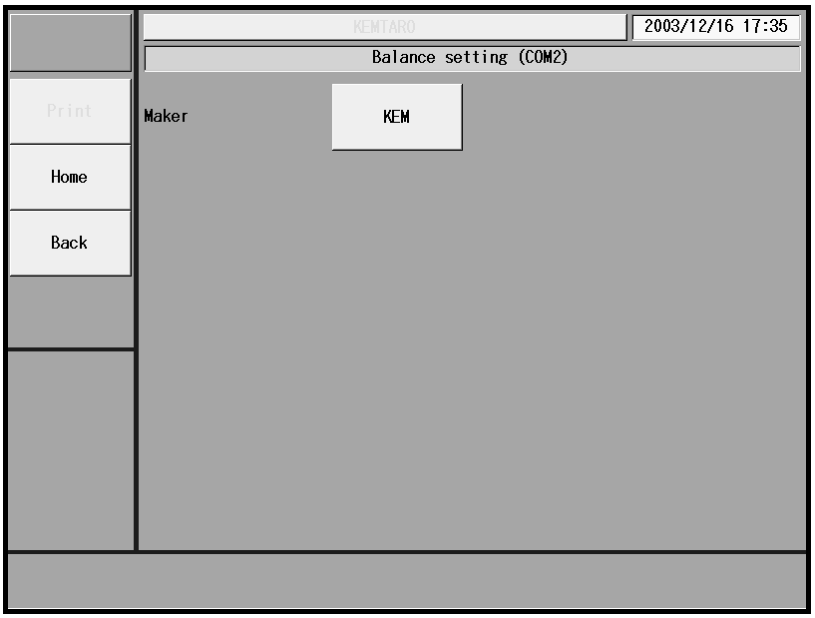
- 7 bit
- 8 bit

Table 3-4-3

Printer	Cables	Titrator setup	Printer settings
Seiko DPU-414	Connecting cable 98-030-0007	Printer DP-	Digital configurations for printer: Baud rate : 4800 Parity : none Stop bits : 1 Data bits : 8
Citizen CBM-910 CBM-910 Type Ⅱ	Connecting cable 98-030-0004	Printer IDP-	Digital configurations for printer: Baud rate : 4800 Parity : none Stop bits : 1 Data bits : 8
Citizen CBM-270	Connecting cable 98-030-0004	Printer Other	No titration curve is available. Match protocol between printer and unit.

3-4-3-2. Balance setting

After Balance is selected on “Interface” by way of COM1 or COM2, press [Details] button to show the display as below:



[Balance]

Select the maker’s name of your balance:

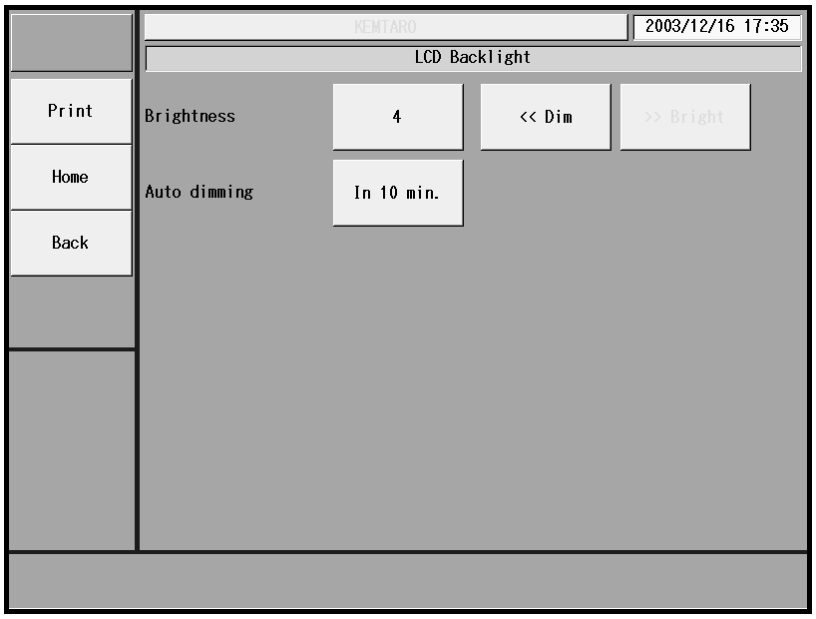
- KEM
- Mettler
- A&D
- Shimadzu
- Sartorius

Note:

Make sure to contact your local dealer to see if any particular connecting cable may be required.

3-4-4. [LCD Backlight]

Here the brightness of backlight for LCD and its auto dimmer can be adjusted:



[Brightness]

The brightness of backlight can be adjusted with 4 steps:

- 1/2/3/4

[Auto dimming]

The auto dimmer turns off the backlight after the preset time elapses:

- Off
- In 10 min.
- In 20 min.
- In 30 min.
- In one hour
- In two hours

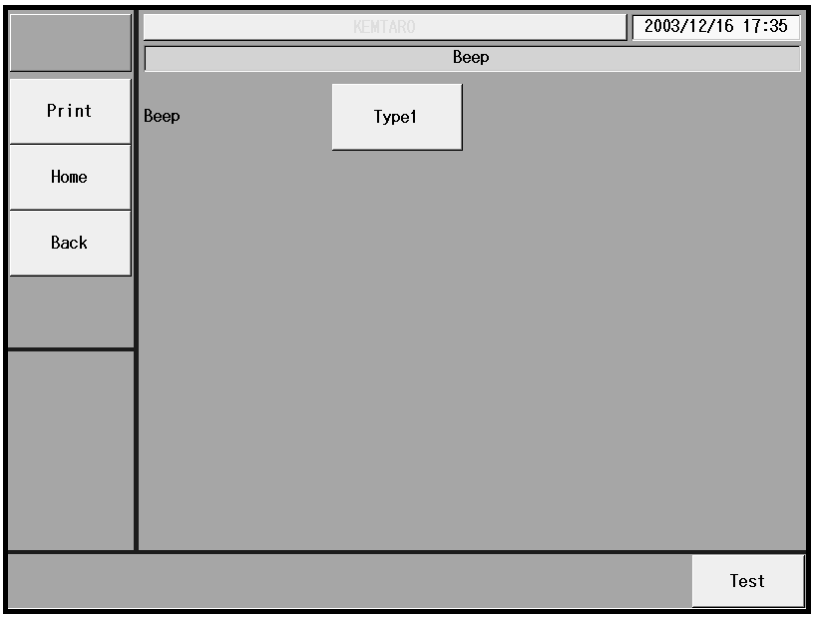
Note:

When 'Auto dimming' is selected and no key entry has been made for three hours, the backlight will eventually go out following auto dimmer feature. In this event, the backlight feature will recover to the state before the dimmer utility was on by touching the screen panel.

3-4-5. [Beep]

Here you can select the beep and its tone as follows:

Press [Beep] on “Setup”.



[Beep]

There are five types of beep tone you can choose from:

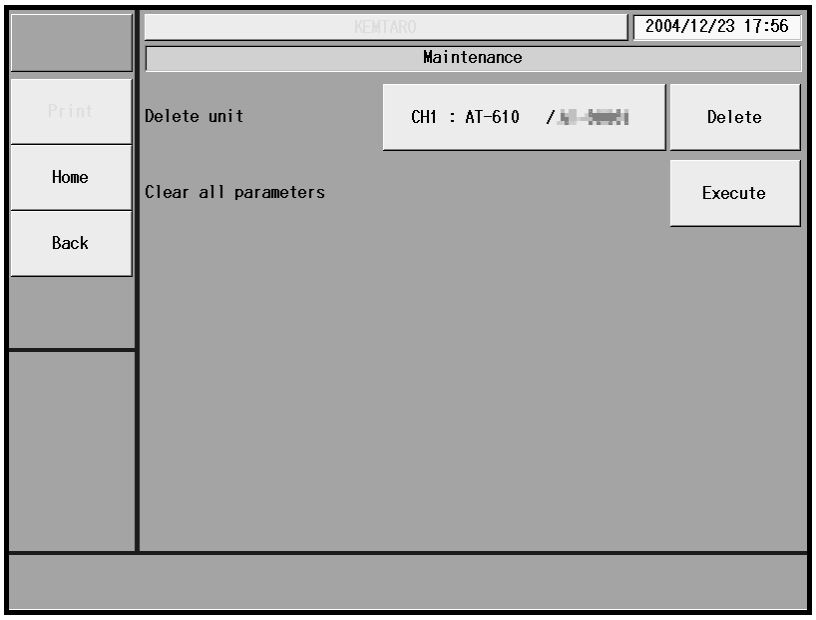
- Off : Setting of beep sound is cancelled. Beep sound is muted even for key operations.
- Type 1 : Beep sound lasts for about two seconds: “pi, pea-pea-pea-pea”
- Type 2 : Beep sound lasts for about four seconds: “pi-pi-pi-pi-pi-pi”
- Type 3 : Beep sound lasts for about ten seconds: “pi, pea-pea-pea-pea”
- Type 4 : Beep sound lasts for about one second: “pi-pi-pi-pi-pi-pi”
- Type 5 : Beep sound lasts for about one second: “pi, pea-pea-pea”

[Test]

The selected beep tone can be tested here.

3-4-6. [Maintenance]

Turn on the mains of the Main Control Unit, MCU-610, only.
Press [Maintenance] button on the “Setup” screen display.



[Delete unit]

The following procedures are necessary when a different measuring unit or units are registered where CH1 and CH2 are occupied by measuring units such as MKC-610, MKA-610 or AT-610.
The first step is the selection of information on the measuring unit to be initialized:

- CH1: (Unit name)/ (Serial No.) : Select information on the measuring unit connected to CH1.
- CH2: (Unit name)/ (Serial No.) : Select information on the measuring unit connected to CH2.

Pressing [Delete] button will lead to deleting the device information on the selected measuring unit.

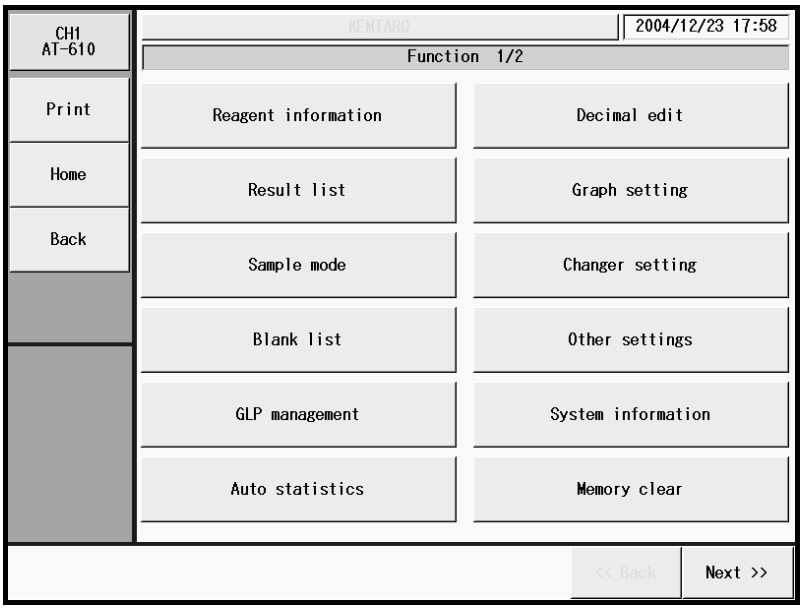
[Clear all parameters]

Here you can initialize all data and setup configurations stored on the measuring units occupying CH1 and CH2. Pressing [Execute] button will allow to initialize all data on the units.
When an initialization is executed, the displayed language will turn to Japanese and the display date format becomes “YYYY/MM/DD”. Change these settings to ‘English’ and to “MM/DD/YYYY”’, respectively, referring to the Section 3-4-2 “International”.

Note:
Be sure to save all necessary measurement and method data to a CF card before initializing measuring units or executing all memory clear.

3-5. Function

Press “Function” button on Main display.



[Reagent information]

Here you set in the information on reagents including their names, reagent factor, replacement date, etc.

[Result list]

You can view the list of measurement results where you can re-calculate or batch-calculate them.

[Sample mode]

Here you can set up how to maneuver sampling after measurement or preset sample parameters in sample file mode, etc.

[Blank list]

This is the list of blank values including 10 different ones you can store.

[GLP management]

Here you set up functions to meet with GLP requirements including periodic check, advance notice of check date at intervals, etc.

[Auto statistics]

The series of measurements performed under the same conditions (Method) can be automatically printed out by this function.

[Decimal edit]

This function includes setting the number of decimal places for a sample size when printed out or displayed on screen as well as how to round off in calculation.

[Graph setting]

Set parameters for graphing the results. Can draw graphs by plotting “Titr. volume vs Pot.”, first-derivative values and the like.

[Changer setting]

Set the sequence for cleaning when using a sample changer.

[Other settings]

This includes the auto input of averaged values and the alarm function, etc.

[System information]

You can view the list of equipment presently connected to the channels in work as well as the information on software version.

[Memory clear]

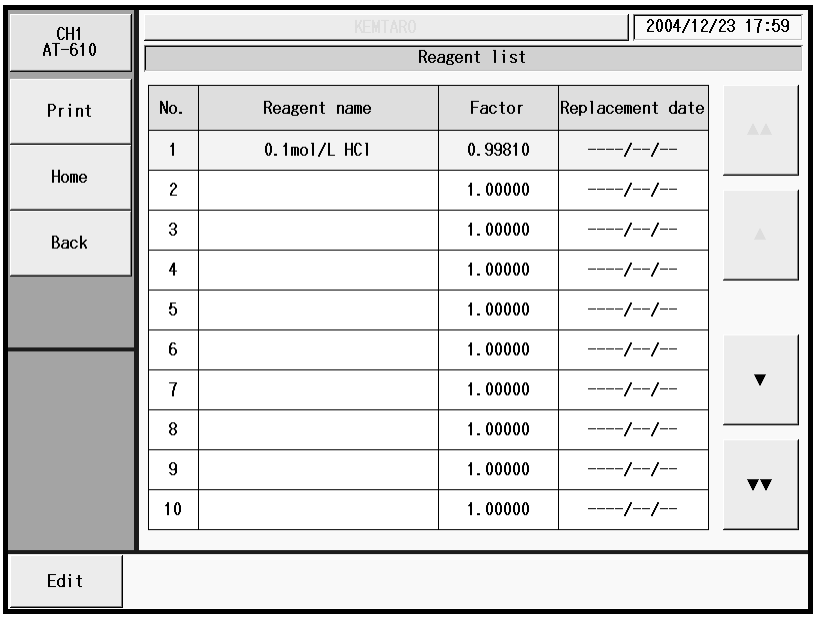
With this function, you can erase measurement results, methods or sample parameters selectively by individual sample.

[Operation of CF card]

Load the data saved on CF card into the measuring unit or delete the saved data.

3-5-1. [Reagent information]

On “Function” display, press [Reagent information] button to show the list of reagent.
By setting reagent information, you can control and manage the information on each burette unit including reagent name, concentration, factor and calculation constant. Up to 20 information files on reagents can be stored.



[▲], [▼]

Moves the cursor on the list.

[▲▲], [▼▼]

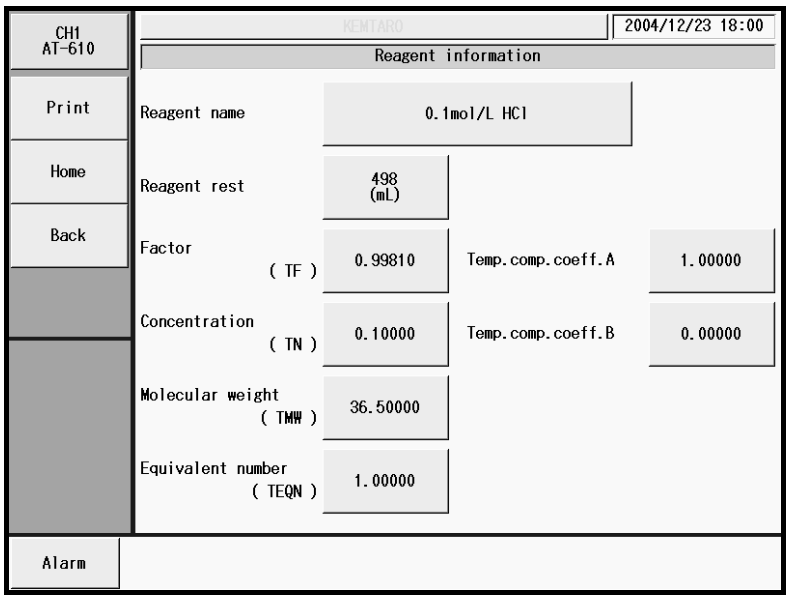
These keys are for page turning. The cursor moves to the top of the list after page break.

[Edit]

With this button, the display of “Reagent information” appears where you can edit the information on the reagent with the cursor pointed on. Such information includes reagent name, reagent factor, consumption volume, alarm setting, replacement date, etc.

3-5-1-1. [Edit] – [Reagent information]

Press [Edit] button on “Reagent list” to show “Reagent information”.



[Reagent name]

Here you enter the name of reagent. Press the button with reagent name for entry.
Up to 20 characters can be entered.

[Reagent rest]

Enter the amount of remaining reagent at the present time.

- 0 ~ 9999mL

[Factor (TF)]

Can enter reagent factor. This value can be used for TF constant for calculation parameter on Method.

- 0.00000 ~ 99999.99999

[Concentration (TN)]

Can enter reagent concentration. This value can be used for TN constant for calculation parameter on Method.

- 0.00000 ~ 99999.99999

[Molecular weight (TMW)]

Can enter reagent molecular weight. This value can be used for TMW constant for calculation parameter on Method.

- 0.00000 ~ 99999.99999

[Equivalent number (TEQN)]

Can enter reagent equivalent number. This value can be used for TEQN constant for calculation parameter on Method.

- 0.00000 ~ 99999.99999

[Temp. comp. coeff. A]

Can enter temperature compensation coefficient A. The meaning of this temperature compensation of titrant is a volumetric correction using the temperature of the titrant.

- -99999.99999 ~ 99999.99999

[Temp. comp. coeff. B]

Can enter temperature compensation coefficient B.

- -99999.99999 ~ 99999.99999

Note:

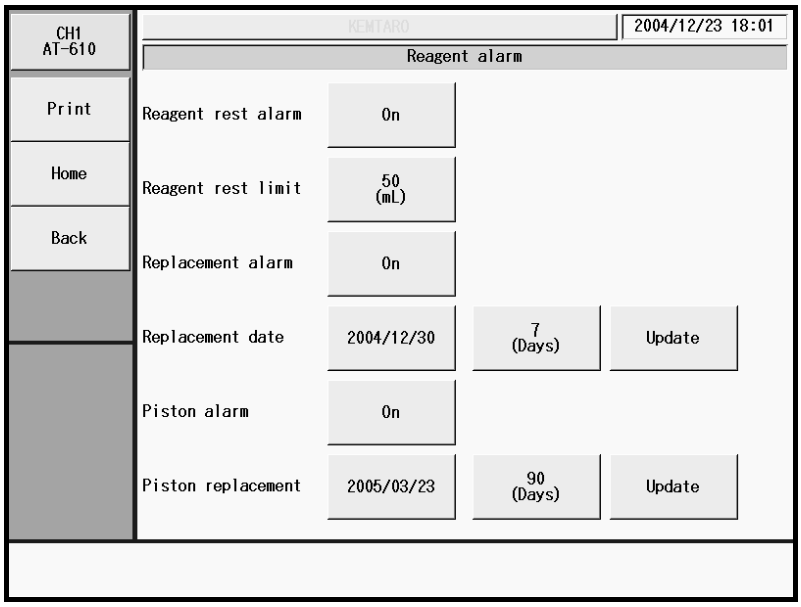
For more details of temperature compensation, refer to the Section "3-8-7-3. Titrant temperature compensation".

[Alarm]

Select the alarm type with this button. When pressed, it shows currently significant alarms.

3-5-1-2. [Edit] – [Reagent alarm]

Press [Alarm] button on “Reagent information” to show “Reagent alarm” dialog box.



[Reagent rest alarm]

Select to activate this alarm or not.

- Off : No alarm
- On : Alarm is on

[Reagent rest limit]

Select the alarm of lower limit of remaining reagent.

- 0 ~ 9999mL

[Replacement alarm]

Here you can choose from on or off for alarming reagent replacement.

- Off : No alarm
- On : Alarm is on

[Replacement date]

Here you can set up a time length by a number of days for next replacement of reagent.

- [xx (Days)] : Set a time interval by a number of days
- [Update] : Set the next date for replacement as preset intervals

[Piston alarm]

Select the alarm about the date for changing the burette piston or not.

- Off : No alarm
- On : Alarm is on.

[Piston replacement]

Here you can set up a time length by a number of days for next replacement of piston.

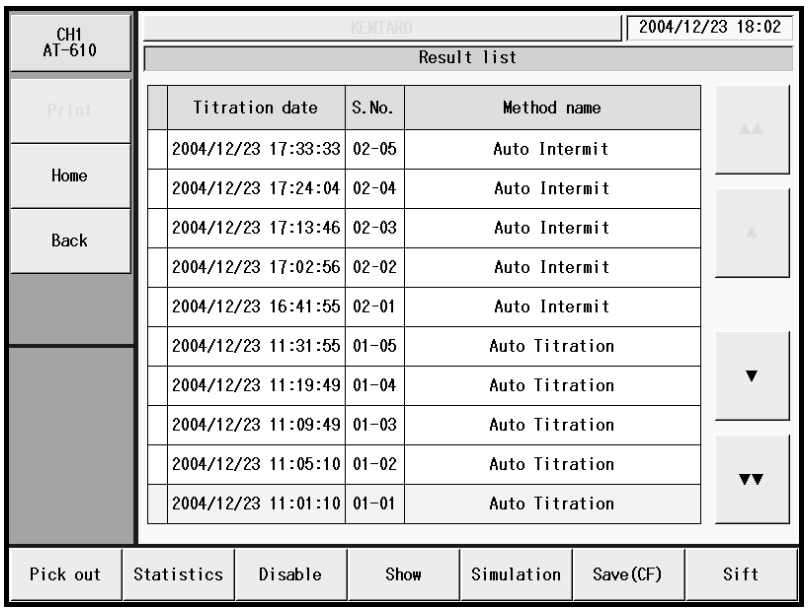
- [xx (Days)] : Set a time interval by a number of days
- [Update] : Set the next date for replacement as preset intervals

Note:

To use the alarm function, make "Alarm" turned "On" when you set up on [Function] – [Other settings].

3-5-2. [Results list]

Press [Results list] button on “Function” to show “Results list”.



[▲], [▼]

Moves the cursor on the list.

[▲▲], [▼▼]

These keys are for page turning. The cursor moves to the top of the list after page break.

Note:

Up to 100 samples measurement results can be stored. As for combined titration results, the number of combined methods is stored. When it exceeds 100, note that data will be erased on the first-in first-out basis.

[Pick out]

On this screen you can select the results you are looking for among the data in the list.

Note:

For details of Pick out, refer to “3-5-2-1. [Pick out]”.

[Statistics]

The measurement results in the list are batch calculated. If the data are selected in Pickout, those selected data will be calculated.

Note:

For details of Statistics, refer to “3-5-2-2. [Statistics]”.

[Disable]

You can delete the data to void batch calculation. Point the cursor on the data and press this button. Those data will be marked with "*"on display.

[Show]

You can view the data with cursor pointed on. This is useful in re-calculation or for re-print.

Note:
For details of resulting data, refer to "3-5-2-3. View titration results".

[Simulation]

This feature allows the unit to redetect the endpoint when the first endpoint has not been found due to very small inflection ratio. This feature is not applicable to the results of a combined titration.

Note:
For details of the redetection of EP, refer to "3-5-2-4. [Simulation]".

[Save (CF)]

Save the measurement data on CF card. When data is narrowed with [Pick out], the narrowed data will be saved on CF card.

Note:
For the details on saving measurement data on CF card, refer to "3-5-2-5. [Save (CF)] (Titration results)".

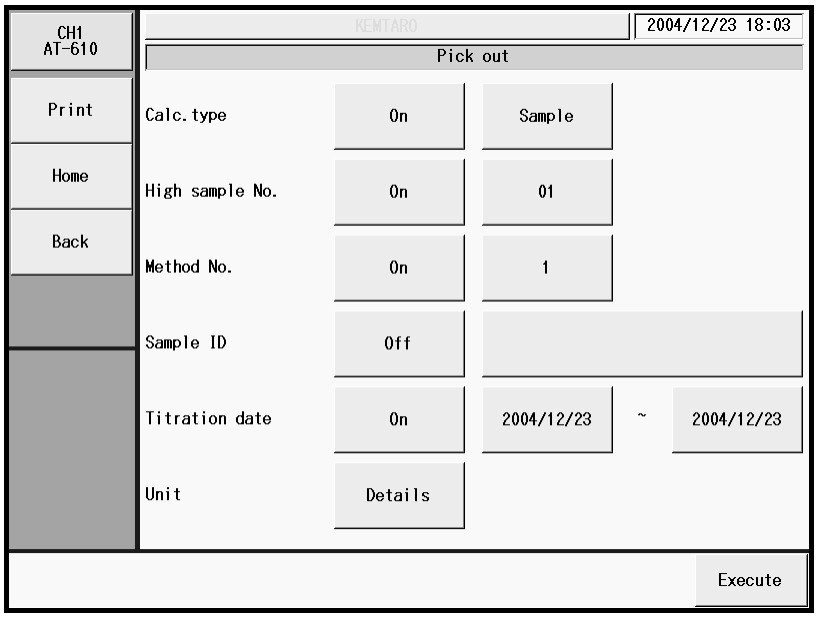
[All] or [Sift]

Here you choose from All or Sift in search for measurement results.
For setting search conditions, press the [Pick out] button.

3-5-2-1. [Pickout]

You can narrow down measurement results with Calc. type, High Sample No., Method No., Sample ID, Titration date or Unit.

Press the [Pick out] button on “Pick out” to show the “Result list”.



< Search conditions >

You can narrow down the data by selecting the following conditions:

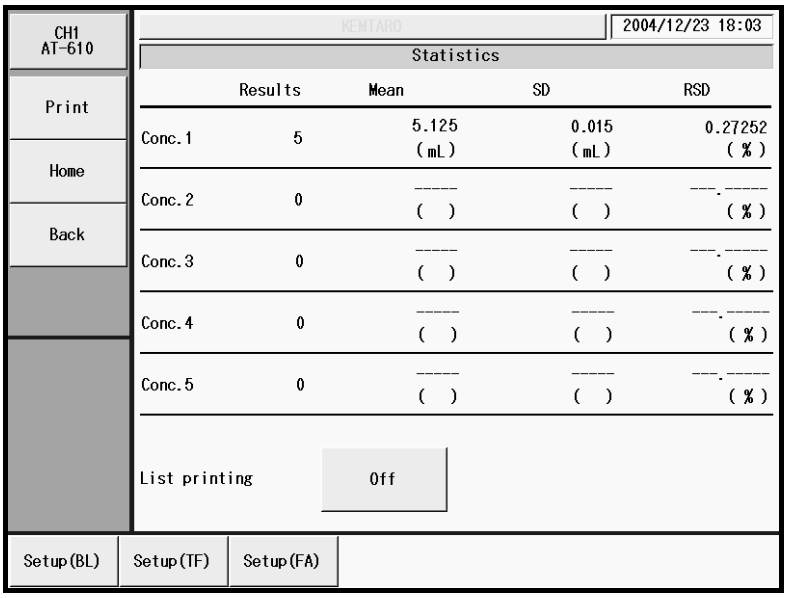
Calc. type	: The titration parameters preset on Calculation Parameter.
High sample No.	: The high order number for grouping the samples.
Method No.	: The number of Method particular to it.
Sample ID	: The identification code particular to the sample.
Titration date	: The date of measurement when it was performed.
Unit	: The unit used in calculation results. Press [Details] button for setting the unit. Unit N allows you to narrow down searched data with the unit used in the Formula N.

[Execute]

The selected data under the conditions as above will appear as a list of results on display.

3-5-2-2. [Statistics]

Press [Statistics] button on “Results list”. The data on the list are going to be batch calculated, and the calculated data will be printed out if [Print] button is pressed.



< About statistics >

The batch calculation determines Mean value, Standard deviation (SD) and Relative standard deviation (RSD), which is the same as coefficient variance (CV).

Those values are calculated by the built-in processor as follows:

Where n number of data (X1, X2, ….. , Xn):

Mean value $$\overline{X} = \frac{(X_1 + X_2 + \cdots + X_n)}{n}$$

Standard deviation $$SD = \sqrt{\frac{\sum_{i=1}^{n}\left(X_i - \overline{X}\right)^2}{n-1}}$$

Relative SD $$RSD(\%) = \frac{SD}{\overline{X}} \times 100$$

[List printing]

You can choose from Yes or No to print the statistical data:

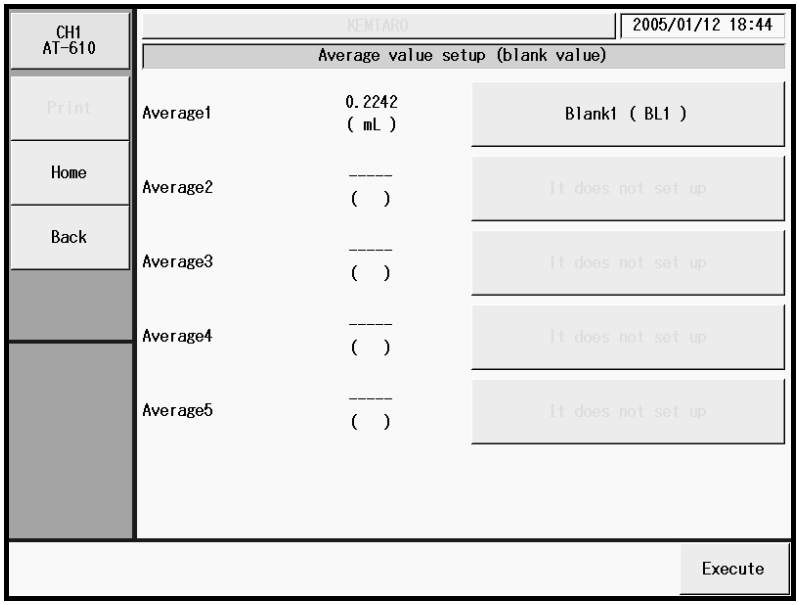
- Off : No printout
- On : Print the results list

Note:

Statistics calculation should set up and perform seach conditions. For example, when the unit of “Pickout” is not set as “On”, the unit of Mean value and SD is not displayed. If the mean value is zero “0”, RSD will appear on display and be printed out as “– –” symbols not as zero “0”. In addition, when the number of digits of statistical calculation results is greater, all digits may not be displayed.

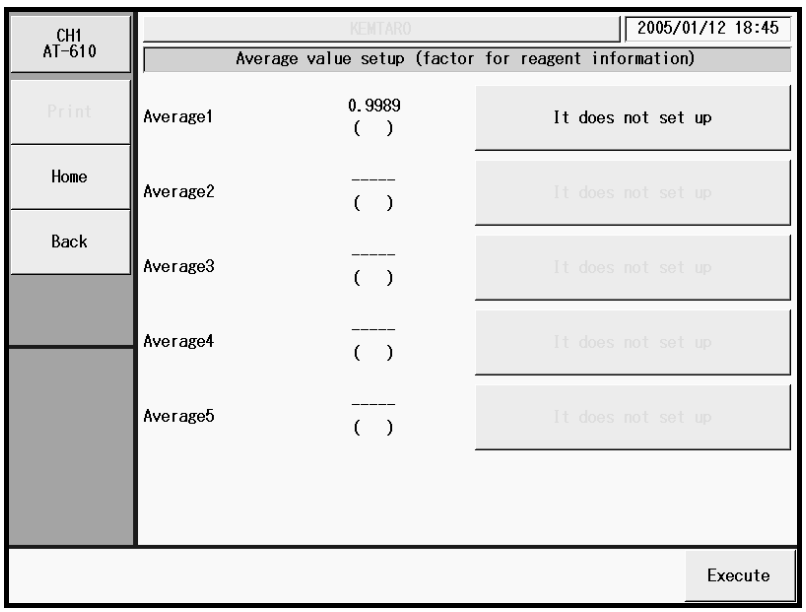
[Setup (BL)]

Here you can register the average value of statistical results as blank value by selecting [Function] – [Blank list]. Then select a blank number (No.) and press [Execute] button. An average value will be registered as Blank N value.



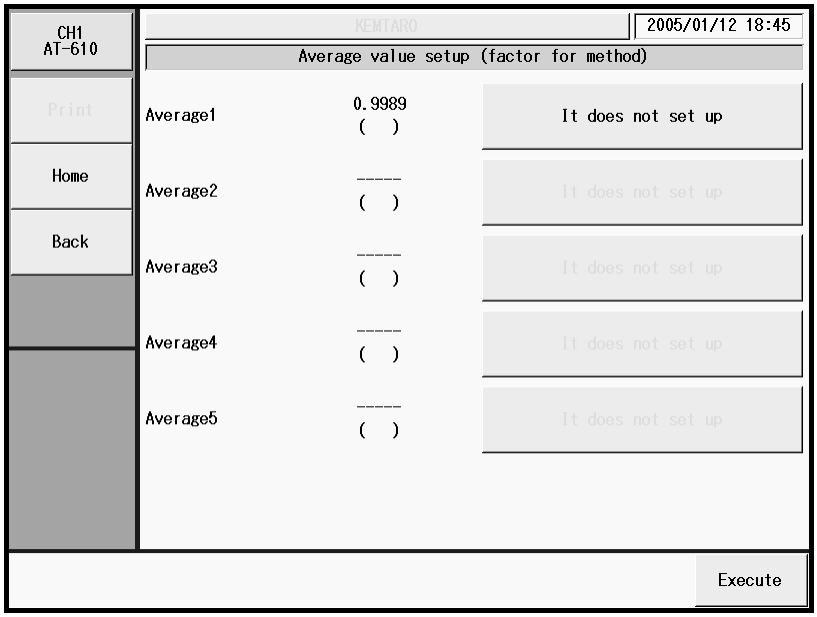
[Setup (TF)]

Here you can register the average value of statistical results as the factor value by selecting [Function] – [Reagent information]. Select a reagent information number (No.) you want to register and press [Execute] button. An average value N will be registered as Factor (TF) on the reagent information N.



[Setup (FA)]

Here you can register the average value of statistical results as the local factor of Method calculation parameter. Select a number (No.) to be registered and press [Execute] button. An average value n will be registered on the Local Factor (FA) of the Method No. N.

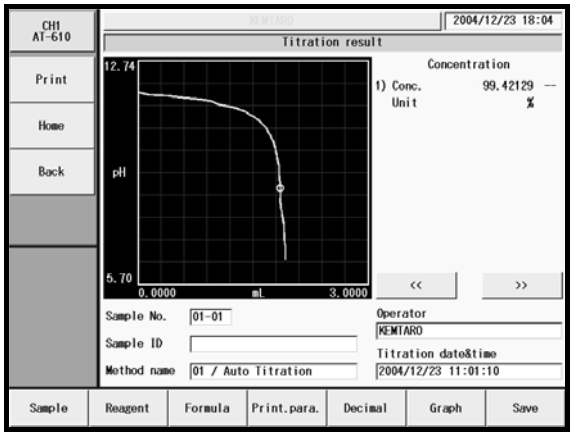


3-5-2-3. View of titration results

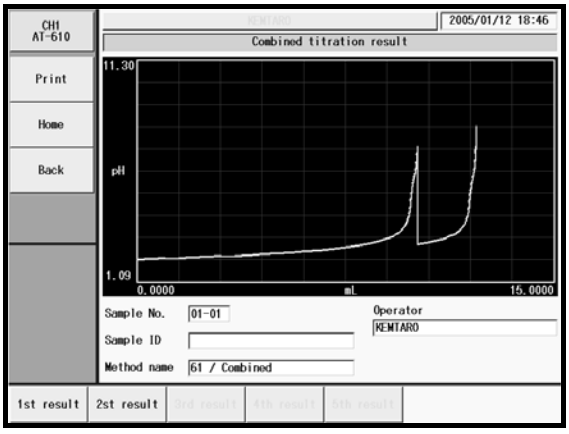
Press [Show] button on “Results list” to view titration results on display. The results of a combined titration show the combined results. When you want to display individual results, press [N result] button. The results can be re-calculated.

Press [Print] button to print out the results of titration or recalculation. The results of recalculation are printed out with sample number (Sample No.) headed with (#) mark.

< Titration results >



<Results of Combined titration>



[<<] [>>]

With these keys you can see the contents of titration results in the order of calculation results, evaluation range, the endpoint and EP level.

[Sample]

Sample conditions can be changed with this key, that is, sample name, sample ID, sample unit, sample size, constant (reagent molecular weight, equivalent number) etc. except sample number that cannot be changed. After changes, if any, are made, press [Re-Calc.] button to confirm the changes. Those changes are displayed as recalculation results. For details of settings, refer to the Section “3-3. Sample settings”.

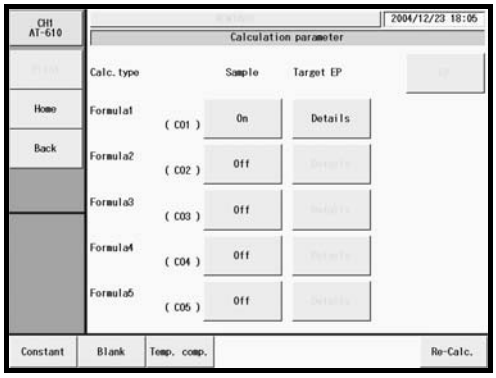
[Reagent]

Here you can change settings of reagent information. After settings are changed, confirm the changes with [Re-Calc.] button. Those changes are displayed as recalculation results.

For details of setting, refer to the Section “3-5-1. [Reagent information]”.

[Formula]

Here you can change the calculation parameter and constant, which were used in titration including calculation formula, constant (C1~C5, R, K1~K5, FA), blank level (BL1~BL10), titration liquid compensation parameter, etc. After settings are changed, confirm the changes with [Re-Calc.] button. Those changes are displayed as recalculation results. For the details of settings, refer to the Sections, "3-5-4. [Blank list]" and "3-8-7. Calculation parameter".



[Print. Para.]

Print parameters used in titration are shown here. After settings are changed, confirm the changes with [Apply] button. Those changes are displayed as titration results. For details of setting, refer to the Section "3-8-8. [Print parameter]".

[Decimal]

You can change the number of digits after decimal point for sample size. After settings are changed, confirm the changes with [Apply] button. Those changes are displayed as titration results.
For details of setting, refer to the Section "3-5-7. [Decimal edit]".

[Graph]

You can change the settings for graph printout. After settings are changed, confirm the changes with [Apply] button. Those changes are displayed as titration results. For details of setting, refer to the Section "3-5-8. [Graph setting]".

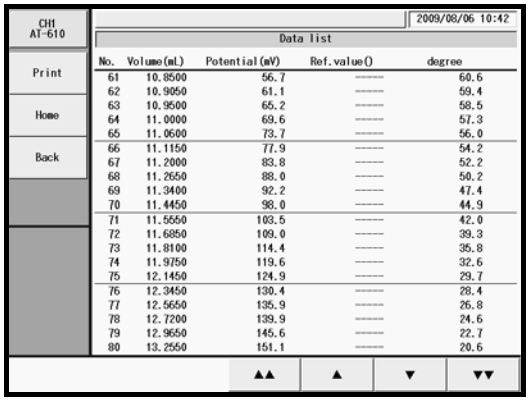
[Save]

Those changes that have been made are saved in memory.

Note:
To save the contents once changed with [Re-Cal.] or [Apply] button, press [Save] button.

<Data list of titration results>

When anywhere on the line graph is pressed, the data list of the touched area will appear. Press [Back] to return to the previous page (“Titration result”).



[▲], [▼]

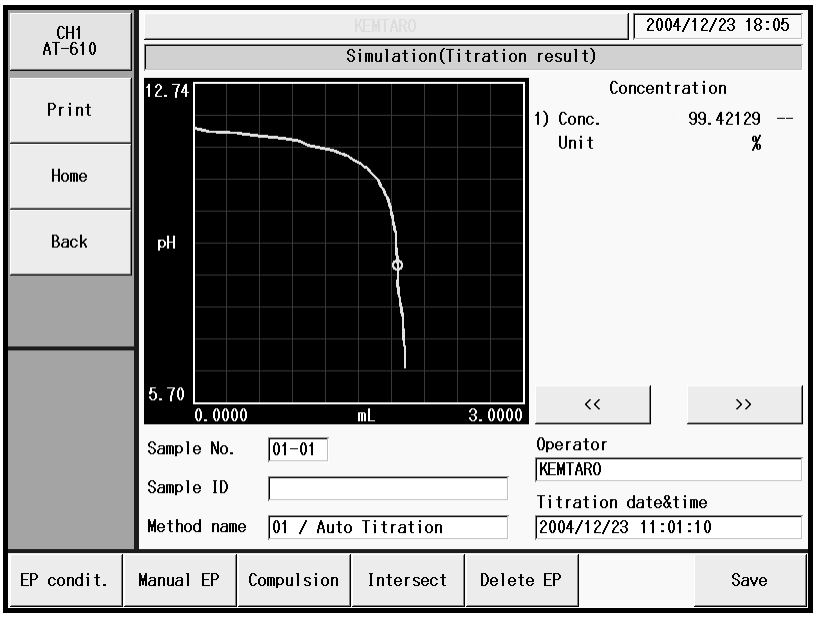
Press these to move up/down the data one by one.

[▲▲], [▼▼]

Press these to go to the previous/next page.

3-5-2-4. [Simulation]

Press [Simulation] button after selecting titration results on “Result list”.
You can redetect the titration results. There are four (4) ways for EP re-detection. After making re-detection on each parameter, press [Save] button to store the results of re-detection.



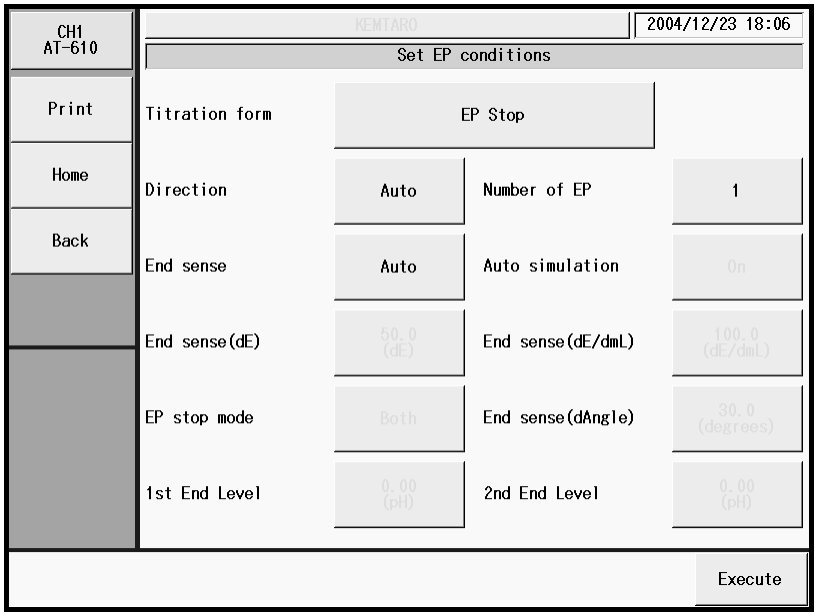
Note:

Redetection of EP is not applicable to titration mode such as “Stat” or “Combined titration”.

[EP condit.]

This function determines the endpoint for which conditions you have preset in advance.

Enter the number of endpoints and EP levels and press [Execute] button. The desired endpoint is redetected and printed out as the result of recalculation according to the preset print parameters when [Print] button is pressed. Those recalculated results appear on printout with sample number with (#) mark as postfix.

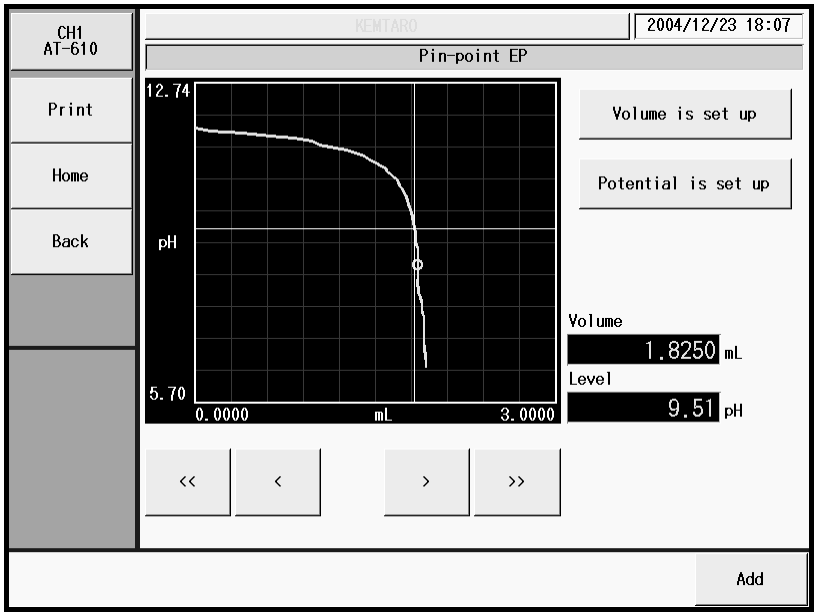


Note:

Regarding parameters for "Set EP conditions", refer to the Section "3-8-6. [Control parameter]".

[Manual EP]

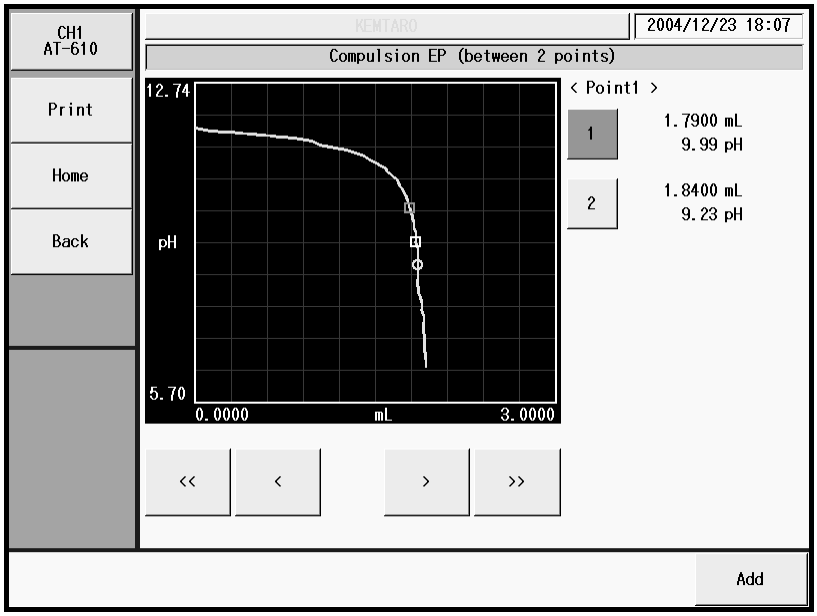
This function allows you to set an EP at any desired point on a titration curve.



Move the cursor line to the vicinity of a desired EP point with [<<], [<], [>] or [>>] button.
Titration volume and EP potential level will be shown on the point to which the cursor points.
When you want to configure more detailed titration volume or EP potential, press [Volume is set up] or [Potential is set up] button to enter an EP value.
The entry of an EP can be confirmed when [Add] button is pressed. The addition of endpoints will lead to the display of recalculated results. Pressing [Save] button will allow the result of re-detecting EP value to be stored in the memory.
Press [Print] button in order to print out recalculation results. The results will be printed according to the preset format.
The Sample No. on this printout is headed with "#" mark to show that the results have been processed.

[Compulsion]

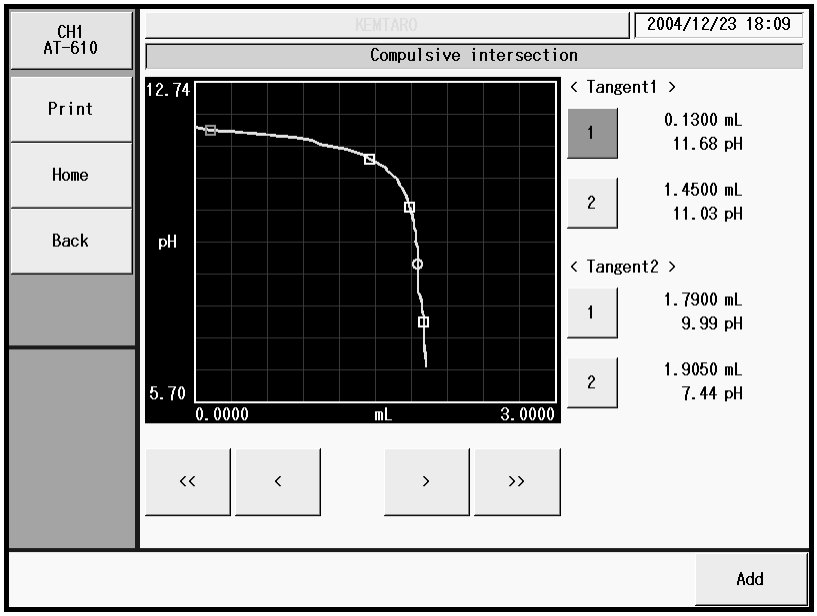
This key features the detection of an EP between two (2) points that are input on a data list.



Here you can set a range where you want to find a desired EP as follows:
First, after [1] button is pushed, drag the cursor over to the desired range on the graph using [<<], [<], [>], [>>] button. Next, after [2] button is pushed, move the cursor to the targeted range in the same manner as for [1]. Then, pressing [Add] button will assign the most appropriate point as an endpoint in the range between 'point 1' and 'point 2'. The addition of endpoints will lead to the display of recalculated results. Pressing [Save] button will allow the result of re-detecting EP value to be stored in the memory.
Press [Print] button in order to print out recalculation results. The results will be printed according to the preset format.
The Sample No. on this printout is headed with "#" mark to show that the results have been processed.

[Intersect]

This button features the detection of an EP at the intersection where two (2) tangent lines cross over each other.

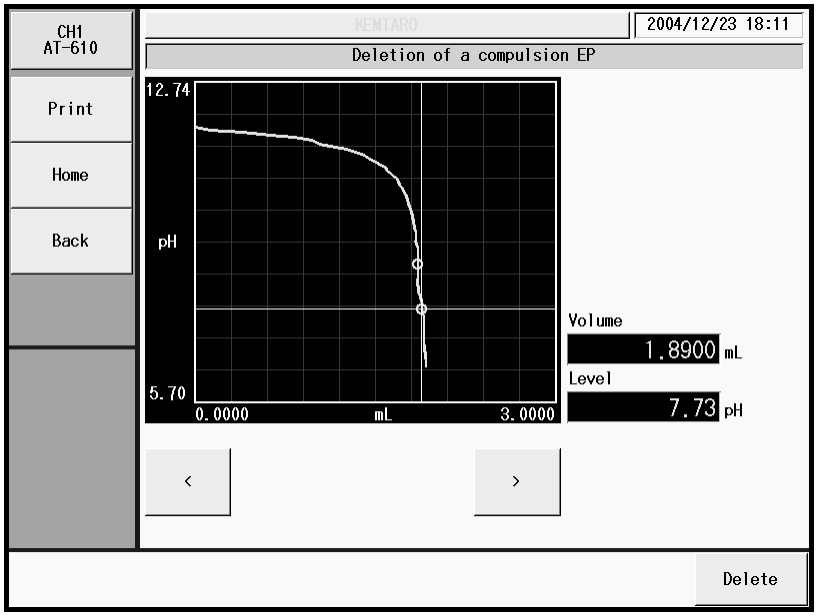


Here you can select two tangent lines by moving the cursor:
First, after [1] button of "Tangent 1" is pushed, drag the cursor over to the starting point that pulls the tangent 1 using [<<], [<], [>] or [>>] button. Next, after [2] button of "Tangent 1" is pushed, drag the cursor over to the terminal that pulls the tangent 1 using [<<], [<], [>] or [>>] button. Similarly, draw another line as "Tangent 2". Then, eventually pressing [Add] button will yield the point (EP1) where these two tangents cross over. The addition of endpoints will lead to the display of recalculated results. Pressing [Save] button will allow the result of re-detecting EP value to be stored in the memory.
The results can be printed out with [Print] button according to the preset format. The Sample No. on this printout is headed with "#" mark to show that the results have been processed.
In the case of two (2) or three (3) endpoints, repeat this procedure by drawing tangent lines as described above for each endpoint.

[Delete EP]

Here you can delete EP's.

Select the EP with [<] or [>] button, and press [Delete] button.



[Save]

Here you can store the results of EP re-detection.

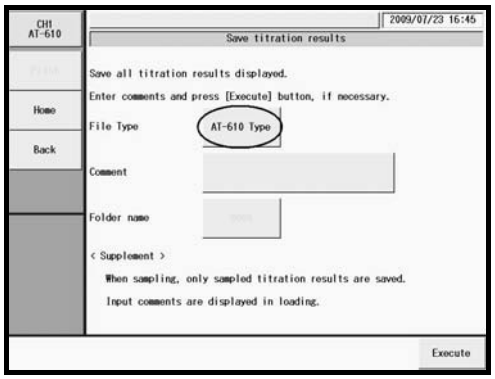
3-5-2-5. [Save (CF)] (Titration results)

Save the titration results on CF card.

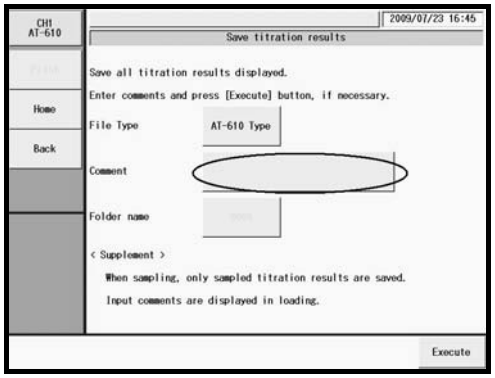
Select the file format to save data.

[File format]

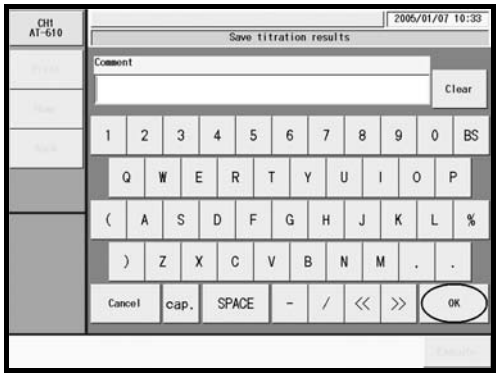
- AT-610 type : Select this if you wish to check data on the MCU-610 or to use data with Tview6, the Analysis Software for Titration Results.
- CSV type : Saved in a CSV file. Select this if you wish to perform your own analysis or to make a report with a commonly-used application software product such as Microsoft Excel, Microsoft Access, Microsoft Word, etc.
  The same results as printout are saved except for titration parameters, control parameters and line chart.



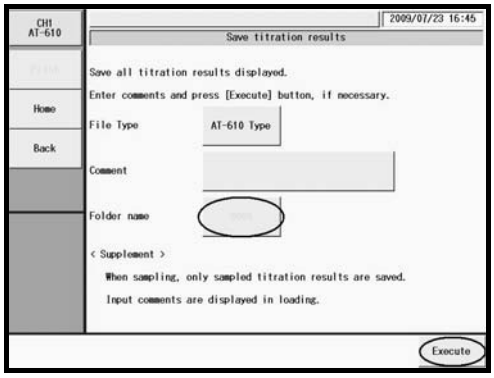
1) Narrow data to be saved according to the section "3-5-2-1 [Pickout]".
2) Press [Save (CF)] button on the "Result list" screen display. "Save titration results" screen will be displayed. If you want to enter your comment regarding the titration results to be stored, press the comment column on display.
3) Select the file format to save.



4) If you want to enter your comment regarding the titration results to be stored, press the comment column on display.



5) The display shows the left screen, and then, press [OK].



6) When saving in a CSV format, enter the folder name (input range: 0000 ~ 9999).
Press [Execute] button on the "Save titration results" screen display. Then, the confirmation screen will be displayed and press [Yes] button.

7) Narrowed titration results are saved on CF card, followed by returning to the "Result list" screen display.

Note:

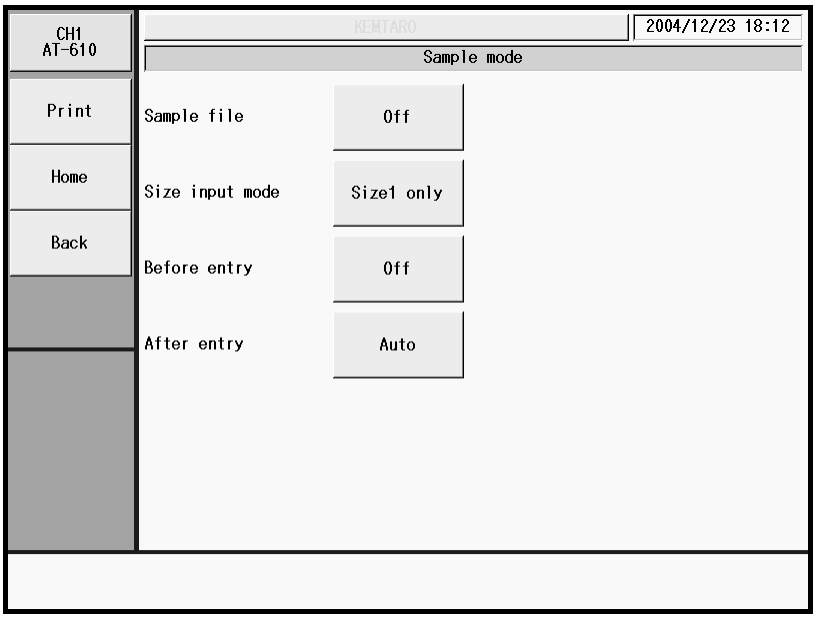
When 100 results of the AT-610 format are saved in a CF card, the file volume will be about 3.5 MB. A CF card needs to have at least 3 MB of space to save the measurement results in a CSV format. In addition, the maximum file number to be stored on CF card is 100. When method data are stored on CF card, the number of file to be stored on CF card will decrease depending on the remaining memory capacity on CF card.

Note:

When you want to allow the titration results saved on CF card to be displayed on the screen of the measuring unit, refer to "3-5-13-2, [Load/Delete titration results]".

3-5-3. [Sample mode]

Press [Sample mode] button on “Function” to show “Sample mode” display, where you define sample settings as follows:



[Sample file]

Here you select sample file mode as a reserved sample for measurement.

- Off : Sample setting display works to Single sample measurement
- On : Sample setting display works to Sample file mode

[Size input mode]

Select entry method for sample quantity. The unit determines whether the sample quantity is already input or not.

- Size 1 only : Entry of Size 1 reads as the sample quantity is already input.
- Size 1, 2 : Entry of both Size 1 and Size 2 reads as the sample quantity is already input.

[Before entry]

Here you select sampling mode before titration;

- Off : Titration starts with [Start] button.
- On : “Sample settings” display appears with [Start] button.
  On “Sample settings”, you enter the sample name and ID, sample size, etc.

[After entry]

Here you select sample size entry mode after titration is over:

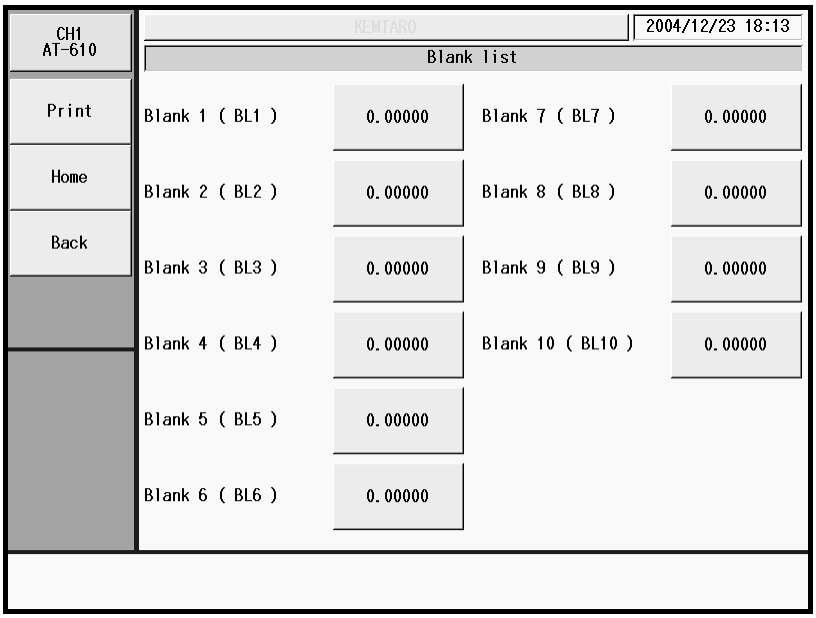
- Off : Water content is calculated and displayed for the sample size currently defined.
- On : After measurement is over, “Sample settings” display appears.
- Auto : After titration is started, it automatically determines if sample size is entered, and if not, the display for sample size entry appears. In the case of sample file mode, it is automatically judged whether a sample has been put between the time after the power was turned on and the time when a titration is completed.

Note:

For details of Sample Setup, refer to “3-3. Sample settings”.

3-5-4. [Blank list]

Press [Blank list] button on “Function” to show the display “Blank list”, where you can compensate water content blending in at time of sample injection. Up to 10 blank values can be preset.



[Blank 1] …..[Blank 10]

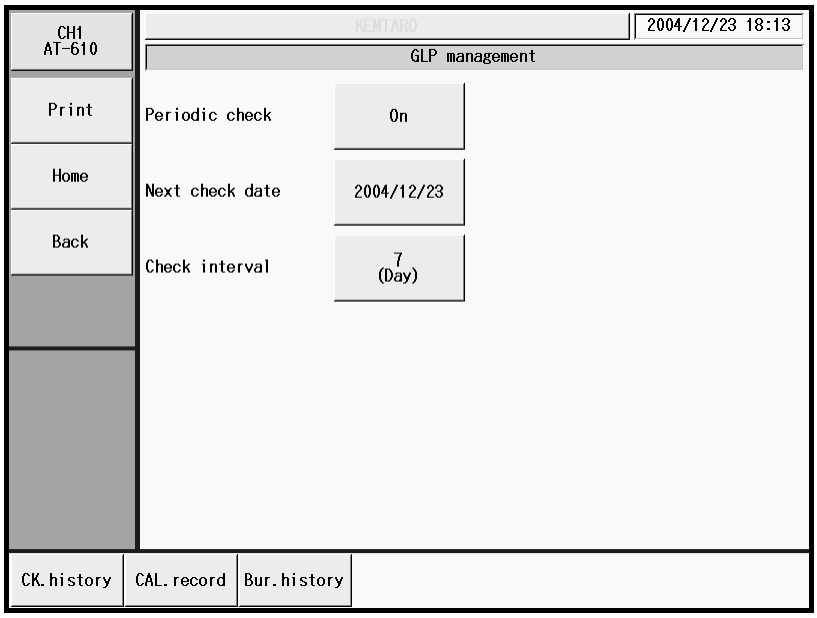
Here you enter blank values.

Such numbered blank values can be selected and used in concentration calculation on Method parameter for calculation parameter.

- 0.00000 ~ 9999.99999

3-5-5. [GLP management]

Press [GLP management] button on “Function” to show the display “GLP management”, where you can check on precision of your instrument periodically. This function works when “Check” is preset on “Calc. type” for calculation parameter on Method parameter.



[Periodic check]

Here you can set check alarm at intervals:

- Off : No alarm will work for periodic check.
- On : Advance notice of check appears when the date becomes due. The check results can be viewed with [CK. histry] button.

[Next check date]

You can select a next check day.

[Check Interval]

The next check day is updated automatically at preset intervals.

Note:
To use the alarm, turn on “Alarm” on [Function] – [Other settings].

[CK. histry]

You can view the periodic check record.

Note:

Up to 100 check records can be stored. When it exceeds 100, the data will be erased in the order of occurrence.

[CAL. record]

Can have a view of the calibration records of detectors and electrodes.

Note:

Up to 100 calibration records can be stored for each calibration channel. Be aware that when it exceeds 100, the data will be erased in the order of occurrence.

[Bur. history]

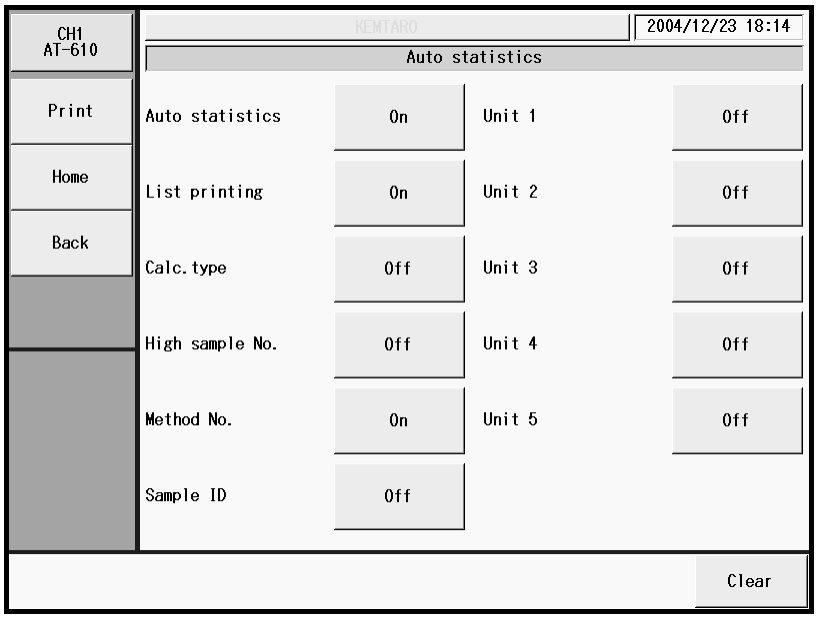
Can have a view of the history of burette precision validation.

Note:

Up to 100 records for validation can be stored.
Be aware that when it exceeds 100, the data will be erased in the order of occurrence.

3-5-6. [Auto statistics]

Press [Auto statistics] on “Function” to show the display [Auto statistics].



[Auto statistics]

Here the results of measurements performed under the same conditions are automatically batch calculated:

- Off : No batch calculation
- On : The results of measurement performed under different conditions will be batch calculated as soon as the measurement is over. Otherwise, the results of measurements performed under the same conditions are automatically batch calculated. After batch calculated, the following data will be calculated. Once power is turned off, this setting will be cleared off.

< Conditions for statistics >

A series of consecutive measurements will be batch calculated and printed out provided the following parameters are preset under the sample conditions:

- Calc. type : Calculation parameter preset on Method
- High sample No. : High order number for sample group
- Method No. : The Method number used in measurement
- Sample ID : The identification code present on Sample settings
- Unit 1~5 : Preset as a calculation parameter on Method

[List printing]

Here you can choose from on or off for printout of statistics data list.

- Off : No printout
- On : Print out the list

[Clear]

You can erase the statistical data.

Note:

For details of statistics, refer to "3-5-2-2. [Statistics]".

3-5-7. [Decimal edit]

Here you select a number of decimal place for view and printout.
Press [Decimal edit] button on “Function” to show the display “Decimal”.

[Sample size]

Here you select a number of decimal place and fraction rounding for sample size as follows:

- Round off : rounded down to nearest preset number of digits after decimal point
- Half adjust : rounded to nearest preset number of digits after decimal point
- Round up : rounded up to nearest preset number of digits after decimal point

[Statistics]

Here you select a number of decimal place and fraction rounding of Mean value and standard deviation for statistics as follows:

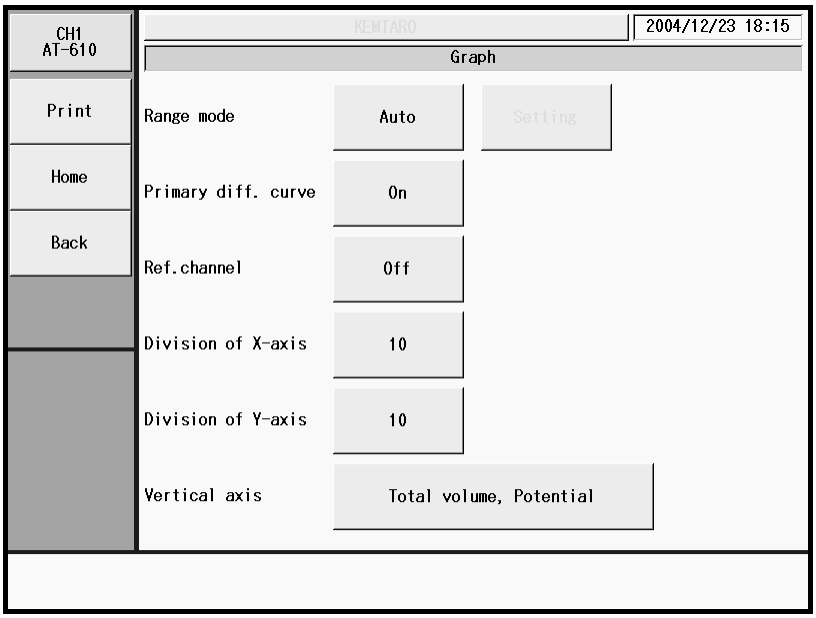
- Round off : rounded down to ·nearest preset number of digits after decimal edit
- Half adjust : rounded to nearest preset number of digits after decimal edit
- Round up : rounded up to nearest preset number of digits after decimal edit

Note:

The above setting of a number of decimal place appears on display and in printing.

3-5-8. [Graph setting]

Press [Graph setting] button on “Function” to show “Graph” display, where you arrange graphic display and printout.



[Range mode]

The graphic range mode can be selected as follows. Usually, “Auto” mode is selected.

- Auto : Graphic range is automatically set up.
- Fixed : You can choose a fixed range by pressing [Setting] button.

[Setting]

Set the fixed range for graph. With this button, “Graph range” screen will be displayed.

This becomes significant when “Fixed” is chosen for “Range mode”.

Note:

For details of setting fixed graph range, refer to the Section “3-5-8-1. Graph range setup”.

[Primary diff. curve]

Select the display for differential curve of normalization potential to determine the endpoint.

- Off : No primary differential curve is displayed on graph.
- On : Primary differential curve will be displayed on graph.

[Ref. Channel]

Select the option of displaying reference channel on the graph:

- Off : No reference channel will be displayed on the graph.
- On : Reference channel will be displayed on the graph.

[Division of X-axis]

Select the division number of X-axis on a graph.

- 2~20

[Division of Y-axis]

Select the division number of Y-axis on a graph.

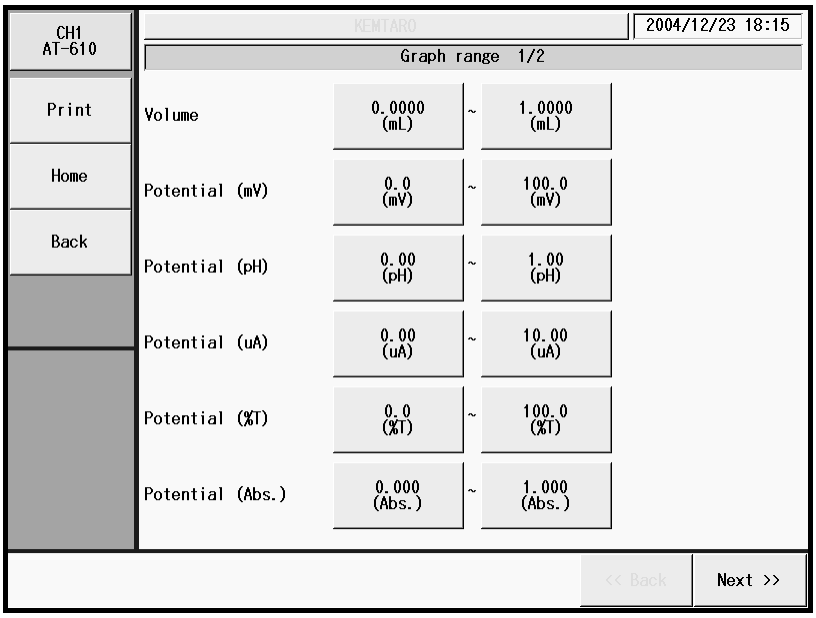
- 2~20

[Vertical axis]

Select graphical data for ordinate (vertical axis) in stat titration.

- Total volume, Potential : Total titration volume and actual potential are plotted on the ordinate.
- Volume, Potential : Titration volume and actual potential are plotted on the ordinate.
- Volume : Titration volume is plotted on the ordinate.

3-5-8-1. Graph range setup



[Low Volume], [Max Volume]

Set the minimum and maximum titration volume.

- 0.0000 ~ 9999.9999mL

[Low Potential (mV)], [High Potential (mV)]

Set the lowest and highest potential level.

- -9999.9 ~ 9999.9mV

[Low Potential (pH)], [High Potential (pH)]

Set the lowest and highest pH level.

- -99.99 ~ 99.99pH

[Low Potential (μA)], [High Potential (μA)]

Set the lowest and highest potential level.

- -999.99 ~ 999.99μA

[Low Potential (%T)], [High Potential (%T)]

Set the lowest and highest potential level.

- -9999.9 ~ 9999.9%T

[Low Potential (Abs.)], [High Potential (Abs.)]

Set the lowest and highest potential level.

- -99.999 ~ 99.999Abs.

[Low Potential (μS)], [High Potential (μS)]

Set the lowest and highest potential level.

- -9999.9 ~ 9999.9μS

[Low Temp. (C)], [High Temp. (C)]

Set the lowest and highest temperature.

- 0.0 ~ 120.0°C

[Low Total volume (Stat)], [High Total volume (Stat)]

Set the minimum and maximum titration volume.

- 0.0000 ~ 9999.9999mL

[Low Volume (Stat)], [High Volume (Stat)]

Set the minimum and maximum titration volume.

- 0.0000 ~ 9999.9999mL

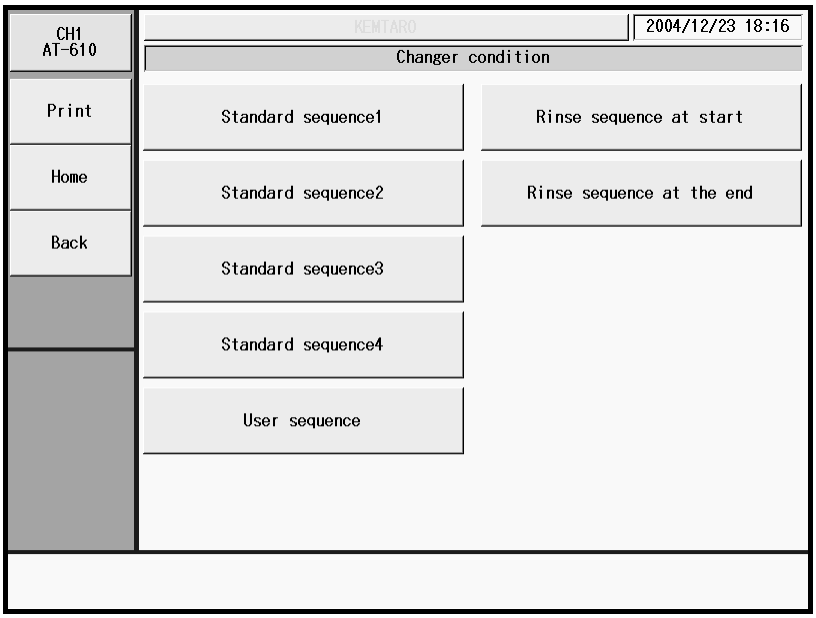
[Short Time (Stat)], [Long Time (Stat)]

Set the shortest and longest time in stat titration.

- 0 ~ 1728000s

3-5-9. [Changer Setting]

To automate rinsing by CHA-600 sample changer, select a cleaning sequence on this unit.
There are 4 standard sequences plus one user sequence.



[Standard sequence 1]

Select the time on display to start each sequence on “Standard 1” mode preset on sample setup.

[Standard sequence 2]

Select the time on display to start each sequence on “Standard 2” mode preset on sample setup.

[Standard sequence 3]

Select the time on display to start each sequence on “Standard 3” mode preset on sample setup.

[Standard sequence 4]

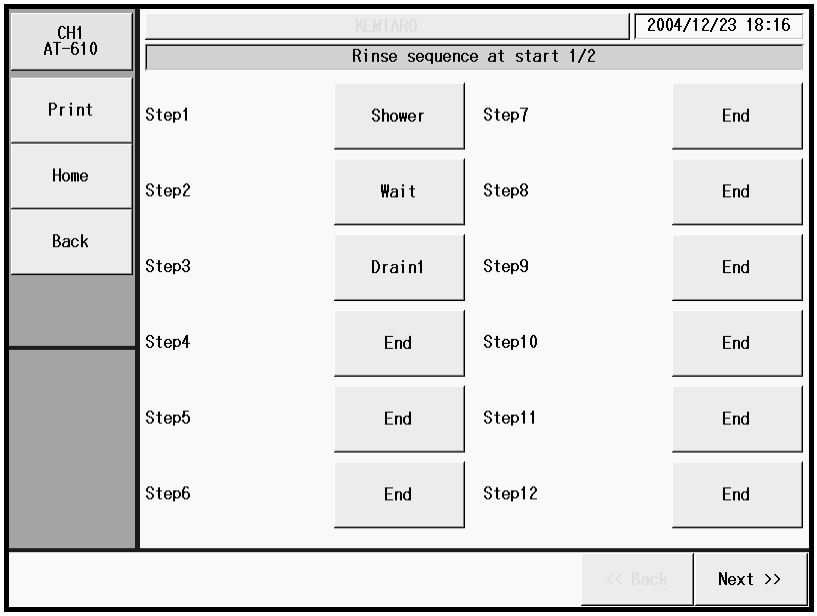
Select the time on display to start each sequence on “Standard 4” mode preset on sample setup.

[User sequence]

Select the time on display to start each sequence on “User sequence” mode preset on sample setup.
Also you select rinse sequence at start and at end.

[Rinse sequence at start]

Select rinse sequence at start on display before titration begins in user sequence mode.



[Rinse sequence at end]

Select rinse sequence at end on display after titration finishes in user sequence mode.

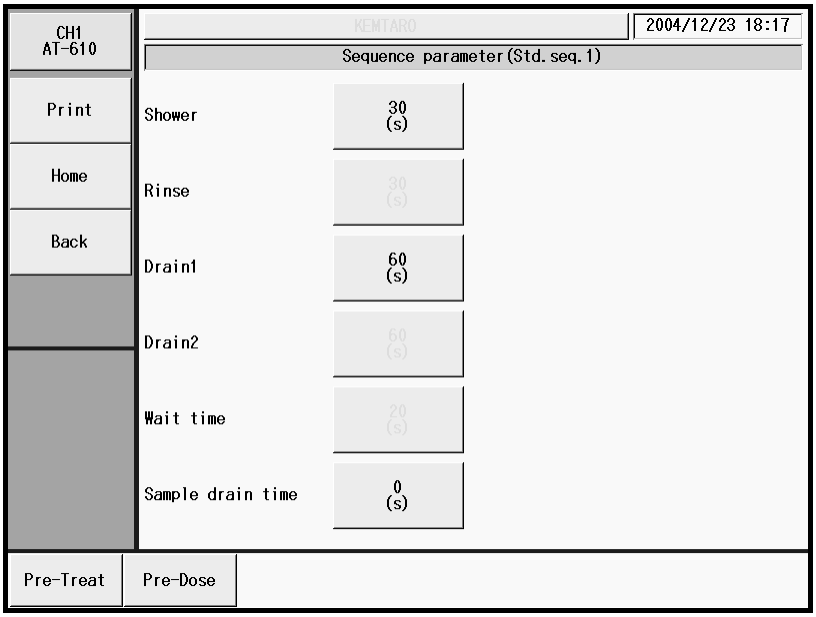
Note:

For the details of display on activating time setup, refer to “3-5-9-1. Acting time setup”.
User sequence setup can be configured on each Method.
Refer to “3-8-10. Option parameter”.
For rinse sequence at the start and the end, refer to “3-8-10. [Option parameter]”.

3-5-9-1. Acting time setup

Select sequence rinse and dose time for the multiple sample changer.

(Example: Standard sequence 1)



[Shower]

Set shower time to rinse the electrode in rinse pot, activated by “Shower” command.

- 0 ~ 9999s

[Rinse]

Set feeding time for solvent to the electrode rinse pot, activated by “Rinse” command.

- 0 ~ 9999s

[Drain 1]

Set draining time for solvent from the electrode rinse pot, activated by “Drain 1” command.

- 0 ~ 9999s

[Drain 2]

Set draining time for solvent from the electrode rinse bath, activated by “Drain 2” command.

- 0 ~ 9999s

[Wait time]

Set immersing or depolarization time for electrodes in rinse pot, activated by “Wait” command.

- 0 ~ 9999s

[Sample drain time]

When the sample drain option is connected, set sample drain time activated by “Sample drain” command.

- 0 ~ 9999s

[Pre-Treat]

Select pre-treat mode for the multiple sample changer.

Pre-treat mode allows the unit to dose measured amount of reagent to all sample vials on the sample rack by the auto piston burette (APB-610, APB-620) and peristaltic pump unit before a titration starts.

Pressing this button will lead to the display of "Setup for pre-treat" screen.

Note:

For the setup of pre-treat, refer to 3-5-9-2. Setup for "Pre-Treat".

[Pre-Dose]

Select pre-dose mode for the multiple sample changer.The reagent is pre-dosed by the auto piston burette (APB-610, APB-620) and the peristaltic pump unit at the position of one step before titration.

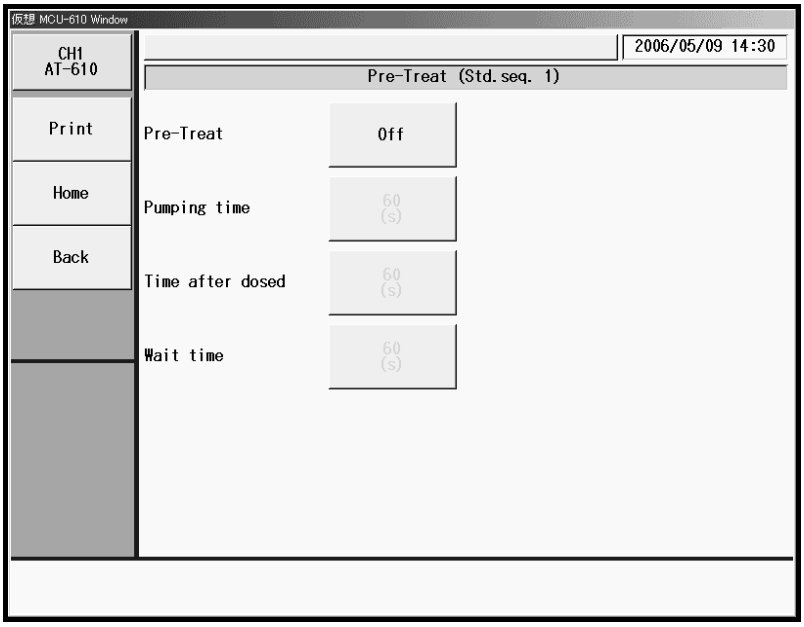
Pressing this button will lead to the display of "Setup for pre-dose" screen.

Note:

For the setup of pre-dose, refer to 3-5-9-3. Setup for "Pre-Dose".

3-5-9-2. Setup for “Pre-Treat”

Press [Pre-Treat] button on the “Sequence parameter” screen display. The “Pre-Treat” screen will then be displayed.



[Pre-Treat]

Select pre-treat mode for the multiple sample changer.

Pre-treat mode allows the unit to dose measured amount of reagent to all sample vials on the sample rack by the auto piston burette (APB-610, APB-620) and peristaltic pump unit before a titration starts.

- Off : No pre-treat
- APB : Pre- treat by auto piston burette
- PUMP : Pre- treat by peristaltic pump
- APB > PUMP : Pre- treat by peristaltic pump after dosing reagent by auto piston burette
- PUMP > APB : Pre- treat by auto piston burette after dosing reagent by peristaltic pump

Note:

When more than one peristaltic pumps are linked, all of them can operate simultaneously.

[Pumping time]

Set peristaltic pumping time in pre-treat. This will be on when “PUMP” is chosen in the “Pre-Dose” setting. When pre-treat by auto piston burette is carried out, set a fixed dose amount on the auto piston burette.

- 0 ~ 9999s

[Time after dosed]

Set the time to allow a sample to be dissolved or the time for the reaction of a sample after a dose. This will be displayed when “Pre-Treat” is set to other than “Off”.

- 0 ~ 9999s

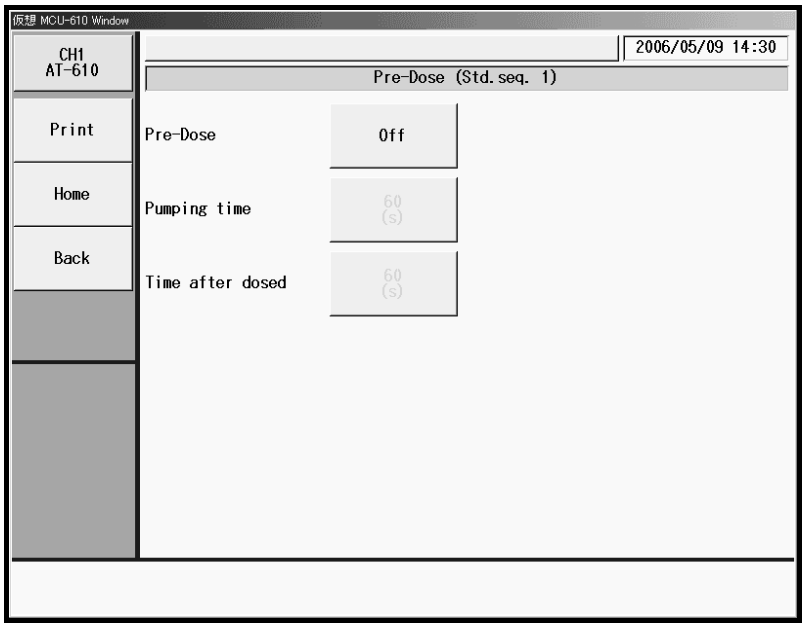
[Wait time]

Set up the time required for resolving sample or allowing reactions after all constant-dosing operations are completed. This will be displayed when “Pre-Treat” is set to other than “Off”.

- 0 ~ 9999s

3-5-9-3. Setup of “Pre-Dose”

Press [Pre-Dose] button on the “Sequence parameter” screen display. The “Pre-Dose” screen will then be displayed.



[Pre-Dose]

Select pre-dose mode for the multiple sample changer.

The reagent is pre-dosed by the auto piston burette (APB-610, APB-620) and the peristaltic pump unit at the position of one step before titration:

- Off : No pre-dosing
- APB : Pre-dose by auto piston burette
- PUMP : Pre-dose by peristaltic pump
- APB > PUMP : Pre-dose by peristaltic pump after dosing a reagent by auto piston burette
- PUMP > APB : Pre-dose by auto piston burette after dosing a reagent by peristaltic pump

Note:

When more than one peristaltic pumps are hooked up, all of them can operate simultaneously.

[Pumping time]

You peristaltic pumping time in pre-dose. This functions when “PUMP” is chosen on “Pre-Dose”.

When pre-dose by auto piston burette is preferred, set the fixed dose amount on the auto piston burette.

- 0 ~ 9999s

[Time after dosed]

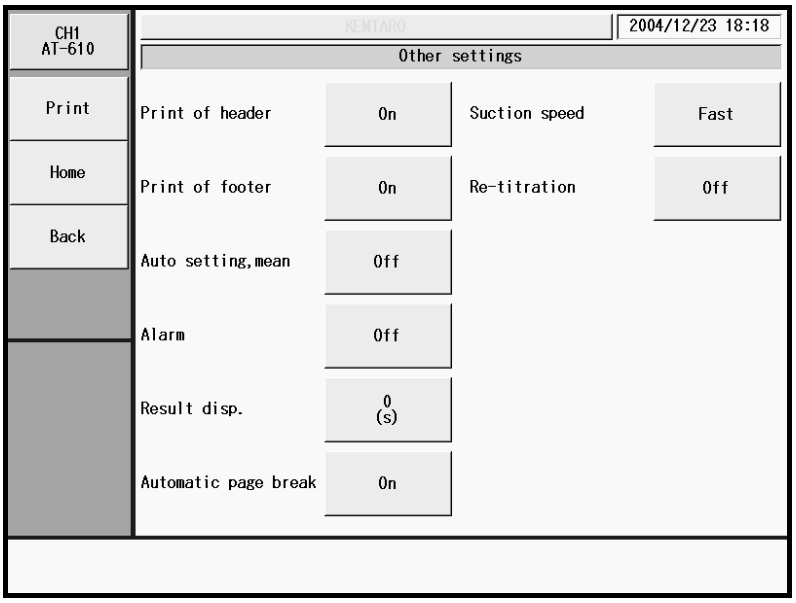
Set the time to allow a sample to be dissolved or the time required for reaction of a sample after a dose.

This is displayed when “Pre-Dose” is set to other than “Off”.

- 0 ~ 9999s

3-5-10. [Other settings]

Press [Other settings] button on “Function” to show “Other settings” display, where you can select the auto input of mean value and alarm function, etc.



[Print of header]

Make setting of header printing. The header includes ‘Model name’, ‘Serial No.’ and ‘Print date’. The header print for titration results can be set on the report parameter of Method parameters.

- Off : No header is printed.
- On : Header is printed.

[Print of footer]

Make setting of footer printing. The footer includes a printing operator. The footer print for titration results can be set on the report parameter of Method parameters.

- Off : No footer is printed.
- On : Footer is printed.

[Auto setting, mean]

The average value of a plural number of blank levels or factor that have been measured will be automatically set into the blank value to be used in sample setup or the factor value to be used in reagent information respectively.

- Off : No setting. Each measurement result is put in the blank or factor.
- On : Auto set in the blank or factor.

< Auto factor input >

When measurements are made by setting “Calc. type” to “Factor” by selecting [Method] – [Edit] – [Calculation parameter], the mean value is automatically input as the factor (TF) of reagent information ([Reagent parameter]) that is preset in “Burette No.” of [Titration parameter] every time measurements are made.

< Auto blank input >

When measurements are made by setting “Calc. type” to “Blank” by selecting [Method] – [Edit] – [Calculation parameter], the mean value is automatically input to “Blank value n” of the “Blank input number” that is preset in [Calculation parameter] – [Formula] – [Details] every time measurements are made.

Note:

The value used in auto input of mean value will be cleared when measured after changing the method contents (incl. when the method is changed) or when the power is turned off.

[Alarm]

This gives the alarm about calibration of detector, periodic check, etc.

- Off : No alarm.
- On : Alarm is on.

[Result disp.]

You can select the display time length of measurement results. Zero “0” second means the display is to be held on screen.

- 0 ~ 3600s

[Automatic page break]

This parameter is not used in this system.

[Suction speed]

Set the speed of filling the built-in burette with reagent or when reset. Slow down the speed for titration liquid like alcoholic solution that can easily generate air bubbles.

- Fast : Burette operates at its maximum speed. Ordinary setting.
- Medium : Burette operates at its medium speed.
- Slow : Burette operates at its low speed.

[Re-titration]

This function is useful when titration may reach maximum volume in halfway, and be ended.

- Off : No further titration is performed.
- On : Titration continues.

< When Re-titration is selected to “On” >

- When the titration does not end up with EP detection by the set EP number.
  When the titrant consumed reaches a maximum volume, the titration falls in a pause mode.
  In order to continue the titration, press [Max. volume] button, reenter a maximum volume titrated, and then press [Pause off] button.
  When terminating the titration immediately, just press [Reset] button.

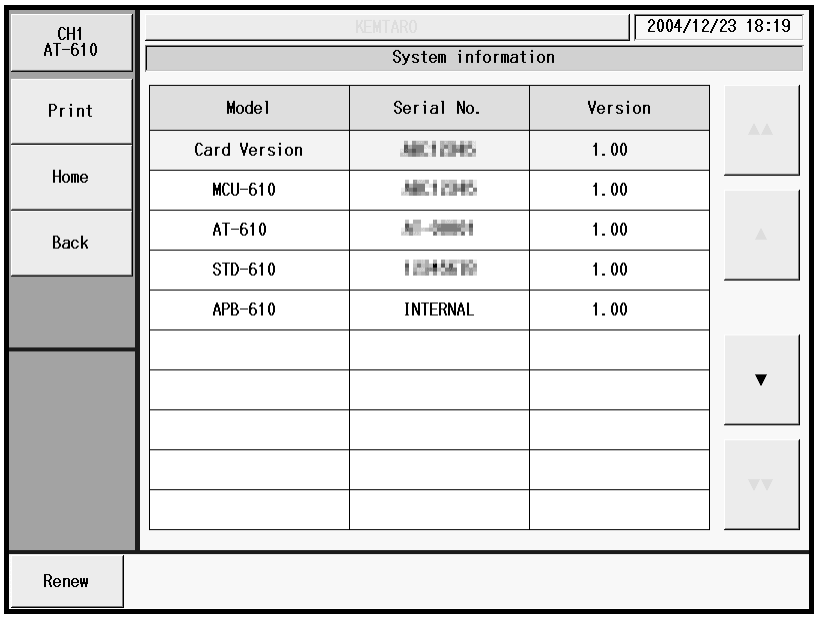
- When the titration ends up with EP detection by the set EP number.
  AT-610 will suspend the operations when the set number of EP is detected.
  Here, for the case where the setting of “Titr. over volume” is effective, the titration will suspend after the dose of “Titr. over volume” of the titrant.
  In order to continue the titration, press [Max. volume] button, reenter a maximum volume titrated, and then press [Pause off] button.
  When terminating the titration immediately, just press [Reset] button.

Note:

- **When a multiple sample changer is used, Re-titration cannot be carried out.**
- **When the titration mode is set to “Learn” and the method is set to “COD”, “Re-titration” cannot be carried out.**

3-5-11. [System information]

You can access to the information about the connected peripherals on their serial number and software version by pressing [System information] button on “Function”.



[Renew]

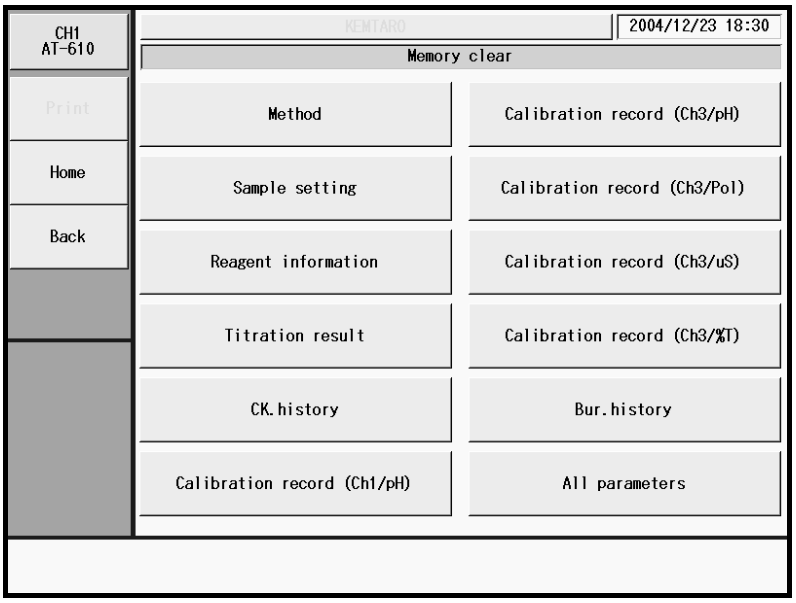
You can make sure if all of the peripherals are connected securely.

Note:

When any peripherals is connected, make sure of their connections by Renew.

3-5-12. [Memory clear]

You can erase all the stored data and set back to default as in “7-4-1. Parameter List”.
Press [Memory clear] button on “Function” to display “Memory clear”.



[Method]

You can erase all of the Methods. Set values (default) are “Auto titration” for “Titration mode” and “EP Stop” for “Titration form”.

[Sample setting]

All the set up contents are erased.

[Reagent information]

You can erase all the information about reagents.

[Titration result]

All the titration results are erased.

[CK. history]

All the check records are erased.

[Calibration record (Ch1/pH)]

All the “Calibration record (Ch1/pH)” are erased.

[Calibration record (Ch3/pH)]

All the “Calibration record (Ch3/pH)” are erased.

[Calibration record (Ch3/pol)]

All the “Calibration record (Ch3/pol)” are erased.

[Calibration record (Ch3/μS)]

All the “Calibration record (Ch3/μS)” are erased.

[Calibration record (Ch3/%T)]

All the “Calibration record (Ch3/%T)” are erased.

[Bur. history]

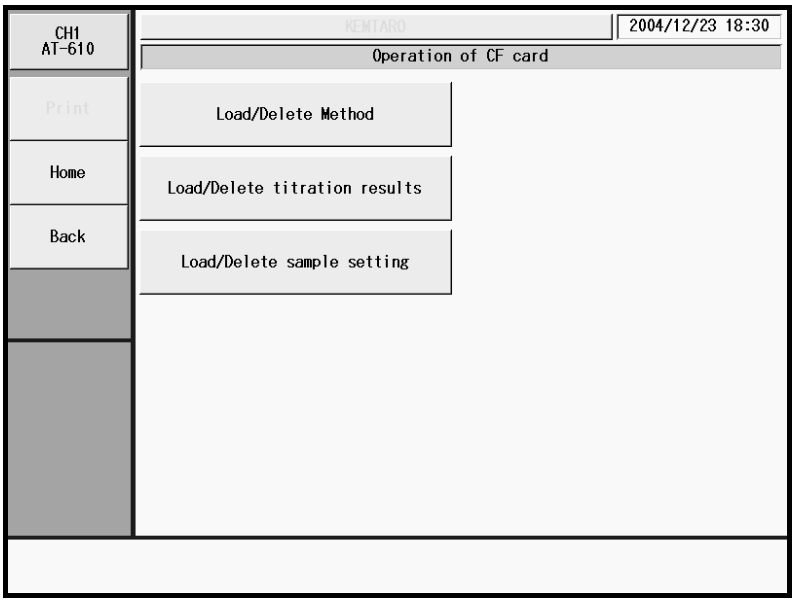
All the the check records for burette inspection are erased.

[All parameters]

All the information and data other than setup contents are erased.

3-5-13. [Operation of CF card]

Either load the data stored on CF card into the measuring unit or delete the data stored on CF card.
After pressing [Next] button on the “Function” screen display, press [Operation of CF Card] button. Then, “Operation of CF Card” screen will be displayed.



[Load/Delete Method]

Either load the method data stored on CF card into the measuring unit or delete the data stored on CF card.

Note:
In regard to loading/deleting method, refer to “3-5-13-1. [Load/Delete Method]”.

[Load/Delete titration results]

Either display the measurement results stored on CF card for the measuring unit or delete the measurement results stored on CF card.

Note:
In regard to loading/deleting titration results, refer to “3-5-13-2. [Load/Delete titration results]”.

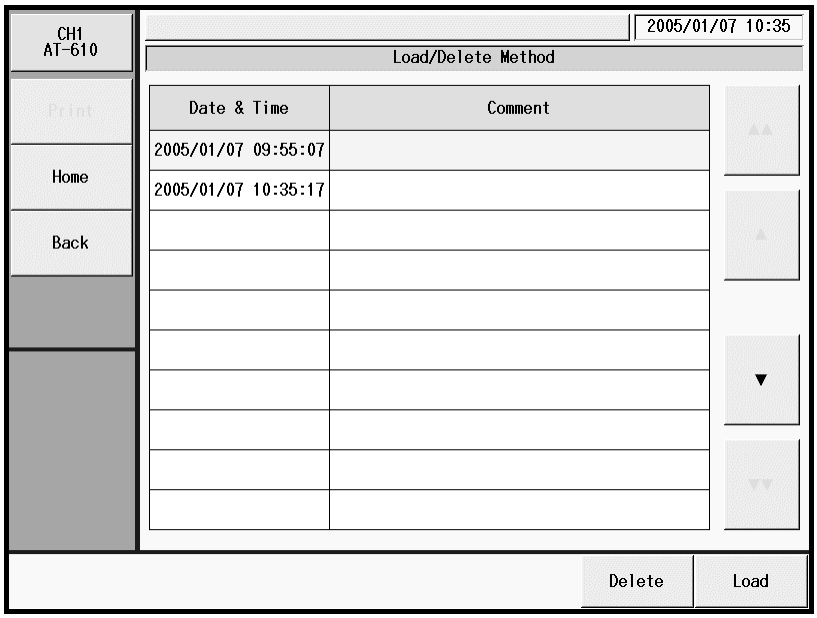
[Load/Delete sample setting]

Load or delete the sample setting on a CF card.

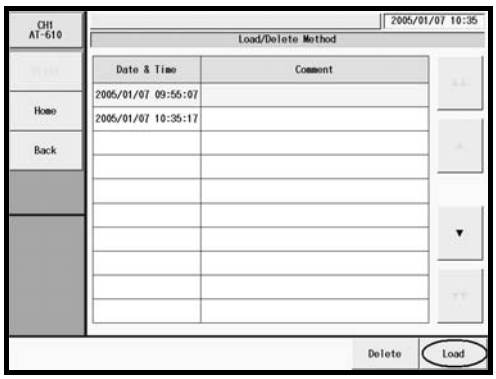
Note:
In regard to loading/deleting sample settings, refer to “3-5-13-3. [Load/Delete sample setting]”.

3-5-13-1. [Load/Delete Method]

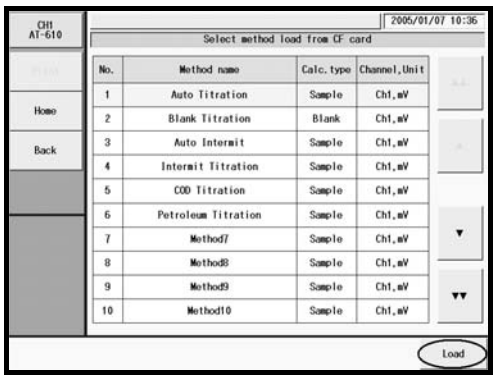
Press [Load/Delete Method] button on the “Operation of CF Card” screen display. Then, “Load/Delete Method” screen will be displayed.



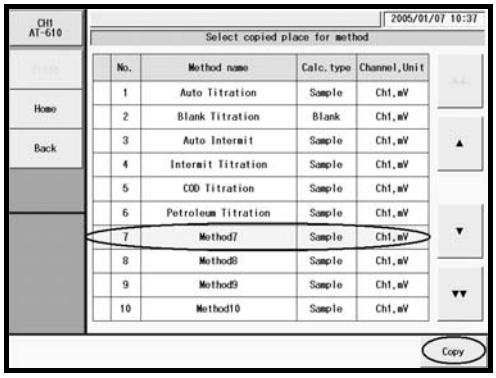
< How to load method >



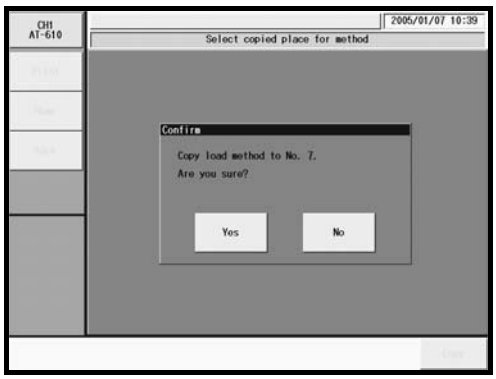
1) Select the method file to be loaded into the measuring unit on the “Load/Delete Method” screen display and then press [Load] button.



2) The screen of “Select method loaded from CF card” will be displayed. Then, select the method to be loaded into the measuring unit and press [Load] button.

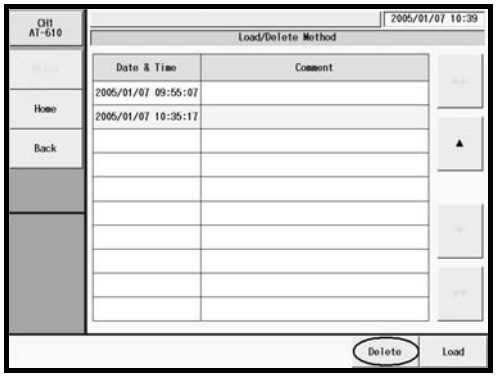


3) The screen of “Select copied place for method” will be displayed. Then, select the method copied to and press [Copy] button.

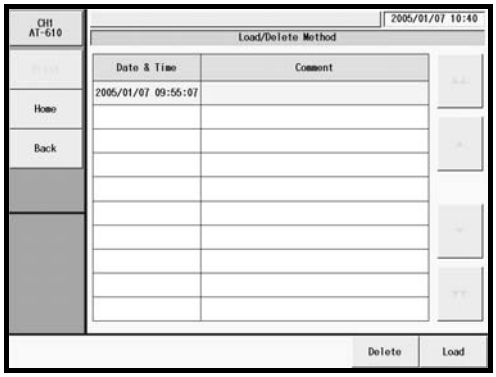


4) When the confirmation screen is displayed, press [Yes] button.
5) The method will be copied onto the method selected in the method list and the screen display will return to “Select method loaded from CF card”. When loading further methods, repeat the above steps 2) through 4).

< How to delete method >



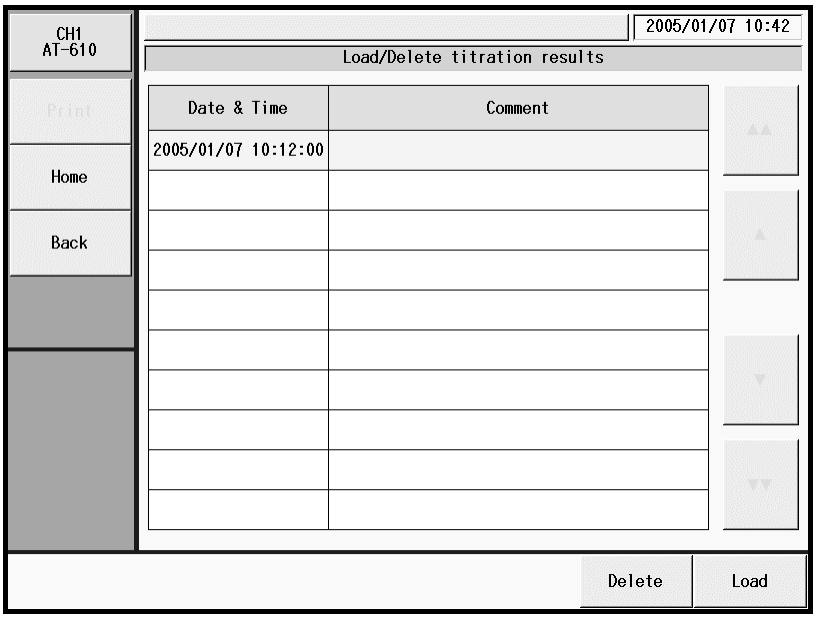
1) Select the method file to be deleted on the "Load/Delete Method" screen display and then press [Delete] button. The screen display will turn to the confirmation screen. Then, press [Yes] button.



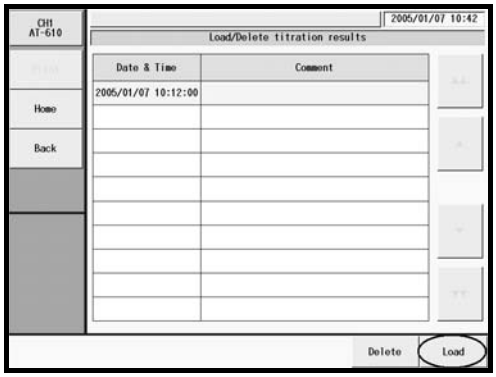
2) The method file selected on CF card will be deleted and the screen display will return to "Load/Delete Method". When deleting further method files, repeat the above steps 1).

3-5-13-2. [Load/Delete titration results]

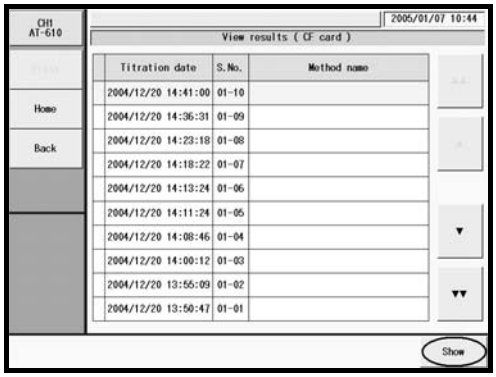
Press [Load/Delete titration results] button on the “Operation of CF Card” screen display. Then, the “Load/Delete titration results” screen will be displayed.



< How to load titration results >



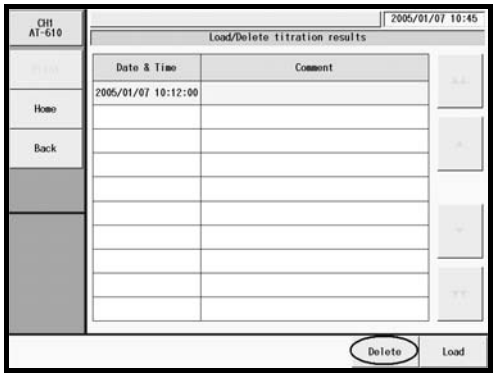
1) Select the file having titration results to be displayed on the “Load/Delete titration results” screen and press [Load] button.



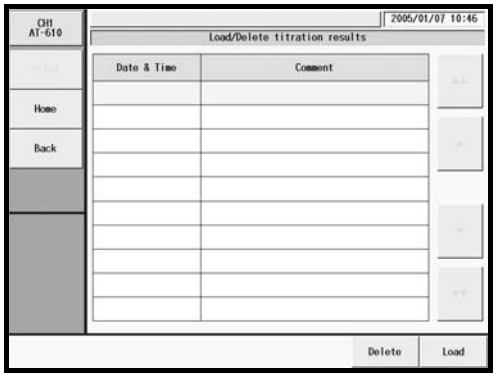
2) The screen of “View results (CF card)” will be displayed. Select the titration results to be displayed on the measuring unit and press [Show] button.

3) The selected titration results will be displayed on the measuring unit.

< How to delete titration results >



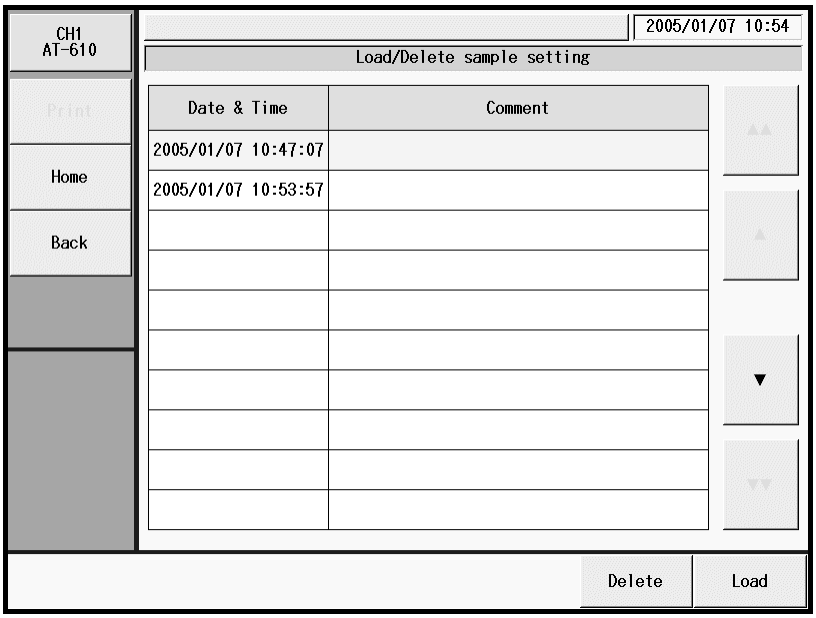
1) Select the file to be deleted on the “Load/Delete titration results” screen and press [Delete] button. The screen display will turn to the confirmation screen. Then, press [Yes] button.



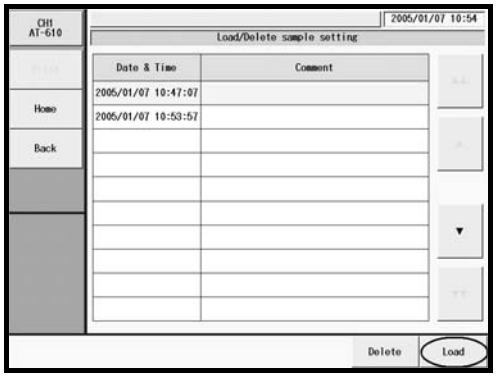
2) The file selected on CF card will be deleted and the screen display will return to “Load/Delete titration results”. When deleting further files of titration results, repeat the above steps 1).

3-5-13-3. [Load/Delete sample setting]

Press [Load/Delete sample setting] button on the “Operation of CF Card” screen display. Then, the “Load/Delete sample setting” screen will be displayed.



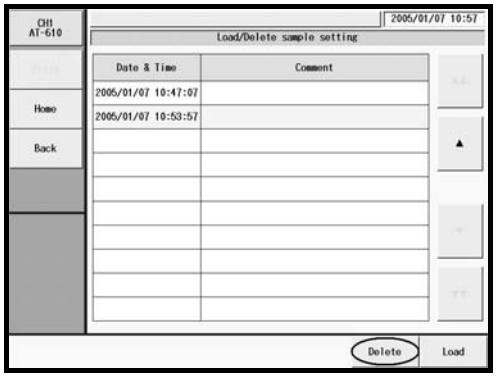
< How to load sample setting >



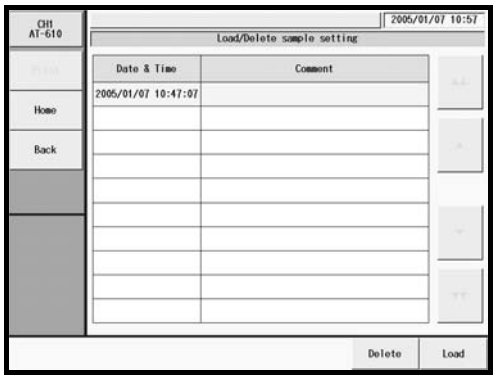
1) Select the sample setting file to be loaded into the measuring unit on the “Load/Delete sample setting” screen display and then press [Load] button.

2) When the confirmation screen is displayed, press [Yes] button.
3) The sample setting will be copied onto the sample setting and the screen display will return to “Load/Delete sample setting”.

< How to delete sample setting >



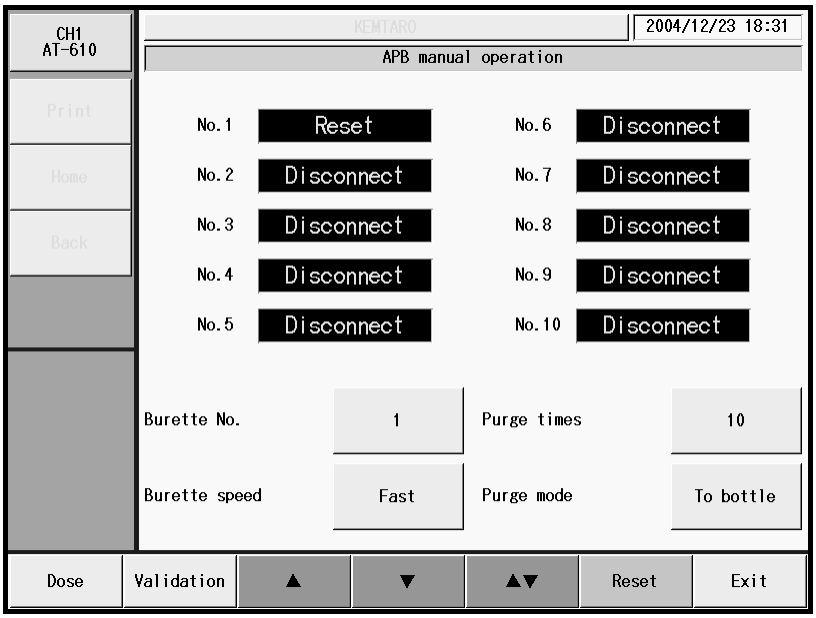
1) Select the file to be deleted on the “Load/Delete sample setting” screen and press [Delete] button. The screen display will turn to the confirmation screen. Then, press [Yes] button.



2) The file selected on CF card will be deleted and the screen display will return to “Load/Delete sample setting”. When deleting further files of sample setting, repeat the above steps 1).

3-6. Burette

The burette can be manually operated for filling or fixed dosing the burette with reagent or to purge the burette. You can manually operate the burette like these only when the unit is in “Wait for Titr.” mode. Press [Burette] button on Main display, to show “APB manual operation”.



[Burette No.]

Select the burette for use in titration:

- All : All burettes can be activated.
- 1 : The supplied one burette works.
- 2 ~ 10 : Additionally installed second burette works.

[Purge times]

Select a number of purge cycles. “0” setting means unlimited number of cycles.

- 0 ~ 99

[Burette speed]

Select the rate of suction, discharge or purge on the APB manual operation screen display.

- Fast : Burette operates at its maximum speed. Ordinary setting.
- Medium : Burette operates at its medium speed.
- Slow : Burette operates at its low speed.

[Purge mode]

You can select a purge mode:

- To bottle : Reagent moves back and forth between the reagent bottle and burette in order to degas the burette and to homogenize the reagent.
- To nozzle : Nozzle is degassed and the reagent is discarded. The operation is the same as discharge and can be repeated by the preset number of purge cycles.

[Dose]

"APB dose mode" display will appear and allow to dispense the fixed amount of reagent. This feature is utilized when degassing the burette.

[Validation]

"Burette capacity validation" screen will be displayed, allowing to check the capacity of the burette on the presetting. This feature is utilized when checking the burette capacity or for other purpose.

[▲]

This button once pressed pushes out the reagent to the nozzle, and stops the piston when it reaches the upper limit top position. The piston also stops when pressed again. The switching valve is turned to discharge direction during this event.

[▼]

This button lowers the piston to aspirate the reagent from the bottle. When pressed again, the piston stops.

[▲▼]

Once pressed, it purges for a number of preset times, and stops by filling the burette with reagent. When pressed again, it stops purging and sets in standby for discharge position.

[Reset]

This button stops discharge or suction, and returns to reset condition.

[Exit]

Returns to Main display.

Status displays

The various burette positions are shown below:

- Reset : Piston is in lower limit bottom position.
- Top : Piston is in upper limit top position.
- Replace : Piston is in a position where the burette unit can be removed. The front lamp blinks.
- Up : Piston is moving upward to discharge reagent.
- Down : Piston is moving downward to aspirate reagent.
- Stop : Piston is stopping at any point in burette.
- Purge : Piston is moving for purge event.
- Disconnect : The burette is not connected for use.

⚠ Caution!

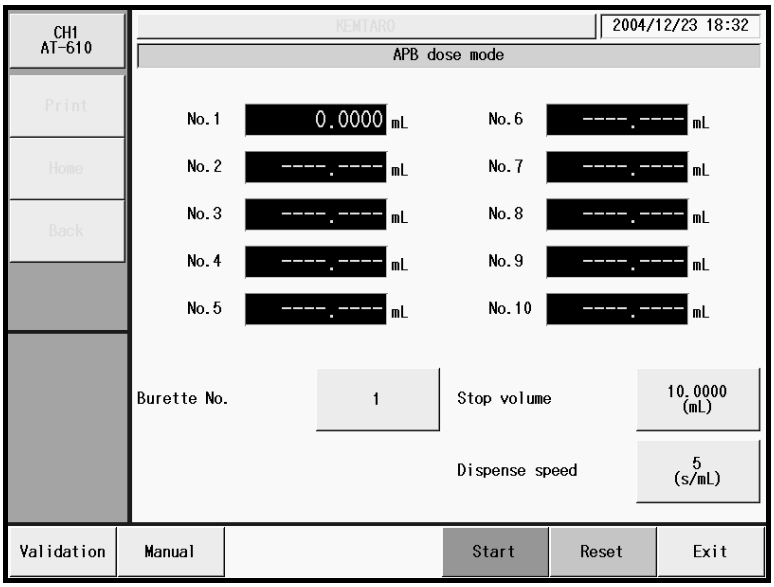
Be aware of discharge rate when pressing [▲], [▼] or [▲▼] button. The reagent may be splashed out of the nozzle when reagent is dispensed into the nozzle with [▲] or [▲▼] button.

Note:

For the replacement of a burette unit, refer to the Section "3-6-3. Replacement of burette unit".

3-6-1. Dosing reagent

Press [Dose] button on “APB manual operation” to display “APB dose mode” screen where the dose volume of each burette shows up.



[Burette No.]

Select the burette to activate:

- 1 : The built-in burette is activated.
- 2 ~ 10 : The additional burettes are activated.

[Stop volume]

Set dispensing volume from a burette. Since the dischargeable amount of reagent depends on the installed burette, see the section “3-8-6-9. Settings of discharge amount of titrant” in this manual.

- 0.0000 ~ 9999.0000mL

[Dispence speed]

Set dispence speed. The higher a set value becomes, the slower dispense rate becomes.

- 1 ~ 999s/mL

⚠ Caution!

There is a danger that a reagent splashes out of the nozzle when burette dispensing rate is too high; set the dispensing rate at about 5 to 10s/mL.

[Validation]

Capacity precision on a burette can be checked under the preset conditions. This feature is utilized when checking the burette capacity or for other purpose.

[Manual]

This button allows to display the screen for APB manual operation.

[Start]

Dosing starts and dispenses up to the preset “Stop volume”.

[Reset]

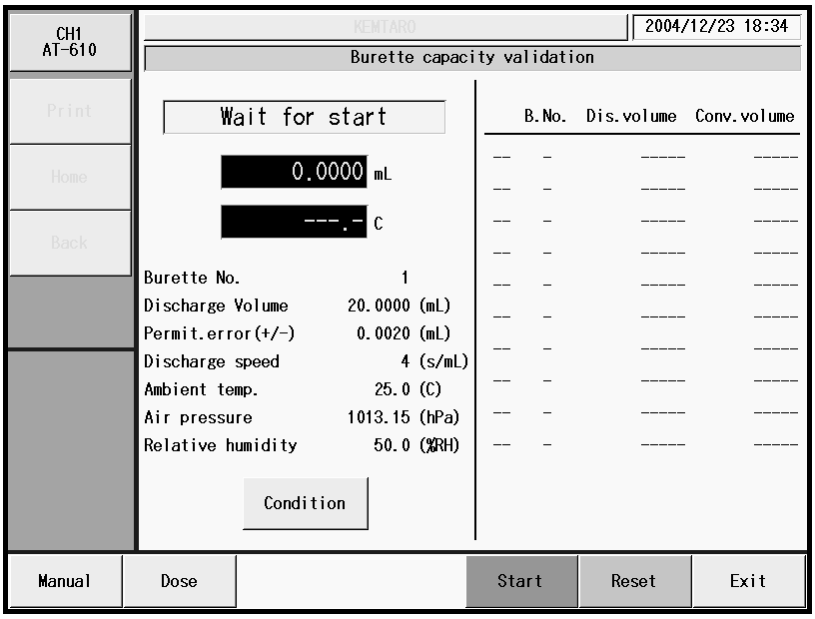
Stop dosing reagent and allow the burette to be reset.

[Exit]

Return to the main screen display.

3-6-2. Validation of burette precision

Press [Validation] button on “APB manual operation” to display “Burette capacity validation” display.



[Condition]

The menu “Parameter settings for burette capacity validation” appears to allow to configure the conditions for the verification of burette capacity.

[Manual]

The menu for APB manual operation appears.

[Dose]

The screen for APB dose mode appears to allow to activate a dose under the preset conditions in order to degas the burette.

[Start]

Verification of burette capacity starts under the conditions present under “Condition”.

[Reset]

Stops dosing reagent and allow the unit to be reset.

[Exit]

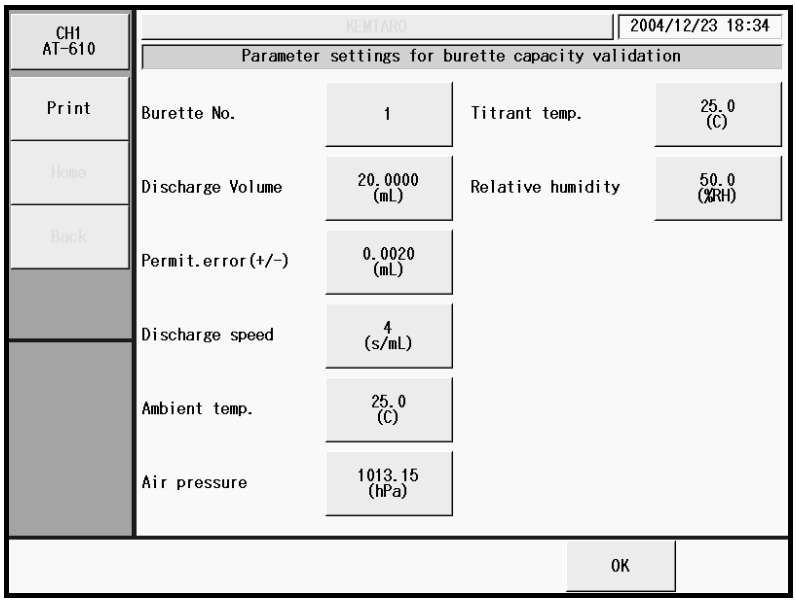
Return to the main screen display.

Status screen display

Display the operational status during burette capacity check (Operation, Dispensed volume, Titrant temperature, Check conditions).

3-6-2-1. Parameter settings for burette capacity validation

Configure conditions for validating burette precision.
Pressing [Condition] button in “Burette capacity validation” screen will allow to display “Parameter settings for burette capacity validation”.



[Burette No.]

Select the burette to activate for precision check:

- 1 : The built-in burette is activated.
- 2 ~ 10 : The additional burettes can be activated.

[Discharge Volume]

Set a volume of dischargeing amount from the burette. Since the dischargeable amount of reagent depends on the installed burette, see the section “3-8-6-9. Settings of discharge amount of titrant” in this manual.

- 0.0000 ~ 9999.0000mL

[Permit. error]

Set a range of criterion for precision check. When the measured value is out of this permissible value to the reference value, the result is judged as ‘out of range’.

- 0.0000 ~ 9999.9999mL

[Discharge speed]

Select the rate of burette dischargeing amount. The higher a set value becomes, the slower dispense rate becomes.

Typically, set at: 80 / [Burette capacity] (s/mL)

- 1 ~ 999s/mL

[Ambient temp.]

Set the ambient temperature in the inspection.

- 0.0 ~ 100.0°C

[Air pressure]

Set atmospheric pressure in the inspection.

- 500.00 ~ 1500.00hPa

[Titrant temp.]

Set the temperature of pure water in reagent bottle.

- 0.0 ~ 100.0°C

[Relative humidity]

Set the relative humidity in the inspection.

- 0.0 ~ 100.0%RH

[OK]

Complete conditional settings, allowing the screen display to return to “Burette capacity validation”.

< Capacity conversion >

In the burette capacity check, weight is converted to volume according to JIS K0050 and JIS K0061 as in the conversion calculation:

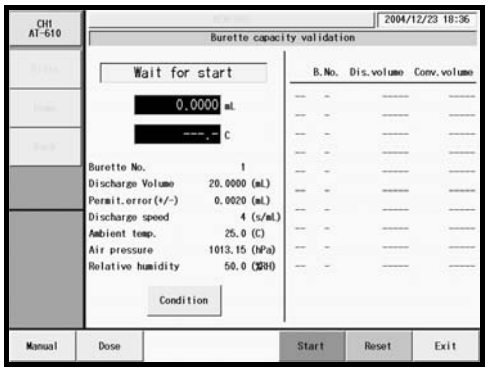
$V\ (mL) = W \times \{1 + \rho \times (1 / dt - 1 / d')\} / [\{1 + a \times (Temp - 20)\} \times dt]$

- W (g) : Dispensed weight of pure water
- ρ (g/cm³) : Barometric pressure and air density at the relative humidity given by the below formula
- dt (g/cm³) : Density of water at the temperature in inspection
- d′ (g/cm³) : Density of the weight (= 8.0g/cm³ fixed)
- α (K^{-1}) : Cubical expansion coefficient (= 97.5×10^{-7} fixed) of burette glass material
- Temp (°C) : Water temperature in inspection

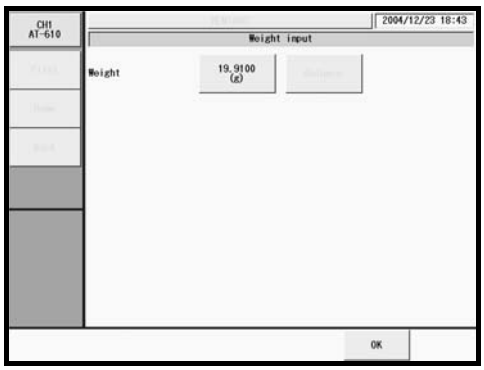
$\rho\ (g/cm^3) = 0.001293 \times \{273.15 / (273.15 + t)\} \times \{(P - 0.378 \times e) / P0\}$

- t (°C) : Ambient temperature
- P (kPa) : Atmospheric pressure in the inspection
  (P = 0.1 × pressure in inspection (hPa))
- e (kPa) : Water vapor pressure (e = 0.1 × RH% × e0)
  e0 is referred to saturated water vapor pressure from Table 2 shown in the Appendix of JIS K0061
- P0 (kPa) : Standard atmospheric pressure (= 101.325kPa)

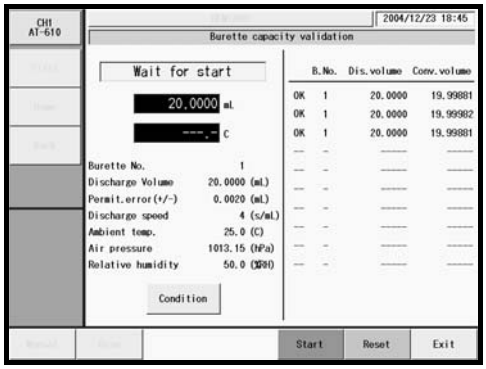
3-6-2-2. Validation of Burette by precision check



1) Click on [Start] button to allow the burette to dose.



2) After the preset volume is dispensed, the screen "weight input" appears. Weigh the dispensed water and click on [OK] button.



3) The validation results appear on the right of the screen display.
B. No. : Burette number used in validation
Dis. volume : Dispensed volume as preset
Conv. volume : Actually dispensed volume

The validation history can be viewed by selecting "Function" – "GLP management" – "Bur. history". When continuing to perform the validation of burette precition, click [Start] button again.

Note:

When Titrant temperature compensation sensor (12-001-6600-48) is connected, sensor reading is applied to the compensation instead of solution temperature.
The precision of sensor reading is ±0.5°C. For precision check, a thermometer with resolution of ±0.1°C is required.

Note:

When an electronic balance is connected, the unit sets in auto input mode with [Balance] button. When the weight reading is stable, press [OK] button to settle it down. For details of input from balance, refer to Section "4-3-3. Input on balance at the time of burette validation".
For accurate test results, ±0.0002g of balance precision is to be required.

Note:

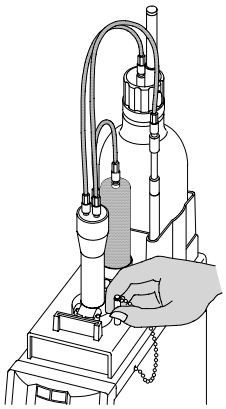
The precision check is performed on user's responsibility.
The resulting precision is warranted only when it's performed on the KEM's quality assurance system. For accurate precision check, it is recommended that users ask our service department for precision check of the burettes.

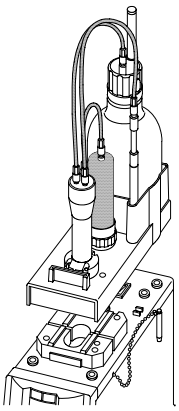
3-6-3. Replacement of burette unit

Pursuant to the procedure described in Section "3-6. Burette", press [▼] button to lower the burette. See to it that the status of burette number to be replaced is in "Replace" on "APB manual operation" screen display.

1) Detach the lock pin of burette unit.
2) Push the unit and then, lift it to remove.
3) Place another unit onto the position, and pull it.
4) Insert the lock pin onto the burette unit.
5) Press [Reset] button.

Note:
When a burette unit is changed, resetting parameters with [Reset] button will automatically set the capacity of the present burette unit.





< Burette size and Knock screw position >
Before different size of burette is used (for example, 10mL size is used intead of 20mL), make sure the knock screw is in the position as in below chart.

Burette size	50mL	20mL	10mL	5mL	1mL
Knock screw Position	1 pce.	none	1 pce.	1 oce.	2 pcs

* Rear view of burette unit mounted on main.

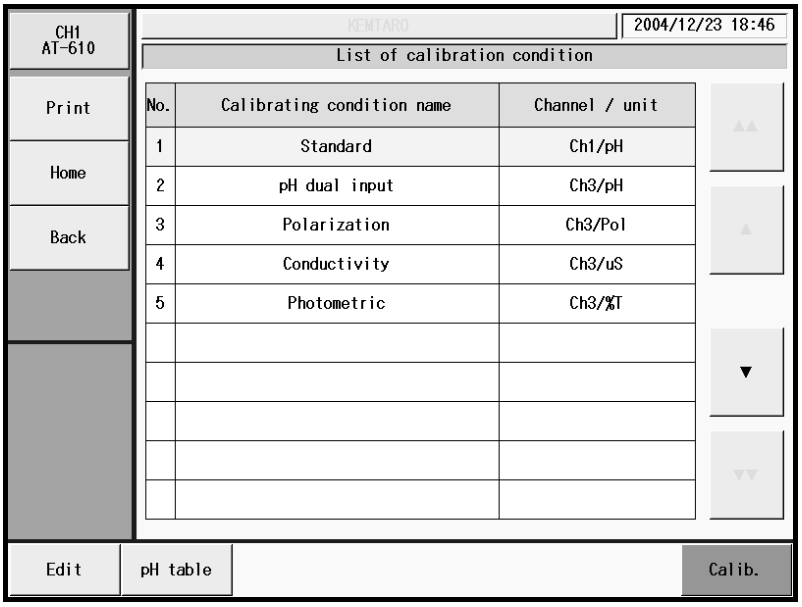
⚠ Caution!
Chart of Burette size by AT-610.

Applied unit	Size	Model		
Karl Fischer Moisture Titrator	10mL	EBU-610-KF	EBU-520-KF	APB-510-KF APB-510-ME
Automatic Potentiometric Titrator	50mL	EBU-610-50B	APB-510-50B	APB-410-50B
	20mL	EBU-610-20B	APB-510-20B	APB-410-20B
	10mL	EBU-610-10B	APB-510-10B	APB-410-10B
	5mL	EBU-610-05B	APB-510-05B	APB-410-05B
	1mL	EBU-610-01B	APB-510-01B	APB-410-01B

3-7. Calibration

3-7-1. Calibration condition setup

Press [Calibration] button on Main display to see “List of calibration”. Up to 5 conditions can be stored. “Calibration condition name” and “Channel/Unit” will be displayed as preset in the calibration condition setup.



[▲], [▼]

Move the cursor on the screen display for ‘List of calibration conditions’.

[Edit]

Display each calibration condition setup screen. Can set “Calibration condition name” and calibration conditions. Calibration condition differs depending on the detector number and unit of a preamplifier.

Note:
For details of calibration condition setup, see “3-7-1-1. [Edit] – [Configure sensor calibration conditions]”.

[pH table]

Can see the pH table setup screen display. AT-610 is equipped with the table for temperature compensation at pH7/pH4/pH9 based on the JIS standard. For other pH standard solutions, you can configure vicinity temperature and pH value for the pH standard solutions so that temperature compensation is automatically carried out for calibration.

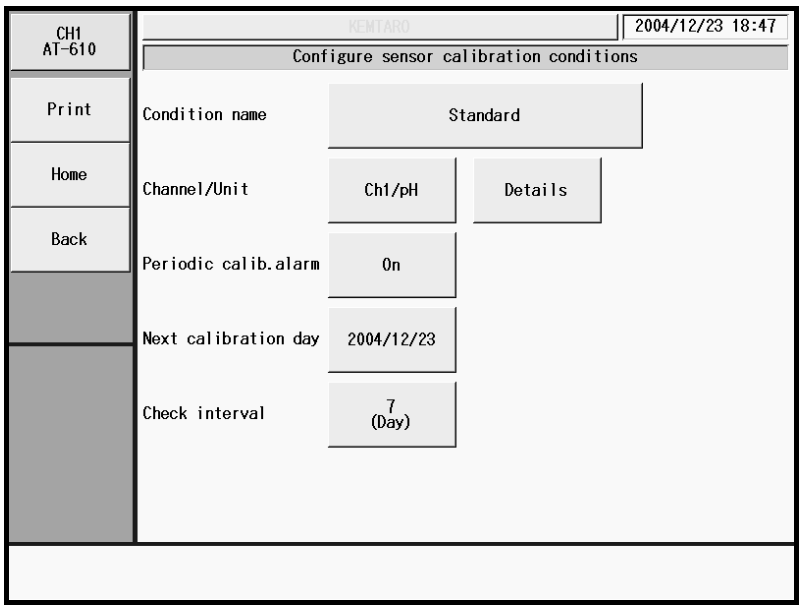
Note:
For pH table setup, refer to Section “3-7-1-6. [pH table]”.

[Calib.]

Calibration is performed according to the present calibration conditions.

3-7-1-1. [Edit] – [Configure sensor calibration conditions]

Set calibration conditions.



[Condition name]

Set sensor name or electrode type used for calibration. Up to 20 characters can be entered.

[Channel/Unit]

Set detector channel and unit for calibration.

- Ch1/pH : pH calibration by Detector 1 common to all preamplifiers. The screen for calibration conditions setup (Ch1/pH) appears when pressing [Details] button.
- Ch3/pH : pH calibration by Detector 3 when TET-610 preamplifier is connected. The screen for calibration conditions setup (Ch3/pH) appears when pressing [Details] button.
- Ch3/Pol : Regulated current/potential calibration by Detector 3 when POT-610 preamplifier is connected. The screen for calibration conditions setup (Ch3/Pol) appears when pressing [Details] button.
- Ch3/μS : Cell conductivity calibration by Detector 3 when CMT-610 preamplifier is connected. The screen for calibration conditions setup (Ch3/μS) appears when pressing [Details] button.
- Ch3/%T : Transmittance, %T, by detector 3 when PTA-610 preamplifier is connected. The screen for calibration conditions setup (Ch3/%T) appears when pressing [Details] button.

Table 3-7-1-1. Combination of preamplifiers and detectors

Preamplifier	Detector 1	Detector 2	Detector 3
STD-610	pH, mV, Temp.	mV	–
PTA-610			%T, Abs
POT-610			μA, mV
CMT-610			μS/cm
TET-610			pH, mV, Temp.

[Details]

The user can see the screen display for various calibration conditions on the channel/unit setup.

Note:

For detailed setup of calibration conditions for "Ch1/pH" or "Ch3/pH" Channel/Unit, see 3-7-1-2. Configure sensor calibration conditions (Ch1/pH, Ch3/pH).

For detailed setup of calibration conditions for "Ch3/Pol" Channel/Unit, see 3-7-1-3. Configure sensor calibration conditions (Ch3/Pol).

For detailed setup of calibration conditions for "Ch3/μS" Channel/Unit, see 3-7-1-4. Configure sensor calibration conditions (Ch3/μS).

For detailed setup of calibration conditions for "Ch3/%T" Channel/Unit, see 3-7-1-5. Configure sensor calibration conditions (Ch3/%T).

[Periodic calib. alarm]

Periodic calibration alarm can be implemented here.

- Off : No alarm is implemented.
- On : Periodic calibration alarm is implemented by letting you know calibration to be performed on the scheduled day. Calibration results can be viewed with [CAL. record] button.

[Next calibration day]

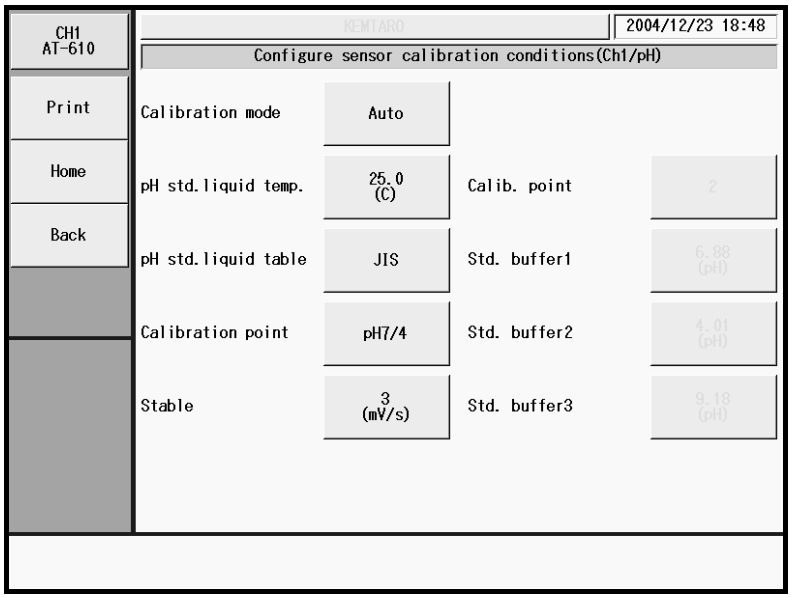
The user can schedule next calibration day for a perildic calibration.

[Check interval]

The user can schedule check interval for next calibration day. Carrying out periodic calibration will allow the next calibration date to be automatically renewed at the preset intervals.

3-7-1-2. Configure sensor calibration conditions (Ch1/pH, Ch3/pH)

Set calibration conditions for pH electrode.



[Calibration mode]

Set calibration mode for pH calibration:

- Auto : This mode automatically calibrates from the table of correlation of the built-in pH standard with temperature. Up to 3 calibration points can be selected.
- Manual : This mode calibrates to the pH value manually entered. Up to 3 calibration points can be selected.

– Parameters for Auto calibration mode –

[pH std. liquid temp.]

Set the temperature of the standard solution. This setting will be invalid when connecting a temperature compensating electrode and allows to read the temperature automatically during a calibration.

- 0.0 ~ 100.0°C

[pH std. liquid table]

The user can select a table of temperature compensation for standard solution as follows:

- JIS : Table of temperature and pH relation as specified in JIS K0019 (pH4), JIS K0023 (pH7), JIS K0021 (pH9)
- ASTM : Table of temperature and pH relation as specified in ASTM E70-97 for pH4/pH7/pH9
- BS : Table of temperature and pH relation as specified in BS 1647 for pH4/pH7/pH9
- NF : Table of temperature and pH relation as specified in NF T90-008 for pH4/pH7/pH9
- DIN : Table of temperature and pH relation as specified in DIN19 266 for pH4/pH7/pH9
- NIST : Table of temperature as specified in US ORION's pH “All in One” buffer kits (Cat. No. 910105)
- User : Table of temperature and pH relation as preset on pH table setup display

Refer to table 3-7-1-2-1 for the relation of each contry's pH standard solution.

Refer to table 3-7-1-2-2 for the NIST's relation between temperature and standard solution.

Table 3-7-1-2-1

Standard	pH liquid	Spec. No.	Standard components
JIS	pH4	JIS K0019	0.05mol/L-Potassium hydrogen phthalate
	pH7	JIS K0023	0.025mol/ L-Potassium hydrogenphosphate – 0.025mol/L-Sodium hydrogenphosphate
	pH9	JIS K0021	0.01mol/L-Sodium tetraborate
ASTM	pH4	E70-97	0.05mol/kg-Potassium hydrogen phthalate
	pH7		0.025mol/kg-Potassium hydrogenphosphate – 0.025mol/kg-Sodium hydrogenphosphate
	pH9		0.01mol/kg-Sodium tetraborate
DIN	pH4	19 266	Dissolve 10.21g ($KHC_8H_4O_4$) in 1000mL (25°C) water.
	pH7		Dissolve 3.38g (KH_2PO_4)+3.53g (Na_2HPO_4) in 1000mL (25°C) water.
	pH9		Dissolve 3.814g ($Na_2B_4O_7{\cdot}10H_2O$) in 1000mL (25°C) water.
BS	pH4	1647	Dissolve 10.21g ($KHC_8H_4O_4$) in 1000mL (20°C) water.
	pH7		Dissolve 3.39g (KH_2PO_4)+3.54g (Na_2HPO_4) in 1000mL(20°C) water.
	pH9		Dissolve 3.80g ($Na_2B_4O_7{\cdot}10H_2O$) in 1000mL (20°C) water.
NF	pH4	T90-008	Dissolve 10.21g ($KHC_8H_4O_4$) in 1000mL water.
	pH7		Dissolve 3.402g (KH_2PO_4) + 3.549g (Na_2HPO_4) in 1000mL water.
	pH9		Dissolve 3.81g ($Na_2B_4O_7{\cdot}10H_2O$) in 1000mL water.

Table 3-7-1-2-1

Standard		pH		
NIST	temperature	pH4	pH7	pH10
	0	4.00	7.11	10.32
	5	4.00	7.08	10.25
	10	4.00	7.06	10.18
	20	4.00	7.01	10.06
	25	4.01	7.00	10.01
	30	4.02	6.98	9.97
	40	4.03	6.97	9.89
	50	4.06	6.97	9.83
	60	4.08	-	-
	70	4.13	-	-
	80	4.16	-	-
	90	4.21	-	-
	95	4.24	-	-

[Calib. point]

Select a combination of pH standard solutions used for calibration:

- pH 7/4
- pH 7/9
- pH 4/9
- pH 7/4/9

[Stable]

Set a potential for stabilization in calibration. When the potential falls in the stable level of within the preset range, the titration will proceed to the next step automatically.

- 0 ~ 100mV/s

– Parameter for manual calibration mode –

[Calib. point]

Select the number of calibration points for manual calibration:

- 2/3

[Std. buffer 1]

Set pH value for the first calibration point.

- 0.00 ~ 14.00

[Std. buffer 2]

Set pH value for the second calibration point.

- 0.00 ~ 14.00

[Std. buffer 3]

Set pH value for the third calibration point.

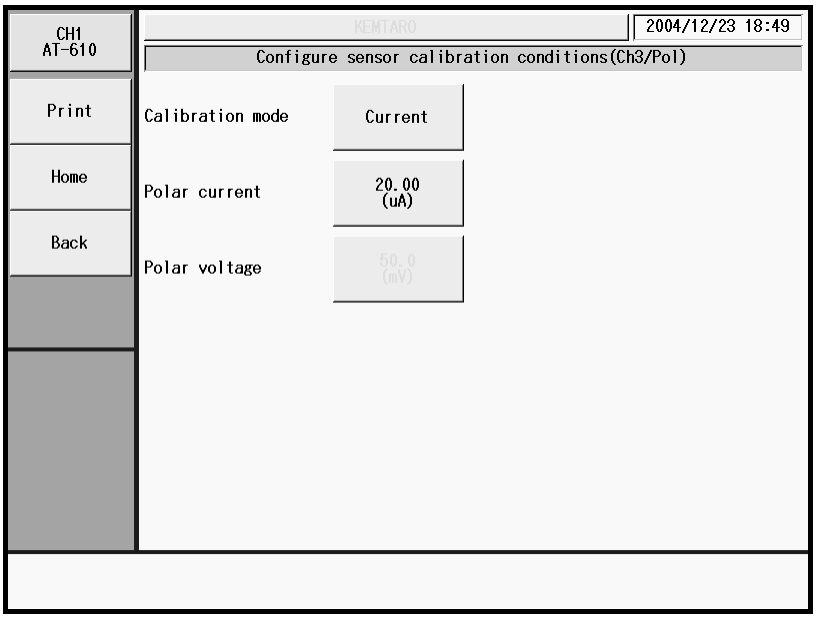
- 0.00 ~ 14.00

Note:

For the details of calibration method, see "3-1-2. Calibration of detectors (preamplifiers) and electrodes".

3-7-1-3. Configure sensor calibration conditions (Ch3/Pol)

Set the conditions of polarization when a preamplifier for polarization titration is used:



[Calibration mode]

Select a polarization mode:

- Constant current polarization
- Constant voltage polarization

[Polar current]

Set a polar current for constant polar current mode:

- 0.00 ~ 20.00μA

[Polar voltage]

Set a polar voltage for constant voltage polarization mode:

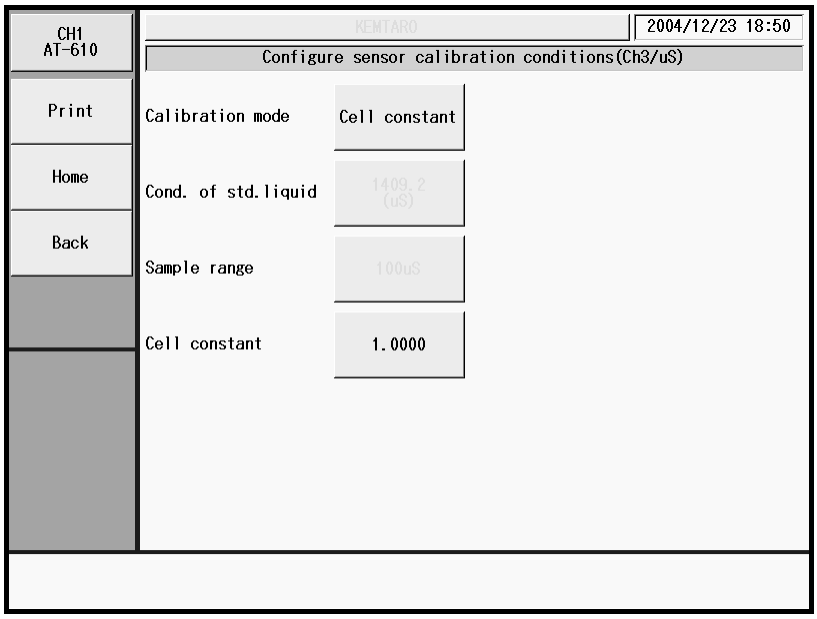
- 0.00 ~ 500mV

Note:

For more details about calibration method, see "4-1-2. Preamplifier for polarization titration (POT-610)".

3-7-1-4. Configure sensor calibration conditions (Ch3/μS)

Set conditions of conductivity cell when a preamplifier for conductometric titration is used:



[Calibration mode]

Select a calibration mode:

- Cell constant
- Std. solution

[Cond. of std. liquid]

Set the conductivity of standard solution:

- 0.0 ~ 9999.9μS

[Sample range]

Set a sample range depending on conductivity of standard solution.

- 100μS/1000μS/10000μS

[Cell constant]

Set the cell constant indicated on a conductivity cell.

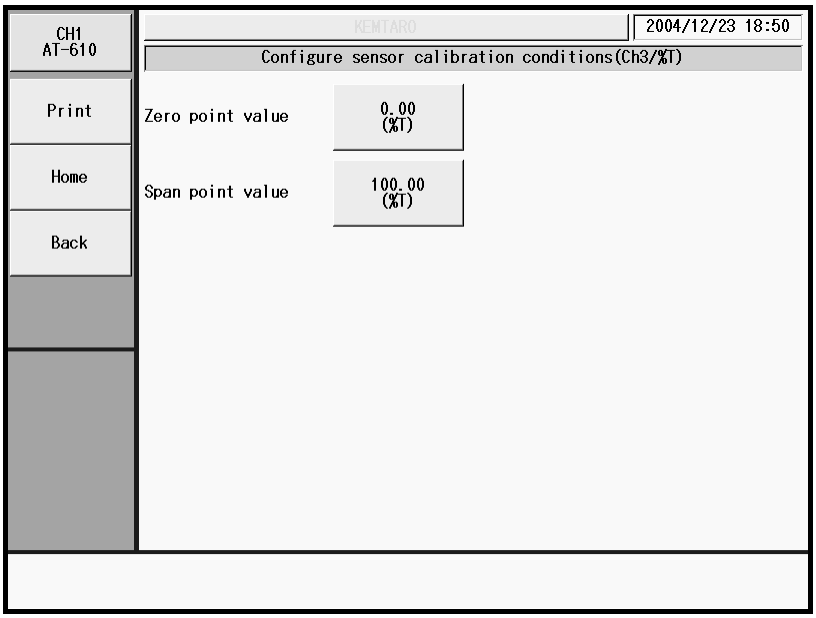
- 0.0000 ~ 99.9999

Note:

For the details on calibration, see "4-1-3. Preamplifier for conductometric titration (CMT-610)".

3-7-1-5. Configure sensor calibration conditions (Ch3/%T)

Set calibration conditions on transmittance of an adapter used for photometric titration when a preamplifier for photometric titration is used:



[Zero point value]

Set a zero calibration value for the photometric titration adaptor. Ordinarily, set it at 0%T when light-transmittance is prevented.

- 0.00 ~ 120.00%T

[Span point value]

Select span calibration value for the photometric titration adaptor. Ordinarily, set it at 100%T for the transmittance of pure water.

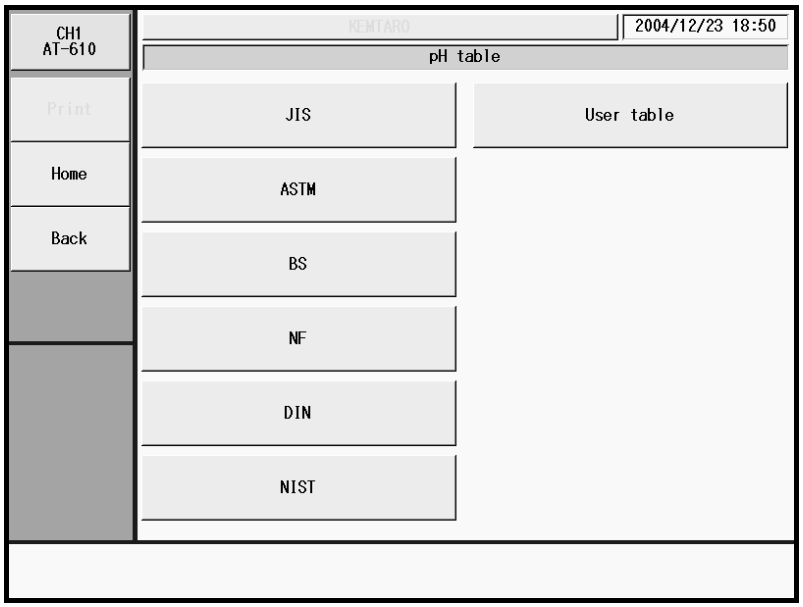
- 0.00 ~ 120.00%T

Note:

For the details on calibration method, see “4-1-1. Preamplifier for photometric titration (PTA-610)”.

3-7-1-6. [pH table]

The user can view the table menu screen (as shown below) for setting temperature-pH relation by selecting [Configure sensor calibration conditions (Ch1/pH)] or [Configure sensor calibration conditions (Ch3/pH)] – [pH Std. liquid table] or configuring the user defined table.



[JIS]

Table for temperature-pH relation as specified in JIS K0019 (pH4), JIS K0023 (pH7) and JIS K0021 (pH9)

[ASTM]

Table for temperature-pH relation as specified in ASTM E70-97 on pH4/pH7/pH9

[BS]

Table for temperature-pH relation as specified in BS 1647 on pH4/pH7/pH9

[NF]

Table for temperature-pH relation as specified in NF T90-008 on pH4/pH7/pH9

[DIN]

Table for temperature-pH relation as specified in DIN19 266 on pH4/pH7/pH9

[NIST]

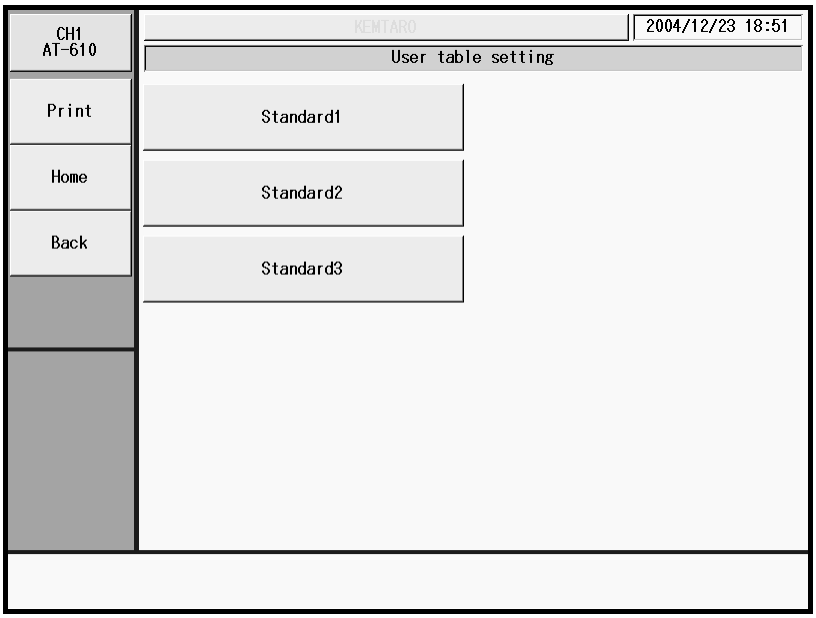
Table for temperature-pH relation as specified in NIST; Actually the temperature table on the US ORION's pH "All in One" buffer kits (Cat. No.910105)

[User table]

Table for temperature-pH relation as specified where the user sets up a table of its own.
User table setup screen will be displayed.

3-7-1-7. [pH table] – [User table]

When pressing [pH table] – [User table], the “User table setting” screen will appear.
AT-610 has various pH tables (pH 4/7/9) on the corresponding standards.
When using pH standard solutions other than the built-in ones, configuring necessary vicinity temperatures and pH values in using the pH standard solution will allow the temperature in calibration to be automatically compensated to perform calibration.



[Standard 1]

The user can set up the second lowest pH table on “User table setting 1/3 (Standard 1)” screen.

[Standard 2]

The user can set up the lowest pH table on “User table setting 1/3 (Standard 2)” screen.

[Standard 3]

The user can set up the third lowest pH table on “User table setting 1/3 (Standard 3)” screen.

< About “User table setting x/3 (Standard X)” screen display >

The user can enter a set of 17 points for temperature (0.0~100.0°C) and pH (0.000~14.000).

Note:

Calibration is mainly carried out on Standard solution 1 as shown below:

Example: pH4 → Standard solution 2, pH7 → Standard solution 1, pH9 → Standard solution 3

This table gets enabled by setting pH table to “User” when calibration mode is “Auto” in the Calibration method.

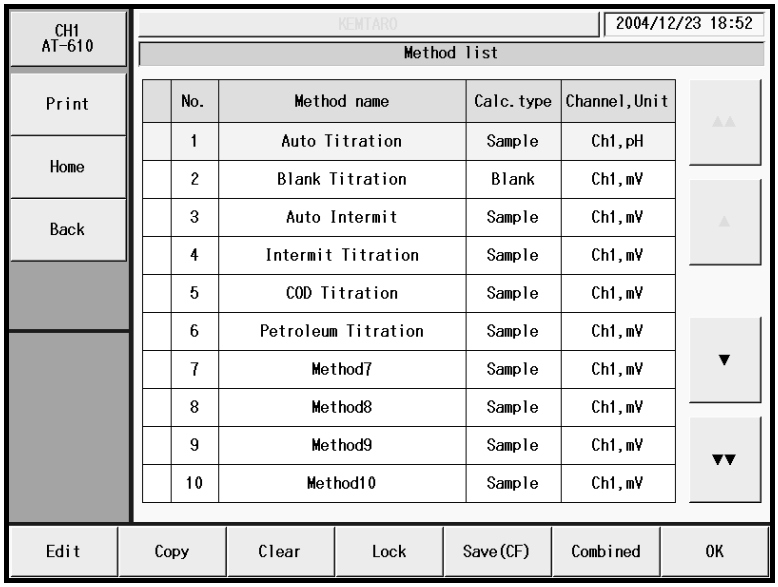
[<<Back], [Next>>]

Move the screen display by one page backward or forward.

3-8. Method

3-8-1. Method list

On “Main” display, press [Method] button to show “Method list”.



[▲], [▼]

Moves the cursor on the list.

[▲▲], [▼▼]

These keys are for page turning. The cursor moves to the top of the list after page break.

[Edit]

When “Method edit” display appears, you can edit the Method (measurement parameters) where the cursor stays on.

Note:
For further information about ‘Method’, see the chapters beginning from “3-8-2”.

[Copy]

On “Method copy” display, you can copy the Method where the cursor stays on.

Note:
For details of Method copy, refer to “3-8-1-1. [Copy]”.

[Clear]

The Method with cursor on is initialized to default preset at time of shipment in plant.

Note:
For details of Method Clear, refer to “3-8-1-2. [Clear] (Method conditions)”.

[Lock]

You can lock the Method with cursor on. The inhibited Method appears on the Method list with "*" mark. To cancel the lock, point the cursor on it and press this button once more.

[Save (CF)]

Save the method data into CF card. "Save method" will be displayed on the screen.

Note:

For the details on how to save methods into CF card, see the section, "3-8-1-3. [Save (CF)] (Method conditions)".

[Combined]

The user can configure Combined Method connecting other methods. The user can implement up to 5 combined Methods out of No.01 through 50 methods. The display "Combined method list" will appear. The measurement results of Method combined with methods of the same burette, potential unit, detector, and preamplifier gain will be printed out in the same graphical way.

Note:

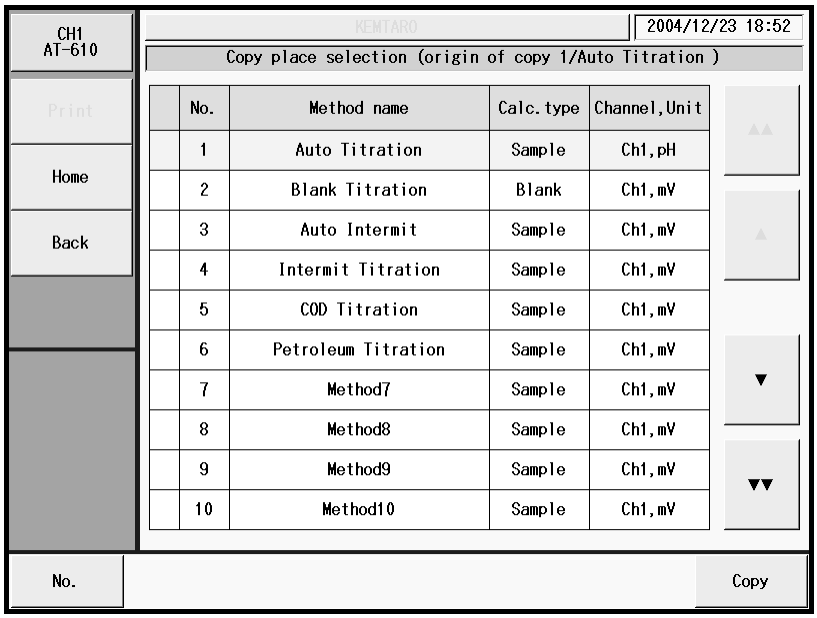
For the details about combined method, see "3-8-11. [Combined]".

[OK]

The user can choose a Method used for measurements with [▲] or [▼] key and press this button to confirm the change.

3-8-1-1. [Copy]

Select the Method on “Method list”, and press [Copy] button. When “Copy place selection” display appears, select a destination where the copied Method will be transferred.



[▲], [▼]

Moves the cursor on the list.

[▲▲], [▼▼]

These keys are for page turning. The cursor moves to the top of the list after page break.

[No.]

Enter the Method number where the copied Method is transferred.

[Copy]

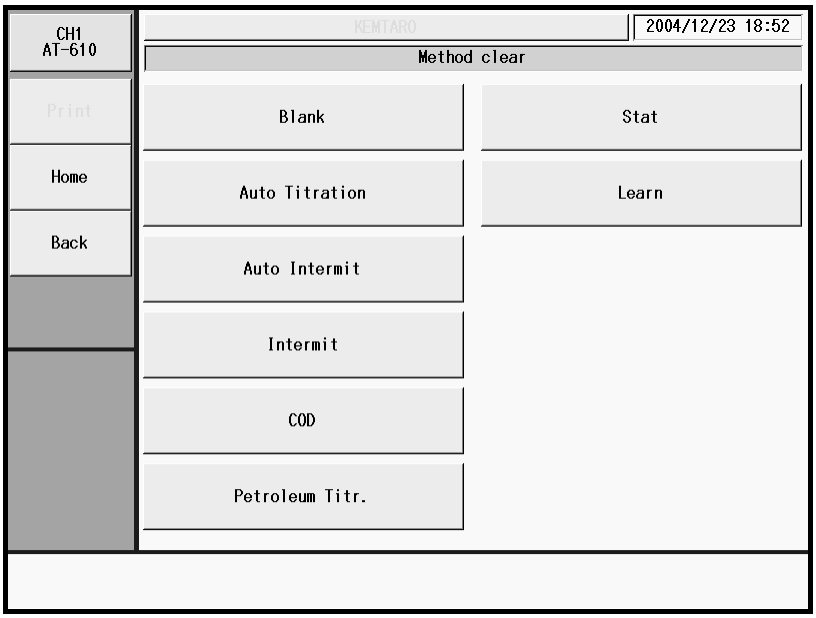
Executes copying the Method.

Note:

The copied and transferred Method rides over the existing Method. It is recommended to print out the existing Method before it is erased.

3-8-1-2. [Clear] (Method conditions)

The user can initialize the currently selected method conditions to the default as in “7-4-1-3. Method parameter”.



[Blank]

Method conditions are initialized to “Blank” method conditions.

[Auto titration]

Method conditions are initialized to “Auto titration” method conditions.

[Auto intermit]

Method conditions are initialized to “Auto intermit” method conditions.

[Intermit]

Method conditions are initialized to “Intermit” method conditions.

[COD]

Method conditions are initialized to “COD” method conditions.

[Petroleum Titr.]

Method conditions are initialized to “Petroleum Titr.” method conditions.

[Stat]

Method conditions are initialized to “Stat” method conditions.

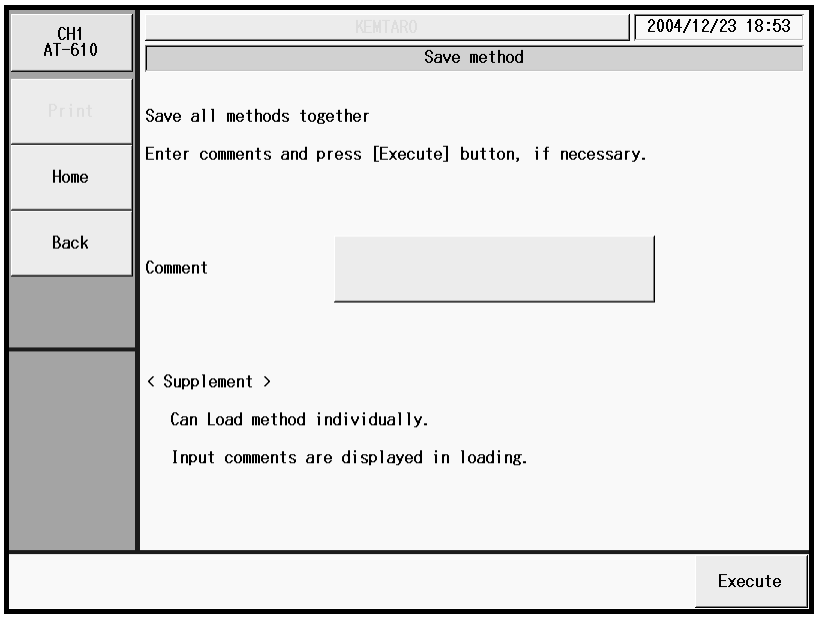
[Learn]

Method conditions are initialized to “Learn” method conditions.

3-8-1-3. [Save (CF)] (Method data)

Save all methods into CF Card together.

1) On “Method list” display, press [Save (CF)] button to show “Save method”.



2) When entering comments with the method data to be saved, press the portion where comment is displayed. After confirming the following screen display, enter comments and press [OK] button.

3) Press [Execute] button on the “Save method” screen display. Confirming the verifying-entry message, press [Yes] button.

4) All methods are saved into CF card and the screen display returns to the initial menu.

Note:

If only method data are saved into CF card, the memory storage is occupied in about 125K bytes. The number of files of method data to be saved in CF card is 100 in maximum. When measurement results are saved in CF card, the number of files saved will decrease depending on the memory capacity of CF card.

Note:

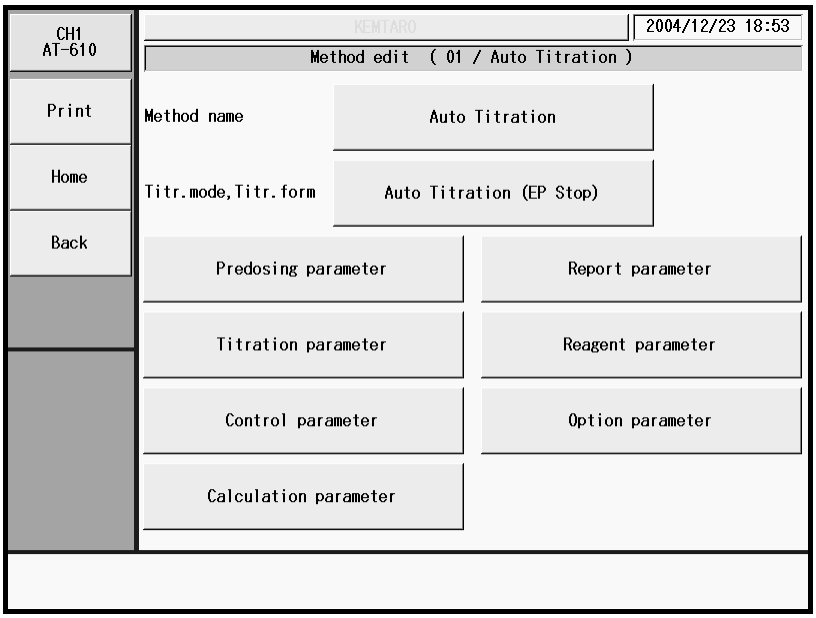
For details on loading the method data saved on CF card into the measuring unit, see the section “3-5-13-1. [Load/Delete Method]”.

3-8-2. Outline of Method

For precise measurement effected in a short span of time, it is necessary to configure conditions appropriate for a sample and a method. The method consists of information on the measuring conditions, calculation of concentration, and the like. AT-610 can store standard methods (No. 01 through 50) and combined methods (No. 61 through 70; up to 5 combined methods for the methods No. 01 through 50).
Each method can be named individually.

A Method consists of [Titr. mode, Titr. form], [Predosing parameter], [Titration parameter], [Control parameter], [Calculation parameter], [Report parameter], [Reagent parameter] and [Option parameter].

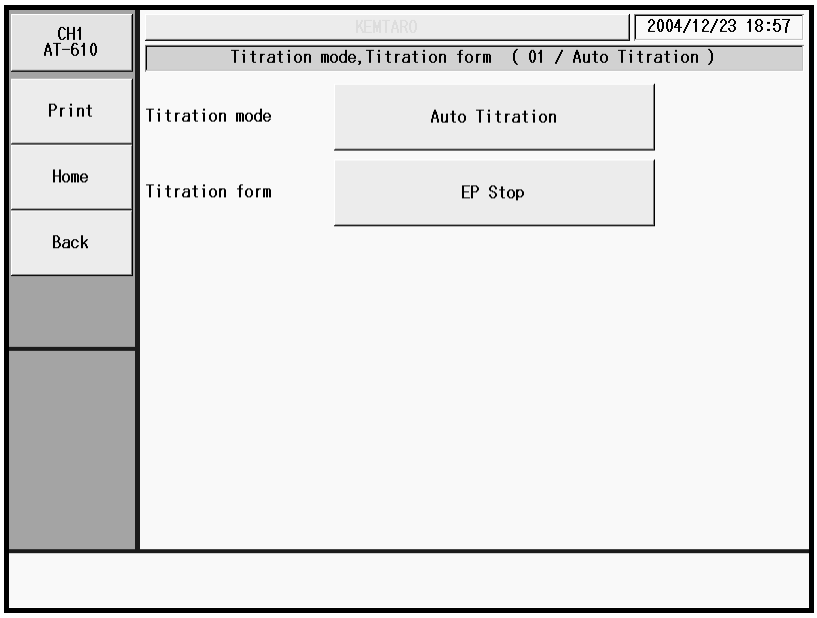
To edit a method, press [Method] button on the Main screen to display “Method list”, and put the cursor on the method to be edited, followed by pressing [Edit] button.



Each parameter can be selected with corresponding button on display.

Note:
For details of each parameter, refer to individual item in this manual.

3-8-3. [Titr. mode, Titr. form]



[Titration mode]

Set a titration mode to determine how to dose titrant:

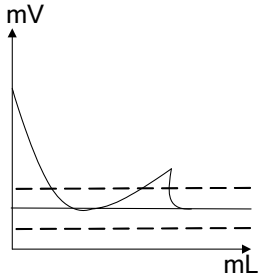
- Blank : Blank mode is designed and programmed for performing a blank test. Titration goes on the auto cut-off dosing by sensing potential stability.
- Auto Titration : This mode allows to titrate according to parameter-controlled rate, thereby it accelerates the titration where potential change is small and slows down where the change is large.
- Auto Intermit : This mode is appropriate for samples featuring slow chemical reaction that takes time before reaching stable potential while adding titrant. Dose volume is automatically set according to potential gradient.
- Intermit : This mode is designed for cut-off or constant rate titration. For continuous constant rate titration, enter “0” for “Cut-off time” as control parameter. Titration rate can be set by “Dispense speed”. Intermittent titration waits for “Cut-off time” each time titrant is dosed at the preset intervals.
- COD : This mode is specific to measurement of COD (Chemical Oxygen Demand) according to the JIS K0102 Testing method for industrial wastewater and requires the optional COD titration unit (COD-510) to perform the titration. When selecting this mode, the titration form is fixed to “COD” only.

Note:

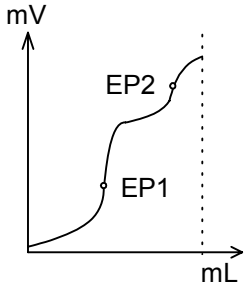
For the use of the COD titration unit, see “4-8. Use COD titration unit (COD-510)”.

- Petroleum Titr. : This is the titration mode according to the JIS K2501or ASTM D-664 for Petroleum products- determination of neutralization number. Titration starts dosing and data sampling when potential reading at Integral time is found lower than the preset level. Unless the potential difference before and after dosing is larger than preset level, the set dose volume changes from 1st Delivery volume to 2nd Delivery volume.

- Stat : Stat titration doses reagent up to maximum volume to the end while keeping Stat level that is preset on control parameter settings. The data are sampled each Lag time when data are read. Time vs. titrant consumption will be printed out as measurement results. The titration form is fixed to “Stat”.



- Learn : The purpose of Learn titration is to select a control mode and parameters appropriate for a given sample. Titration will end up to the maximum titration volume. When the number of endpoints detected reaches the preset number, the titration form and mode will be automatically changed to the optimal settings. However, optimal parameters may not be obtained for those particular samples of which reaction is very slow or potential change is small, abrupt or the like. The titration results are stored in “Auto Intermit” mode and “Full” form.
The titration form is fixed to “Learn” when selecting this mode.



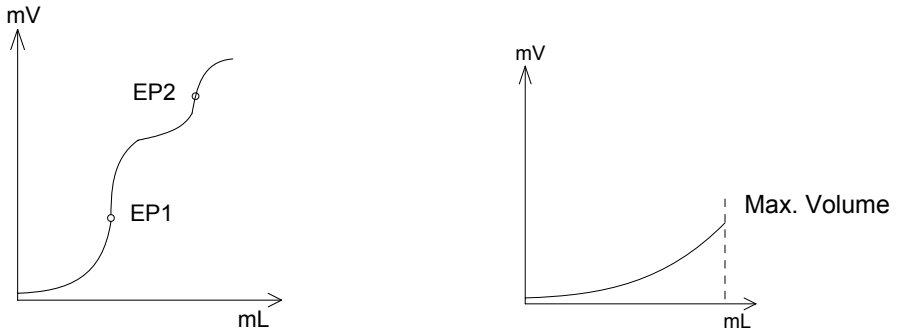
[Titration form]

Here you can select a titration form mainly used to find endpoints.

Note:

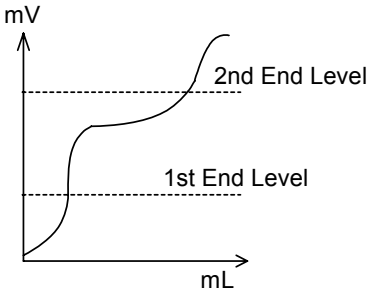
When a titration form is selected, the control parameters of Method are initialized to the default as described in the Chapter "7-4-1. Parameter list".

- EP Stop : Titration can detect endpoints to the number (up to 5) of EP (endpoint) preset on Control parameters. If titration volume reaches the maximum volume, however, it ends halfway. You can set a potential level of the first endpoint by separating the first and second EP or set the EP area for the first EP.



This EP Stop titration form is the typical titration form popularly used. It detects the highest inflection point as EP, and is least influenced by titration conditions, resulting in good repeatability. When the inflection point is unclear, it is recommended to detect the first endpoint by Separation level thereby the first and second EP are separated.

- Level Stop : Titration can detect endpoints to the number (up to 2 EP potential levels) of EP preset on Control parameters. When titration volume reaches the maximum volume, however, it ends halfway.

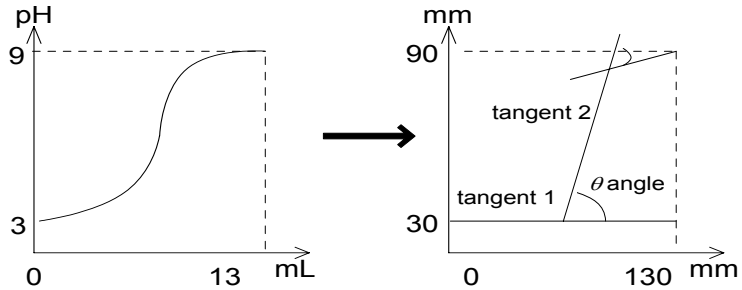


This form is useful for those samples measured by such method as non-aqueous buffer method for petroleum products, M-alkali or P-alkali measurement or the like where the EP level is known. For titration with unclear inflection points, it is also recommended to determine endpoints using this titration form where the titration continues to the preset potential level.

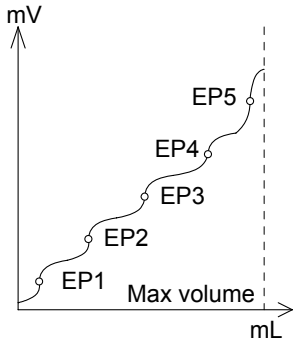
- Intersect : Titration can detect endpoints to the preset number (up to 3) of EP on control parameter. If titration reaches the maximum volume, however, it will end halfway. This form is used for titration like diazotation , conductivity and photometry. This form automatically detects the intersection point where two tangent lines cross when the angle changes more than preset degrees on titration curve. The angle is determined by converting titration volume and potential to the unit of length as shown below. Titration volume and potential level will be converted to the length of 10 mm as shown below:

1mL	1pH	→	10mm
100mV	10%T	→	10mm
0.1Abs	10μA	→	10mm
	CMT each Range × 0.01μS/cm	→	10mm

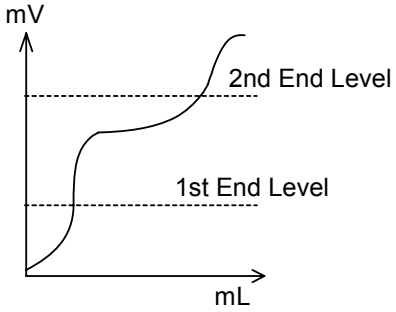
For example;



- Full : Titration goes on to the maximum volume as preset on titration parameter. This titration form can detect the endpoint by EP Stop form up to 5 EPs. This form is useful for samples where the number of EP is unknown.



- Level & EP : This titration form can simultaneously perform 'EP Stop' and 'Level Stop' titration, ending up with the detection of the preset number of sets of endpoint found by 'EP Stop' and 'Level Stop'. Titration can detect the endpoints to the preset number of EP (up to 2 sets: 2 EPs by EP Stop and 2 EPs by Level Stop) on control parameter. When a titration reaches the maximum volume, however, it ends halfway.



3-8-3-1. Titration, electrode and preamplifier

For correct titration, it is important to know the characteristics of reagent and reaction of solutions, and then to select appropriate titration control, detection electrode and preamplifier. The below chart shows the relations of titration, electrode, preamplifier and control.

Titration		Control	Remark	Electrode/Preamplifier
Blank titration of reagent		Blank Titration	For titration less than 0.3mL	
Strong acid – Strong base HCl – NaOH H_2SO_4 – NaOH		Auto Titration	Increase control speed when reaction is fast.	Combination glass electrode 98-100-C171 STD preamplifier
Weak acid – Strong base Strong acid – Weak base Weak acid – Weak base Benzoic acid – KOH HCl – Na_2CO_3 $HClO_4$–Potassium hydrogen phthalate		Auto Titration	Slow down control speed if reaction is slow with less than 1/100mol/L. Also use Auto Intermit	Combination glass electrode 98-100-C171 or Combination double junction electrode 98-100-C173 STD preamplifier
Precipitation titration	$AgNO_3$ – I^- Br^- Cl^- CN^- S^{2-} SCN^- $Pb(ClO)_2$– SO_4^{2-}	Auto Titration	Slow down control speed if reaction is slow with less than 1/100mol/L. Also use Auto Intermit	Silver electrode 98-100-M371 Ref. electrode 98-100-R272 For non-aqueous: Silver electrode 98-100-M371 Glass electrode 98-100-H171 STD preamplifier
Redox titration	$Na_2S_2O_3$ – I_2 $KMnO_4$ – Fe^{2+} I_2 – As_2O_3	Auto Titration	Use Auto Intermit if reaction is slow and potential comes back.	Combination Pt electrode 98-100-C272 If inner solution affect; Silver electrode 98-100-M271 and Ref.electrode 98-100-R173 STD preamplifier
Petroleum neutralization titration	Acid value of fats/oil Nutralizatyion of fatty acid Acid number of petroleum products Base number of petroleum products	Fats and oil acid Auto Intermit Petroleum Titr.	Use Petroleum Titr. for standard analysis. For quick measurement, use Auto Intermit.	Combination glass electrode 98-100-C171 when noisy, use: Glass electrode 98-100-H171 Ref.electrode 98-100-R115 STD preamplifier
Chelatometric titration by ion electrode	EDTA – Zn^{2+} EDTA – Ca^{2+}	Auto Titration	Use ionic electrode for detection	For Zn^{2+} – Cu-EDTA, use copper ionic electrode. For Ca^{2+}, use calcium ionic electrode STD preamplifier
Chelatometric titration by photometric titration	EDTA – Ca^{2+}, Mg^{2+} EDTA – Zn^{2+} EDTA – Ni^{2+}	Auto Intermit	Use preamplifier for photometric titration	Ca^{2+},Mg^{2+}, Zn^{2+}–EBT indicator λ=630nm Ni^{2+} – MX indicator λ=530nm PTA preamplifier
Bromine titration	KBr, $KBrO_3$ – Olefin Back titration $Na_2S_2O_3$ – Petroleum resin	Auto Intermit Back titration, use Auto Titration	Use preamplifier for polarization titration	Twin Pt electrode 98-100-M511 For low current fluctuation: 98-100-M512 POT preamplifier
Diazotation titration	$NaNO_2$ – Sulfonamide acid, Aromatic promary amine	Auto Intermit Intermit	Use preamplifier for polarization or redox titration Use STD. for redox.	Twin Pt electrode 98-100-M511 For low current flucturation: 98-100-M512 POT preamplifier

3-8-3-2. Preamplifiers

There are five sorts of preamplifiers connectable with detecting electrode as shown in Table 3-8-3. Select a preamplifier appropriate for your titration. For connecting the preamplifier, refer to the following chapter 4-1-5. How to Change preamplifier.

Table 3-8-3

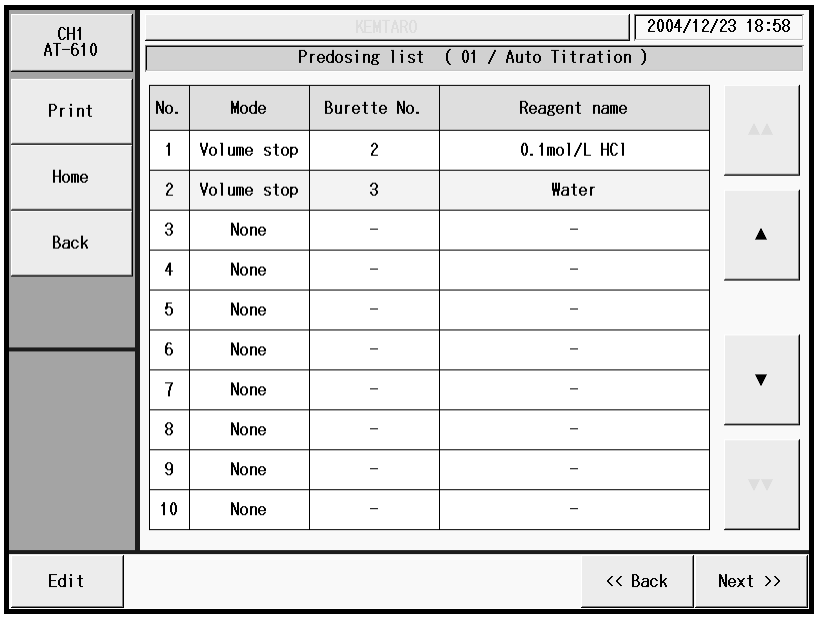
Detector number / Titration type	1	2	3	Description
Standard preamplifier (STD-610)	pH / mV	mV	—	Acid base titration, Redox titration, etc. Detector 1: Range 0-14pH Resolution: 0.01pH(0.1mV) Detector 2: 0-±2000mV Resolution: 0.1mV
Photometric preamplifier (PTA-610)	pH / mV	mV	%T / Abs	Acid base titration, Redox titration, Analysis of hydraulic modulus, metal concentration in plating liquid. Detector 1: Detector 2 is same as standard preamplifier Detector 3: Transmittance range: 0-120%T Resolution: 0.1%T Absorbance : 0-9.999Abs Resolution: 0.001Abs
Polarization preamplifier (POT-610)	pH / mV	mV	μA / mV	Acid base titration, Redox titration, Diazotization of dye. Detector 1: Detector 2 is same as standard preamplifier Detector 3: Regulated current polar potential titration Loaded current: 0-20μA Voltage : 0-2V Resolution: 0.1mV Regulated voltage polar current titration Voltage : 0-500mV Current : 0-100μA Resolution: 0.01μA
Conductivity preamplifier (CMT-610)	pH / mV	mV	μS/cm	Acid base titration, Redox titration, Electrical conductivity measurement. Detector 1: Detector 2 is same as standard preamplifier Detector 3: Measuring range: 1-100, 1-1000, 1-10000μS/cm Resolution : 0.01% in each full scale Temperature compensation coefficient : 2% / 1°C (fixed) Range of cell constant : **.*** ~ 0.**** Reference temperature: 25°C
pH dual input preamplifier (TET-610)	pH / mV	mV	pH / mV	Titration in general like Acid base titration, Redox titration, etc. Detector 1: Detector 2 is the same as standard preamplifier Detector 3: same as detector 1

Note:

Performance of Detector 1 and 2 of each preamplifier is the same as that of STD-610 preamplifier.

3-8-4. [Predosing parameter]

Press [Predosing parameter] button on “Method edit” screen to display “Predosing list”.
“Predosing parameter” allows to set the predosing conditions on a sample before measurements.
With up to 10 burettes, samples can be previously dispensed.



[No.]

Here you can see the order of predosing for up to 10 burettes.

[Mode]

Display of the preset dose mode.

[Burette No.]

Display of the preset burette number.

[Reagent name]

Display of the preset reagent name in reagent information.
You can relate a burette to a reagent information preset in [Reagent parameter].

[▲], [▼] button

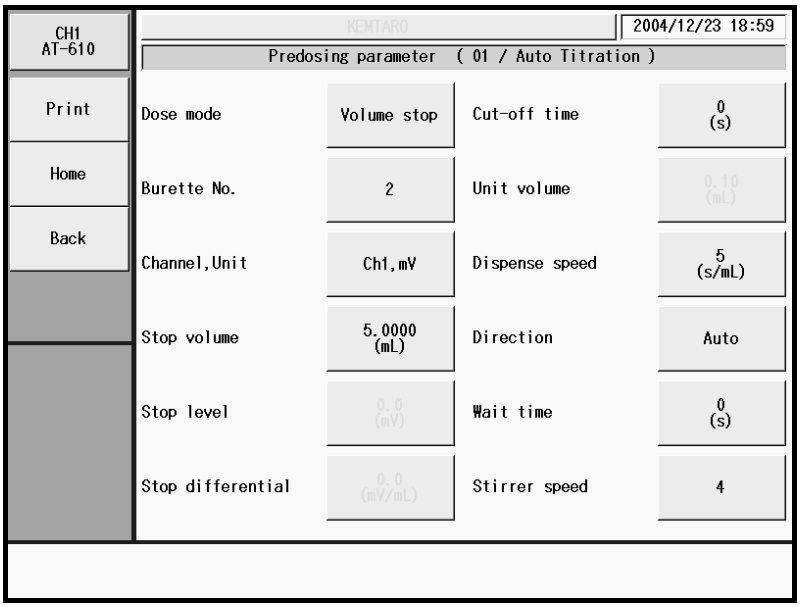
You can move the cursor on the list of predosing parameters.

[Edit] button

Pressing this button leads to display the “Predosing parameter” screen where you can edit the predosing parameters on the position of the present cursor.

3-8-4-1. [Edit] – [Predosing parameter]

Press [Edit] button on “Predosing list” to display “Predosing parameter”.

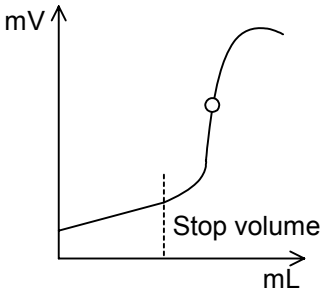


[Dose mode]

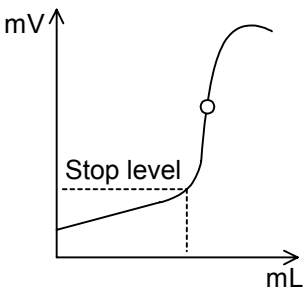
Here you can select a dose mode from the followings:

- None : No dosing is applied.
- Volume stop: Dose a reagent up to preset volume on “Stop volume”. When potential change of a sample is small, you can shorten measurement time by using “Volume stop”.
- Level stop : Dose up to the potential level preset on “Stop level”. When the potential at inflection points is stable, you can predose by “Level stop” regardless of titration volume.
- Diff. stop : Doses until it detects differential point (potential difference against minute titration volume) preset on “Stop differential”. Where potential difference is stable on titration curve though starting level may move, you can doses by “Differential stop”.

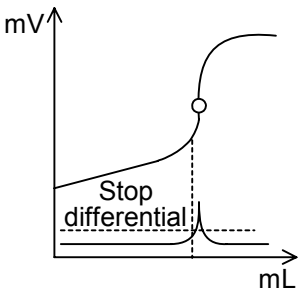
Typical plot for volume stop



Typical plot for Level stop



Typical plot for Differential stop



[Burette No.]

Here you can select the burette numbers for dosing.

- 1 ~ 10

[Channel, Unit]

Here you can select the detector number and the unit of detected potential unit-- settable unit depends on the preamplifier selected.

- Ch1, mV : Use for detector 1 and unit in mV.
- Ch1, pH : Use for detector 1 and unit in pH.
- Ch2, mV : Use for detector 2 and unit in mV.
- Ch3, mV : Use for detector 3 and unit in mV when POT-610 or TET-610 preamplifier is connected.
- Ch3, pH : Use for detector 3 and unit in pH when TET-610 preamplifier is connected.
- Ch3, %T : Use for detector 3 and unit in %T when PTA-610 preamplifier is connected.
- Ch3, Abs. : Use for detector 3 and unit in Abs when PTA-610 preamplifier is connected.
- Ch3, μA : Use for detector 3 and unit in μA when POT-610 preamplifier is connected.
- Ch3, 100μS : Use for detector 3 and conductivity range in 100μS when CMT-610 preamplifier is connected.
- Ch3, 1000μS : Use for detector 3 and conductivity range in 1000μS when CMT-610 preamplifier is connected.
- Ch3, 10000μS: Use for detector 3 and conductivity range in 10000μS when CMT-610 preamplifier is connected.

[Stop volume]

When "Volume stop" is set for "Dose mode", you select reagent volume to be dosed.

When either "Level stop" or "Diff. stop" is set for "Dose mode", you select the maximum dose volume for the burette to be used. When dosed volume reaches stop volume, the burette stops dosing regardless of "Stop level" or "Stop differential" as shown below.

The setting range for stop volume differs according to the burette unit. See below chart:

Burette capacity	Setting range
1mL	0 ~ 1000mL
5mL	0 ~ 5000mL

Burette capacity	Setting range
10,20,50mL	0 ~ 9999.0000mL

[Stop level]

Here you can select potential level to end dosing when it reaches the set level. This dialog box appears only when "Dose mode" is set to "Level stop". Dosing will stop when detected potential reaches the set level.

- See Chapter "3-8-6-7. Input range for potential parameter" about the input range.

[Stop differential]

Here you can select derivative level for ending dosing. This screen display will appear only when "Dose mode" is set to "Diff. stop". Dose will stop when the detected derivative gets to set value.

- See Chapter "3-8-6-7. Input range for potential parameter" about the input range.

[Cut-off time]

Here you can select a cut-off time for intermittent dosing. [Cut-off time]=0 means continuous dosing.

- 0 ~ 9999s

[Unit volume]

Here you can select reagent volume for each cut-off time in intermittent dosing. You cannot set Unit volume when [Cut-off time] is set at '0'. Since the dischargeable amount of reagent depends on the installed burette, see the section "3-8-6-9. Settings of discharge amount of titrant" in this manual.

- 0.001 ~ 9999.000mL

[Dispense speed]

Here you can select dispense speed. This speed differs depending on the burette unit. The range of speed should be set according to the table below:

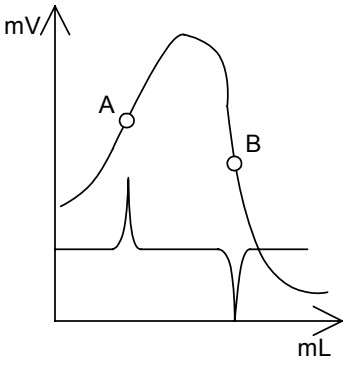
Burette capacity	Setting range
1mL	20 ~ 999s/mL
5mL	4 ~ 999s/mL
10mL	2 ~ 999s/mL

Burette capacity	Setting range
20mL	1 ~ 999s/mL
50mL	1 ~ 600s/mL

[Direction]

Here you can select the direction of EP detection:

- Auto : The endpoints of both directions (A and B) are detected regardless of the direction of change in potential.
- Positive : The endpoint like A below with positive direction of change in potential is selectively detected.
- Negative : The endpoint like B below with negative direction of change in potential is selectively detected.



[Wait time]

Here you can set a time to wait before starting dose. This is useful for viscous or hardly soluble samples.

- 0 ~ 9999s

[Stirrer speed]

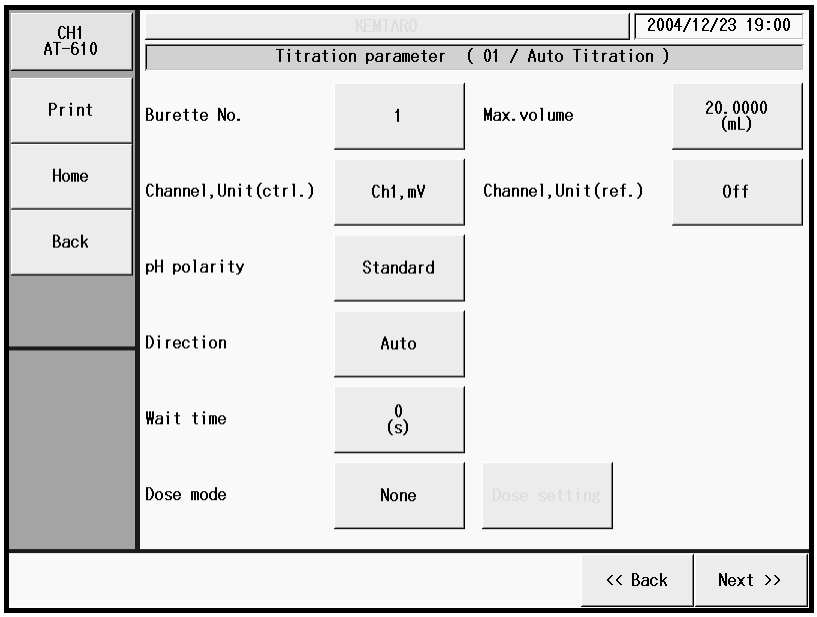
Here you can select a speed of the rotator bar for the stirrer. Speed can be selected from nine steps:

- 0 ~ 9

3-8-5. [Titration parameter]

Press [Titration parameter] button on “Method edit” screen display to have “Titration parameter” setup display.

On this setting screen, you can configure general parameters relevant to titration.



[Burette No.]

Here you can select the burette number used for titration.

- 1 ~ 10

[Max. volume]

Here you can set maximum titration volume. When it reaches the preset volume, titration will end regardless of the detection of EP or not. The selective range depends on the burettes selected. The Max. volume should include dose volume.

Burette capacity	Setting range
1mL	0 ~ 1000mL
5mL	0 ~ 5000mL

Burette capacity	Setting range
10,20,50mL	0 ~ 9999.0000mL

⚠ Caution!

Do not set an excessive volume that will overflow reagent out of a sample vessel like beaker.

[Channel, Unit (ctrl.)] [Channel, Unit (ref.)]

Here you can select the detector number and the unit of detected potential unit-- settable unit depends on the preamplifier selected. For "Channel, Unit (ref.)", select the unit of potential and the detector number as well as "Channel, Unit (ctrl.)". The control of titration will be performed on the settings selected in "Channel, Unit (ctrl.)".

- Off : No selection. Can configure in "Channel, Unit (ref.)".
- Ch1, mV : Use for detector 1 and unit in mV.
- Ch1, pH : Use for detector 1 and unit in pH.
- Ch2, mV : Use for detector 2 and unit in mV.
- Ch3, mV : Use for detector 3 and unit in mV when POT-610 or TET-610 preamplifier is connected.
- Ch3, pH : Use for detector 3 and unit in pH when TET-610 preamplifier is connected.
- Ch3, %T : Use for detector 3 and unit in %T when PTA-610 preamplifier is connected.
- Ch3, Abs. : Use for detector 3 and unit in Abs when PTA-610 preamplifier is connected.
- Ch3, μA : Use for detector 3 and unit in μA when POT-610 preamplifier is connected.
- Ch3, 100μS : Use for detector 3 and conductivity range in 100μS when CMT-610 preamplifier is connected.
- Ch3, 1000μS : Use for detector 3 and conductivity range in 1000μS when CMT-610 preamplifier is connected.
- Ch3, 10000μS: Use for detector 3 and conductivity range in 10000μS when CMT-610 preamplifier is connected.
- Temp. : Select when the unit detected is temperature and "Channel, Unit (ref.)" is selected. The channel is the same as in the "Channel, Unit (ctrl.)".

Note:

"Channel, Unit (ref.)" will not be displayed when it is the same as for Channel, Unit (ctrl.) or it is not selected along with Channel, Unit (ctrl.).

Table 3-8-5-1. Combination of preamplifiers and detectors

Preamplifier	Detector 1	Detector 2	Detector 3
STD-610	pH, mV, Temp.	mV	—
PTA-610			%T, Abs
POT-610			μA, mV
CMT-610			μS/cm
TET-610			pH, mV, Temp.

[pH polarity]

Select the direction of the change in pH potential.

Here a pH glass electrode can be used for a reference electrode in order to avoid the effect of flowing-out inner filling in the reference electrode (e.g. determination of chlorine by non-aqueous titration). Here you need to inverse polarity of electrode potential.

- Standard : Detect potential in the normal direction.
- Reverse : Detect reversed potential.

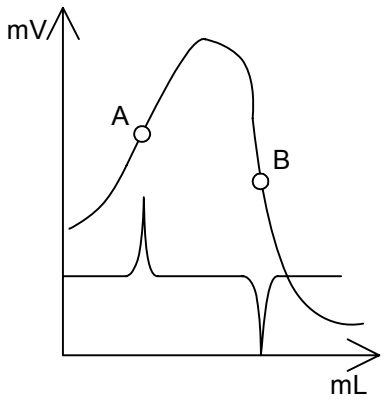
Note:

When titrating with other type of electrodes, set the parameter to "Standard". If "Reverse" mode is applied, a graph or data list will be recorded in inverted condition.

[Direction]

Here you can select the direction of EP detection:

- Auto : The endpoints of both directions (A and B) are detected regardless of the direction of change in potential.
- Positive : The endpoint like A below with positive direction of change in potential is selectively detected.
- Negative : The endpoint like B below with negative direction of change in potential is selectively detected.



[Wait time]

Here you can select time delay before titration starts. When the preset delay time elapses after pressing [Start] button, actual titration will start. This is useful when it takes a time in titrating hardly soluble samples or in stabilizing potential level. This setting will be unable when the titration mode is set to "COD ".

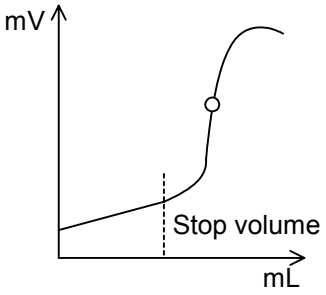
- 0 ~ 9999s

[Dose mode]

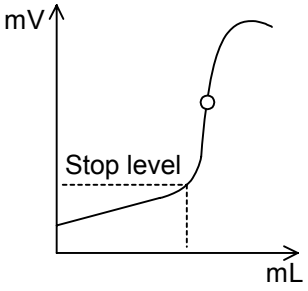
Here you can select a dose mode from the followings. The burette for dosing reagent will be one set in “Burette No.”. The dose amount set in this dose mode will affect the titration volume of measurement results. This setting will be unable when the titration mode is set to “COD ”.

- None : No dosing is applied.
- Volume stop : Dose a reagent up to preset volume on “Stop volume”. When potential change of a sample is small, you can shorten measurement time by using “Volume stop”.
- Level stop : Dose up to the potential level preset on “Stop level”. When the potential at inflection points is stable, you can predose by “Level stop” regardless of titration volume.
- Diff. stop : Doses until it detects differential point (potential difference against minute titration volume) preset on “Stop differential”. Where potential difference is stable on titration curve though starting level may move, you can doses by “Differential stop”.

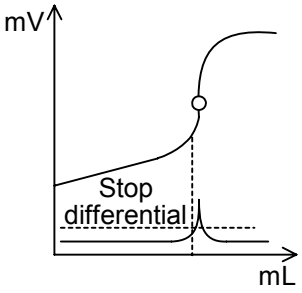
Typical plot for volume stop



Typical plot for Level stop



Typical plot for Differential stop



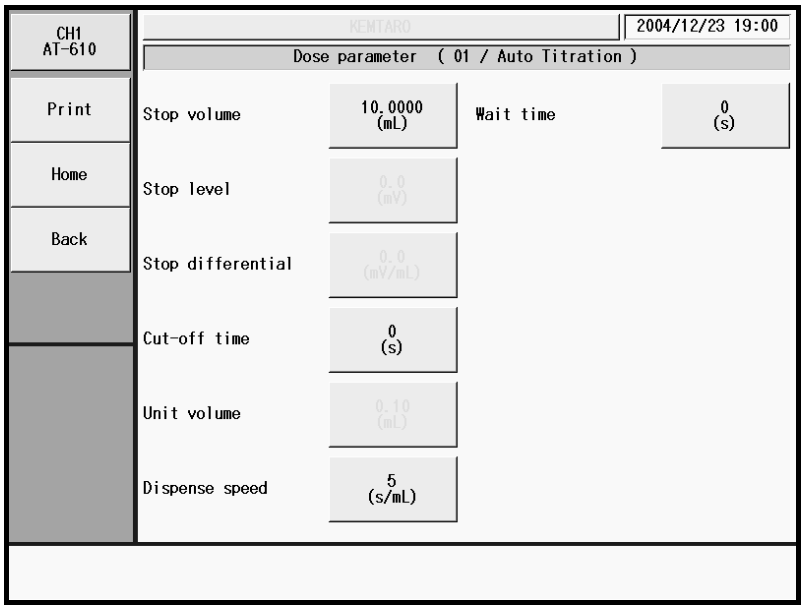
[Dose setting]

When pressing this button, the display “Dose parameter” will appear where you can configure does setting. This is significant when “Dose mode” is set to other than “None”.

Note:
For Dose parameter, see Chapter “3-8-5-1. Dose parameter”.

3-8-5-1. [Dose Parameter]

Make settings of parameters for dosing.



[Stop volume]

When “Volume stop” is set for “Dose mode”, you select reagent volume to be dosed.

When either “Level stop” or “Diff. stop” is set for “Dose mode”, you select the maximum dose volume for the burette to be used. When dosed volume reaches stop volume, the burette stops dosing regardless of “Stop level” or “Stop differential” as shown below.

The setting range for stop volume differs according to the burette unit. See below chart:

Burette capacity	Setting range
1mL	0 ~ 1000mL
5mL	0 ~ 5000mL

Burette capacity	Setting range
10,20,50mL	0 ~ 9999.0000mL

[Stop level]

Here you can select potential level to end dosing when it reaches the set level. This dialog box appears only when “Dose mode” is set to “Level stop”. Dosing will stop when detected potential reaches the set level.

- See Chapter “3-8-6-7. Input range for potential parameter” about the input range.

[Stop differential]

Here you can select derivative level for ending dosing. This screen display will appear only when “Dose mode” is set to “Diff. stop”. Dose will stop when the detected derivative gets to set value.

- See Chapter “3-8-6-7. Input range for potential parameter” about the input range.

[Cut-off time]

Here you can select a cut-off time for intermittent dosing. [Cut-off time]=0 means continuous dosing.

- 0 ~ 9999s

[Unit volume]

Here you can select reagent volume for each cut-off time in intermittent dosing. You cannot set Unit volume when [Cut-off time] is set at '0'. Since the dischargeable amount of reagent depends on the installed burette, see the section "3-8-6-9. Settings of discharge amount of titrant" in this manual.

- 0.001 ~ 9999.000mL

[Dispense speed]

Here you can select dispense speed. This speed differs depending on the burette unit. The range of speed should be set according to the table below:

Burette capacity	Setting range
1mL	20 ~ 999s/mL
5mL	4 ~ 999s/mL
10mL	2 ~ 999s/mL

Burette capacity	Setting range
20mL	1 ~ 999s/mL
50mL	1 ~ 600s/mL

[Wait time]

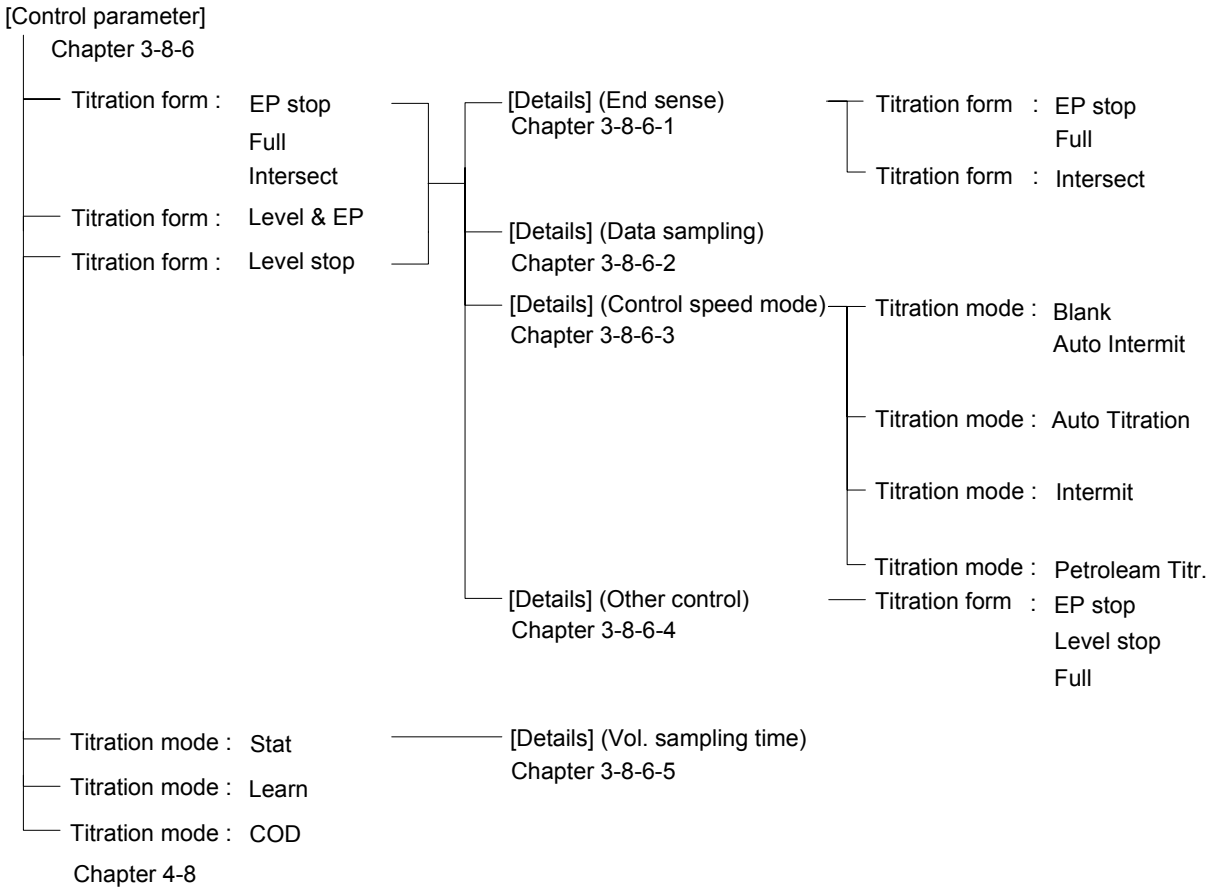
Here you can set a time to wait before starting dose. This is useful for viscous or hardly soluble samples.

- 0 ~ 9999s

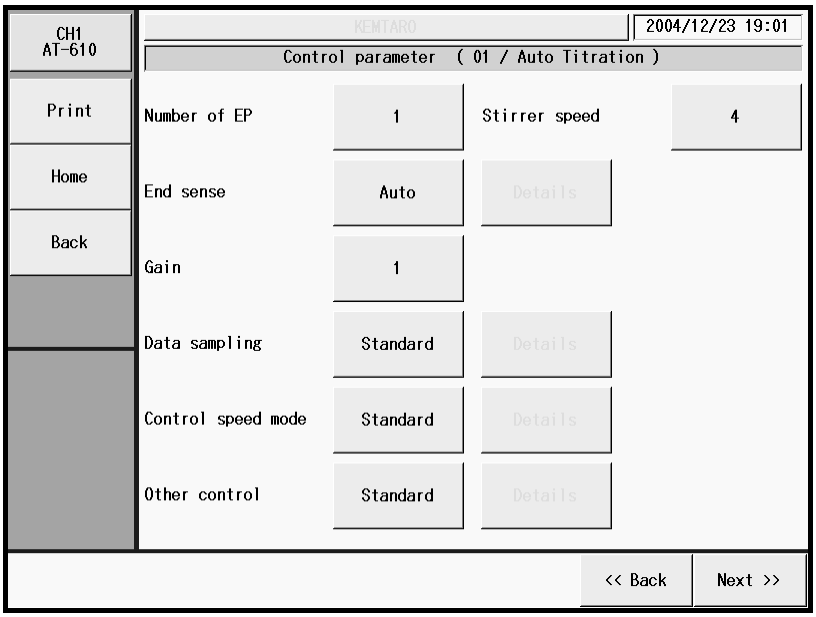
3-8-6. [Control parameter]

Here you can configure various settings for your intended titration including titrant dose speed, data sampling mode, EP detection method and its conditions.

Control parameters differ depending on the titration form and mode of the prset method as shown below. For the details about each parameter, refer to the corresponding chapter.



(When titration form is “EP Stop”, “Intersect” or “Full”)



[Number of EP]

Here you can select the number of endpoints. Titration ends when it detects the preset number of endpoints. This setting will be unable when the titration form is set to “Full ”.

- 1 ~ 5 : When titration form is set to “EP Stop”
- 1 ~ 3 : When titration form is set to “Intersect”

Note:

When titration form is set to “Full”, a titration goes on up to the maximum volume regardless of the number of endpoints (up to 5) that are detected during a titration.

[End sense]

Here you can select Auto or Set for EP sensing method.

- Auto : End sense is determined automatically. It starts EP sense by default value and then automatically changes EP sense if an endpoint is not found. The change EP sense is stored as “Set”, and therefore, chose “Set” from second measurement onward.
- Set : The endpoint is detected according the preset end sense value (dE, dE/dmL or dDeg).

[Details]

Here you can select how to detect EP. Press this button to show “EP sense method” dialog box on display. This is valid when “Set” is chosen in the “End sense” setting.

Note:

For the setup of ‘End sense’, see Chapter “3-8-6-1. EP sense method”.

[Gain]

Here you can select the sensitivity of detection signal. Typically, use ‘1’ for this setting.
When potential change is too small to detect, increase the gain.

- 1 ~ 10

[Data sampling]

Here you can set the condition for data sampling. The data list will be made from measurement results under the following conditions on detection signal:

- Standard : Sampling is made at 4.0mV sampling potential with 0.50 titration volume. Data sampling volume will be 0.10mL when 'Titration mode' is set to "Blank".
- Set : You can set the data sampling potential and titration volume.

[Details]

Here you can select the sampling conditions. Press this button to display "Data sampling condition". This setting becomes valid when "Data sampling" is set to "Set".

Note:
For setting data sampling condition, see Chapter "3-8-6-2. Data sampling condition".

[Control speed mode]

Choose your desired speed out of the following modes:

- Fast : For fast reaction like strong acid – strong base.
- Standard : For typical measurements like weak acid – weak base · strong acid – weak base.
- Slow : For slow reaction in dilute titrant (e.g. no more than 0.01mol/L).
- Set : Manually set the control speed.

[Details]

Here you can select the control speed mode. Press this button to display "Control speed mode". This setting becomes valid when "Control speed mode" is set to "Set".

Note:
For setting the control speed, see Chapter "3-8-6-3. Control speed mode".

[Other control]

Here you can configure potential level for the 1st EP level when separate 2nd EP levels or the range for detecting the 1st EP is set. This is not applicable when the titration form is set to "Intersect".

- Standard : Cannot set other control parameters. "Titr. over volume" is equal to 0mL.
- Set : Can set other control parameters.

[Details]

Here you can select the control speed mode. Press this button to display "Other control". This setting becomes valid when "Other control" is set to "Set".

Note:
For setting 'Other control', see Chapter "3-8-6-4. Other control".

[Stirrer speed]

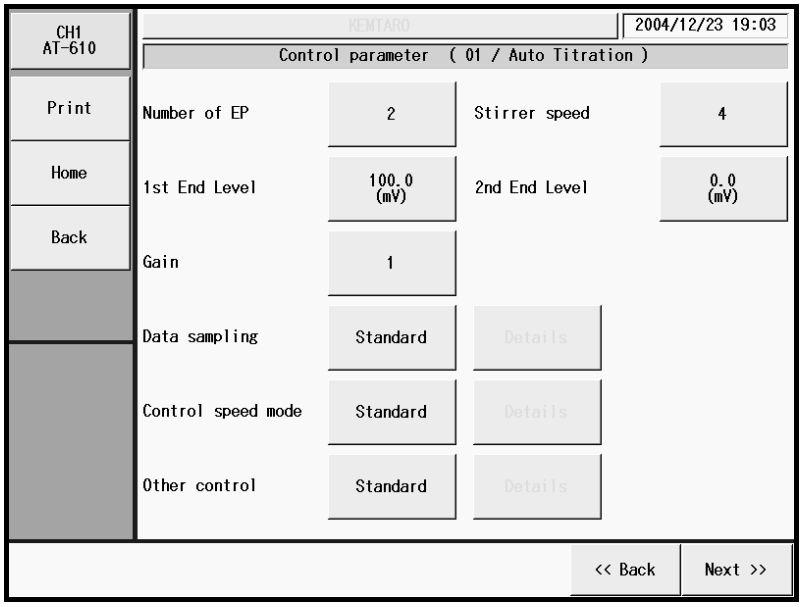
Here you can select an initial stirrer speed for titration. You can select a speed appropriate for sample properties.

- 0 ~ 9

⚠ Caution!

Normally, set the stirrer speed at 4. When precipitation is anticipated during titration, set it at 6 to 8. Care should be taken not to allow the stirrer speed to be too high because the rotator bar may spin out of a beaker depending on the size of the bar, resulting in damages on electrodes.

(When titration form is “Level Stop”)



[Number of EP]

Here you can select a number of endpoints. Titration ends when the preset number of endpoints has been detected.

- 1 ~ 2

[1st End level]

Here you can set the potential level of a first endpoint.

- See Chapter “3-8-6-7. Input range for potential parameters” about the input range.

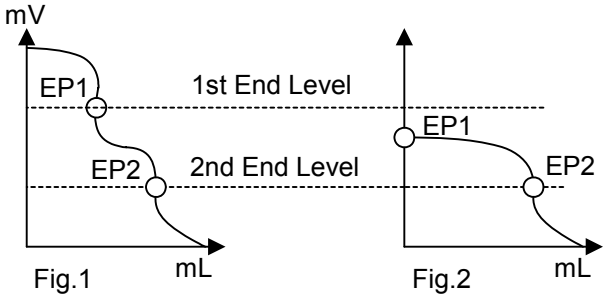
[2nd End level]

Here you can select the potential level of a second endpoint when the number of EP’s is set to “2”.

- See Chapter “3-8-6-7. Input range for potential parameters” about the input range.

It should be noted that a titration will be carried out in the following way depending on the “Direction” of “Titration parameter”:

- Auto : After a titration is initiated, the first endpoint potential level is to be EP1. Then, the second endpoint potential level is to be EP2. As shown in Fig. 2 below, a titration will continue to the maximum volume preset when the first endpoint is not detected.
- Negative : In negative direction, all the endpoints shown below will be detected as EP. When the initial level is set between levels e.g. 1st and 2nd EP, [1st EP] = [Volume at start of titration], and when the initial potential level is lower than EP1 and EP2, [1st EP] = [2nd EP] = [Volume at start of titration].
- Positive : When the initial level is set between levels e.g. 1st and 2nd EP, [1st EP] = [Volume at start of titration], and when the initial potential level is higher than EP1 and EP2, [1st EP] = [2nd EP] = [Volume at start of titration].



[Gain]

Here you can select the sensitivity of detection signal. Typically, use '1' for this setting. When potential change is too small to detect, increase the gain.

- 1 ~ 10

[Data sampling]

Here you can set the condition for data sampling. The data list will be made from measurement results under the following conditions on detection signal:

- Standard : Sampling is made at 4.0mV sampling potential with 0.50 titration volume. Data sampling volume will be 0.10mL when 'Titration mode' is set to "Blank".
- Set : You can set the data sampling potential and titration volume.

[Details]

Here you can select the sampling conditions. Press this button to display "Data sampling condition". This setting becomes valid when "Data sampling" is set to "Set".

Note:
For setting data sampling condition, see Chapter "3-8-6-2. Data sampling condition".

[Control speed mode]

Choose your desired speed out of the following modes:

- Fast : For fast reaction like strong acid – strong base.
- Standard : For typical measurements like weak acid – weak base · strong acid – weak base.
- Slow : For slow reaction in dilute titrant (e.g. no more than 0.01mol/L).
- Set : Manually set the control speed.

[Details]

Here you can select the control speed mode. Press this button to display "Control speed mode". This setting becomes valid when "Control speed mode" is set to "Set".

Note:
For setting the control speed, see Chapter "3-8-6-3. Control speed mode".

[Other control]

Here you can configure potential level for the 1st EP level when separate 2nd EP levels or the range for detecting the 1st EP is set.

- Standard : Cannot set other control parameters. "Titr. over volume" is equal to 0mL.
- Set : Can set other control parameters.

[Details]

Here you can select the control speed mode. Press this button to display "Other control". This setting becomes valid when "Other control" is set to "Set".

Note:
For setting 'Other control', see Chapter "3-8-6-4. Other control".

[Stirrer speed]

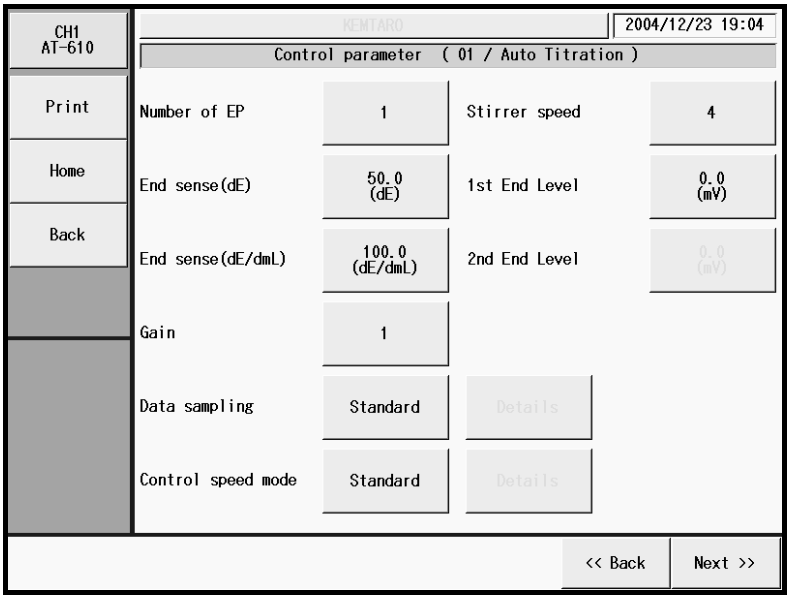
Here you can select an initial stirrer speed for titration. You can select a speed appropriate for sample properties.

- 0 ~ 9

⚠ Caution!

Normally, set the stirrer speed at 4. When precipitation is anticipated during titration, set it at 6 to 8. Care should be taken not to allow the stirrer speed to be too high because the rotator bar may spin out of a beaker depending on the size of the bar, resulting in damages on electrodes.

(When titration form is “Level & EP”)



[Number of EP]

Here you can select a number of endpoints. Titration ends when the preset number of endpoints is detected. Set a pair of EP potentials of Level Stop and EP Stop.

- 1 ~ 2

[End sense (dE)]

Here you can select a normalized potential to detect EP. The potential difference is the gap between E2 (normalized potential where maximum differential value is detected) and E1 (normalized potential where minimum differential value is detected). When the potential changes more than the preset end sense level, the point will be regarded as a possible endpoint.

- 0.0 ~ 99999.9dE

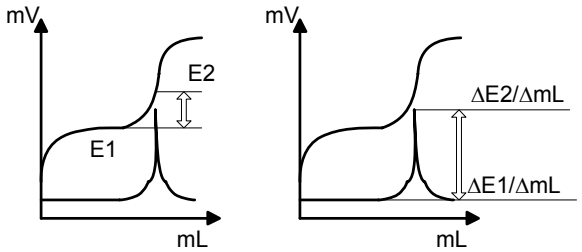
[End sense (dE/dmL)]

Here you can select the differential difference in normalized potential to evaluate EP. Select a differential difference between a maximum differential value (dE2/dmL) and a minimum value (dE/dmL).

When the potential changes more than preset end sense level, the point is determined to be a possible endpoint.

- 0.0 ~ 99999.9dE/dmL

The endpoint is thus determined by preset two end sense levels when the requirements for both dE and dE/dmL are fulfilled.



[1st End level]

Here you can set the potential level of a first endpoint.

- See Chapter "3-8-6-7. Input range for potential parameters" about the input range.

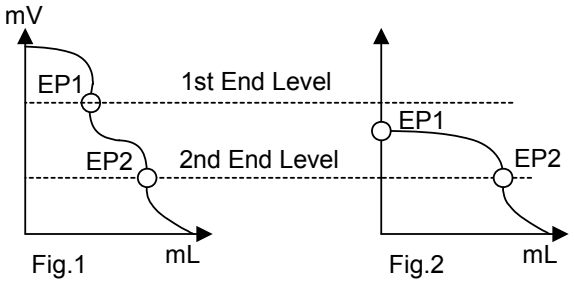
[2nd End level]

Here you can select the potential level of a second endpoint when the number of EP's is set to "2".

- See Chapter "3-8-6-7. Input range for potential parameters" about the input range.

It should be noted that a titration will be carried out in the following way depending on the "Direction" of "Titration parameter":

- Auto : After a titration is initiated, the first endpoint potential level is to be EP1. Then, the second endpoint potential level is to be EP2. As shown in Fig. 2 below, a titration will continue to the maximum volume preset when the first endpoint is not detected.
- Negative : In negative direction, all the endpoints shown below will be detected as EP. When the initial level is set between levels e.g. 1st and 2nd EP, [1st EP] = [Volume at start of titration], and when the initial potential level is lower than EP1 and EP2, [1st EP] = [2nd EP] = [Volume at start of titration].
- Positive : When the initial level is set between levels e.g. 1st and 2nd EP, [1st EP] = [Volume at start of titration], and when the initial potential level is higher than EP1 and EP2, [1st EP] = [2nd EP] = [Volume at start of titration].



[Gain]

Here you can select the sensitivity of detection signal. Typically, use '1' for this setting.
When potential change is too small to detect, increase the gain.

- 1 ~ 10

[Data sampling]

Here you can set the condition for data sampling. The data list will be made from measurement results under the following conditions on detection signal:

- Standard : Sampling is made at 4.0mV sampling potential with 0.50 titration volume. Data sampling volume will be 0.10mL when 'Titration mode' is set to "Blank".
- Set : You can set the data sampling potential and titration volume.

[Details]

Here you can select the sampling conditions. Press this button to display "Data sampling condition". This setting becomes valid when "Data sampling" is set to "Set".

Note:

For setting data sampling condition, see Chapter "3-8-6-2. Data sampling condition".

[Control speed mode]

Choose your desired speed out of the following modes:

- Fast : For fast reaction like strong acid – strong base.
- Standard : For typical measurements like weak acid – weak base · strong acid – weak base.
- Slow : For slow reaction in dilute titrant (e.g. no more than 0.01mol/L).
- Set : Manually set the control speed.

[Details]

Here you can select the control speed mode. Press this button to display "Control speed mode". This setting becomes valid when "Control speed mode" is set to "Set".

Note:

For setting the control speed, see Chapter "3-8-6-3. Control speed mode".

[Stirrer speed]

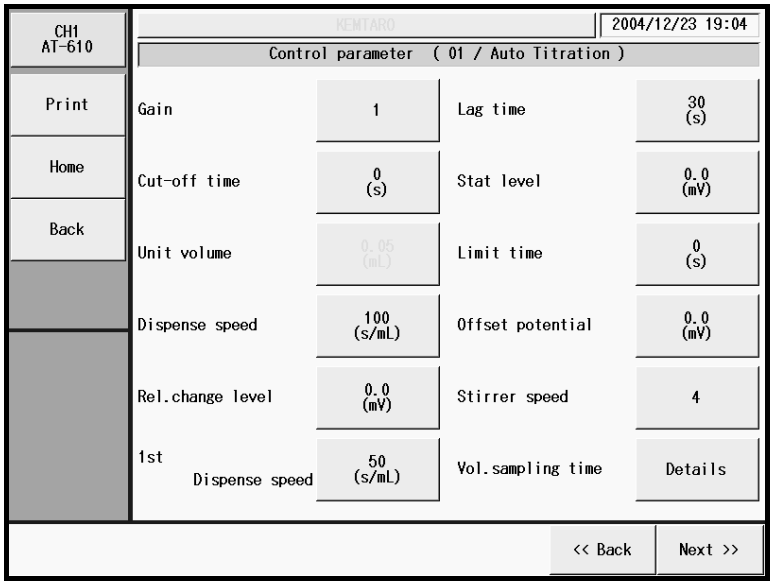
Here you can select an initial stirrer speed for titration. You can select a speed appropriate for sample properties.

- 0 ~ 9

⚠ Caution!

Normally, set the stirrer speed at 4. When precipitation is anticipated during titration, set it at 6 to 8. Care should be taken not to allow the stirrer speed to be too high because the rotator bar may spin out of a beaker depending on the size of the bar, resulting in damages on electrodes.

(When titration mode and titration form are set to “Stat”)



[Gain]

Here you can select sensitivity of detection signal. Usually, set it at 1. When potential change is lower and endpoint is hard to detect, increase the gain.

- 1 ~ 10

[Cut-off time]

Here you can select a Cut-off time for intermittent dosing. It doses at preset intervals.
[Cut-off time]=0 means continuous dosing at constant speed.

- 0 ~ 9999s

[Unit volume]

Here you can select a unit volume when the potential gets to the “Dose speed switching potential” ([Rel. Change level]). You cannot set Unit volume when [Cut-off time] is set at ‘0’.
Since the dischargeable amount of reagent depends on the installed burette, see the section “3-8-6-9. Settings of discharge amount of titrant” in this manual.

- 0.001 ~ 9999.000mL

[Dispense speed]

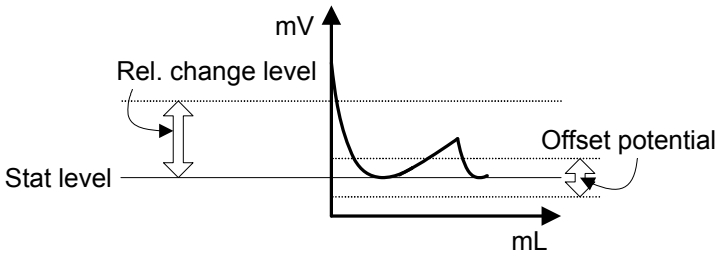
Here you can select a dispense speed after [Rel. Change level] is reached.

- 1 ~ 999s/mL

[Rel. Change level]

Here you can set “Dose speed switching potential”. Setting this level allows dose speed to alter.
[Rel. Change level] is set as the potential level relative to “Stat level”.

- See the Chapter “3-8-6-7. Input range for potential parameters” about the input range.



[1st Dispense speed]

Here you can select a dose speed until the potential reaches [Rel. Change level].

- 1 ~ 999s/mL

[Lag time]

Here you can select a data sampling lag time. The data (titration volume, potential, time) will be stored in the memory at preset intervals when Stat titration is performed.

- 1 ~ 9999s

[Stat level]

The potential for Stat control can be set here.

- See the Chapter "3-8-6-7. Input range for potential parameters" about the input range.

[Limit time]

Here you can set a time to limit titration. When titration time arrives at the preset time, a titration will be completed.

- 0 ~ 9999s

[Offset potential]

Offset potential can be set here.

Dosing will stop when the potential falls within the offset potential even when there is a deviation between control potential and detection potential. "Offset potential" is set as such potential level is relative to "Stat level".

- See the Chapter "3-8-6-7. Input range for potential parameter" about the input range.

[Stirrer speed]

Here you can select an initial stirrer speed for titration. You can select a speed appropriate for sample properties.

- 0 ~ 9

⚠ Caution!

Normally, set the stirrer speed at 4. When precipitation is anticipated during titration, set it at 6 to 8. Care should be taken not to allow the stirrer speed to be too high because the rotator bar may spin out of a beaker depending on the size of the bar, resulting in damages on electrodes.

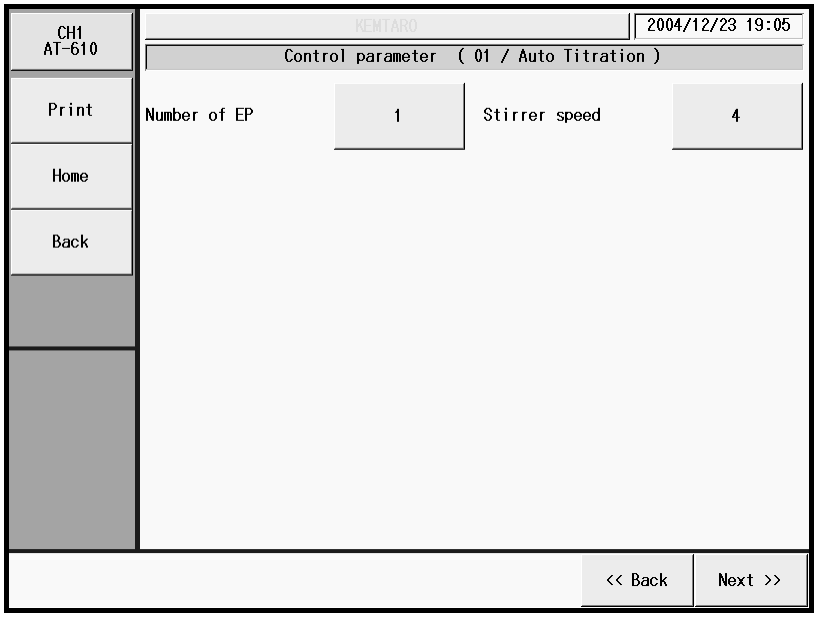
[Vol. sampling time]

Here you can set dose volume sampling time (the time elapsed since Stat has started) used in the calculation formula where VT1 ~ VT5 can be applied. Pressing [Details] button will turn the screen display to "Dosing time setting".

Note:

For more information on "Dosing time setting", see the Chapter "3-8-6-5. Dosing time setting".

(When titration mode and titration form are set to “Learn”)



[Number of EP]

Here you can select a number of endpoints. Titration ends when the preset number of endpoints has been detected.

- 1 ~ 5

[Stirrer speed]

Here you can select an initial stirrer speed for titration. You can select a speed appropriate for sample properties.

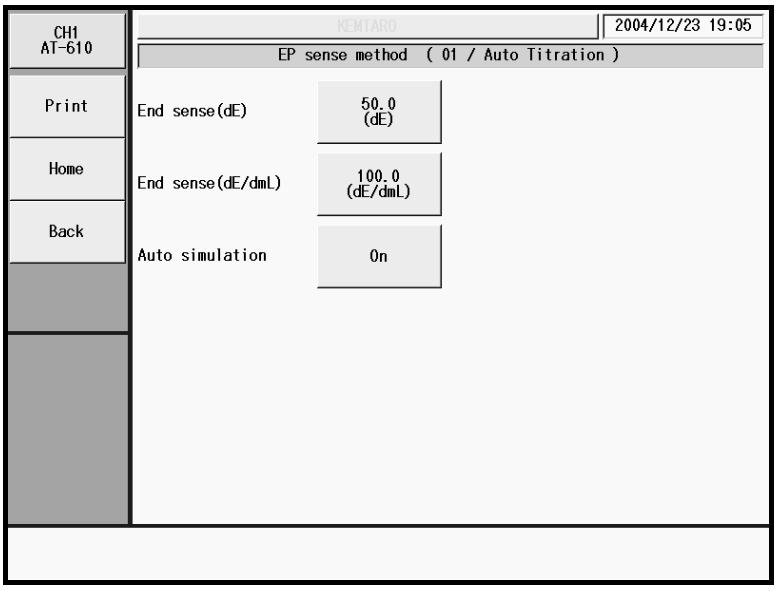
- 0 ~ 9

⚠ Caution!

Normally, set the stirrer speed at 4. When precipitation is anticipated during titration, set it at 6 to 8. Care should be taken not to allow the stirrer speed to be too high because the rotator bar may spin out of a beaker depending on the size of the bar, resulting in damages on electrodes.

3-8-6-1. EP sense method

(When titration form is “EP Stop” or “Full”)



[End sense (dE)]

Here you can select a normalized potential to detect EP. The potential difference is the gap between E2 (normalized potential where maximum differential value is detected) and E1 (normalized potential where minimum differential value is detected). When the potential changes more than the preset end sense level, the point will be regarded as a possible endpoint.

- 0.0 ~ 99999.9dE

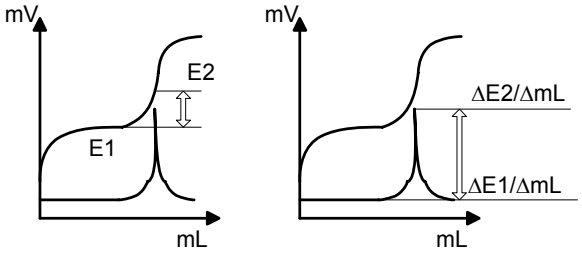
[End sense (dE/dmL)]

Here you can select the differential difference in normalized potential to evaluate EP. Select a differential difference between a maximum differential value (dE2/dmL) and a minimum value (dE/dmL).

When the potential changes more than preset end sense level, the point is determined to be a possible endpoint.

- 0.0 ~ 99999.9dE/dmL

The endpoint is thus determined by preset two end sense levels when the requirements for both dE and dE/dmL are fulfilled.



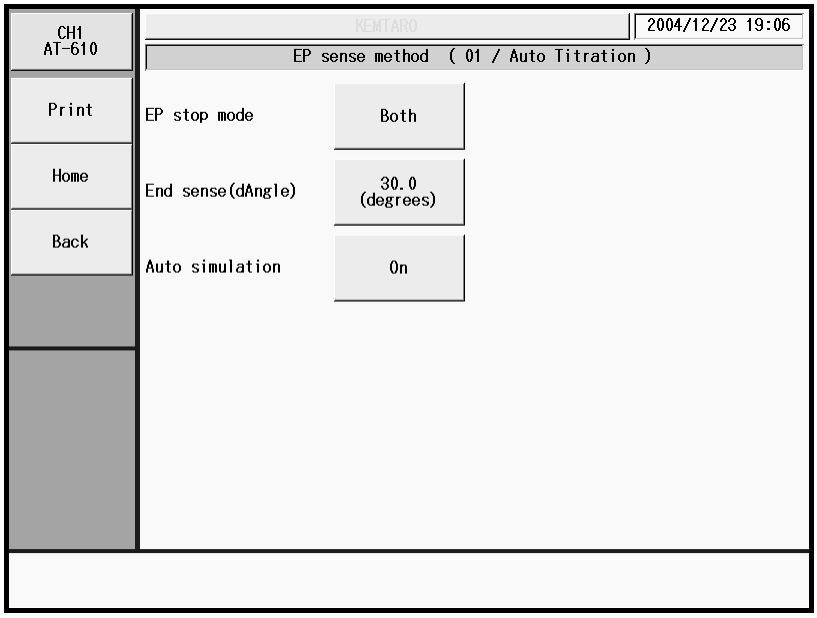
[Auto simulation]

Here you can select the redetection of endpoints using the automatic simulation. When a titration form is set to “Full” and at least one endpoint is detected, this function will not be implemented.

When “Titration mode” is set to “Blank”, usually select “Set”.

- Off : Auto simulation will not be put into effect after a titration is completed.
- On : Auto simulation will be put into effect after a titration is completed.

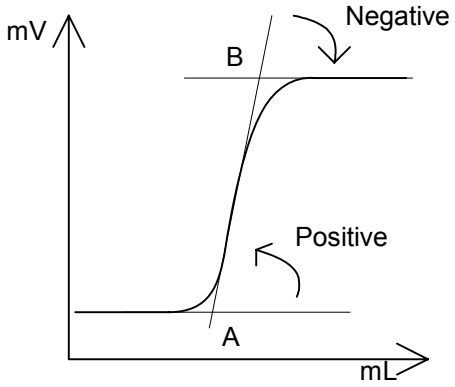
(When the titration form is set to “Intersect”)



[EP stop mode]

Here you can select the EP stop mode from the following directions:

- Both : The intersection points (A and B) of two tangent lines are determined to be the EP’s.
- Positive : The intersection, (A), of two tangent lines on a titration curve that are directed counterclockwise will be an EP.
- Negative : The intersection, (B), of two tangent lines on a titration curve that are directed clockwise will be an EP.



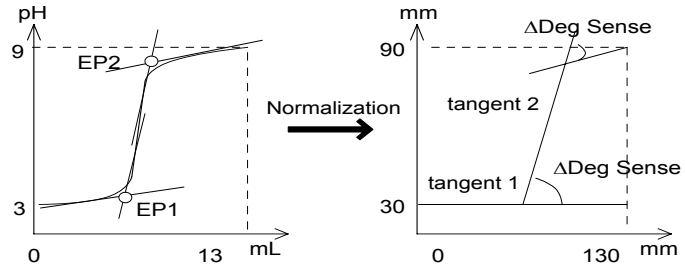
[End sense (dAngle)]

Here you can set an angular difference (normalized) of crossing tangent lines to determine EP.

When the actual angle by two tangent lines exceeds a preset value for detection, the intersection points will be EP's.

- 0.0 ~ 180.0°

The endpoints will be determined on the preset end sense (dDeg) when they meet 'End sense'.

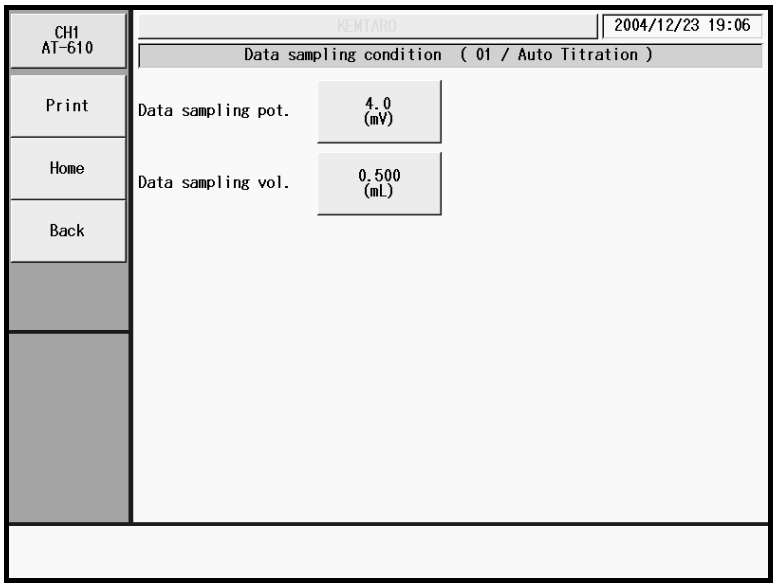


[Auto simulation]

Here you can select the redetection of endpoints using the automatic simulation.

- Off : Auto simulation will not be put into effect after a titration is completed.
- On : Auto simulation will be put into effect after a titration is completed.

3-8-6-2. Data sampling condition



[Data sampling pot.]

Here you can set potential variation for sampling detection signal. Select a narrower range (1-2 mV) when you want to increase the data density in the vicinity of an EP.

Data sampling starts when potential deviation from previously sampled data exceeds a preset value.

- 0.1 ~ 9999.9mV

[Data sampling vol.]

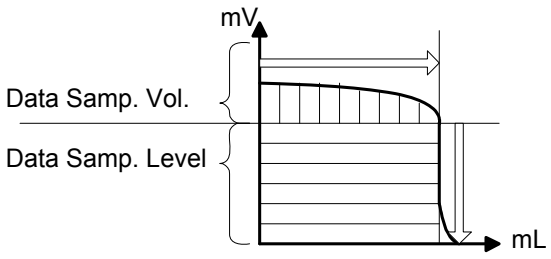
Here you can select titration volume for sampling detection signal.

Select a narrower range (0.1-0.2mL) if potential change in the vicinity of inflection point is weak.

Data sampling starts when volumetric deviation from previously sampled data exceeds preset volume.

Since the dischargeable amount of reagent depends on the installed burette, see the section "3-8-6-9. Settings of discharge amount of titrant" in this manual.

- 0.001 ~ 9999.000mL



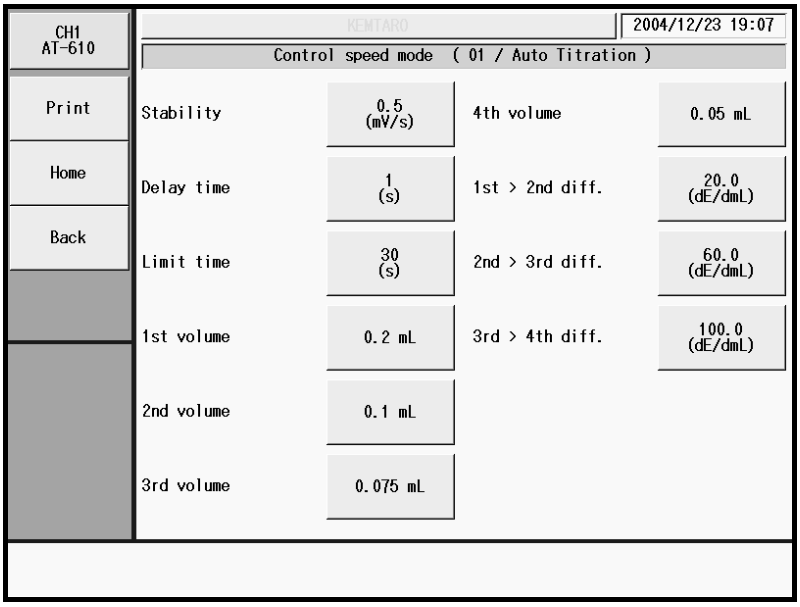
Note:

When a too narrow range of data sampling in potential or titration volume is set, the sampled data may exceed the memory capacity (Max. 512 points), causing failure in drawing graphical curve or performing simulation. Thus, care should be taken of setting these parameters in consideration of maximum possible titration volume and potential variation.

3-8-6-3. Control speed mode

Here you can manually set control speed mode.

(When “Titration mode” is set to “Blank” or “Auto Intermit”)



[Stability]

Here you can select a stability level so that titrant can start to be dosed when the potential per unit time (1s) becomes lower than a preset level. The control speed mode corresponding to each stability is classified as follows:

[Fast] = 10.0, [Standard] = 3.0 and [Slow] = 0.5

- 0.0 ~ 9999.9 mV/s

[Delay time]

Here you can set a delay time before stability is checked. For a slower reaction system, ordinarily set it at 0 to 30(s). The control speed mode corresponding to each delay time is classified as follows:

[Fast] = 0, [Standard] = 0, [Slow] = 1.

- 0 ~ 9999s

[Limit time]

Here you can set a limit time for sensing the stability. Titrant will be forced to be dosed even when the potential does not reach below a preset stability level. The control speed mode corresponding to each stability is classified as follows:

[Fast] = 7, [Standard] = 15 and [Slow] = 30

- 0 ~ 9999s

[1st volume]

Here you can select dose volume of titrant until it reaches a first differential level for switching after titration starts. This setting will be unable when the titration mode is set to “Blank”.

- 1/0.5/0.2/0.1/0.075/0.05/0.025/0.02/0.01/0.005/0.001/0.0005 mL

[2nd volume]

Here you can select dose volume of titrant until the potential reaches the second differential level for switching after getting to the first differential level. This setting will be unable when the titration mode is set to “Blank”.

- 1/0.5/0.2/0.1/0.075/0.05/0.025/0.02/0.01/0.005/0.001/0.0005 mL

[3rd volume]

Here you can select dose volume of titrant until the potential reaches a third differential level for switching after getting to the second differential level. This setting will be unable when the titration mode is set to “Blank”.

- 1/0.5/0.2/0.1/0.075/0.05/0.025/0.02/0.01/0.005/0.001/0.0005 mL

[4th volume]

Here you can select dose volume of titrant until the potential reaches a fourth differential level for switching after getting to the third differential level. This setting will be unable when the titration mode is set to “Blank”.

- 1/0.5/0.2/0.1/0.075/0.05/0.025/0.02/0.01/0.005/0.001/0.0005 mL

Note:

The minimum amount of [n volume] depends on the burette capacity.

Set at least 0.025mL for 50mL burette unit and 0.005mL for 20, 10 and 5mL burette units.

When less amount is set, the burette will identify its minimum capacity.

[1st >2nd diff.]

Here you can set a differential level for switching a first titration volume to a second one.

- 0.0 ~ 9999.9 dE/dmL

[2nd >3rd diff.]

Here you can set a differential level for switching a second titration volume to a third one.
This setting will be unable when the titration mode is set to “Blank”.

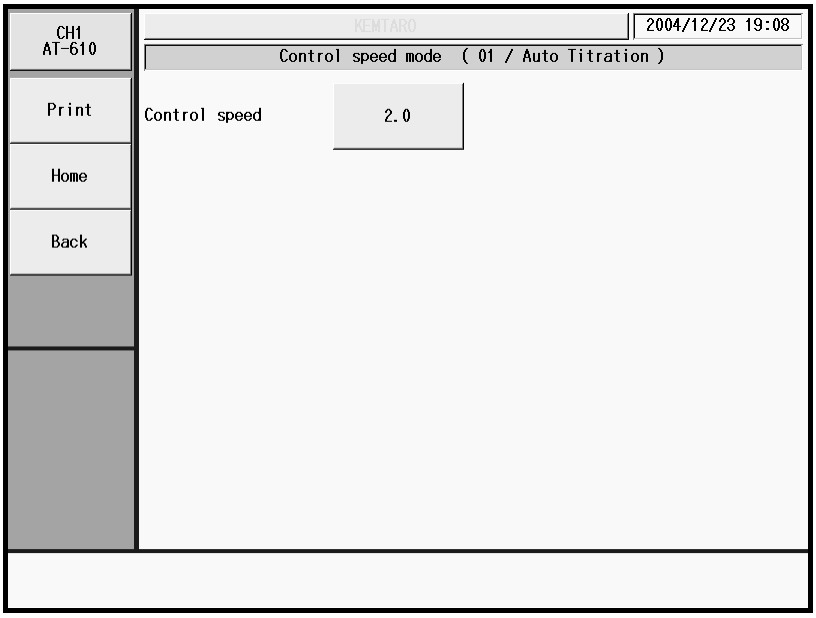
- 0.0 ~ 9999.9 dE/dmL

[3rd >4th diff.]

Here you can set a differential level for switching a third titration volume to a fourth one.
This setting will be unable when the titration mode is set to “Blank”.

- 0.0 ~ 9999.9 dE/dmL

(When Titration mode is set to “Auto titration”)



[Control speed]

Here you can set a control speed. Control speed is determined by potential stability.

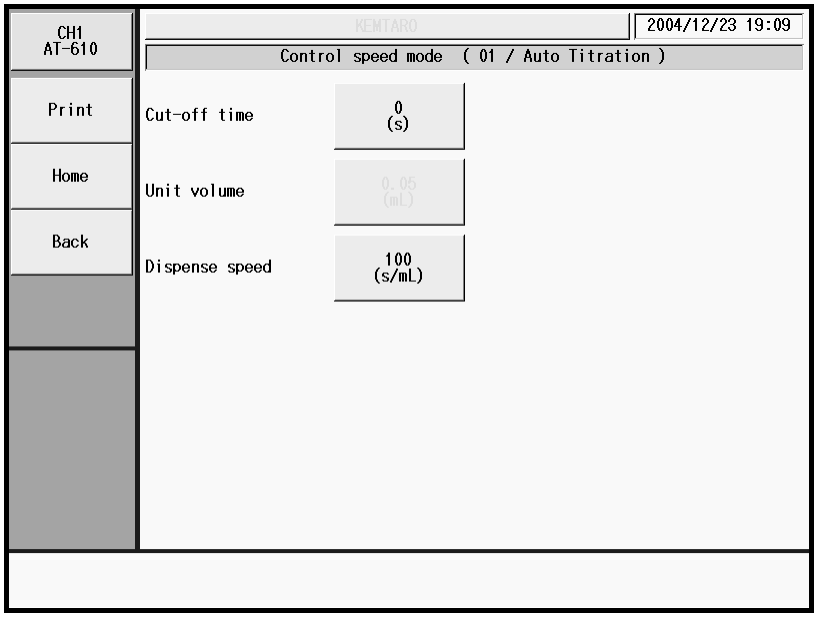
The lower (higher) value is set, the slower (faster) control speed is gained.

The speed corresponding to the setting is defined as follows:

[Fast] = 4.0, [Standard] = 2.0 and [Slow] = 0.5

- 0.0 ~ 10.0

(When titration mode is set to “Intermit”)



[Cut-off time]

Here you can set a cut-off time for an intermittent dose. Continuous dose will be applied when [Cut-off time] = 0. The corresponding speeds for control speed are as follows:

[Fast] = 1, [Standard] = 5 and [Slow] = 10

- 0 ~ 9999s

[Unit volume]

Here you can set unit volume. This setting will be enable when [Cut-off time] = 0(s).

The corresponding speeds for control speed are as follows:

[Fast] = 0.050, [Standard] = 0.020 and [Slow] = 0.010

Since the dischargeable amount of reagent depends on the installed burette, see the section “3-8-6-9. Settings of discharge amount of titrant” in this manual.

- 0.001 ~ 9999.000mL

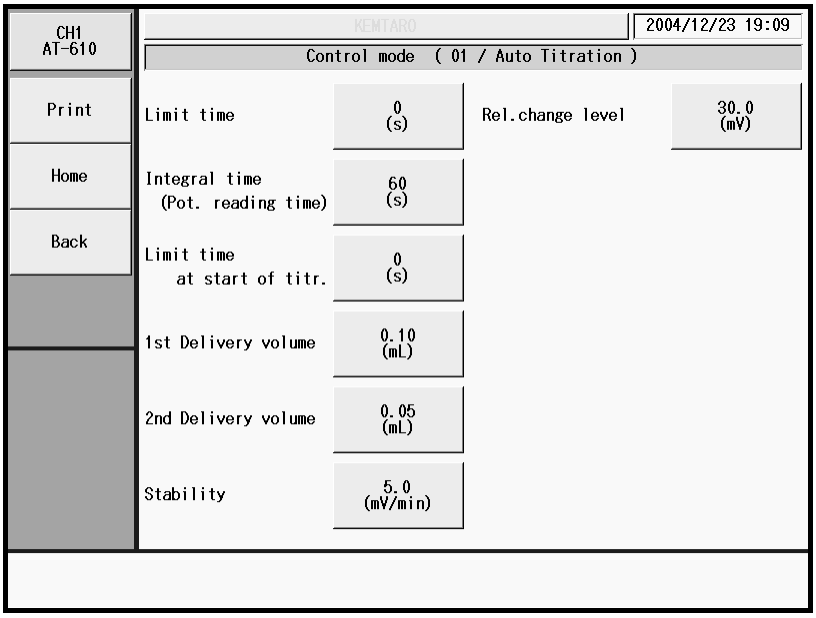
[Dispense speed]

Here you can set dispense speed. The corresponding speeds for control speed are as follows:

[Fast] = [Standard] = [Slow] = 1

- 1 ~ 999s/mL

(When titration mode is “Petroleum Titr.”)



[Limit time]

Here you can set a limit time on sense stability. When the time exceeds a limit time, data will be forcefully sampled, followed by the start of dispensing titrant.

- 0 ~ 9999s

[Integral time (Pot. reading time)]

Here you can set the time to read potential of stability sense for petroleum products.
When it is set at 60 seconds, for example, the stability is sensed on the potential change for 60 seconds, as specified in the standards like JIS K2501 and ASTM D664.

- 0 ~ 9999s

[Limit time at start of titr.]

Here you can set the time to limit reading potential for stability sense at the start of titration.
When it is set at zero (0) second, there is no limit for that time.

- 0 ~ 9999s

[1st Delivery volume]

Here you can set the first delivery volume. The set volume of titrant will be dosed when potential change after starting dosing is less than a set potential for Rel. change level.

- 0.05 ~ 0.20mL

[2nd Delivery volume]

Here you can set the second delivery volume. The set volume of titrant will be dosed when potential change after starting dosing is more than a set potential for Rel. change level. Normally, set the second delivery volume as such it is less than the first delivery volume.

- 0.05 ~ 0.20mL

[Stability]

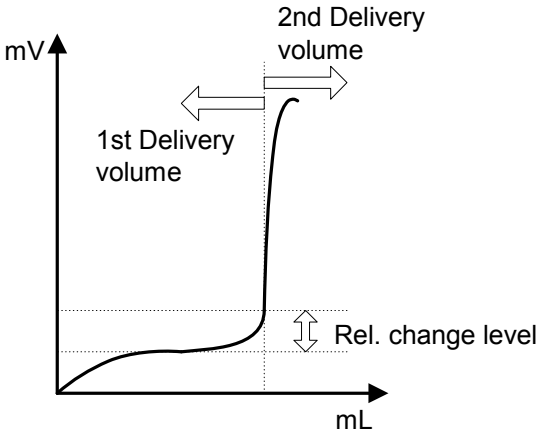
Here you can set the potential for stability sense potential. JIS K2501 and ASTM D664 describe it as 5.0(mV/min). Dosing starts when the potential change for one minute is less than 5.0mV. Setting at least 60 seconds should be required by converting the value even when the time to read potential does not reach 60 seconds.

- 0.0 ~ 9999.9mV/min

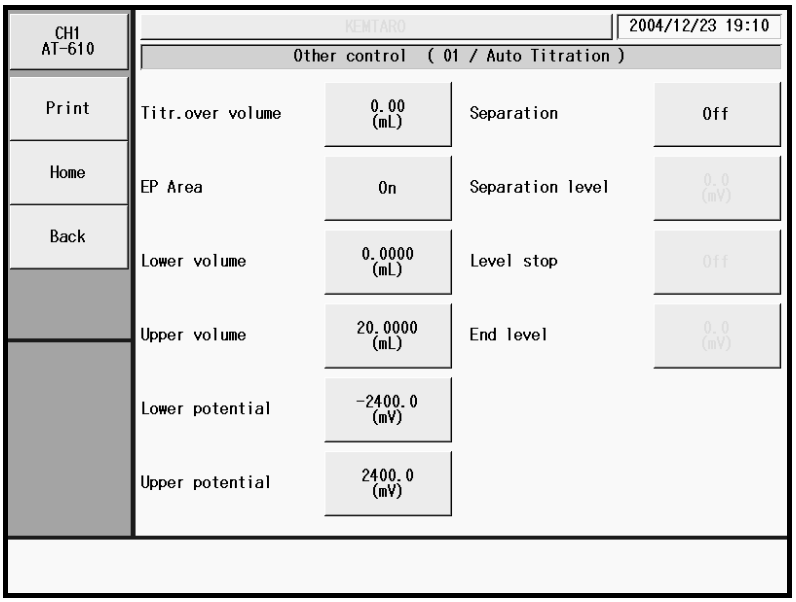
[Rel. change level]

Here you can set the potential to change dose volume. When the potential change grows due to ongoing reaction and the potential after dosing titrant exceeds a preset value, one dose volume will be switched from the first dose volume to the second one.

- See the Chapter "3-8-6-7 Input range for potential parameters" about the input range.



3-8-6-4. Other control



[Titr. over volume]

Here you can set the titration volume for which amount the titration continues even after the last endpoint is detected. In the case where titration volume exceeds the preset volume when the last endpoint is found, the titration will be completed as over-titration. This feature will be effective when the titration form is “EP Stop” or “Level Stop”.

- 0.00 ~ 9999.00mL

[EP area]

Here you can select EP area setting to set a range (titration volume, potential) in which EP’s are possibly found.

This setting will be useful to avoid the effect of noise or carbonated gas during titration.

This feature will be effective when the titration form is “EP Stop”, or “Full”.

- Off : Disable for EP area setting.
- On : Enable for EP area setting.

[Lower volume]

Here you can set the lower limit of titration volume in EP area.

- 0.0000 ~ 9999.0000 mL

[Upper volume]

Here you can set the upper limit of titration volume in EP area.

- 0.0000 ~ 9999.0000 mL

[Lower potential]

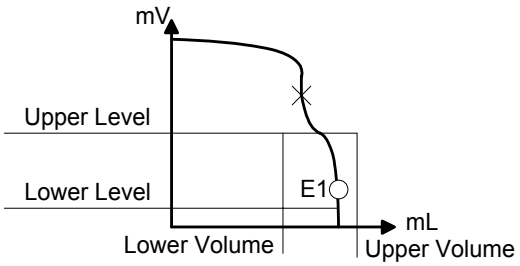
Here you can set the lower limit of potential in EP area.

- See the Chapter “3-8-6-7 Input range for potential parameters” about the input range.

[Upper potential]

Here you can set the upper limit of potential in an EP range.

- See the Chapter "3-8-6-7 Input range for potential parameters" about the input range.



[Separation]

Here you can select potential separation function that is "enable" when the titration form is set to "EP Stop".

- Off : Disable for Separation
- On : Enable for Separation

[Separation level]

Here you can set the potential separation level.

- See the Chapter "3-8-6-7 Input range for potential parameters" about the input range.

[Level stop]

Here you can select the potential level stop function for the first endpoint (EP1).

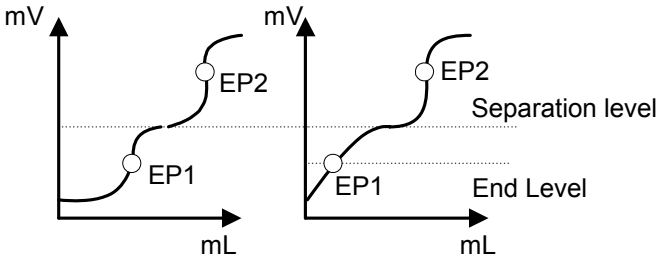
- Off : Disable 'Level stop' for EP1.
- On : Enable 'Level stop' for EP1.

[End level]

Here you can set the potential for the first endpoint.

- See the Chapter "3-8-6-7 Input range for potential parameters" about the input range.

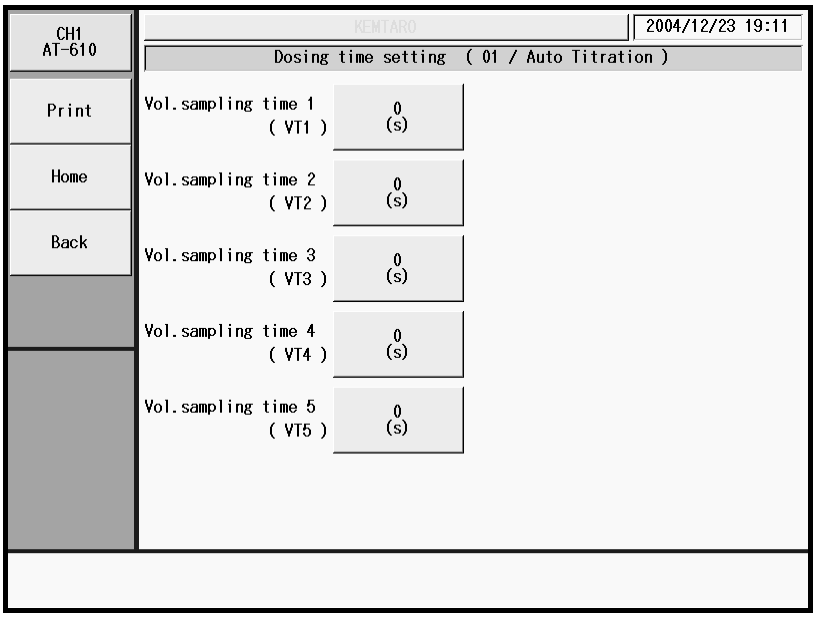
"Separation" where separation level is set in between inflection points or beyond determines the inflection point exceeding preset level to be the second endpoint (EP2) regardless of EP found at the start of titration. "Separation" will enable "Level stop" to function. The preset potential (End level) will become an endpoint when no inflection point is automatically found.



Upper left fig. : The first endpoint is found with EP Stop mode before reaching "Separation level" since clear inflection points are detected.

Upper right fig.: The preset end level will be regarded as EP1 since an unclear inflection point is found with EP Stop mode before reaching "Separation level".

3-8-6-5. Volume sampling time



[Vol. sampling time 1]

Here you can set a volume sampling time (time elapsed from starting Stat) used for VT1 in the calculation formula.

- 0 ~ 99999s

[Vol. sampling time 2]

Here you can set a volume sampling time (time elapsed from starting Stat) used for VT2 in the calculation formula.

- 0 ~ 99999s

[Vol. sampling time 3]

Here you can set a volume sampling time (time elapsed from starting Stat) used for VT3 in the calculation formula.

- 0 ~ 99999s

[Vol. sampling time 4]

Here you can set a volume sampling time (time elapsed from starting Stat) used for VT4 in the calculation formula.

- 0 ~ 99999s

[Vol. sampling time 5]

Here you can set a volume sampling time (time elapsed from starting Stat) used for VT5 in the calculation formula.

- 0 ~ 99999s

3-8-6-6. Initial values of Control parameters

Parameter	Setup range	Titration form and default				
		EP	Full	Level	Lev.&EP	Intersect
Number of EP	1 ~ 5	1	—	—	—	—
	1 ~ 2	—	—	1	1	—
	1 ~ 3	—	—	—	—	1
End sense						
(Blank)	Auto / Set	Set	Set	—	—	Set
(Other than blank)	Auto / Set	Auto	Auto	—	—	Auto
End sense (dE)	0 ~ 99999.9dE	50.0	50.0	—	50.0	—
End sense (dE/dmL)	0~99999.9dE/mL	100.0	100.0	—	100.0	—
1st End Level	*	—	—	0.0	0.0	—
2nd End Level	*	—	—	(0.0)	(0.0)	—
EP stop mode	Both / Positive/ Negarive	—	—	—	—	Both
End sense (dAngle)	0.0 ~ 180.0	—	—	—	—	30.0
Auto simulation						
(Blank)	Off / On	Off	Off	—	—	Off
(Other than blank)	Off / On	(On)	(On)	—	—	(On)
Gain	1 ~ 10	1	1	1	1	1
Data sampling	Standard / Set	Standard	Standard	Standard	Standard	Standard
Data sampling pot.	0.1 ~ 9999.9mV	(4.0)	(4.0)	(4.0)	(4.0)	(4.0)
Data sampling vol.						
(Blank)	0.001 ~ 9999.000mL	(0.100)	(0.100)	(0.100)	(0.100)	(0.100)
(Other than blank)	0.001 ~ 9999.000mL	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)
*1 Control speed mode						
Other control	Standard / Set	Standard	Standard	Standard	—	—
Titr. over volume	0.00~9999.00mL	(0.00)	—	(0.00)	—	—
EP area	Off / On	Off	Off	—	—	—
Lower volume	0.0000 ~ 9999.0000mL	(0.0000)	(0.0000)	—	—	—
Upper volume	0.0000 ~ 9999.0000mL	(20.0000)	(20.0000)	—	—	—
Lower potential	*	(-2400.0)	(-2400.0)	—	—	—
Upper potential	*	(2400.0)	(2400.0)	—	—	—
Separation	Off / On	(Off)	—	—	—	—
Separation level	*	(0.0)	—	—	—	—
End separation	Off / On	(Off)	—	—	—	—
End Level	*	(0.0)	—	—	—	—
Stirrer speed	0 ~ 9	4	4	4	4	4

*1 The titration mode will be set to ‘Control mode’ for “Petroleum Titr.” (Petroleum neutralization number). Settings on ‘Control speed mode’ or ‘control mode’ depend on the relevant titration mode. See the Chapters that follow.

About the input range for “*” in the above table, see the Chapter “3-8-6-7 Input range for potential parameters”.

< “Control speed mode” when <Titration mode> is ‘Blank’ and ‘Auto Intermit’ >

Parameter	Setup range	Titration mode and default	
		Blank	Auto Intermit
Control speed mode	Fast / standard / slow / set	Standard	Standard
Stability	0.0 ~ 9999.9mV/s	(0.5)	(0.5)
Delay time	0 ~ 9999s	(1)	(30)
Limit time	0 ~ 9999s	(30)	(30)
1st volume	1 / 0.5 / 0.2 / 0.1 / 0.075 / 0.05 / 0.025 / 0.02 / 0.01 /0.005 / 0.001 / 0.0005mL	—	(0.2)
2nd volume		—	(0.1)
3rd volume		—	(0.075)
4th volume		—	(0.05)
1st > 2nd diff.	0.0 ~ 9999.9dE/dmL	—	(20.0)
2nd > 3rd diff.		—	(60.0)
3rd > 4th diff.		—	(100.0)

< “Control speed mode” when <Titration mode> is ‘Auto Titration’ >

Parameter	Setup range	Default
Control speed mode	Fast / Standard / Slow / Set	Standard
Control speed	0.0 ~ 10.0	(2.0)

< “Control speed mode” when <Titration mode> is ‘Intermit’ >

Parameter	Setup range	Default
Control speed mode	Fast / Standard / Slow / Set	Standard
Cut-off time	0 ~ 9999s	(0)
Unit volume	0.001 ~ 9999.000mL	(0.050)
Dispense speed	1 ~ 999s/mL	(100)

< “Control mode” when <Titration mode> is ‘Petroleum Titr.’ >

Parameter	Setup range	Default
Control mode	Standard / Set	Standard
Limit time	0 ~ 9999s	(0)
Integral time (Pot. reading time)	0 ~ 9999s	(60)
Limit time at start of titr.	0 ~ 9999s	(0)
1st Delivery volume	0.05 ~ 0.20mL	(0.10)
2nd Delivery volume	0.05 ~ 0.20mL	(0.05)
Stability	0.0 ~ 9999.9mV/min	(5.0)
Rel. change level	*	(30.0)

About the input range for “*” in the above table, see the Chapter “3-8-6-7 Input range for potential parameters”.

< “Stat” is selected for ‘Titration mode’ and ‘Titration form’ >

Parameter	Setup range	Default
Gain	1 ~ 10	1
Cut-off time	0 ~ 9999s	0
Unit volume	0.001 ~ 9999.000mL	0.050
Dispense speed	1 ~ 999s/mL	100
Rel. change level	*	0
1st Dispense speed	1 ~ 999s/mL	50
Lag time	1 ~ 9999	30
Stat level	*	0
Limit time	0 ~ 9999s	0
Offset potential	*	0
Stirrer speed	0-9	4
Vol. Sampling time		
Vol. Sampling time 1	0 ~ 9999s	0
Vol. Sampling time 2	0 ~ 9999s	0
Vol. Sampling time 3	0 ~ 9999s	0
Vol. Sampling time 4	0 ~ 9999s	0
Vol. Sampling time 5	0 ~ 9999s	0

About the input range for “*” in the above table, see the Chapter “3-8-6-7 Input range for potential parameters”.

< “Learn” is selected for ‘Titration mode’ and ‘Titration form’ >

Parameter	Setup range	Default
Number of EP	1 ~ 5	1
Stirrer speed	0 ~ 9	4

< “COD” is selected for ‘Titration mode’ and ‘Titration form’ >

Parameter	Setup range	Default
Data sampling pot.	0.1 ~ 9999.9mV	1000.0
Data sampling vol.	0.01 ~ 9999.00mL	0.05
Rel. change level	0.0 ~ 9999.9mV	110.0
End time	0 ~ 9999s	30
EP level	–9999.9 ~ 9999.9mV	660.0
1st Dispense speed	1 ~ 999s/mL	50
Limit time	0 ~ 9999s	240
Stirrer speed	0 ~ 9	4

3-8-6-7. Input range for potential parameters

The input range for potential parameters depends on “Channel, Unit” of “Predosing parameter” or “Channel, Unit (ctrl.)” of “titration parameter”.

Table 3-8-6-7. Relation of Detector channel and unit with Potential parameters

Channel/unit	Input range	Potential unit	Differential unit
Ch1, mV Ch2, mV Ch3, mV	-9999.9 ~ 9999.9	mV	mV/mL
Ch1, pH Ch3, pH	-99.99 ~ 99.99	pH	pH/mL
Ch3, %T	-9999.9 ~ 9999.9	%T	%T/mL
Ch3, Abs.	-99.999 ~ 99.999	Abs.	Abs/mL
Ch3, uA	-999.99 ~ 999.99	μA	μA/mL
Ch3, 100uS	-9999.9 ~ 9999.9	100μS	100 μS/mL
Ch3, 1000uS	-99999 ~ 99999	1000μS	1000 μS/mL
Ch3, 10000uS	-99999 ~ 99999	10000μS	10000 μS/mL

3-8-6-8. Normalized potential

A normalized potential is a calculated potential for eliminating the difference in titration conditions on preamplifiers used. This parameter is utilized for control, data sampling, EP detection or the like. Sampled potential data will be actually converted according to the following table:

Preamplifier	Unit	Actual potential range	Normalized potential range
STD- TET-	mV	-2000 ~ 2000 mV	-2000 ~ +2000 mV
	pH	0 ~ 14 pH	0 ~ +1000 mV
PTA-	%T	0 ~ 100 %T	0 ~ +1000 mV
	Abs.	0 ~ 1 Abs.	0 ~ +1000 mV
POT-	μA	0 ~ 100 μA	0 ~ +1000 mV
	mV	0 ~ 2000 mV	0 ~ +1000 mV
CMT-	μS	0 ~ 100, 1000, 10000 μS	0 ~ +1000 mV

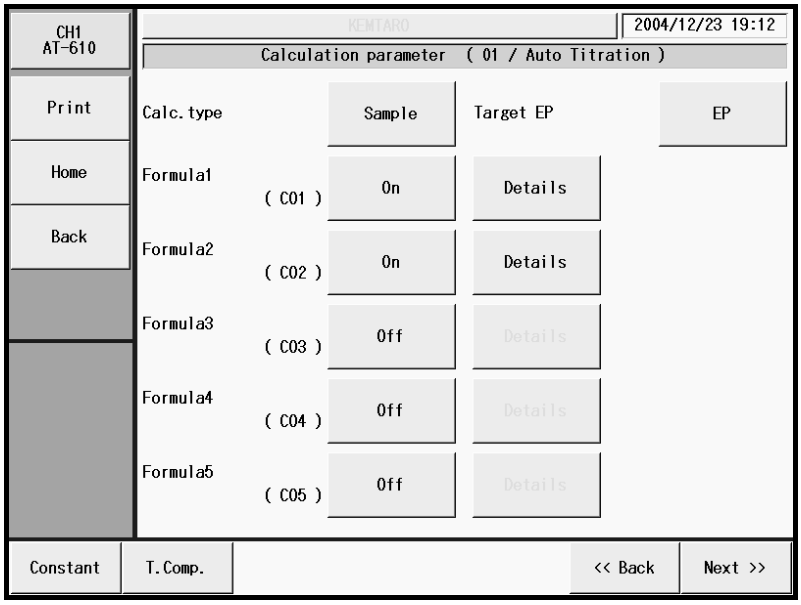
3-8-6-9. Settings of discharge amount of titrant

The minimum discharge amount for the titrator depends on the capacity of the burette that is combined with the titrator.

Type of burette unit (Capacity)	Minimum discharge amount
EBU-610-01B (1 mL)	0.0005 mL
EBU-610-05B (5 mL)	0.0025 mL
EBU-610-10B (10 mL)	0.005 mL
EBU-610-20B (20 mL)	0.005 mL
EBU-610-50B (50 mL)	0.025 mL

3-8-7. [Calculation parameter]

Here you can freely set equations (Max. 5) for concentration calculation.



[Calc. type]

Selection of calculation type:

- Sample : Set up a Method for sample measurement.
- Blank : Set up a Method for blank measurement.
- Factor : Set up a Method for factor measurement.
- Check : Set up a Method for check measurement with standard substance.

Note:

When "Check" is chosen, the measurement results will be stored in memory as a check history.

[Target EP]

Here you can lay down an order of priority for endpoints. This target EP function can be set when the titration form is set to "Level & EP".

- EP : The endpoint found with EP Stop is preferred as EP in calculation. When no endpoint is found with EP Stop before the titration volume reaches a maximum value, the endpoint determined by Level stop will be assigned as EP for calculation.
- Level : The endpoint found with Level Stop is preferred as EP in calculation. When no endpoint is found with Level Stop before the titration volume reaches maximum value, the endpoint determined by EP Stop will be assigned as EP for calculation.

[Formula 1 (CO1)]

Here you can set a calculation formula 1.

- Off : Disable formula 1
- On : Enable formula 1

[Details]

Here you can set 'Formula 1' with this button to display "Formula 1" on the screen. This setting will be valid when selecting "On" in the setting of formula 1.

Note:

About the settings on a calculation formula, see the Chapter "3-8-7-1. Calculation formula".

[Formula 2 (CO2)], [Formula 3 (CO3)], [Formula 4 (CO4)], [Formula 5 (CO5)]

These formulas can be set in the same way (settings) as Formula 1 (COM1). This setting will be unable when the "Calc. type" is set to "Factor " or "Check ".

[Constant] button

Here you can set constants Concentration conversion coefficient, Unit conversion coefficient or the like used in a Concentration calculation formula.

Note:

About constants in a calculation, see Chapter "3-8-7-2. Constant".

[T. Comp.] button

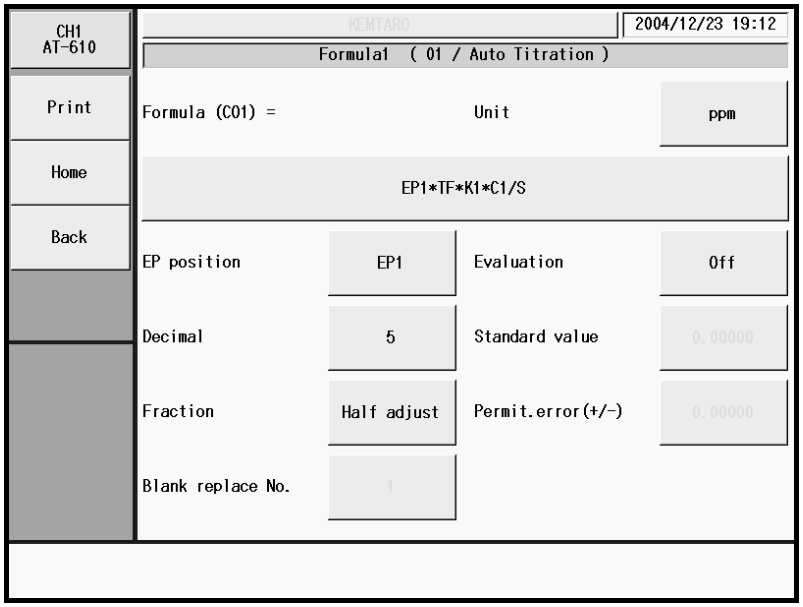
Here you can set "Temperature compensation function" for titrant.

Note:

About temperature compensation, see Chapter "3-8-7-3. Titrant temperature compensation".

3-8-7-1. Calculation formula

[Example: Formula 1]



[Unit]

Enter a unit used for calculation. Max 10 characters can be set as unit.

[Formula]

Here you can set a calculation formula. You can directly input numeric numbers. You can use symbols such as '(', ')', symbols for four arithmetic operations and the coefficients shown in the tables '3-8-7-1-1' and '3-8-7-1-2' below. A maximum of 64 characters can be input in a calculation.

Table 3-8-7-1-1. Enabled symbols for calculation

EP1 ~ EP5	: Titration volume	TM	: Titrating time
CEP1 ~ CEP5	: Volume (Temp. comp.)	IP	: Initial potential
CO1 ~ CO5	: Concentration calculation	FP	: End potential
PK1 ~ PK5	: Acid dissociation constant	FCO1 ~ FCO5	: Latest concentration calculation
FV	: Final titration volume	FI	: Latest titration volume

Chart 3-8-7-1-2. Symbols

Symbol	Meaning	Reference chapter
TF	: Factor value of titrant	Chapter 3-5-1-1.
TN	: Titrant concentration	Chapter 3-5-1-1.
TMW	: Molecular weight of titrant	Chapter 3-5-1-1.
TEQN	: Equivalence of titrant	Chapter 3-5-1-1.
BL1 ~ BL10	: Blank value	Chapter 3-5-4.
S	: Sample size	Chapter 3-3.
S1	: Sample size 1	Chapter 3-3.
S2	: Sample size 2	Chapter 3-3.
SMW	: Molecular weight of sample	Chapter 3-3.
SEQN	: Equivalence of sample	Chapter 3-3.
PD1 ~ PD10	: Pre-dosed volume	Chapter 3-8-4.
DV	: Dosed volume	Chapter 3-8-5-1.
VT1 ~ VT5	: Volume sampling time	Chapter 3-8-6-5.
C1 ~ C5	: Concentration conversion factor	Chapter 3-8-7-2.
R	: Purity, dilution factor	Chapter 3-8-7-2.
K1 ~ K5	: Unit conversion factor	Chapter 3-8-7-2.
FA	: Local factor	Chapter 3-8-7-2.

Table 3-8-7-1-3. Example of calculation formula

Calculation Type		Example of calculation formula
Sample	Normal titration	(EPn−BLn)×TF×Cn×Kn/S (EPn−EPn-1)×TF×Cn×Kn/S
	Back titration	(BLn−EPn)×TF×Cn×Kn/S
	Hydroxyl value	$((EP_n-BL_n)\times TF\times C_n\times K_n+S\times K_{n+1})/((EP_n-BL_n)\times TF\times C_n\times K_{n+2}+S\times K_{n+3})+R$
	Acid dissociation constant	PKn The acid dissociation constant is defined as follows. $pKa=pH-\log\frac{[B]}{[HB^+]}$ $BH^+ \rightleftarrows B+H^+$ From this Eq., [B]=[HB+], that is, half neutralized pH shows pKa. More precisely, approximately [B]=[HB+] at half equivalent point, however, due to little error at pKa3-11, the pH at half equivalent point is regarded as pKa.
Factor	Factor	Normal titration $(S\times R\times K_n)/((EP_n-BL_n)\times C_n)$ Back titration (S×R×Kn)/((BLn−EPn)×Cn)

[EP position]

Here you can set the EP position to carry out computation:

- EP1 : Calculate at EP1.
- EP2 : Calculate at EP2.
- EP3 : Calculate at EP3.
- EP4 : Calculate at EP4.
- EP5 : Calculate at EP5.

[Decimal]

Enter a number of digits after decimal point for calculation results:

- 0 ~ 8 place

[Fraction]

Selection of fraction rounding in calculation:

- Round off : Rounded down to nearest preset number of digits after decimal point
- Half adjust : Rounded to nearest preset number of digits after decimal point
- Round up : Rounded up to nearest preset number of digits after decimal point

[Blank replace No.]

Set the blank replace number. This setting takes effect when “Calc. type” of calculation parameters is set to “Blank”.

- 1 ~ 10

[Evaluation]

The measurement results will be evaluated by this function:

- Off : Not evaluated.
- On : The measurement results are evaluated.

[Standard value]

Enter a standard value to make the evaluation in the following range. This setting will take effect when “Evaluation” is set to “On”.

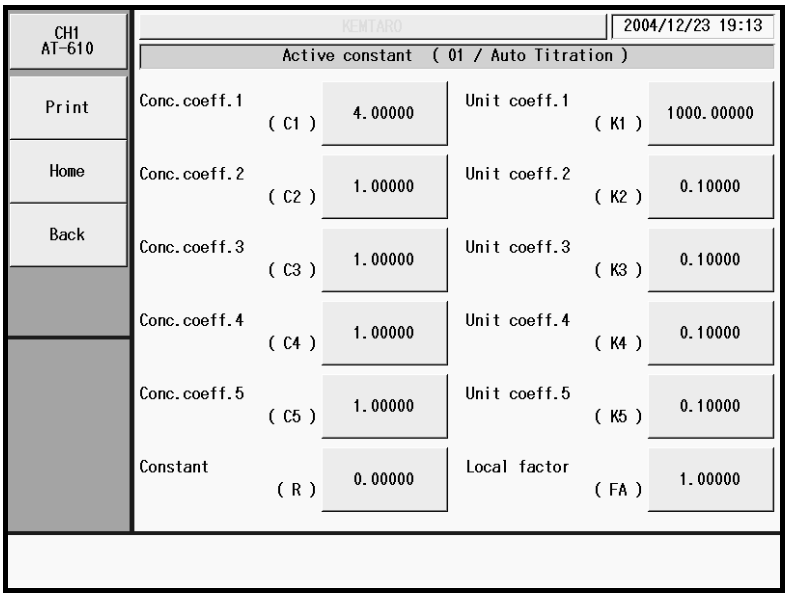
- 0.00000000 ~ 99999.99999999

[Permit. error]

Enter permit error to determine if the calculation result is off the range against the standard value. This setting will take effect when “Evaluation” is set to “On”.

- 0.00000000 ~ 99999.99999999

3-8-7-2. Constant



[Conc. Coeff. 1]

Enter a concentration conversion coefficient for a measured sample.

For example, when NaOH is titrated with 1mol/L-HCl, the reaction is expressed as:

HCL + NaOH → NaCl + H2O

Since this reaction proceeds on 1-to-1 equivalence, 40.00mg of NaOH (M_w=40.00) is consumed per 1mL of 1mol/L-HCl. Accordingly, C1 becomes 40.00mg/mL.

- 0.00000 ~ 99999.99999

[Conc. Coeff. 2], [Conc. Coeff. 3], [Conc. Coeff. 4], [Conc. Coeff. 5]

Same definition as for [Conc. Coeff. 1].

[Constant (R)]

Here you can set a constant of purity or dilution factor.

- 0.00000 ~ 99999.99999

[Unit coeff. 1 (K1)]

Here you can set a unit conversion coefficient to convert a unit to like percent (%) or ppm.

For example, when NaOH is titrated with 1mol/L-HCl and the result is expressed in %, the calculation equation will be:

NaOH (%) = (EP1 – BL1) × TF × C1 × K1 / S

Here, when EP1=10(mL), BL1=0.02(mL), TF=1.006, C1=40.00(mg/mL) and S=5.0000(g), K1 should be 0.1 – becomes 1000 when expressed in ppm.

- 0.00000 ~ 99999.99999

[Unit coeff. 2(K2)], [Unit coeff. 3(K3)], [Unit coeff. 4(K4)], [Unit coeff. 5(K5)]

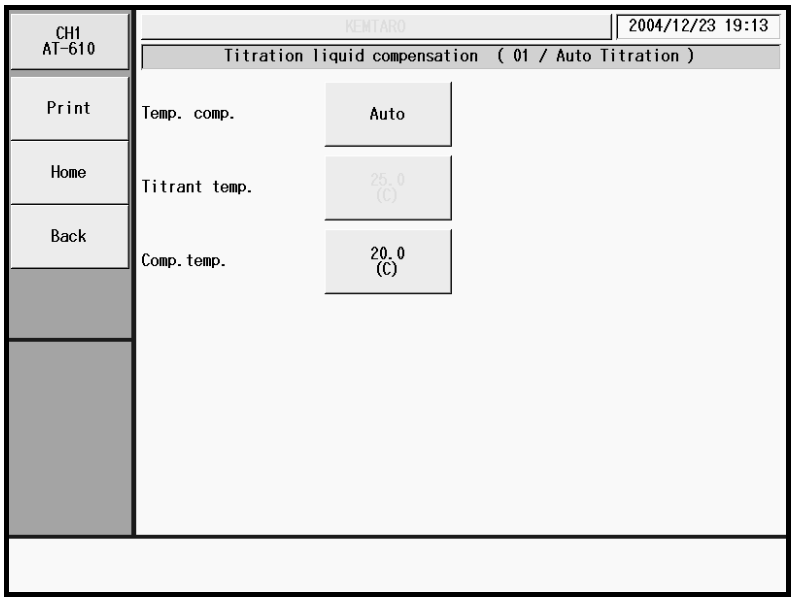
Same definition as for [Unit coeff. 1(K1)].

[Local factor]

Here you can set a factor for the method, which is different from a factor (TF) set on a reagent information:

- 0.00000 ~ 99999.99999

3-8-7-3. Titrant temperature compensation



[Temp. comp.]

Here you can select a method for titrant temperature compensation from:

- Off : No compensation.
- Fixed : Manual compensation.
- Auto : Automatic compensation with the optional sensor for titrant temperature compensation.

[Titrant temp.]

Here you can set titrant temperature when “Temp.comp.” is set to “Fixed”.

- 0.0 ~ 100.0°C

[Comp. temp.]

Here you can set titrant compensation temperature when “Temp.comp.” is set to either “Fixed” or “Auto”.

- 0.0 ~ 100.0°C

< About Temperature compensation for titrant >

Titration volume needs to be corrected when organic solvent like Acetic acid, Dioxane or Ethanol is used for titrant. Normally, titrant is used at the temperature in factor calibration, however, when titrant temperature differs by more than ±3°C compared with that in standardization, the volume titrated needs to be corrected:

Liquid temperature compensation formula:

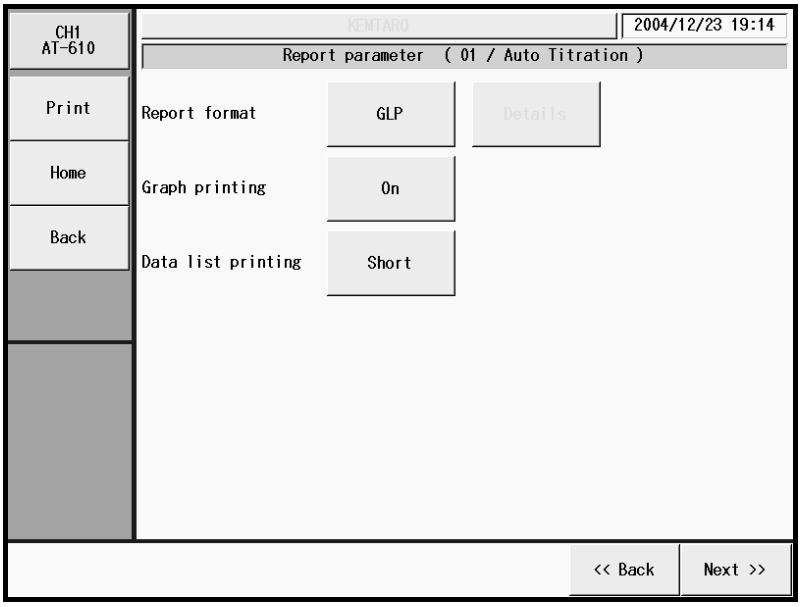
$$V = V_0 \times (1 + A \times \Delta T \times 10^{-3} + B \times \Delta T^2 \times 10^{-6})$$

V : Compensated volume

V_0 : Titration volume

ΔT : (Compensated temperature – Titrant temperature)

3-8-8. [Report parameter]



[Report format]

Selection of print format:

- Off : No printout.
- GLP : Prints all of measurement parameters and results.
- Short : Prints sample number, measurement date, sample size, measurement results, titration time.
- Variable : You can choose from printing items from [Details] button when pressed.

[Details]

The display “Report format ” appears where you can select those items you want to print out.

This buttons works only when the above “Variable” for report format is chosen.

Note:

For print parameters and items, refer to “3-8-8-1. Report format”.

[Graph printing]

Selection of graphic print together with measurement results when they are printed out.

Graphic printout is significant when it is set in “Graph setting” on “Function”.

- Off : No printout of graph
- On : Printout of graph

[Date list printing]

Selection of printout of the data list, which is significant with data sampling time preset on "Control parameter".

- Off : No printout of data list.
- Short : Prints the endpoint, data number, potential difference and differential difference.
- Detail : Prints Data list and Short form.

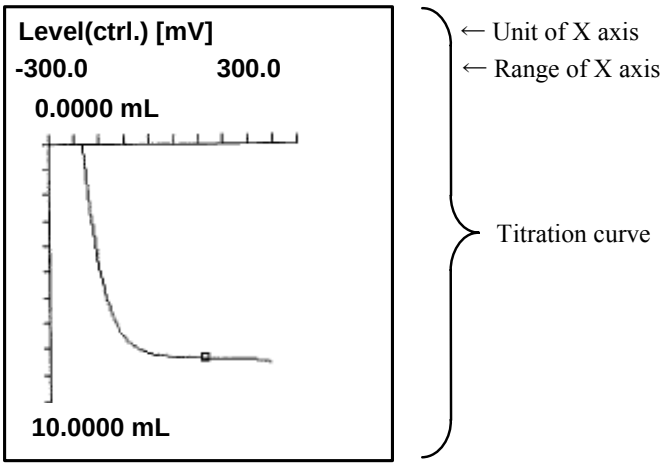
3-8-8-1. Report format

	Print format			
Item	Off	Short	GLP	Variable
Model/Serial No.	Off	Off	On	On/Off
Method name	Off	On	On	On/Off
Sample No.	Off	On	On	On/Off
Sample ID	Off	On	On	On/Off
Titration date	Off	On	On	On/Off
Reagent name	Off	On	On	On/Off
Titration parameter	Off	Off	On	On/Off
Control parameter	Off	Off	On	On/Off
Calc. parameter	Off	Off	On	On/Off
Reagent constant	Off	Off	On	On/Off
Blank	Off	Off	On	On/Off
Predose result	Off	Off	On	On/Off
Initial information	Off	Off	On	On/Off
Final information	Off	Off	On	On/Off
Dose volume	Off	Off	On	On/Off
Last volume	Off	Off	On	On/Off
Titration time	Off	On	On	On/Off
Sample size	Off	On	On	On/Off
Sample constant	Off	Off	On	On/Off
EP Data	Off	On	On	On/Off
Conc.	Off	On	On	On/Off
Operator	Off	Off	On	On/Off

Note:

For meanings of parameter name, report format and setup contents, refer to Parameter List at the end of this manual.

< Graph >



< Data List >

Titration volume

Actual potential

Status

< Data List >

No.	Volume [mL]	Potential [mV]	St
1	0.00000	- 40.00	0
2	0.43000	-192.20	0
3	0.46000	-196.30	0
4	0.79500	-200.30	0
5	1.14500	-204.40	0
6	1.47500	-208.40	0
7	1.82000	-212.90	0
8	2.20000	-217.10	0
9	2.58000	-221.30	0
10	2.96000	-225.10	0
11	3.46000	-100.00	0
12	3.57000	1.30	3
13	3.64000	228.80	0
14	3.80000	224.90	0
18	5.38000	212.90	0
19	5.76000	208.60	0
20	6.11500	204.40	2
21	6.47000	200.20	0
22	6.83000	195.90	0
23	7.16000	191.50	0

[dE]	[dE/dmL]	St
No. 12		
1.66E+02	4.91E+02	3

Data count : 23

EP determined value

Total number of data

- Meaning of status -

1 : This status number means the max inflection point is not determined to be the EP since it is out of the preset range both in titration volume and potential.

2 : This status appears when the max inflection point has been found somewhere a little further than the inflection point that was first found. The status is labeled with 3, 6 or 7 in this case.

3 : The max inflection point satisfying the End Sense (dE) and End Sense (dE/dmL) is found, and its measurement results will be then printed out.

4 : When a max inflection point is not detected as EP with a titration in the set direction on the titration parameter.

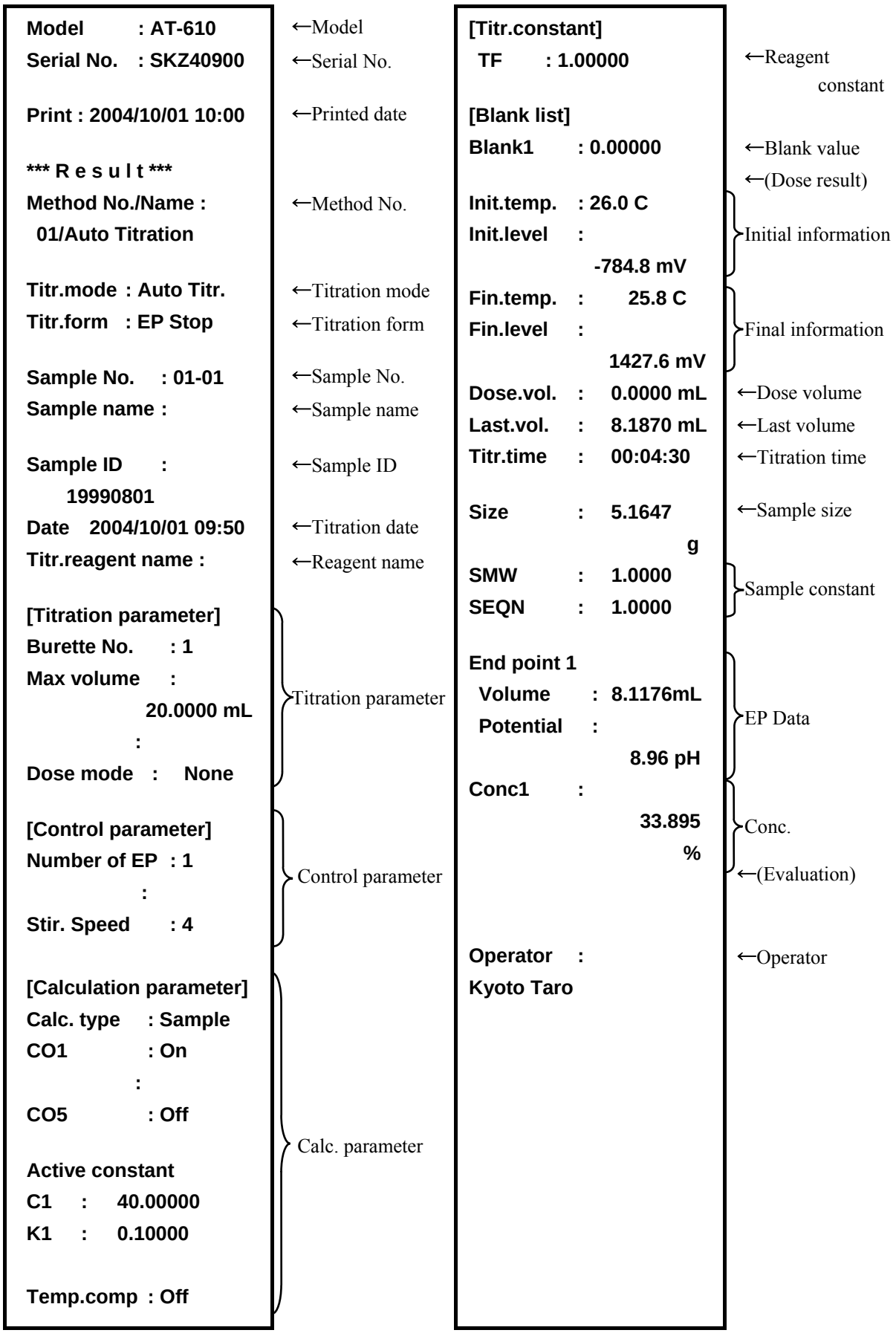
6 : When a max inflection point is not detected as EP since the End Sense (dE) value is less than a preset End Sense (dE).

7 : When a max inflection point is not detected as EP since the End Sense (dE/dmL) value is less than a preset End Sense (dE/dmL).

Note:

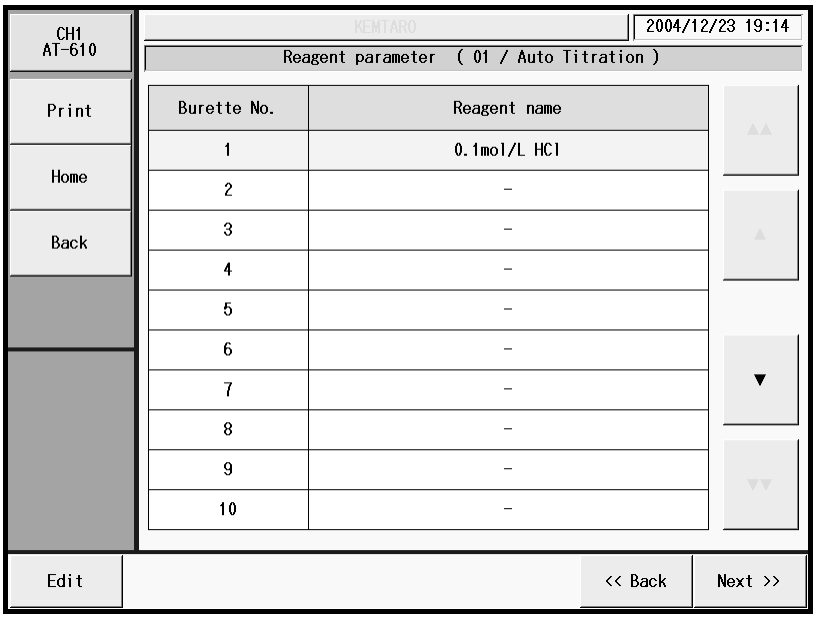
Data list will save all measurement results.

<Example of printing measurement results: GLP form>



3-8-9. [Reagent parameter]

Here you can set the reagent information relevant to a corresponding burette number.
The reagent information comes from the information preset on “Function”–“Reagent information”.



[Burette No.]

Display burette number where the reagent information is to be stored.

[Reagent name]

Display reagent name registered in reagent information on the numbered burette. For the burette numbers not in use under the current method, “-” will be displayed in the reagent name column.

[▲], [▼]

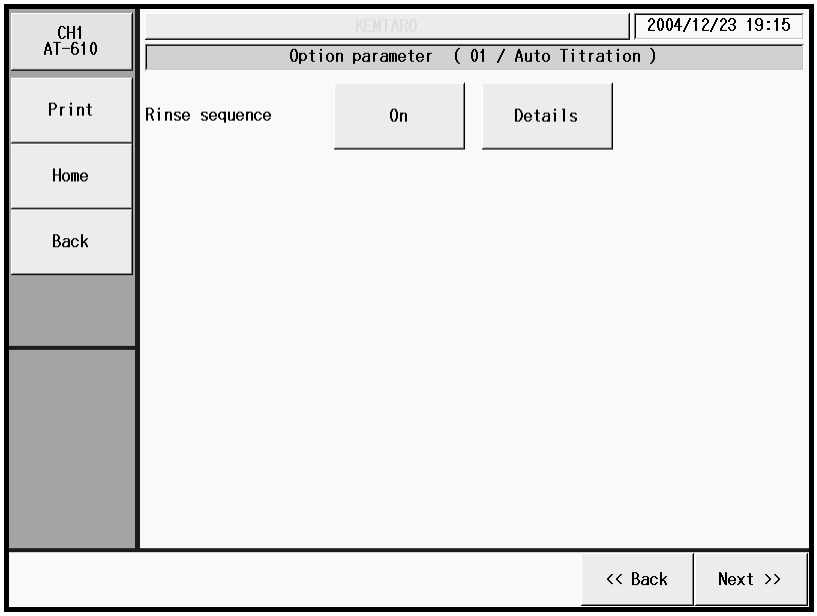
You can move the cursor on the list of reagent parameters.

[Edit]

Here you can select the reagent information for the numbered burette. Put the cursor on the burette number set in reagent parameters and press this button to have “Reagent” screen display. Now, you can select the desired reagent information among from No.1 to No. 20 that has been preset on “Function”–“Reagent information”.

3-8-10. [Option parameter]

The option parameter is necessary for user sequence when a multiple sample changer is used.



[Rinse sequence]

Here you can set the user sequence for a sampler changer. The setup of operation time of user sequence comes from the information preset on "Function"–"Changer setting".

- Off : Rinse sequence is not in use.
- On : Rinse sequence is in use.

[Details]

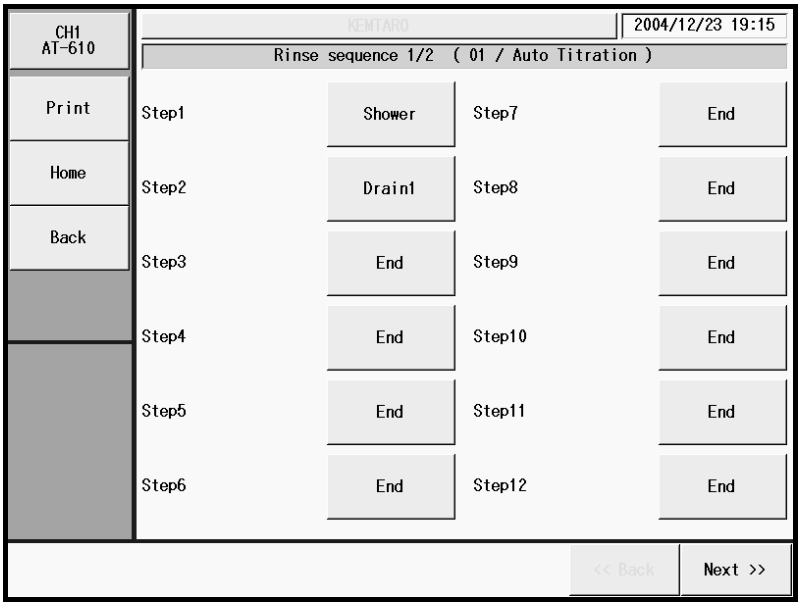
Press this button to display "Rinse sequence" screen where you can set up details of Rinse sequence. This button will be enabled only when selecting "On" in the above setting for "Rinse sequence".

Note:

About the setup of Rinse sequence, see the Chapter "3-8-10-1. Rinse sequence".

3-8-10-1. Rinse sequence

Here you can set the operational sequence for a sampler changer in the user sequence.
Up to 20 commands can be preset in this setting.



[Step 1]

Here you can select the operation for the first step of a user sequence:

- End : End of sequence.
- Shower : Rinse by showering in a rinse pot.
- Rinse : Rinse solvent is dispensed in the rinse pot. Rinse time can be set on “Rinse time”.
- Drain 1 : Drain rinse solvent used for shower rinsing. Drain time can be set on “Drain time 1”.
- Drain 2 : Forcefully drain rinse solvent after shower rinsing with the optional drain pump. Drain time can be set on “Drain time 2”.
- Wait : Dip an electrode in the rinse pot. Can be used for depolarizing an electrode after a non-aqueous titration.
- W.Stir.On : The stirrer at the rinse position is turned on.
- W.Stir.Off : The stirrer at the rinse position is turned off.
- T.Stir.On : The stirrer at the titration position is turned on.
- T.Stir.Off : The stirrer at the titration position is turned off.

[Step 2] ~ [Step 20]

Here you can select commands for the second up to 20th step.
The command for the last step should be always “End”.

Note:

About the setup of operation time for each command, see the Chapter “3-5-9-1. Acting time setup ”.

⚠ Caution!

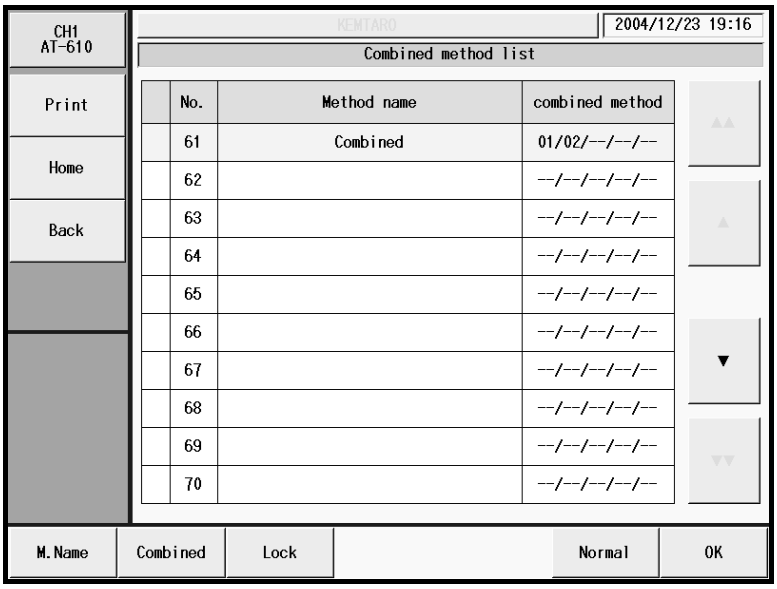
User sequence is the user-defined sequence. It is user's responsibility for measurement results if affected by your settings. Maker will not be liable for any unexpected results by such.

- **Example 1: Prolonged measurement time due to unstable potential, originated by insufficient regeneration time for the electrode after non-aqueous titration.**
- **Example 2: Shortened time length for Drain 1 and 2 for separated draining causes the liquids mixed together with generation of unexpected gas.**

3-8-11. [Combined]

3-8-11-1. General description

You can combine up to 5 methods out of Method No.1 to 50. Such method is called Combined Method, which is to be filed on any Method No. 61 through 70. The combined method can be used when more than one titration are performed for single sample.
Press [Method] – [Combined] button to show "Combined method list", where combined methods and related Method No. will appear.



[▲], [▼]

You can move the cursor on the list.

[M. Name]

Here you can type a method name. Up to 20 characters can be used.

[Combined]

When "Edit combined Method" display appears, you can combine the methods with the Combined method where the cursor stays on.

Note:
About editing combined methods, see the Chapter "3-8-11-2. [Combined] – [Combined]".

[Lock]

You can inhibit the use of combined method at cursor position, which appears on the combined method list with "*" mark. To use the method, point the cursor on this method and press this button to unlock.

[Normal]

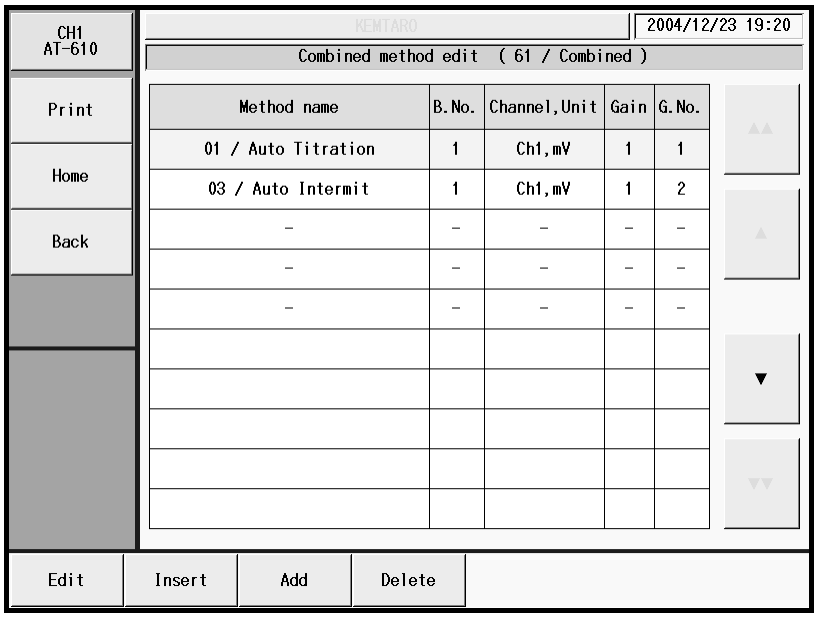
Return to the normal method list.

[OK]

You can change the combined method of use to measure. Select the method with [▲] or [▼] key and press [OK] button.

3-8-11-2. [Combined] – [Combined]

Press [Method] – [Combined] – [Combined] button to display “Combined method edit” dialog box, where combined methods are displayed. “Combined method edit” screen display shows the connected methods, their conditions and the group number “G.No.” for combined titrations. When Titration parameters (“Burette No.”, “Channel, Unit (Ctrl.)”, “Control parameter” and “Gain”) on combined methods are all the same, the same “G. No.” will be assigned. The results with the same “G.No.” number will be output on the same graph.



[▲], [▼]

You can move the cursor on the list across the screen.

[Edit]

You can change the method where the cursor is sitting over.

[Insert]

You can insert another method before the method where the cursor stays.

[Add]

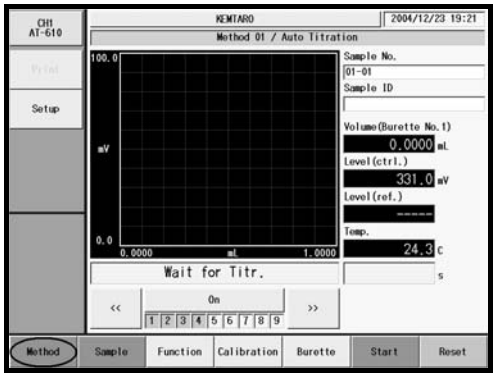
You can add another method at the cursor position where no method is yet configured.

[Delete]

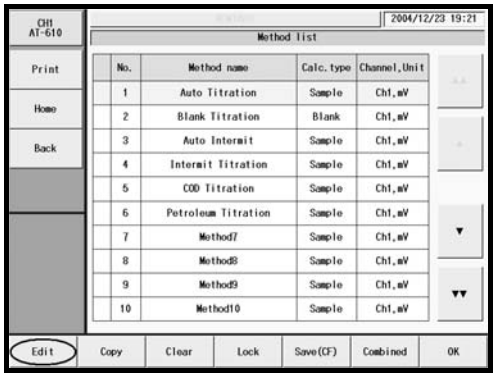
You can delete the combined method where the cursor is sitting over.

3-8-11-3. Combine a plural number of method

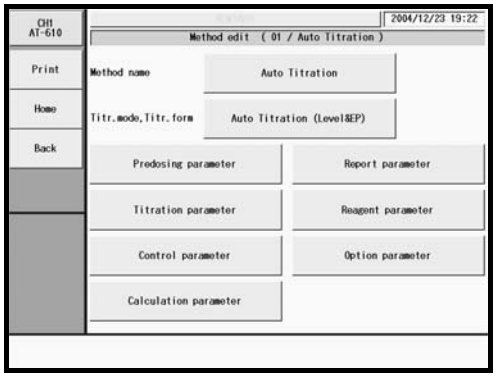
The following description explains how to configure a combined method and measure.



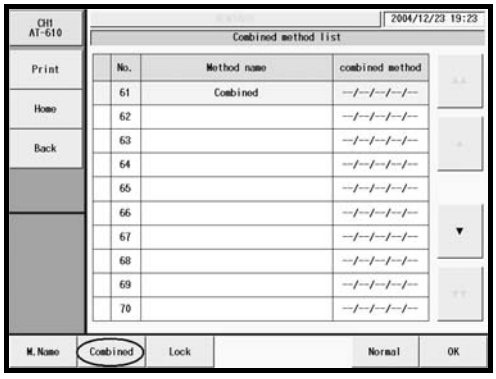
1) Press [Reset] button.
2) Confirm the message reads as “Wait for Titr.”.
3) Press [Method] button.



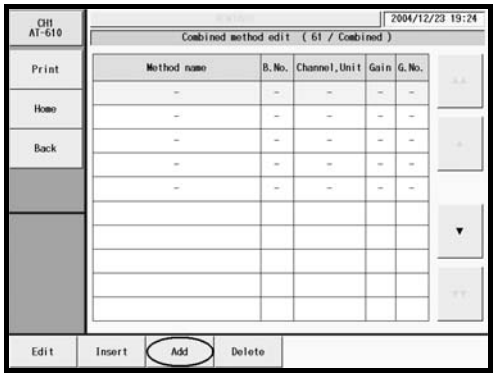
4) “Method list” dialog box appears. With [▲], [▼], [▲▲], [▼▼] buttons, select the methods to combine from Method No. 01 to 50. (When the method is already a combined method, press [Normal] button on “Combined method list”.
5) Press [Edit] button.



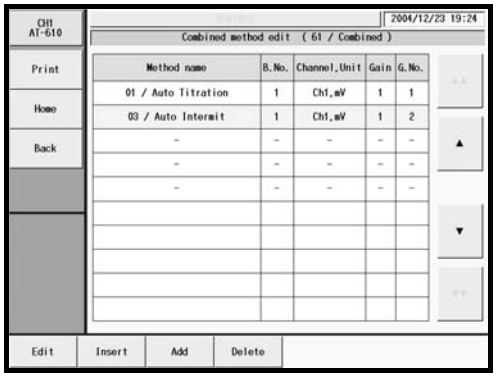
6) Here you configure parameters for measurement and control. If it is the first combined method, also configure parameters for calculation and print.
7) Press [Back] button.
8) Likewise as in step 2) to 5), configure all parameters for measurement and control used in combined methods.



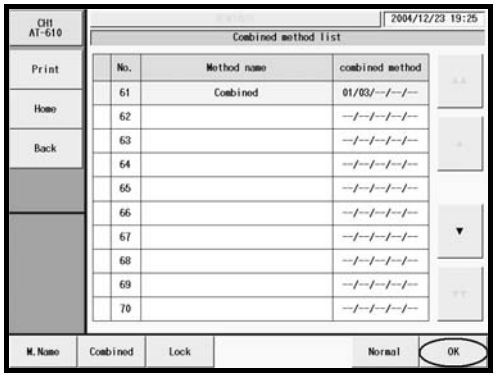
9) Press [Combined] button.
10) Select a combined method from No.61 to 70 with [▲], [▼] button.
11) Press [M. name] button, and enter the name of combined method.
12) Press [Combined] button.



13) Here you see the dialog box “Combined method edit”. Choose the first one with [▲] or [▼] button, and press [Add]. Select the previously configured Method from No. 01 to 50 for combined method and press [OK] button.



14) Likewise, you can set up 5 methods in succession.
15) Press [Back] button.



16) Press [OK] button to switch it to the configured combined method. It will return to Main display and to the combined method.

17) Press [Sample] button on Main display where you set up sample conditions including size, etc.
18) Set a sample in the designated position.
19) Press [Start] button to start titration.

Note:

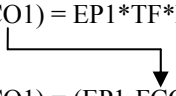
Combined titration does not apply to those methods like “COD ”,“Stat” or “Learn” titration mode.

3-8-11-4. Setup of calculation formula when combined method is applied

When a combined method is applied, the calculation formula has to be set for each method according to the section “3-8-7. [Calculation parameter]”. However, when the previous measurement results on the combined method are applied to the next method, the constants (FCO1 through FCO5) listed in Table 3-8-7-1 should be used — e.g. “FCO1” should be used when applying “CO1” (results on the first method) to the next method.

(Example)

First method of a combined method: Calculation formula (CO1) = EP1*TF*K1*C1/S



Second method of a combined method: Calculation formula (CO1) = (EP1-FCO1)*TF*K1*C1/S

4. Others

4-1. When a preamplifier other than STD-610 is used

4-1-1. Preamplifier for photometric titration (PTA-610)

Photometric titration

This method detects endpoint by color tone or color depth of titrated solution. However, if the sample is turbid, it may not detect correct endpoint. Photometeric titration is widely used in chelatometric titration with indicators.

It is recommended to have a full understanding of the characteristics of the reacting metals the selection of metal indicators, titration conditions such as pH, titration procedures and others.

The week point of this method is the difficulty of receiving optical signal correctly is the Sample is turbid. In this case, remove the turbid substance in the sample by filtering.

○ Metal Indicator

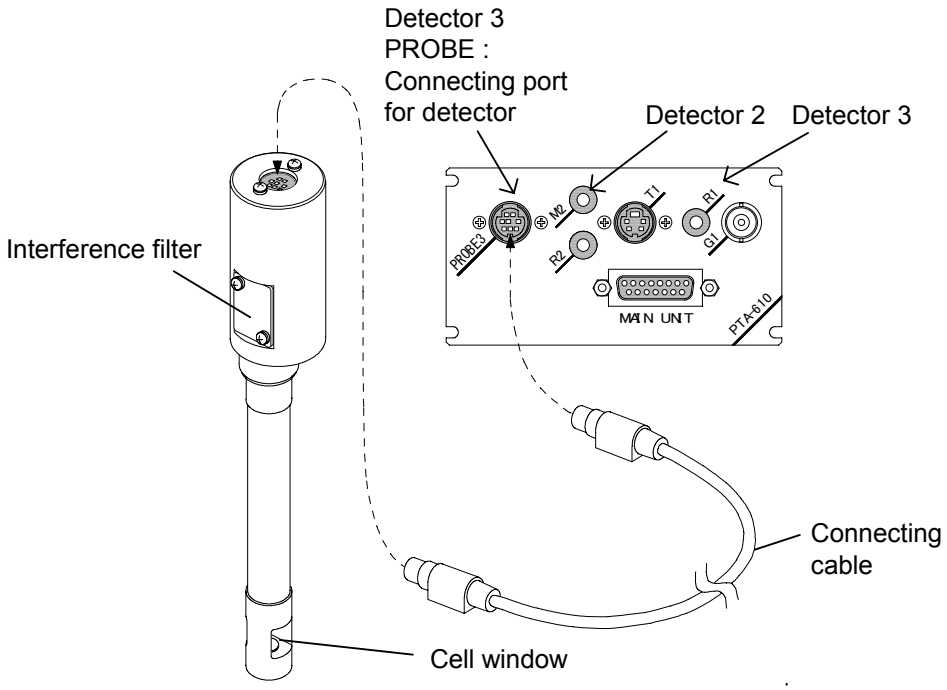
Chelatometric titration on the photometric titration detects endpoint by the change of color with the indicator. This indicator is called a metal indicator since it changes its color responding to metal ions.

○ Buffer solution in chelatometric titration

In chelatometric titration, buffer solution must be added in order to control the pH of titrated solution depending on the sorts of reacting metals.

< Parts name and installation >

1) Install an interference filter with suitable wave length for the titration.
2) Connect the photometric sensor and the connecting port for detector with the connecting cable.

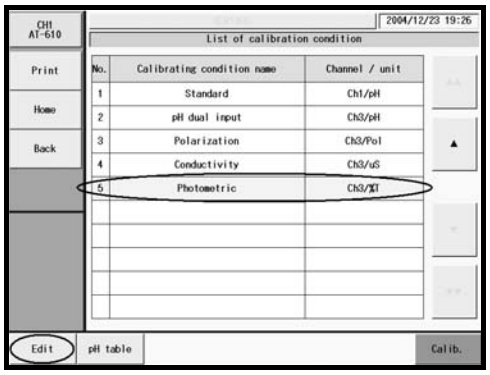


< Preparation for measurement >

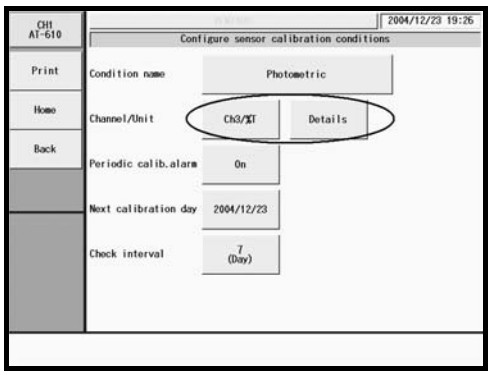
1) Ensure the interference filter is inserted in the photometric sensor. The relation of the interference filter and liquid color are shown below:

Color change from to				Wave length of filter
Yellow	← →	Red	:	530nm
Clear	← →	Red	:	530nm
Yellow	← →	Blue	:	630nm
Clear	← →	Blue	:	630nm
Blue	← →	Red	:	530nm or 630nm

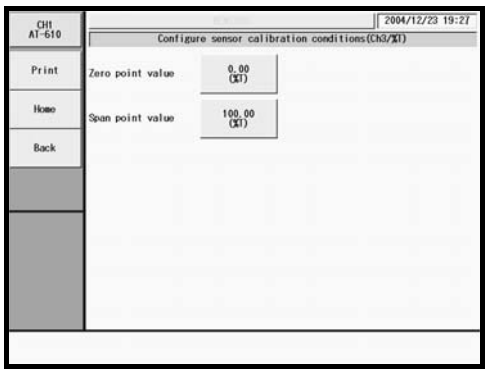
2) Ensure no dirt or stains around the cell window of photometric sensor. (To remove the dirt or stains, carefully wipe the cell window with gauze soaked in methanol or cleanse it with detergent)
3) Dip the cell window completely into the solution. At this point, be careful not to generate any air bubbles around the cell window by stirring or otherwise.
4) Here you calibrate the preamplifier. Press [Calibration] button on the titrator.



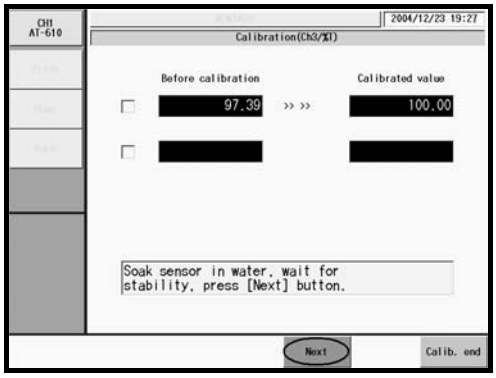
5) When “List of calibration condition” appears, select calibration conditions for use, and press [Edit] button.



6) Select “Ch3/%T” for Channel/Unit and press [OK] button.
7) Press [Details] button.

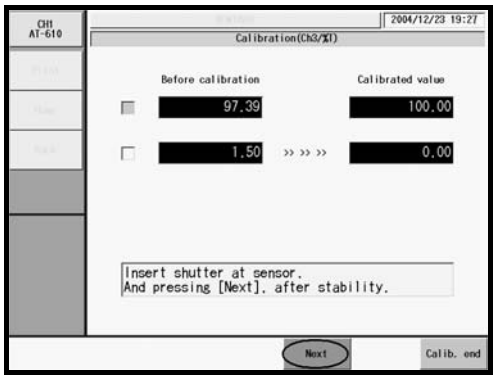


8) Enter zero point value, and press [OK] button. (Typically, enter zero ‘0’)
9) Enter span point value, and press [OK] button. (Typically, enter ‘100’)
10) Press [Back] button twice to return to “List of calibration condition”.



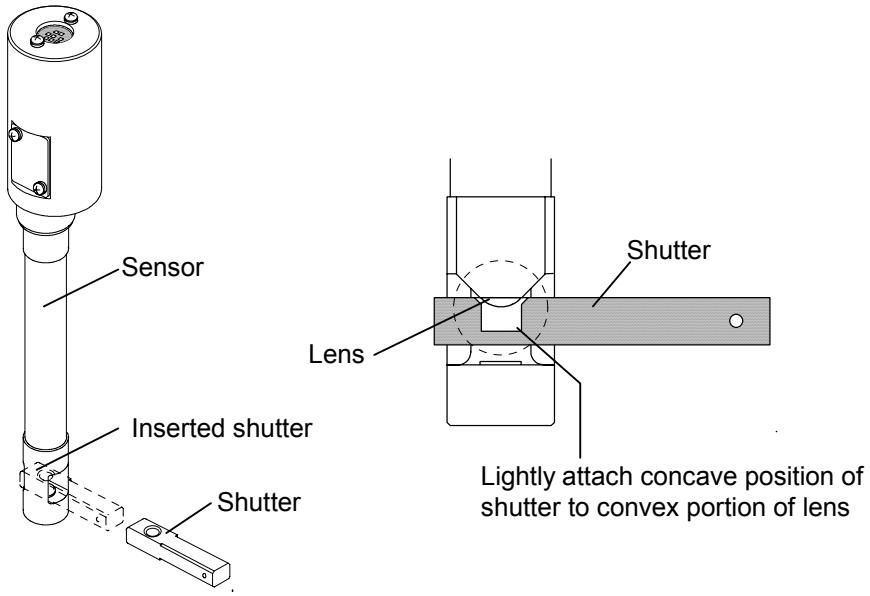
11) Dip the photo sensor in pure water, and press [Calib.] button

12) Here you perform 100%T calibration. When the %T displayed on the left is stable, press [Next] button.



13) Now you perform 0%T calibration. Lift the photo sensor out of the liquid, and insert the shutter into the cell window. When the %T shown on the left is stable, press [Next] button.

14) Press [Calib. end] button.



How to insert the shutter

< How to titrate >

1) Parameter setup on the measuring unit

For photometric titration, use “Auto Intermit” mode and “Ch3/%T” for Channel, Unit (ctrl.) as titration parameter.

2) Operation

Dip the photometric sensor in sample solution deep enough, and press [Start] button to start titration.

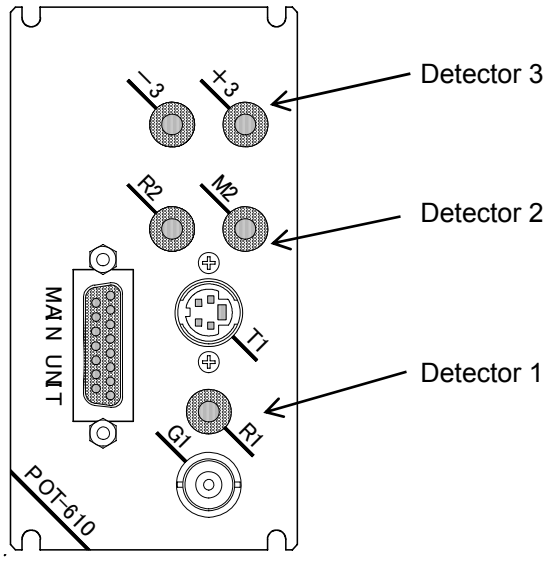
4-1-2. Preamplifier for polarization titration (POT-610)

Polarization titration

There are two methods in polarization titration; one is called, “Amperometric titration method at constant voltage”, which determines endpoint by measuring the current change in applying very low voltage between the two electrodes after submerging the twin platinum electrodes into the titration solution, and another method is called, “Potentiometric titration method at constant current”, which determines endpoint by measuring the potential between the two electrodes in applying constant current of very low ampere.

These methods feature distinctive change in potential or current because the phenomena, polarization converting to depolarization or vice versa, are often observed at the end point.

< Part description >



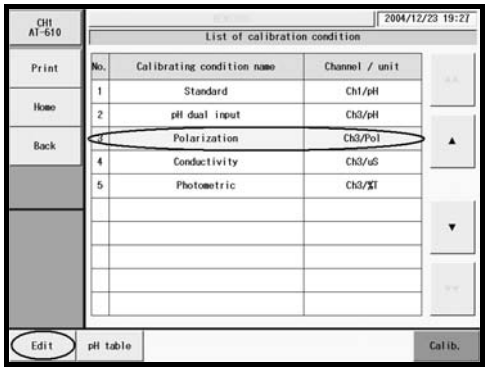
Detector 3 + −: Connecting terminal for Twin platinum electrode

Note!

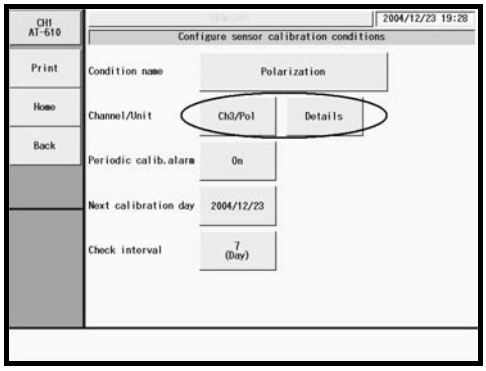
When a twin platinum electrode is connected to Detector 3, do NOT dip it into the solution where electrodes connected to Detectors 1 & 2 are immersed

< Preparation for measurements >

1) Fix the twin Pt. electrode (98-100-M511) onto the holder.
2) Insert the cable from the electrode into the + – terminal of POT-610 preamplifier.
3) Here you set up a configuration for the preamplifier. Press [Calibration] button of the titrator.

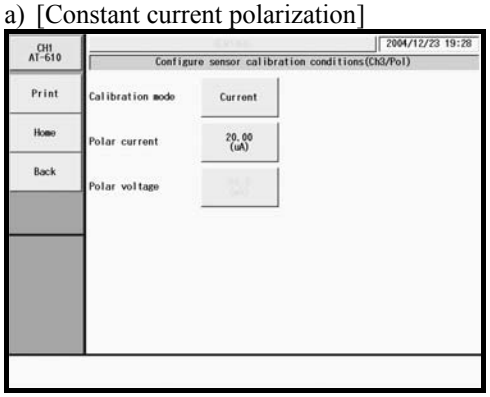


8) When “List of calibration condition” appears, select the conditions to be used, and press [Edit] button.



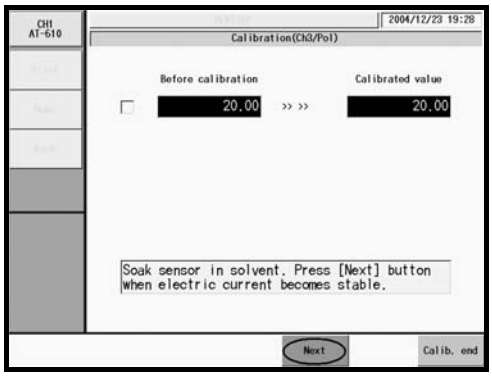
9) Select “Ch3/Pol” for Channel/Unit, and press [OK] button.
10) Press [Details] button.

a) [Constant current polarization]



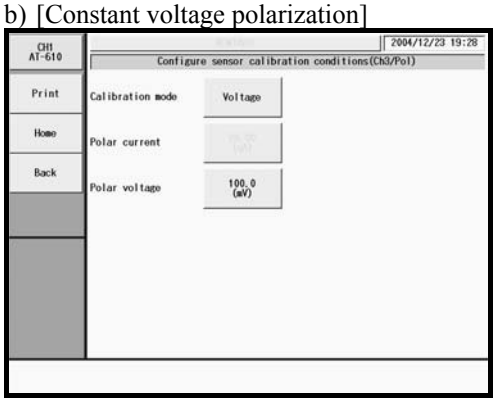
11) Set up parameters for calibration.

Select “Current ” for calibration mode, and press [OK] button. Enter the polar current and press [OK] button. Press [Back] button twice to return to “List of calibration condition”.
Press [Calib.] button.

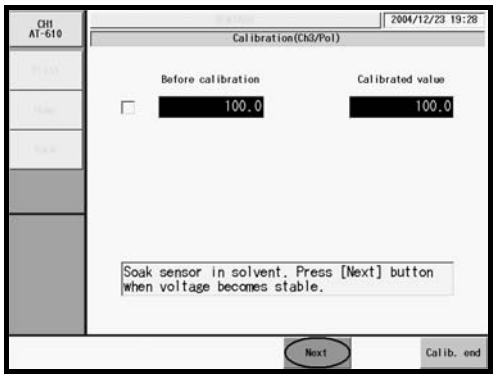


After dipping the Twin Pt. electrode in the solvent to be used and confirming that the current level on the left and right agrees, press [Next] button.

b) [Constant voltage polarization]



Select “Voltage” for calibration mode, and press [OK] button. For polar voltage, enter the constant voltage of the standard solution at time of calibration, and press [OK] button.
Press [Back] button twice to return to “List of calibration condition”.
Press [Calib.] button.



Dip the Twin Pt. electrode in the solvent to be used. After confirming that the potential level on the left and right agrees, press [Next] button.

12) Press [Calib. End] button.

< How to titrate >

5) Parameter setup on the measuring unit
For constant current polar potential titration, set Channel, Unit (ctrl.) to “Ch3, mV” as titration parameter. For constant voltage polar current titration, set Channel, Unit (ctrl.) to “Ch3, μA” as titration parameter.

2) Operation
Dip the platinum of the electrode in a sample solution well and then press [Start] button to start a titration.

4-1-3. Preamplifier for conductometric titration (CMT-610)

Conductometric titration

This method detects an equivalence point on the titration curve of "titer VS. Conductivity", making use of the change in concentration of the related ions in the solution during titration.

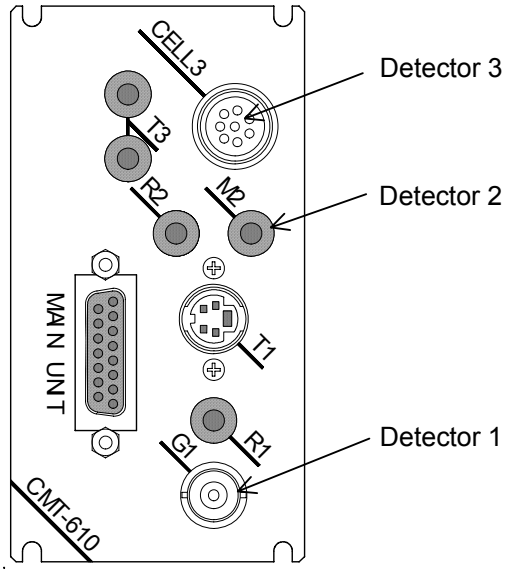
In this form, an endpoint is determined by an Automatic Intersection Detection.

An "Intersect" is applied to the endpoint detection by this method.

Note!

The electric conductivity sensor does not guarantee conductivity values as the sensor is designed to quickly respond to a change of the conductivity at the time of titration. Just for your information, measurement errors of ±10%, ±20% and ±30% are seen at around 1000uS/cm, 10000uS/cm and 100uS/cm, respectively.

< Part description >



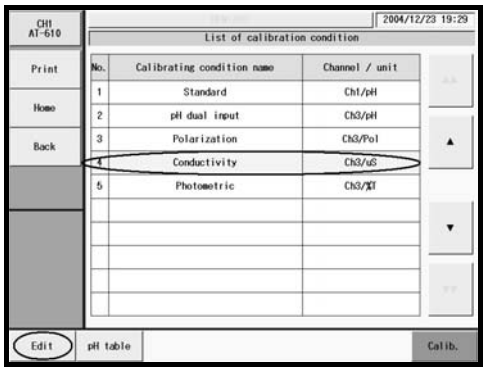
Detector 3 CELL 3 : Conductivity cell terminal

T3 : This is not necessary when K-321 conductivity cell is going to be used. (This terminal is for connecting temperature compensation electrode when a conductivity detection sensor without built-in thermistor for temperature compensation is used. Temperature compensation electrode use T-111.)

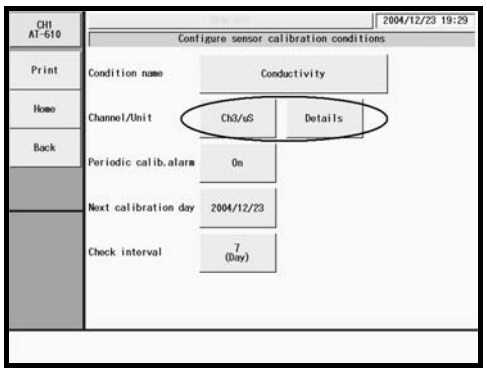
[Note] Be careful not to use both electrodes at the same time, that is, an electrode for conductivity with built-in thermistor for temperature compensation and an electrode for temperature compensation.

< Preparation for measurement >

1) Fix the conductivity cell onto the electrode holder.
2) Insert the cable from conductivity cell into CELL3 terminal of CMT-610 preamplifier.
3) Here you set up a configuration for the preamplifier. Press [Calibration] button on the titrator.



4) When “List of calibration condition” appears, select the conditions to be used, and press [Edit] button.

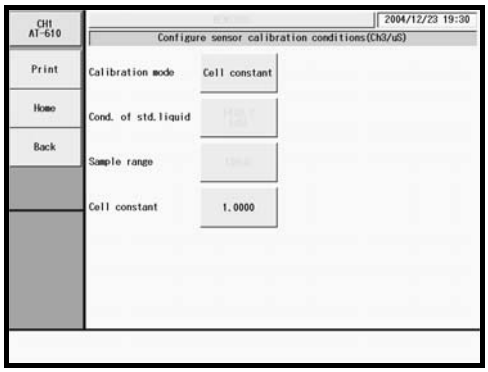


5) Select “Ch3/μS” for Channel/Unit, and press [OK] button.
6) Press [Details] button.

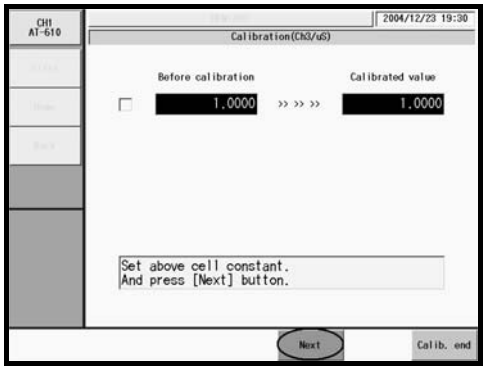
7) Set up parameters for calibration.

a) [Cell constant] – when standard solution is not used

Enter the cell constant that has been validated in the plant at the time of shipment (labeled on the cell cap) or the constant validated with a reference of known conductivity.



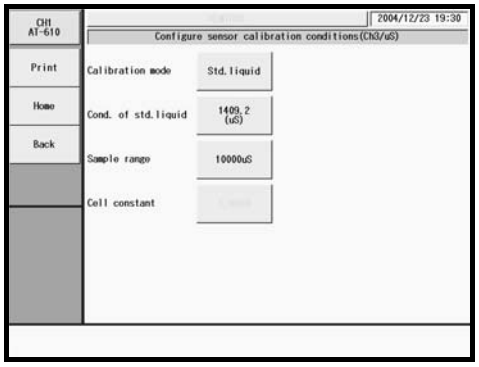
Select “Cell constant” for calibration mode, and press [OK] button.
Enter the “Cell constant” labeled on the cell or the constant of which conductivity is known, and press [OK] button.
Press [Back] button twice to return to “List of calibration condition”.
Press [Calib.] button.



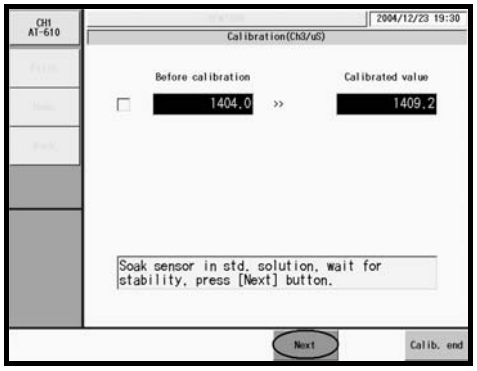
When the constant displayed on the right agrees with the cell constant of the sensor, press [Next] button.

b) [Calibration with a reference solution]

The conductivity cell changes its cell constant as time goes by. When precision is required in measurement, you need to calibrate with conductivity standard solution, specified in JIS or of which conductivity is known (usually potassium chloride is used). See the Section “Conductivity standard solutions” for how to prepare standard solution and the conductivity at varying temperatures.



Set the calibration mode to “Std.liquid”, and press [OK] button.
Enter the conductivity of the standard liquid at time of calibration for “Cond. of Std.liquid ”, and press [OK] button.
Select “Sample range” to the standard range, and press [OK] button. (Select 10000μS for more than 1000μS standard conductivity, and 1000μS or 10000μs for more than 100μS)
Press [Back] button twice to return to “List of calibration condition”.
Press [Calib.] button.



Dip the conductivity sensor in the standard solution. When the conductivity on the right and left on display match, press [Next] button.

8) Press [Calib. End] button.

Note!

When dipping the electric conductivity sensor in a solution, make sure to allow 5mm or more between the sensor head and the bottom of the beaker. Measurement will not be performed properly when the sensor is obstructed.

< How to titrate >

1) Parameter setup on the measuring unit
   For conductivity titration, select “Intermit” titration mode and “Intersect” titration form. Set Channel, Unit (ctrl.) to “Ch3/μS” as titration parameter. (Select sample range to measurement range)
2) Operations
   Dip the conductivity cell in sample solution and press [Start] button to start titration.

Note!

When dipping the electric conductivity sensor in a solution, make sure to allow 5mm or more between the sensor head and the bottom of the beaker. Measurement will not be performed properly when the sensor is obstructed.

< Conductivity standard solution >

Preparation for conductivity standard solution can be made according to JIS K0130 General rules for electric conductivity measuring method and JIS K0112 General rules for conductometric titration as described below. Also, see the appendix for conductivity at varying temperature.

- Preparation of conductivity standard solution (JIS K0130 General rules for electric conductivity measuring method)

  Dry potassium chloride (KCl) at 500 C for 4 hours, and dissolve 0.74552g KCl in 1000.00g pure water of which conductivity is less than 0.2mS/m at 25 C. Store the solution in a polyethylene or hard glass bottle after sealed.

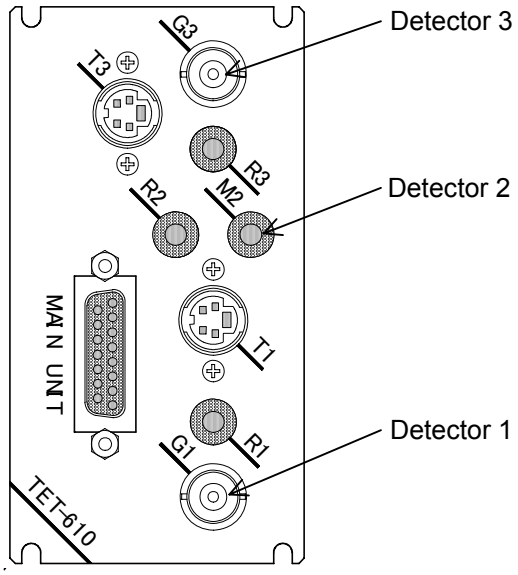
Conductivity of standard solution

Temperature (°C)	Conductivity (mS/m)	Conductivity (μS/cm)
0	77.292	772.92
5	89.096	890.96
10	101.395	1013.95
15	114.145	1141.45
18	121.993	1219.93
20	127.303	1273.03
25	140.823	1408.23
30	154.663	1546.63
35	168.779	1687.79
40	183.127	1831.27
45	197.662	1976.62
50	212.343	2123.43

4-1-4. Preamplifier for pH dual input (TET-610)

pH-calibration values should be individually stored on each detector.

< Part description >



Detector 1 G1 : Port for Glass electrode
R1 : Port for Reference electrode
T1 : Port for Temperature compensation electrode

Detector 2 M2 : Port for Metal electrode
R2 : Port for Reference electrode

Detector 3 G3 : Port for Glass electrode
R3 : Port for Reference electrode
T3 : Port for Temperature compensation electrode

< Preparation for measurement >

1) Mount the glass combination electrode (or glass electrode and reference electrode) and temperature compensation electrode onto the electrode holder.
2) Plug each electrode cable terminal into Detector 1 or 3 of TET-610 preamplifier.
3) Press [Calibration] button of AT-610 to calibrate the preamplifier.

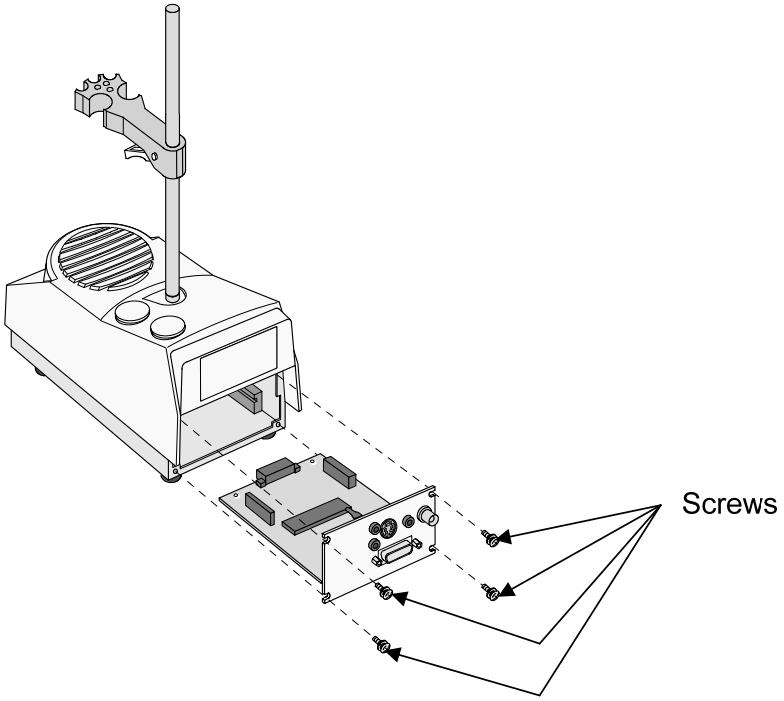
Note:

About the calibration method, see the chapter "3-1-2. Calibration of detectors (preamplifiers) and electrodes".

4-1-5. How to change preamplifier

> ⚠ **Caution!**
>
> **Before changing a preamplifier, turn off the power of the main unit. Otherwise, malfunction of the main unit, stirrer or preamplifier may occur.**

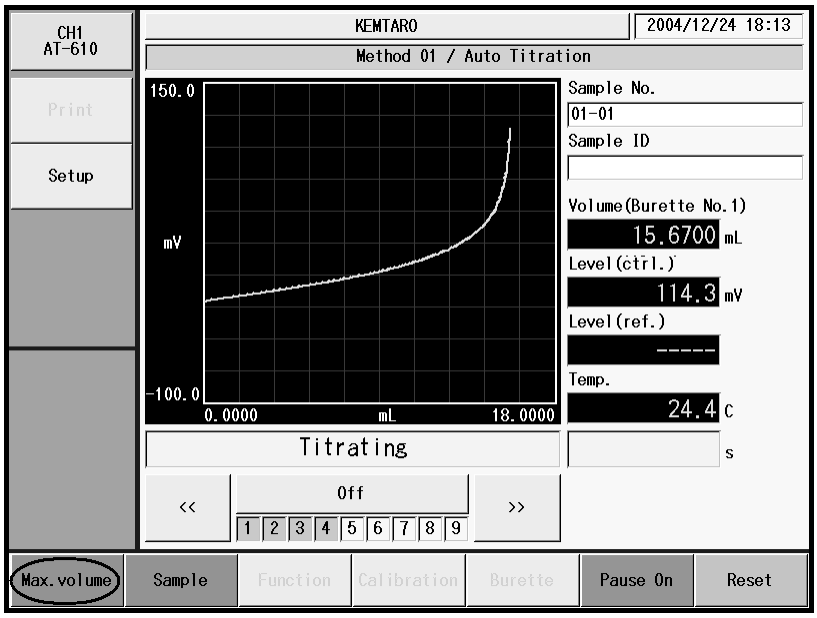
1) Undo four (4) screws fastened to a preamplifier.
2) Pull the preamplifier towards you to remove it from the stirrer unit.
3) Slowly insert another preamplifier to be used for measurement sliding along the guide rail.
4) Fasten the four screws securely once removed in the Step 1).



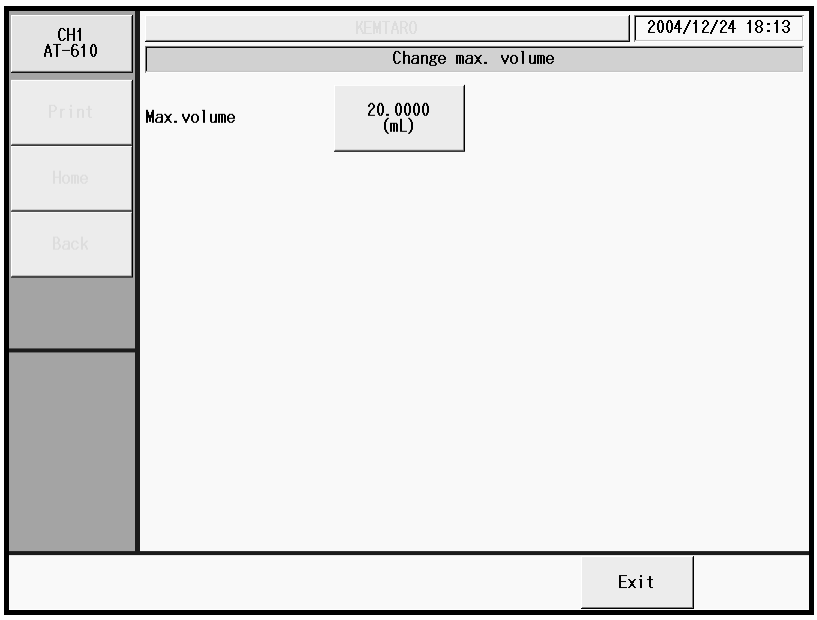
4-2. Change maximum titration volume

Here can you change the max volume for titration. The changed titration volume will be reflected on the "Max. volume" of the titration parameter that are currently used in an ongoing measurement.

1) Press [Max. volume] button while performing a titration.



2) When "Change max. volume" screen display appears, press [Exit] button after changing the value of max volume.



4-3. Connecting Balance

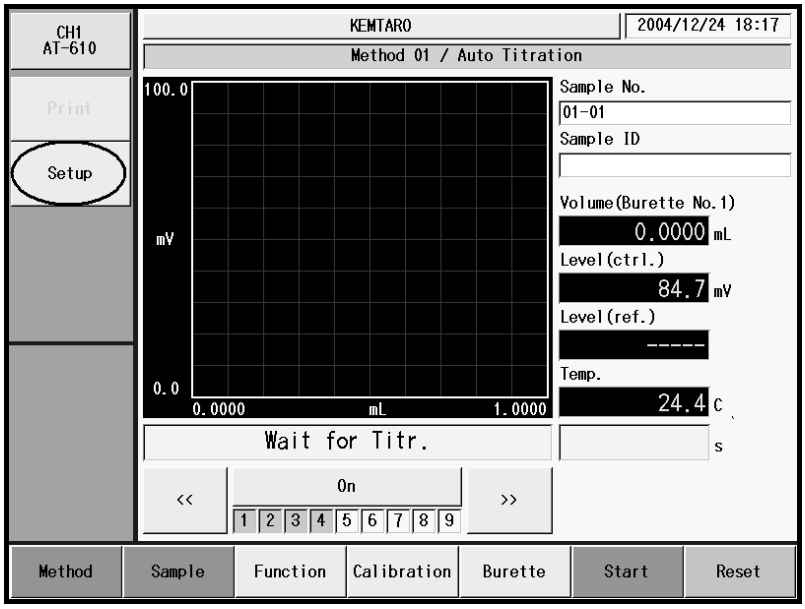
4-3-1. How to connect a balance

When an electronic balance is connected and set up appropriately, the sample size (weight) is automatically input into the measuring unit.

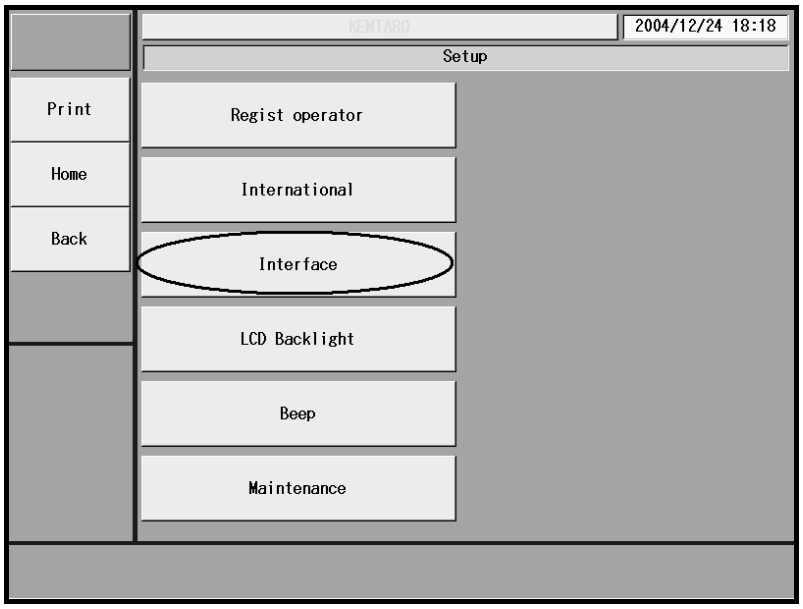
Note:

Check with your local dealer to see if your balance needs a special cable to be connected.

1) Press [Setup] button on Main display.

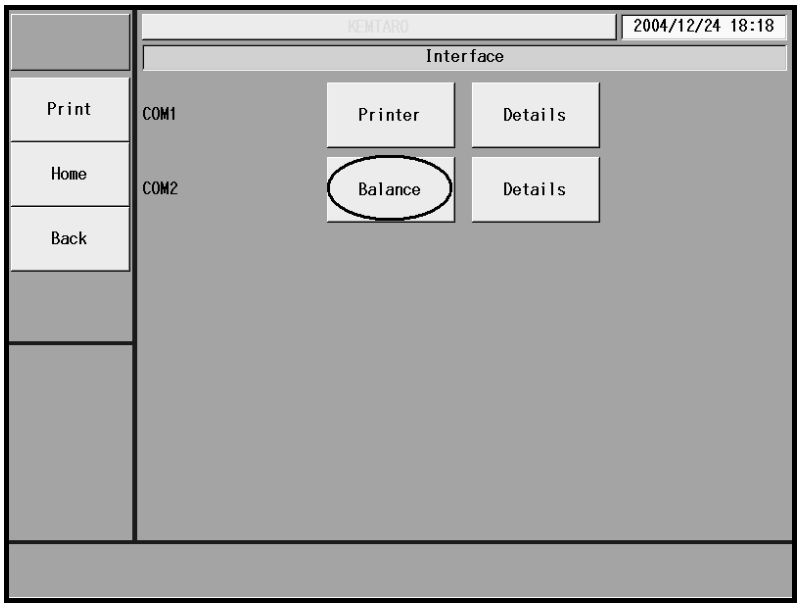


2) Press [Interface] button on “Setup”.

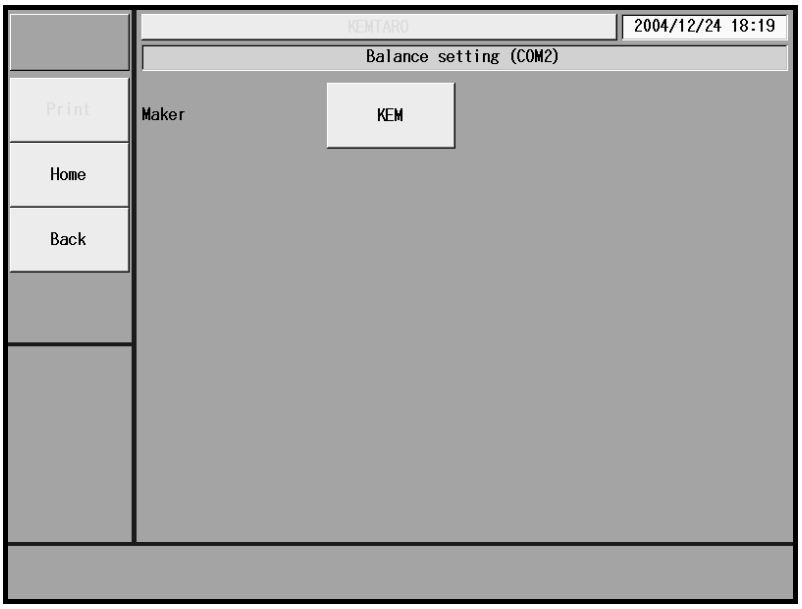


3) Select a COM port for “Balance” on “Interface”.

4) Press [Details] button.

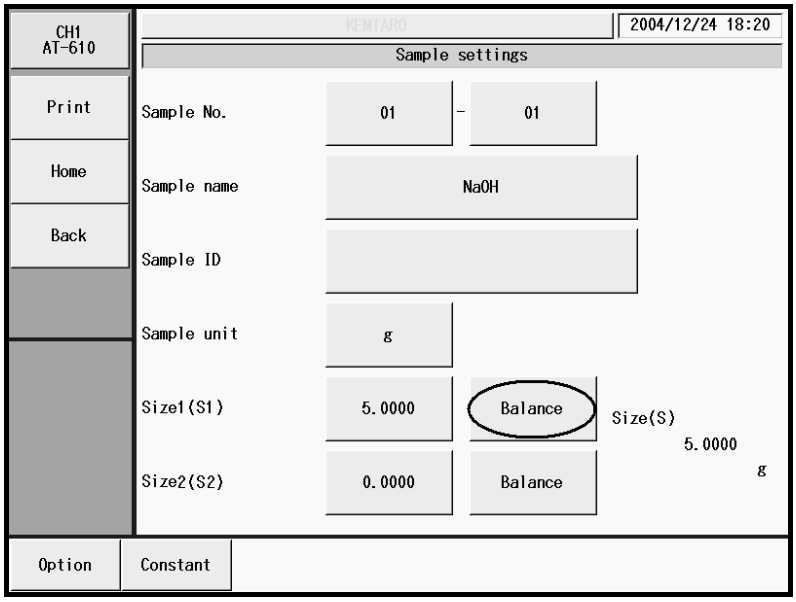


5) Choose the maker of your balance from the list on display.

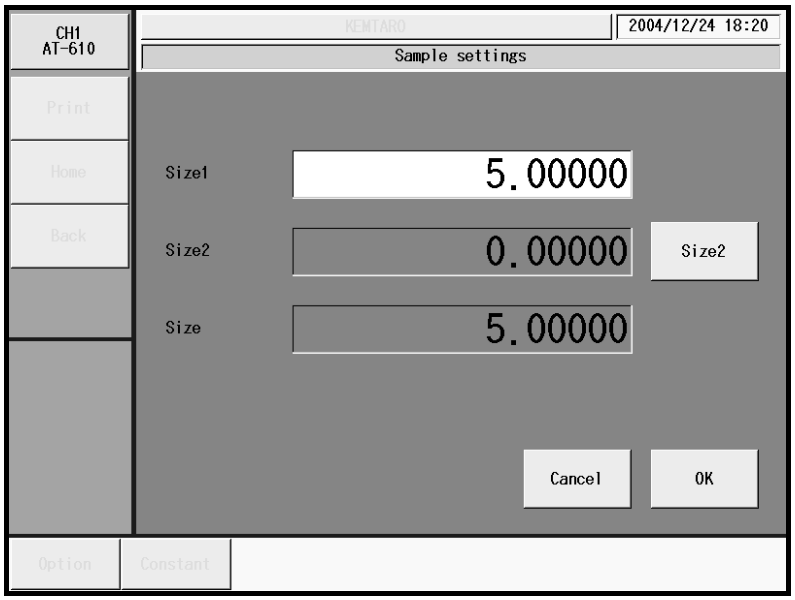


4-3-2. Input sample size on balance

1) Press [Sample] button on Main display to show “Sample settings”.



2) Press [Balance] button for Size 1. The present input data in balance appears on “Sample settings” on display. When the reading becomes stable, press [OK] button. The display returns to “Sample settings”.



3) When “Size 1, 2” is selected in “Sample input mode” by choosing [Function] – [Sample mode] and sample weight is continuously input, press [Size 2] button on the (Size 2) row and allow the weight to be input from the balance.

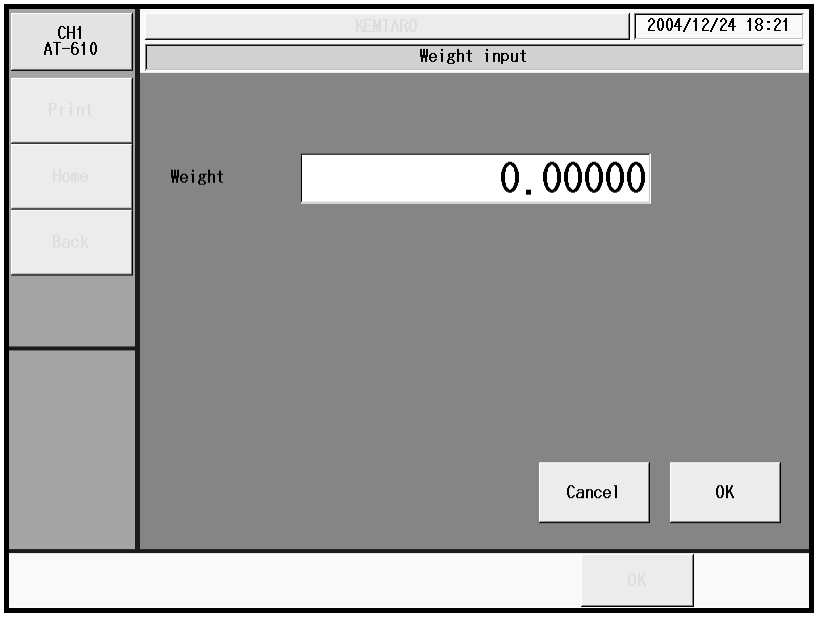
Note:

When the “After entry” is selected on sample mode, the display for sample size input appears after titration is over. Press [Balance] button likewise for balance input.

4-3-3. Input on balance at the time of burette validation

1) Press [Burette] button on Main display.
2) Press [Validation] button.
3) Put a beaker on the balance to cancel tare. Then the display will show 0.0000g.
4) Press [Start] button. The burette starts action to discharge water into the beaker.
5) When the display for weight input appears on screen, press [Balance] button. Place the beaker with water discharged from the burette on the balance. When the display stabilizes, press [OK] button. The discharged weight is input at this moment.

(Screen Display for weight input by balance)



4-4. Usage of a multiple sample changer

When a multiple sample changer is connected to this titration unit, it can perform continuous titration of a series of the same sample liquids or different kinds of samples repeatedly. It also automatically performs sequential events like pre-dosing, electrode cleaning after measurement and draining out the liquid in beaker. For details of connecting the sampler and operating instructions, refer to the instruction manual for a multiple sample changer.

4-4-1. Selection of sampler

1) Press [Function]–[Sample mode] button, and select “On” on “Sample file”.
2) Press [Sample] button on Main display, and select “On” on “Changer”.
3) On “Sequence mode”, you select how to clean the sampler.

4-4-2. Standard sequence setup

Five (5) sequential modes are available including Standard sequence (1 to 4) and User sequence (user). Below description explains the sequence setup when a standard mode is chosen among from standard sequence modes 1 to 4 in Section “4-4-1. Selection of sampler”.
Press [Function]–[Changer setting] button, and select an action time for “Standard sequence n”.
For details of action time, see Section “3-5-9-1. Acting time setup”.

4-4-3. User sequence setup

The user sequence when “User” mode is chosen consists of three (3) different kinds of actions including the cleaning sequence at time of starting the sampler, cleaning after individual sample titration and after all the samples on rack are finished.

1) Press [Function]–[Changer setting] button, and press [Rinse sequence at start] button to select rinsing steps (up to 20) for cleaning before a series of titrations starts. For setup procedure, see Section “3-8-10-1. Rinse sequence”.
2) Press [Back] button, and then, press [Rinse sequence at end] button to select rinsing steps (up to 20) for cleaning after the last titration in series is completed. For the setup procedure, see Section “3-8-10-1. Rinse sequence”.
3) Press [Back] button, and select “User sequence” to set up each acting time for commanded event in user sequence. For acting time setup, see Chapter “3-5-9-1. Acting time setup”.
4) Press [Method] button on Main display, and select the method to be used. Then, press [Edit] button.
5) Press [Option parameter] button to set the “Rinse sequence” to “On”.
6) Press [Details] button and select rinse steps (Max. 20) after completing a titration. See Section “3-8-10-1. Rinse sequence”. Rinse sequence after titration needs to be set up for each method individually.

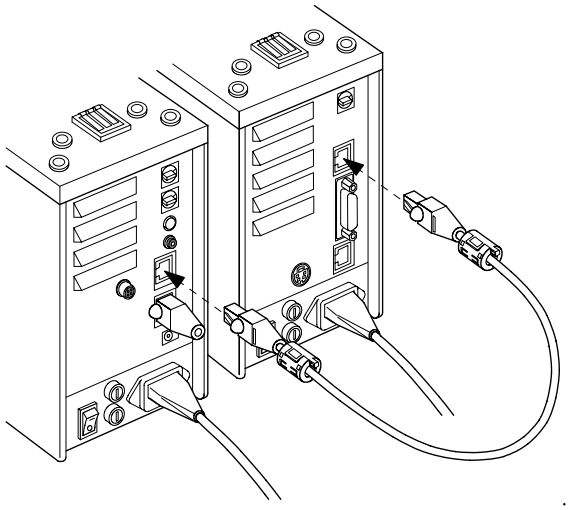
4-4-4. Setup sample conditions

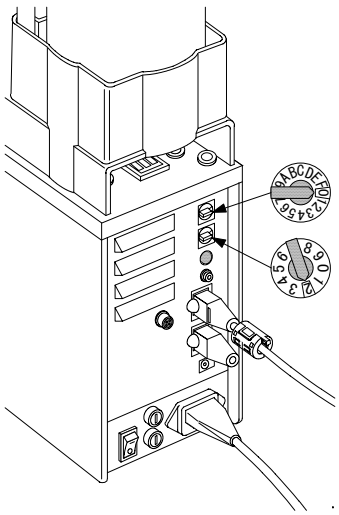
Press [Sample] button on the main screen display to configure samples for the number of measurements. About the sample setup, see Section “3-3-1.Sample file mode”.

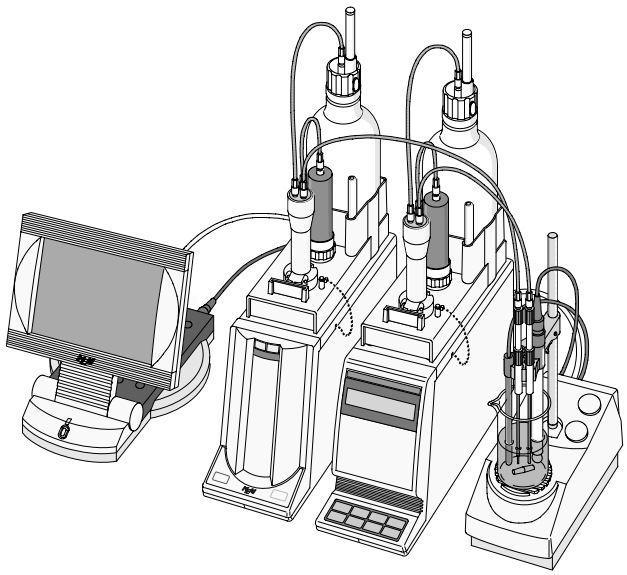
4-5. Connecting additional burette

This titration unit can command and activate up to nine (9) Auto piston burettes.

1) Connect each S-BUS port on the back of measuring unit and additional burette with APB−APB cable. Ensure to connect the supplied terminator to S-BUS port of the last burette.
2) Select "APB No." switch on the back of additional burettes. For details, see the instruction manual for the Auto piston burette to be connected.
3) Turn on the power.







⚠ Caution!

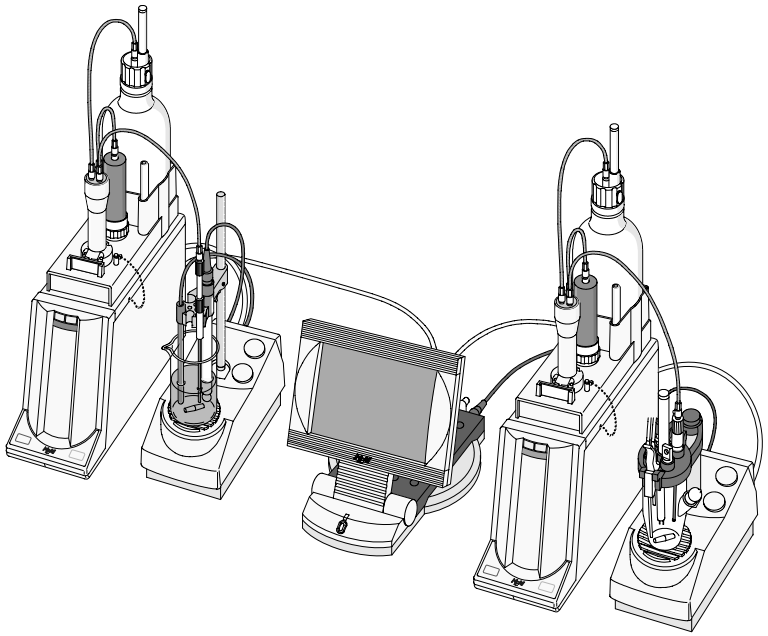
Be sure to turn off the unit before plugging in or out the cable.

⚠ Caution!

Be sure to plug in the terminator in order to avoid influence of noise leading to communication error (halt of operation).

4-6. Connecting a plural number of measuring unit

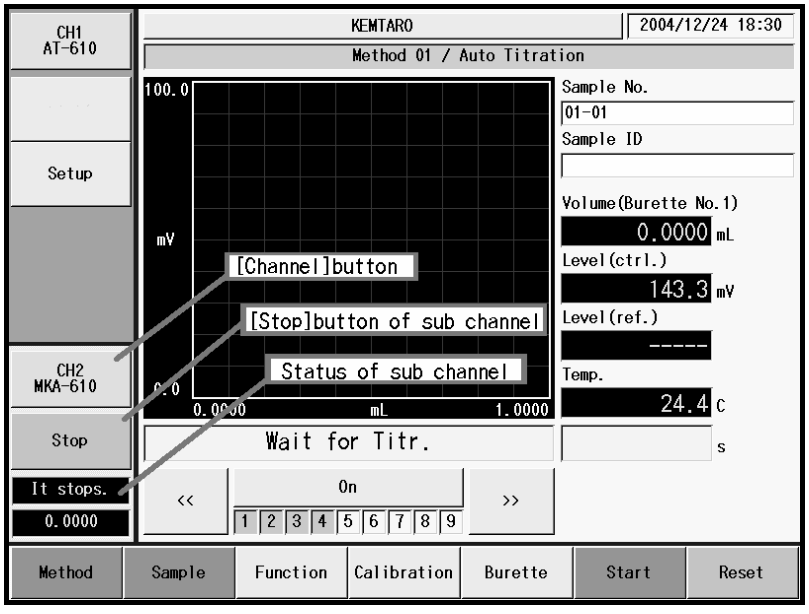
1) Connect the additional unit and Main control unit MCU-610 as below.
2) Set MCU number on the back of the additional unit to “1”.
3) Turn on the power of the measuring units and optional peripherals.
4) Turn on MCU-610. The additional measuring unit is taken for channel2 (CH2).



Note:

The power for Main control unit MCU-610 must be turned on only after the peripherals are turned on. Do not turn ON simultaneously the power supply of measuring units and optional peripherals.

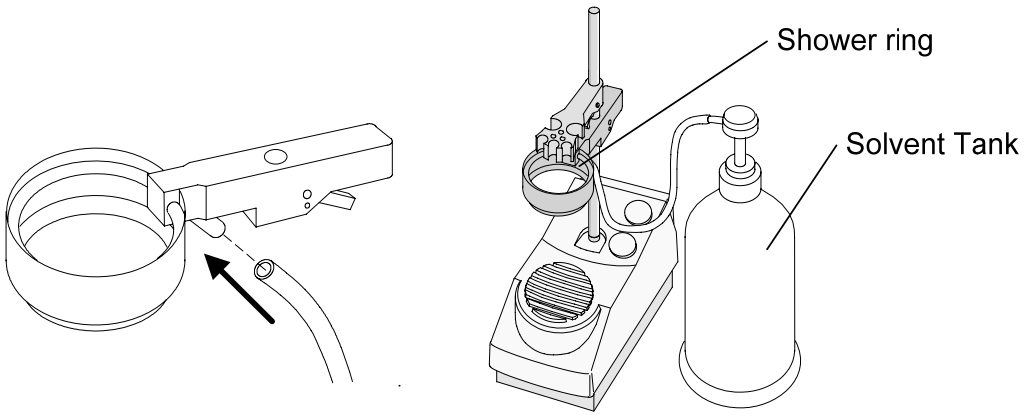
< When MKA-610/2ND is connected >



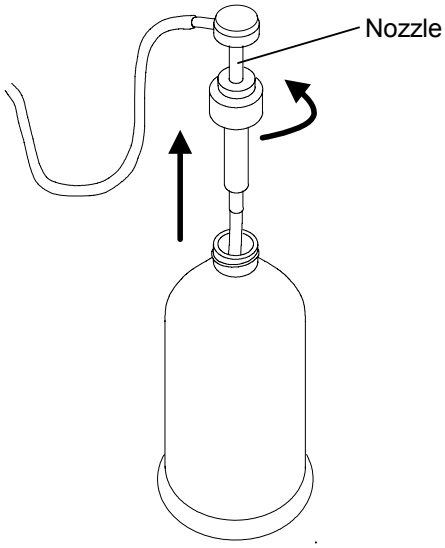
4-7. Optional electrode cleaning unit (MW-510)

4-7-1. Connecting the electrode cleaning unit

1) Insert the tube from the manual pump (98-509-0008) to the inlet for shower ring (98-550-0050) supplied with the electrode cleaning unit.
2) Remove the electrode holder from the stand bar.
3) Mount the shower ring to the stand bar instead.
4) Connect the other end of tube to the pump.
5) Mount the electrode holder, detached in the above Step 2), to the stand bar.



6) Remove the nozzle of solvent tank.
7) Fill the tank with approximately 1L of pure water for rinsing.

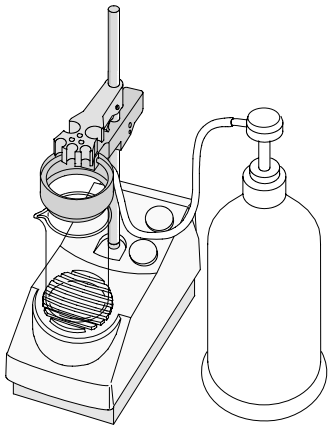


⚠ Caution!

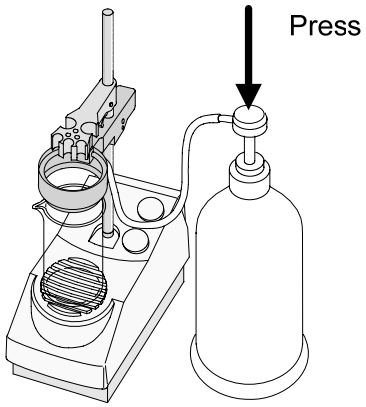
The rinse solvent tank is made of polyethylene. The tube is made of silicone material. Do not use organic solvent or acid /alkali solvent. The failure may cause the leakage of liquid.

4-7-2. Cleaning the electrode

1) Place a container (beaker) for dripping solvent under the shower ring.



2) Raise the electrode holder a little bit upwards.
3) Press down the pump head of solvent tank.



⚠ Caution!

If the pump head is pushed too hard, the solvent may splash out.

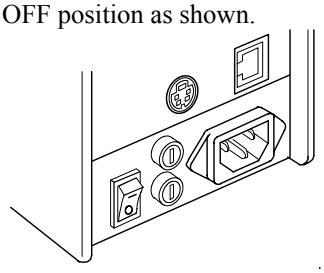
Care should be taken in pressing down.

4-8. Use COD titration unit (COD-510)

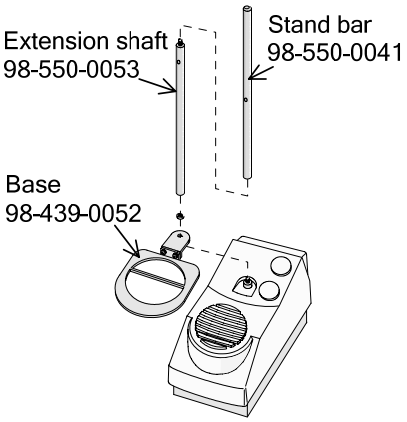
When the COD titration unit is connected with Main unit, this titration unit can measure chemical oxygen demand specified in JIS K0102 Testing method for Potassium permanganate number at 100°C.

4-8-1. Connecting the COD titration unit

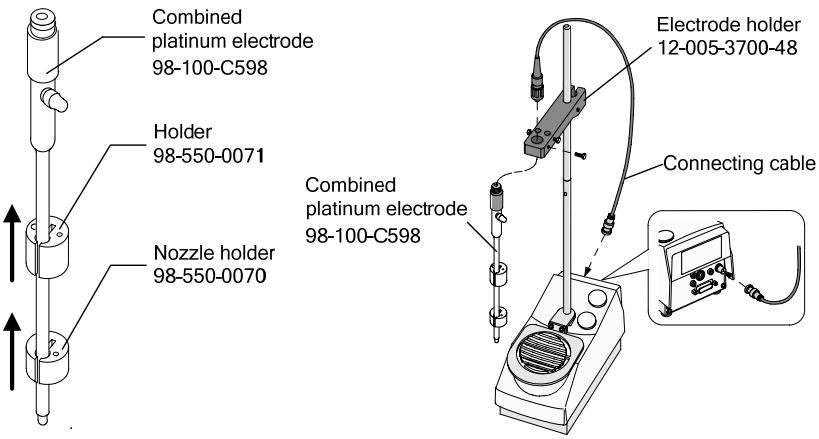
1) Make sure the power switch is in OFF position as shown.



2) Remove the stand bar.
3) Place Base (98-439-0052) on the magnet stirrer.
4) Install Extension shaft (98-550-0053) to the COD unit.
5) Attach the stand rod to the extension shaft.



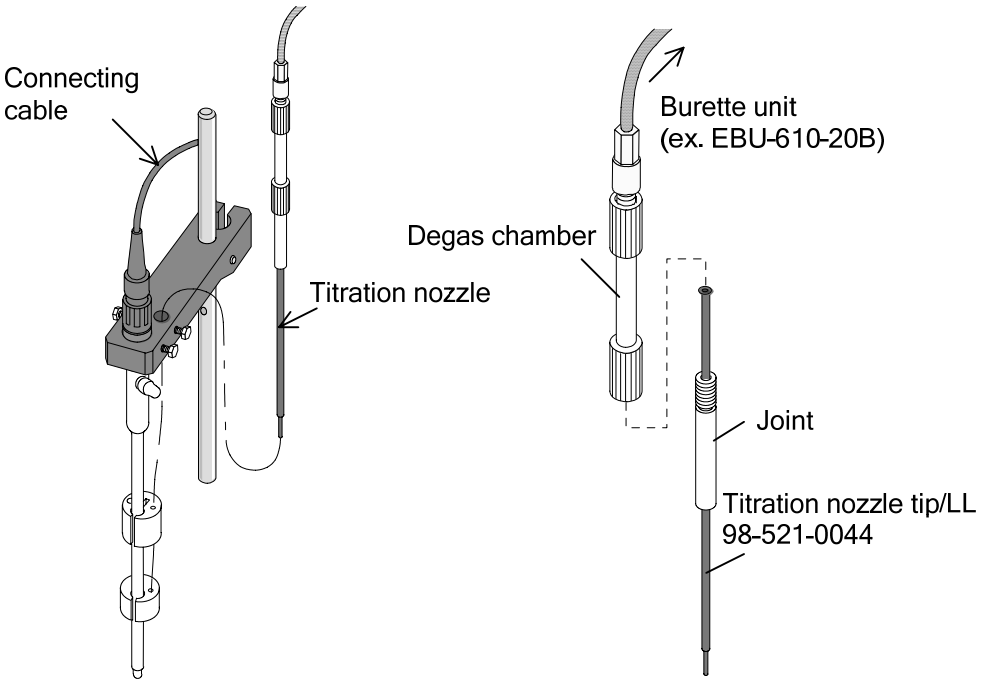
6) Fix Nozzle holder (98-550-0070) and Holder (98-550-0071) to Combined platinum electrode (98-100-C598).
7) Install Electrode holder (12-005-3700-48) onto Extention shaft.
8) Install combined platinum electrode onto its holder.



9) Remove the degas nozzle tube from the degas chamber, and put the head of the provided titration nozzle/LL (98-521-0044) instead.
10) Put the titration nozzle through the electrode holder, the nozzle holder and the holder, and fix it to the electrode holder as shown below.
11) Hook the electrode cable to the combined platinum electrode.

Note:
Use the electrode cable, which is supplied with the titration unit.

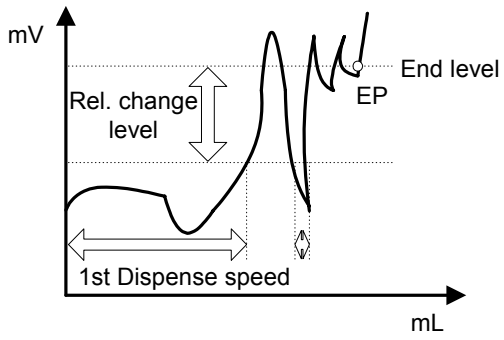
12) Connect the other end of cable to G1 terminal of preamplifier in the rear of magnetic stirrer.



4-8-2. Parameter setup

Here you have to configure parameters necessary for COD titration on the measuring unit, where COD titration mode is pre-installed.

< Titration mode: COD >

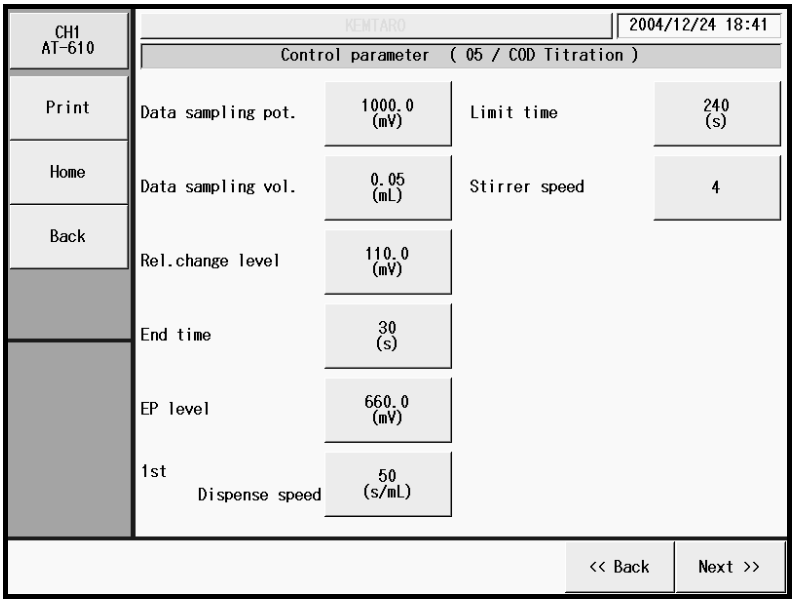


- When detection potential is lower than “Rel. change level”, it doses titration liquid continuously until it reaches “1st Dispense speed”. When it exceeds “Rel. change level”, it switches to intermit titration until it reaches “EP level”.
- When the potential decreases to the level of lower than “Rel. change level”, it doses until it reaches “1st Dispense speed”.
- An endpoint will be detected when titration exceeds “End level” and satisfies “End time”.

Table 4-8-2-1

Settings	Parameters
Method name	Name the method.
Titration mode	Select “COD”.
Burette No.	Select the burette number among from No. 1 to 10.
Channel, Unit (ctrl.)	Select the detector number and potential unit. Choose “Ch1, mV”.
pH polarity	Select the direction of pH potential.
Direction	Select the direction of titration. Here choose “Positive” direction.
Max. volume	Select max titration volume (0 to 9999.0000mL).
Channel, Unit (ref.)	Fixed to “Off”.

(Control parameter: when titration mode and form are set to “COD”)



[Data sampling pot.]

Here you can select data sampling potential. The potential in COD titration changes rapidly during titration. A wide range of data sampling potential is recommended. Typically, set at 1000mV.

- 0.1 ~ 9999.9mV

[Data sampling vol.]

Here you can select data sampling volume. Typically set the titration volume in COD to approximately 0.05mL.

- 0.01 ~ 9999.00mL

[Rel. change level]

Here you set the potential level where constant speed titration and intermit titration is switched. “Rel. change level” is the relative potential to “EP level”. Typically set it to 110mV in COD.

- 0.0 ~ 9999.9mV

[End time]

Here you set the end sense time. EP is found when the potential exceeds “End level” within this preset time. Typically, set it at 30 seconds for the COD titration.

- 0 ~ 9999s

[EP level]

Here you set the endpoint potential level. Typically set it to 660mV for the COD titration.

- –9999.9 ~ 9999.9mV

[1st Dispense speed]

Here you can set dispense speed before reaching the “Rel. change level”.

- 1 ~ 999s/mL

[Limit time]

Here you can set a limit time for titration. When it elapses the preset time, titration will be stopped.

- 0 ~ 9999s

[Stirrer speed]

The spinning speed of stir bar in the stirrer can be selected according to sample type. The range for selection of its speed is in nine steps:

- 0 ~ 9

4-8-3. Calculation formulas for COD measurement

COD measurement requires an equation to calculate concentration. For the details of its setup, see the Chapter "3-8-7. [Calculation parameter]". The typical calculation formulas are shown in the table below:

Table 4-8-2-1

Object of Analysis	Calc. type	Calculation formula	Constants
Blank (mL)	Blank	BL1	
Factor	Factor	(S*Kn)/(EP1*Cn)	Kn = Sodium oxalate purity (%) Cn = 1.675(mg / mL)
Sample (ppm)	Sample	(EP1-BL1)*TF*Cn*Kn/S	Kn = 1000 Cn = 0.2(mg / mL)

4-8-4. Calculation formulas for COD measurement

1) According to JIS K0102 Testing method for Potassium permanganate number at 100°C, prepare the sample in a 300mL conical flask.

<Pre-treatment>

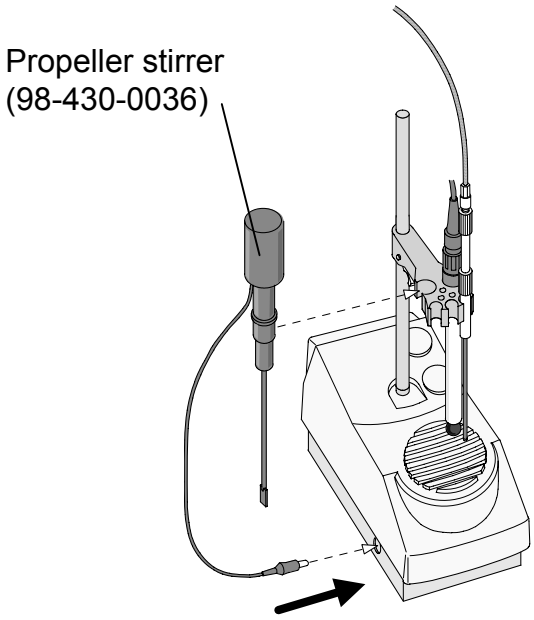
I. Transfer the prepare 100mL sample solution to 300mL conical flask.
II. Add 10mL sulfuric acid (1+2) to the sample, and add silver nitrate solution equivalent to chloride ion masking+1g.
III. Add 10mL of 5m mol/L-potassium permanganate solution.
IV. Put the sample in boiling water and heat it for 30 minutes.
V. Cool down to room temperature, and add 10mL of 12.5mmol/L-sodium oxalate solution.
VI. Heat the sample up to about 60°C, and wait until the sample liquid turns to transparent after the reaction of sodium oxalic added at step V.

2) Heat the sample up to approximately 70°C.
3) Put a stirrer bar in the sample, and dip the electrode in it.
4) Press [Start] button on the titration unit to start titration.

4-9. Propeller stirrer (98-430-0036)

The optional propeller stirrer can be used with this unit. By using the propeller stirrer, the stir bar is no more necessary.

1) Turn off the power of the titrator.
2) Install the propeller stirrer to the electrode holder.
3) Remove the rubber stopper on the left of magnet stirrer.
4) Attach the packing to the magnet stirrer for a rubber stopper.
5) Plug in the power cord of propeller stirrer to the jack.



That's it for setting the propeller stirrer (98-430-0036).
Propeller stirrer can be turned on or off with the stirrer button. For the details of speed adjustment, see the Chapter "2-4-2.Main channel display area".

⚠ Caution!

Do not take out the propeller stirrer while it is spinning. It must be stopped first.
Care should be taken when strong acid or alkali solution is stirred.

4-10. Use CF card

The optional CF card can store the method data, titration results or sample file configurations. Insert the CF card into the slot of the Main Control Unit (MCU-610) for use.
Further, the data stored on CF card can be sent to a PC with the optional Titration Data Analysis Software Tview6. The Titration Data Analysis Software Tview6 features the consolidation, recalculation, generation of Word®-formatted report, storage in CSV format on measured data and so on.
This software can run on the Windows® 2000 or XP platform.

<Basic functions of Titration Data Analysis Software Tview6>	
Displayed contents	Titration curve, Calculation results, Data list
Recalculation	Sample amount, ID, Factor, Changeable blank data
Statistical calculation	Mean, Standard Deviation (SD), Relative SD
Overwritten titration curve	Can be overwritten up to 10 curves
Printing	One result/one page, Two results/one page Four results/one page, View all results
Data processing	Generation of Word®-formatted report, Save in CSV format

Note:

- **Use CF card with FAT (FAT16) formatted. The Memory Card (P/N: 98-435-0008) is already FAT16 formatted when purchased. Otherwise, use your PC to initialize the card for the FAT (FAT16) format.**
- **Do not copy data files from a PC to the CF card. Failure can lead to the inability of access of data on the CF card by the titrator main unit.**
- **Do not execute scandisk from a PC to the CF card. Failure can lead to the inability of access of data on the CF card by the titrator main unit.**
- **The data stored with Tview6 cannot be read by the titrator main unit through the CF card.**

Note:

For storage of method data, refer to "3-8-1-3. [Save CF] (Method data) ". For storage of titration results, refer to "3-5-2-5. [Save CF] (Titration results) ". For storage of sample files, refer to "3-3-1-5. [Save CF] (Sample settings) ".
For manipulating stored data, refer to" 3-5-13. [Operation of CF card] ".

⚠ Caution!

Do not detach the CF card from the slot when making access to it.

5. Maintenance

5-1. Daily maintenance

In order to maintain the system in good conditions for a long period of time, it is important to observe the following instructions.

5-1-1. Check the instrument

Make sure the instrument is not dirty nor stained by visual check. If any dirt is found, wipe it off with clean gauze. Do not use solvent but use water only.

5-1-2. Check the electrode

Make sure the electrode is not dirty, stained or short of inner solution.
Replace the electrode if it is broken.
If dirty, wipe it off with tissue paper.
Fill the inner solution if it is not enough.

5-1-3. Check the cable

Make sure by visual check all the cables including power cord, various cables and electrode lead to see if any dent or bent is found. Replace the cable if it is dent or bent.

5-1-4. Check the connectors

Make sure the connectors are not dusty or rusted. If dusty clean it by a vacuum cleaner. If rusted, repair is necessary.

5-1-5. Check any leaking

Make sure there is no leaking from the nozzle, tube lines, cocks or joints. If any leaking is found, tighten the joints. If it does not improve, replace with new one.

5-1-6. Check burette performance

Press [Burette] button. Press [▼], [▲], [▲▼] key to make sure the burette works properly. If it does not work properly, correct it by referring to “6. Troubleshooting”.

5-1-7. Check stirrer performance

Make sure the stirrer works properly. If it does not, correct it by referring to “6. Troubleshooting”.

5-1-8. Check the nozzle

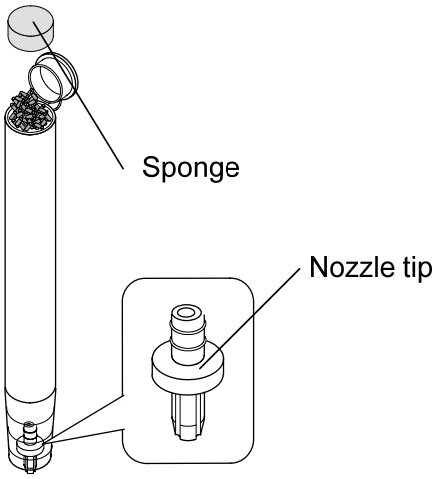
Check the nozzle to see any damage or clogging. If it is broken, replace it with new one.
If it is clogged, remove the clogging article by a thin wire or with hot water.

5-1-9. Preamplifier

Calibrate the preamplifier if necessary. (See “3-1-2. Calibration of detectors (preamplifiers) and electrodes”.)

5-1-10. Replacement of Zeolite (molecular sieves)

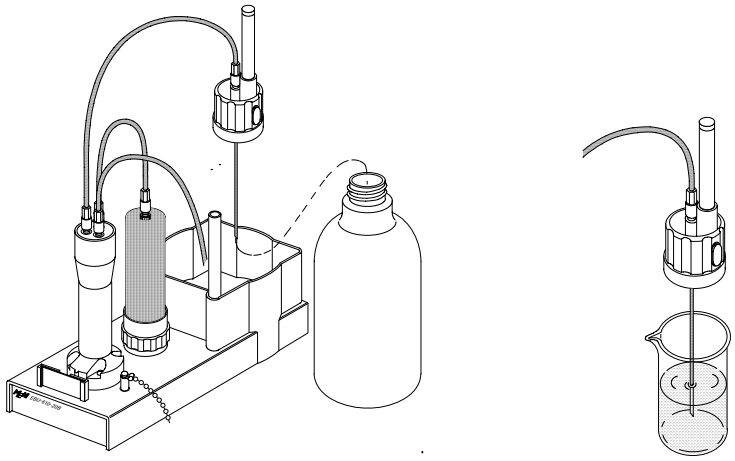
Detach the Zeolite tube from the reagent bottle.
Replace the molecular sieves with Zeolite sold under 5A.



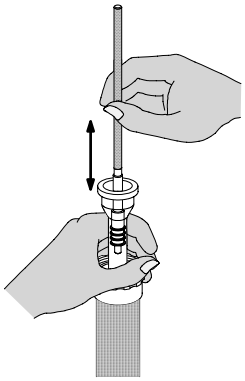
Note:
If the nozzle chip slips from the zeolite tube when replacing the zeolite, ensure that you return the nozzle chip in the tube with its trenches downward as shown above.

5-1-11. How to clean the burette unit

1) Detach the reagent bottle from the burette unit.
2) Prepare solvent (pure water or ethanol) in a beaker. Put the tube end dipped in the reagent bottle into a beaker to prevent it from splashing reagent.



3) Ensure the titration nozzle is in the beaker.
4) Press [Burette] button to show “APB Manual operation” on display.
5) Press [▲] button to drain out the reagent in burette cylinder.
6) Press [▼] button to fill the cylinder with solvent.
7) Press [▲] button to drain out the solvent in cylinder.
8) Repeat the steps 6) through 7) several times in order to replace liquid in the burette with rinse solution.
9) Loosen the burette stopper and remove burette cylinder from the unit. Pull out the piston head, and clean it with solvent. Use the piston extraction rod to move the piston head for cleaning.

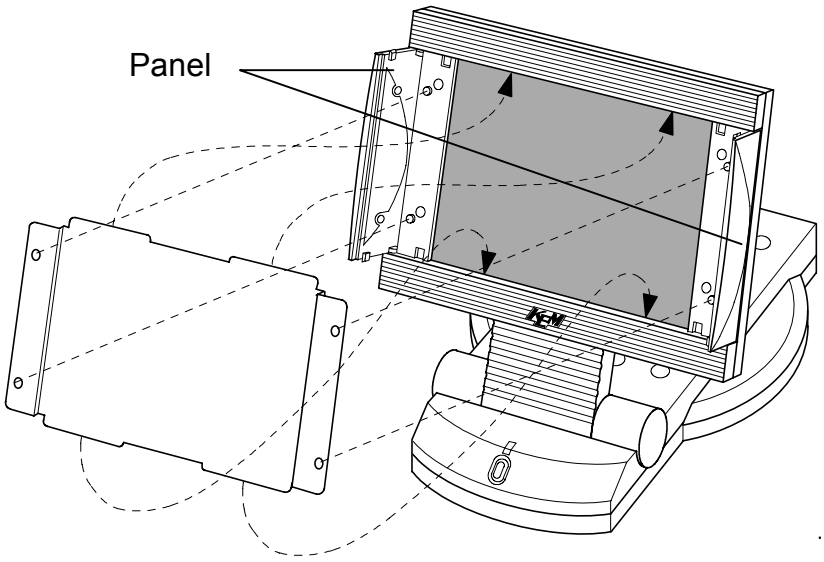


10) After completely draining out the liquid in burette, reassemble the burette unit.

5-1-12. Replacement of protection film

Change the protection film on the touch-on panel of Main control unit MCU-610 with new one when it is stained or if you observe dirt retention on it.

1) Turn off power of MCU.
2) Open its left and right doors on panel.
3) Remove the old film. (The film is inserted onto the panel vertically.)
4) Insert the new film while aligning the film holes with hooks on panel.
5) Close the panel doors.



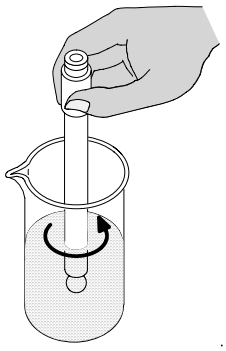
5-2. Other Maintenance

5-2-1. Storage of the instrument

Store the instrument, if it is not going to be operated for a long period of time in a place where there is no direct sunlight or under no vibration, and the place is dry, not humid. It is recommended to pack it in the carton box in which the instrument was first delivered.
Keep the rinsed electrodes detached from the titrator.

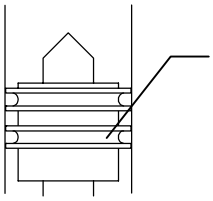
5-2-2. Cleaning the electrode

Glass electrode and reference electrode have to be rinsed with pure water at least three times and then wiped with clean filter paper or absorbent cotton. If it is stained, rinse with 0.1mol/L-hydrochloric acid, detergent water or other solvent in a short time, and then rinse well with pure water. In case an electrode is not in use for a long period, dip it in pure water and only use it when it reaches equilibrium. If any foreign article exists in junction of a reference electrode, it may cause abnormal potential reading. In this case clean the junction part with pure water. If you use an electrode of other makes than KEM, refer to the manual of its manufacturer.
After the electrode is rinsed, clean its tip with pure water and ten wipe it with clean filter paper or absorbent cotton. Connect the glass electrode, reference electrode and temperature compensation electrode to the preamplifier, and dip the electrode in pH7 standard solution. Slowly move the beaker with standard liquid in it so that equilibrium can be reached faster.



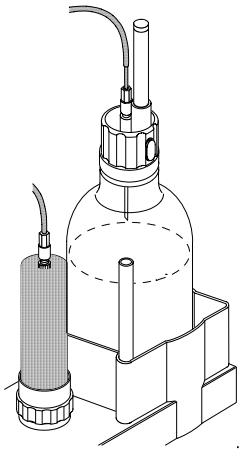
5-2-3. Replacement of piston head

The piston head is subject to wear due to abration during the course of an extended period of use, thus causing eventual leak. If it leaks, replace it with a new head. It is time to replace it if the reagent permeates down to the level indicated in the figure below after a few cycles of movement with the burette unit cleaned up, dried and refilled with reagent.

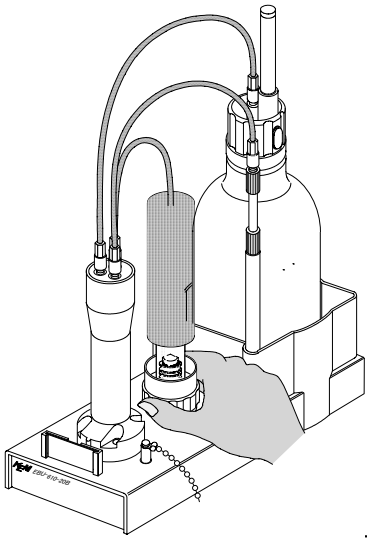


< How to remove the piston burette >

1) Lift the tube tip in reagent bottle above liquid surface.

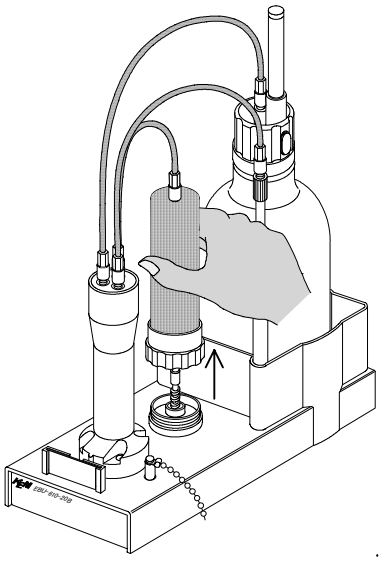


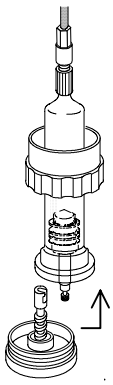
2) Press [Burette] button on the Main display.
3) Select No. “1” for burette number.
4) Press [▼] button, and ensure that the burette number on APB manual operation is in “Replace” position.
5) Loosen the burette stopper to remove it.



6) While holding the burette straight upright, press [▲] button to lift the piston of a burette.

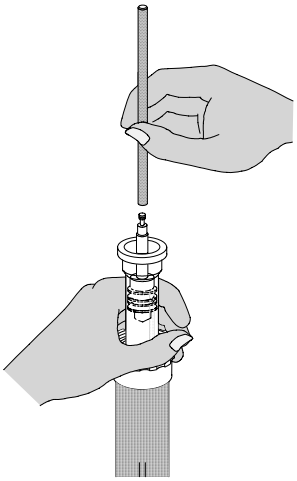
7) Press [▲] button again where the burette can be detached in order its drive to halt, followed by detaching it together with the piston.



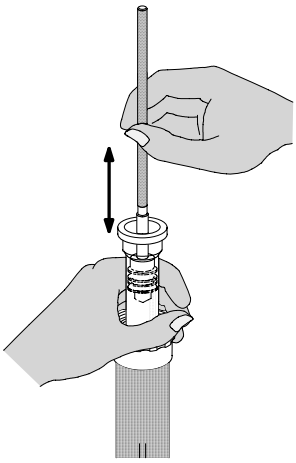


< Remove piston head >

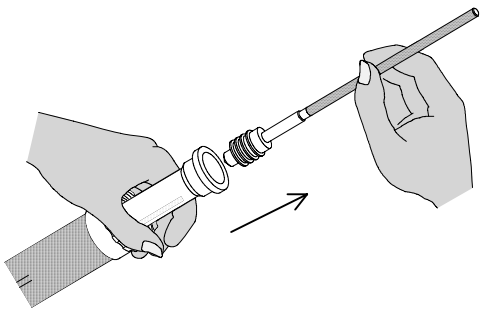
1) Hold the burette upside down and screw the piston extraction rod into the piston screw.



2) Move the piston up and down a couple of times to discharge the remaining reagent from the burette through titration nozzle.

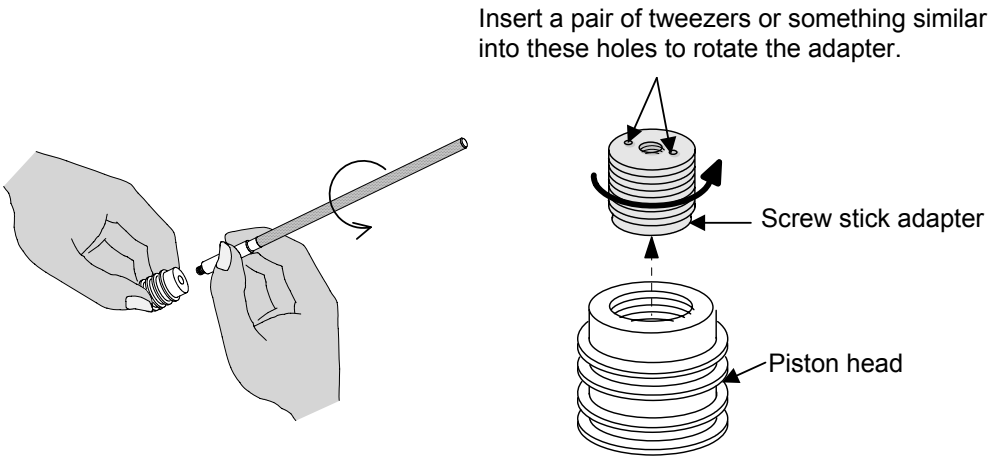


3) Pull out the piston head.

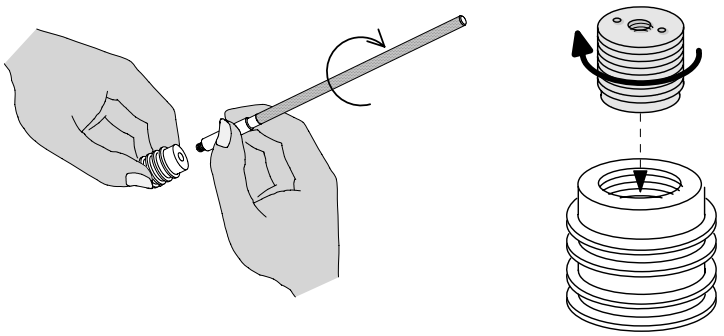


< Replacement of piston head >

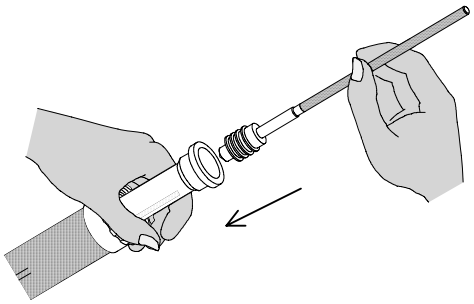
1) Rotate the piston screw to remove it from the old piston head.
   In the case of the 50mL piston head, rotate the screw adapter, too, to remove it from the piston head.



2) Screw the piston screw into the new piston head.
   In the case of the 50mL piston head, attach the screw adapter to the new piston head before screwing the piston screw there.



3) Push the new piston head into the burette.

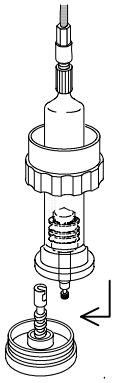


⚠ Caution!

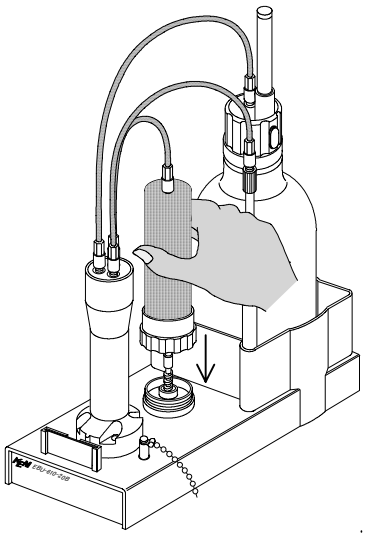
Take utmost care not to damage the piston head, and insert the head by keeping the piston screw in parallel with the burette wall.

< Fitting the piston burette >

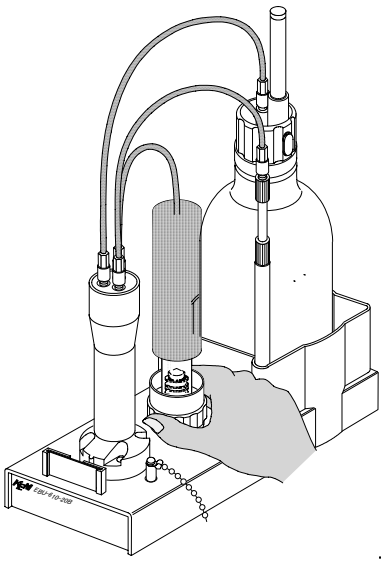
1) Fit the piston screw into the drive shaft as shown.



2) While holding the burette, press [▼] button to slowly push the piston head, paying attention to the coaxial position.



3) Tentatively tighten the burette holder. Do not squeeze in securely at this moment.
4) After moving the piston head upward and downward with [▲], [▼] button, press [▼] button to move down the head to the bottom position. Tighten the holder, making sure that the piston rod and drive screw should be in a coaxial position.



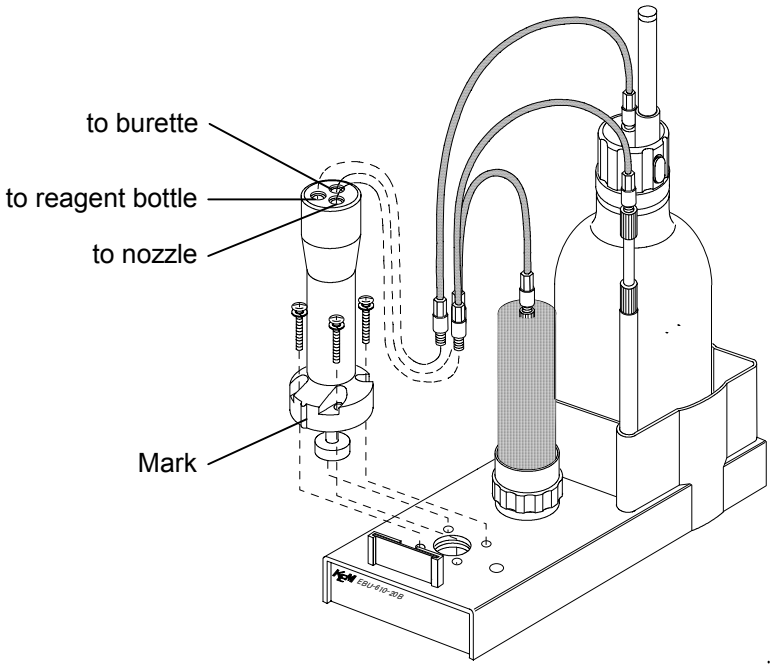
⚠ Caution!

Handle with care not to give damage inside wall of Burette while replacing a head.

5-2-4. Change switching valve

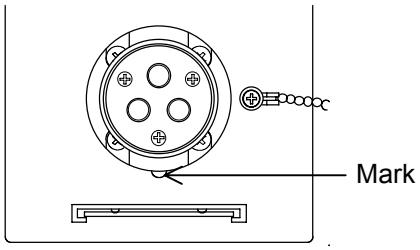
Replace the switching valve if it leaks due to crystallization or after use for an extended period of time.

1) Detach the burette unit according to the Chapter “3-6-3. Replacement of burette unit”.
2) Undo the screw holding the valve case.
3) Undo four screws holding the valve for removal.
4) Place a new valve with its mark facing out front, followed by tightening the screws.
5) Reconnect the tube lines.



⚠ Caution!

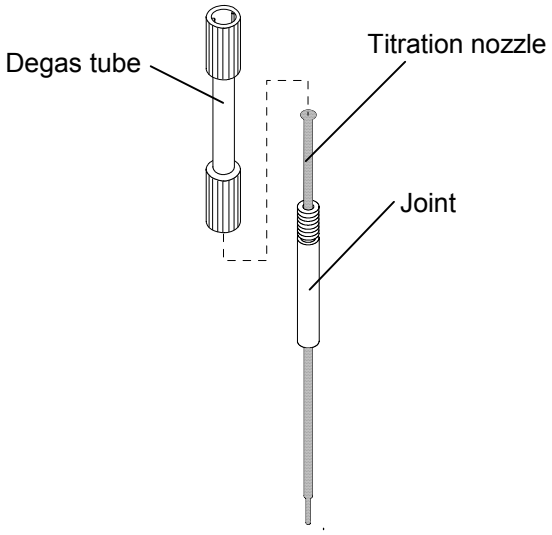
Fix the casing screw shown as below. (The mark is coming below.)



Unless properly installed, liquids cannot be sucked nor discharged. It may also cause leak.

5-2-5. Replace titration nozzle

1) Detach the degas tube and the joint.
2) Pull out titration nozzle from the joint.
3) Squeeze a new titration nozzle into the joint.
4) Attach the joint and degas tube again.

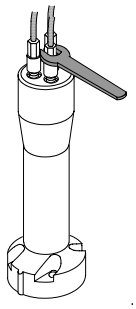


⚠ Caution!

Wear safety glasses and protective gloves during operation.
There is a danger that reagents can contact your hands or the like.
In addition, reagents can fly into your eyes.

5-2-6. Replace tube

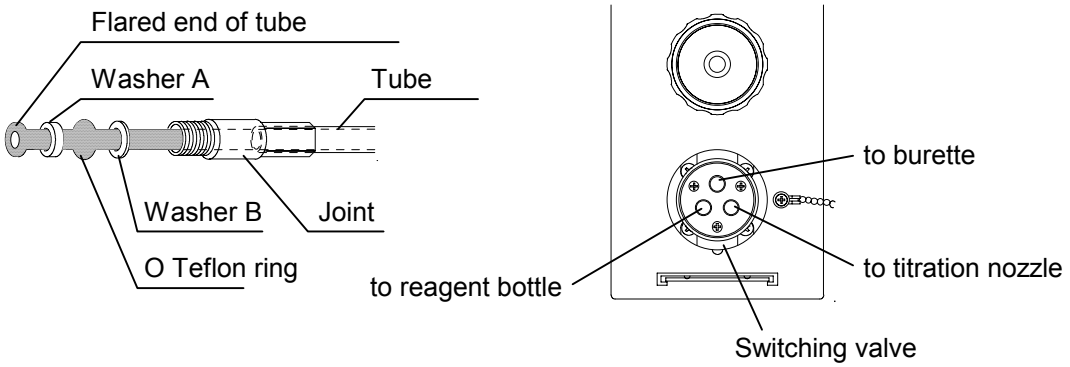
Replace the tube if it is bent or leaks in the connection portion. Use the supplied wrench to tighten the joints of switching valve, whereas other joints can be tightened with hand.



⚠ Caution!

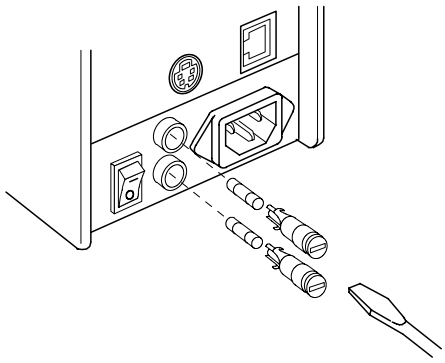
When replacing the tube, connect it facing joint surface vertically straight. Keep dust or dirt away from the joint surface. Failure may cause a leakage.

The assembly of tube end is as shown below.



5-2-7. Changing the blown off power fuse

1) Turn the power switch to off position, and remove the power cord.
2) Open the cover over the power receptacle with a flat screw driver.
3) Remove the fuse holders using the screw driver.
4) Insert new fuse into the holder and close the cover.



⚠ Warning!

Be aware of electric shock. When replacing the power fuse, always turn off the power first, and remove the power cord.

⚠ Caution!

There are two fuses. It is recommended to change them all at a time.

5-2-8. Replacing the clock battery

If the clock does not function correctly, the inside battery needs to be replaced with new one. Ask your local dealer for its replacement.

6. Troubleshooting

6-1. Error messages and remedies

<Error messages on AT-610>

Error message	Probable causes	Countermeasures
Error: Preamplifier ↑↓ Check connect	· Start titration without preamplifier · Start titration without stirrer	· Ensure that preamplifier and stirrer unit are connected with AT-610.
Parameter error (Ch, Unit (ctrl.)) ↑↓ Review settings	· Start titration with a wrong measuring unit for the connected preamplifier	· Select “Channel/Unit” appropriate for the method. · Change the preamplifier to a correct selected one, and press [Reset] button.
Parameter error (Ch, Unit (ref.)) ↑↓ Review settings		
Burette error ↑↓ Check Burette	· Burette cock does not work · Lock pin is missing · Switching cock is jammed	· Insert the lock pin and clean the valve.
	· Cock sensor is defective · Motor is malfunctioning	· If the motor does not run, contact your local dealer.
Reset error ↑↓ Check Burette	· Lock pin fell off	· Ensure that the lock pin is securely inserted in place.
Communication error (Preamplifier) ↑↓ Check connect	· Communication failure between AT-610 and the preamplifier	· Check on connection with connecting cable. · Replace the connecting cable.
Problem occurred. ↑↓ Please press [Reset] button	· Communication failure on the device other than MCU-610 main unit.	· Check and see the connection of connectors and cables on the measuring devices, followed by touching [Reset] button. (If touching [Reset] button does not lead to the solution, i.e. the error message still stays, then) · Reboot the system. · After backing up titration results or parameters on CF card or the like, initialize all parameters stored on the system by selecting [Function] – [Memory clear] – [All parameters].

< Parameter errors on AT-610>

Error message	Probable causes	Countermeasures
Parameter error ↑↓ Please press [Reset] button	· The currently used parameters are not adaptive to the method	· When parameter error occurs, it is specified in dialog box on side. Correct the parameter accordingly.

Sub-message	Probable causes	Countermeasures
Method** Disconnect (Burette**)	· The burette is not connected · The burette number is wrong	· Select the correct burette number for Method** predosing parameter or titration parameter. The built-in burette number is "1". · Connect the burette as is numbered for Method** predosing parameter or titration parameter.
Disconnect (Changer)	· A multiple sample changer is not connected	· If a sampler is not going to be used, select "Off" for "Changer" on [Sample] – [Option] (when sample file is "Off") or select "Off" for "Changer" on [Sample] (when sample file is "On"). · If a sampler is going to be used, connect a sampler and ensure [Renew].
Method** Not connected	· A combined method is not constructed	· Configure method on Method ** for combined method.
Method** Channel, Unit (ctrl.)	· Titration is started by selecting an unit not available for the connected preamplifier on the method preset on sample file	· Select a correct "Channel/Unit" for Method** predosing parameter or titration parameter.
Method** Channel, Unit (ref.)		
Method** Combine with COD titr.	· Titration mode for "COD" is connected to the combined method preset in sample file	· Change the titration mode for combined methods of Method** to the mode other than "COD", "Stat" and "Learn".
Method** Combine with Stat titr.	· Titration mode for "Stat" is connected to the combined method preset in sample file	
Method** Combine with Learn titr.	· Titration mode for "Learn" is connected to the combined method preset in sample file	

< Error messages on CHA-600 (appear on the display of AT-610)>

Error message	Probable causes	Countermeasures
Turntable malfunctions ↑↓ Check changer	The turntable does not finish a turn-round event within a given time (step-turn; 20s, home coming turn; 36s(12 vials), 54s (18 vials)	Press [Reset] button on AT-610 to stop the changer. Press [Step] key to turn the table. If the error message appears again, contact your local dealer.
Changer malfunctions ↑↓ Check changer	The multiple sample changer does not finish the event within a given time or does not work.	Press [Stop] key on sampler to cancel the error.
Elevator malfunctions ↑↓ Check changer	The elevator does not finish its vertical movement within a given time (20 second).	Press [Reset] button on AT-610 to stop the changer. Press [Up] or [Down] key to move it upward or downward. If the error message appears again, contact your local dealer.
Swing mechanism defective ↑↓ Check changer	The swinging arm does not finish its motion within a given time (20 second).	Press [Reset] button on AT-610 to stop the sampler. Press [Rinse] or [Titration] key to swing the arm. If the error message appears again, contact your local dealer.
Swing position is not correct ↑↓ Check changer	The elevator does not go down due to the swing arm positioned somewhere other than at rinse bath or titration.	Press [Reset] button on AT-610 to stop the changer. Press [Rinse] or [Titration] key to swing the arm. Then, press [Down] key on changer. If the error message appears again, contact your local dealer.
Elevator position is not correct ↑↓ Check changer	The turntable does not turn since the elevator is not at upper most position.	Press [Reset] key on AT-610 to cancel the error. Press [Up] key on changer to lift the elevator. Then, press [Step] key on changer. If the error message appears again, contact your local dealer.
Communication error (S-BUS) ↑↓ Check connect	Communication failure with the measuring unit	Check on the connecting cable to see if it is disconnected. Replace the connecting cable. If the error message appears again, contact your local dealer.
Time-out error (S-BUS) ↑↓ Check connect	Communication with the measuring unit runs out of time	

6-2. Alarm message and remedies

Error message	Probable causes	Countermeasures
Reagent vol. low limit, No.n ↑↓ Replace reagent	The reagent of burette No. n goes down to the preset lowest amount.	Supply reagent, and change the setting of regent amount on reagent information to the present volume.
Replace reagent, No.n ↑↓ Replace reagent	Change reagent of burette No. n is due.	Replace reagent, and clear reagent change day setting.
Reagent replace. overdue, No.n ↑↓ Replace reagent	Replace reagent of burette No. n is past due after the preset alarm day.	Replace reagent, and clear reagent change day setting.
Replace reagent in xx days, No.n	Replace reagent of burette No. n is due in XX days.	Continue measurements as planned, or change reagent and clear the reagent change day.
Periodic check date ↑↓ Make a periodic check	Periodic check is due as preset on alarm.	Perform periodic check accordingly.
Periodic check date overdue ↑↓ Make a periodic check	Periodic check is past due after the alarm day.	Perform periodic check accordingly.
Periodic check in xx days	Periodic check is due in XX days before alarm.	Continue measurements as planned, or perform periodic check accordingly.
Periodic calib. day (No.n) ↑↓ Make periodic calibration	Periodic calibration for No. n is due.	Perform periodic calibration.
Periodic calib. overdue (No.n) ↑↓ Make periodic calibration	Periodic calibration for No. n is past due.	Perform periodic calibration.
Periodic calib. in xx days (No.n)	Periodic calibration is due in XX days before alarm.	Continue measurements as planned, or perform periodic calibration accordingly.
Replace piston, No.n ↑↓ Replace piston head	Replace piston for burette unit No. n is due.	Replace the piston head, and set another change day.
Piston replacement overdue, No.n ↑↓ Replace piston head	Replace piston for burette unit No. n is past due.	Replace the piston head, and set another change day.
Replace piston in %d days, No.n	Replace piston for burette unit No. n is due in XX days.	Continue measurements as planned, and when the piston head is changed, set another change day.

6-3. Clogging of titration nozzle or switching valve

Some reagents may be crystallized as the time goes by, and such crystallization may cause clogging or stains inside titration nozzle or switching valve. Follow the below steps for cleaning:

< When titration nozzle (diffusion proof nozzle) is clogged >

1) Remove the titration nozzle.
2) Dissolve the reagent by dipping it in the solvent. (An ultrasonic cleaning is effective.)
3) Then, rinse well by pure water.
4) Connect the titration nozzle to the tube.
5) Fill titration reagent up to the tip of nozzle.

⚠ Caution!

A diffusion type titration nozzle may be clogged easily. Fill the nozzle pocket with pure water to keep its tip from being dried.

< When the switching valve is clogged or stained >

1) Remove all the connecting including titration nozzle, burette, and the tube. If reagent flows out, wipe it off with waste cloth.
2) Fill the cock with solvent to dissolve the reagent using a dripping pipette.
3) Suck out the fluid in the switching valve with a dropping pipette or the like, followed by cleaning the valve with waste or the like.
4) Repeat step 2) and 3) if necessary.
5) Reassemble all the connections.

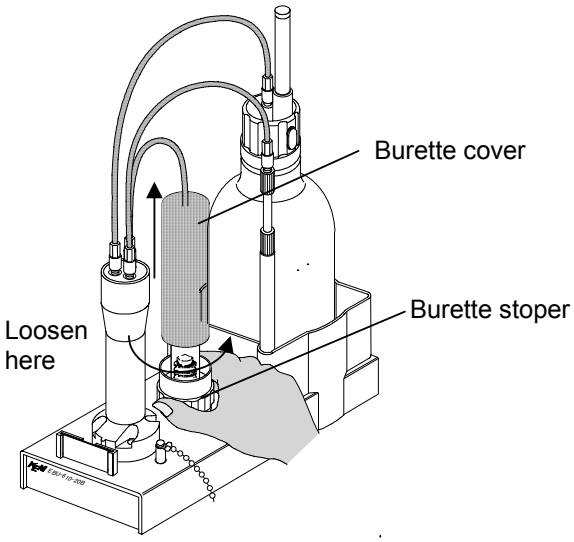
⚠ Caution!

If a reagent bottle is left unused for more than a week, make sure to check any crystallization in it. If any should be found, perform cleaning as above.
Dispensing without cleaning mat cause leaking.

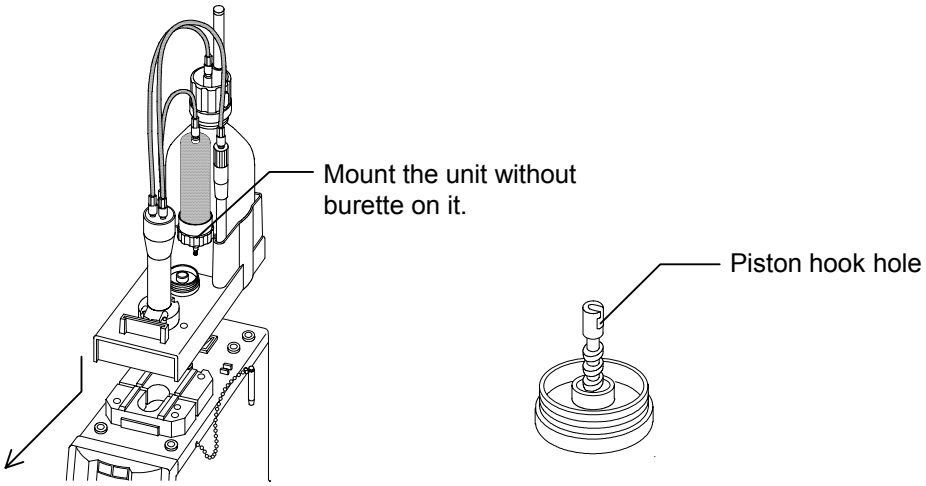
6-4. When it is difficult to mount the burette unit

Follow the below steps when you find it difficult to set it onto the unit:

1) Remove the burette cover, and loosen burette stoper to remove it.



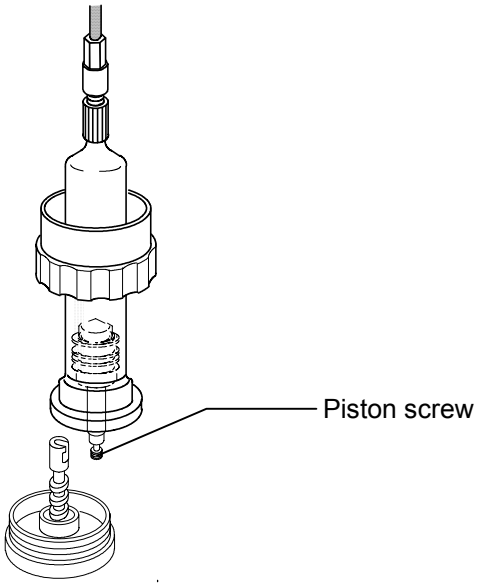
2) Place the burette unit without burette on it, and pull back the unit towards you, and then, insert the rock pin to fix it.
3) Turn on the power and press [Burette] button on Main display. Select the burette number on "APB manual operation" dialog box, and press [▲]button. When the piston hook hole appears, press [▲] button again to stop it.



Note:

The rock pin to fix the burette unit is interlocked. Therefore, the pin must be inserted into the hole in order to use the piston extraction rod. When you set in the burette unit, make sure the status is in "Replace" on "APB manual operation" dialog box (Press [Burette] button on Main display). Otherwise, press [▼] button to show "Replace" first on display before the burette unit is mounted.

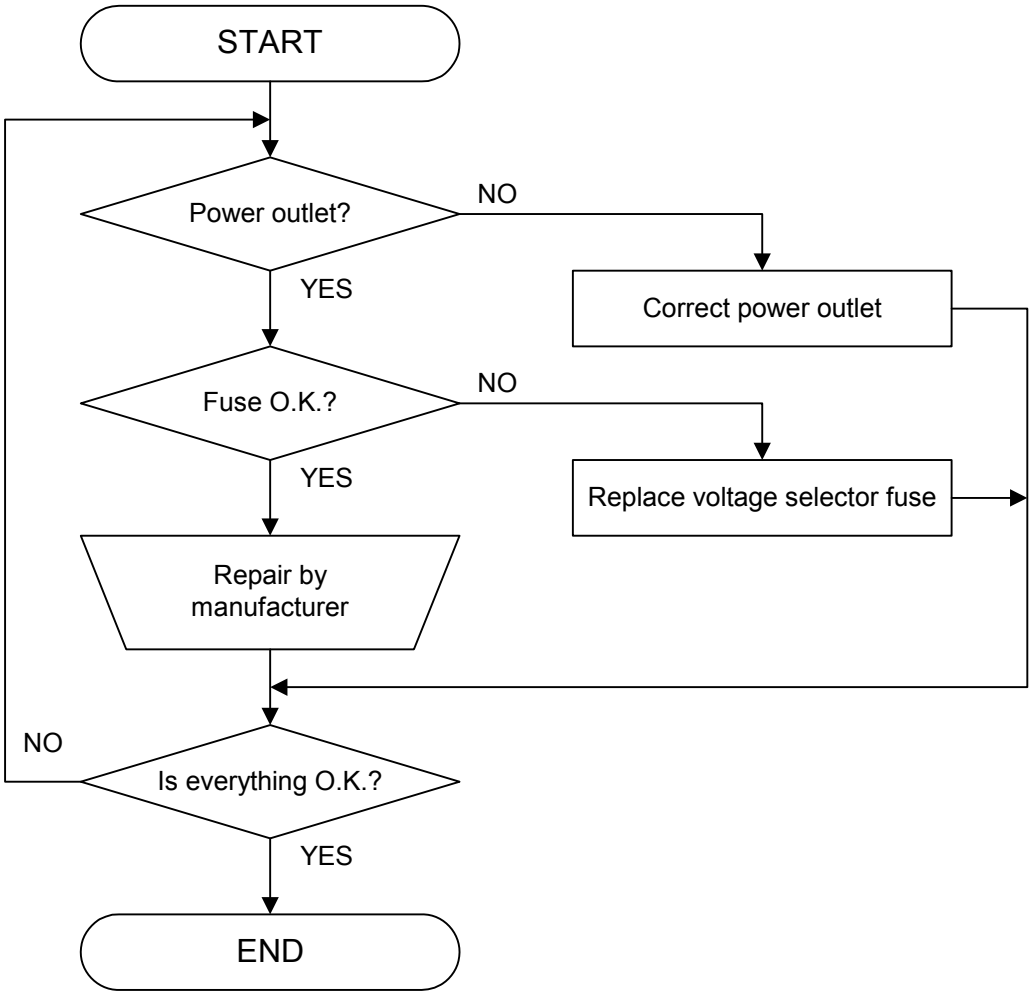
4) Hook the piston screw in the hole, and press [▼] button to lower it. At this point, hold the burette in order to align it with the piston extraction rod on the same axis. When the piston stops, fasten it with the stopper and fix the burette.



⚠ Caution!

In order to avoid breaking the burette, hold the burette with your fingers upright and align it with the piston extraction rod on the same axis while the piston is moving down.

6-5. Power failure



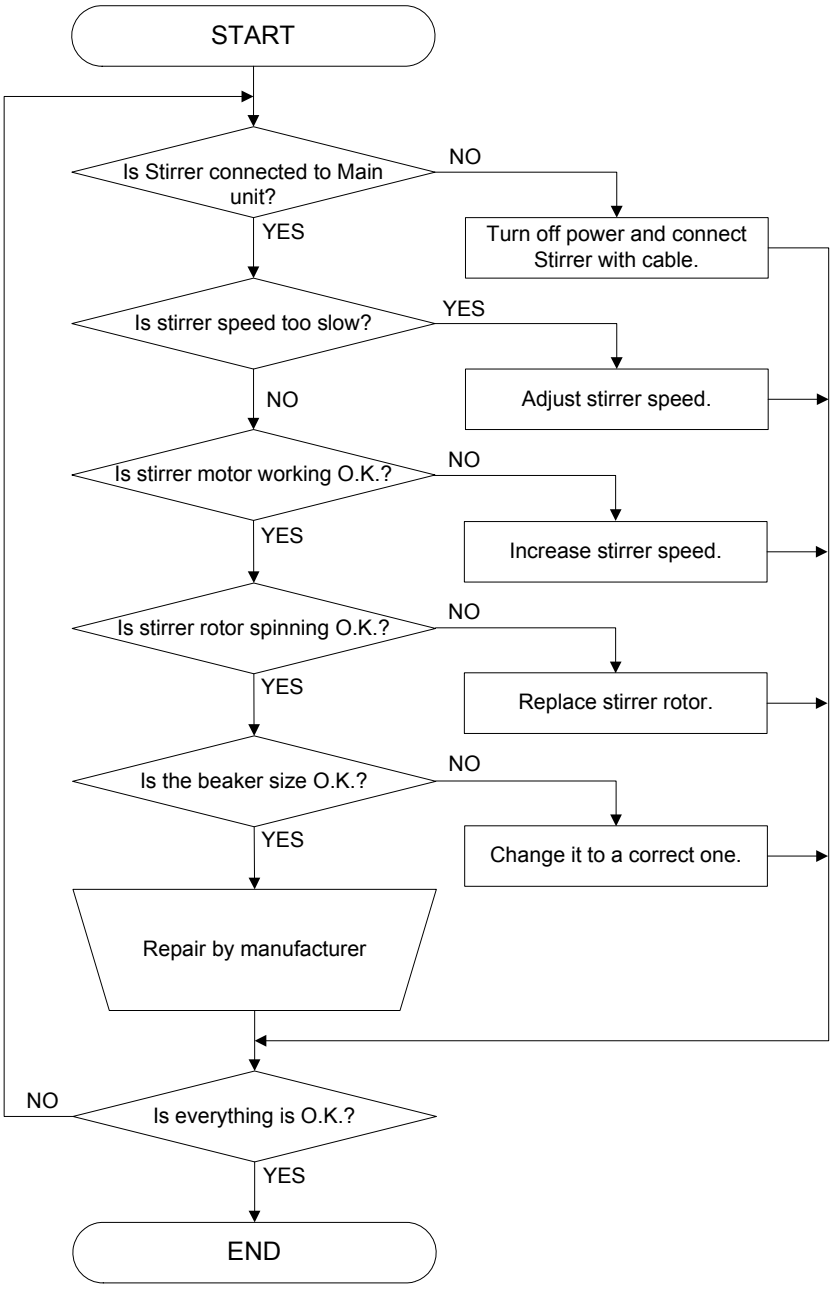
⚠ Warning!

For continued protection against risk of fire:
Replace only with same type and rating of fuse.

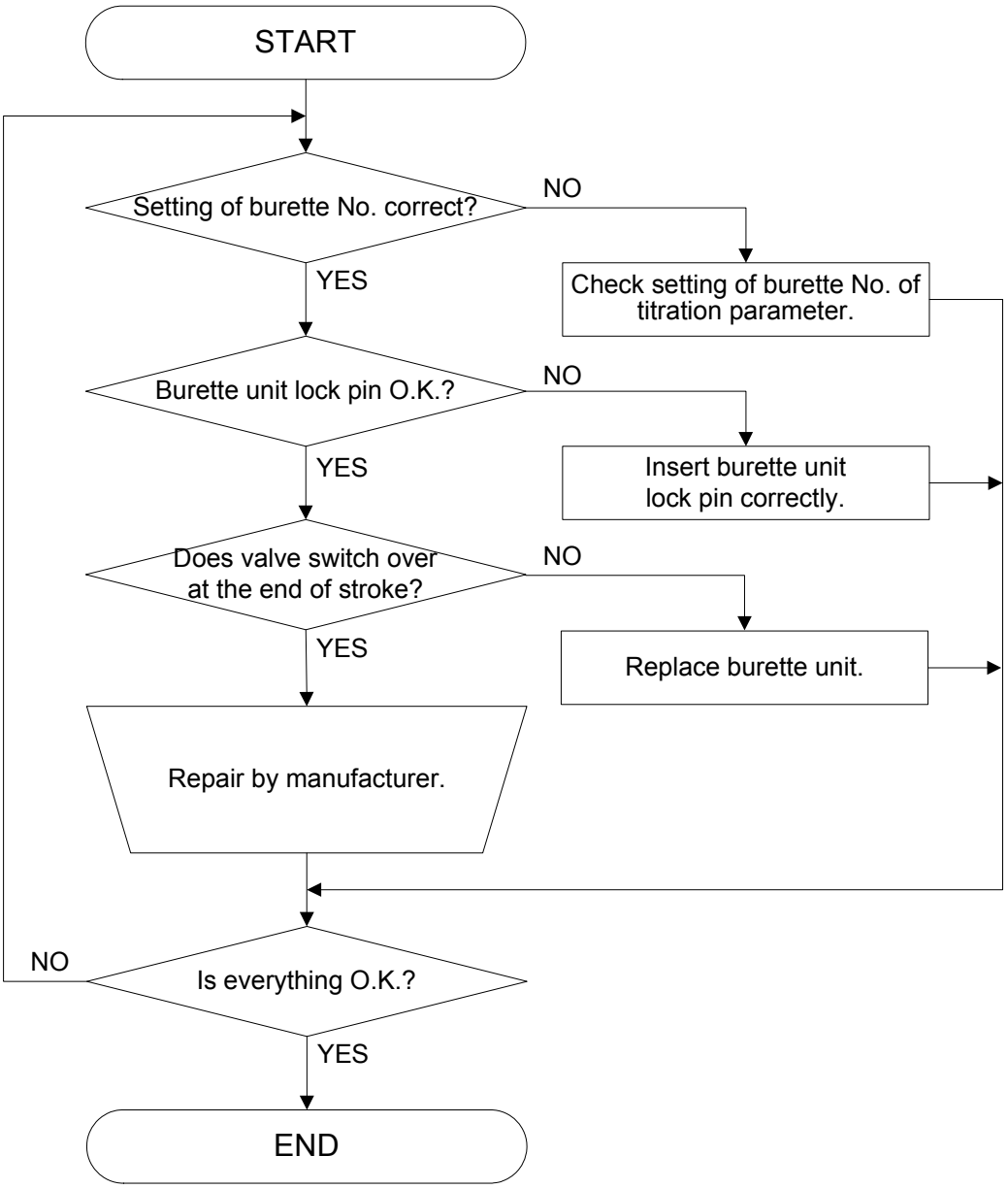
⚠ Caution!

The warranty does not apply to any troubles on the electric circuit when input voltage is applied improperly.

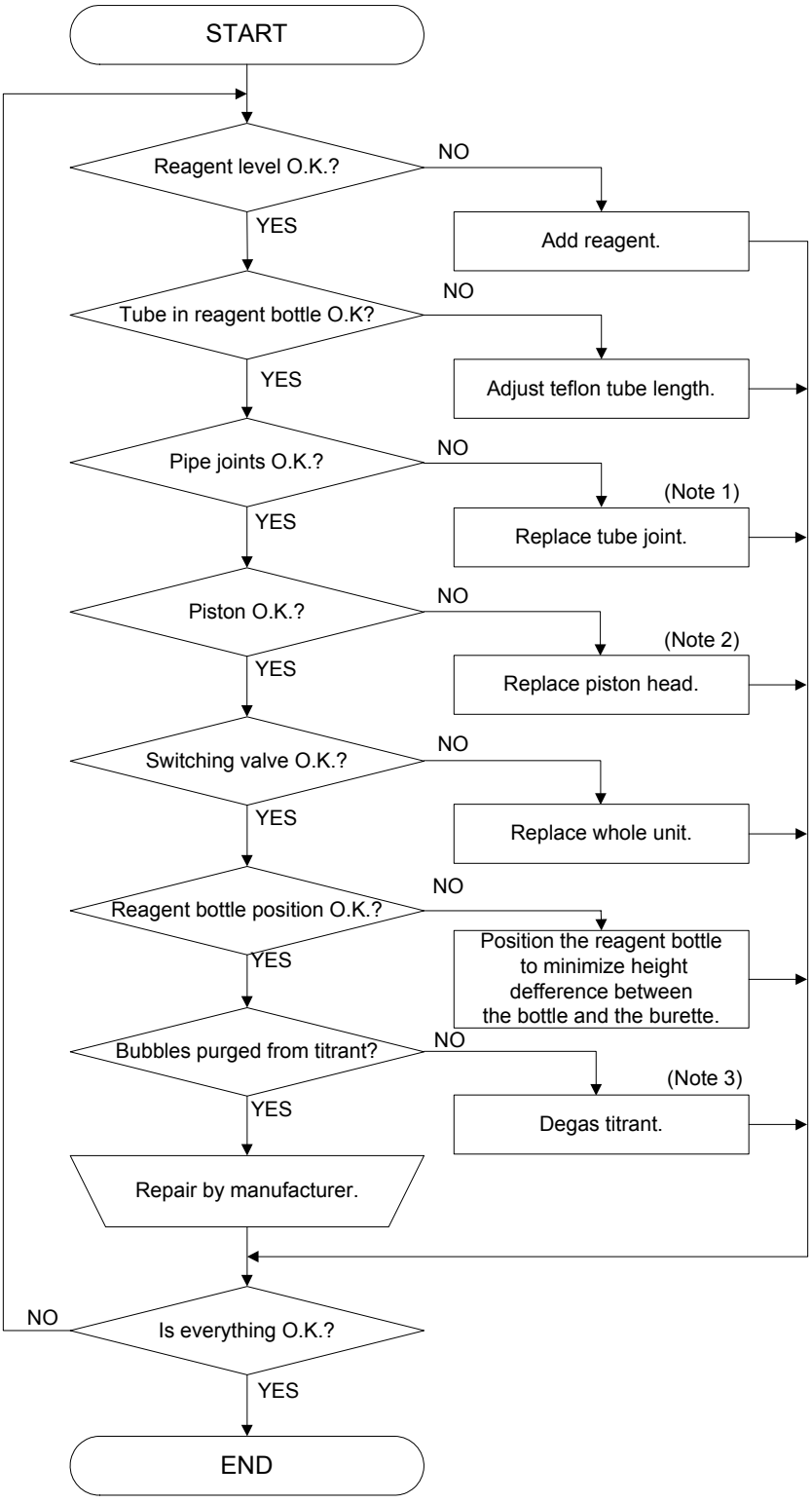
6-6. Stirrer does not work properly



6-7. Piston burette does not work properly



6-8. Air bubbles are trapped in the piston burette

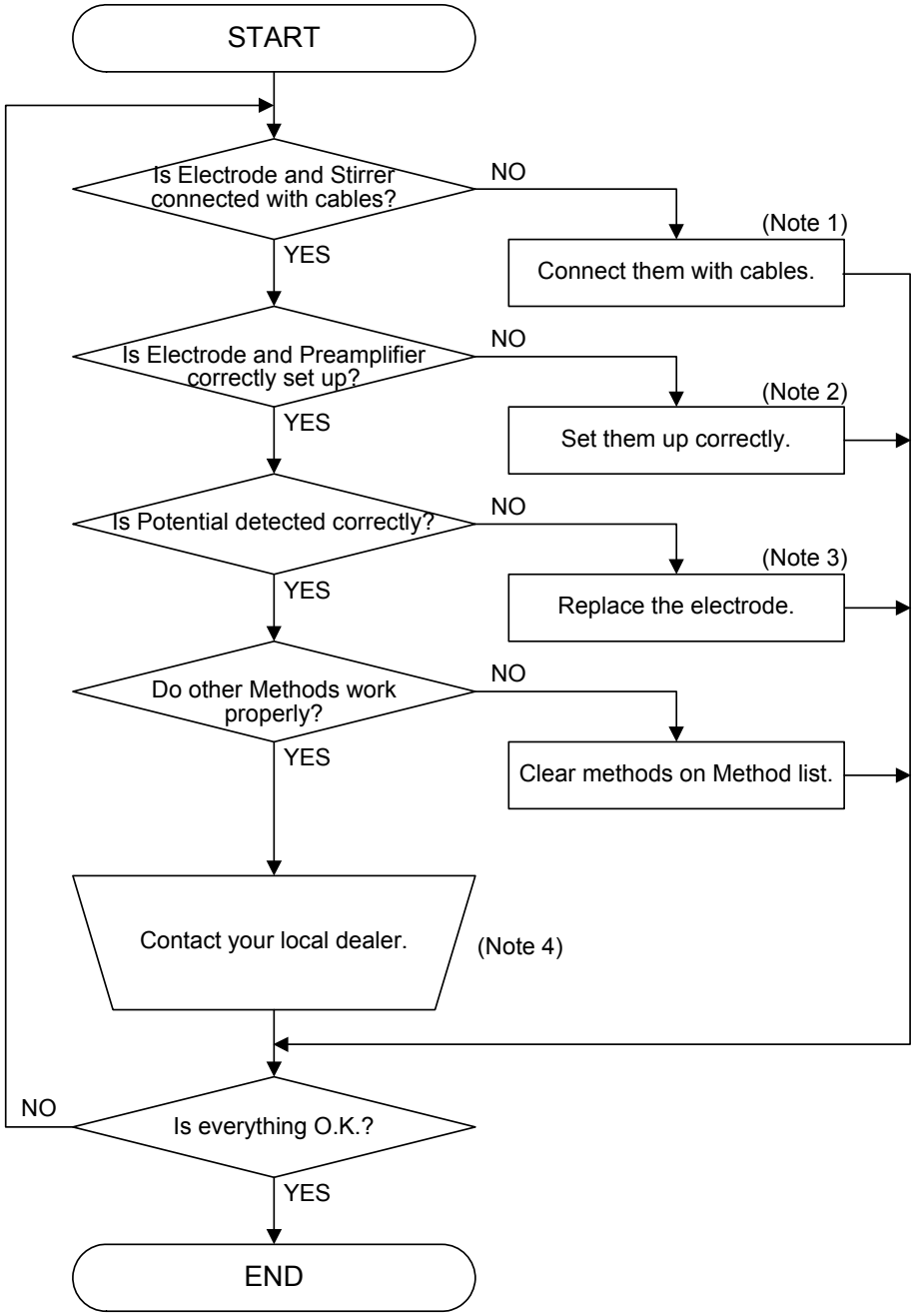


(Note 1) Refer to "5-2-6. Replace tube" in this manual.

(Note 2) Refer to "5-2-3. Replacement of piston head" in this manual.

(Note 3) Purge the titrant by either vacuuming the titrant storage container by pump or placing it in an ultrasonic cleaning tank.

6-9. Titration is not controlled properly



(Note 1) Potential level does not vary due to loose contact by broken cable. Replace the cable.

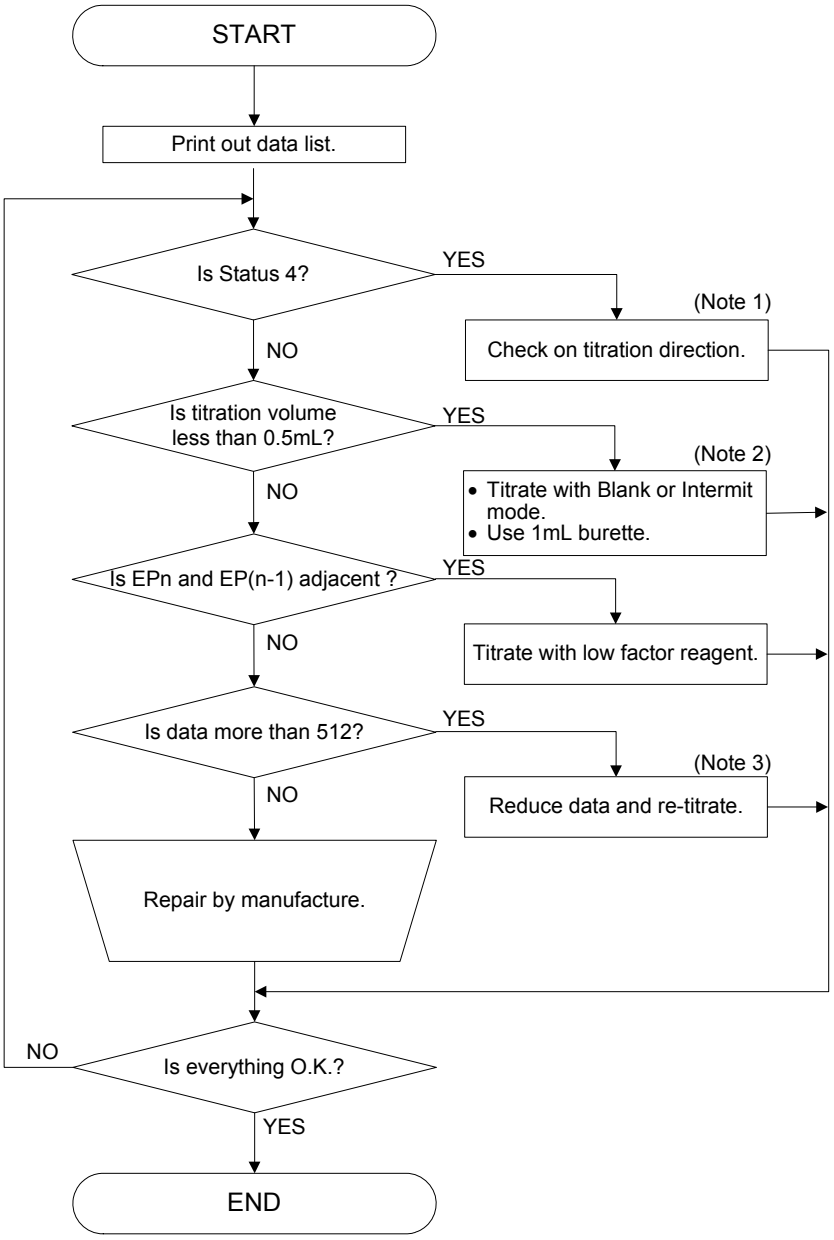
(Note 2) Configuration of Burette No. and Channel No. are wrong.

(Note 3) Unstable potential may be caused by deteriorated electrode or clogged liquid junction. If the junction in electrode is clogged, replace the electrode to a combination of pH glass electrode (98-100-H171) and sleeve type (98-100-R172) or cork type (98-100-R115).
If potential is unstable even after the electrode is replaced or changed to new one, the preamplifier may be malfunctioning. Contact your local dealer in such a situation.

(Note 4) For analysis and cause investigation by our specialists, send the titration curve, parameters of your method and the data list to us by fax.

6-10. Endpoint is not detected by EP Stop or Full titration

When the inflection points can be seen visually:



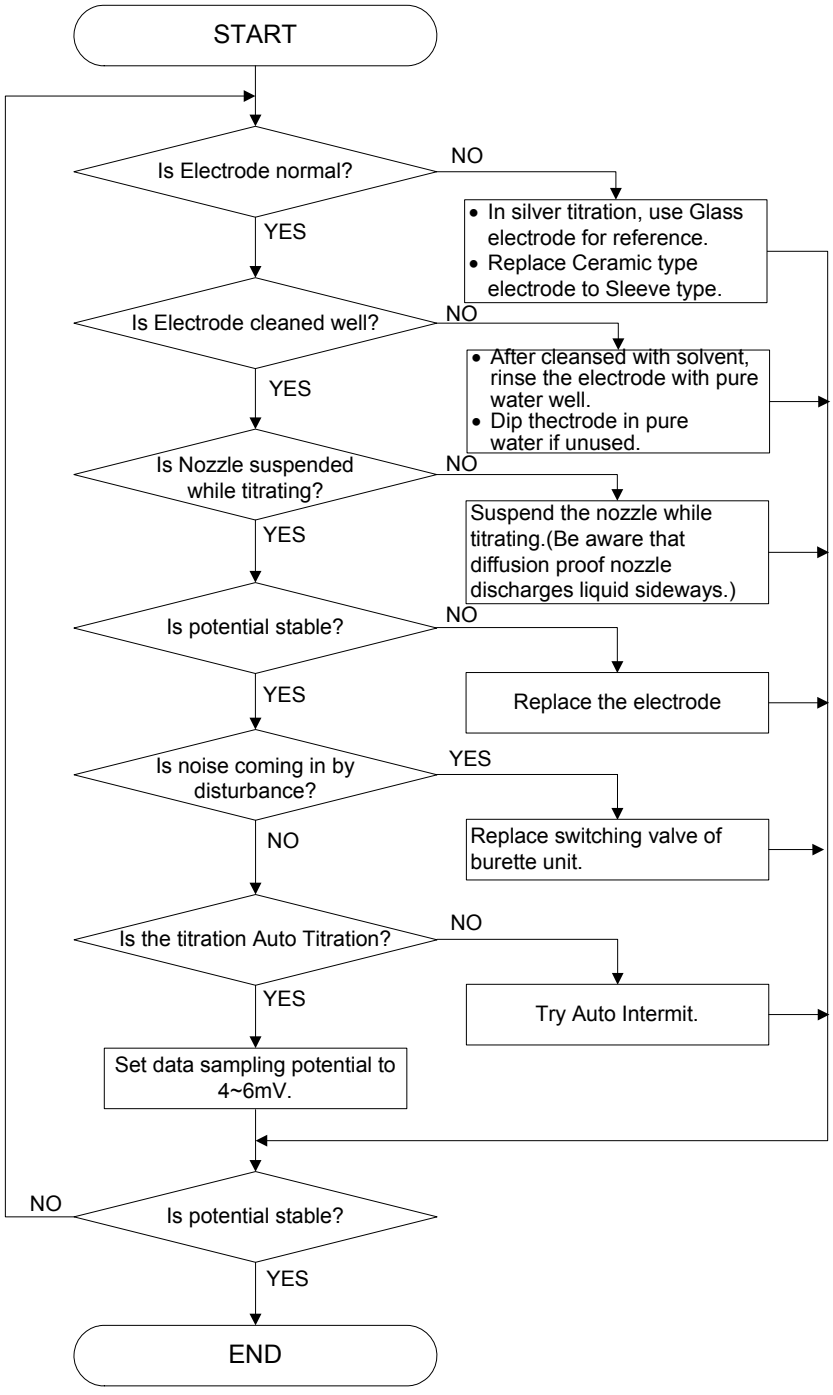
(Note 1) Titration direction setup for titration parameter is wrong.

(Note 2) For a small amount of titration volume to reach the inflection point, try a blank or Intermit titration. Use of 1mL burette will increase precision.

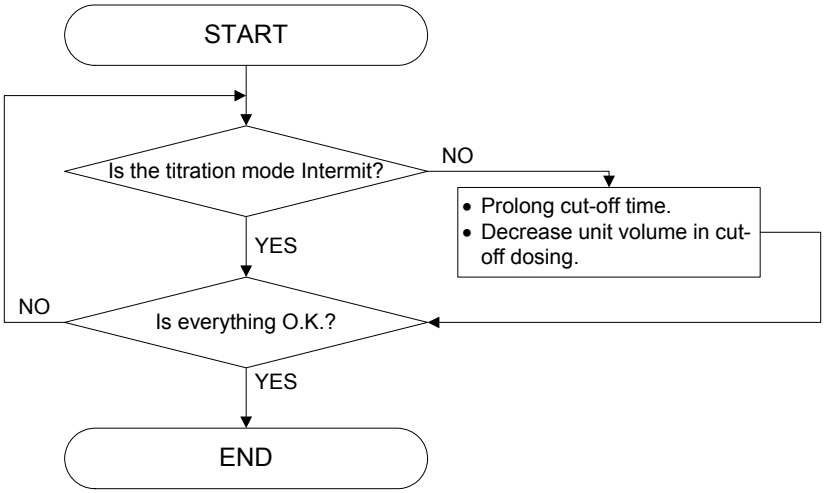
(Note 3) To reduce the amount of data, start titration after fixed dosed. When the amount of data exceeds 512, the data will not be sampled without detecting the endpoint.

6-11. Erroneous endpoint is detected in Full or EP Stop titration

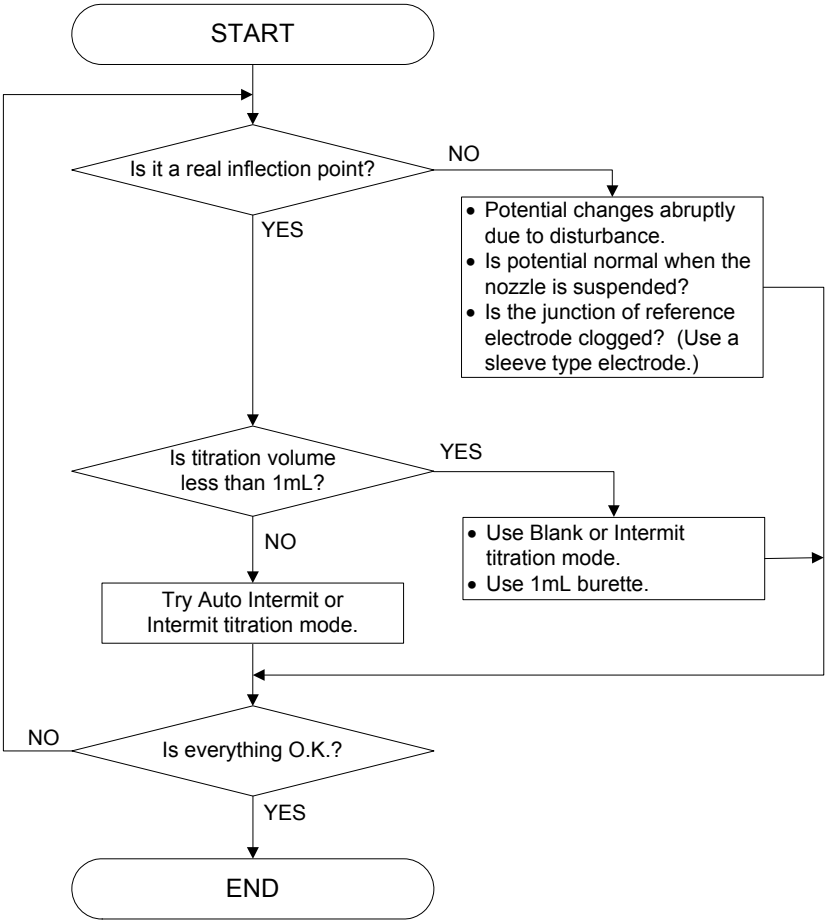
1) When the electrodes noise is found to be EP due to unstable potential in non-aqueous titration



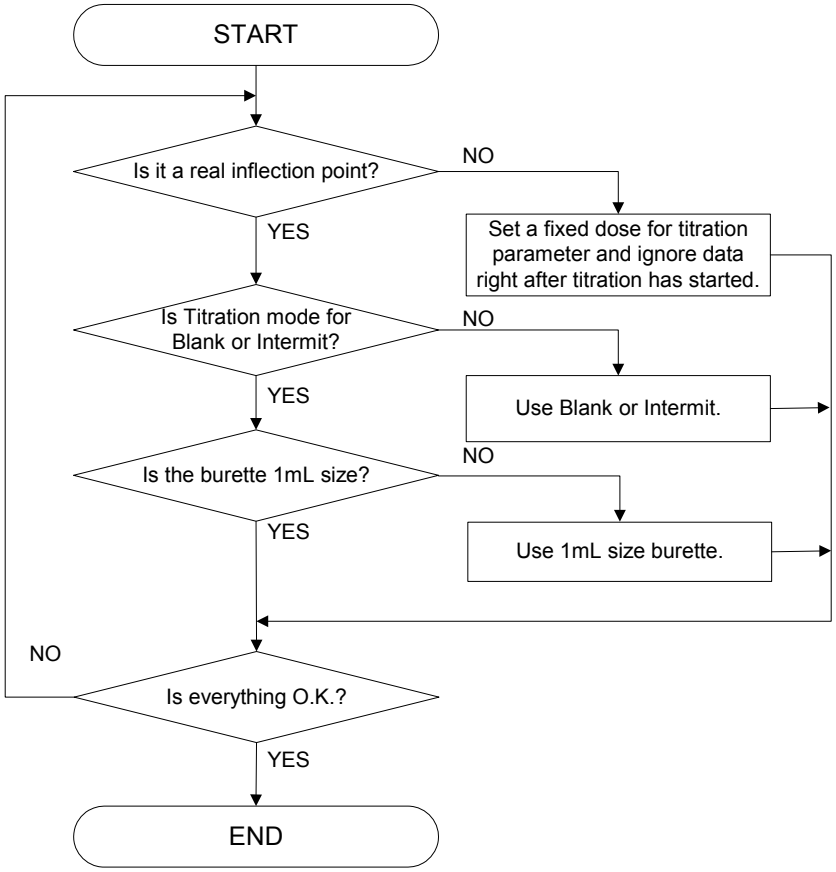
2) When reaction is so slow that it takes more than 10 seconds until potential stabilizes after dosing titrant. Use Auto Intermit or Intermit titration mode.



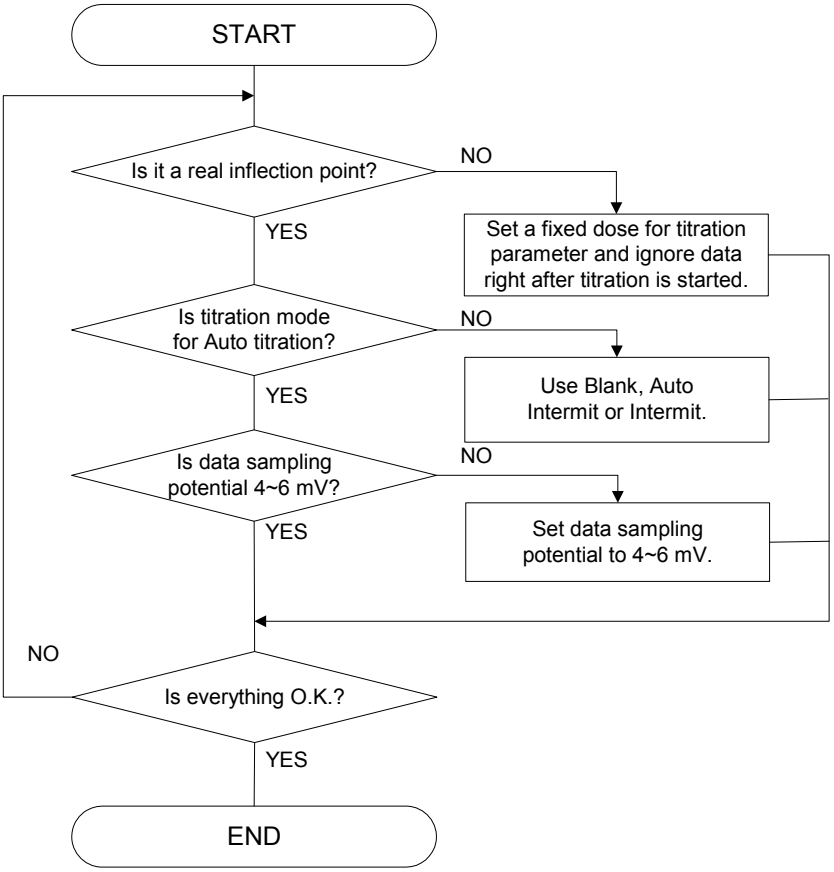
3) When potential changes sharply so that an endpoint is picked up abruptly.



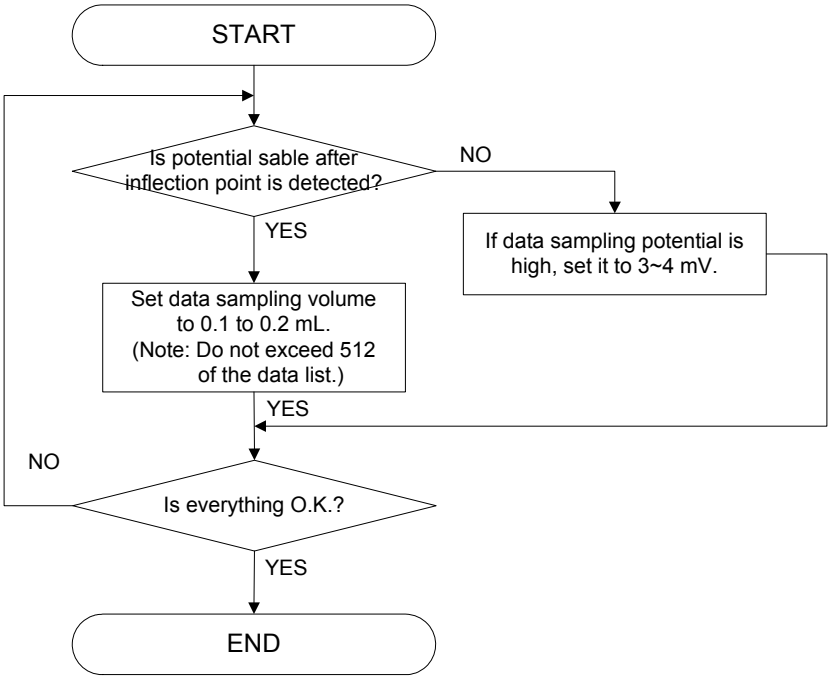
4) When endpoint is detected right after start of titration.



5) When endpoint is detected while potential angle is constant on titration curve.



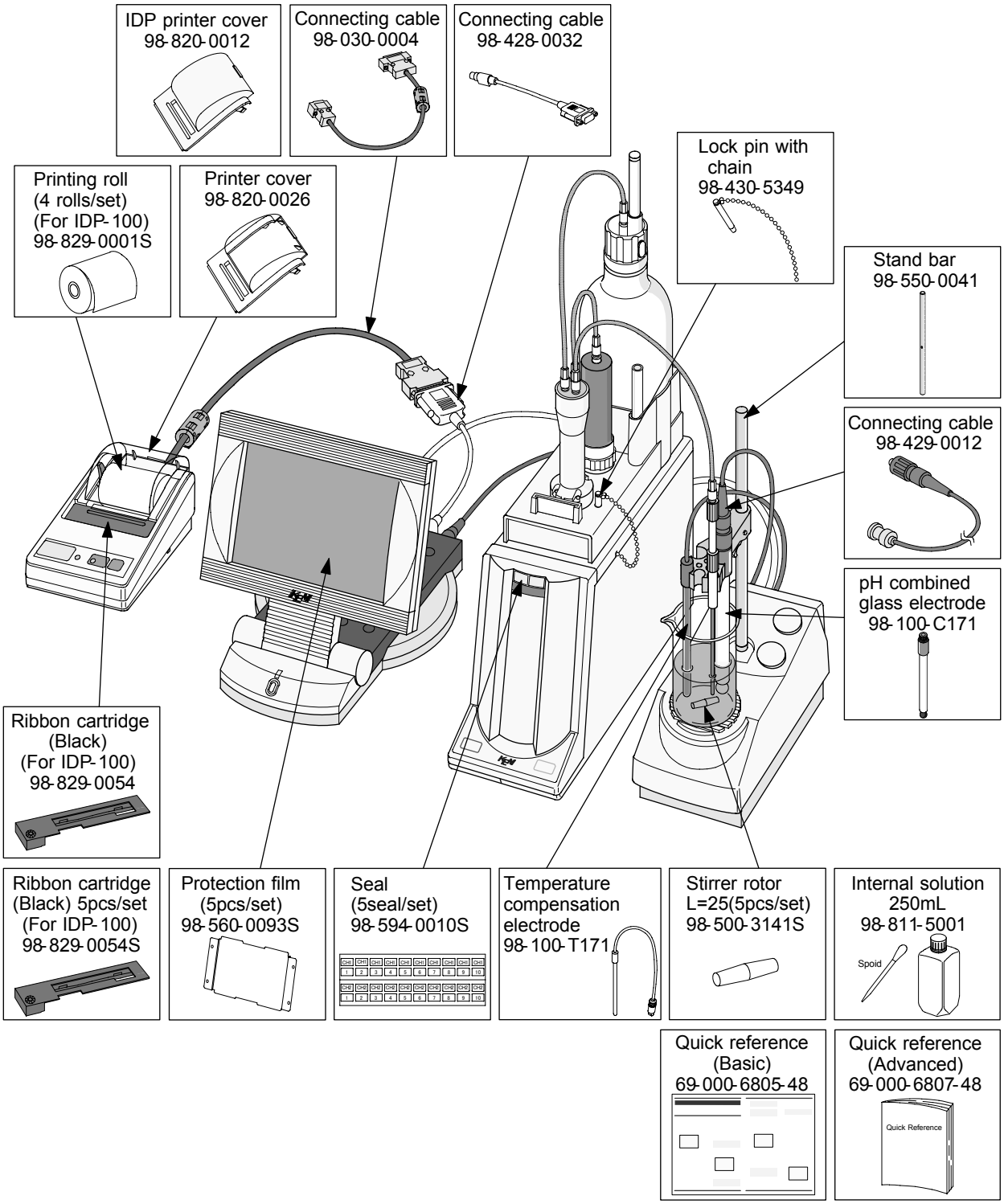
6) When endpoint is not detected unless over-titrated (2~5mL).

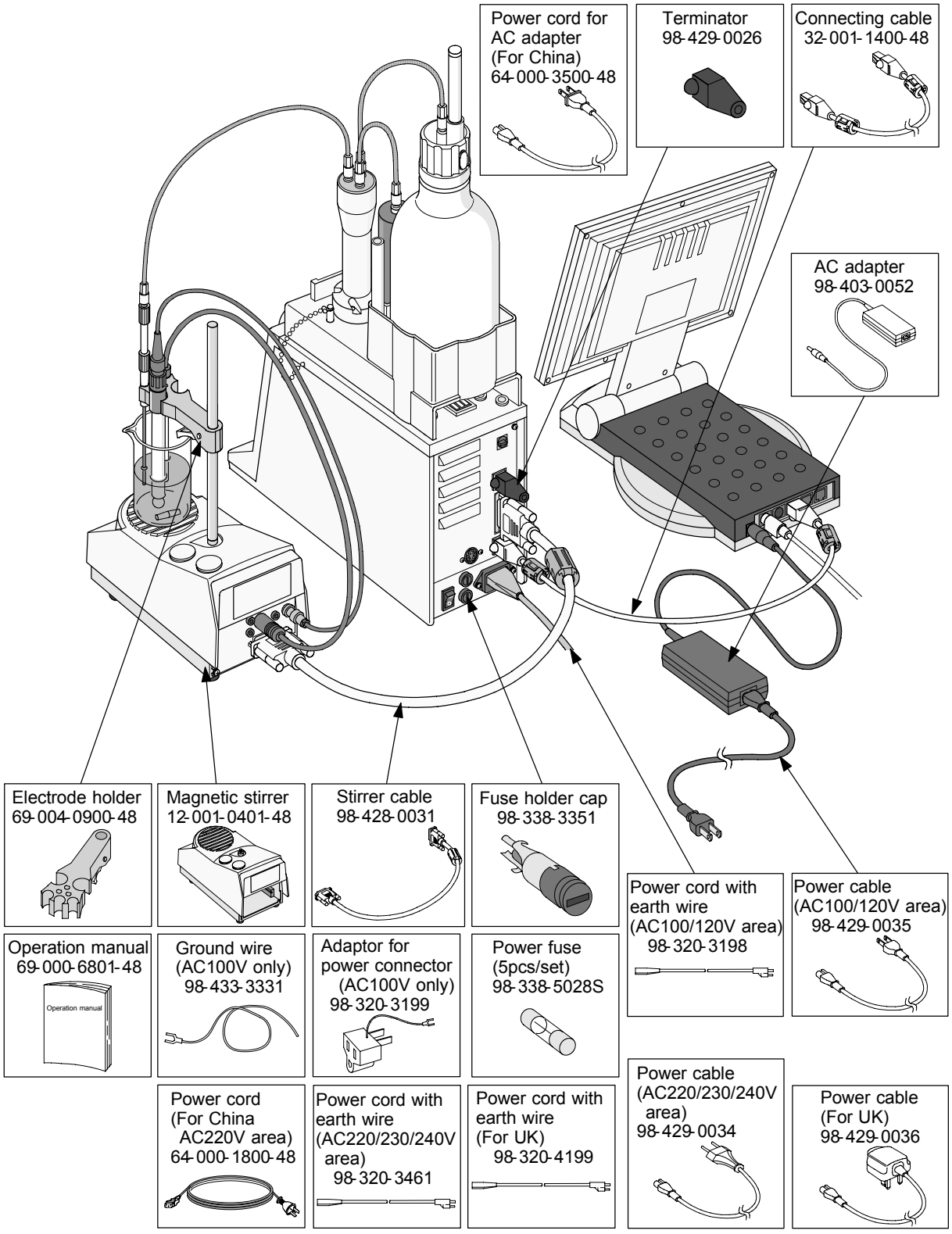


7. Others

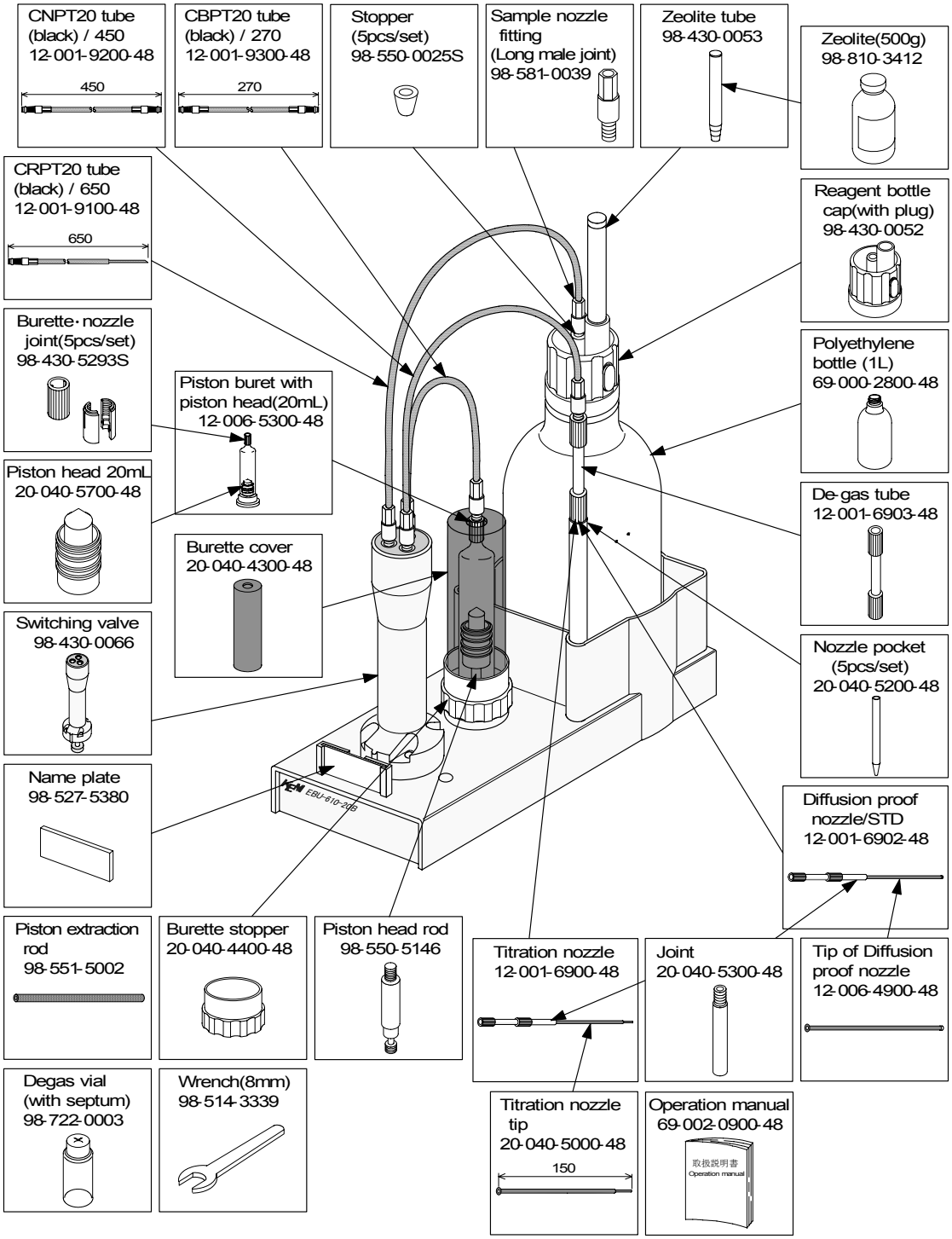
7-1. Part list

7-1-1. Consumable parts · Maintenance parts

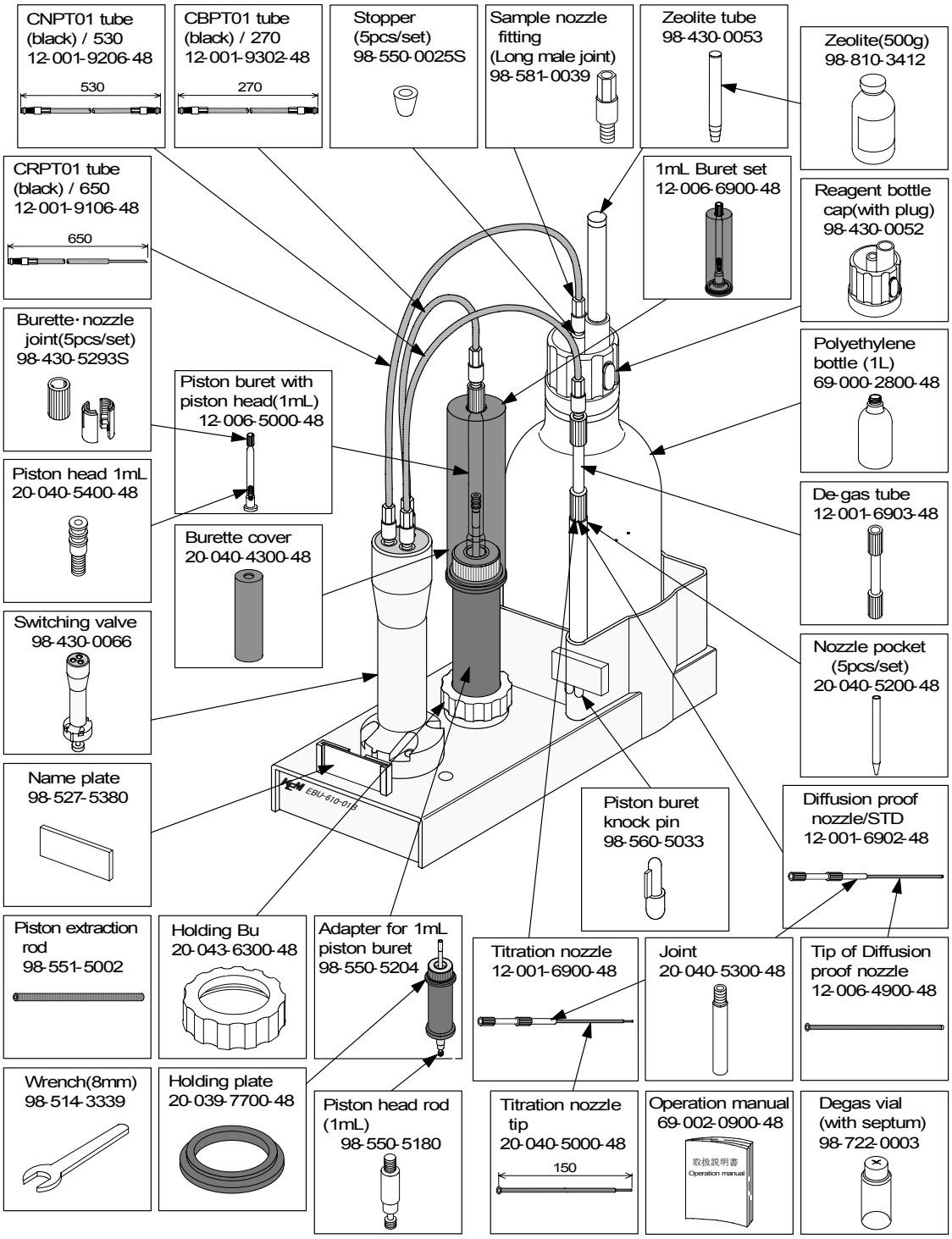



Power cord for AC adapter (For China) 64-000-3500-48
Terminator 98-429-0026
Connecting cable 32-001-1400-48
AC adapter 98-403-0052
Electrode holder 69-004-0900-48
Magnetic stirrer 12-001-0401-48
Stirrer cable 98-428-0031
Fuse holder cap 98-338-3351
Power cord with earth wire (AC100/120V area) 98-320-3198
Power cable (AC100/120V area) 98-429-0035
Operation manual 69-000-6801-48
Operation manual
Ground wire (AC100V only) 98-433-3331
Adaptor for power connector (AC100V only) 98-320-3199
Power fuse (5pcs/set) 98-338-5028S
Power cable (AC220/230/240V area) 98-429-0034
Power cord (For China AC220V area) 64-000-1800-48
Power cord with earth wire (AC220/230/240V area) 98-320-3461
Power cord with earth wire (For UK) 98-320-4199
Power cable (For UK) 98-429-0036

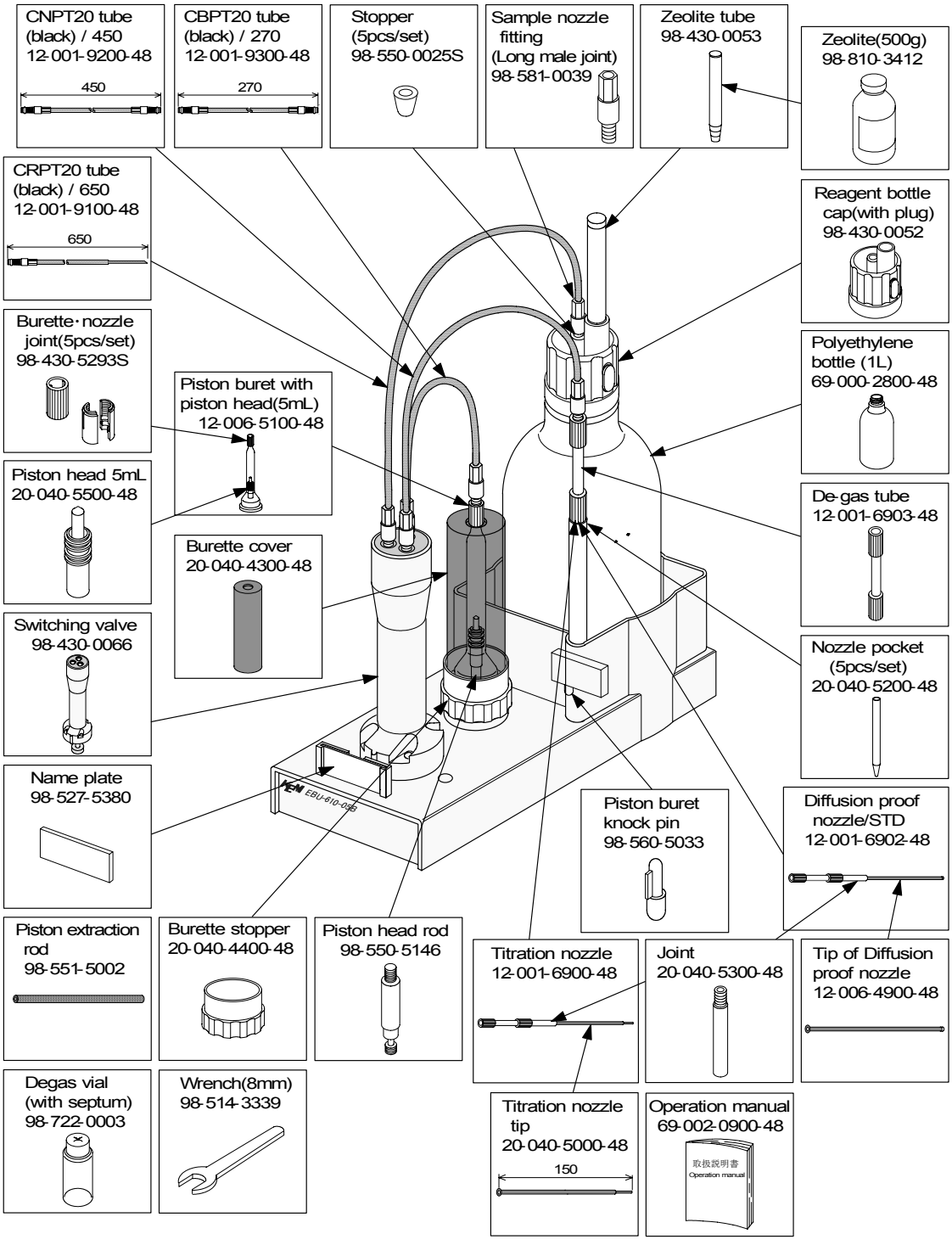
< Burette unit: EBU-610-20B >



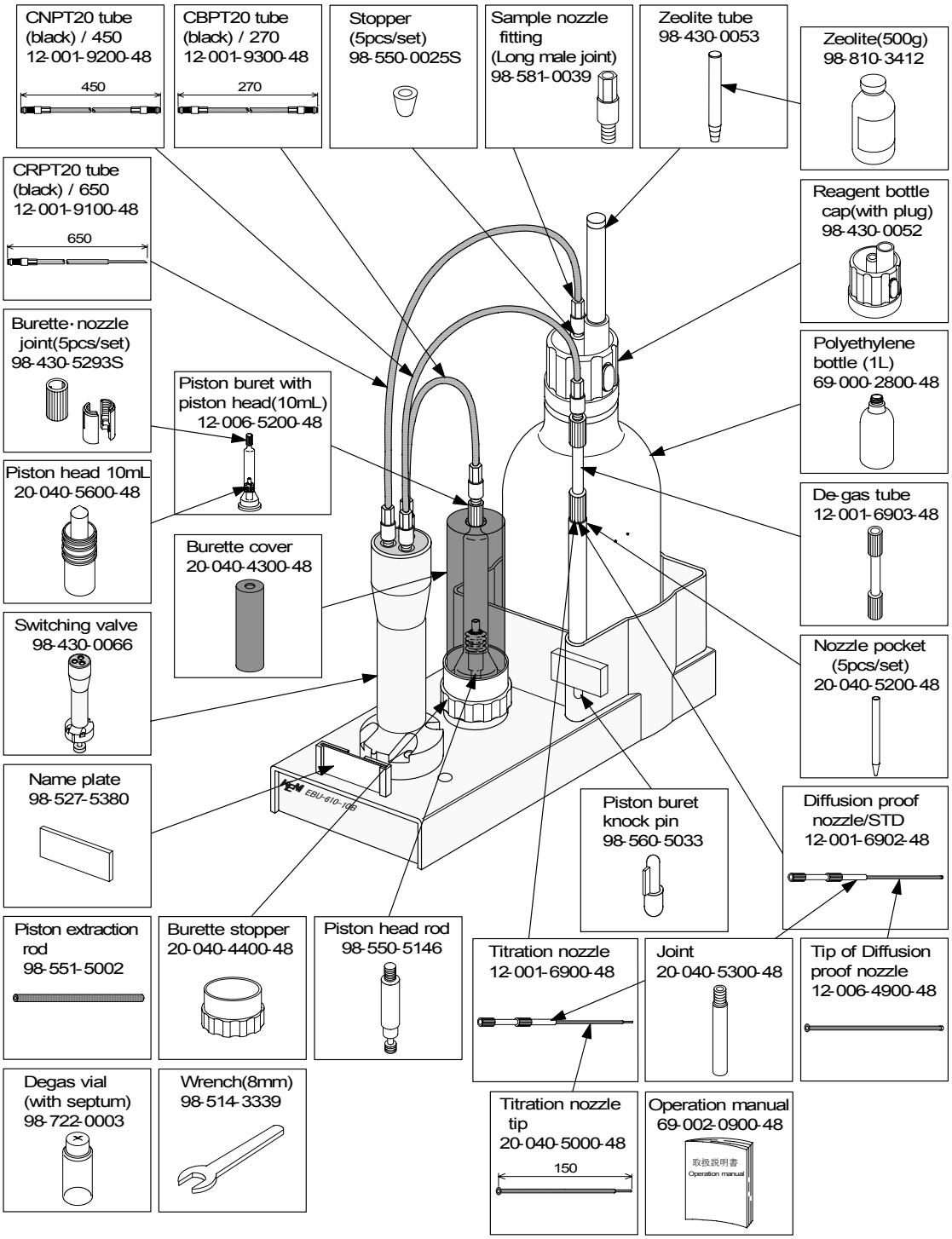
< Burette unit: EBU-610-01B >



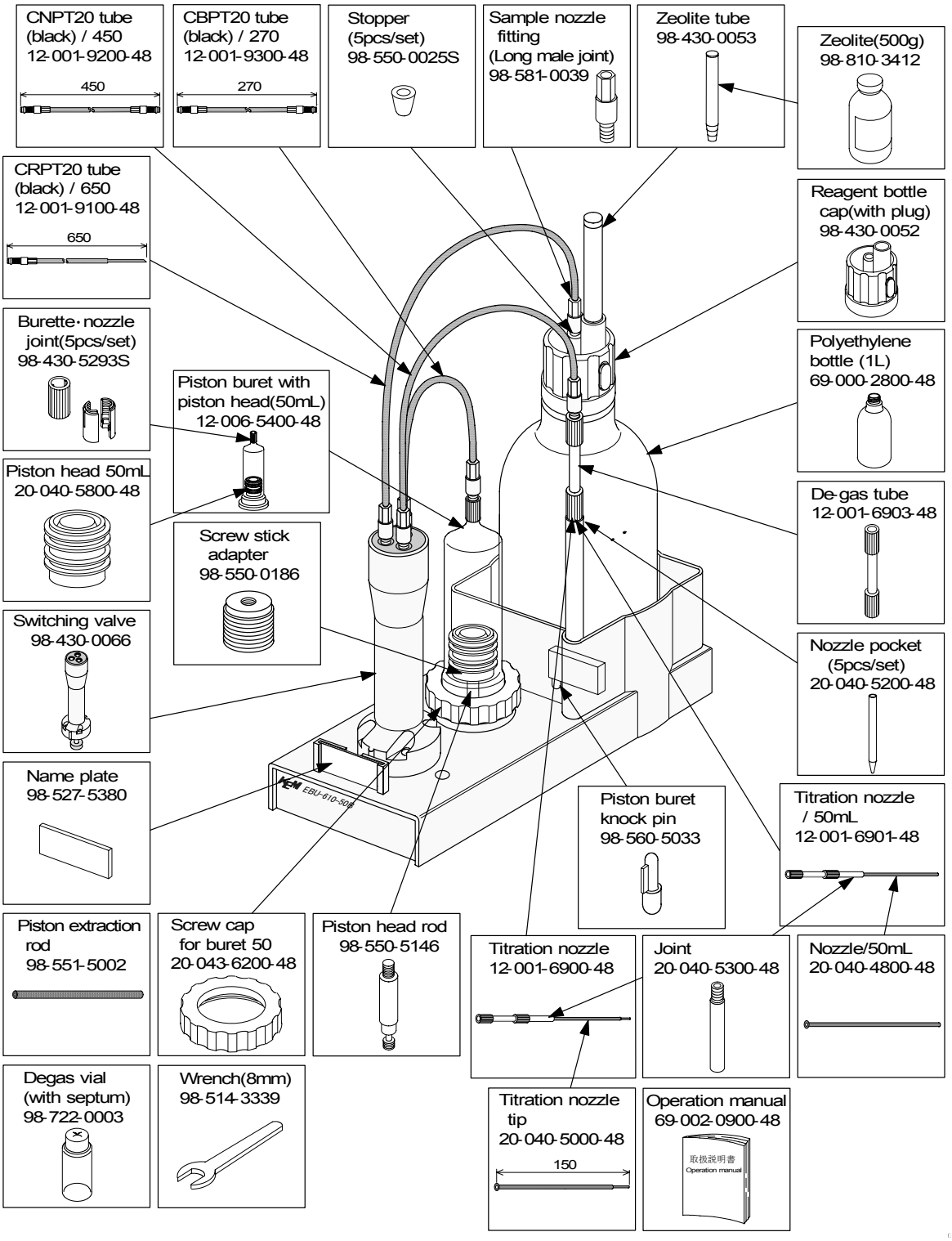
< Burette unit: EBU-610-05B >



< Burette unit: EBU-610-10B >

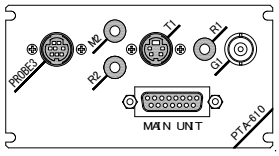
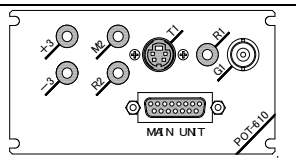
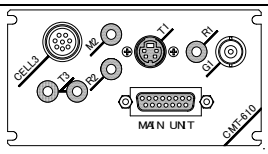
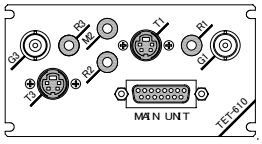


< Burette unit: EBU-610-50B >

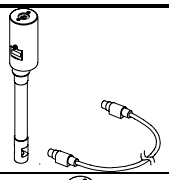
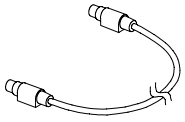
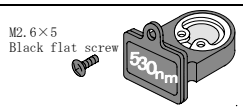
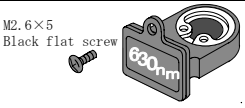
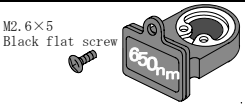
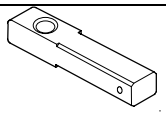


7-1-2. Option

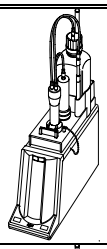
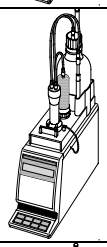
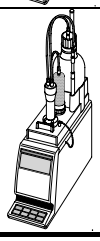
< Preamplifier >

Part code	Part name	Remarks	Sketch
PTA-610	Preamplifier for photometric titration	Including photo sensor, connection cable, interference filters (530 nm & 630 nm) and shutter	
POT-610	Preamplifier for polarization titration	Including Twin platinum electrode (P/N: 98-100-M511)	
CMT-610	Preamplifier for conductometric titration	Including conductivity cell (P/N: 98-101-K321)	
TET-610	Preamplifier for pH dual input		

< Components of PTA-610 >

Part code	Part name	Remarks	Sketch
12-001-1001-48	Photometric sensor	Including connection cable (98-428-0030) Interference filter is available as option	
12-001-1000-48	Photometric sensor	Interference filter is available as option	
98-428-0030	Conncting cable		
12-001-1200-48	Interference filter (530nm)		
12-001-1201-48	Interference filter (630nm)		
12-001-1202-48	Interference filter (650nm)		
98-550-5502	Shutter		

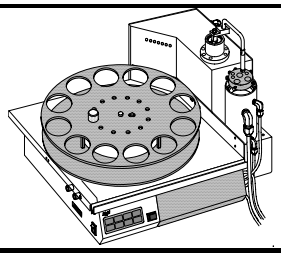
< Automatic piston burette >

Part code	Part name	Remarks	Sketch
APB-600-AT	Automatic piston burette	For Potentiometric titrators	
APB-610	Automatic piston burette		
APB-620	Automatic piston burette		

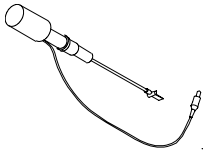
< Burette unit >

Part code	Part name	Remarks	Sketch
EBU-610-01B	Burette unit	1mL Burette	
EBU-610-05B		5mL Burette	
EBU-610-10B		10mL Burette	
EBU-610-20B		20mL Burette	
EBU-610-50B		50mL Burette	

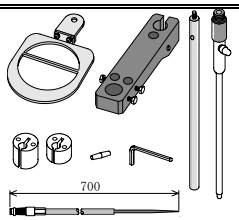
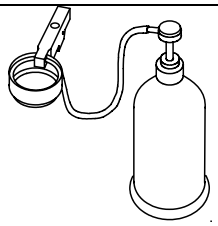
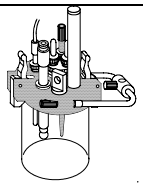
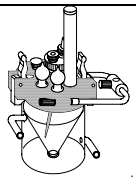
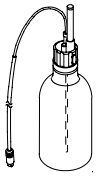
< Multiple sample changer >

Part code	Part name	Remarks	Sketch
CHA-600-12 CHA-600-18	Multiple sample changer	For 12 samples For 18 samples	

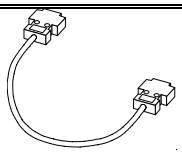
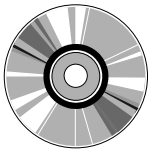
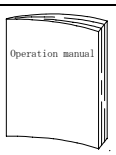
< Stirrer >

Part code	Part name	Remarks	Sketch
98-430-0036	Propeller stirrer		

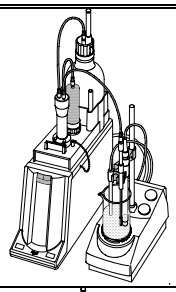
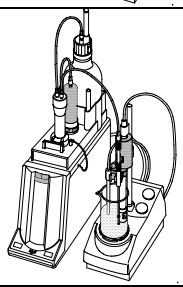
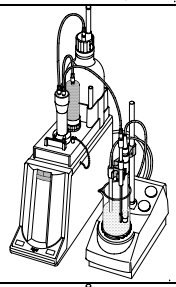
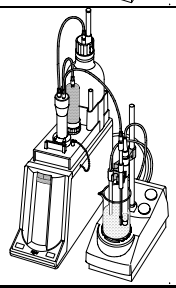
< Measuring unit >

Part code	Part name	Remarks	Sketch
COD-510	COD Titration Unit		
MW-510	Manual washing unit		
SCU-118	Sealed cell flask assembly		
MTA-118-1 MTA-118-5 MTA-118-50	Micro titration unit		
12-001-6600-48	Titrant temperature compensation sensor		

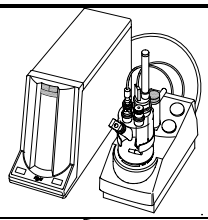
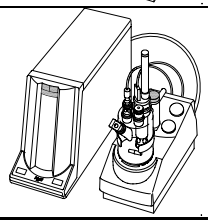
< Connection with PC >

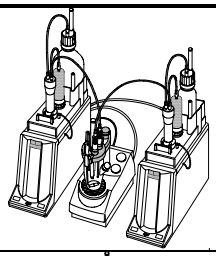
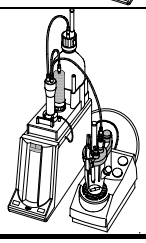
Part code	Part name	Remarks	Sketch
98-030-0002	Connecting cable	9pin-9pin	
SOFT-CAPE	Data capture software		
69-000-6803-48	Operation manual	RS-232C	

< Additional unit (Automatic Potentiometric Titrator) >

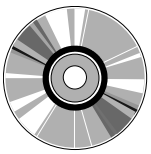
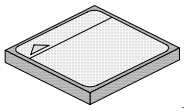
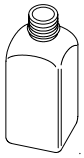
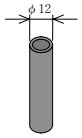
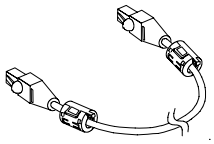
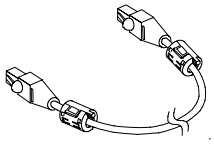
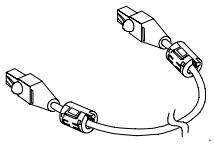
Part code	Part name	Remarks	Sketch
AT-610-S/2ND AT-610-T/2ND	Titration Unit	Standard For pH dual input	
AT-610-P/2ND	Titration Unit	For photometric titration Including photo sensor, connection cable, interference filters (530 nm & 630 nm) and shutter	
AT-610-O/2ND	Titration Unit	For polarization titration Including Twin platinum electrode (P/N: 98-100-M511)	
AT-610-C/2ND	Titration Unit	For conductometric titration Including conductivity cell (P/N: 98-101-K321)	

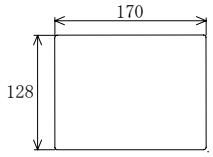
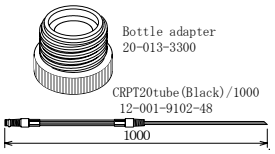
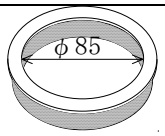
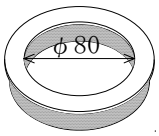
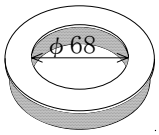
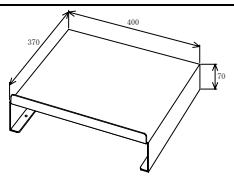
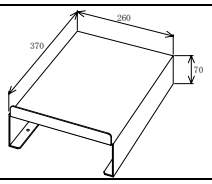
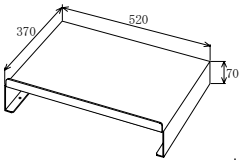
< Additional unit (Karl Fisher Moisture Titrator) >

Part code	Part name	Remarks	Sketch
MKC-610-D/2ND	Karl Fisher Moisture Titrator for Coulometric Method	Two-component cell type	
MKC-610-N/2ND	Karl Fisher Moisture Titrator for Coulometric Method	One-component cell type	

Part code	Part name	Remarks	Sketch
MKA-610-T/2ND	Karl Fisher Moisture Titrator for Volumetric Method	Twin burette type	
MKA-610-S/2ND	Karl Fisher Moisture Titrator for Volumetric Method	Single burette type	

< Others >

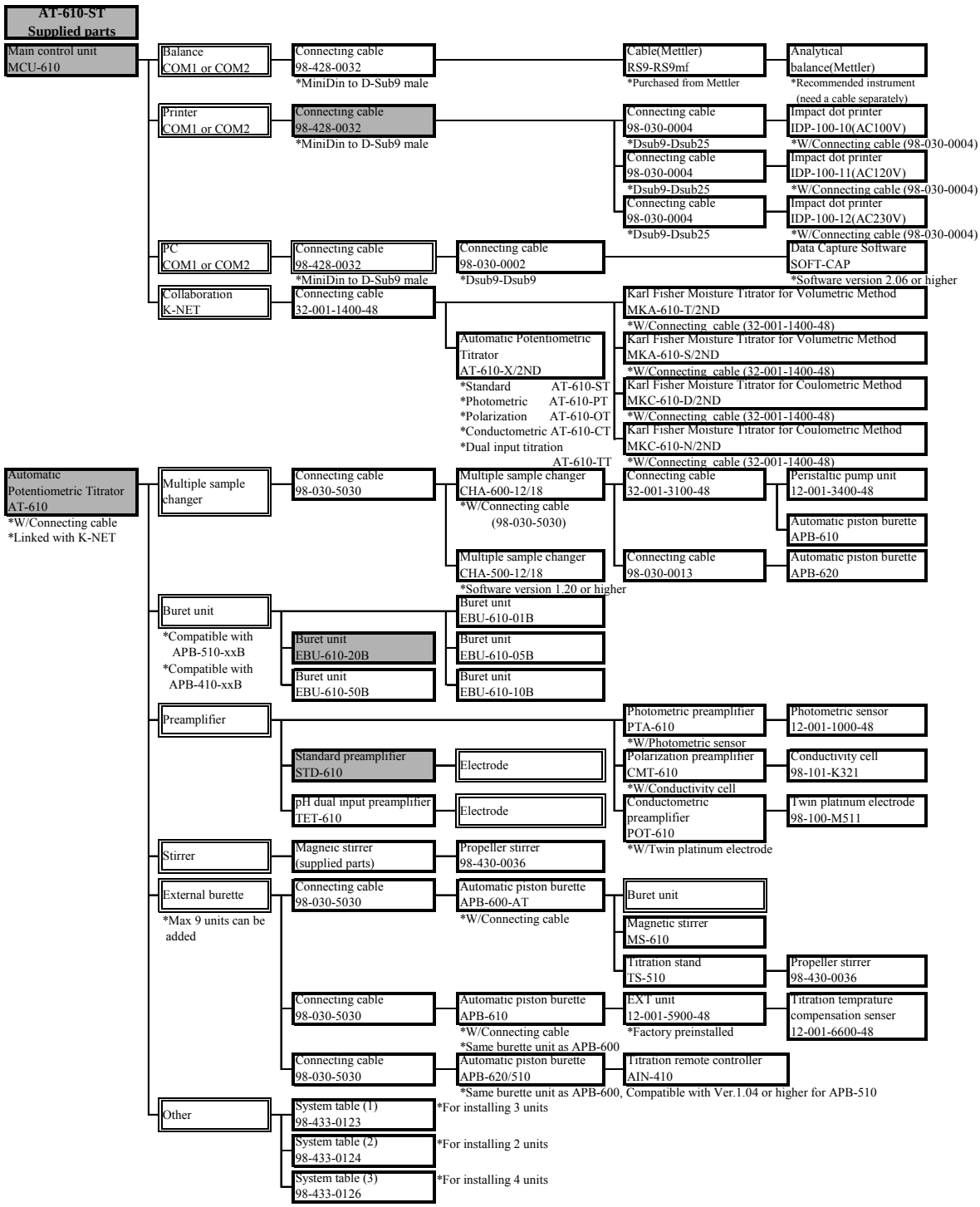
Part code	Part name	Remarks	Sketch
TVIEW6	Analysis software for Titration Results		
98-435-0008	Memory card	32MB	
98-500-0035	Reagent bottle (1L/brown)	Brown bottle	
20-039-9700-48	Brown cover for De-gas tube		
32-001-1401-48	Connecting cable	3m	
32-001-1402-48	Connecting cable	5m	
32-001-1403-48	Connecting cable	10m	

Part code	Part name	Remarks	Sketch
20-024-5400-48	Protection film	Luster type	
12-001-6700-48	Bottle adapter	For 3L bottle (manufactured by Japanese makers) with tube (12-001-9102-48, L=1m)	
98-569-0001S	Bottle holder 1	5pcs/set ϕ85	
98-569-0002S	Bottle holder 2	5pcs/set ϕ80	
98-569-0003S	Bottle holder 3	5pcs/set ϕ68	
98-433-0123	System table (1)	For MKA-610-TT	
98-433-0124	System table (2)		
98-433-0126	System table (3)		

Electrode list

Part code	Part name	Remark
98-100-C171	Combination glass electrode (standard type)	Glass electrode and reference electrode in one unit. (ODϕ12, length: 135mm)
98-100-T171	Temperature compensation electrode (standard type)	For AT-610
98-100-T111	Temperature compensation electrode (standard type)	For conductometric titiration
98-100-C678	Combination glass electrode (micro titration)	For vial (dip area: OD ϕ6, length: 220mm)
98-100-C272	Combination Pt electrode	Pt electrode and reference electrode in one unit (ODϕ12, length: 135mm)
98-100-H171	pH glass electrode (standard type)	For general use
98-100-R171	Ceramic type reference electrode	For general use
98-100-R172	Sleeve type reference electrode	For sample coating junction
98-100-R173	Double junction reference electrode	For sample contaminating inner solution
98-100-R272	Mercury sulfate type reference electrode	For silver titration
98-100-M271	Platinum electrode (standard type)	For redox potentiometric titration
98-100-M511	Twin Pt electrode	For polarization titration
98-100-M371	Silver electrode (standard type)	For silver titration
98-101-K321	Conductivity cell	For conductivity titration
98-811-5001	Inner solution (250mL)	3.33M-KCl solution
98-811-5012	Inner solution (250mL)	K_2SO_4 solution
98-811-0026	Inner solution (250mL)	1M-KNO_3 solution
61-000-8100-48	Inner solution (250mL)	1M-LiCl in Acetic acid for non-aquos titration
61-000-8101-48	Inner solution (250mL)	1M-LiCl in EtOH for non-aquos titration

7-2. System Configuration



7-3. Specification

Specification	Contents
Type and model	AT-610 Automatic Potentiometric Titrator
Detection range	1) Potentiometric : -2000mV~+2000mV 2) pH : 0.00~14.00pH 3) Temperature : 0~100°C
Titration mode	Blank, Auto Titration, Auto Intermit, Intermit, Petroleum Titration, COD, Stat, total 7 modes
Method	Standard 50, Combined methods 10 (Max 5 methods can be linked)
Kinds of titration	Potentiometric (acid/base, redox, precipitation) Photometric, Polarization, Conductivity
Titration form	Full titration (Auto EP detection), EP Stop, Level Stop, Intersect, EP Stop/Level Stop
Special application	Measurement of electrode potential (pH, potential), Acid dissociation constant(pKa), Learn, Simultaneous recording of 2-way input potential (e.g. Titer vs. pH+%T, Titer vs. pH+μS)
Key operation	Direct input on Touch-on panel
Displays	1) 8-inch LCD in 256 colors 800 × 600 dots 2) Simultaneous 2-channel display (Can also display a KF titrator simultaneously) 3) Selective English or Japanese on display
Calculation	Concentration of content, statistics data processing (mean, SD and RSD) and automatic averaging of blank and factor value
Data storage	On-board memory : 100 samples Memory card (Compact Flash) : ca. 800 samples
GLP conformance	Up to 50 operators can be registered. Titrant : Reminder of date of factor measurement, Alarm to indicate remaining titrant, Reminder of date for replacing piston and reagent change, Records of history of factor measurement Inspection : Notice of scheduled validation and reagent change date, and recording of the results Maintenance of electrodes : Reminder of calibration date and Records of history of electrode calibration Inspection of burette capacity : Records of inspecting function and records
Burette size	20mL glass burette with brown cover (Standard) Optional burette units: 50mL, 10mL, 5mL, or 1mL
Burette accuracy	50mL burette ± 0.05mL; reproducibility ± 0.02mL 20mL burette ± 0.02mL; reproducibility ± 0.01mL 10mL burette ± 0.015mL; reproducibility ± 0.005mL 5mL burette ± 0.01mL; reproducibility ± 0.003mL 1mL burette ± 0.005mL; reproducibility ± 0.001mL
Preamplifier	1) STD-610 : pH (mV) and mV, 2 inputs (standard) 2) PTA-610 : pH (mV), mV and photometric, 3 inputs (option) 3) POT-610 : pH (mV), mV and polar, 3 inputs (option) 4) CMT-610 : pH (mV), mV and conductivity, 3 inputs (option) 5) TET-610 : pH (mV) 2 ways and mV, 3 inputs (option)
External control	COM port × 2 channels for printer/electronic balance/ Data Capture Software (SOFT-CAP) K-NET port × 2 channels for measuring unit Jack for temperature probe (correction of reagent volume) and Pt100 probe, precision of temperature reading: ±0.5°C

Specification	Contents
Extensibility	Automatic piston burette : Can control max 10 burette drives (Including one built-in AT-610) Measuring instrument : Titrator (AT-610), Moisture titrator (MKA-610/MKC-610); one of these instruments can be added. Multiple sample changer : CHA-600
Ambient condition	1) Temperature : 5 ~ 35°C 2) Humidity : less than 85%RH (no condensation)
Power source	1) Voltage : 100 ~120/200 ~ 240VAC±10%, 50/60Hz 2) Power consumption : Touch-on panel control Aprox. 20W Measuring unit and stirrer Aprox. 25W Printer (100V) Aprox. 7W
Dimensions	1) Touch-on panel controller : 230(W) × 280(D) × 255(H)mm 2) Titration unit : 120(W) × 363(D) × 610(H) mm 3) Stirrer : 118(W) × 225(D) × 336(H) mm 4) Printer : 106(W) × 180(D) × 88(H) mm
Weight	1) Touch-on panel controller : Aprox. 2.0kg 2) Titration unit : Aprox. 4.0kg 3) Stirrer : Aprox. 2.0kg 4) Printer : Aprox. 0.4kg
CE marking	EMC : EN61326 conforming LVD : EN61010-1 conforming

7-4. Reference

7-4-1. Parameter list

7-4-1-1. Setup parameters

[Regist operator]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Operator name	—	Within 64 characters A-Z,a-z,+,-,/,*,(,),.,,%	User name	As displayed

[Display setup]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Language	Japanese	Japanese/English	Language	As displayed
Date format	YYYY/MM/DD	YYYY/MM/DD MM/DD/YYYY DD/MM/YYYY	Date format	As displayed
Date&time	Present date and time	2001/01/01 00:00 ~ 2099/12/31 23:59	Date & time	As displayed

[Interface]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
COM1	Off	Not connected/ Printer/Balance/PC	COM1	None/Printer/Balance/PC
Printer	IDP-	IDP-/DP-/Other	Printer	As displayed
Channel	ch1+ch2	ch1/ch2/ch1+ch2	Channel	As displayed
Baud rate	4800bps	600bps/1200bps/2400bps /4800bps/9600bps	Baud rate	As displayed
Parity	None	None/Even/Odd	Parity	As displayed
Stop bit	1bit	1bit/1.5bit/2bit	Stop bit	As displayed
Data bit	8bit	7bit/8bit	Data bit	As displayed
Balance	KEM	KEM/Mettler/A&D /Shimadzu/Sartorius	Balance	As displayed
COM2	Off	Not connected/ Printer/Balance/PC	COM2	None/Printer/Balance/PC

[LCD backlight]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Brightness	4	1/2/3/4	Brightness	As displayed
Auto dimming	In 10 min.	Off/In 10 min./In 20min./ In 30min./In one hour/ In two hours	A.dmming	Off/10min/20min /30min/1hour/2hours

[Beep]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Beep	Type 1	Off/Type1/Type2 /Type3/Type4/Type5	Beep	As displayed

7-4-1-2. Function parameters

[Reagent information]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Reagent name	—	Within 20 characters A-Z,a-z,+,-,/,*,(,),.,,%	Reagent name	As displayed
Reagent rest	1000mL	0-9999mL	Reagent rest	As displayed
Factor	1.00000	0.00000-99999.99999	TF	As displayed
Concentration	1.00000	0.00000-99999.99999	TN	As displayed
Molecular weigh	1.00000	0.00000-99999.99999	TMW	As displayed
Equivalent number	1.00000	0.00000-99999.99999	TEQN	As displayed
Temp.comp.coeff.A	1.00000	-99999.99999-99999.99999	Temp.comp.coeff.A	As displayed
Temp.comp.coeff.B	0.00000	-99999.99999-99999.99999	Temp.comp.coeff.B	As displayed
Reagent rest alarm	Off	Off/On	Reagent rest alarm	As displayed
Reagent rest limit	50mL	0-9999	Rest limit	As displayed
Replacement alarm	Off	Off/On	Replacement alarm	As displayed
Replacement date	—	Day intervals	Replacement date	As displayed
Interval	7 Day	1-999	Interval	As displayed
Piston alarm	Off	Off/On	Piston alarm	As displayed
Piston replacement	—	Day intervals	Replacement date	As displayed
Interval	7 Day	1-999	Interval	As displayed

[Sample mode]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Sample file	Off	Off/On	Sample file	As displayed
Size input mode	Size 1 only	Size 1 only/ Size 1,2	Size input	As displayed
Before entry	Off	Off/On	Before entry	As displayed
After entry	Auto	Off/On/Auto	After entry	As displayed

[Blank list]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Blank 1-10	0.00000	0.00000-99999.99999	Blank 1-10	As displayed

[GLP management]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Periodic check	Off	Off /On	Periodic check	As displayed
Next check date	—	Day intervals	Next check	As displayed
Check Interval	7 Day	1–999	Interval	As displayed

[Auto statistics]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Auto statistics	Off	Off /On	Auto statis.	As displayed
List printing	(Off)	Off /On	List printing	As displayed
Calc. type	(Off)	Off /On	Calc.type	As displayed
High sample No.	(On)	Off /On	Hi No.	As displayed
Method No.	(Off)	Off /On	Method No.	As displayed
Sample ID	(Off)	Off /On	Sample ID	As displayed
Unit 1-5	(Off)	Off /On	Unit	As displayed

[Decimal edit]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Sample size	4	0-8	Sample size	As displayed
	Half adjust	Round up/ Half adjust /Round down	Fraction	As displayed
Statistics	4	0-8	Statistics	As displayed
	Half adjust	Round up/ Half adjust /Round down	Fraction	As displayed

[Graph setting]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Range mode	Auto	Auto/Fixed	Range mode	Auto/Fixed
Primary diff. curve	Off	Off/On	Primary diff.	As displayed
Ref. channel	Off	Off/On	Ref. Channel	As displayed
Division of X-axis	10	2-20	Division of X axis	As displayed
Division of Y-axis	10	2-20	Division of Y axis	As displayed
Vertical axis	Total volume, Potential	Total volume, Potential/ Volume, Potential/ Volume	Vertical axis	Total vol., Pot./ Vol., Potential/ Volume

[Changer setting] — [Standard sequence n]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Shower	30s	0-9999	Shower	As displayed
Rinse	30s	0-9999	Rinse	As displayed
Drain1	60s	0-9999	Drain1	As displayed
Drain2	60s	0-9999	Drain2	As displayed
Wait time	20s	0-9999	Wait	As displayed
Sample drain time	0s	0-9999	Samp. drain	As displayed
Pre-Treat	Off	Off/On	Pre-Treat	As displayed
Pumping time	(60s)	0-9999	Pumping	As displayed
Time after dosed	(60s)	0-9999	After dose.	As displayed
Wait time	(60s)	0-9999	Wait time	As displayed
Pre-Dose	Off	Off/On	Pre-Dose	As displayed
Pumping time	(60s)	0-9999	Pumping	As displayed
Time after dosed	(60s)	0-9999	After dose.	As displayed

[Other settings]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Print of header	On	Off/On	Header	As displayed
Print of footer	On	Off/On	Footer	As displayed
Auto setting, mean	On	Off/On	A.set mean	As displayed
Alarm	Off	Off/On	Alarm	As displayed
Result disp.	0s	0–3600s	Disp time	As displayed
Automatic page break	On	Off/On	A. page break	As displayed
Suction speed	Fast	Fast/Medium/Slow	Suct. speed	As displayed
Re-Titration	Off	Off/On	Re-titration	As displayed

7-4-1-3. Method parameters

Selection of Method parameters and printout

[Method name, Titr. mode, Titr. form]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Method name	—	Within 20 characters A-Z,a-z,+,-,/,*,(,),.,,%	Method name	As displayed
Titr. mode	Auto Titration	Blank/Auto Titration/ Auto Intermit/ Intermit/ COD/ Petroleum Titr./ Stat/ Learn	Titr. mode	Blank/Auto Titr./ Auto Int./ Intermit/ COD/ Petroleum Titr./ Stat/ Learn
Titr. form	EP Stop	EP Stop/ Level Stop/ Intersect/ Full/ Level&EP	Titr. form	As displayed

[Predosing parameter]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Dose mode	Off	None/ Volume Stop/ Level Stop/ Diff. Stop	Dose mode	As displayed
Burette No.	1	1-10	Burette No.	As displayed
Channel, Unit	Ch1, mV	Ch1,mV/ Ch1,pH/ Ch2,mV/ Ch3,mV/ Ch3,pH/ Ch3,%T/ Ch3,Abs./ Ch3, μA/ Ch3, 100μS/ Ch3, 1000μS/ Ch3, 10000μS	Channel, Unit	As displayed
Stop volume	20.0000mL	0.0000-99999.0000	Stop volume	As displayed
Stop level	(0.0mV)	*	Stop level	As displayed
Stop differential	(0.0mV/mL)	*	Stop diff.	As displayed
Cut-off time	0s	0-9999	Cut-off time	As displayed
Unit volume	(0.100mL)	0.001-9999.000	Unit volume	As displayed
Dispense speed	50s/mL	1-999	Disp. speed	As displayed
Direction	Auto	Auto/ Positive/ Negative	Direction	As displayed
Wait time	0s	0-9999	Wait time	As displayed
Stirrer speed	4	0-9	Stir. speed	As displayed

About the input range for "*" in the above table, see the Chapter "3-8-6-7 Input range for potential parameters".

[Titration parameter]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Burette No.	1	1-10	Burette No.	As displayed
Max. volume	20.000mL (Titration mode is "Blank", 2.0000)	0.0000-9999.0000	Max. volume	As displayed
Channel, Unit (Ctrl.)	Ch1,mV	Ch1,mV/ Ch1,pH/ Ch2,mV/ Ch3,mV/ Ch3,pH/ Ch3,%T/ Ch3,Abs./ Ch3, μA/ Ch3, 100μS/ Ch3, 1000μS/ Ch3, 10000μS	Channel, Unit ctrl.	As displayed
(ref.)	Off	Off/ Ch1,mV/ Ch1,pH/ Ch2,mV/ Ch3,mV/ Ch3,pH/ Ch3,%T/ Ch3,Abs./ Ch3, μA/ Ch3, 100μS/ Ch3, 1000μS/ Ch3, 10000μS/ Temp.	ref.	As displayed
pH polarity	Standard	Standard/ Reverse	pH polarity	As displayed
Direction	Auto	Auto/ Positive/ Negetive	Direction	As displayed
Wait time	0s	0-9999	Wait time	As displayed
Dose mode	Off	None/ Volume Stop/ Level Stop/ Diff. Stop	Dose mode	As displayed
Stop volume	20.0000mL	0.0000-9999.0000	Stop volume	As displayed
Stop level	0.0mV	*	Stop level	As displayed
Stop differential	0.0mV/mL	*	Stop diff.	As displayed
Cut-off time	0s	0-9999	Cut-off time	As displayed
Unit volume	(0.100mL)	0.001-9999.000	Unit volume	As displayed
Dispense speed	50s/mL	1-999	Disp. speed	As displayed
Wait time	0s	0-9999	Wait time	As displayed

About the input range for "*" in the above table, see the Chapter "3-8-6-7 Input range for potential parameters".

[Control parameter]

(<Titration mode> is "Blank", "Auto Titration", "Auto Intermit" and "Intermit")

Parameter	Printout	
Item	Item	Printing
Number of EP	Number of EP	As displayed
End sense	End sense	Auto/Set
End sense (dE)	dE	As displayed
End sense (dE/dmL)	dE/dmL	As displayed
1st End Level	1st End Level	As displayed
2nd End Level	2nd End Level	As displayed
EP stop mode	EP stop mode	As displayed

Parameter	Printout	
Item	Item	Printing
End sense (dAngle)	dAngle	0.0-180.0degrees
Auto simulation	Auto simulation	On/Off
Gain	Gain	As displayed
Data sampling	Data sampling	Std./Set
Data sampling pot.	Data samp. pot.	As displayed
Data sampling vol.	Data samp. vol.	As displayed
Control speed mode	Ctl. speed mode	Fast/ Std./ Slow/ Set
Stability	Stability	As displayed
Delay time	Delay time	As displayed
Limit time	Limit time	As displayed
1st volume	1st volume	As displayed
2nd volume	2nd volume	As displayed
3rd volume	3rd volume	As displayed
4th volume	4th volume	As displayed
1st > 2nd diff.	1st > 2nd diff.	As displayed
2nd > 3rd diff.	2nd > 3rd diff.	As displayed
3rd > 4th diff.	3rd > 4th diff.	As displayed
Control speed	Control speed	As displayed
Cut-off time	Cut-off time	As displayed
Unit volume	Unit volume	As displayed
Dispense speed	Disp. speed	As displayed
Other control	Other control	Std./Set
Titr. over volume	Titr. over vol.	As displayed
EP area	EP area	As displayed
Lower volume	Lower vol.	As displayed
Upper volume	Upper vol.	As displayed
Lower potential	Lower pot.	As displayed
Upper potential	Upper pot.	As displayed
Separation	Separation	As displayed
Separation level	Sepa. level	As displayed
End separation	Level stop	As displayed
End Level	End Level	As displayed
Stirrer speed	Stir. speed	As displayed

(“Speed control mode” when <Titration mode> is ‘Petroleum Titr.’)

Parameter	Printout	
Item	Item	Printing
Control speed mode	Control smode	Std./Set
Limit time	Limit time	As displayed
Integral time	Integral time	As displayed
Limit time at start of titr.	Start limit	As displayed
1st Delivery volume	1st Dose vol.	As displayed
2nd Delivery volume	2nd Dose vol.	As displayed
Stability	Stability	As displayed
Rel. change level	dE(1st -2nd)	As displayed

("Stat" is selected for <Titration mode>)

Parameter	Printout	
Item	Item	Printing
Gain	Gain	As displayed
Cut-off time	Cut-off time	As displayed
Unit volume	Unit volume	As displayed
Dispense speed	Dispense speed	As displayed
Rel. change level	Rel. change level	As displayed
1st Dispense speed	1st Dispense speed	As displayed
Lag time	Lag time	As displayed
Stat level	Stat level	As displayed
Limit time	Limit time	As displayed
Offset potential	Offset potential	As displayed
Stirrer speed	Stirrer speed	As displayed
Vol. Sampling time	Vol. Sampling time	
Vol. Sampling time 1	VT1	As displayed
Vol. Sampling time 2	VT2	As displayed
Vol. Sampling time 3	VT3	As displayed
Vol. Sampling time 4	VT4	As displayed
Vol. Sampling time 5	VT5	As displayed

("COD" is selected for <Titration mode>)

Parameter	Printout	
Item	Item	Printing
Data sampling pot.	Data samp. pot.	As displayed
Data sampling vol.	Data samp. vol.	As displayed
Rel. change level	Rel. change level	As displayed
End time	End time	As displayed
EP level	EP level	As displayed
1st Dispense speed	1st d. speed	As displayed
Limit time	Limit time	As displayed
Stirrer speed	Stir. speed	As displayed

Note:

About the initial values of control parameters, see the Section "3-8-6-6. Initial values of Control parameters".

[Calculation parameter]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Calc. type	Sample	Sample/ Blank/ Factor/ Check	Calc. type	As displayed
Target EP	(EP)	EP/Level	Target EP	As displayed
Formula 1	On	Off/On	CO1	As displayed
Unit	—	Within 10 characters A-Z,a-z,+,-,/,*,(,),.,,%	Unit	As displayed
Formula (CO1)	(EP1-BL1)* TF*K1*C1/S	Within 64 characters A-Z,a-z,+,-,/,*,(,),.,,%	Formula	As displayed
EP position	EP1	EP1/ EP1/ EP3/ EP4/ EP5	EP position	As displayed
Decimal	5	0-8	Decimal	As displayed
Fraction	(Half adjust)	Round Off/ Half adjust/ Round Up	Fraction	As displayed
Blank replace No.	(1)	1-10	Blank replace No.	As displayed
Evalution	Off	Off/On	Evalution	As displayed
Standard value	(0.00000000)	0.00000000-9999.99999999	Std. value	As displayed
Permit. error	(0.00000000)	0.00000000-9999.99999999	Permit. Err.	As displayed
Formula 2-5	Off	Off/On	CO2-5	As displayed

[Report parameter]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Report format	Standard	Off/ GLP/ Short/ Variable	Report format	As displayed
Graph printing	Off	Off/On	Graph	As displayed
Data list printing	Off	Off/ Short/ Detail	Data list	As displayed

[Option parameter]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Rinse sequence	Off	Off/On	Rinse seq.	As displayed

7-5. Warranty and After-Sale Service

1. The product you have purchased passed factory inspection and testing prior to shipment, and its quality is guaranteed by free of charge replacement during warranty period except consumable parts provided the instrument has been under normal use and operation, however, depending on operational and environmental condition under which the instrument has been in use may require chargeable service work.

2. For service during and after warranty period, please contact your local dealer or distributor.

3. Read the manual thoroughly before you decide to call for service.
   When you should need servicing, please provide with the following information:

   Production number of unit
   Description of the trouble
   Person to contact

4. Parts and spares can be purchased separately and will be available for seven (7) years after termination of production of the model.

5. This warranty does not cover claims due to any of the following conditions:

   1) Any modification or specification change by an unauthorized person
   2) Damage by splashed water (the instrument is not water-proof)
   3) Use in range or condition other than specified
   4) Operated in other way than specified in the manual or negligence of maintenance
   5) Physical force given to the instrument during transportation or move
   6) Use of parts or reagent other than specified
   7) Caused by use under extreme ambient or environmental condition
   8) By fire, riots, earthquake, lightning, or Act of God in any form or manner

6. Escape clause
   Under no circumstances will Manufacturer be liable for any damage, whether incidental, consequential or other, or for any other remedy arising from any loss, damage, expenses or inquiry in connection with use of the article.

KYOTO ELECTRONICS MANUFACTURING CO., LTD.

Overseas Division: Yamawaki Bldg 9F 4-8-21 Kudan Minami,
Chiyoda-ku, Tokyo 102-0074 JAPAN
FAX: +81-3-3237-0537, Phone: +81-3-3239-7333
E-mail: overseas-tokyo@kyoto-kem.com
URL:http://www.kyoto-kem.com
Factory: 56-2 Ninodan-cho,Shinden Kisshoin,Minami-ku,KYOTO
601-8317,JAPAN
FAX: +81-75-691-9961, Phone: +81-75-691-4122