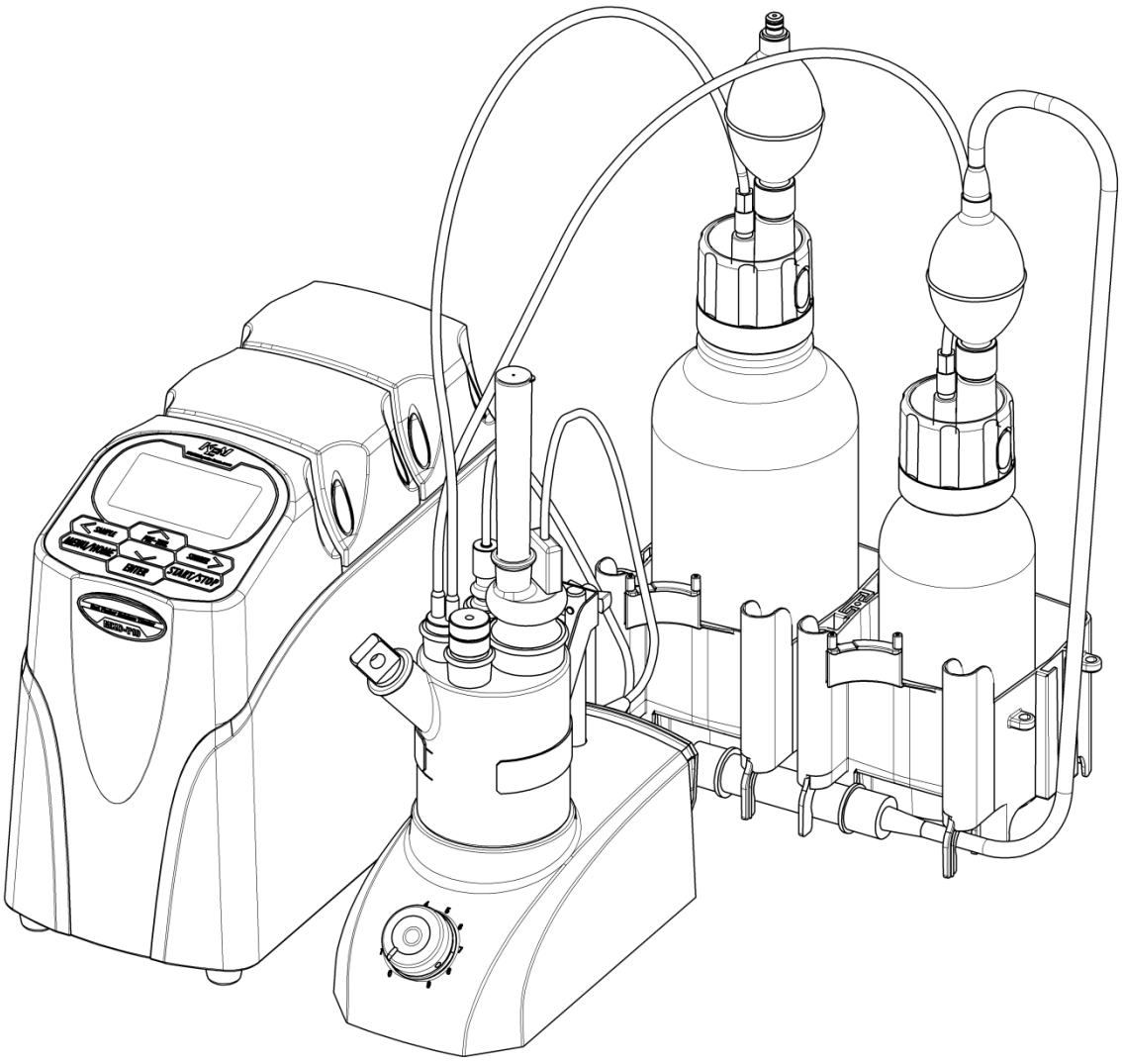
Karl Fischer Moisture Titrator
(for coulometric method)

MKC-710

Operation Manual

P590039201



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

KYOTO ELECTRONICS
MANUFACTURING CO.,LTD.
http://www.kyoto-kem.com
AN 59-00392-01Ver.13

Introduction

The MKC-710 you have purchased is Karl Fischer Coulometric Moisture Titrator, by which you can measure micro amount of water content which exists in liquid or in solid sample material. The measurement is easy to perform, fast in operation with its results of high precision and accuracy.

【 Features 】

1） **Compact design**
Burette drive unit is designed more compact than before and can be installed in A4 size.

2） **Simple operation**
Measurement can be performed with PRE-TITR. key and START key only.

3） **Energy-saving designing**
Power consumption was reduced by 30% compared with conventional models.

4） **USB flash drive is designed at external control**
The measurement result and the method are stored in USB flash drive, and data can be managed as an electron record. Moreover, the measurement result can be stored as PDF file, and the convenience of data has been improved. A keyboard for the input of number, a barcode reader for the sample setting and a foot switch that can start to measure without touching a device are installed as option. The working efficiency of measurement improved for customer's usage

5） **For several languages**
Chinese (Chinese classics), Korean, Russian and Spanish are installed besides English and Japanese.

6） **GLP/GMP conformed**
Operator names can be registered. And check results with standard substances can be recorded.

7） **Can be upgraded to high-end model.**
Measurement by moisture titrator and potentiometric titrator can simultaneously be performed by connecting with the MCU-710.

8） **SOFT-CAP(option)**
Data of Excel and CSV format can be edited directly by SOFT-CAP with PC.

Important:

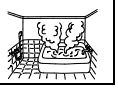
You must observe the following rules in order to prevent physical or property damage of yourself as well as of the others.

Meaning of Symbols

Warning	Danger of severe injury or possible death
Caution	Risk of physical or property damage
	This symbol means Prohibition.
	This symbol means Mandatory.

Place for Installation

Use the devices indoors, and avoid a place under any of the following conditions to avoid malfunction.

Caution		
Operation of devices with strong electric motors using common power source	Near strong magnetic/electric field Under direct sun light	Corrosive gas atmosphere
Heavily loaded and fluctuated or near power source or magnetic field	Excessive range of temperature other than specified	Ambient humidity exceeding 85%RH 
Under vibration	Location with large temperature difference	

Power Source

Warning		
You must ground earth wire of power cable. Danger of electric shock if not grounded to earth. The power supply from AC adapter other than that are specific to the equipment, we can not guarantee the safety of the product.		
Caution		
Plug out power cord in case of unit malfunction or possible lightning. Otherwise, the unit may be broken.	Power source for this unit: AC100-240V Frequency: 50Hz/60Hz	Do not share power as shown below. 
	Supply power direct from power outlet. 	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.

Test Sample

Warning	
Some sample or chemical requires protective gloves, glasses and mask. Ventilate the room. Splashing chemical may injure the eyes or skin. Windpipe may be hurt if fume is inhaled.	Do not use chemical which may generate inflammable gas or work in such atmosphere. Be aware of a risk of explosion inside the system.

About place for storage

Caution		
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 reagents

Caution	
Karl Fischer reagent is a toxic chemical. Use it in a well ventilated room, and handle it with utmost care.	Note that Precautionary statements of the reagent label. Drained before the waste bottle is full the amount of waste. Dispose of in accordance with laws and regulations.
If spilled reagent, after measurement may corrode the tube connector causing the dispenser malfunction.	

Other Cautions

Caution	
Do not attempt overhaul or repair the unit by unauthorized person except authorized by KEM. Danger of electric shock, fire or malfunction.	Do not use the unit in a way other than specified. Danger of fire, electric shock or malfunctioning of the unit.
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.	Handle glassware with care. Can cause injury if the glassware breaks.
Environment This equipment shall be used under the following conditions classified in the section 1.4.1 of the CE marking (Low Voltage Directive, 2006/95/EC, EN61010-1): altitude up to 2000m; over voltage CAT II; pollution degree 2.	

About the Manual

Read this operation manual thoroughly before use.
It describes all that are required for routine measurements.
Keep this manual beside your equipment so that you can refer to whenever necessary.

For detailed test methods, see the separate Function Description.

The following symbols indicate the important notes that raise your attention.

1. Note

Note

Unless you observe the note, you may not be able to obtain specified performance of the unit, and your unit may not be covered by warranty.

2. Hint

This symbol notes technical tips which are convenient to your measurement work.

※In this manual, [∧], [∨], [<SAMPLE] and [STIRRER>] key are explained the sign each of [↑ PRE-TITR.], [↓], [←]and [→].

※It is prohibited to duplicate any part or all of manual without prior consent.

※This manual has been prepared to the best of our knowledge; however, if you should find any missing or ambiguous description, please contact your nearest dealer or sale representative.

※Maker will not be liable for any loss or damage caused by use of or the result of the product.

※This manual describes usage according to standard specification. For special version, refer to the accompanying document.

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Table of Contents

1. Preparations for measurement

1-1. Supplied parts

Check the supplied parts referring to the following parts list. If you should find any missing or broken parts including the measuring unit, accessories or manual, contact your sales representative or local dealer.

Part Number	Part Description	Qty	Remarks
-	Main unit	1	
12-05356-04	MS-710C Magnetic Stirrer	Either 1	
12-05356-03	MS-710CP Magnetic Stirrer		With Auto Solvent unit
12-05685	Manual Solvent Change Unit	1	Only when ordered
12-07355-01	2Component Type Titration Cell Unit	Either 1	
12-07139-01	1Component Type Titration Cell Unit		
12-06956	AC Adapter	1	With Clamp Filter
64-00633	Power Cord (EU,KR) with PlugC(WS-010)	1*	200-240 V
64-00633-01	Power Cord (US,TW) with PlugB(WS-001)		100-120 V
64-00633-02	Power Cord (GB) with PlugG(WS-012A)		220-240 V
64-00633-03	Power Cord (CN) with PlugI(WS-015D)		200-240 V
64-01386	Stirrer Cable 0.6m	1	
12-04251	Washing Bottle	1	
12-01394-10	Septum (10pcs/set)	1	
12-04232	KF Grease (5g)	1	
20-06380-01	Anode Adjuster	1	
66-00141	Funnel 6-316-03	1	
66-00071	Pipette 10mL	1	
12-05186	MKC-710 Operation Manual（CD-ROM）	1	
59-00392-06	MKC-710 Quick Reference	1	
59-00392-07	MKC-710 Quick Reference	1	
-	Inspection Certificate/Warranty	1	
59-00405	Safety Instructions	1	
50-00761	Contact	1	
59-00398	Packing List	1	

*Make sure your country's power requirement.

Note Please refer to the section "9-1. Parts list" when ordering these parts.

1. Preparations for measurement

＜Components of Titration Cell Unit＞

Part Number	Part Description	Qty	Remarks
12-07105	2Component Inner Burette	Either	
12-07054	1Component Inner Burette	1	
20-07188	Port Plug 19/25 PTFE	2	
12-00661-11	Syringe Inlet (with Septum)	1	
66-00125-06	Stirrer Rotor (35mm)	1	
12-01260	Desiccant Tube phi18x120 with Silica Gel	1	
12-03755	Twin Platinum Electrode / KF M-713	1	
20-04041-00	Titration Cell (Transparency)	1	

＜Components of Manual Solvent Change Unit(12-05685)＞

Part Number	Part Description	Qty	Remarks
12-05686	Bottle Holder Unit	1	with Desiccant Tube
69-00028-00	Polyethylene Bottle 1L	1	
12-03926	Reagent Bottle Cap with Plug	1	
12-03926-01	Reagent Bottle Cap for Injection	1	
12-04875	Rubber Glove for Suction	1	
12-04875-01	Rubber Glove for Drain	1	
12-02020-11	Injection Tube 2×3 L=1180mm PFA	1	
12-02020-01	Drain Tube 2×3 L=1130mm PFA	1	
20-02559-00	Plug for Titration Flask	1	
60-00109-02	Tube 4x8 L=1m Silicone	1	
20-06823	Bottle Holder(1)	1	
20-06823-01	Bottle Holder(2)	1	
20-06823-02	Bottle Holder(3)	1	

＜Components of MS-710CP Magnetic Stirrer(12-05356-03)＞

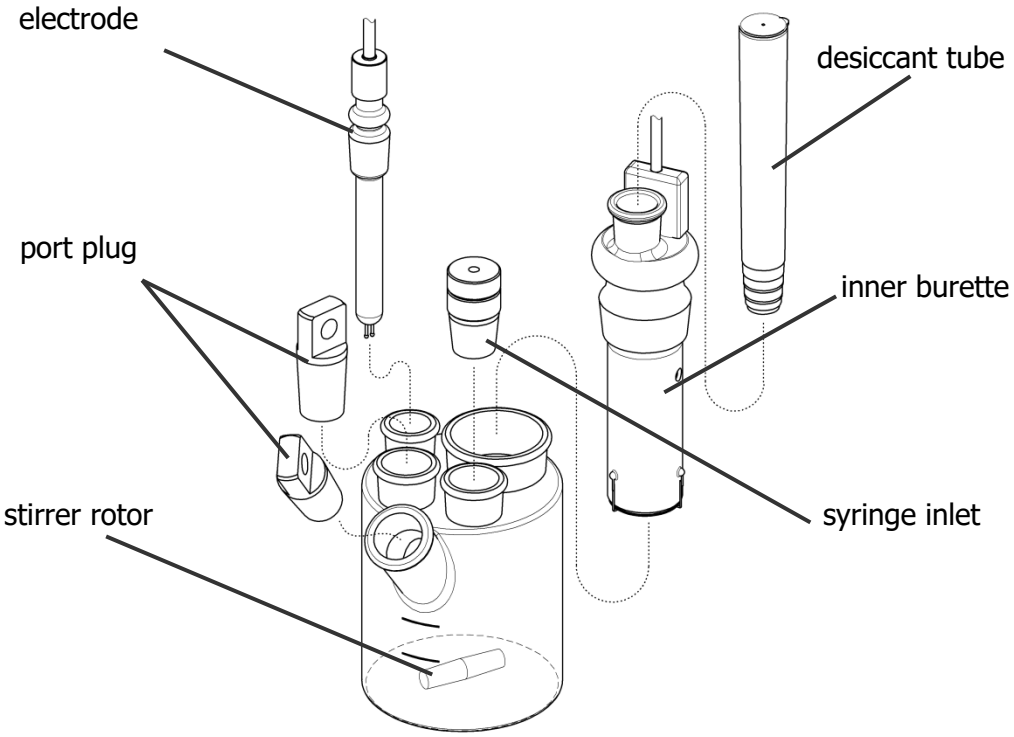
Part Number	Part Description	Qty	Remarks
12-05686	BottleHolder Unit	1	with Desiccant Tube
69-00028-00	Polyethylene Bottle 1L	1	
12-03926	Reagent Bottle Cap with Plug	1	
12-02021-10	Solvent/Waste Bottle Cap	1	
12-02020-11	Injection Tube 2×3 L=1180mm PFA	1	
12-01260	Desiccant Tube phi18x120 with Silica Gel	1	
12-04538-02	Drain Tube to Cell 2×3 L=0.69m PFA	1	
12-04539	Drain Tube to Waste Bottle 2 × 3 L=1100mm PFA	1	
20-02559-00	Plug for Titration Flask	1	
60-00109-02	Tube 4x8 L=1m Silicone	2	
12-06270-01	Suction Tube (Bottle Cap- Pump)	1	
12-06832	Waste Bottle Cap	1	
20-06823	Bottle Holder(1)	1	
20-06823-01	Bottle Holder(2)	1	
20-06823-02	Bottle Holder(3)	1	

Note Please refer to the section "9-1. Parts list" when ordering these parts.

1-2. **Installation and start-up**

1-2-1.Assembly of titration cell

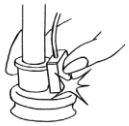
1) Put a stirrer rotor into the cell, and install the inner burette, the electrode, desiccant tube, the port plug and syringe inlet.



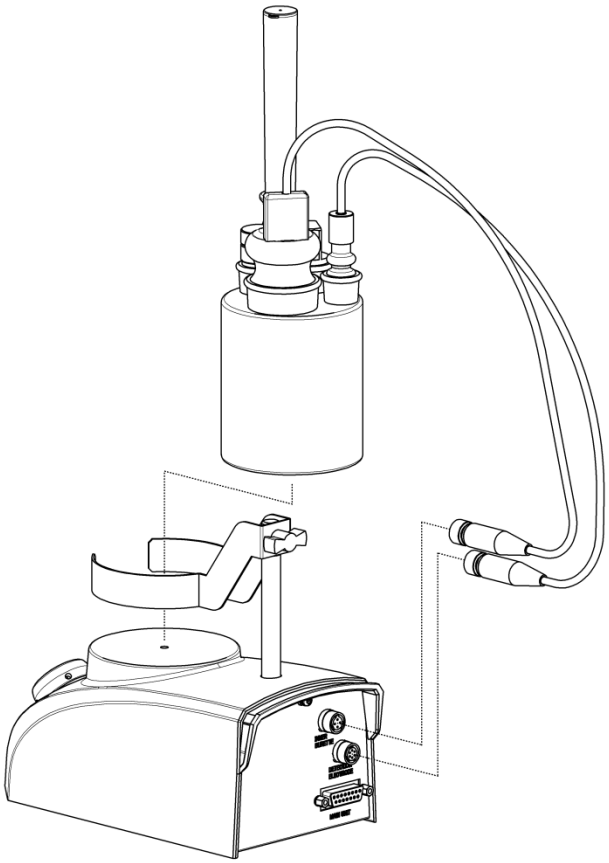
Note Make sure to apply KF grease around glass sliding area.

Note The seal on desiccant tube A on titration flask must be removed before using.

Warning **When handling the inner burette, do not hold the housing (black resin area) and sliding area of desiccant tube in order to avoid breakage.**

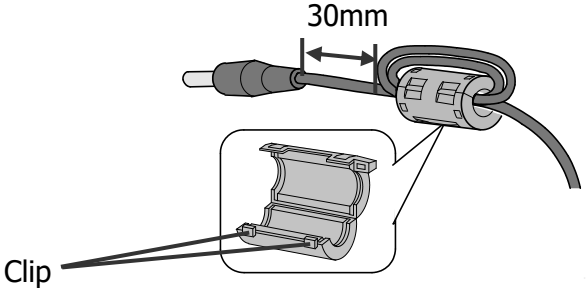


2) Place the titration cell onto the titration holder, and plug in the cable from the inner burette and the electrode. Tighten the plug screws firmly.



1-2-2.Installation of Clamp Filter

Install the clamp filter to AC adapter as figure below. Hold the clip of the clamp filter and open as figure below, and wrap treble remaining the tip by about 30mm.

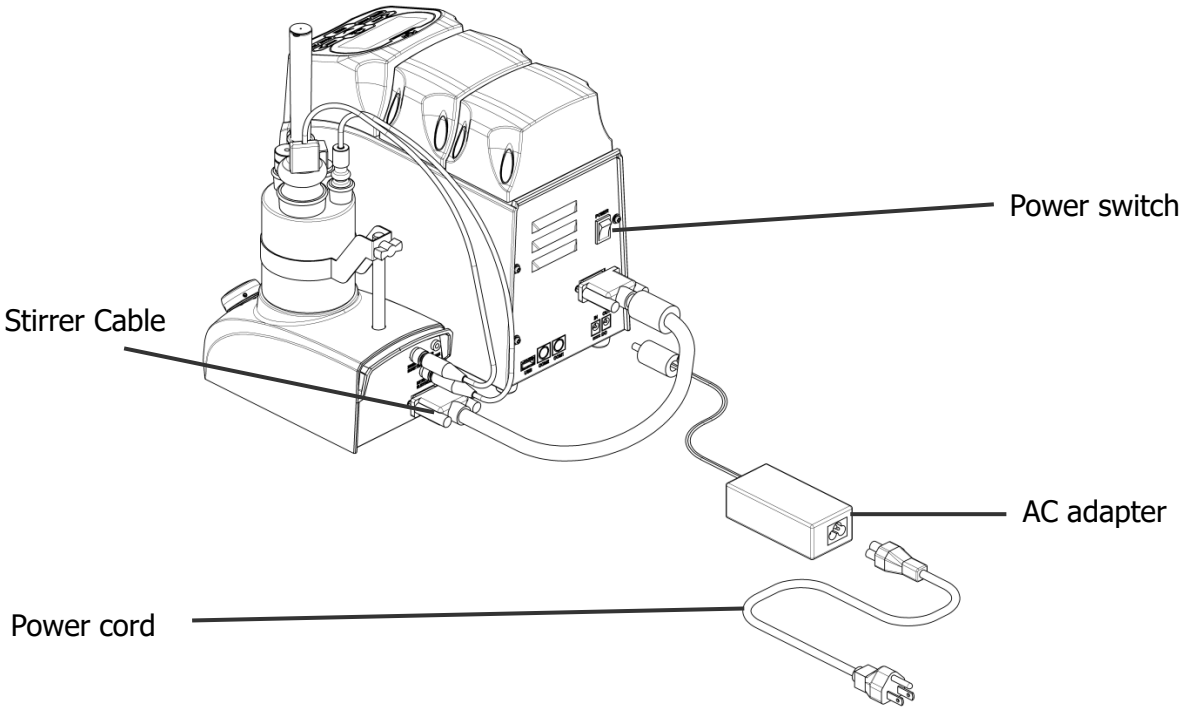


Note Please be sure to install a clamp filter in the AC adaptor.

1-2-3.Power cable

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

2) Connect the cables as shown below. Install Power cord to AC adapter and plug in AC adapter on the back of main unit.

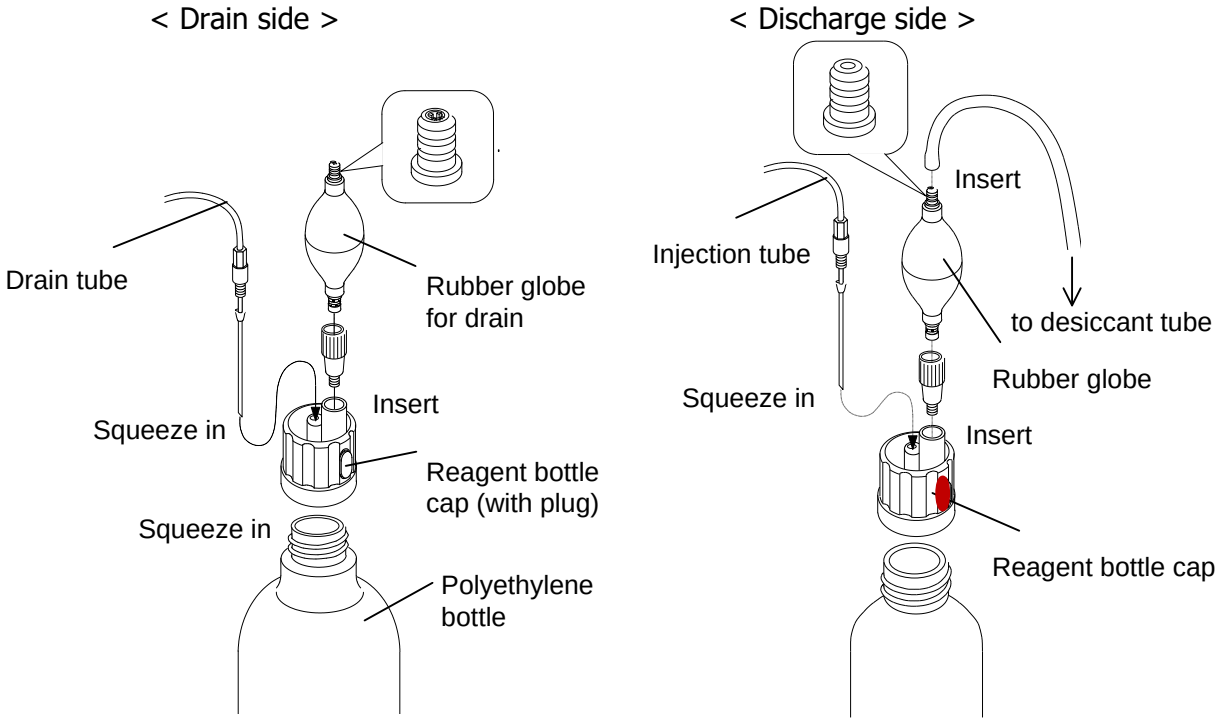


3) Connect Power cord to the power outlet.

1-3. Installation of Solvent Change Unit(Option)

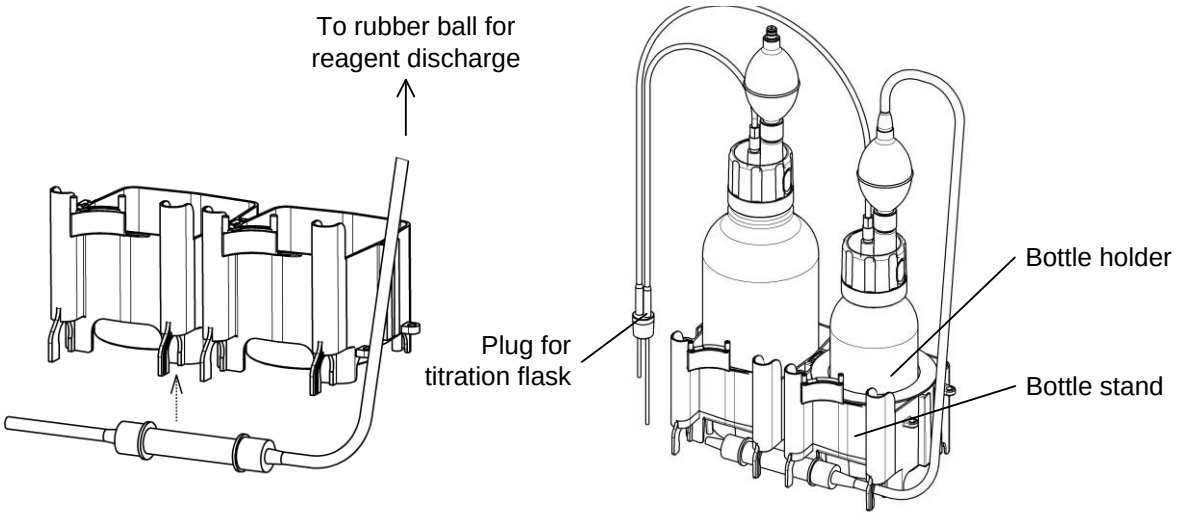
1-3-1.Installation of Manual Solvent Change Unit

1) Insert the rubber glove onto the reagent bottle cap.
2) Connect the drain tube to the reagent bottle cap (with rubber stopper), and the injection tube to the reagent bottle cap.
3) Fix the cap (with plug) to the polyethylene bottle.
4) Fix the desiccant tube to the rubber glove.
5) Connect the reagent bottle to a commercially sold KF reagent bottle filled with anolyte.

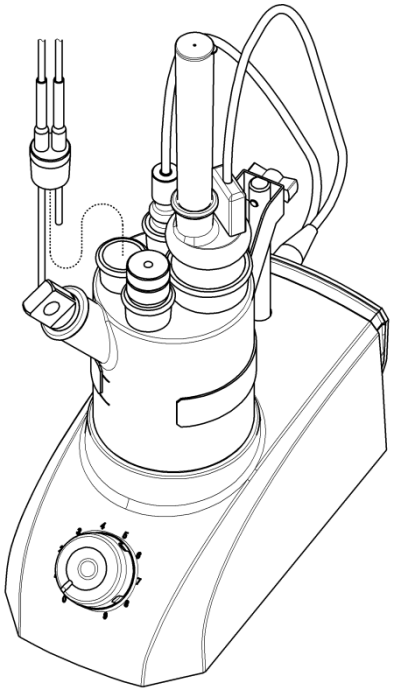


Note	If loosely squeezed it in, pressurized air may leak and it may cause malfunction of dispensing KF reagent. There are two kinds of rubber gloves, one for drain and the other for discharge of reagent. Both of them are indicated by the joint on top of each.

6) Install the desiccant tube onto the reagent bottle holder.
7) Place the reagent bottle in the bottle holder. If the outside diameter of reagent bottle does not match the holder, use the bottle holder as shown below.
8) Connect the tube for drain and injection to the Plug for titration flask as shown below respectively.

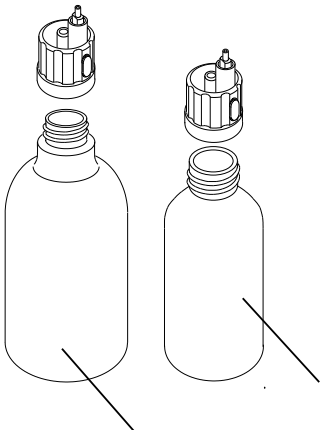


9) Insert the Plug for titration flask carefully into the titration cell. At this point, apply a small amount of KF grease on slide contact area.



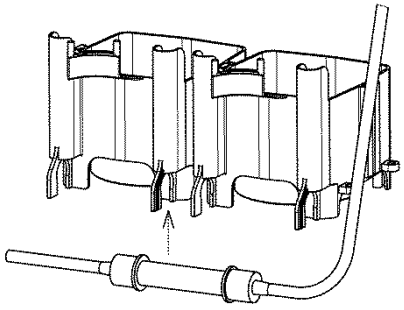
1-3-2.Installation of Auto Solvent Change Unit

1) Fix the bottle for dehydrated solvent and bottle for waste with the cap (waste bottle cover) respectively.



Note The bottle caps must be securely fixed in order to avoid air leak, which would prevent the dispenser from working properly in suction and draining.

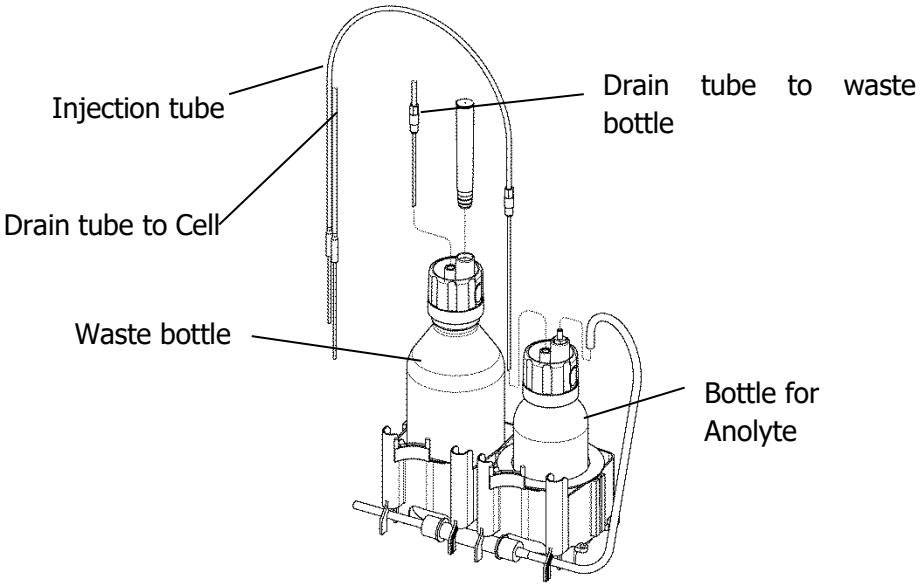
2) Connect the silicone tubes on both ends of desiccant tube, and put the tube in place as shown below



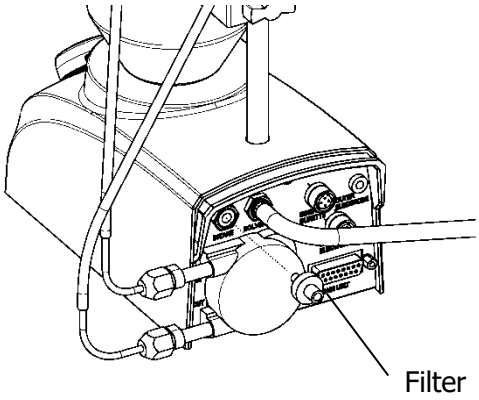
Silicone tube

3) Put the above 1) bottle in reagent bottle holder. If the outside diameter of solvent bottle does not match the holder, use the bottle holder as shown below.
4) Connect the silicon tubes, one to the top of solvent bottle.

5) Connect the tubes, one for draining to waste bottle and the other for injection to the two bottles respectively.
6) Connect the drain tube to Cell and injection tube to the plug for titration flask.

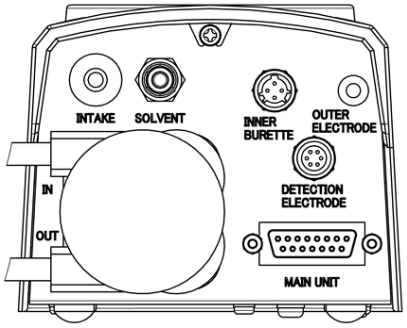


7) Connect the drain tube to waste bottle and the drain tube to Cell to magnetic stirrer back side pump.
8) Connect the silicone tube connected 2) to SOLVENT port on the rear panel of magnetic stirrer.
9) Attach a filter to INTAKE port on the rear panel of magnetic stirrer.



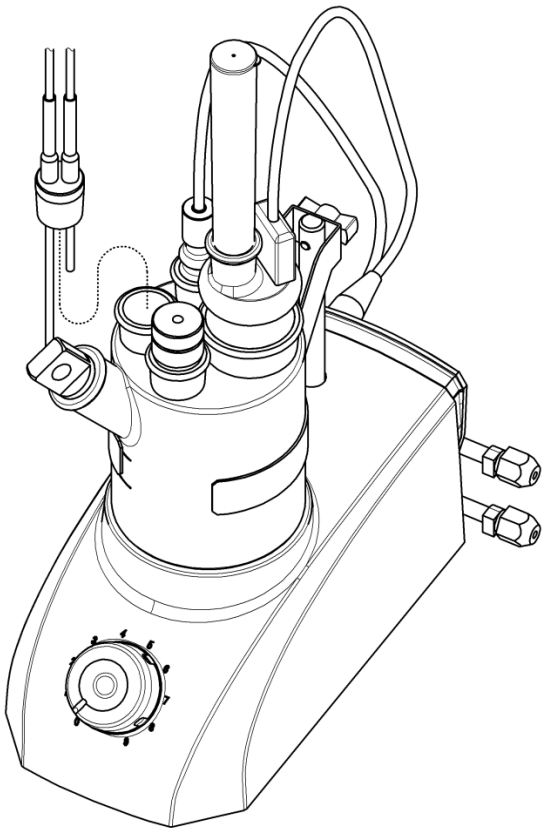
Note Please attach a filter to INTAKE by all means. In other words it might break down in the electromagnetic valve in the flow when absorb dust.

< Rear view of magnetic stirrer >



- SOLVENT : Connecting port for pressurized transfer of solvent.
- INTAKE : Inlet port of air.

10) Insert the plug for titration cell carefully into the lid. At this point, apply a small amount of KF grease on slide contact area.



⚠ **Caution**	When handling this chemical, protect yourself with gloves and glasses. If it touches your skin, immediately rinse it with running water.

1. Preparations for measurement

The following chloroform-containing reagents (see table below) or oil-based samples deteriorate the drain pump.

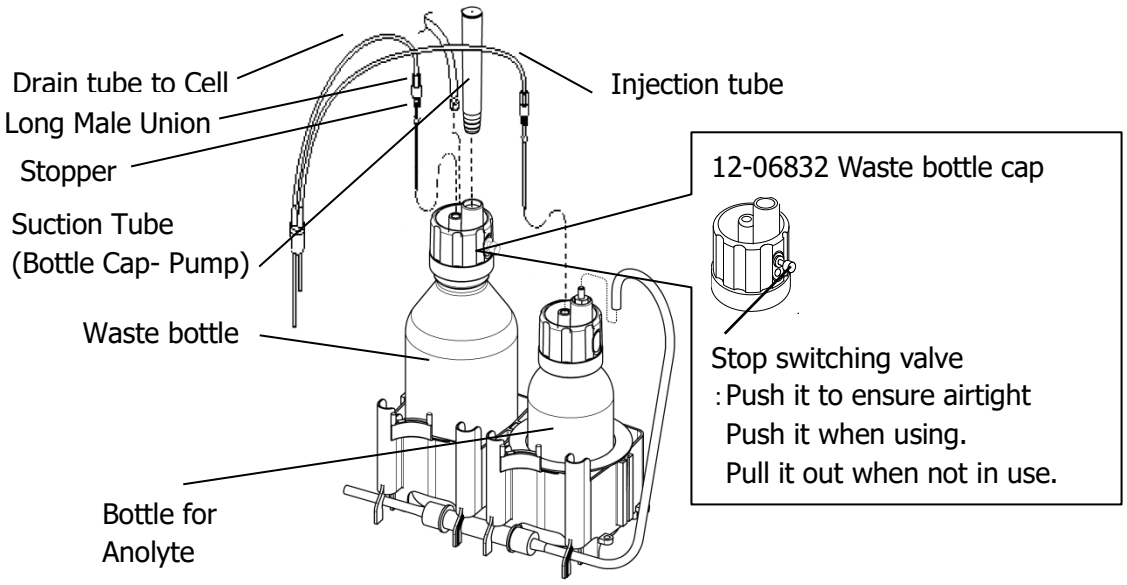
<Do not use the standard drain pump with the following Anolyte:>

	KEM	Hydranal	Mitsubishi
Anolyte	AO	AK	AS

Therefore, when using such reagents or samples, change the connecting of the Auto Solvent Change Unit as follows.

<Installation (in the negative pressure)>

Use 12-06832 waste bottle cap as a waste bottle cap.
Connect the Drain tube to Cell to waste bottle. (Use Stopper and Long Male Union supplied to Drain tube to Waste Bottle.
Connect the Suction tube (Bottle Cap – Pump) to waste bottle.
Connect the Suction tube (Bottle Cap – Pump) to magnetic stirrer back side pump IN.



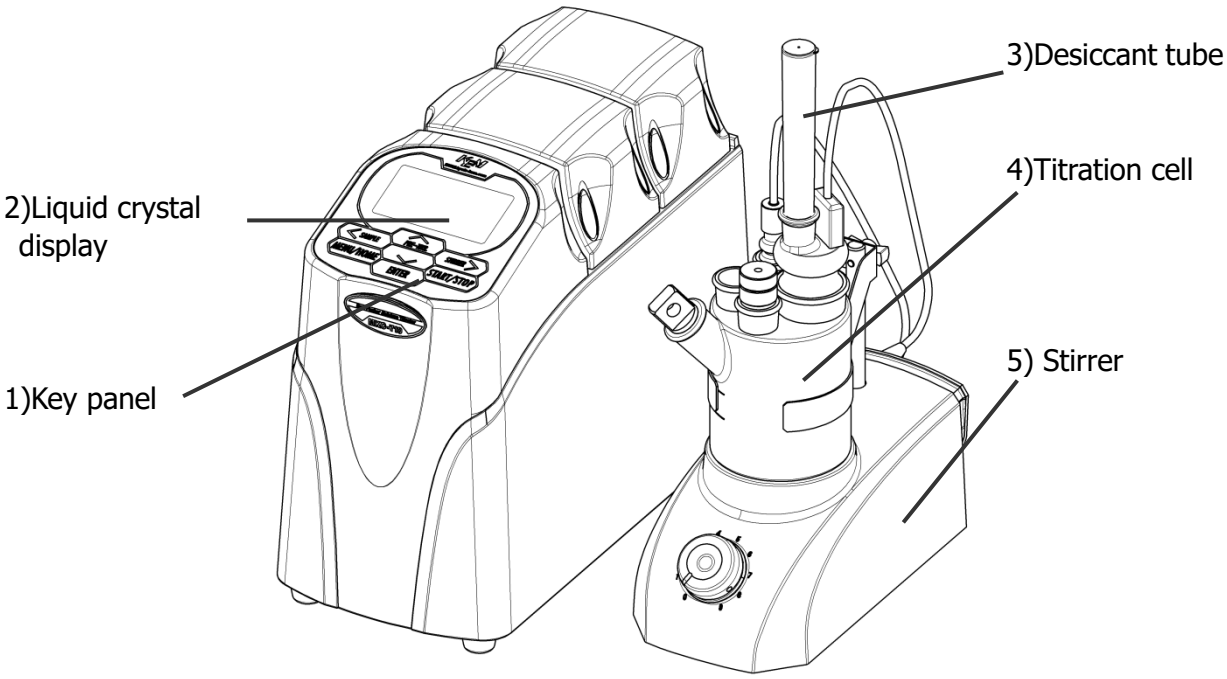
Note Please refer to a previous page for the connection of other parts.

Note Pull out the stop switching valve when the drain operation is not done.
When the stop switching valve is in the pressed-in, the solution in the titration cell may enter the waste bottle with temperature change.

2. Parts configuration and each function

2-1. **Appearance and Name**

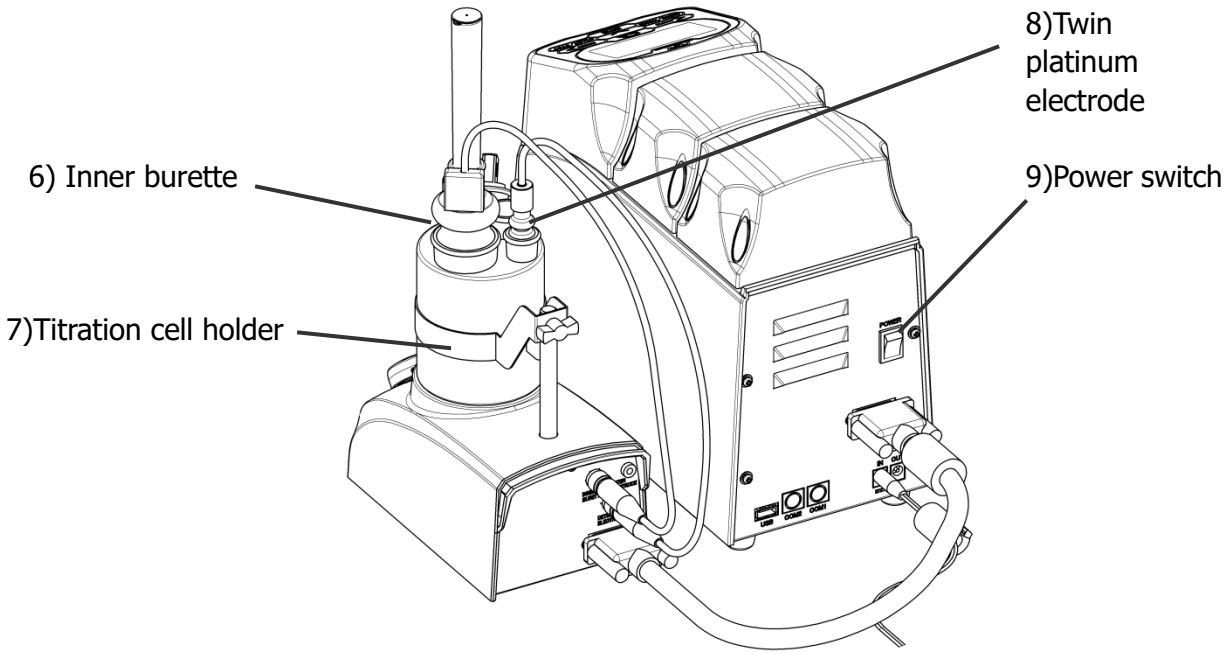
＜Front＞



1) Key panel
   Use for each setting.
2) Liquid crystal display
   Display the measurement result or parameters.
3) Desiccant tube
   The gas fume from titration cell is exhausted through this tube.
4) Titration cell
   The iodine generated in electrolysis and water in sample reacts here.
5) Stirrer
   Measuring unit for Karl Fischer titration with a magnetic stirrer.

   0（STOP） → 9（FAST）

＜Back＞



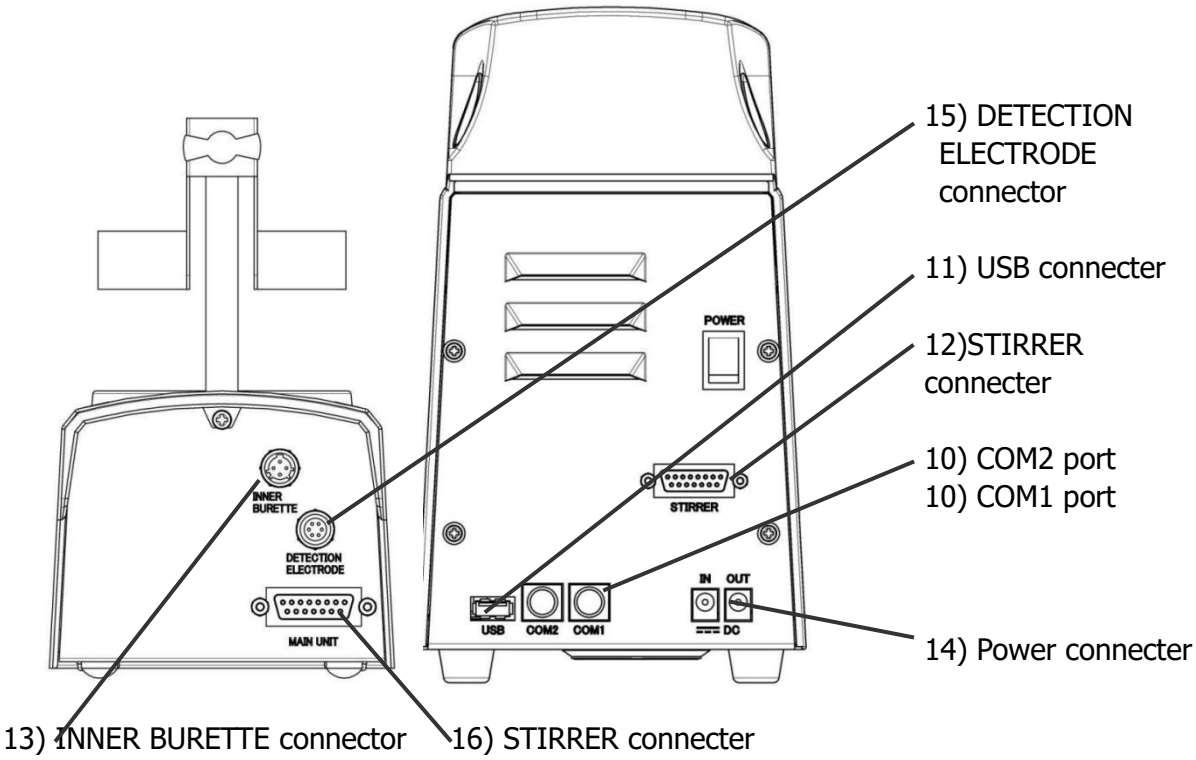
6) Inner burette
The anode and cathode liquid reacts here for electrolysis.

7) Titration cell holder
This is the lid for titration cell.

8) Twin platinum electrode
This electrode detects the potential level of the anolyte inside the titration cell.

9) Power switch
This switch turns on or off the unit.

＜Rear Connector＞



10) COM1 and COM2 port
These ports are for connections to Dot printer, Balance or PC. Dot printer can be connected only COM1 port.

11) USB connecter
This connects USB flash drive to store the measurement result and method.
Moreover, can be connected USB printer, the key board for inputting letters, the barcode reader for sample setting or the foot switch that can start to measure without touching the unit. The control with PC and the data communication with PC are possible by connecting PC (special data installation software "SOFT-CAP" is necessary).

12) STIRRER connecter (to Stirrer)
This connects the stirrer to stir sample solution.

13) INNER BURETTE connector
The inner burette for electrolysis electrode is connected here.

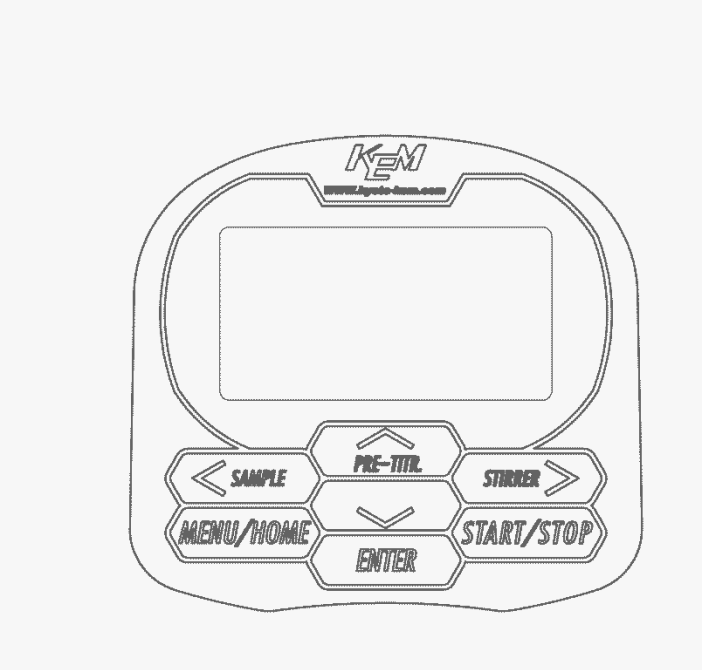
14) Power connecter
This is for connecting the power cable.

15) DETECTION ELECTRODE connector
The twin platinum electrode is connected here.

16) STIRRER connecter (to MAIN UNIT)
The connecting cable to the stirrer is plugged in here.

2-2. **Key functions (general)**

Each key is positioned as shown below:



Description of each key

Key	Description
START/STOP	Key to start titration and to stop measurement on the main screen. Key to return to the previous screen on a screen other than the above.
MENU/HOME	Key to move to menu screen from the main screen and to set the parameter. Also key to return to the main screen from each input screen.
∧ PRE-TITR.	Key to start/stop pretitration. Cursor key and to change number.
∨	Cursor key and to change number.
<SAMPLE	Cursor key and to move to the sample setting screen from the main screen. Parameter regarding the sample such as number or size can be set on the sample setting screen.
STIRRER>	Cursor key and to operate On/Off of the stirrer on the main screen.
ENTER	Key to confirm.

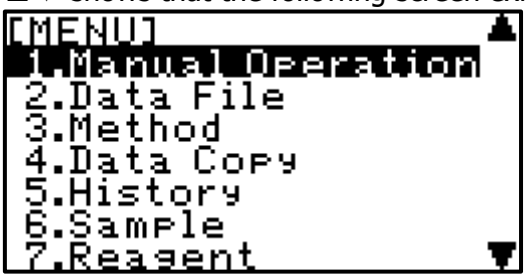
After the stirrer is stopped with the stirrer key, if you turn the knob of the stirrer main unit, the stirrer rotates by the setting speed of the knob.

2-2-1.Basic key operation

<Select menu>

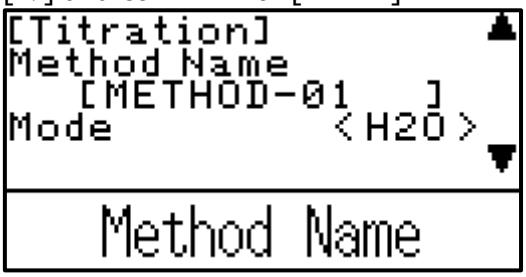
Menu screen displays when [MENU/HOME] is pressed. To select an item on the menu, move the cursor with [↑], [↓] and confirm with [ENTER].

▲▼ shows that the following screen exists.



<Select parameter>

To move parameters, use [↑], [↓]. When an item on the screen is shown by < ○○○ > parenthesized, it must be selected by key entry. To show item for selection, use [←], [→] and confirm with [ENTER].



<Entry of parameter and character>

Parameters shown by [△△△] in parenthesis on the screen are set the alphabetic with [↑][↓] after moving the cursor with [↑][↓] and pressing [ENTER] or [←][→]. The movement of inside [ ] is operated with [←] [→] and confirmed with [ENTER]. The character is changed with [↑] in order in the following tables, and with [↓] to the opposite direction in the following tables. Input only the number due to the position of " . " are fixed when inputting the number.

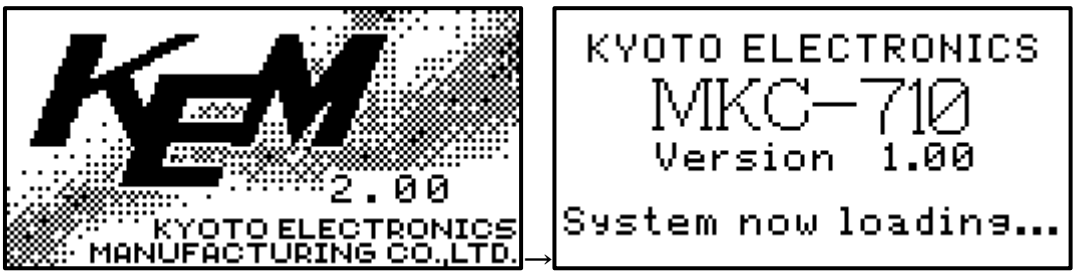
ex)To input C at the uninput cursor position, press [↑] 3 times. Moreover, to input [2] at the uninput cursor position, press [↓] 16 times. [−] is input with [↑][↓] when inputting the number after moving to the left with [←]. Input only the number due to the position of " . " is fixed when inputting the number after matching the digit with [←][→].

Table.2-2-1-1

Operation key	[↑]
Alphabetic parameter	(space)→A→B→C→D→E→F→G→H→I→J→K→L→M→N→O→P →Q→R→S→T→U→V→W→X→Y→Z→0→1→2→3→4→5→6→7 →8→9→ . →−→+→／→×→ (→) →%→(space)
Numeric parameter	(space)→0→1→2→3→4→5→6→7→8→9→−→(space)

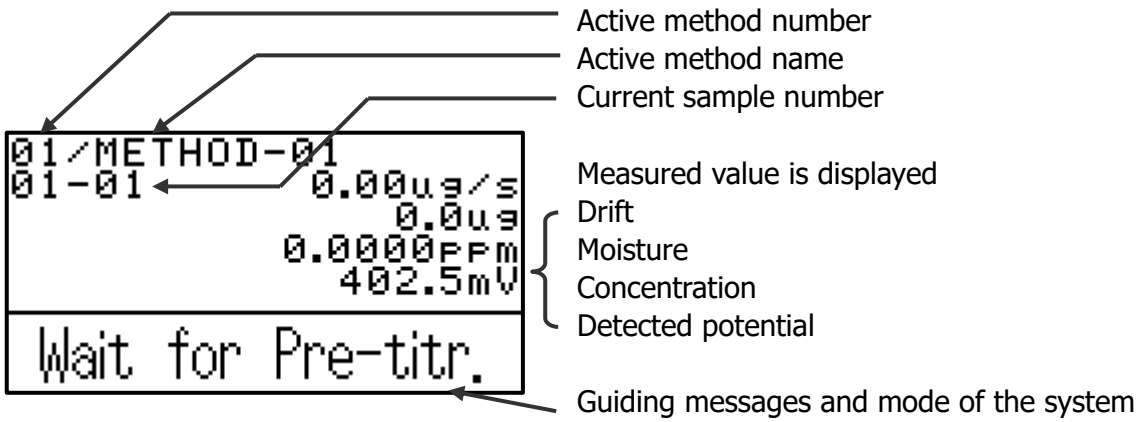
2-2-2.Description of display messages

When the power is turned on, the initial displays appear one after another as follows:



When the main screen displays, it is the standby mode ready for titration.

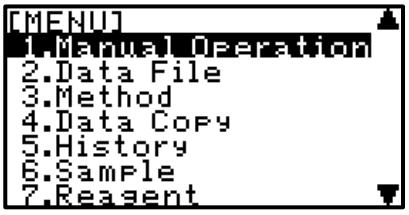
< Main screen **>**



2-3. **Setting Language**

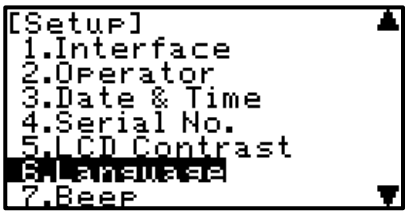
Set language displayed on the screen.

1) Press [MENU/HOME].



2) Press [↑] twice, select 8.Setup and [ENTER] to confirm.

3) Press [↓] 5 times, select 6.Language and confirm with [ENTER].

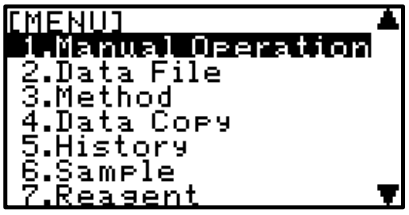


4) Select language with [←] [→] and confirm with [ENTER].

2-4. **Setting date and time**

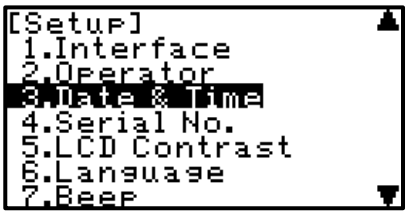
Set date and time.

1）Press [MENU/HOME].



2）Press [↑] twice, select 8.Setup and [ENTER] to confirm.

3）Press [↓] 2 times, select 3.Date &Time and confirm with [ENTER].



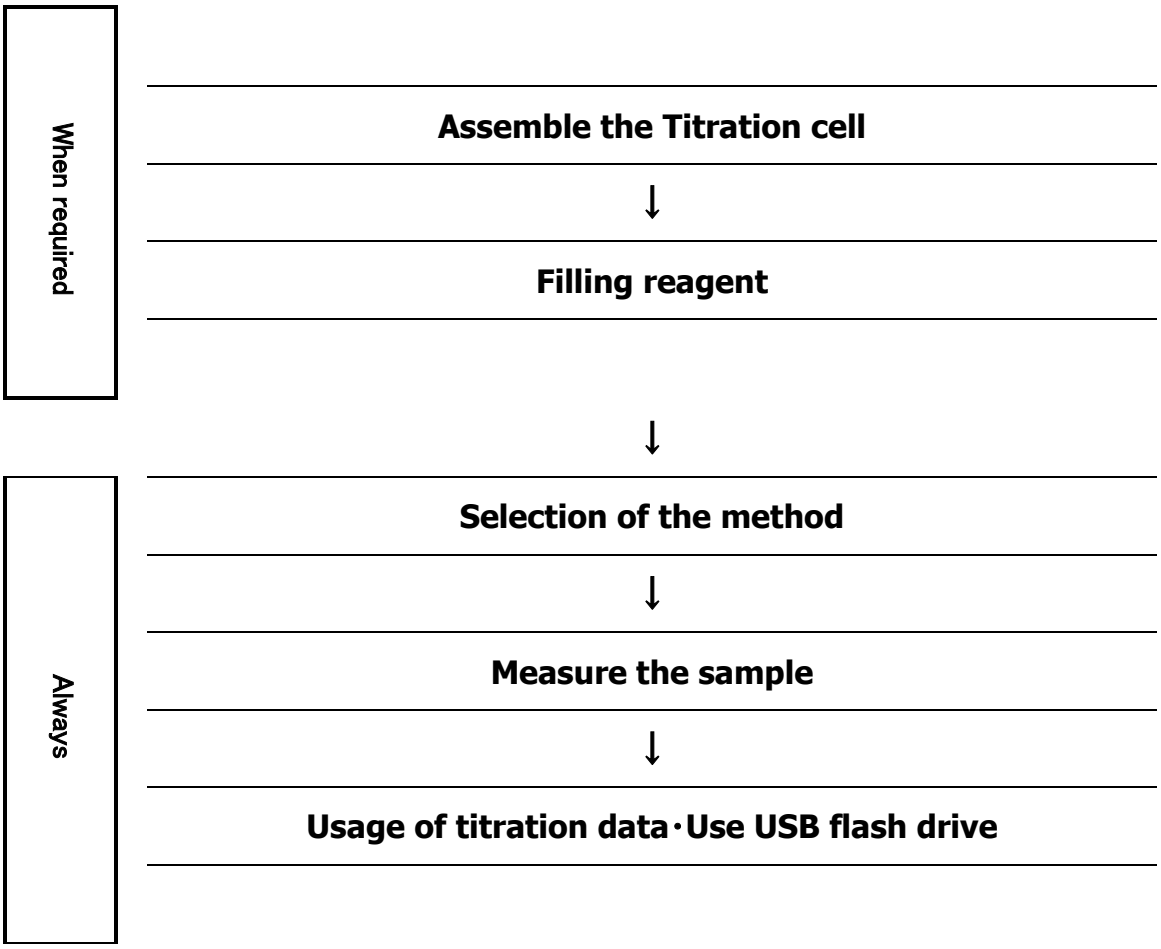
4）Select "Date Style" with [←][→] and confirm with [ENTER]. Press [ENTER] at "Date" and "Time",
set with each of [↑] [↓] [←] [→], and confirm with [ENTER].
Move the cursor to [Exit] and with [ENTER] to escape from the screen.

The time of clock starts when "Time" is confirmed with [ENTER].

3. Basic operation

Here is the description on basic measurement sequence.

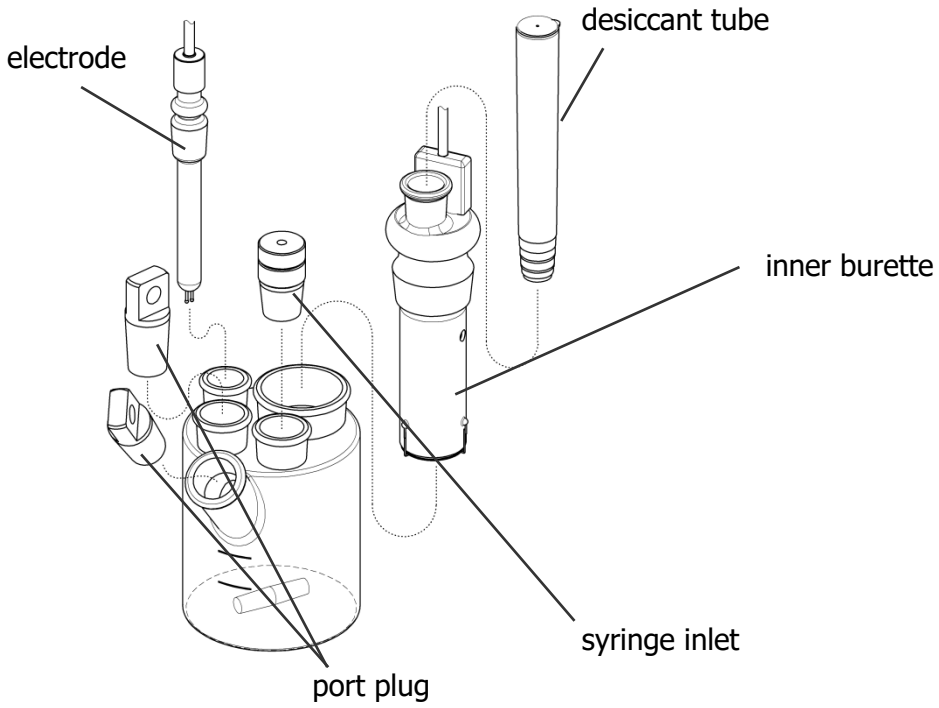
3-1. Sequence of measurement



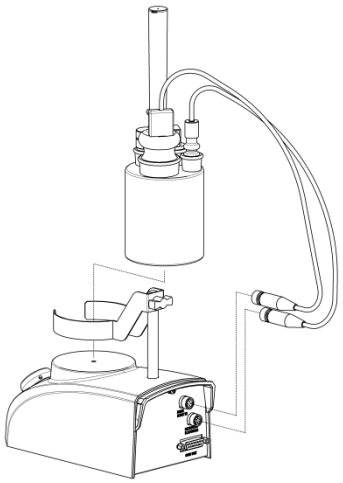
3-2. **Assemble the Titration cell**

Assemble the Titration cell

1) Put a stirrer rotor into the cell, and install the inner burette, the electrode, desiccant tube A, the port plug and syringe inlet.



2) Place the titration cell onto the titration holder, and plug in the cable from the inner burette and the electrode. Tighten the plug screws firmly.



Note

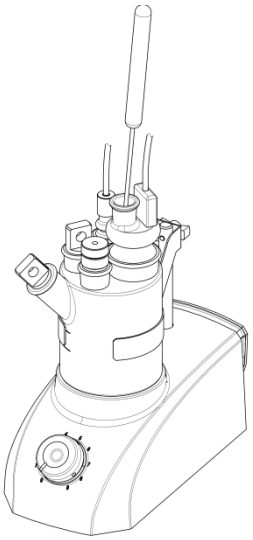
Make sure to apply KF grease around glass sliding area.

3-3. **Filling reagent and draining**

3-3-1. Catholyte

＜ **Injection** ＞

1) Inject 5mL catholyte into the inner burette using a syringe. (The lower line outside the cell shows approx.5mL.)

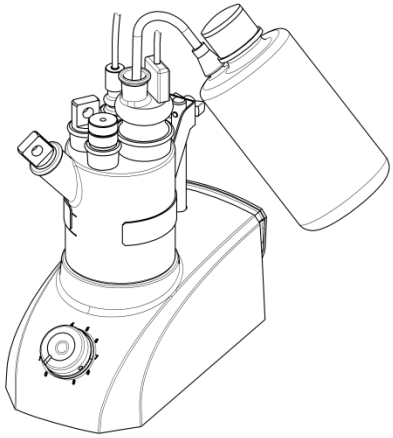


2) After changing catholyte, to change the life value of catholyte to zero.

To change the life value of catholyte to zero, press [Reagent]→[Cathode]→[Life] →Select reagent of current life value→set [0] → [Enter].

＜Drain＞

1) To drain out the liquid, use the supplied washing bottle for draining.



Note

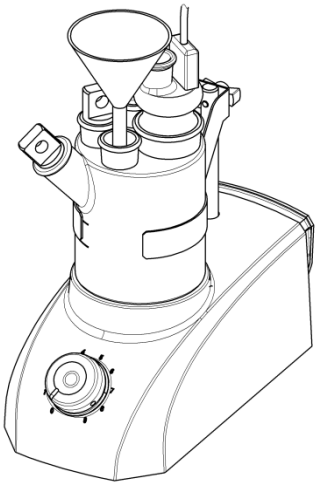
When one component cell is used for inner burette, catholyte is not needed

3-3-2. Anolyte

＜When do not use the Auto Solvent Change Unit ＞

＜Injection＞

1) With Funnel, pour a solvent into the titration cell. Fill the titration cell with 100mL reagent for two component cell, and fill the titration cell with 150mL reagent for one component cell. The lower line outside the titration cell indicates approx.100mL line for anolyte, and the middle point between upper and lower line marked outside the titration cell indicates approx.150mL line for anolyte.)

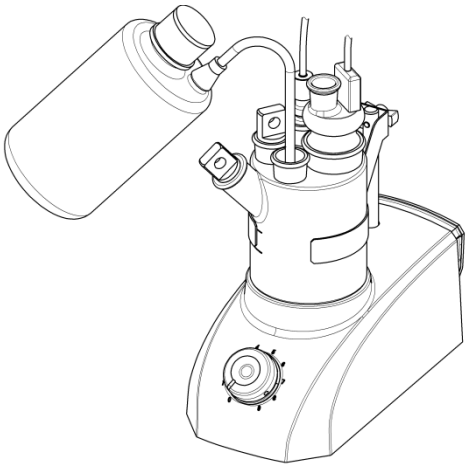


2) After changing anolyte, change the life value of anolyte to zero.

To change the life value of catholyte to zero, press [Reagent]→[Anode]→[Life] →current life value→[0]to[ENTER]key

＜Drain＞

1) To drain out the liquid, use the supplied washing bottle for drainingct.



＜When use the Manual Solvent Change Unit ＞

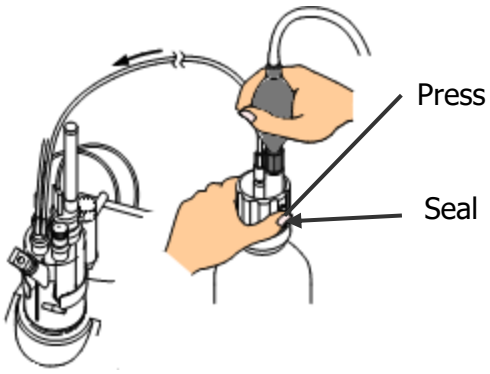
1 **＜Injection＞**

To fill the reagent, pump the rubber glove with fingers while holding the seal of reagent bottle cap.

Fill the titration cell with 100mL reagent for two component cell, and fill the titration cell with 150mL reagent for one component cell.

(The lower line outside the titration cell indicates approx.100mL line for anolyte, and the middle point between upper and lower line marked outside the titration cell indicates approx.150mL line for anolyte.)

To stop filling, detach your finger which is holding the seal.



＜To fill the reagent＞

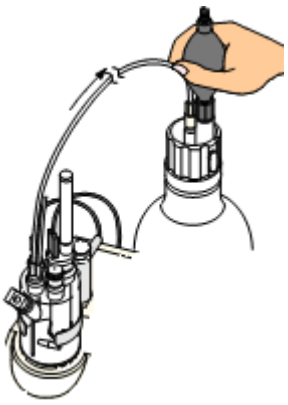
2 After changing anolyte , change the life value of anolyte to zero.

To change the life value of catholyte to zero, press [Reagent]→[Anode]→[Life] →current life value→[0]to[ENTER]key

3 **＜Drain＞**

To drain it out, pump the rubber glove of drain bottle a few times.

The used reagent in the cell transfers to the waste bottle.



＜Drain out＞

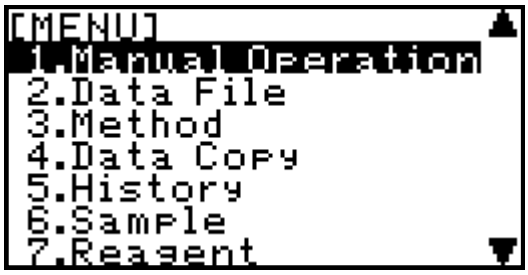
＜When use the Auto Solvent Change Unit ＞

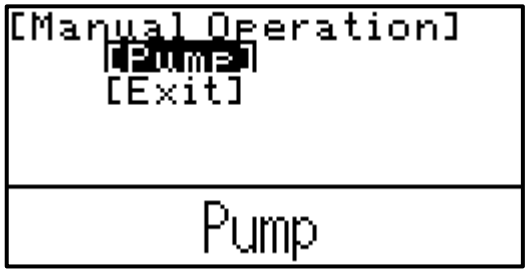
＜Injection ＞

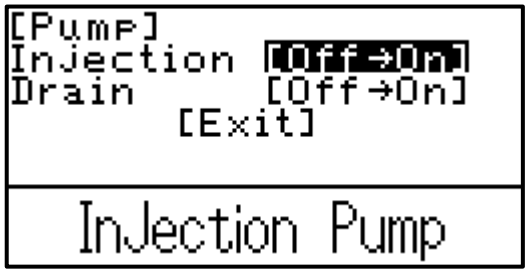
1) Press [MENU/HOME] key.
Select "1.Manual Operation" and press [ENTER] key. Select [Pump].
Press Injection Pump [On] key to inject anolyte into the titration cell. Fill the titration cell with 100mL reagent for two component cell, and fill the titration cell with 150mL reagent for one component cell.
(The lower line outside the titration cell indicates approx.100mL line for anolyte, and the middle point between upper and lower line marked outside the titration cell indicates approx.150mL line for anolyte.)

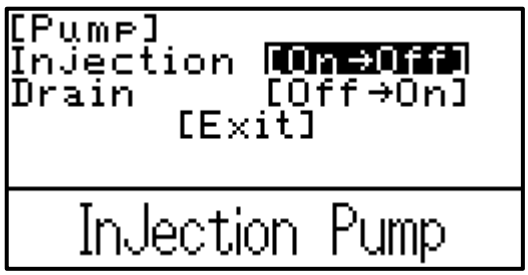
[Off→On] key automatically changes to [On→Off] at this time.

Press Injection Pump again, and injection will stop.







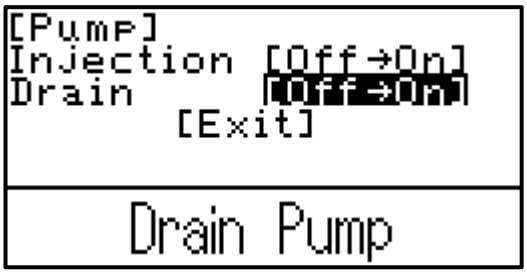


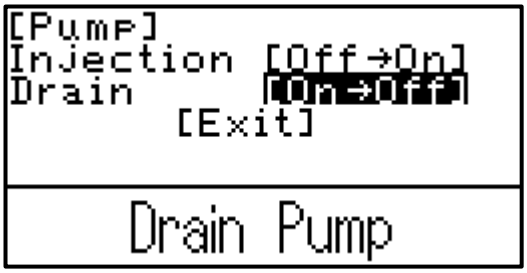
2) After changing anolyte, set the life value of anolyte to 0.

To change the life value of anolyte to zero, press [Reagent]→[Anode]→[Life] →current life value→[0]to[ENTER]key

<Drain>

1) Press Drain Pump [On] key to drain waste liquid.



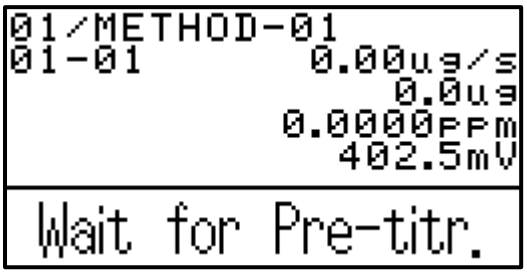


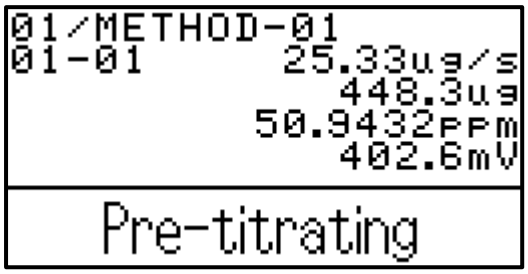
Note Do not use the Auto Solvent Change Unit for those samples which are hard to dissolve or insoluble in solvent in order to avoid clogging of drain tube. Such waste liquids, if spilled, after measurement may corrode the tube connectors causing the Auto Solvent Change Unit malfunction.

Note Change the connecting of the Auto Solvent Change Unit for those samples which are oily in order to avoid damage of drain tube.

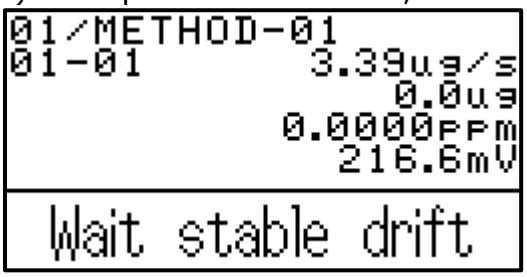
3-4. **Measure the sample**

1) The Karl Fisher reagent after a period of storage may have absorbed moisture, and correct measurement for water content cannot be expected if it is directly used.
   Press ［↑ PRE-TITR.］key to start pretitration. The display will show the message of pretitration going on.

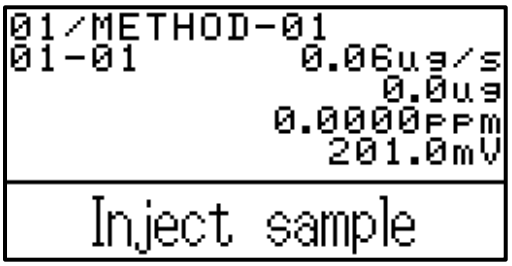




2) After pretitration is finished, it will shift to Standby mode.



3) Press［START/STOP］key.The message "Inject sample" on display.



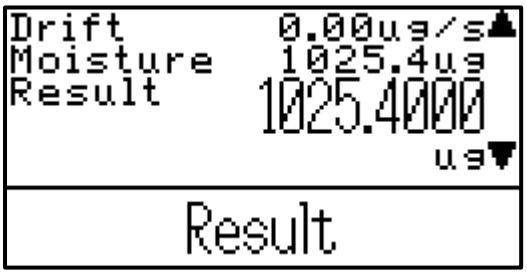
4) Weigh the syringe with sample in it, and record the weight (Wt1).
5) Press [SAMPLE] key and enter the weight of 4) in [Wt1].
   Sample name and sample ID can be entered in the same manner.

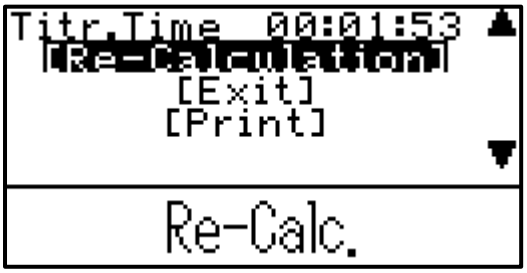
6) inject the sample into the cell, and then, press [Start]。

7) weigh the syringe after sample is injected, and record the weight (Wt2)

※Press [START/STOP] again when the measurement is discontinued on the way.

8) When titration is finished by reaching an endpoint, the results will be shown on the screen.



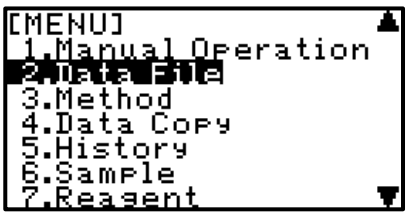


A setup of font size is Please refer to 6-10. "Other "

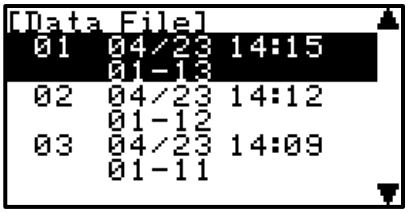
3-5. **Re-calculate titration data**

Result of size, unit, blank and factor, and print format can be changed.

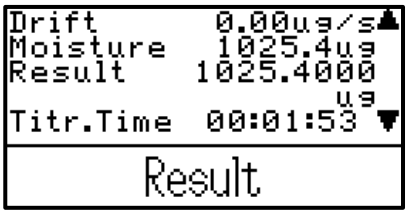
1) Press [MENU/HOME], select "2.Data File" with [↑] [↓] and press [ENTER].



2) Select the result with [↑] [↓] and press [ENTER].



3) Select [Re-Calculation] and confirm with [ENTER].



4) Change the sample size, unit, print format with [↑] [↓] [←] [→], and move the cursor to [Execute] and press [ENTER] to re- calculate.
ex)Change the sample size

Note Move the cursor to [Exit] and press [ENTER] if the change is not executed.

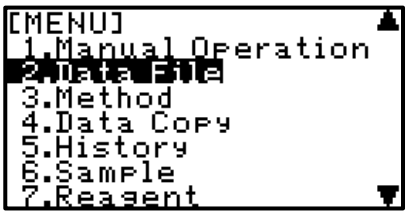
5) Select “Size” with [↑] [↓] and press [ENTER]. Change the sample size with [↑] [↓] [←] [→] and press [ENTER].

6) Move the cursor to [Execute] with [↑] [↓] and press [ENTER] to re- calculate.
Move the cursor to [Exit] and with [ENTER] to escape from the screen.

3-6. **Batch processing of titration data**

Batch the calculated data on the list. The batch calculation determines Mean value, Standard deviation (SD) and Relative standard deviation (RSD).

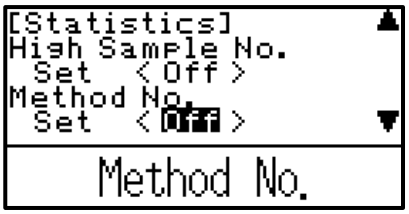
1) Press [MENU/HOME], select "2.Data File" with [↑] [↓] and press [ENTER].



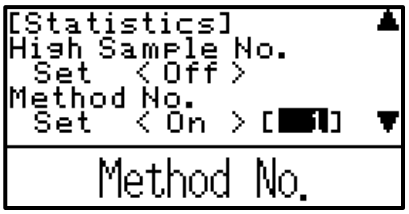
2) Move the cursor to [Statistics] with [↑] [↓] and press [ENTER].

3) Sort out the data for batch calculation. Select High Sample No., Method No. and Date with [↑] [↓] [←] [→], and move the cursor to [Execute] and press [ENTER] to batch.
ex)Sort out Method No. and Date

4) Select "Method No." with [↓] and press [ENTER]. Change "On" with [←] [→] and press [ENTER].

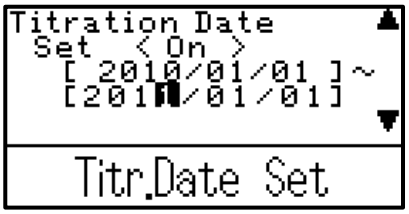


5) Set Method No. with [↑] [↓] [←] [→] and press [ENTER].



6) Change “Titr. Date” to “On” with [←] [→] and press [ENTER].

7) Set the term of date with [↑] [↓] [←] [→] and press [ENTER].



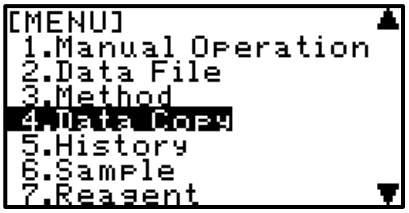
8) Press [ENTER] to batch at [Execute] and the result is displayed.
Move the cursor to [Exit] and with [ENTER] to escape from the screen.

The result can be excluded from the batch calculation by pressing [←] on the result list. “*” is displayed ahead of the exclude result.

3-7. **Read Data, Store in USB Flash Drive**

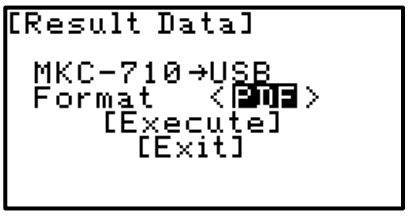
Store the result data in USB and can be used on PC.

1) Press [MENU/HOME], select “4.Data Copy” with [↑] [↓] and press [ENTER].

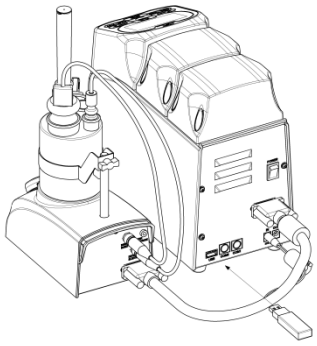


2) Select “1.Result Data” and press [ENTER].

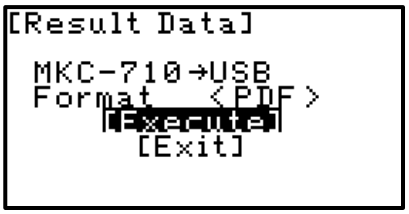
3) Select the stored format, which is CSV or PDF with [←] [→] and confirm with [ENTER].



4) Insert USB to the USB connecter.



5) Move the cursor to [Execute] with [↑] [↓] and press [ENTER].



6) Select [Yes] with [↑] [↓] and press [ENTER] to store.

Note

USB of FAT16 and FAT32 format can be used. However all operation of USB is not guaranteed.
Remove USB only after saving data is complete.
When data reading is underway, all buttons stop functioning.
Never remove it halfway. Otherwise, it may be broken.
There is no guarantee of data stored in USB flash memory regardless of any failure source. Make sure to backup data routinely as necessary with your responsibility.

All date of the result is collectively stored.

[Format]

- PDF : Select this when saving a file in PDF format or when using data with Tview6. Use this format when sending measurement results to KEM or your nearest distributor.
- CSV : Saved in 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.

Note It takes about six (6) seconds to save one measurement data in PDF format to a USB flash drive.

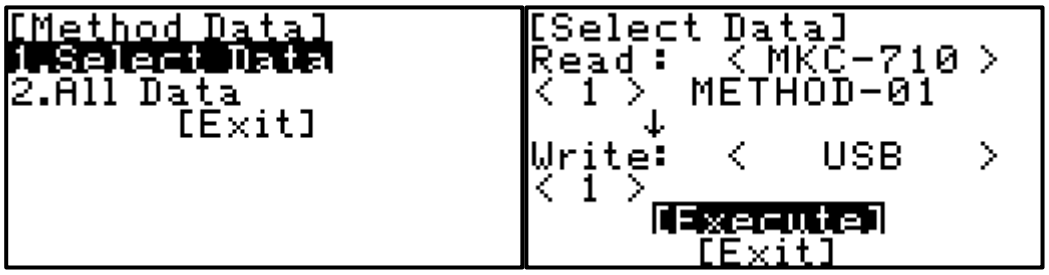
Note If you will save the 100 measurement results in PDF in USB memory, the capacity is about 2.5M byte.

3-8. **Saving Method Conditions, Setting Up on PC**

Method conditions can be saved to a USB flash drive. They can also be copied from a USB flash drive to the titrator.

Press [MENU/HOME] key on the main screen. Select "4. Data Copy" and press [ENTER]. Select "2.Method Data" and press [ENTER].

Note This function is not available when method contents are locked. Follow the steps in 4-1 and unlock method first.



Select how you wish to save method conditions.

Item	Description
1. Select Data	Copies each method individually. Select a method No. of either MKC-710 or the USB flash drive, and select the method No. of MKC-710 or the USB flash drive to which you wish to copy. Then execute copying.
2. All Data	Copies all data at a time. Select "MKC-710→USB" or "USB→MKC-710." Then execute copying.

[Execute]

Copies the titration method to a USB flash drive or to MKC-710 as you have desired. Move the cursor here and press [ENTER].

4. Method

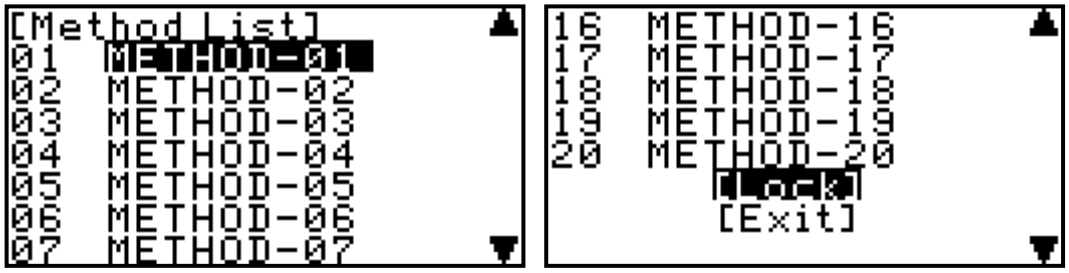
4-1. **Method**

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.

MKC-710 can store standard methods (No. 01 through 20). Each method can be named individually.

A Method consists of, [Titration parameter], [Calculation parameter] and [Report parameter].

To edit a method, press [MENU/HOME] on the Main screen to display "3.Method", and put the cursor on the method to be edited, followed by pressing [ENTER] key.



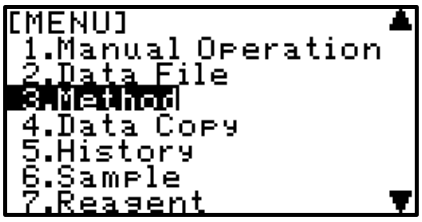
Each parameter can be selected with corresponding Key on display.

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

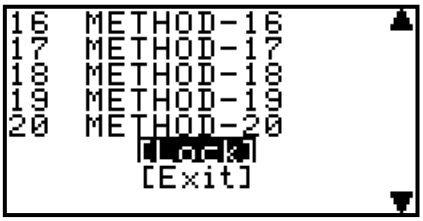
[Lock]
Protects method contents.

Setting up a lock on method

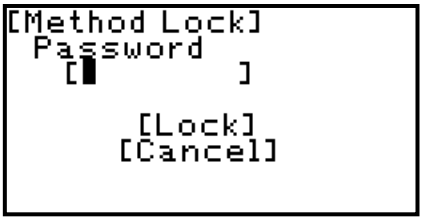
1) Press [MENU/HOME].
2) Select "3. Method" and press [ENTER].



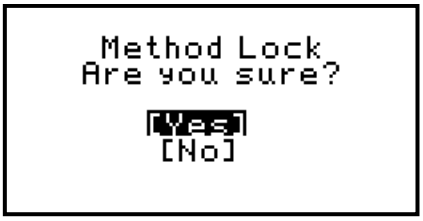
3) Select "Lock" with [↑] [↓] and press [ENTER].



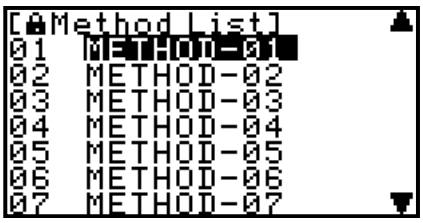
4) Enter your password in "Password" with [↑] [↓] [←] [→] and press [ENTER].
5) Move the cursor to [Lock] and press [ENTER].



6) Select "Yes" with [↑] and press [ENTER].

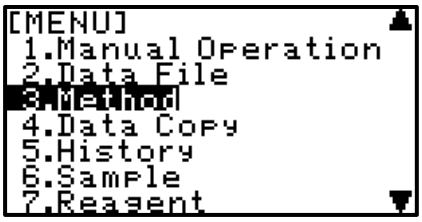


7) An icon of key will appear next to "Method List," and method contents are now protected.

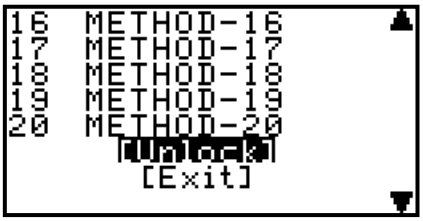


Unlocking method

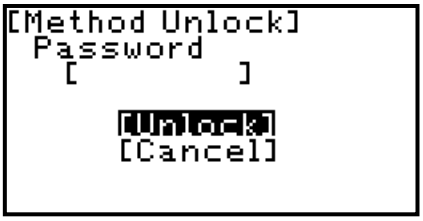
1) Press [MENU/HOME].
2) Select "3. Method" and press [ENTER].



3) Select "Unlock" with [↑] [↓] and press [ENTER].



4) Enter your password in "Password" with [↑] [↓] [←] [→] and press [ENTER].
5) Move the cursor to [Unlock] and press [ENTER]. Method is now unlocked.

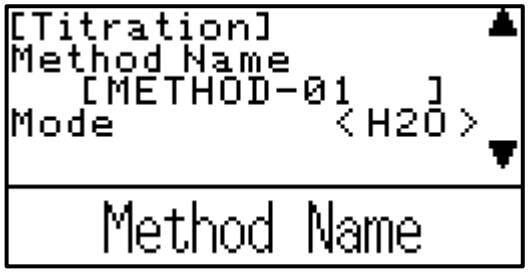


Note Once method is locked, "2. Method Data" on Menu 4. Data copy may not be used. Once method is unlocked, "2. Method Data" on Menu 4. Data copy may be used.

4-2. **Titration Parameter**

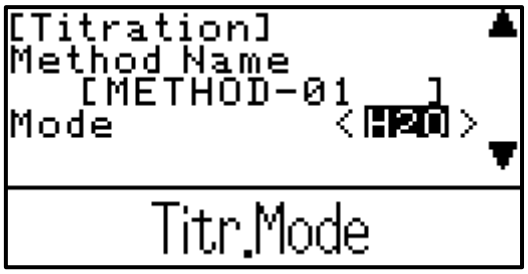
Setup the general parameters relevant to titration.

Select [Titration] on the screen where you have selected the method, and press [ENTER]. "Titration" screen will then appear.



[Method Name]

Setup Method Name. The character can be set up to 10.

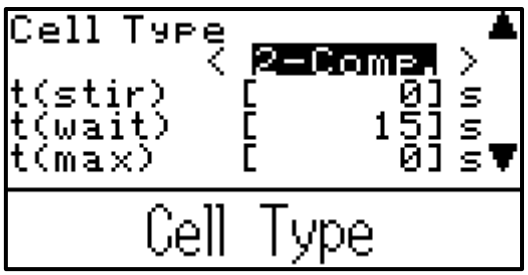


[Titration Mode (Mode)]

Titration mode is selective as follows.

H2O : This mode is selected for measurement of water content, for regular moisture titration.

Br2 : This is for measurement of bromine number

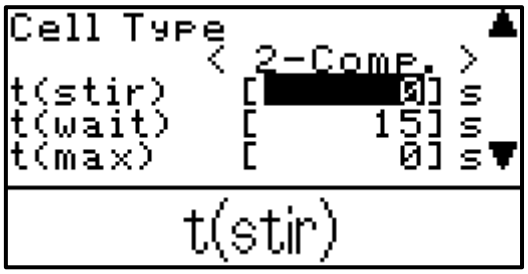


[Cell type]

Selection of titration cell type:

2-comp. : This cell is generally used for titration with anode/cathode reagent using an electrolytic electrode with diaphragm.

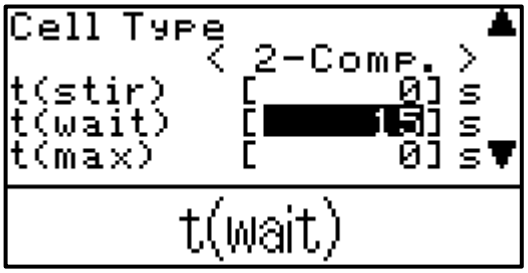
1-comp. : This cell is generally used for titration using anode reagent (anolyte) only and diaphragm-less electrode.



[t(stir)]

Select a time length to wait for titration (electrolysis) start after a sample is discharged into the titration cell, particularly for those samples which are hard to dissolve in the anolyte and difficult to extract moisture.

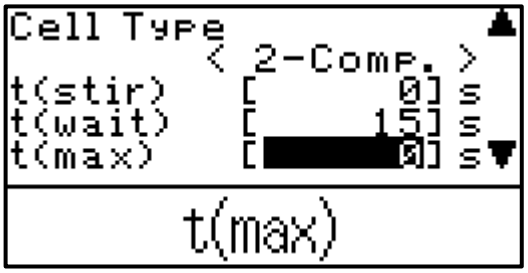
- 0 – 99999s



[t(wait)]

Enter the shortest time length for a measurement from start to end in case a plural number of inflection points exist or unexpected endpoint is detected due to fluctuating drift level.

- 15 – 99999s



[t(max)]

Limit a time length for a titration (electrolysis). This means the total time length from start to end is [t(stir)] + [t(wait)]+ [t(max)].
The printing covers the measuring process.
[t(max)=0] means titration will not terminate by time limit. This is useful when an oven is connected and End point is hard to be found due to drift.

- 0 – 99999s

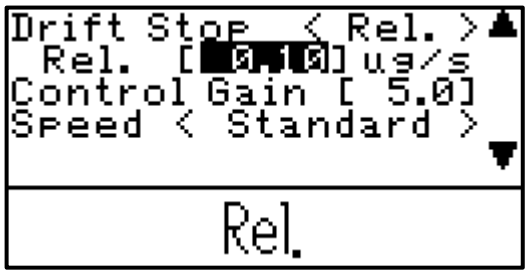
[Drift Stop]

Selection of three modes by drift level as follows:

- Off ： Regardless of drift level, end point is determined when [t(stir)]+ [t(wait)]+ [t(max)] elapses. This mode is useful when end point is not found by drift or when the amount of water extraction per unit time is needed.

- Rel. ：This mode determines end point when the drift level during titration goes down below [Drift at time of start] + [Relative drift]. This mode is typical for regular direct titration method.

- Abs. ：Regardless of drift level at start, end point is determined when the drift level during titration goes down below [Absolute drift] level. In this mode, titration will not end if the drift level at the end of titration goes up. To prevent this, select a [t(max)]to end the titration.



[Rel.]

Here you enter a relative drift level. This entry appears only when "Drift stop" is set to "Rel.".

- 0.00 – 9.99 μg/s

[Abs.]

Enter an absolute drift level. This entry appears only when "Drift stop" is set to "Abs."

- 0.00 – 9.99 μg/s

[Control Gain]

Here you enter a coefficient for electrolysis speed, typically 5.0. If reaction speed is so fast that an over-titration is expected, decrease the value. To the contrary, if reaction speed is expected to be slow with a sample which contains a large amount of water, increase this value.

- 1.0 – 9.9

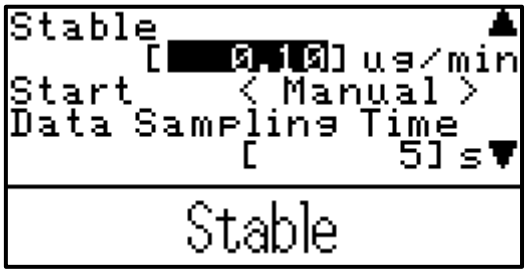
[Electrolysis speed]

Selection of electrolysis mode:

- Standard : Use this mode for regular type of measurement.
- Fast : Use this mode for a sample with water more than 5000ug/H_2O.

Note

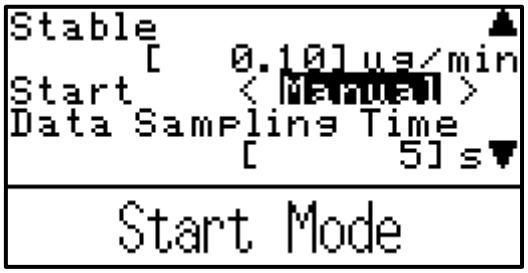
Measurement results may be deviated with "Fast" mode more than "Standard". Check on the expected precision with the sample you are going to measure.



[Stable]

To display "Stable" status, you need to enter the drift change rate ∆ug/min. Typically for regular moisture titration, enter · 0.1ug/min and for bromine number, ∆0.5ug/min. The "Stable" message appears when the rate of drift change goes down lower than preset level. Select a larger amount for the rate in case the moisture in carrier gas is unstable to start titration. However, this means it will increase the error and deviation of measurement results.

- 0.00 – 99.99 μg/min

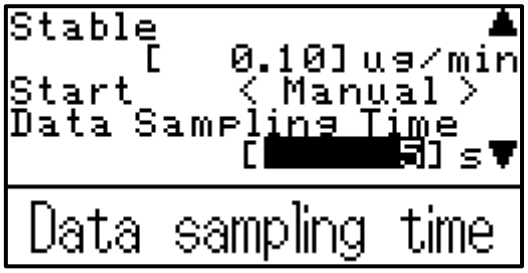


[Start Mode]

Selection of titration start:

・ Manual ：Use this mode for blank test or for samples with a small amount of water.

・ Auto ：Titration starts automatically by sensing water increase in the sample after discharged into the cell.



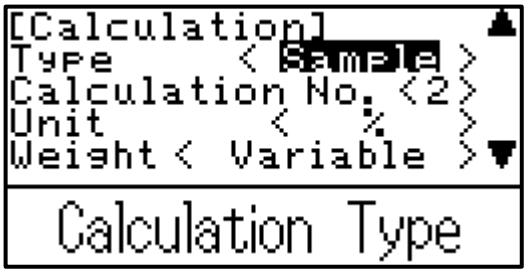
[Data sampling time]

Select a time interval for data sampling. Titration volume and accumulated amount will be automatically sampled at the interval of an input time.

・ 1 – 99999s

4-3. **Calculation parameter**

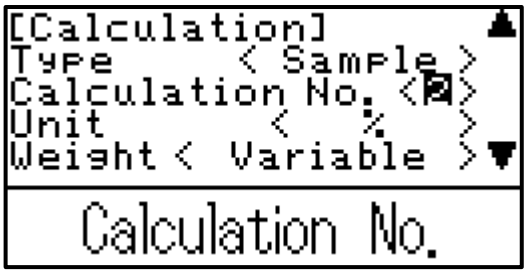
Equation for concentration calculation is set.



[Calculation Type)]

Selection of calculation type:

- Sample :Set up a Method for sample measurement.
- Blank :Set up a Method for blank measurement.
- Check :Set up a Method for check measurement with standard substance.



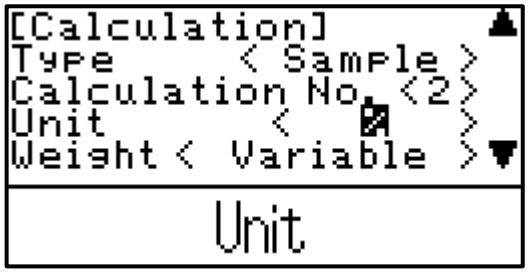
[Calculation No.]

Here you select the numbered equation. Choose Eq.1 for water content and Eq.2 for concentration:

- For titration mode of H2O 1 - 6
- For titration mode of Br2 7 - 8

For calculation units and numbers, refer to"4-4. Calculation formula".

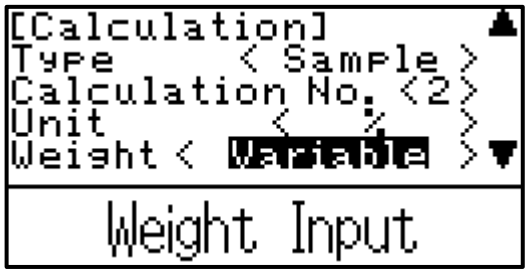
Note



[Unit]

Here you select a unit used in calculation.

Note For calculation units and numbers, refer to"4-4. Calculation formula".



[Weight Input]

Select how to enter weight of sample.

・Fixed : "Fixed" is concentration calculation by constant sample weight.

・Variable : "Variable" is calculation by individual sample weight at each time.

This setting is for Calc.No.2, 3, 6 only, and not available for Calc.No.1, 4, 5.

The weight is entered by [Sample] key.

[Drift Comp.]

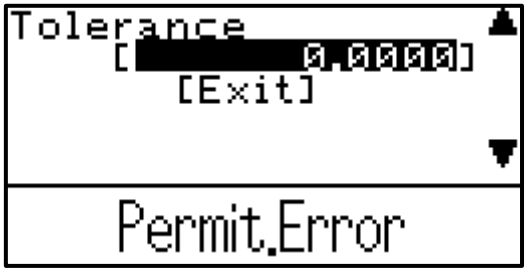
Selection of drift compensation:

- Off : No compensation is made. Select this to know total water content including drift.
- Manual : Enter offset value. This is useful when there is much difference in drift level between start and the end of titration.
- Auto : The drift level is automatically corrected with the level at time of start.

[Standard Value]

Enter a standard value to make the evaluation in the following range:

- 0.0000～99999.9999



[Permit. Error]

Enter permit error to determine if the calculation result is off the range against the standard value.

- 0.0000 – 99999.9999

4-4. **Calculation formula**

Calc. No.	Purpose	Equation
1	Calculation of water content	$FA \times (Moisture) \times k$ Unit: µg (k=1), mg (k=0.001)
2	Concentration of liquid or solid by weighing	$FA \times \frac{Moisture}{Wt1 - Wt2} \times k$ Unit: %(k=0.0001),ppm, mg/kg, µg /g (k=1)
3	Concentration of a weighed part of water in liquid or solid dissolved with solvent extraction	$FA \times (\frac{Moisture}{Wt1 - Wt2} \times \frac{B + Wt0}{Wt0} - \frac{A \times B}{Wt0}) \times k$ Unit: %(k=0.0001),ppm, mg/kg, µg /g (k=1)
4	Concentration when the volume of liquid sample is measured	$FA \times \frac{Moisture}{V1 \times Dens} \times k$ Unit: %(k=0.0001),ppm, mg/kg, µg /g (k=1)
5	Concentration when the volume of gas sample is measured	$FA \times \frac{(Moisture) \times 22.4}{V2 \times 18} \times (1 + \frac{Temp.}{273}) \times k$ Unit: %(k=0.0001),ppm, mg/kg, µg /g (k=1)
6	Concentration of a weighed part of water in solid dissolved with solvent extraction (Sample is not soluble)	$X = \frac{Moisture}{Wt1 - Wt2} \times (\frac{B}{Wt0} + \frac{X}{10^6}) - \frac{A \times B}{Wt0}$ $\therefore FA \times X \times k$ Determine X from this equation Unit: %(k=0.0001),ppm, mg/kg, µg /g (k=1)
7	Concentration when liquid or solid is weighed in bromine number measurement	$FA \times \frac{Moisture}{Wt1 - Wt2} \times D \times k$ Unit : Bromine numberg/100g (k=0.0001) Bromine index mg/100g (k=0.1)
8	Concentration when the volume of liquid sample is measured in bromine number measurement	$FA \times \frac{Moisture}{V1 \times Dens} \times D \times k$ Unit : Bromine numberg/100g (k=0.0001) Bromine index mg/100g (k=0.1)

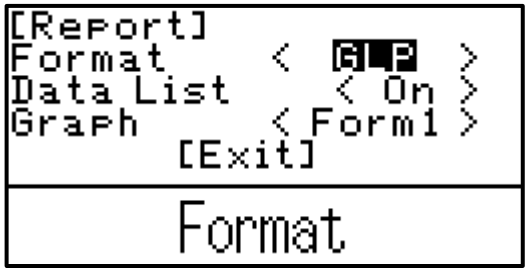
* "Moisture" in the equation is identical to "Data-Drift × (t − t(stir))-Blank ".

< Symbols used in calculation formulas >

Moisture (μg)	: Net water amount Water obtained by subtracting "Drift value x titrating time and Blank value" from total water titrated (electrolyzed).
FA	: Compensation coefficient for calculation results
Data (ug)	: Total water content after electrolysis in the titration cell
Drift (ug/s)	: Drift level which changes by ambient moisture and carrier gas permeating into the titration cell
t (s)	: Titration time length from start to the end of titration after sample is discharged. When titration ends by preset time, it runs for (t(stir)) + (t(wait)) + (t(max)).
Blank (ug)	: Blank level. This is the moisture coming in from other source than sample itself, and must be deducted from titrated water volume.
Wt1 (g)	: The total weight of sample and sampler before sample is discharged. The sample actually discharged is |Wt1 − Wt2|.
Wt2 (g)	: The total weight of sampler and sample residue after sample is discharged. The sample actually discharged is |Wt1 − Wt2|.
Wt0 (g)	: The amount of sample discharged into extracting solvent, a part of which is taken out for measurement
B (g)	: Weight of solvent extraction to dissolve a sample, a part of which is taken out for measurement by Indirect method
A (ppm)	: Water concentration of solvent extraction before the sample is discharged into the solvent in Indirect method.
V1 (mL)	: The amount of sample discharged by volume
Dens (g/mL)	: Density of sample discharged by volume
V2 (L)	: The volume of gas sample
Temp. (°C)	: Temperature of gas sample when measured
D	: Dilution coefficient in measurement of sample for its bromine number
K	: Unit conversion coefficient

4-5. **Report parameter**

Report is set when printer is connected.



[Format]

Selection of print format:

- Short : Prints sample number, measurement date, sample size, measurement results, titration time except measurement condition.
- GLP : Prints all of measurement parameters and results.
- Off : No printout.

[Data List]

Selection of print out of the data list.

- Off : No printout of data list.
- On : Printout of data list.

[Graph]

Selection of graphic print together with measurement results when they are printed out.

- Off : No printout of graph
- Form1 : The accumulated titrated water is printed in graphic form. The axis of accumulated amount is shown in percent, and the evaporation rate against 100% water at EP is shown on display or printed out.
- Form2 : Titration volume (electrolysis) per set time and accumulated amount are shown in graph on display or printed out.

<Print contents>

	Print format		
Item	Off	Short	GLP
Model/Serial No.	Off	On	On
Printed date		On	
Method name		On	
Sample No.		On	
LOT No.		On	
Titration date		On	
Calculation No.		Off	
Drift compensation		Off	
Moisture		Off	
Result		On	
Reagent life		Off	
Titration time		On	
Blank		Off	
Sample size		On	
Sample constant		Off	
Operator		On	

< Example of printout:GLP >

Model	Model : MKC-710
Serial number	Serial No. : 20200001
Printed date	Print : 2014/10/23 17:30
	Recalculation
Method name	Method No./Name 01/ METHOD-01
Sample number	Sample No. : 01-02 (#)
LOT No.	LOT No. : ABCDEFGHIJ
Titration date	Date : 2014/10/23 17:02
Calculation number	Calc.No. : 2
Drift	Drift : 0.05 ug/s
Moisture	Moisture : 109.4 ug
Result	Result : 0.0022 %
Anolyte Capa.	A.Capa. : 1 mg
Catholyte Capa.	C.Capa. : 1 mg
Titration time	Titr.Time: 00:01:00
Blank	Blank : 0.0000 ug
Net weight	Wt1 : 5.0000 g Wt2 : 0.0000 g Net : 5.0000 g
Constant	FA : 1.0000
A comment appears when titration is reset halfway or sample size is input after titration.	(Stop by reset)
Operator: when re-calculated, its person's name appears hereModel	Operator : KEMTARO

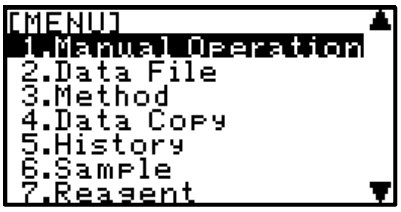
5. Function Tools

5-1. Function

Menu window is a convenient tool to practice exciting features of the unit. To start with, let us learn about Menu window itself.

1) Press [MENU/HOME].

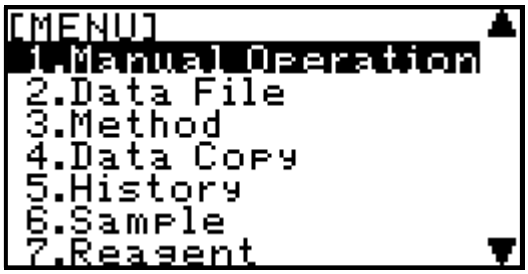
2) Select.

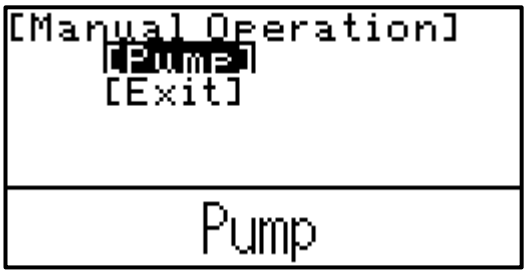


Menu has the following items.

Item	Description
1. Manual Operation	Allows you to manually operate the auto dispensing system. Select this when injecting reagents or draining.
2.Data File	Shows and prints out titration results. Also conducts recalculation and statistic calculation.
3.Method	Edits methods to be used in titration.
4.Data Copy	Saves measurement results in a USB flash drive. Also transfers data to edit methods on PC.
5.History	Reviews check records or calibration records.
6.Sample	Sets up sample-related parameters.
7.Reagent	Sets up about reagent information.
8.Setup	Sets up system-related settings.

5-1-1. Manual Operation





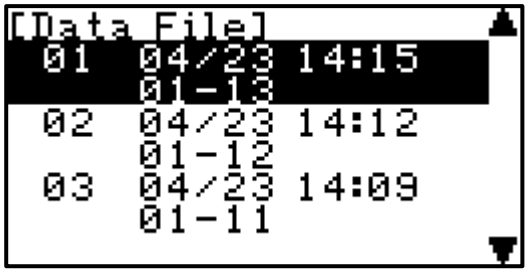
[Pump]
When connecting with the auto dispensing system, you can turn on or off the injection pump and the drain pump. Refer to 3-3-2. Anolyte <When use the Auto Solvent Change Unit> for details.

5-1-2. Data File

Press [MENU/HOME], select "2.Data File" with [↑][↓] and press [ENTER]

[Display of Titration result and Recalculation]

Move the cursor to a result you wish to display and press [ENTER] to display a result. The results can be re-calculated.
Move the cursor to [Print] and press [ENTER] to reprint and recalculate the result. The results of recalculation are printed out with sample number (Sample No.) headed with (#) mark.



Note Up to 100 samples measurement results can be stored.
When it exceeds 100, note that data will be erased on the first-in first-out basis.

[Re-Calculation]
Move the cursor to [Re-Calculation] and press [ENTER] to recalculate. Sample size and unit of the result and print format can be changed.

- Lot : Change a LotNo.
- Blank : Change a blank value
- Wt1(Wt2) : Change a sample size
- FA : Change a factor value

Report

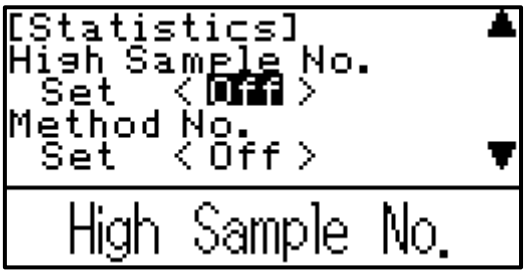
- Format : Change a print format of result
- Data List : Change a print format of data list
- Graph : Change a print format of titration curve

[Execute]
Execute to recalculate. A result screen is displayed.

[Exit]
Cancel to recalculate. A result screen is displayed without recalculation.

[Statistics]

Move the cursor to [Statistics] and press [ENTER].



< Search conditions >

You can narrow down the data by selecting the following conditions. Set to narrow down the condition as for being intended when condition is "On".

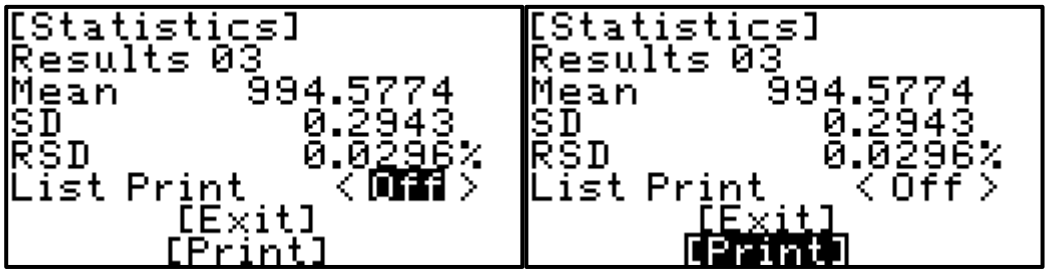
- High sample No. : The high order number for grouping the samples.
- Method No. : The number of Method particular to it.
- Titration Date : The date of measurement when it was performed.

[Execute]

The selected data under the conditions as above will appear as a list of results on display. And the result can be excluded from a statistic calculation by pressing [←] on a result display screen. " * " is displayed on the excluded result before displaying a result.

[Statistics]

Press [Statistics] on "Results list". The data on the list are going to be batch calculated. Move the cursor to [Print] and press [ENTER] to print out the result.



< 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 Print]

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

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

Note

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. Refer to "3-6. Batch processing of titration data" in the operation manual how to operate.

5-1-3. Method

Please refer to "the method" of Chapter 4.

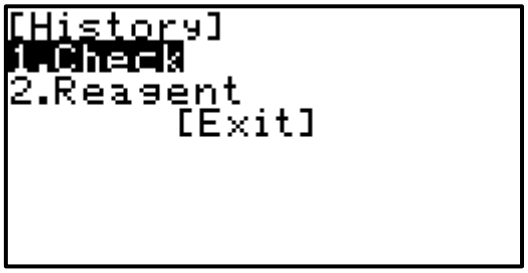
5-1-4. Data Copy

Please refer to "3-7. Read Data, Store in USB Flash Drive" and "3-8. Saving Method Conditions, Setting Up on PC".

5-1-5. History

Check history/record and calibration history/record can be reviewed.

Press [MENU/HOME], select "5.History" with [↑][↓] and press [ENTER]
Calibration results can be reviewed if you print out with [Print] key.

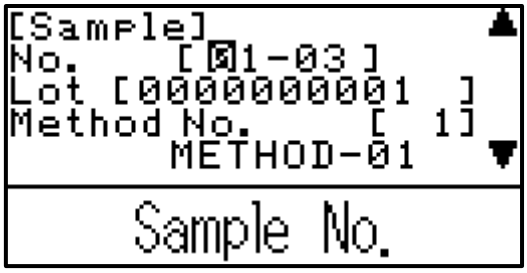


Item	Contents
1. Check	Shows history/record of a periodic check. The measurement result will appear that set up a Method for check measurement.
2. Reagent	The exchange history of an anolyte and a catholyte is displayed.

Note Up to 10 data can be saved. When exceeding, data will be deleted from the oldest.

5-1-6. Sample

Sets up sample-related parameters.
Select [SAMPLE] on main screen. Or press [MENU/HOME], select "6.Sample" with [↑][↓] and press [ENTER].



[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

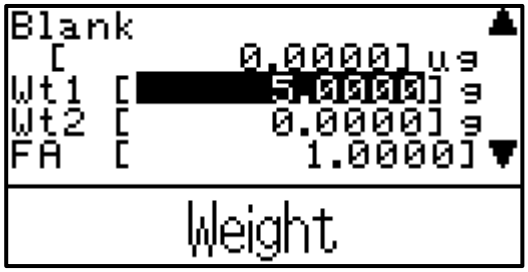
[Lot]

You can No. a Lot with characters up to 10 letters.

[Method No.]

Sets up the method No. you wish to use in measurement. Once set, the method name will appear in "Method Name."

- 01～20



[Blank]

Enter Blank value of sample.

- 0 - 99999.9999μg

[Wt1/Wt2]

Enter tare weight+sample weight in Wt1 and tare weight after injecting the sample in Wt2. If a balance is connected, you can follow its instructions. Absolute values are entered with a balance connected.

- 0 - 9999.9999g

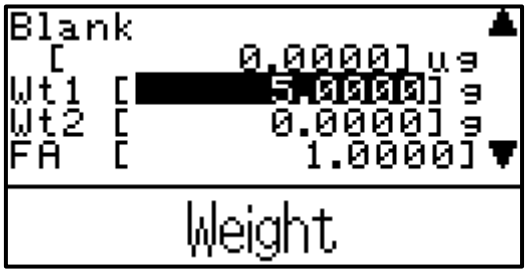
[FA]

Factor value that is coefficient related to the results.

- 0～99999.9999

<Sample setting after titration has started>

If you press [SAMPLE] key during titration, the following display will appear and you can enter sample setting. Enter items you wish to set up. Then move the cursor to [Exit] and press [ENTER] key.

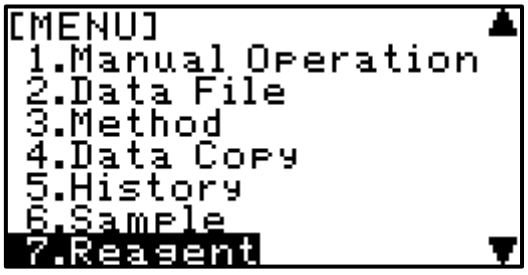


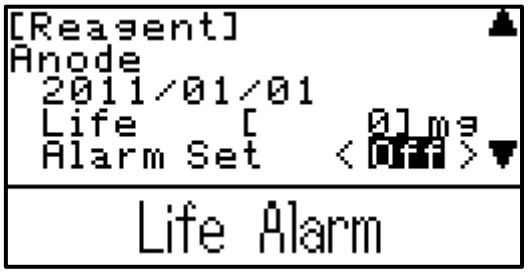
Note

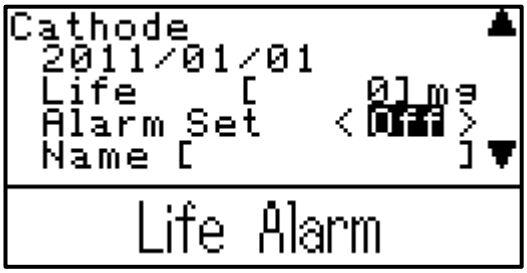
Sample No. and Method No. cannot be changed once measurement as started.

5-1-7. Reagent

Set up reagent-related parameters.
Press [MENU/HOME] key. Select 7.Reagent with [↑][↓] and press [ENTER] key.







[Life]
Current consumption of reagent and the last date when reagent was replaced are displayed. If you have replaced reagents, enter 0mg and press [ENTER] key.

[Alarm Set]
Alarm by consumption of reagent can be set. If you turn it on, you can set up the life upper limit and the reagent replacement interval.

[Name]
A reagent name can be set. Up to ten (10) letters can be input.

[Lot]
A lot No. can be set. Up to ten (10) letters can be input.

5-2. **Bromine number and index**

The degree of unsaturated hydrogen carbide in oil and petroleum products is indicated by bromine number or index. The volumetric test method is specified in ASTM D2710, JIS K2605 and K2435. The coulometric method with this unit is easier than volumetric, however, it is recommended to refer to the volumetric testing procedure and specifications.

< Bromine number and index >

Bromine number : The amount of bromine (unit: g/100) consumed in 100g sample.
Bromine index : The amount of bromine (unit: mg/100) consumed in 100g sample.

< Principle of measurement >

The unsaturated hydrogen carbon reacts with bromine as follows:
$R\text{-}CH=CH\text{-}R+Br_2 \rightarrow R\text{-}CHBr\text{-}CHBr\text{-}R^-$ ..... (1)

In coulometric titration, bromine is generated by electrolysis of anolyte containing bromine ion:
$2Br^- Br_2+2e^-$ ..... (2)

When generated bromine is consumed according to Eq. (1), the electrode detects bromine consumption, and continues generating bromine according to Eq. (2).
Such bromine is generated in proportion to the electricity determined by Faraday's Law. From Eq. (1), Bromine reacts with coupled C=C evenly (1:1). Thus, one mol of bromine (159.8g) is equivalent to 2×96500 coulomb, which means 1.2 coulomb/1mgBr_2.
Based on the above principle, the electricity consumed in electrolysis is converted to the exiting bromine.

Note

Follow the below instructions in order to obtain correct measurement results:
Replace anode and cathode reagent with new one respectively each day.
When the anolyte turns to white turbidity, change it with new one.
When the same anolyte and catholyte are continuously used, the measurement results may produce larger amount in value than expected. Change the anolyte in this case.
Do not share the titration cell with moisture titration.

5-2-1.Preparation of reagent

Prepare the reagents and samples for measurement of bromine number and bromine index.

< Preparation of reagent >

Use the following reagent for measurement of bromine number or index:

: Mixture of Acetic acid (high grade) 600mL; Methanol (high grade) 260mL; 1M-Potassium bromide solution 140mL. Blend it well and use 100mL each time.

Cathode reagent : 0.2M-Potassium chloride solution. Use 5mL each time.

Check solution : 0.05Wt-Cyclohexene·toluene mixture (Approx. 93 ~ 102mgBr_2/100g). Theoretical value is calculated by the below formula:

$$\text{Theoretical value (mg } Br_2/100g) = \frac{159.83(\text{bromine molecular mass}) \times \text{cyclohexene(g)}}{82.15(\text{cyclohexene molecular mass})} \times \frac{100}{\text{toluene (g)} + \text{cyclohexene(g)}} \times 1000$$

< Prepare reagent >

Refer to the below chart for sample size:

Bromine index (mg/100g)	Sample size (g)
Below 10	10 ~ 15
10 ~ 50	5 ~ 10
50 ~ 100	3 ~ 5
100 ~ 200	1 ~ 3
More than 200	~ 1

For bromine number, a sample is diluted with toluene to Bromine number 0.2 (g/100g), and approximately 1g is used for measurement. Calculate the toluene to be used for diluting to Bromine number 0.2 (g/100g) with the following equation:

$$\text{toluene(g)} = \text{sample(g)} \times \frac{\text{Expected bromine number in sample(g}Br_2/100g)}{0.2(gBr_2/100g)}$$

Obtain the dilution coefficient in advance according to the following equation:

$$\text{Dilution coefficient } D = \frac{\text{sample (g)} + \text{toluene(g)}}{\text{sample (g)}}$$

5-2-2.Measurement procedure

Measure bromine number and bromine index.

1) Discharge 20 ~ 100μL check solution into the electrolysis cell, and press [Pre-titr.] key.

2) After pre-titration is finished, press [Sample] key to enter sample name, its ID and size, and enter the dilution coefficient (D) .
Press [MENU/HOME] to Main display.

3) Press [Start] key, and discharge the sample into the cell.

Again press [Start] key for titration to start.

4) After titration is over, the measurement results appear on display with printout when a printer is connected.

Note

When discharged samples exceed 100mL in total, change the anolyte.
Changing the anolyte may be required each time for those samples, which do not dissolve in anolyte or measurement results deviate substantially each time.

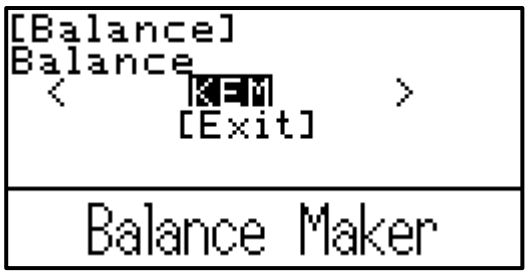
5-3. **Balance setting**

Connecting a balance enables the sample size (weight) to automatically be input. A correct setting of the balance is required for automatic input.

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

Balance setting

Select "3. Balance" with [↑][↓] and press [ENTER].



[Balance maker (Balance)]

Select the maker's name of your balance. Select "NONE" if no balance is connected. For details data format, refer to the Table5-3.

- NONE
- KEM
- Mettler
- A&D
- Shimadzu
- Sartorius
- Mettler-Old

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

Table 5-3. Balance setting

Balance	KEM	Mettler	Mettler-Old	A&D	Shimadzu	Sartorius
Baud Rate	2400	9600	2400	2400	1200	1200
Parity	Even	None	Even	Even	None	Odd
Data Bits	7	8	7	7	8	7
Stop Bits	1	1	1	1	1	1
Handshake					H-oFF	
Delimiter	CR/LF	CR/LF	CR/LF	CR	CR	CR/LF

[Interface]

Select a COM port on which you wish to output the balance. Only one balance can be connected. Select where a printer or RS-232C is not connected.

- COM1 : Output of balance is set to COM1.
- COM2 : Output of balance is set to COM2.

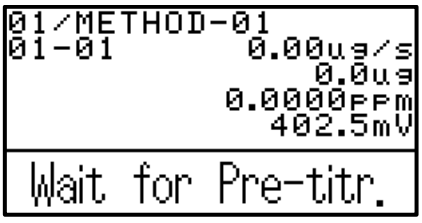
[Mode]

Select the receive mode from the balance.

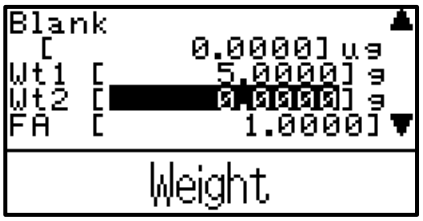
- Continuous : Select "Continuous" mode on the balance to enter the weight of the balance from the titrator.
- Print : Press "Print" key of the balance to enter the weight from the balance.

<Inputting sample size>

1) Select [Sample] on main screen. "Sample" screen will appear.



2) Move the cursor to "Wt1" and press [Enter].
3) Tare the balance and then place the sample. Once the balance becomes stable, press [Enter] to fix the sample size. (When "Continuous" is selected on output mode of the balance.)



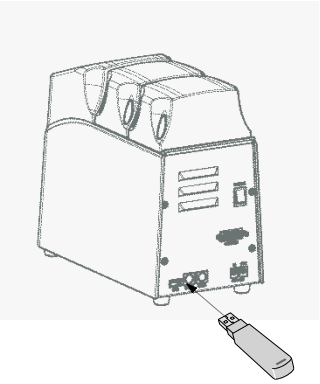
After tarring the balance, place the sample and then press the "Print" key of the balance. The sample size will be entered in "Size" of the current sample setting. (When "Print" is selected on output mode of the balance.)

5-4. **Connecting USB Devices**

The MKC-710 can be connected with various USB devices such as printers, keyboards and foot switches.

Connecting USB devices

Connect the devices you wish to use to the USB port at the back of the MKC-710.
See below for details of USB devices which can be connected.



Connected device	Contents
USB Flash Drive	Measurement results or methods can be transferred to a USB flash drive, which enables you to use the data on your PC.
USB Keyboard (USB Numeric Keypad)	Parameters of methods can be entered with a keyboard. A 101-key PC keyboard can be used.
USB Printer	The Thermal Printer "DP-600" can be connected to print out parameters and measurement results.
USB Barcode Scanner	A barcode scanner can be connected to import a sample ID. If you use a barcode scanner on main screen, a sample ID can be imported into the sample ID on current sample conditions.
USB Foot Switch	Pressing the foot switch can start a measurement.

Table of Keys

Key on MKC-710	Keyboard
START/STOP	F5
MENU/HOME	Esc
∧	↑
∨	↓
<SAMPLE	←
STIRRER>	→
ENTER	Enter

Note

Make sure that the USB setup on MENU > 8. Setup > 1. Interface > 4. USB is "Host" when using USB devices.
Some USB devices may not be recognized. Do not use USB devices if performance of the MKC-710 is slowed down after connecting such devices.

Several USB devices may be used at a time with a self-powered USB hub. Some USB hubs may not be recognized.

5-5. **Connecting Android Devices**

Android devices can be connected to this instrument via USB port, and the weight can be input. A titration curve will be shown on the Android device during titration.

Android devices can be connected to the MKC-710 via USB port, and the weight can be input with a special app.

System requirements

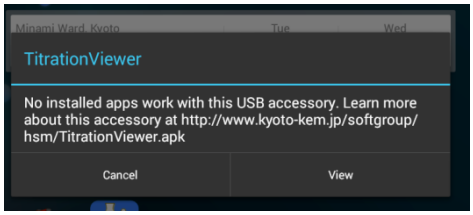
- **Android Ver. 4.0 or later**
- **USB port required**

* Internet access is required at the time of software installation.

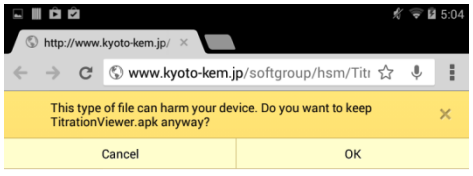
⚠ **Caution!**	**KEM warranty does not cover malfunction or breakdown of Android devices regardless of the cause. Operation check was performed per ADK Protocol Ver.1.0 stipu -lated in the Android specifications. Some Android devices, however, may not be connected.**

5-5-1.Connecting to instrument

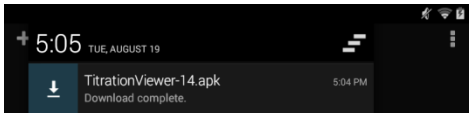
1) Connect an Android device and the MKC-710 with a USB cable.
2) Some messages will appear on the display, and press "View."



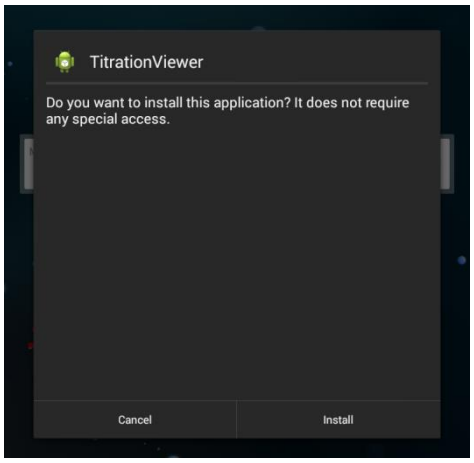
3) When you access the download URL on the browser, a confirmation message will appear on the top. Press "OK" to start download. Description and position of the message may differ on some browsers.



4) When download is completed, an installer for the app will appear on the notification bar. Click the installer.



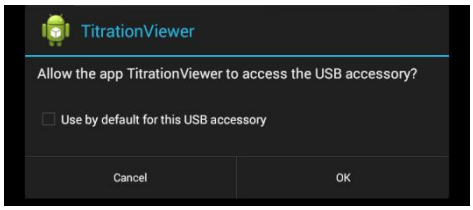
5) A confirmation message for install will appear, and press "Install" to start installation of the app.
6) Press "OK" when installation is completed.

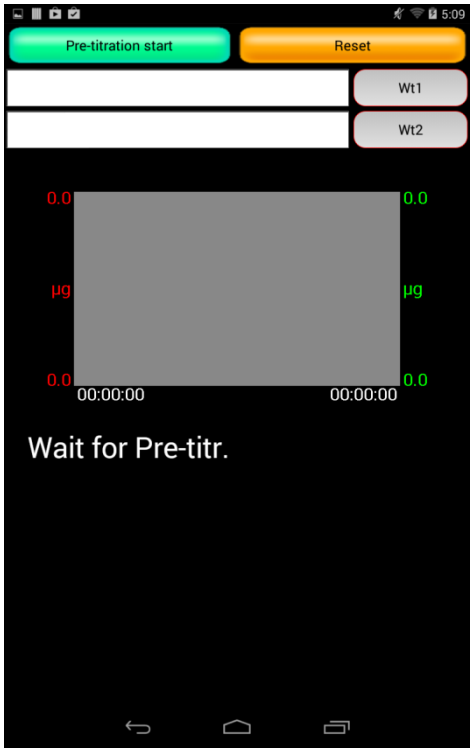


This app will not appear in the app list of the menu even after installation. (It will appear in the app management.)

5-5-2.Starting app

1) Connect an Android device and the MKC-710 with a USB cable.
2) A confirmation message will appear when you start the TitrationViewer. Press "OK."
3) If you wish to start the TitrationViewer every time you connect the Android device to the MKC-710, check ""Use by default for this USB accessory."
4) The TitrationViewer will start.





* This app cannot be started from the app list or start record (recently used apps). Always follow the steps above.

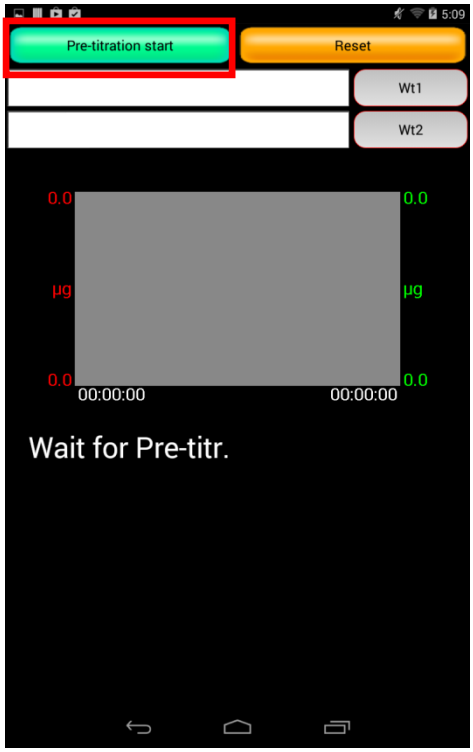
5-5-3.Starting Pre-titration

1) When equipment is the waiting for preliminary titration, an upside green button changes to "Pre-titration start."

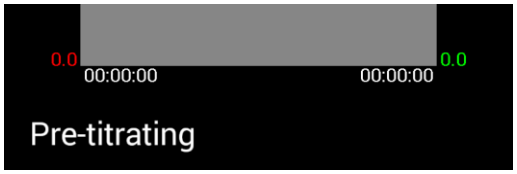
2) Press "Titration start."

3) Titration will start. During titration, a titration curve will appear on the display.

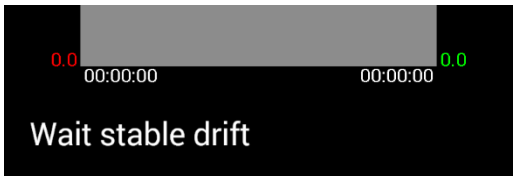
   If you press "Titration start" or "Reset," or if titration starts, display of titration results will be cleared.



4) If pre-titration is started, a display will come "pre-titrating".

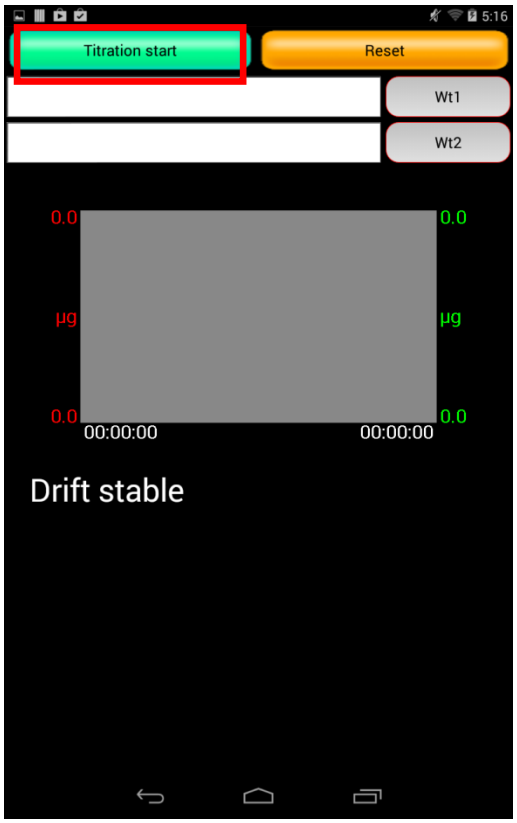


5) After pre-titration is completed, a display will be the wait stable drift (or drift stable state).



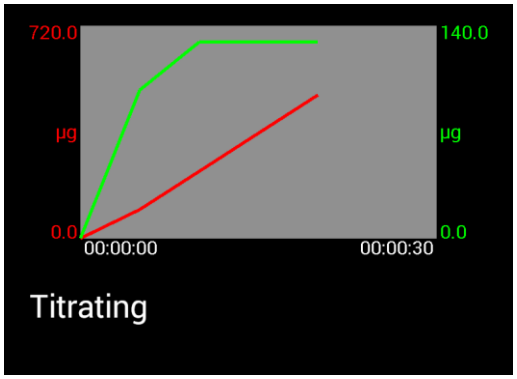
5-5-4.Starting measurement

1) If equipment will be in the wait stable drift, and a Drift stable, an upside green button will change to "Titration start." Press "Titration start."

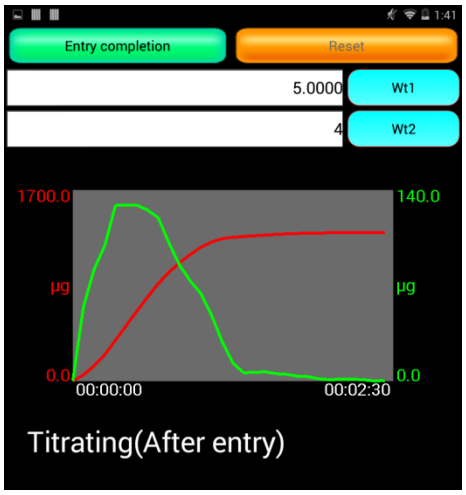


2) A message becomes "Inject sample" by setup of equipment. Inject the sample into the cell, and press" Titration start".

3) Titration will start.

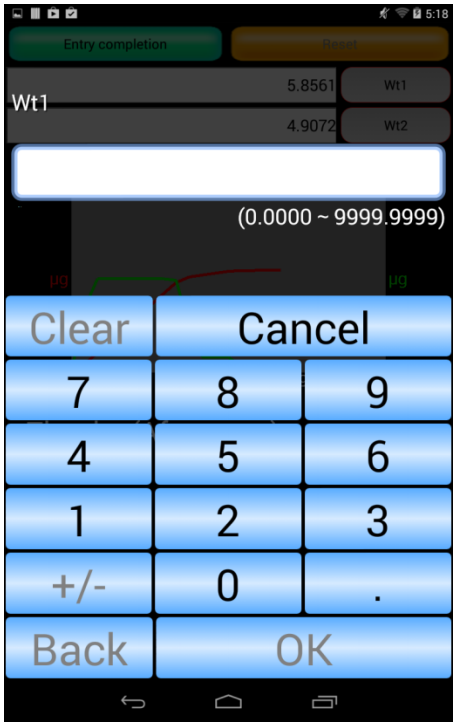


4) After titration is terminated, the instrument state becomes 'post entry completion standby' mode. And the upper green button changes to "Entry completion".

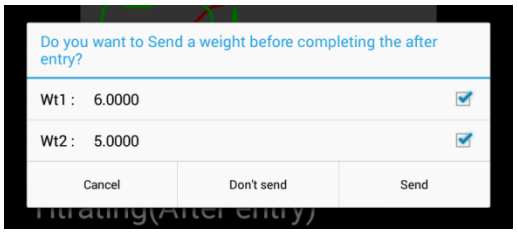


5) Enter weight and send it.

6) Press [Entry completion] button to complete 'after entry'.



7) Entering weight and pressing [Entry completion] button before sending the weight will show the right dialog box.



*When sending entered weight to complete after entry:
- Check sent weight box and press [Send] button.
*When completing after entry without sending entered weight:
- Press [Don't send] button.
*When re-entering weight:
- Press [Cancel] button.

5-5-5.Measurement

1) When titration is finished by reaching an endpoint, the results will be shown on the screen.

2) If you press "Titration start" or "Reset," or if titration starts, display of titration results will be cleared.

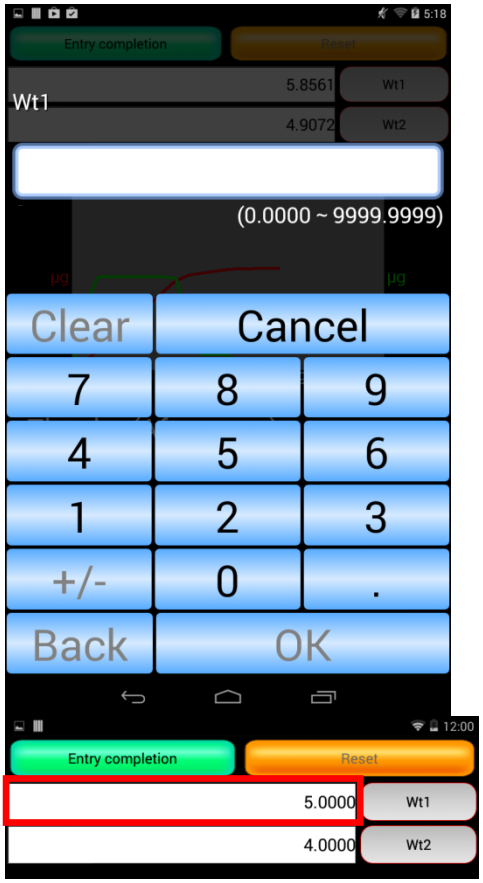
5-5-6.Entering weight

1) If you touch the edit box on the top of the display, soft keys will appear. Enter the weight.

2) If the weight remains unsent, transmission button will turn light blue.

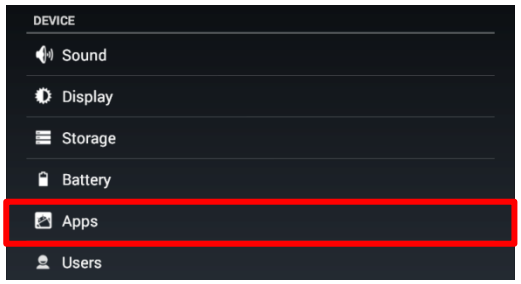
3) Once you have entered the weight, press "Wt1or Wt2" button to send the weight.

4) Once the weight has been sent, the transmission button will turn gray.

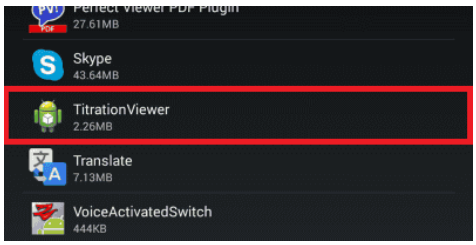


5-5-7.Uninstall Android apps

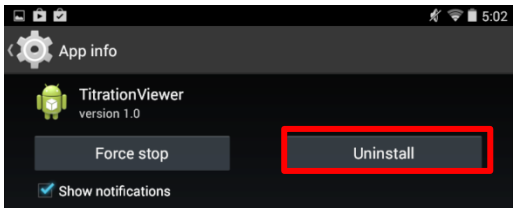
1) Apps or Application manager (this may differ depending on your device).

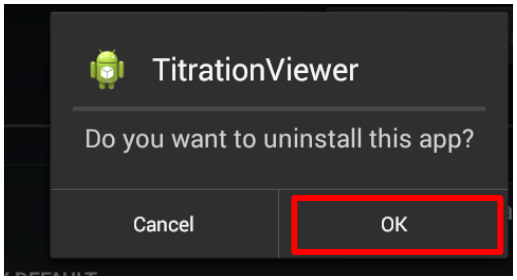


2) Touch the app you'd like to uninstall 「TitrationViewer」.



3) Select Uninstall. The messages will appear on the display, and press "OK."





5-6. Use an inner burette with a replaceable diaphragm

Easy to replace a diaphragm of an inner burette by using Titration cell unit (12-03635-03) and Cell Holder (for Hybrid) (20-11582). Easy maintenance when measuring samples which tend to contaminate the diaphragm as eg. Oils.

5-6-1. Supplied parts

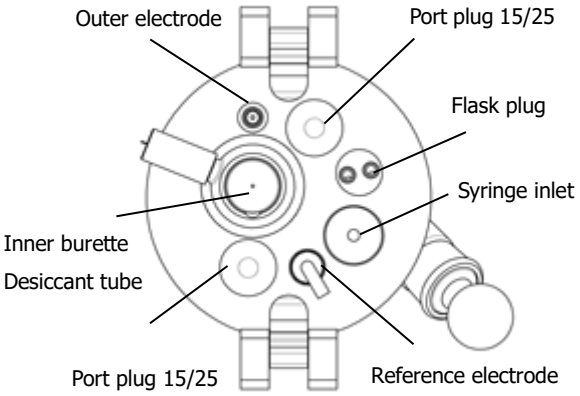
＜Components of Titration Cell Unit (12-03635-03)＞

Part Number	Part Description	Qty	Remarks
12-04485	Syringe Inlet Port Stopper	1	
20-08151-01	Port Plug 19/15	1	
20-07170	Titration Cell	1	
12-07019	Inner Burette	1	
66-00147	Port Plug 15/25	3	
20-07187	Titration Vessel Plug (phi15 1/10 Taper Plug)	1	
12-04483-01	Titration Cell Stopper	1	
12-03638	Outer Electrode	1	
12-03637	Twin Platinum Reference Electrode	1	
20-08601	Outer Electrode Holder	1	
12-04440	Outer Electrode Cable	1	
69-00447	Bamboo Skewer	1	
66-00125-06	Stirrer Rotor L=35	1	
12-04570	Diaphragm Set (2pcs/set)	1	
12-01394-10	Septum (10pcs/set)	1	
12-01260	Desiccant Tube phi18x120 with Silica Gel	1	

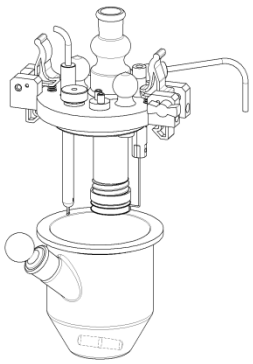
5-6-2. Assembly of titration cell

1) Install the twin platinum reference electrode, inner burette, outer electrode, desiccant tube and the port plug and syringe inlet. The position for installation is shown below. At this point, apply a small amount of KF grease on slide contact area.

   Please use the part placement properly like the chart below by a titration method.

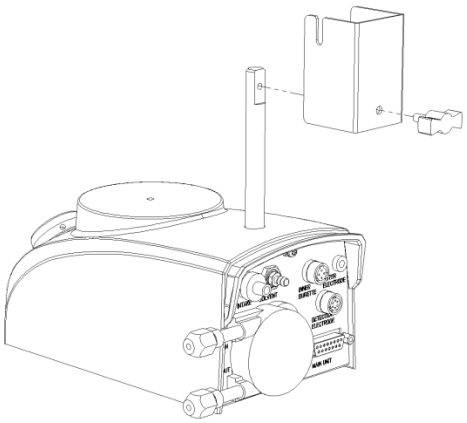


2) Put a stirrer rotor in a titration cell and combine it with a titration cell stopper of 1).

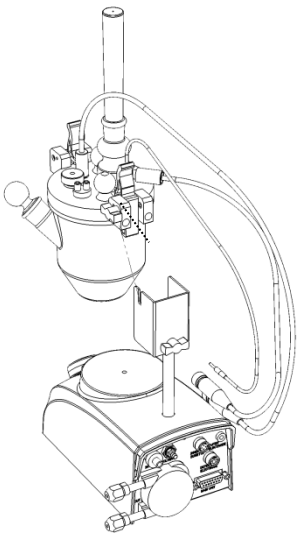


Note	KF grease must be applied on all the slide contact areas. The seal on desiccant tube on titration flask must be removed before using.

3) Install the cell holder to the magnetic stirrer.

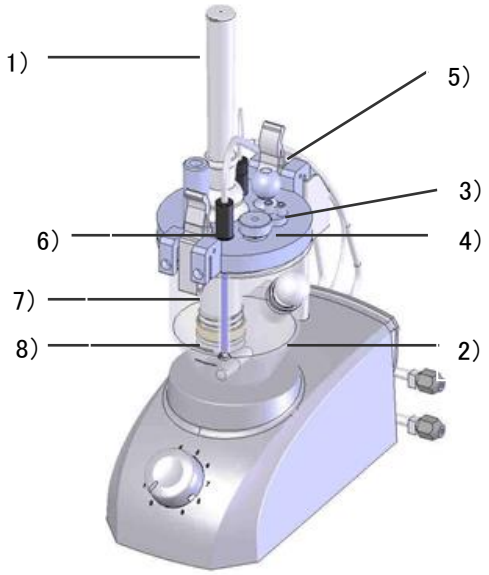


4) Fix the titration cell to the cell holder.



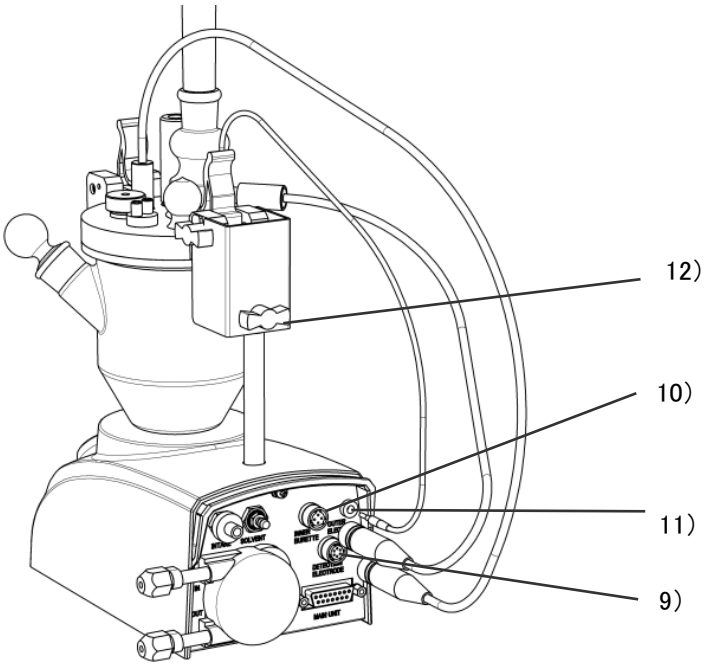
5-6-3. Appearance and Name of Stirrer unit

＜Front＞



1) Desiccant tube
   The gas fume from titration flask is exhausted through this tube.
2) Titration cell (Flask)
   The iodine generated in electrolysis and water in sample reacts here.
3) Plug for titration flask
   Dispensing tubes for KF reagent are inserted here.
4) Syringe inlet
   This is the sample inlet.
5) Titration cell (stopper)
   This is a stopper to seal a titration cell.
6) Twin platinum reference electrode
   The electrode detects the potential of solvent inside the flask.
7) Inner burette
   The anode and cathode liquid reacts here for electrolysis.
8) Outer electrode
   This is electrode for electrolysis.

＜**Back**＞



9) Detection electrode connector
The twin platinum reference electrode is connected here.

10) Inner burette connector
The inner burette for electrolysis electrode is connected here.

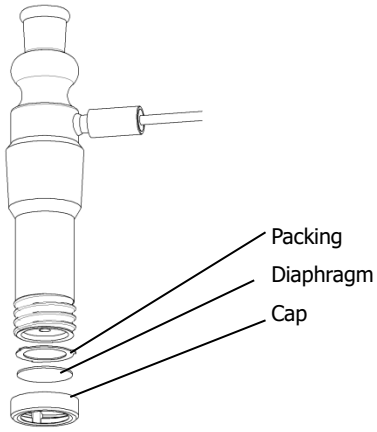
11) Outer electrode connector
The outer electrode is connected here.

12) Cell holder
This is a holder for fixing the titration cell.

5-6-4. Preparation before measuring

Assemble the Titration cell

1 Attach the diaphragm, packing, cap to Innner burette.



Note

When handling the diaphragm, please use the rubber gloves or tweezers by all means.
If you touch the diaphragm with your bare hands, fat and oil or dirt of the hands may put on the diaphragm, which may increase the drift value.

Note

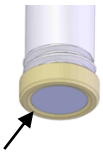
Negligence of replacing cathode reagent will cause higher drift level, foreign objects generated around the diaphragm and may lead to measurement errors.

Note

Do not tighten the cap too much.
Doing so may break the diaphragm.

Note

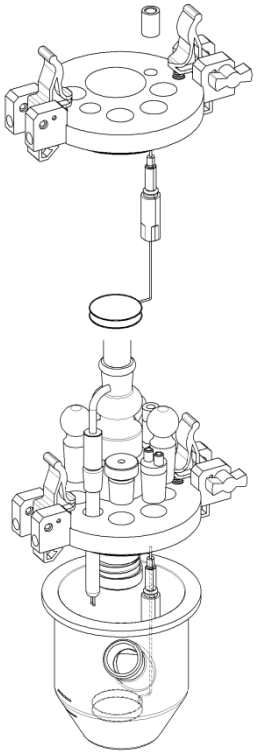
Please make sure that there is no gap between the diaphragm and the diaphragm cap.
Catholyte leak if there is a gap, which may increase the drift value.


There is no gap

2 Install inner burette, outer electrode, twin platinum reference electrode, dispensing nozzle, desiccant tube, syringe inlet and port plug which were assembled per #1 above to the stopper.
Insert outer electrode from the bottom of the stopper and turn it to be under the diaphragm of the inner burette, and fix with the holder.

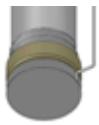
At this point, apply a small amount of KF grease on slide contact area.

⇒ Please refer to 5-6-2 Assembly of titration cell.



Note KF grease must be applied on all the slide contact areas.

Note Adjust the inner burette and the outer electrode as shown on the right.
When the outer electrode shifts from the bottom of the inner burette, it may influence the results.



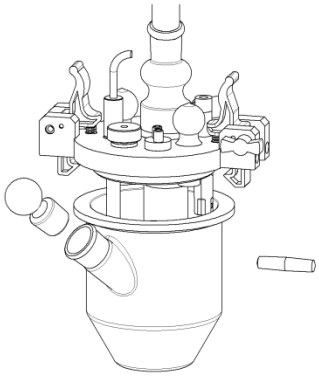
Note Adjust not to contact inner burette and outer electrode.
When the gap between inner burette and outer electrode is 1mm or less, the stir of liquid worsens and may influence the result.

Caution **When handling the inner burette, do not hold the housing (black resin area) and sliding area of desiccant tube in order to avoid breakage.**

Note Rubber plug and Port plug, please store in a desiccator together, such as a box to avoid lost or damaged in that you do not use.

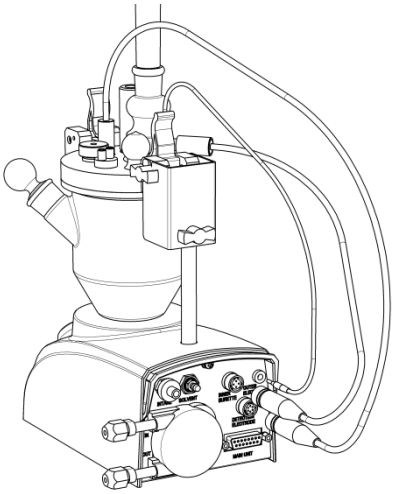
3 Put a stirrer rotor into the titration cell, and place the port plug.
Fix the cap assembled per #2 above with the clip.

At this point, apply a small amount of KF grease on slide contact area.



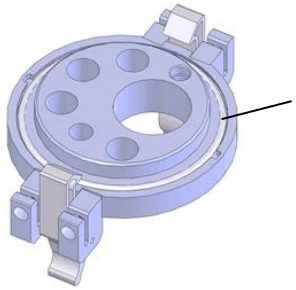
4 Place the titration cell onto the titration holder, and plug in the cable from the inner burette and the electrode.
Tighten the plug screws firmly.

IInsert the plug of the outer electrode in a connector.

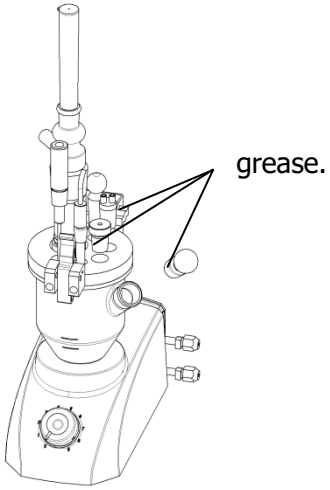


5-6-5. Karl Fischer grease

1) Twin platinum reference electrode, inner burette, syringe inlet, desiccant tube, port plug and plug for titration flask are removed from a titration cell.
2) Titration cell stopper are removed from a titration cell.
3) Apply KF grease around the titration cell stopper to fill the O-ring groove of the titration cell stopper.



4) Apply KF grease around contact areas.
5) Check those parts once a week to ensure they rotate smoothly. If not, apply thin coating of grease.



Note

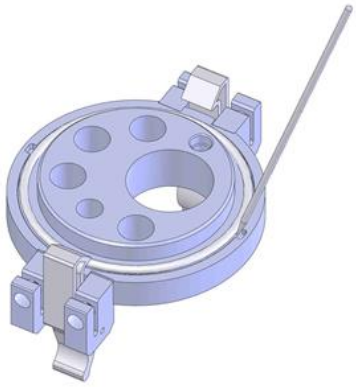
Make sure to apply the KF grease on the O-ring. This is because water may enter if there is a gap between the O-ring and the cap, which may increase the drift value.

Note

Check the glass joints from time to time so that applied grease will not solidifies.

5-6-6. Cleaning the Titration cell stopper

1) Twin platinum reference electrode, inner burette, syringe inlet, desiccant tube, port plug, and plug for titration flask are removed from the titration cell stopper.
2) Titration cell stopper are removed from a titration cell.
3) Remove the O ring of the titration cell stopper. using flathead screwdriver along a guide.
4) Cleanse the titration cell stopper and the O ring .with commercially sold neutral detergent.
5) Dry the flask in a heater dryer or the like, and leave it in a desiccator to cool it down.
6) Apply KF grease to the groove of the titration cell stopper and attach an O ring
7) Wipe the KF grease which protruded from the groove.



Note

Make sure to apply the KF grease on the O-ring. This is because water may enter if there is a gap between the O-ring and the cap, which may increase the drift value.

Note

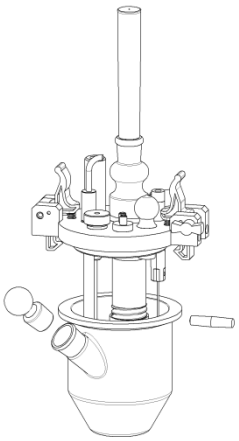
Place the O-ring; make sure that there is no deflection. Airtightness of the titration cell will be impaired by deflection, which may increase the drift value.

Note

Remove the O-ring from two places along the ditch of the cap.
O-ring might be hurt when being pulled from one place.

5-6-7. Cleaning the titration cell

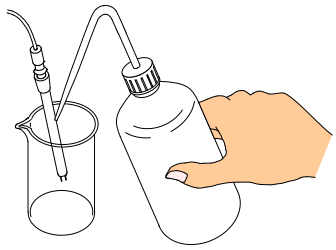
1) Remove twin platinum reference electrode, Inner burette and Sampling port stopper, and then drain out the reagent.
2) Rinse by neutral detergent under running water.
3) After drying the glassware in a heater, either cool them in desiccator or dry them.



5-6-8. Cleaning the electrode

＜Twin platinum reference electrode＞

If the electrode is heavily stained and the potential is unstable and measurement reading fluctuates, cleanse it with nitric acid, and after cleaning by methanol, wipe off with clean gauze.



＜Inner burette, Outer electrode, Diaphragm＞

Periodical cleaning of inner burette is recommended since if the inner burette is stained, the electrolysis reaction will not run smoothly, and may cause a longer time length in measuring process with measurement results higher than theoretical value

Cleaning with alcohol: general method

1) Turn off all the powers.
2) Disconnect the electrodes from their ports.
3) Take out both anolyte and catholyte.
4) Wipe off grease around sliding area with methanol.
5) Remove the diaphragm cap, diaphragm packing, diaphragm from the inner burette.
6) Rinse the inner burette with methanol, and fill it with approximately 10mL of methanol, and then, put it in a beaker. Fill the beaker with methanol up to the level of methanol inside the inner burette, and leave it for about 30 minutes.
7) After the above 6), dry it.

Cleaning with potassium iodide solution: If iodine stains

Potassium iodide solution： 1.2 to 2.5g of potassium iodide dissolved in 100mL of water

1) Follow the same steps as above for methanol.
2) Drain out the potassium iodide solution inside the cell, and rinse it with pure water for 5 to 6 times until yellowish color disappears.
3) Clean the inner burette with methanol or with alcohol.
4) After cleaning, dry the inner burette.

Cleaning with nitric acid (boiling) : If the color of inner burette or diaphragm does not disappear

When there is a deposition of iodine on the diaphragm or the electrode surface, clean with 1mol nitric acid (boiling):

1) Immerse the diaphragm or the electrode surface in nitric acid, and boil with a hot stirrer.
2) Drain out the chromate inside the cell, and rinse it with pure water for 2 to 3 times until yellowish color disappears.
3) Clean the inner burette with methanol or with alcohol.
4) Repeat the above steps several times when dirt does not come off.

⚠ **Caution**	**When handling this chemical, protect yourself with gloves and glasses. If it touches your skin, immediately rinse it with running water.**

⚠ **Caution**	**Be careful not to burn yourself when using a hot stirrer.**

Cleaning with chromic acid mixture : When a dirt does not come off

If foreign objects are observed on diaphragm and platinum surface, use chromic acid mixture instead of methanol for cleaning.

Chromic acid mixture:

1.5g approx. potassium dichromate dissolved in 100mL of concentrated sulfuric acid

⚠ **Caution**	**Chromic acid mixture is a very strong oxidizing reagent. When handling this chemical, protect yourself with gloves and glasses. If it touches your skin, immediately rinse it with running water.**

1) Follow the same steps as above for methanol.
2) Drain out the chromate inside the cell, and rinse it with pure water for 5 to 6 times until yellowish color disappears.
3) Clean the inner burette with methanol or with alcohol.

⚠ **Caution**	**Chrome is a heavy metal. Do not discard the used mixture or rinsing solvent as wastewater. First, dilute the collected chromic acid mixture down to 1% concentration, and then, reduce it. After confirming no Cr6+ is contained in it, adjust its pH to 7.5 ~ 8.5. Filter the liquid, and store the precipitation. For more details, refer to the corresponding documents regarding how to dispose of heavy metals.**

How to dry the inner burette and diaphragm

Dry it in a decompression dryer for more than 2 hours.
Below sketch shows an example of commercially sold drying under reduced pressure.

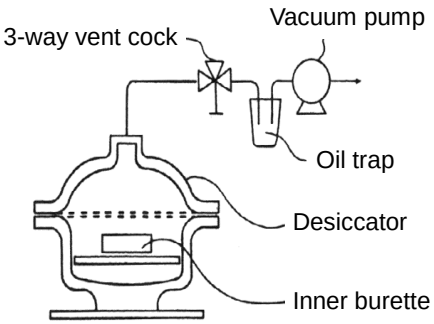
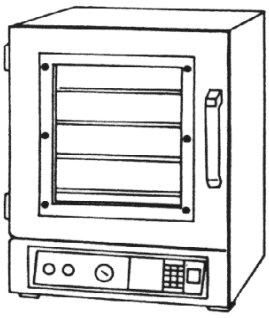


Diagram of Decompression dryer



Commercially available vacuum dryer

Note

Dry the inner burette itself only after removed from the titration cell in order to avoid possible breakage of inside ceramic diaphragm.

Use a hair dryer if a compression dryer is not available. With a hair dryer, dry the inner burette well enough as long as for more than 10 minutes, especially dry the diaphragm until it is really dried. Any residue of moisture will cause high drift level.

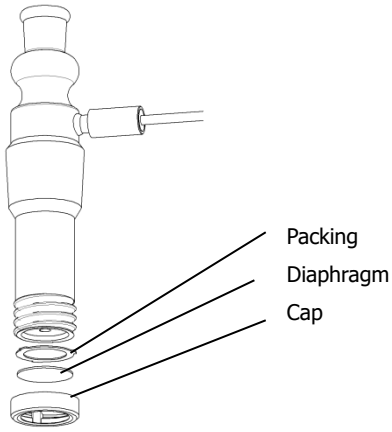
Note

When handling the diaphragm, please use the rubber gloves or tweezers by all means.
If you touch the diaphragm with your bare hands, fat and oil or dirt of the hands may put on the diaphragm, which may increase the drift value.

5-6-9. Replacement of diaphragm

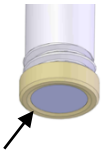
Replace the diaphragm if foreign objects generated around the diaphragm.

1) Remove the inner burette from the titration cell.
2) Remove the old diaphragm and packing and cap from the inner burette.(CCW)
3) Attach the new diaphragm and packing and cap to the inner burette.



Note	When handling the diaphragm, please use the rubber gloves or tweezers by all means. If you touch the diaphragm with your bare hands, fat and oil or dirt of the hands may put on the diaphragm, which may increase the drift value.

Note	Do not tighten the cap too much. Doing so may break the diaphragm.

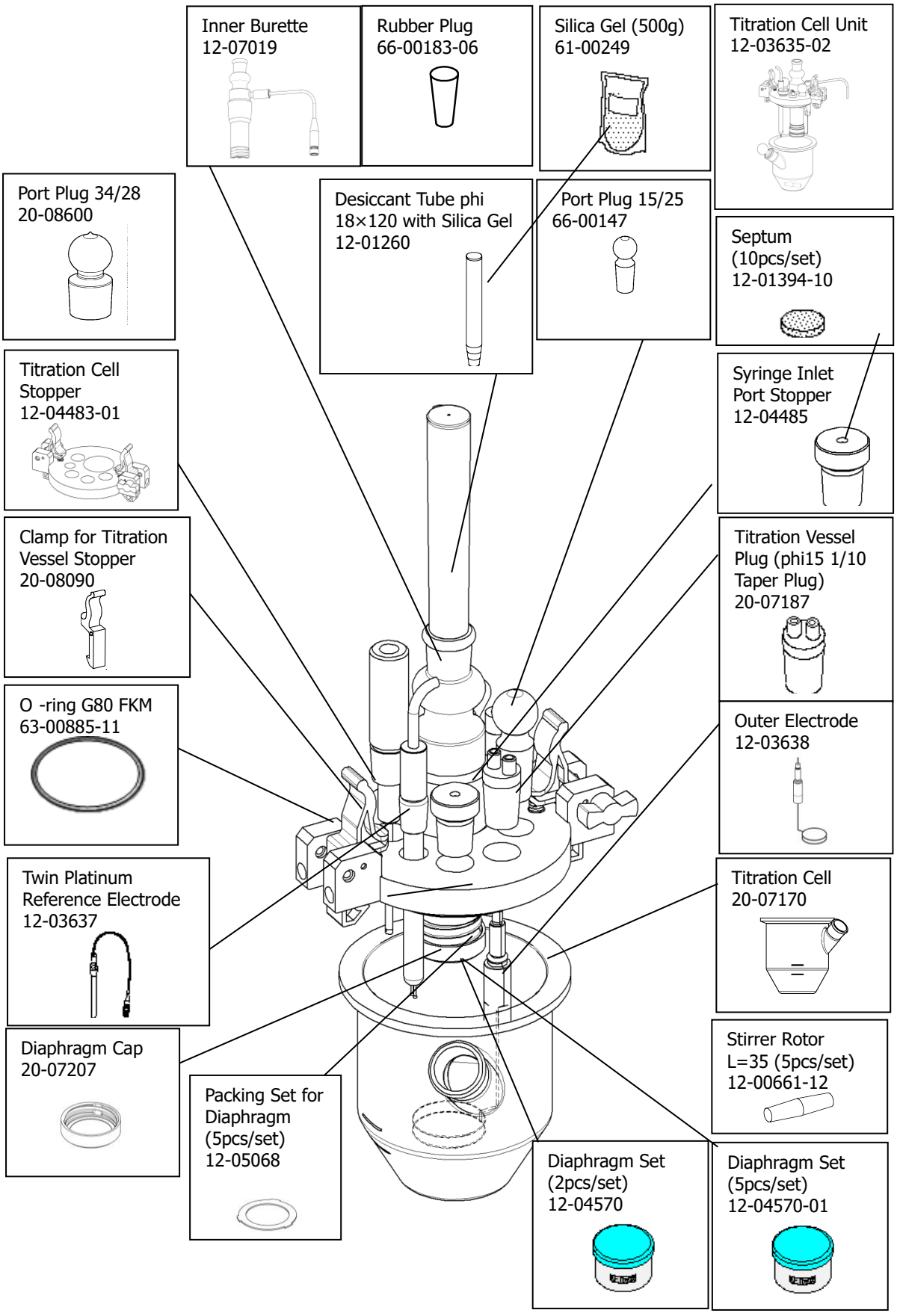
Note	Please make sure that there is no gap between the diaphragm and the diaphragm cap. Catholyte leak if there is a gap, which may increase the drift value.	 There is no gap

5-6-10.One point

Problem	Check point	Remedies
It runs into over-titration.	Away from sunlight?	Keep away from sunlight.
	Is reagent new?	Change with new one.
	Is reagent correct?	Use correct reagent.
	Is electrode working alright?	Clean the electrode.
	Is the length of stirrer roter narmal?	Change with correct roter.
	Is stirrer speed appropriate?	Make stirrer speed increase.
	Are the positions of inner burette and outer electrode appropriate?	Adjust to the correct positions.
Poor repeatability or no EP found.	Is reagent correct?	Use correct reagent.
	Any interfering substance?	Change reagent or use indirect method.
	Is sampling method correct?	Correct it based on water content and sample size.
	Is sampling volume correct?	Correct it based on water content and sample size.
	Start with stable drift?	Wait for stable drift.
	Is drift<0.1ug/s?	Wait unit drift settle down.
	Measurement parameters correct?	Check on drift stop mode.
	Inner burette or Electrode good?	Rinse and clean them.

Drift level is too high.	Are joints greased?	Apply grease.
	Is the grease applied to the titration cell stopper and an O ring?	Apply grease.
	O-ring and the titration cell stopper is clean?	Remove the O-ring from the titration cell stopper and clean it.
	Is septum new?	Change with new one.
	Is reagent new?	Change with new one.
	Is reagent correct?	Use correct reagent.
	Is diaphragm dry?	Dry the diaphragm.
	Do not touch with bare hands to diaphragm?	Cleaning and drying the diaphragm, assemble the inner burette using the tweezers or rubber gloves.
	Diaphragm good?	Cleaning or Change with new one.
	Inner burette or Electrode good?	Change it if malfunctioning.

5-6-11.Consumables and Service Parts



6. Setup

Sets up system-related settings.

Press [MENU/HOME], select "8.Setup" with [↑][↓] and press [ENTER].

Items and contents, please see below.

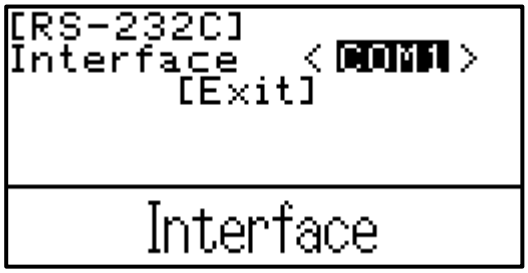
Items	Contents
1. Interface	Set up the use of printers, balance , Personal computers and / or USB.
2. Operator	Here the operator is defined for identification.
3. Date&Time	Date and clock time can be set.
4. Serial No.	The connected device, burette, the version number of the auto sampler and software version number can be checked.
5. LCD Contrast	The contrast for LCD can be adjusted.
6. Language	Languages can be set.
7. Beep	Beep tone for alarm can be selected on this display.
8. Parameter Clear	It is necessary to initialize preset parameters and setting in order to reset the system to default value. In this instrument, partial initialization (measurement date only, etc.) is possible.
9.Operation Lock	Prohibit operation of equipment.
10.Other	Automatically sets up blank, factor or display size of results.

6-1. **Interface**

Select "1.Interface" with [↑][↓] and press [ENTER].

6-1-1.RS-232C setting

Select "1.RS-232C" with [↑][↓] and press [ENTER].



[Interface]

Select a COM port on which you wish to output RS-232C. Only one RS-232C can be connected. Select where a printer or a balance is not connected.

- COM1 : RS output is set to COM1.
- COM2 : RS output is set to COM2.

[Baud Rate]

Select baud rate:

- 300 bps /600 bps / 1200 bps / 2400 bps / 4800 bps / 9600 bps

[Parity]

Select parity:

- NONE/EVEN/ODD

[Stop Bits]

Select stop bits:

- 1bit / 2bits

[Data Bits]

Select data bits:

- 7bits / 8bits

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

6-1-2.Date acquisition software (SOFT-CAP)

The optional software SOFT-CAP is Windows®-based application and can download the measurement data to Microsoft® Excel® workbook or store in CSV format through RS232C port.
By this software, starting titration or reset can be commanded by the computer.

＜Receiving date＞

The SOFT-CAP software can export the measurement results as follows:

1) It transfers the data to Microsoft® Excel® workbook.
2) It stores the data in CSV format so that spreadsheet can be used.

＜Sending date＞

The personal computer can send commands including titration start and reset.

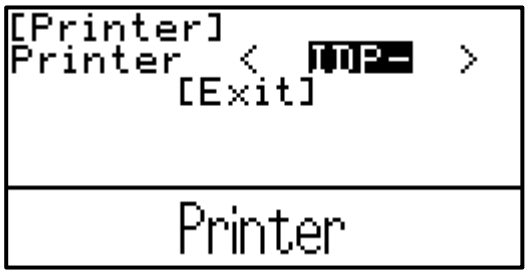
Note For details, see the operation manual for Data Acquisition Software (SOFT-CAP).

6-1-3.Printer setting

<IDP-100>
Connect the IDP-100 to COM1.

<DP-600>
Connect the DP-600 to the USB port.

Select "2. Printer" with [↑][↓] and press [ENTER].



[Printer]

Select a type of printer you are going to use: Select "NONE" if no printer is connected.

- NONE : No printer.
- IDP- : KEM's impact dot printer model IDP-100.
- DP-USB : Select this when connecting our thermal printer (DP-600) to the USB port.
- OTHER : Other printer than the above.

Note Connect to COM1 when selecting 'IDP-' or 'OTHER'. Connecting to COM2 leads to failure in printing.

Note For printer type and configurations, refer to the Table 6-1-3-1. 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.

[Baud Rate]

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

- 300 bps /600 bps / 1200 bps / 2400 bps / 4800 bps / 9600 bps

[Parity]

If you use "Other" printer as defined on ［Printer］, you have to select parity for your printer:

- NONE/EVEN/ODD

[Stop Bits]

If you use "Other" printer as defined on ［Printer］, you have to select stop bits for your printer:

- 1bit / 2bits

[Data Bits]

If you use "Other" printer as defined on "Printer", you have to select data bit for your printer:

- 7bits / 8bits

Table6-1-3-1

Printer	Cables	Titrator setup	Printer settings
Citizen	Connecting cable	Printer IDP-	Digital configurations for printer:
CBM-910	12-02013		Baud rate :4800
CBM-910	64-00625		Parity :none
Type Ⅱ			Stop bits :1
			Data bits :8

How to print

Printing out measurement results
Set the report format on "Method" to "Short" or "GLP."
When measurement is done, results will automatically be printed out.

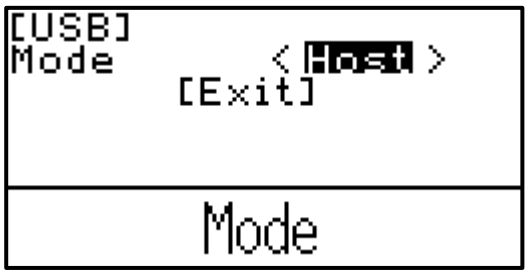
Printing out parameters
Move the cursor to [Print] on wherever [Print] is shown. Press [ENTER] to start printing.

6-1-4.Balance setting

For details on balance setting, refer to "5-3. Balance setting".

6-1-5.USB setting

Select "4. USB" with [↑][↓] and press [ENTER].



[Mode]

Select USB mode. Normally select "Host." Once setup is completed, restart the titrator.

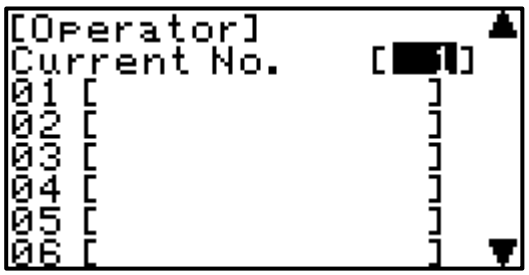
- Host : Select this when connecting USB devices.
- MCU : Select this when connecting MCU-710 through USB.

Note When setting to "HOST," power will be supplied to connected instruments. When MCU-710 is connected, make sure to supply power only to MKC-710 and to change the mode to "MCU." Otherwise, connected instruments may break.

6-2. **Operator**

Up to 10 operators can be registered with individual names. The registered name will be automatically printed out together with measurement results. (Characters: alphanumeric capital letters)

Select "2. Operator" with [↑][↓] and press [ENTER].



[Current No.]

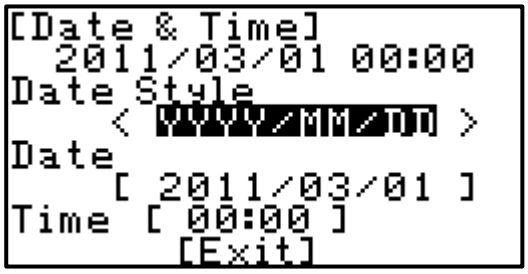
Select the number of the operator you wish to put on the measurement data. Select with [←] [→] keys and press [ENTER].

To enter an operator: Move the cursor with [↑] [↓] keys to the number (01 to 10) you wish to enter. Press [ENTER]. Then enter a name with [↑] [↓] [←] [→] keys, and press [ENTER] again. Up to twenty (20) letters can be input.

6-3. **Date&Time**

Date and clock time can be set.

Select "3.Date&Time" with [↑][↓] and press [ENTER].



[Date Style]

Here you select and update the date of year, month and day. Select with [←][→]and press[ENTER].

- 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]

Input the present date (2001/1/1 - 2099/12/31). Input with [↑] [↓] [←] [→] keys, and press [ENTER].

[Time]

Input the present time (00:00 - 23:59). Input with [↑] [↓] [←] [→] keys, and press [ENTER].

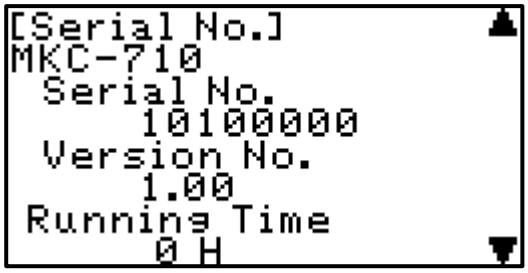
Note

See "2-4. Setting date and time" of this Operation Manual for how to set.

6-4. **Serial No.**

Serial No. and the software version of the titrator are shown.

Select "4. Serial No." with [↑][↓] and press [ENTER].



[Serial No.]
When the multiple sample changer is connected, its serial No. and software version will also be shown.

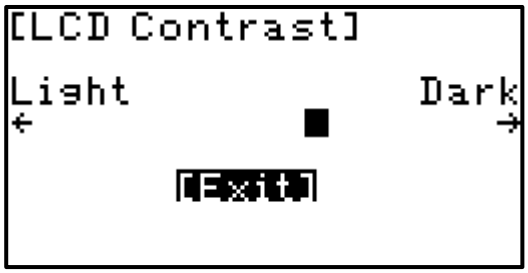
Note Make sure to advise your distributor of the serial No. and the software version should you require servicing.

[Running Time]
Multiplication of the operation time for measuring equipment is displayed.

6-5. **LCD Contrast**

The contrast for LCD can be adjusted.

Select "5. LCD Contrast" with [↑][↓] and press [ENTER].

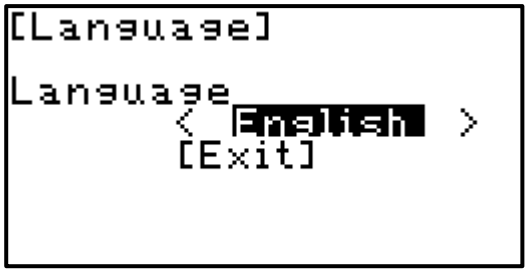


[LCD Contrast]
Adjust contrast of LCD with 14 steps by [←], [→] key and confirm by [ENTER] key.

6-6. **Language**

Select the language you wish to use.

Select "6. Language" with [↑][↓] and press [ENTER].



[Language]

Move the cursor with [←] [→] keys to the language you wish to use, and press [ENTER].

- English : Shows in English.
- Japanese : Shows in Japanese.
- Mandarin : Shows in Mandarin Chinese.
- Korean : Shows in Korean.
- Russian : Shows in Russian.
- Spanish : Shows in Spanish.

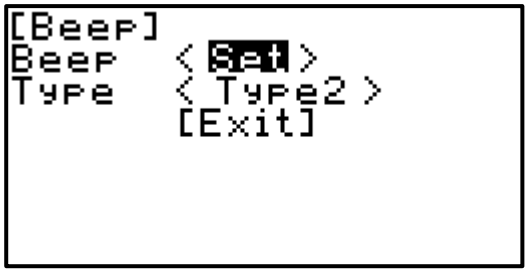
Note

See "2-3. Setting Language" of this Operation Manual for how to set.

6-7. **Beep**

Select the beep at the end of measurement.

Select "7. Beep" with [↑][↓] and press [ENTER].



[Beep]

Select the beep.

- Off : Turns off the beep. Turns off the beep during measurement as well.
- Set : Sets up the beep. Select from types below

[Type]

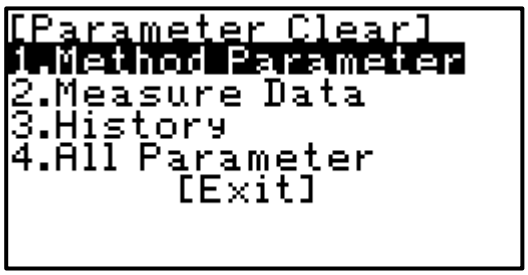
Select the beep from the five (5) types below.
Move the cursor with [←] [→] keys to the type you wish to use, and press [ENTER].

- Type1 : 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"

6-8. **Parameter Clear**

It is necessary to initialize preset parameters and settings in order to reset the system to default value. In this instrument, partial initialization (measurement data only, etc.) is possible.

Select "8. Parameter Clear" with [↑][↓] and press [ENTER].



Select the item to initialize by [↑], [↓] key and confirm by [ENTER] key. See items that can be initialized in below.

Items	Contents
1. Method Parameter	Initialize Parameters (Titration, Control, Result) of each Method.
2. Measure Data	Erase all measurement results data stored in Data File.
3. History	Erase all the calibration records and the check records in History.
4. All Parameter	Initialize all of the above items once for all.

When initialization is chosen, the confirming message appears. Select Yes/No by [↑], [↓] key and confirm by [ENTER] key.

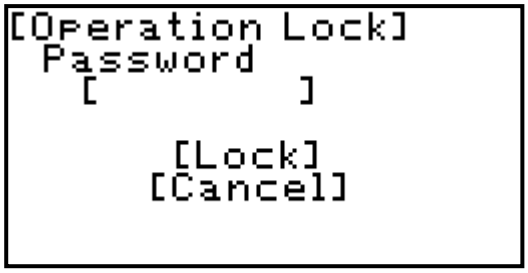
Note

1. Method Parameter and 4. All Parameter are not available when method contents are locked. Follow the steps in 4-1 and unlock method first.

6-9. **Prohibition of operation of equipment**

Prohibit operation of equipment.

Select "9. Operation Lock" with [↑][↓] and press [ENTER].



[Lock]
Prohibit operation of equipment.

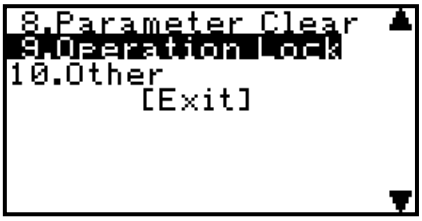
Note

If a user performed Operation Lock and lost Password, the user cannot unlock Operation Lock. Therefore, please strictly control and manage Password.
Please ask our service department for unlock if Password is lost. In that case, all data in The equipment will be initialized to the factory default settings due to initialization processing.

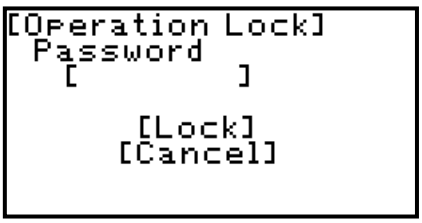
Settings of prohibition of operation of equipment.

1) Press [MENU/HOME].
2) Select 8.Setup and press [ENTER].

3) Select 9.Operation Lock and press [ENTER].

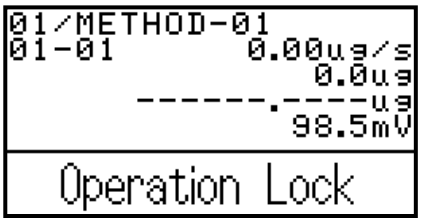


4) Enter the password in "Password" with [↑][↓] [←][→] and press [ENTER].
5) Move the cursor to [Lock] and press [ENTER].



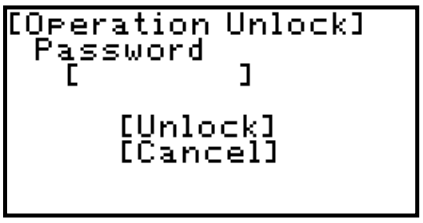
6) Select [Yes] with [↑] and press [ENTER].

7) "Operation Lock" is displayed at the bottom of the screen、thus it prohibits operation of equipment.



Unlock of prohibition of operation of equipment.

1) Turn on the power of the equipment.
2) Press [MENU/HOME].
3) Enter the set password in "Password" with [↑][↓] [←][→] and press [ENTER].
4) Move the cursor to [Unlock] and press [ENTER].
   The method lock is unlocked.

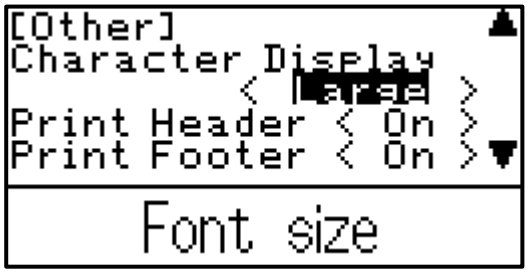


Note When connected to MCU-710 or KF-Win, it is not possible to unlock Operation Lock.
Perform unlocking after disconnecting the connection.

6-10. **Other**

Display/printout format and automatic setting of mean values can be set up.

Select "10.Other" with [↑][↓] and press [ENTER].



[**Character Display (Font size)**]

Select the font size of measurement results on screen. Select with [←] [→] keys, and press [ENTER].

- Normal : Results are shown in normal size.
- Large : Results are shown in twice the size of "Normal."

[Print Header]

Make setting of header printing. The header includes 'Model name', 'Serial No.' and 'Print date'. Select with [←] [→] keys, and press [ENTER].

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

[Print Footer]

Make setting of footer printing. The footer includes a printing operator. Select with [←] [→] keys, and press [ENTER].

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

[Auto Set., mean]

The average value of a plural number of blank levels that have been measured will be automatically set into the blank value to be used in sample setup to be used in reagent information respectively. Select "Auto Set. mean" with [←] [→] keys, and press [ENTER].

- Off : No setting. Each measurement result is put in the blank or factor.
- On : Auto set in the blank. A mean value of up to five (5) results is obtained. The value for "Auto Set. mean" is cleared when the method No. is changed on sample setting or when the titrator is turned off.

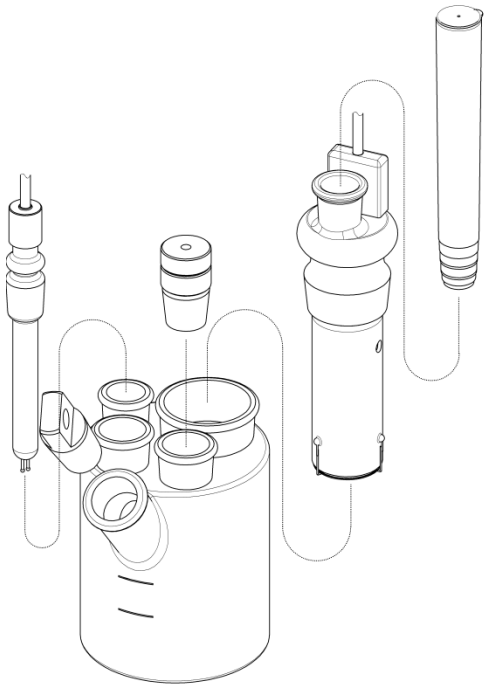
7. Maintenance

7-1. 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.

7-1-1.Karl Fischer grease

Twin platinum electrode, inner burette, syringe inlet, desiccant tube, port plug, and plug for titration flask are removed from a titration cell. Apply KF grease around glass contact areas. Check those parts once a week to ensure they rotate smoothly. If not, apply thin coating of grease. Do not apply too much grease as it may penetrate the titration cell and increase the background owing to the water content of the grease.



⚠ **Caution!**	**Check the glass joints from time to time so that applied grease will not solidifies.**

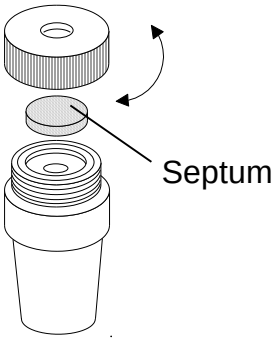
If grease on the glass contact areas becomes hard and the respective parts are difficult to separate, take the following steps;

1) Discharge anolyte and catholyte.
2) When using a glass port plug, warm it up with a hair dryer or something similar to soften KF grease before removing. When using a PTFE port plug, remove it after cooling the titration flask in a freezer for about five (5) minutes.

⚠ **Caution!**	**Care should be taken not to get burned when heating the unit. Do not try and open solidified jointed parts by force. Glassware may break into piercing pieces for injury.** **Do not warm up a PTFE port plug when removing it as doing so may inflate the material and the titration flask may be broken.**

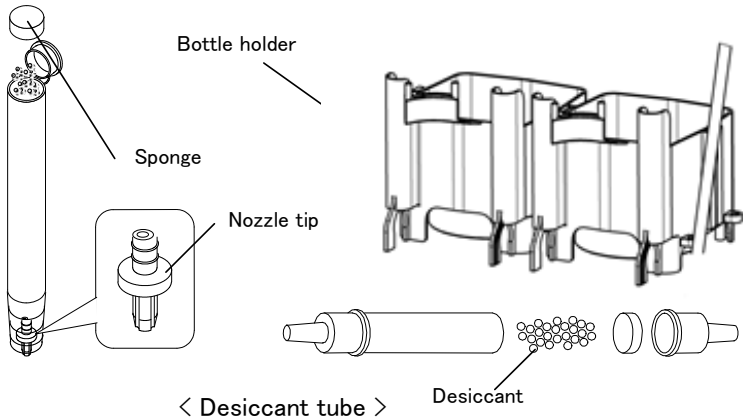
7-1-2.Replacement of septum

The syringe inlet is removed from a titration cell like the clause of an application of KF grease. Change the syringe inlet port septum occasionally. An old septum is easily broken and allows air into titration cell to increase the background.



7-1-3.Changing the desiccant

The desiccant tube is removed from a titration cell like the clause of an application of KF grease.And the desiccant tube is removed from a bottle holder.
Replace the desiccant with new one when its moisture absorption turns down to reddish color.Be sure to apply KF grease around sliding area between the titration cell and desiccant tube.



Note	If the nozzle chip slips from the desiccant tube when replacing the desiccant, ensure that you return the nozzle chip in the tube with its trenches downward as shown above.

7-1-4. Replacement of the anolyte (anode reagent)

＜Exchange timing＞

- When the accumulated moisture measurement (=reagent life) has reached 1000mgH_2O after the last replacement with new one
- When the surface of anolyte exceeds the upper line on cell wall when sample liquid is discharged into the cell.
- When drift level goes up.

For reagent capacity, see Instruction of the reagent you have purchased.

⇒ Please refer to 3-3-2 Anolyte

7-1-5. Replacement of the catholyte (cathode reagent)

＜Exchange timing＞

- When the accumulated moisture measurement (=reagent life) has reached 300mgH_2O after the last replacement with new one.
- When drift level goes up.

Note

Negligence of replacing cathode reagent will cause higher drift level, foreign objects generated around the diaphragm and may lead to measurement errors.

For reagent capacity, see Instruction of the reagent you have purchased.

⇒ Please refer to 3-3-1 catholyte

7-1-6.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.

7-1-7.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.

7-1-8.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.

7-2. **Other Maintenance**

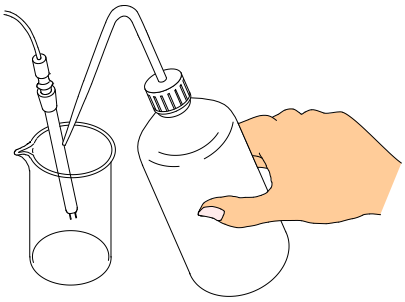
7-2-1.Storage of the instrument

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.
Store in a desiccant container the disassembled titration cell, inner burette and electrode as they are after cleansed and dried.

7-2-2.Cleaning the electrode

＜Twin platinum reference electrode＞

If the electrode is heavily stained and the potential is unstable and measurement reading fluctuates, cleanse it with nitric acid, and after cleaning by methanol, wipe off with clean gauze.



＜Inner burette＞

Periodical cleaning of inner burette is recommended since if the inner burette is stained, the electrolysis reaction will not run smoothly, and may cause a longer time length in measuring process with measurement results higher than theoretical value

Cleaning with alcohol: general method

1) Turn off all the powers.
2) Disconnect the electrodes from their ports.
3) Take out both anolyte and catholyte.
4) Wipe off grease around sliding area with methanol.
5) Rinse the inner burette with methanol, and fill it with approximately 10mL of methanol, and then, put it in a beaker. Fill the beaker with methanol up to the level of methanol inside the inner burette, and leave it for about 30 minutes.
6) After the above 5), dry the inner burette.

Cleaning with chromic acid mixture : When a dirt does not come off

If foreign objects are observed on diaphragm and platinum surface, use chromic acid mixture instead of methanol for cleaning.

Chromic acid mixture:

1.5g approx. potassium dichromate dissolved in 100mL of concentrated sulfuric acid

⚠ **Caution**	**Chromic acid mixture is a very strong oxidizing reagent. When handling this chemical, protect yourself with gloves and glasses. If it touches your skin, immediately rinse it with running water.**

1) Follow the same steps as above for methanol.
2) Drain out the chromate inside the cell, and rinse it with pure water for 5 to 6 times until yellowish color disappears.
3) Clean the inner burette with methanol or with alcohol.
4) After cleaning, dry the inner burette.

⚠ **Caution**	**Chrome is a heavy metal. Do not discard the used mixture or rinsing solvent as wastewater. First, dilute the collected chromic acid mixture down to 1% concentration, and then, reduce it. After confirming no Cr6+ is contained in it, adjust its pH to 7.5 ~ 8.5. Filter the liquid, and store the precipitation. For more details, refer to the corresponding documents regarding how to dispose of heavy metals.**

How to dry the inner burette and diaphragm

Dry it in a decompression dryer for more than 2 hours.
Below sketch shows an example of commercially sold drying under reduced pressure.

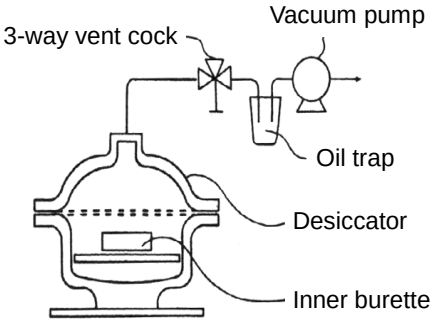
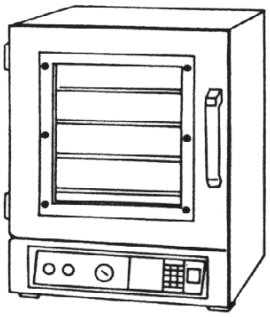


Diagram of Decompression dryer



Commercially available vacuum dryer

Note Dry the inner burette itself only after removed from the titration cell in order to avoid possible breakage of inside ceramic diaphragm.

Use a hair dryer if a compression dryer is not available. With a hair dryer, dry the inner burette well enough as long as for more than 10 minutes, especially dry the diaphragm until it is really dried. Any residue of moisture will cause high drift level.

Caution

Set the temperature of the constant temperature drying oven at 65°C or below.
When drying with a hair dryer, make sure not to overheat its cable and connector.
Overheating may result in malfunction.

7-2-3.Cleaning the titration cell

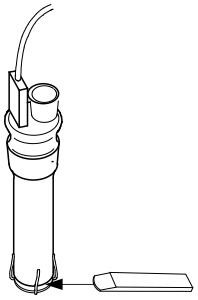
1) Remove Detection electrode, Inner burette and Sampling port stopper, and then drain out the reagent.
2) Wipe off the grease around the sliding area with methanol.
3) Rinse by neutral detergent under running water.
4) After drying the glassware in a heater, either cool them in desiccator or dry them.

Note

Insufficiently dried glassware may cause higher drift level.

7-2-4.Distance adjustment between anode electrode and diaphragm

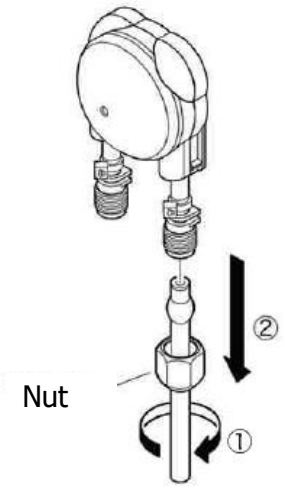
If the anode electrode in the inner burette and the diaphragm are too close together, electrolysis reaction will not run in normal condition. Use the supplied anode adjuster to adjust the distance in between.



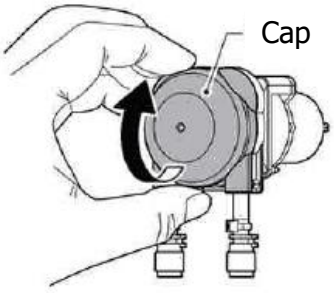
7-2-5.Replacement of pump tube

Initial pump flow rate is about 20mL/10 sec at the fastest, which may be reduced when the tube is used for a long time. This may result in leakage of samples at the time of measurement.
Follow the instructions below.

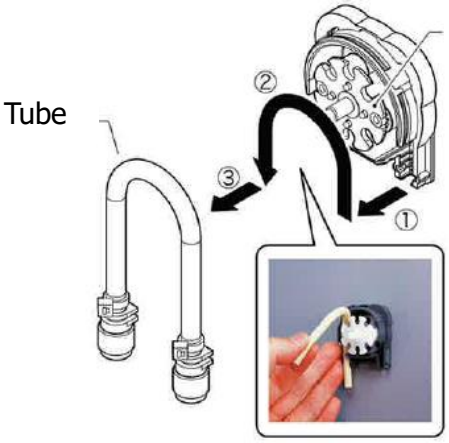
1) Remove the tubes connected to cassette.



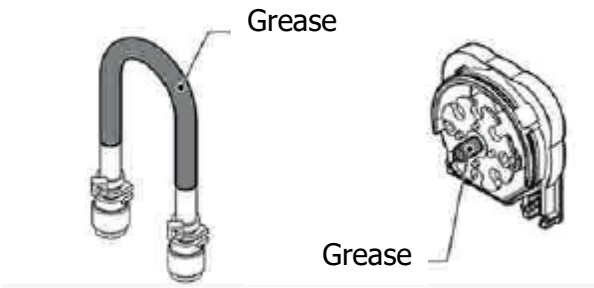
2) Remove the pump tube cap, as shown on the right.



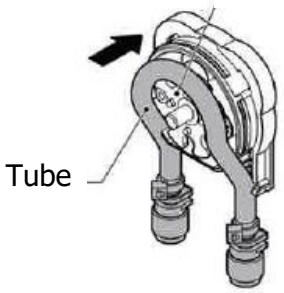
3) Remove the pump tube, as shown on the right.



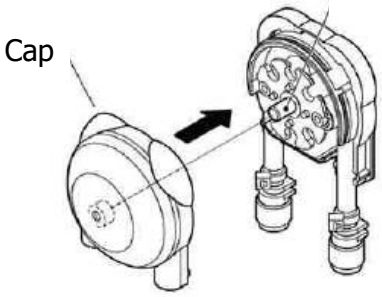
4) Apply the supplied grease around the new tube and axle of cassette.



5) Fit the new pump tube onto the rotor. To fit, draw the rotor toward you as shown in figure.



6) Fix the cap and connect the tubes.



In addition, when using chloroform-containing reagents or oil-based samples, you can use the 64-01473 pump tube (option).

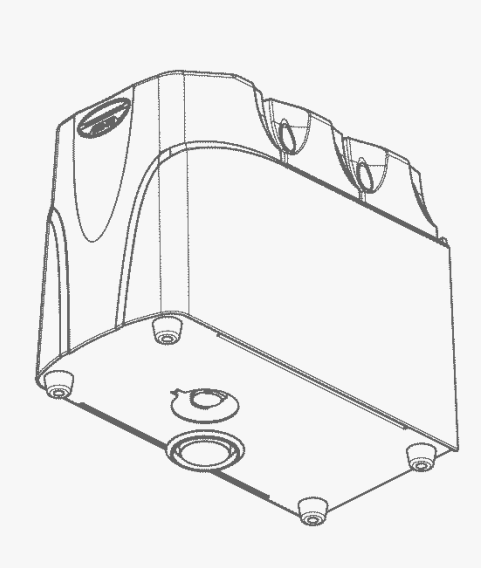
7-2-6.Replacement of the filter

Place the filter for injection pump as a dustproof to the back of auto dispensing part. Since the filter might be dirty when the flow of injection pump becomes lower, change the filter.

Note With no filter, dust may go into the tubing of the injection pump, which may break the inner switching valve.

7-2-7.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.



Open the battery cover on the bottom of the main unit with a slotted screwdriver. Replace the old battery with a new one (CR2032).

Caution **Follow your national, regional and local regulations for disposal of batteries**.

8. Troubleshooting

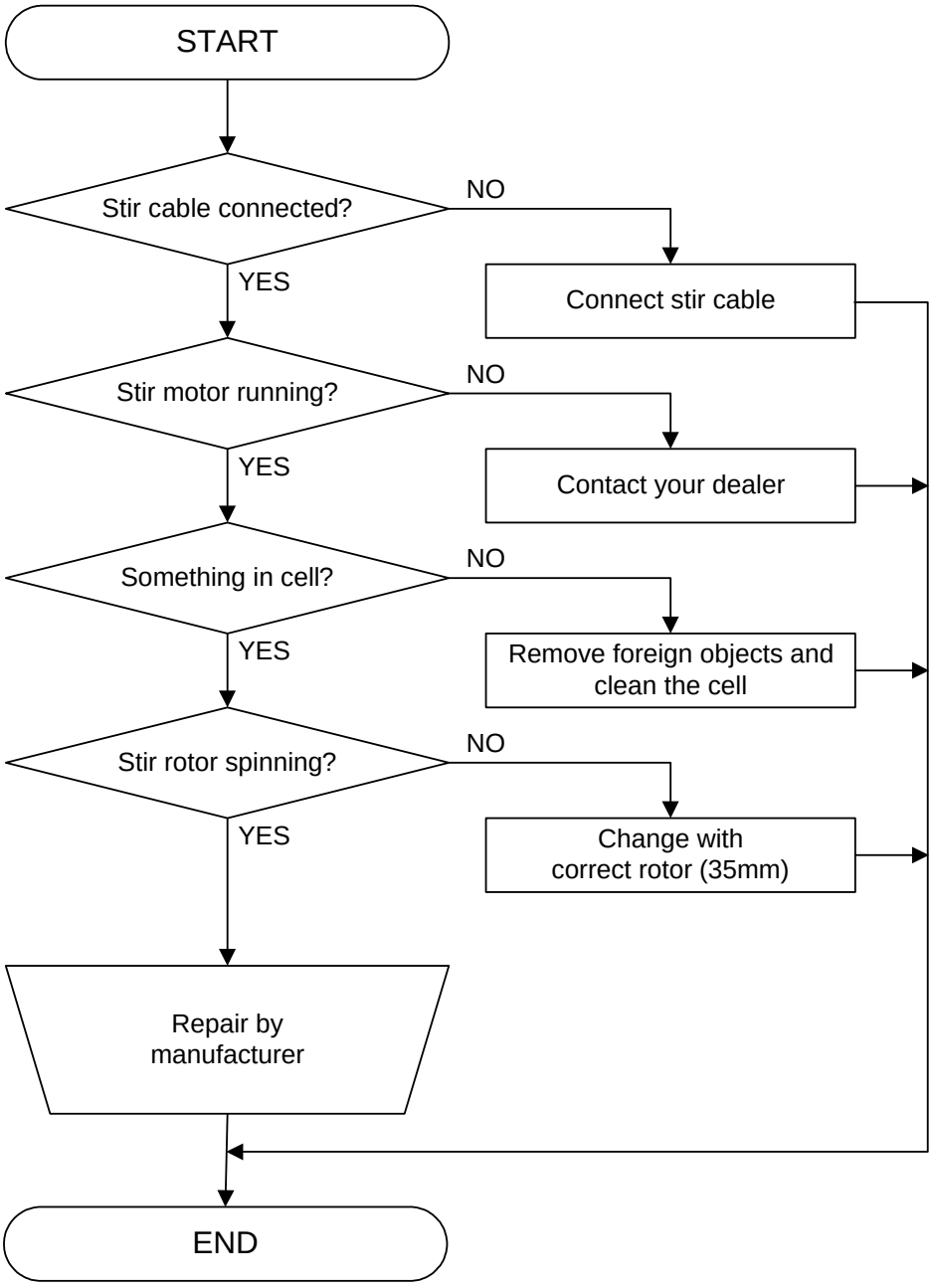
8-1. Error messages and alarm messages

Error message	Trouble	Remedies
Electrode Open!	Connecting cable is not connected.	Check on connection between the detection electrode and stirrer.
	Electrode cable is broken or loosely connected.	Replace the electrode.
Electrode short!	When the electrode is shorted. Twin Pt pins of electrode are in contact.	Correct the two pins to extend in parallel.
	It is over-titration.	Add water to polarize the cell.
	The tip of electrode is cracked.	Replace the detection electrode.
Over Titr!	Over-titration is underway. Reagent with too much iodine is cell.	Add water to the cell.
	The titration cell is under direct sunlight.	Refrain from direct sun's ray or use a brown cell.
	The anode is stained with foreign objects.	Clean the inner burette and the electrode.
Meas. Over!	When measurement exceeds the range.	Change the catholyte. Also change the anolyte if necessary.
	One time measurement exceeds 300mgH_2O.	Reduce sample size not to exceed 300mgH_2O, and try again.
Current Error!	Sample liquid resistance is too high or the electrode cable is broken causing no current flow for electrolysis in inner cell.	Check on electrode connection. Reduce sample size.
Preamp Error!	Preamplifier circuit is now defective.	Contact your local dealer.
Communication Error!	Communication failure.	Reboot the system. Contact your local dealer when recurring.

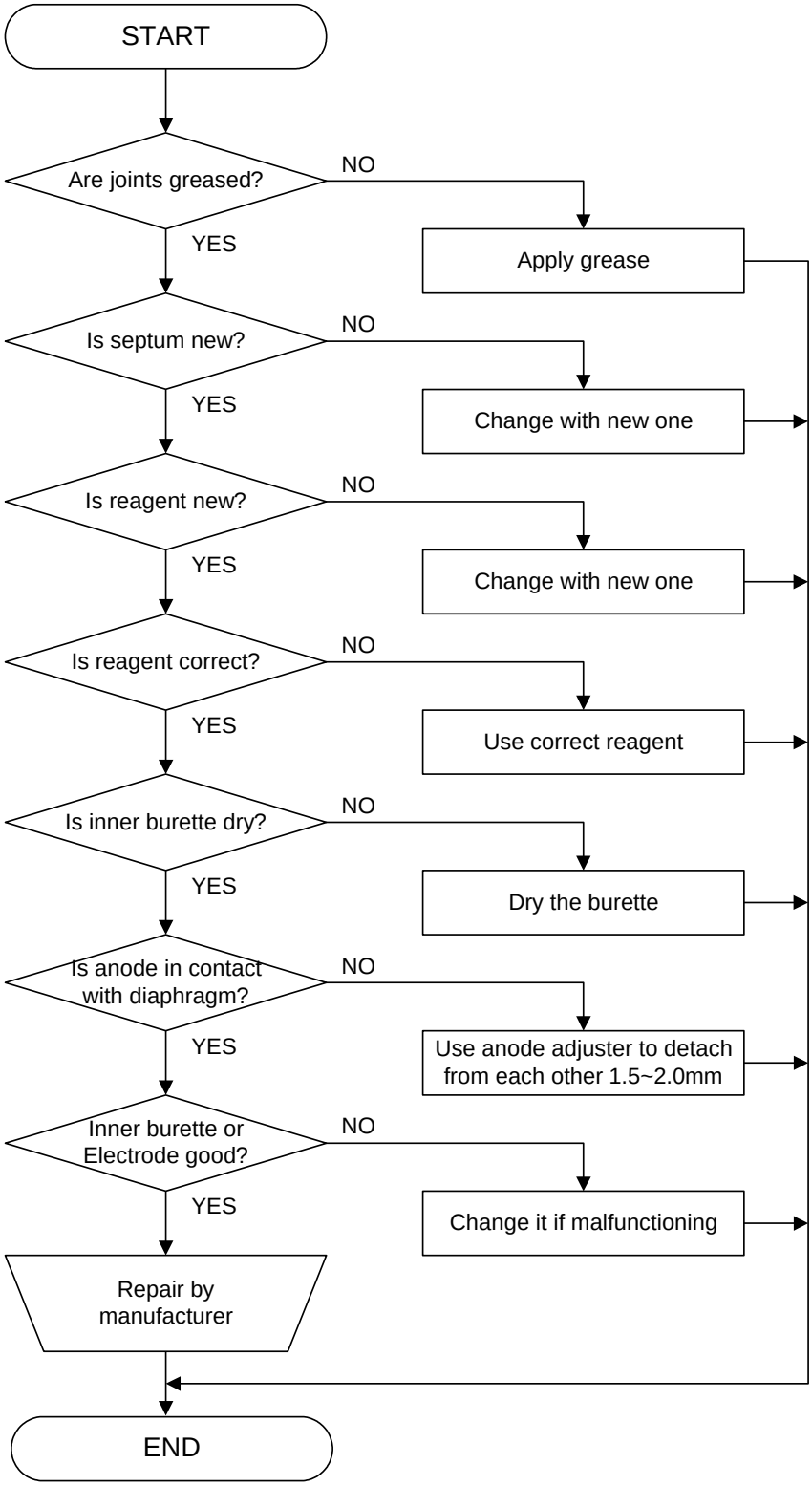
8. Troubleshooting

Alarm message	Reason	Remedies
A.Capa. Over!	Because the total anode reagent consumed in electrolysis exceeds the preset level.	Change the anolyte and clear the reading and reset the now life to zero.
C.Capa. Over!	Because the total cathode reagent consumed in electrolysis exceeds the preset level.	
A.replace Day!	Because the date for changing the anolyte becomes due today.	Change the reagent and clear the due date setting.
C.replace Day!	Because the date for changing the catholyte becomes due today.	
A.Replace now!	Because the date for changing the anolyte is past.	
C.Replace now!	Because the date for changing the catholyte is past.	
A.replace in xx days	Because the preset due date to change anolyte is xx days.	
C.replace in xx days	Because the preset due date to change catholyte is xx days.	

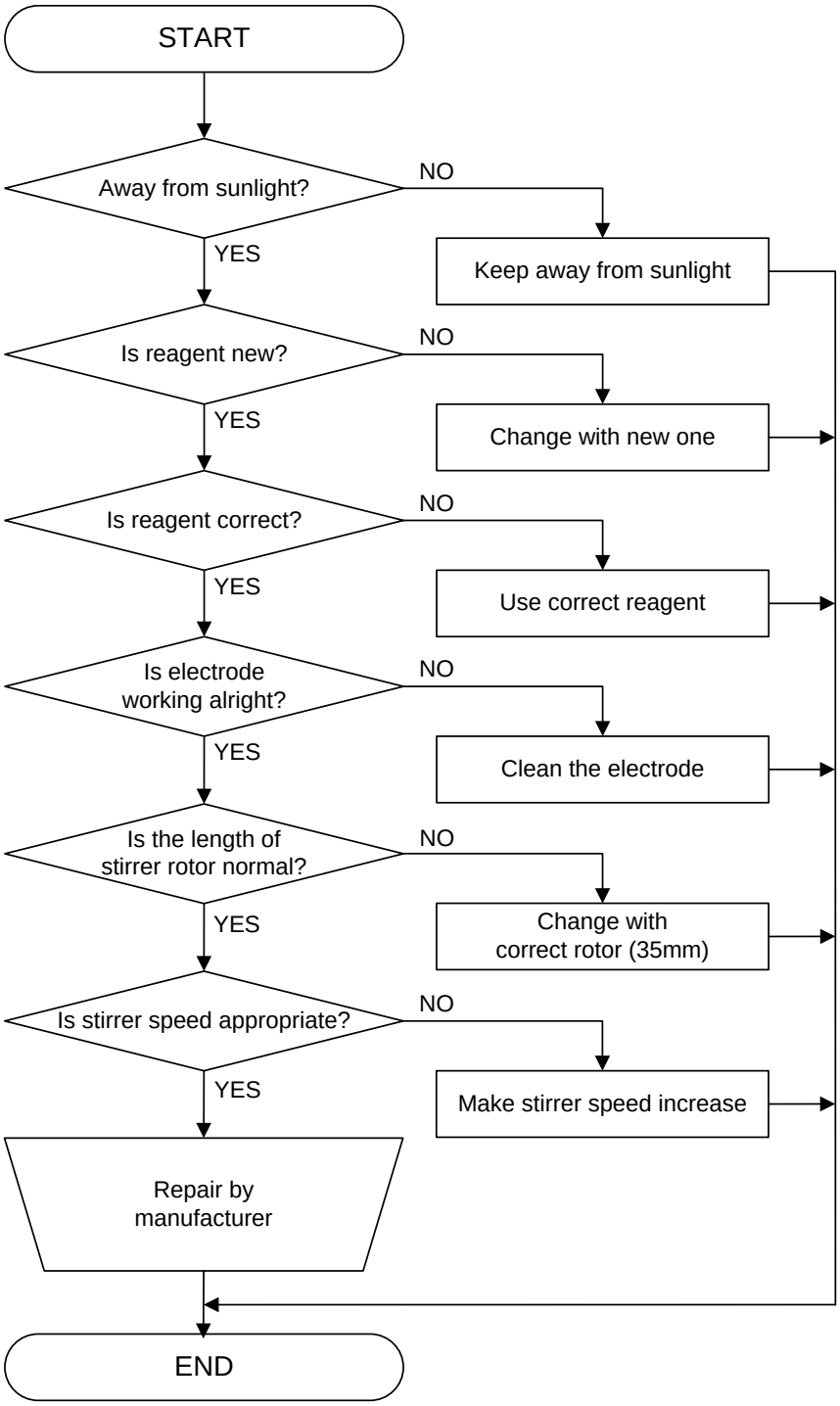
8-2. **Stirrer does not work properly**



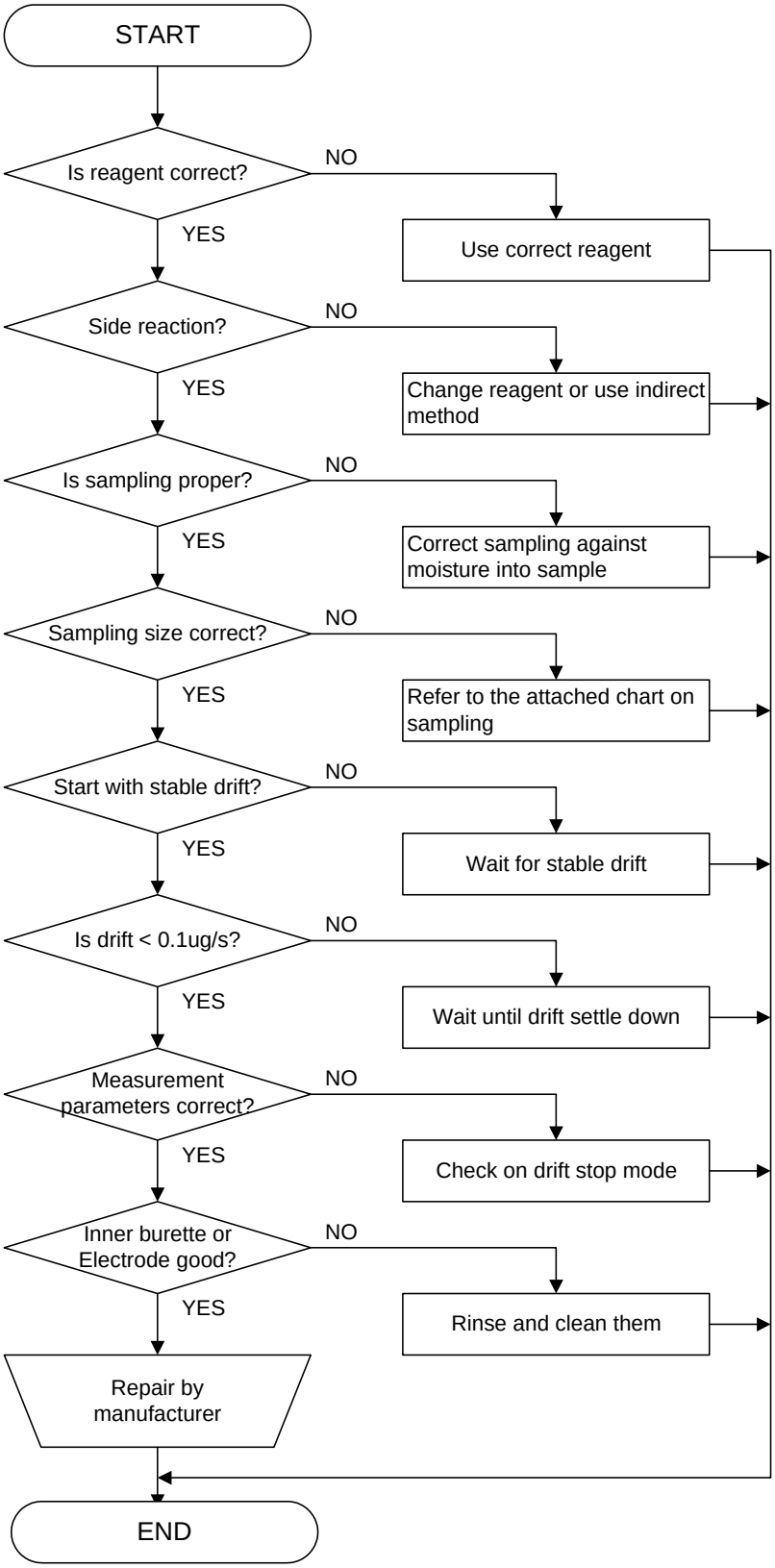
8-3. **Drift level is too high**



8-4. **It runs into over-titration**



8-5. **Poor repeatability or no EP found**



For reproducibility of measurement results, moisture content and sample size relations in below chart is important.

Moisture Content	Sample Size
50 ~ 100 %	10 mg
10 ~ 50 %	10 ~ 20 mg
1 ~ 10 %	10 ~ 50 mg
0.1 ~ 1 %	10 ~ 100 mg
0.01 ~ 0.1 %	100mg ~ 1.0 g
0.001 ~ 0.01%	1 ~ 10 g
0.0001 ~0.001 %	10 ~ 20 g

8-6. **Glass contact area jammed**

If grease on the glass contact areas becomes hard and the respective parts are difficult to separate, take the following steps;

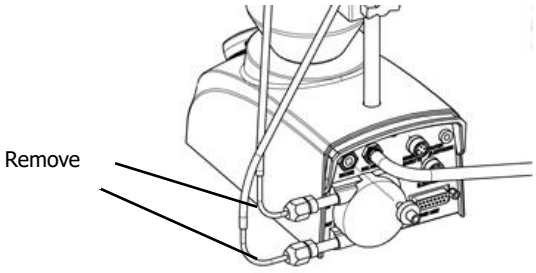
1) Discharge anolyte and catholyte.
2) When using a glass port plug, warm it up with a hair dryer or something similar to soften KF grease before removing. When using a PTFE port plug, remove it after cooling the titration flask in a freezer for about five (5) minutes.

⚠ **Warning!**	**Do not try and open solidified jointed parts by force. Glassware may break into piercing pieces for injury. Do not warm up a PTFE port plug when removing it as doing so may inflate the material and the titration flask may be broken.**

8-7. **When the drain pump is clogged**

The sample which can not be dissolved in the solvent, clogged the piping and pump tube. Please remove the clogging by the following steps when the drainage volume is lowered.

1) Remove the tube.



2) Insert the dropping pipette to the tip of the pump tubing or tube, remove the clogging.

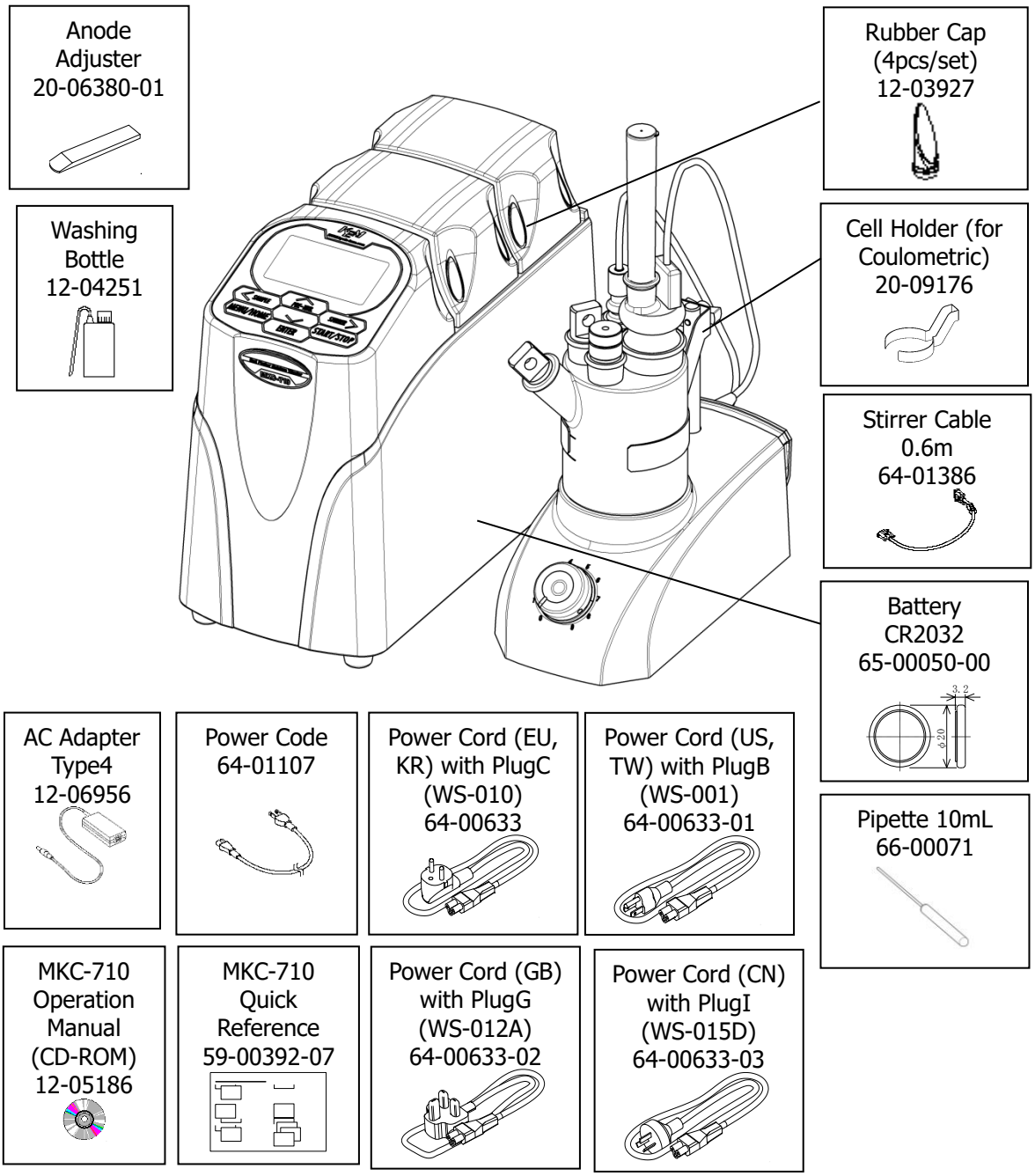
Caution	When removing the tube, please attach the eye protection and gloves. Please be careful because there is a possibility that the drainage jump out.

9. Others

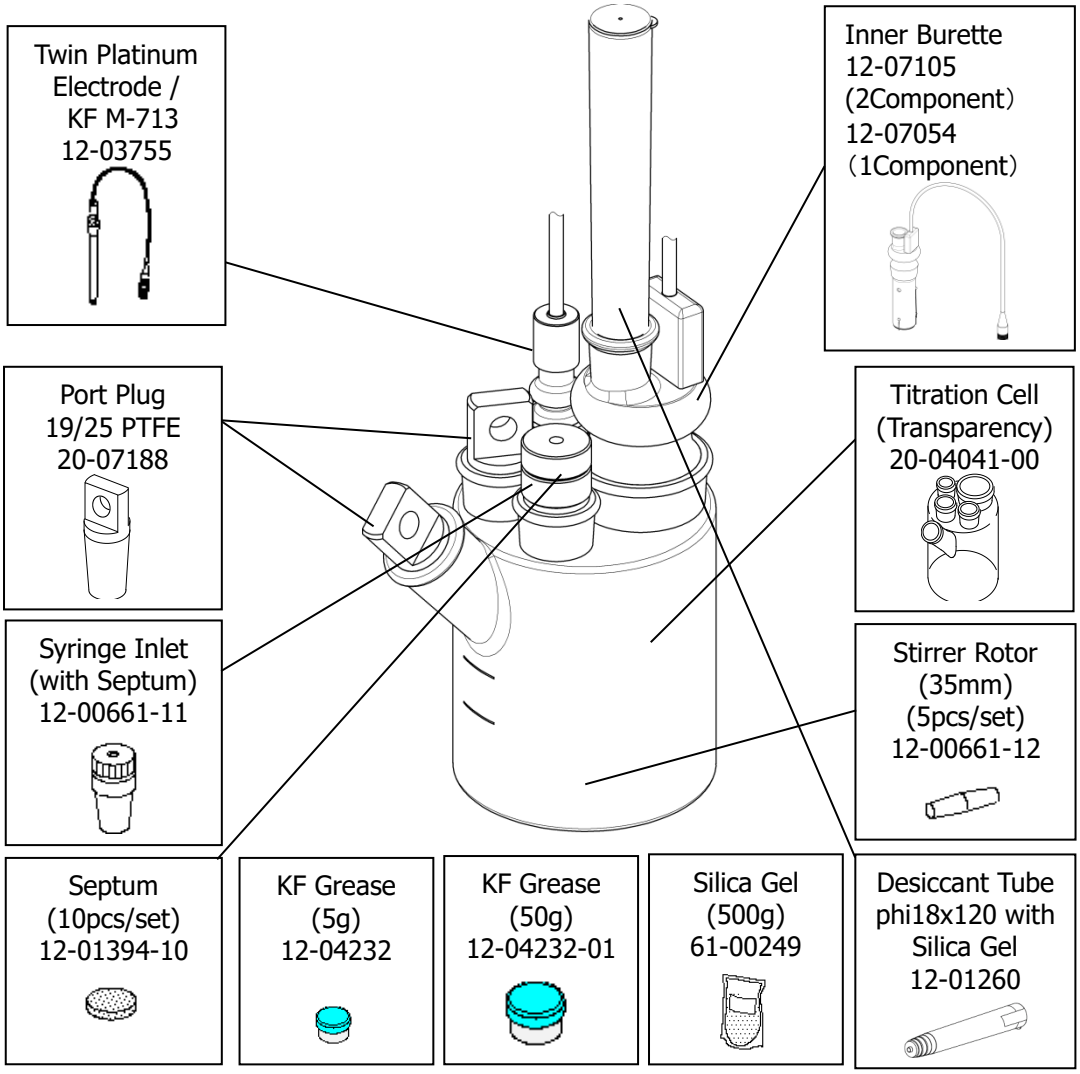
9-1. **Parts list**

The supplied parts, consumable parts and optional components are shown in the following lists, and you can obtain any of these parts at your dealer or from sales representative.

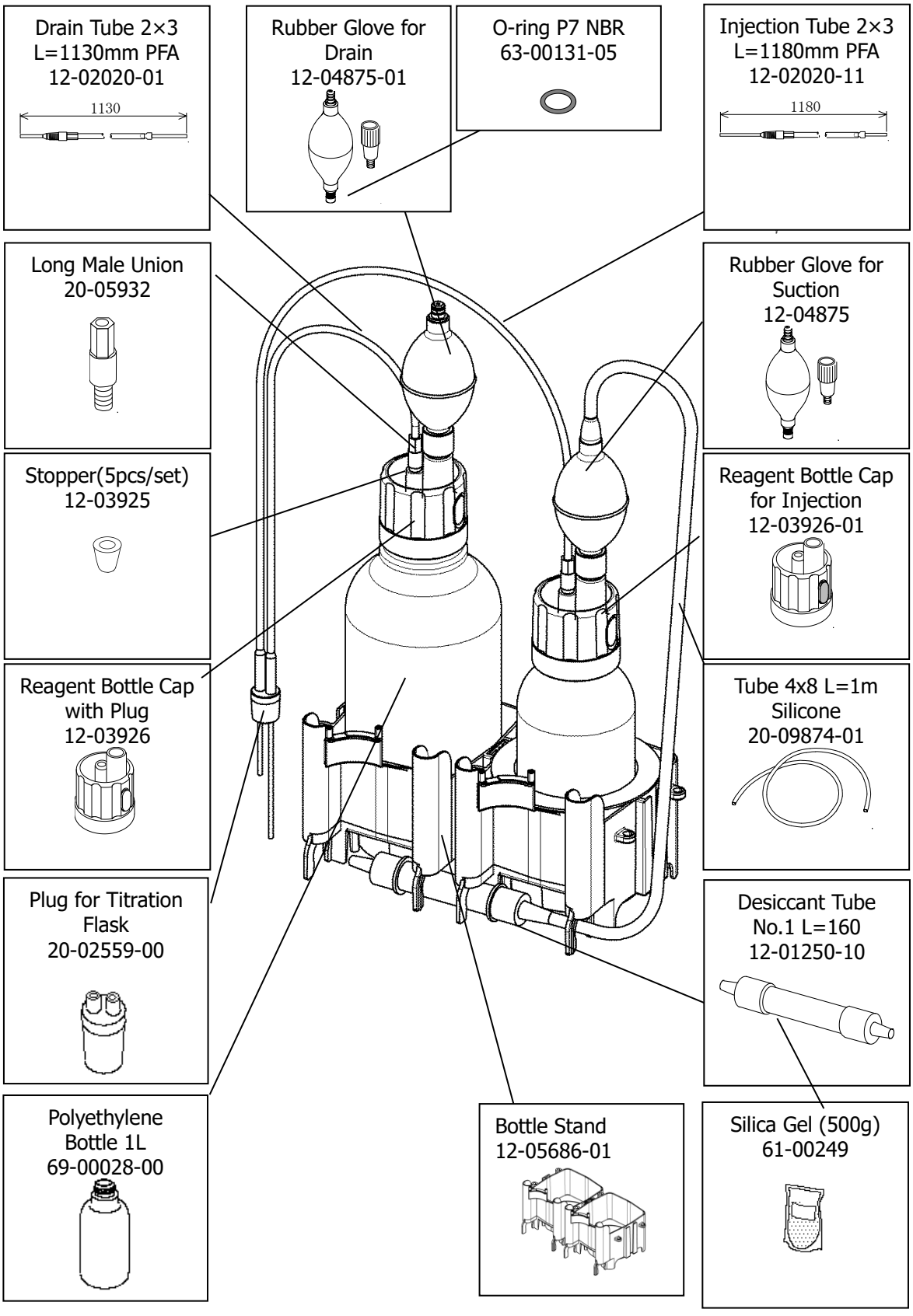
Parts



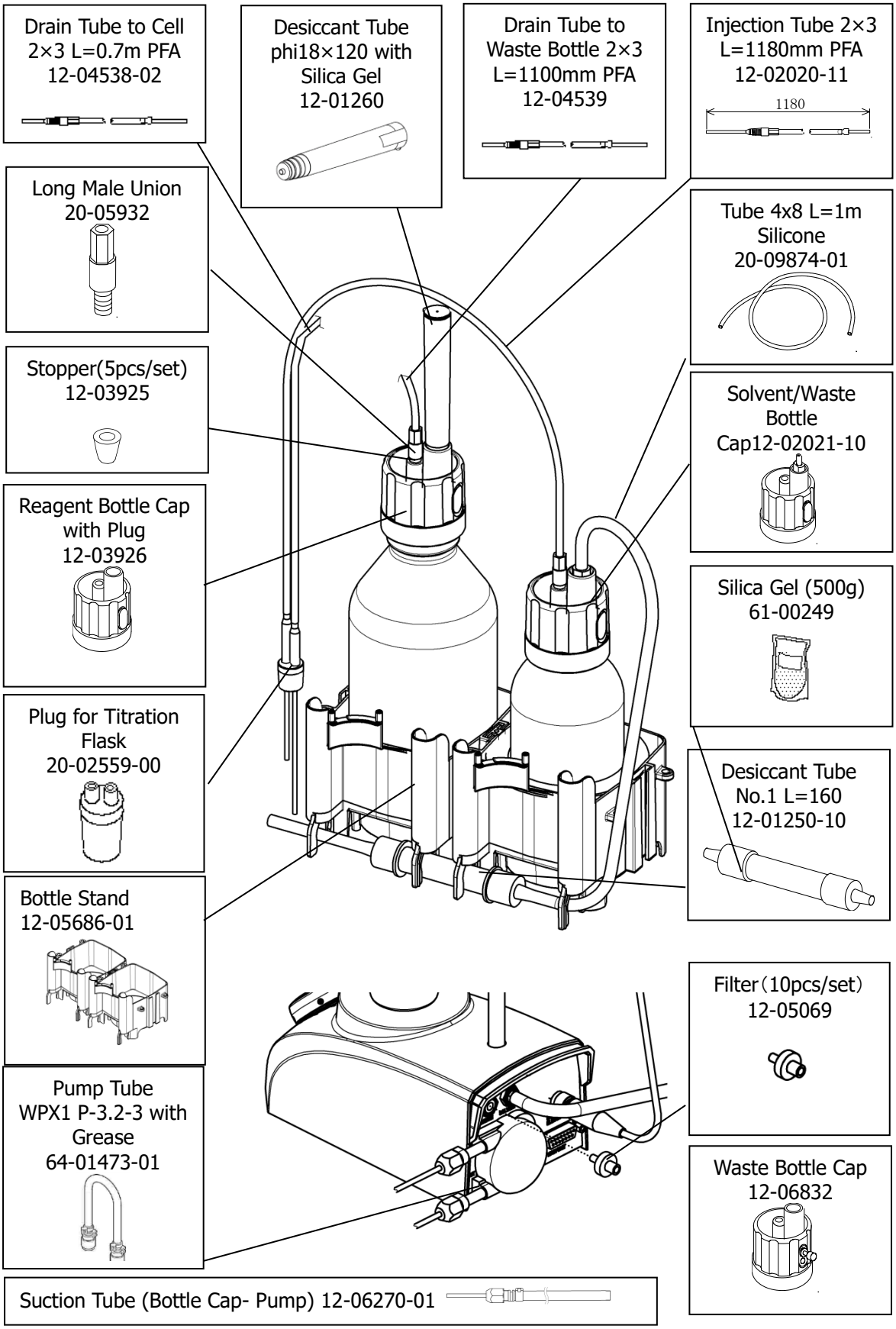
Parts (Titration Cell)



Manual Solvent Change Unit

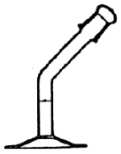
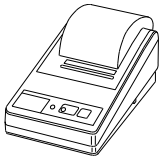
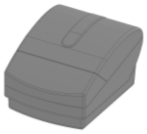
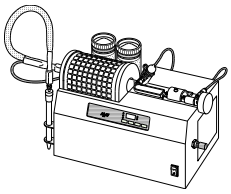
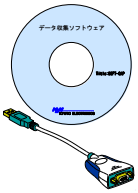


Auto Solvent Change Unit

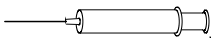
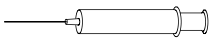
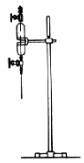
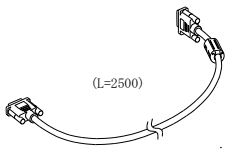
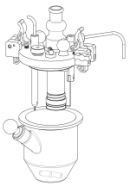


9-2. **Options**

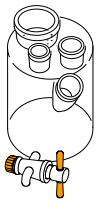
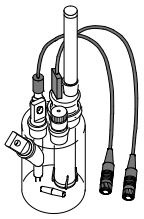
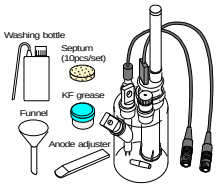
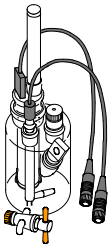
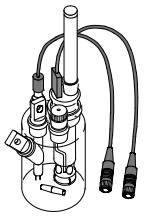
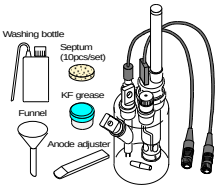
Various convenient peripherals are available as shown below. These options can be purchased from KEM. Contact your local dealer or sales representative

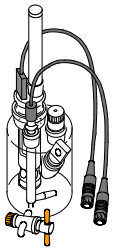
	Application		Option
MKC-710	Collect in a way that is appropriate for the sample size		Sampler
	Print out of measurement results		Dot Matrix Printer IDP-100
			Thermal Printer DP-600
	Measure the moisture in the sample by Evaporator		Evaporator
	Control from your PC		KF-Win Software for Moisture titrator
	Date capture into your PC		SOFT-CAP Date Acquisition Software

Sampler ,Consumables

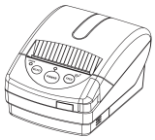
Part code	Part name	Remarks	Sketch
12-00696-10	Micro Sampling Unit (for Coulometric)		
12-04577-10	Silicone Rubber (5pcs/set)		
12-04577-02	Syringe 2mL with Needle		
12-04577-01	Syringe 20mL with Needle		
12-05143	Liquefied Gas Sampler		
64-00049-01	Stirrer Cable 2.5m		
12-03635-03	Titration Cell Unit	Easy to replace a diaphragm of an inner burette. MS-710CP and 20-11582 Cell Holder required.	
20-11582	Cell Holder (for Hybrid)		

Titration cell

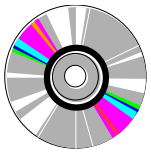
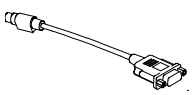
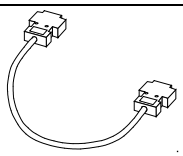
Part code	Part name	Remarks	Sketch
20-04042-00	Titration Cell with Drain Cock	Transparent cell with a drain cock	
12-07355-01	2Component Type Titration Cell Unit	Transparent cell with a drain cock Two-component cell Twin platinum electrode / KF and other attachment	
12-07355-10	2Component Type Titration Cell Unit with Funnel	Transparent cell Two-component cell Twin platinum electrode / KF and other attachment	
12-07356	2Component Type Titration Cell Unit with Cock	Transparent cell with a drain cock Two-component cell Twin platinum electrode / KF and other attachment	
12-07139-01	1Component Type Titration Cell Unit	Transparent cell with a drain cock One-component cell Twin platinum electrode / KF and other attachment	
12-07139-10	1Component Type Titration Cell Unit with Funnel	Transparent cell One-component cell Twin platinum electrode / KF and other attachment	

Part code	Part name	Remarks	Sketch
12-07140	1Component Type Titration Cell Unit with Cock	Transparent cell Two-component cell Twin platinum electrode / KF and other attachment	

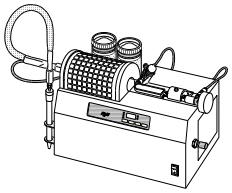
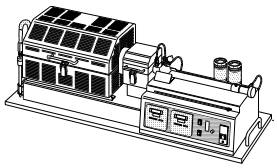
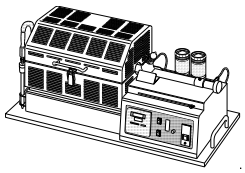
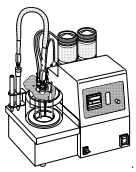
Printer

Part code	Part name	Remarks	Sketch
12-02028-01 12-02028-02	Dot Matrix Printer	AC120V AC230V	
12-02618-01 12-02618-02 12-02618-03 12-02618-04	Thermal Printer	(EU/KR) (GB) (US/TW) (CN)	

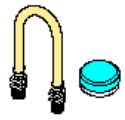
Software

Part code	Part name	Remarks	Sketch
12-04473	KF-Win Software for Moisture Titrator	Connecting cable (MiniDIN8P-DSUB9 PM (64-00625)) required.	
12-03265	Data Acquisition Software	Connecting cable (12-02012 and 64-00625) required.	
64-00625	Connecting Cable (MiniDIN8P-DSUB9PM) 160mm		
12-02012	RS-232C Connecting Cable (9P-9P) 2m		

Evaporator

Part code	Part name	Remarks	Sketch
ADP-611	Evaporator		
ADP-512	Evaporator for ores	Non-CE	
ADP-512S	Evaporator for high temperature	Non-CE	
ADP-513	Evaporator for high temperature	Non-CE	

Pump Tube

Part code	Part name	Remarks	Sketch
64-01473	Pump Tube WPX1 F-3.2-3 with Grease	Fluorine tube	

9-3. **Specification**

Specification	Contents
Type and Model	MKC-710 Karl Fischer Moisture Titrator
Measuring method	Karl Fischer coulometic Titration method
Measuring range	Water content 1μg to 300mg
Reproducibility	within 0.3%CV (n=10)/water-standard 1mgH_20 *
Display resolution	0.1μg
Control method	Constant current pulse time control
Endpoint detection	AC polarization
EP sense method	Selective drift stability or Limit measurement time
Measurement cell	2-Component or 1-Component
Titration cell	Anolyte 100mL (max 150mL)
	Catholyte 5mL
Number of methods	20
Display	White LED-backlit LCD
On-screen display	Potential, titration volume/ Measurement Results/ Titration conditions / Parameters Japanese / English / Mandarin Chinese / Korean / Russian / Spanish
Calculation	Concentration Statistics (mean, SD, RSD) / Auto input of blank
Data memory	100 samples
GLP support	Registration of operator / Record of calibration results / Record of date for changing reagent
External I/O	RS-232C ×2: for dot matrix printer, electronic balance, Data Acquisition Software (SOFT-CAP) USB ×1: for USB flash drive, thermal printer, keyboard, barcode reader, foot switch
Ambient conditions	Temperature :5 to 35°C Humidity :85%RH or below (no condensation)
Power supply	DC24V 1.9A(Main unit) AC100 - 240V ±10% 50/60 Hz (Comes with AC Adapter)
Power consumption	Approx. 20W
Dimensions	Main unit 141(W)×292(D)×244(H)mm Stirrer 110(W)×206(D)×340(H)mm (not incl. Solvent Change Unit)
Weight	Approx. 3kg
CE marking	EMC : EN61326 LVD : Conforming to EN61010-1

*Per KEM standard measurement conditions and standard liquids

9-4. **Principle of measurement**

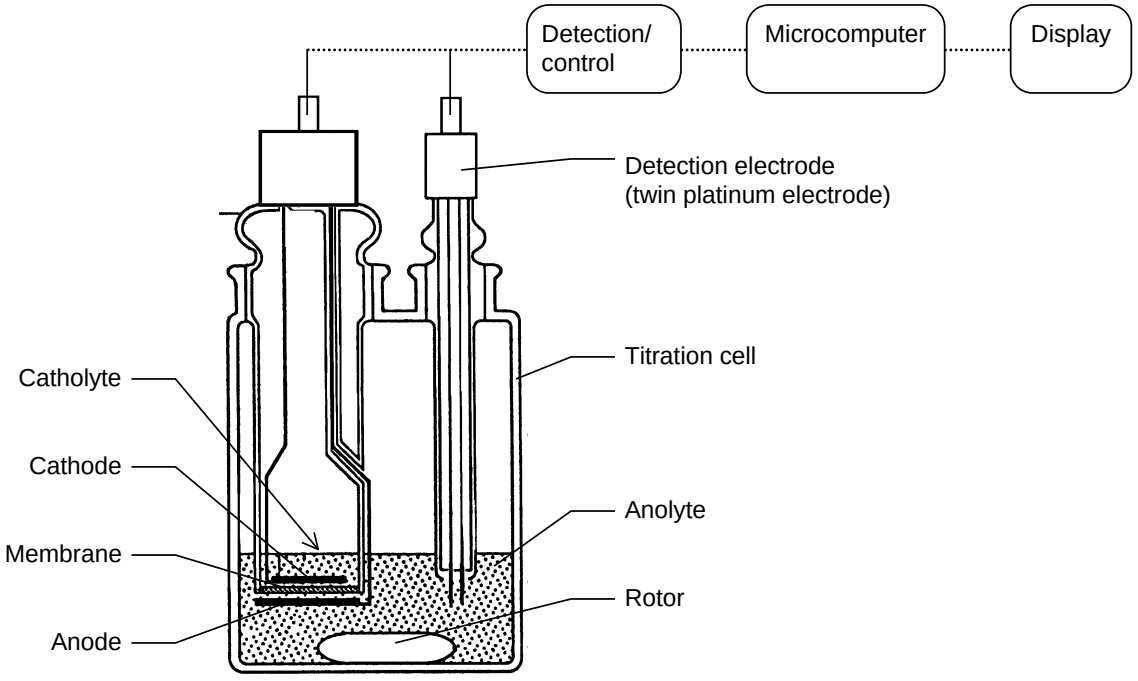
In the Karl Fisher moisture content measurement, water reacts with iodine and sulfur dioxide in the presence of base and alcohol.

$$H_2O + I_2 + SO_2 + CH_3OH + 3RN \rightarrow [RNH]SO_4CH_3 + 2[RNH]I \quad \text{.....(1)}$$

In the volumetric titration, iodine is added as a titrant. In the coulometric technique, iodine is electrolytically generated in the anolyte, which contains iodide.

$$2I^- \rightarrow I_2 + 2e^- \quad \text{.....(2)}$$

As long as water is present in the titration cell the generated iodine reacts according to (1).
As soon as all the water reacts, excess of iodine appears in the anolyte. This iodine is detected by the platinum electrode and the iodine production is stopped. According to Faraday's law, the quantity of iodine produced is proportional to the current generated. In equation (1), I_2 and H_2O react with each other in proportion 1:1.
Therefore a mole of water (18 g) is equivalent to 2×96500 coulombs, or 10.71 coulombs/ 1 mg H_2O. The total amount of moisture can thus be determined by measuring the total consumption of electricity.



9-5. **Karl Fischer reagent**

For Karl Fischer titration, appropriate reagent must be selected to the sample that you are going to analyze. Below chart shows the type of sample and its corresponding reagents available on the market.

< Kyoto electronics manufacturing co.,ltd.>

Application		Dehydrated Solvent	Remarks
General titration (Alcohols) (Hydrocarbons) (Ethers) (Esters) (Gases) (Fats and Oils) (Amines)	Anolyte	KEMAQUA Anolyte AGE	KEMAQUA AGE/CGE are non-organic chlorines. Amines To use KEMAQUA AGE, add 10g salicylate acid to 100mL KEMAQUA AGE.
	Catholyte	KEMAQUA Catholyte CGE	
Fats and Oils (Alcohols) (Hydrocarbons) (Ethers) (Esters) (Gases)	Anolyte	KEMAQUA Anolyte AO	
	Catholyte	KEMAQUA Catholyte CGE	
Ketones	Anolyte	KEMAQUA Anolyte AKE	Formaldehyde can only be titrated among other aldehydes.
	Catholyte	KEMAQUA Catholyte CGE	

< Hydranal >

Application		Dehydrated Solvent	Remarks
General titration (Alcohols) (Hydrocarbons) (Ethers) (Esters) (Amines)	Anolyte	Coulomat AG*	Coulomat AG/CG are non-organic chlorines. Amines To add, neutralize a basic amine with an acid. To use Coulomat AG, Add acetic acid, Salicylate or benzoic Acid to 20% of 100mL of Coulomat AG.
	Catholyte	Coulomat CG	
Ketones	Anolyte	Coulomat AK*	Formaldehyde can only be titrated among other aldehydes. Coulomat CG-K are non-organic chlorines.
	Catholyte	Coulomat CG-K	
Gases	Anolyte	Coulomat AG-Oven*	
	Catholyte	Coulomat CG	
Fats and Oils	Anolyte	Coulomat AG-H*	Coulomat AG-H/CG are non-organic chlorines.
	Catholyte	Coulomat CG	
General titration (Alcohols) (Hydrocarbons) (Ethers) (Esters) (Amines) (Gases)	1-component cell	Coulomat CG**	

Note) ** possible to use for only single component cell
* possible to use for 2-compoonent cell or 1-component cell

< Mitsubishi Chemical >

Application		Dehydrated Solvent	Remarks
General titration (Alcohols) (Hydrocarbons) (Ethers) (Esters) (Gases) (Fats and Oils) (Amines)	Anolyte	Aquamicron AX	Aquamicron AX/CXU are non-organic chlorines. Amines To use Aquamicron AX, add 10g salicylate acid to 100mL Aquamicron AX.
	Catholyte	Aquamicron CXU	
Fats and Oils (Alcohols) (Hydrocarbons) (Ethers) (Esters) (Gases)	Anolyte	Aquamicron AS	
	Catholyte	Aquamicron CXU	
Ketones	Anolyte	Aquamicron AKX	Formaldehyde can only be titrated among other aldehydes. Aquamicron CXU are non-organic chlorines.
	Catholyte	Aquamicron CXU	

9-6. **Parameter list**

9-6-1.Setup parameters

[Interface]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
RS-232C	NONE	NONE/COM1/COM2	RS-232C	As displayed
Baud rate	4800bps	300bps/600bps/1200bps/ 2400bps/4800bps/9600bps	Baud Rate	As displayed
Parity	-	None/Even/Odd	Parity	As displayed
Stop bits	1	1/2	Stop Bits	As displayed
Data bits	8	7/8	Data Bits	As displayed
Printer	NONE	NONE/ OTHER /DP-USB/ IDP-	Printer	As displayed
Balance	NONE	NONE/KEM/Mettler/A&D /Shimadzu/Sartorius /Mettler-Old	Balance	As displayed
Interface	COM1	COM1/COM2	Interface	As displayed
Mode	Continuous	Continuous/Print	Mode	As displayed
USB	Host	Host/MCU	Mode	As displayed

[Beep]

Parameter and default		
Item	Default	Selection range
Beep	Set	Set/off
Type	Type1	Type1 /Type2/Type3 /Type4/Type5

[Operator]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Current No.	1	01-10	Current No.	As displayed
Operator	-	Within 20 characters A-Z, +,-,/,*,(,),.,,%	Operator	As displayed

[Display setup]

Parameter and default		
Item	Default	Selection range
Date Style	YYYY/MM/DD	YYYY/MM/DD MM/DD/YYYY DD/MM/YYYY
Date	2001/01/01	2001/01/01 - 2099/12/31
Time	00:00	00:00 - 23:59
Language	English	Japanese/English/ Mandarin/Korean/ Russian/Spanish

[Other setup]

Parameter and default			Printout	
Item	Default	Selection range	Item	Printing
Character Disp.lay	Large	Normal/Large	Character Disp.	As displayed
Print Header	On	Off/On	Print Header	As displayed
Print Footer	On	Off/On	Print Footer	As displayed
Auto set.,mean	On	Off/On	AutoSet. Mean	As displayed

9-6-2.Method parameters

[Parameter and default]

Method No.	01	02	03	04	05	06	07-20
[Titration Parameter]							
Titration Mode	H2O	H2O	H2O	H2O	Br2	H2O	H2O
Cell Type	2-Comp.	2-Comp.	2-Comp.	2-Comp.	2-Comp.	2-Comp.	2-Comp.
t(stir)	0s	0s	0s	0s	0s	0s	0s
t(wait)	15s	15s	15s	15s	15s	15s	15s
t(max)	0s	0s	1200s	1200s	0s	0s	0s
Drift Stop	Rel.	Rel.	Off	Off	Rel.	Rel.	Rel.
Rel.	0.10ug/s	0.10ug/s	-	-	1.00ug/s	0.10ug/s	0.10ug/s
Abs.	-	-	-	-	-	-	-
Control Gain	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Electrolysis Speed	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Stable	0.1ug/ min	0.1ug/ min	0.1ug/ min	0.1ug/ min	0.5ug/ min	0.1ug/ min	0.1ug/ min
Start Mode	Manual	Manual	Auto	Auto	Manual	Manual	Manual
Data Sampling Time	5s	5s	5s	5s	5s	5s	5s
[Caluculation Parameter]							
Caluculation Type	Sample	Sample	Sample	Sample	Sample	Check	Sample
Caluculation No.	1	2	2	2	7	2	1
Unit	ug	ppm	ppm	ppm	mg/100g	ppm	ug
Weight Input	Variable	Variable	Variable	Variable	Variable	Variable	Variable
Drift Comp.	Auto	Auto	Auto	Auto	Auto	Auto	Auto
Drift	-	-	-	-	-	-	-
Standard Value	-	-	-	-	-	0.0000	-
Permit. Error	-	-	-	-	-	0.0000	-
[Report]							
Format	Short	Short	Short	Short	Short	Short	Short
Data List	Off	Off	Off	Off	Off	Off	Off
Graph	Off	Off	Off	Off	Off	Off	Off

9-6-3.Selection of Method parameters and printout

[Titration Parameter]

Displays		Printout	
Item	Selection	Item	Printing
Titration Mode	H2O/ Br2	Mode	As displayed
Cell Type	2-Comp./1-Comp.	Cell Type	As displayed
t(stir)	0-99999s	t(stir)	As displayed
t(wait)	15-99999s	t(wait)	As displayed
t(max)	0-99999s	t(max)	As displayed
Drift Stop	Off/ Rel./ Abs.	Drift Stop	As displayed
Rel.	0.00-9.99µg/s	Rel.	0.00-9.99ug/s
Abs.	0.00-9.99µg/s	Abs.	0.00-9.99ug/s
Control Gain	1.0-9.9	Control Gain	As displayed
Electrolysis Speed	Standard/Fast	Speed	As displayed
Stable	0.00-99.99µg/s	Stable	0.0-99.9ug/s
Start Mode	Manual/Auto	Start	As displayed
Data Sampling Time	1-99999s	Samp.Time	As displayed

[Caluculation Parameter]

Displays		Printout	
Item	Selection	Item	Printing
Caluculation Type	Sample/Blank/Check	Calc.Type	As displayed
Caluculation No.	1-6/7-8	Calc.No.	As displayed
Unit	µg, mg, % ,ppm, mg/kg, µg/g,g/100g,mg/100g	Unit	ug,mg,% ,ppm, mg/kg, ug/g, g/100g,mg/100g
Weight Input	Variable/Fixed	Weight	As displayed
Drift Comp.	Off/Manual/Auto	Drift Comp.	As displayed
Standard Value	0.0000-99999.9999	Std.Value	As displayed
Permit. Error	0.0000-99999.9999	Permit.Err.	As displayed

[Report Parameter]

Displays		Printout	
Item	Selection	Item	Printing
Format	Off/GLP/Short	Format	As displayed
Data List	Off/On	Data List	Off/On
Graph	Off/On	Graph	Off/On

9-7. **International standards**

List of supported standards

Standard	Country
Pharmacopoeia	Eur., Japan, U.S.A.
ASTM（American Society for Testing and Materials）	U.S.A.
ASTM D 1533 （Standard Test Method for Water in Insulating Liquids by Coulometric Karl Fischer Titration）	U.S.A.
ASTM D 4928 （Standard Test Method for Water in Crude Oils by Coulometric Karl Fischer Titration）	U.S.A.
ISO 760 （Determination of water -- Karl Fischer method (General method)）	International

10. Warranty and After-sales Service

1. Warranty Period

One (1) year from the date of receipt of this product or the date of installation by KEM service personnel or by authorized personnel.

2. Warranty Details, After-sales Service

This product passed the strict inspections of KEM and, except for consumables, KEM warrants this product, under normal use, for one (1) year from the date of receipt of this product or the date of installation by KEM service personnel or by authorized personnel. (In principle parts and consumables will be supplied for at least seven (7) years after discontinuation of this product.)
Should an initial failure occur during the warranty period, KEM will decide whether to replace the product or to correct defects.
This product can be repaired at user's site by KEM service personnel or by authorized personnel. Note that secondhand or pre-owned products are not covered by warranty.

3. Exclusion

Warranty shall be void where:

- any part is replaced or any repair or remodeling is performed by unauthorized personnel;
- unauthorized service parts, spare parts and/or consumables are used;
- the user does not follow the instructions for installation, correct use, maintenance and/or storage, resulting in malfunction;
- the user does not follow the ranges and/or conditions stated in the product brochure, flyer or specifications;
- periodic checks and/or maintenance is not performed;
- breakage and/or malfunction is caused by careless handling such as, but not limited to, exposing to or submerging in water, or dropping down;
- breakage and/or malfunction is caused by excessive force applied to glassware or plastics;
- malfunction or leakage is caused by sample properties (corrosively, solid materials, etc.);
- malfunction is caused by any device, part and/or chemical other than those supplied by KEM;
- overuse has led to fatigue or wear of parts;
- items are consumables or wearing parts;
- this product has been moved or transported to another place once accepted and installed;
- breakage and/or malfunction is caused by conditions beyond control of KEM including, but not limited to Acts of God such as fire, earthquake, lightning strike, flood, etc.;
- parts including, but not limited to the touch screen LCD, are broken due to improper or inadequate handling such as spilling chemicals;
- items are consumables, accessories or wearing parts, or parts which are in direct contact with samples and/or reagents and are considered consumables due to normal wear.

KEM is also unable to offer warranty and related services of repairs and maintenance checks of any kind once specifications, capability, features and/or functions of this product as well as its parts are changed, altered or remodeled by unauthorized personnel.

4. Disclaimer

KEM is not held liable, during or after the warranty period, regardless of whether loss or damage is caused by any event beyond control of KEM, or it is the user's opportunity loss and/or lost earnings caused by failure or malfunction of KEM products, or with or without predictability of KEM, for loss or damage resulting from a particular reason, secondary loss or damage, accident compensation, damage to products other than those supplied by KEM, and any other incidental compensation.
KEM is also not held liable for physical and/or economic loss or damage resulting from the use of KEM products, or loss of stored data during repair or servicing of such product.