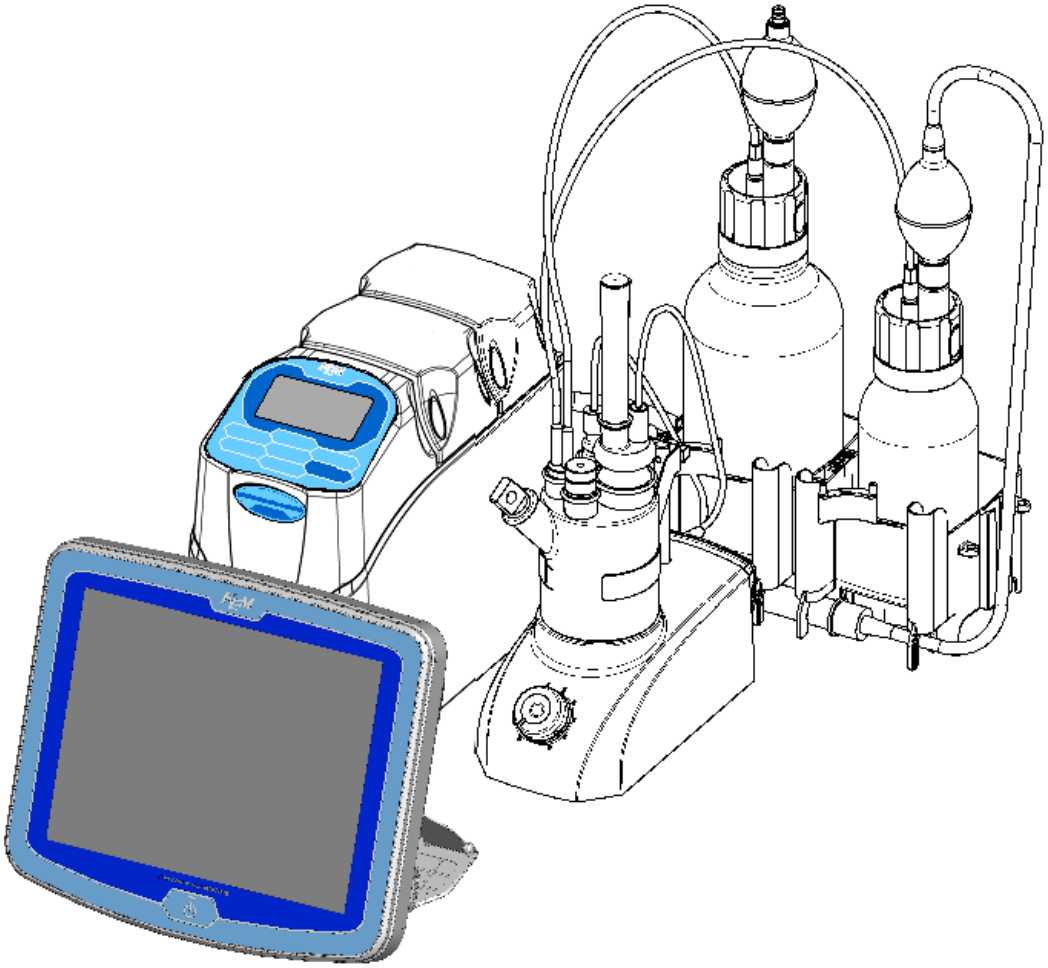
Main Control Unit

MCU-710M/S

(for use with MKC-710)

Operation Manual



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 59-00392-11Ver.00

Introduction

We thank you for your continued patronage of KEM products.
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) **8.4 inch large color TFT-LCD with touch panel**
8.4 inch large color TFT-LCD is easy to see with excellent visibility.
The touch panel makes a key input so much easier.

2) **Four (4) measuring units can be connected (simultaneous measurements in parallel)**＜MCU-710M＞
By connecting optional expansion units (a Karl Fischer Moisture Titrator, an Automatic Potentiometric Titrator), up to 4 titrators can operate in the same way. For example, both a titration and a moisture measurement can be performed simultaneously. An installation of multiple titrators realizes space-saving.

3) **Separated touch panel and measurement unit with Bluetooth®**
＜MCU-710M＞
By connecting a wireless adapter (Bluetooth® ,a commercially available product), the touch panel operation panel can be used without connecting a cable to any titrator. As for the measurement of a sample that may produce toxic gas, you can carry it out safely by placing the titrator in a draft chamber and the operation panel outside the draft chamber.
＜MCU-710M/S＞
Furthermore, you can use it placing the operation panel on the opposite side of an aisle or hand carrying the panel connecting a battery (a commercially available product). An MCU-710 can be mounted on a monitor arm and free to fix in a desired position (the arm mount to a display meets the VESA standard (75mm x 75mm)

4) **Setting of operation permission on user group basis**
Set operation permission of various functions on user basis as requested by CSV (computer System Validation).
2 levels of permission can be set. Administration mode (all operations, with password) and Users mode (burette handling, calibration, measurement, change of method number (sample file) and viewing).

5) **Titration results provided in PDF**
Measurement results are converted to PDF and stored in the USB flash memory, electric media. There is no need to print them out and that contributes to paper reduction.

6) **Water content displayed in real time**
During measurement, calculation of from titration volume to calculation is used, and results will be displayed in real time.

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

8) **Max. electrolytic speed: 2.6mgH_2O/min**
Our proprietary technology achieves Max. electrolytic speed of 2.6mgH_2O/min. This reduces pre-titration time and measurement time.

Important:

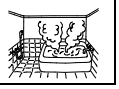
You must observe the following rules in order to prevent physical or property damage of yourself as well as of the others.

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 cannot 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.	
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.

※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.

※All other product and service names listed in this website are trademarks or registered trademarks of their respective companies.

※Internet Explorer and Microsoft Excel® is the registered trademark of US Microsoft Corporation in US and other countries. Google and Android are trademarks or registered trademarks of Google Inc.

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

Please refer to "Function Description" for details of each function.

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 main unit, accessories or manual, contact your sales representative or local dealer.

＜MCU-710 Main Unit＞

Part Number	Part Description	Qty	Remarks
-	MCU-710M Main Unit	1	For M model
-	MCU-710S Main Unit		For S model
64-00643-33	USB Cable(A-A) 0.9m	1	
64-01338	DC Plug Cable 1.0m	1	
-	Stopper	1	
59-00493	Packing List	1	
-	Inspection Certificate/Warranty	1	

＜MKC-710 Main Unit＞

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 you are ordered
12-00661-01	2Component Type Titration Cell Unit	Either 1	
12-00662-01	1Component Type Titration Cell Unit		
65-00028-01	Clamp filter	1	
64-00898	AC Adapter Type4	1	
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	1	
66-00071	Pipette 10mL	1	
12-05186	MKC-710 Operation Manual（CD-ROM）	1	
59-00392-06	MKC-710 Quick Manual	1	
59-00392-07	MKC-710 Quick Manual	1	
20-05627	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.

1. Preparations for measurement

＜Components of Titration Cell Unit＞

Part Number	Part Description	Qty	Remarks
12-05195	2Component Inner Burette	Either	
12-05194	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 φ18x120 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 Globe for Suction	1	
12-04875-01	Rubber Globe 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）＞

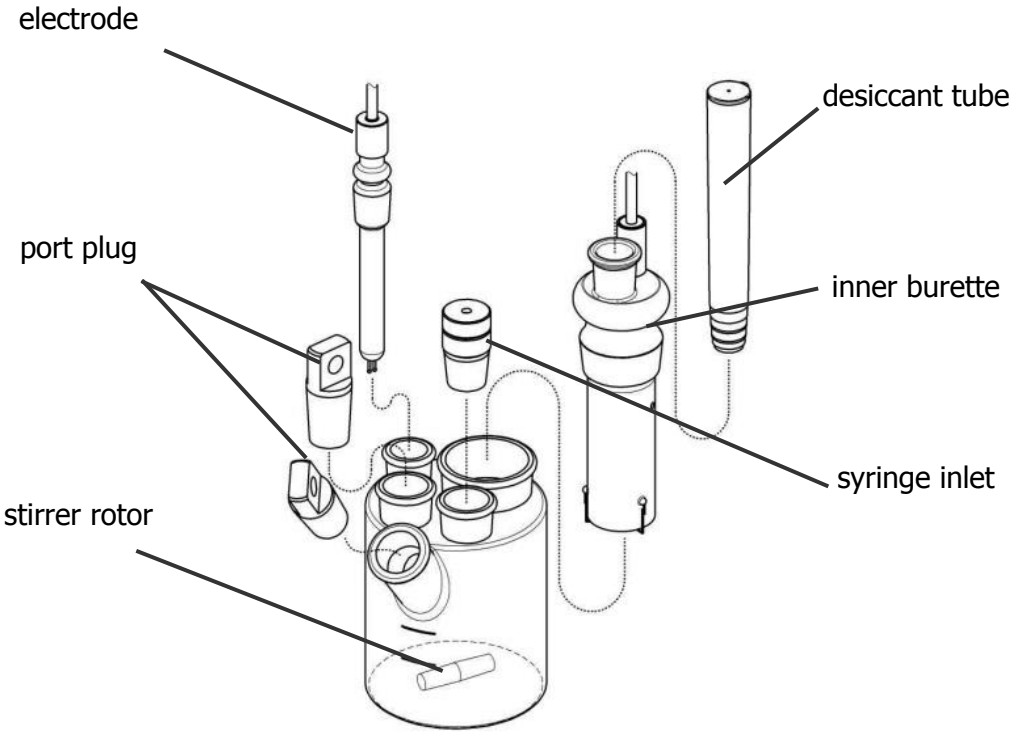
Part Number	Part Description	Qty	Remarks
12-05686	Bottle holder unit	1	with Desiccant Tube
69-00028-00	Polyethylene Bottle 1L	1	
12-03926	Reagent Bottle Cap with Plug	1	
12-02021-10	Solvent/Waste Bottle Cap	2	
12-02020-11	Injection Tube 2×3 L=1180mm PFA	1	
12-01260	Desiccant Tube φ18x120 with Silica 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=1m PFA	1	
20-02559-00	Plug for Titration Flask	1	
60-00109-02	Tube 4x8 L=1m Silicone	2	
12-06270	Suction Tube (Bottle Cap- Pump)	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**

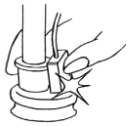
1) Put a stirrer rotor into the cell, and install the inner burette, the electrode, desiccant tube, the port plug and syringe inlet.



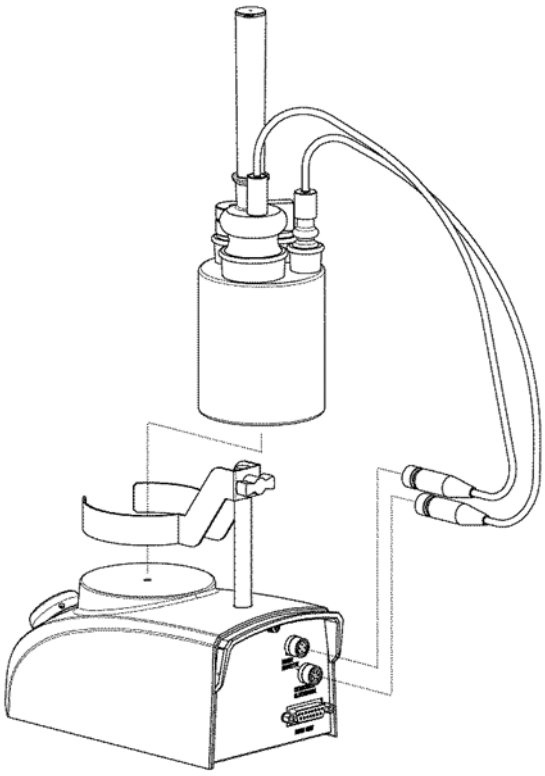
Note Make sure to apply KF grease around glass sliding area.

Note The seal on desiccant tube 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.**



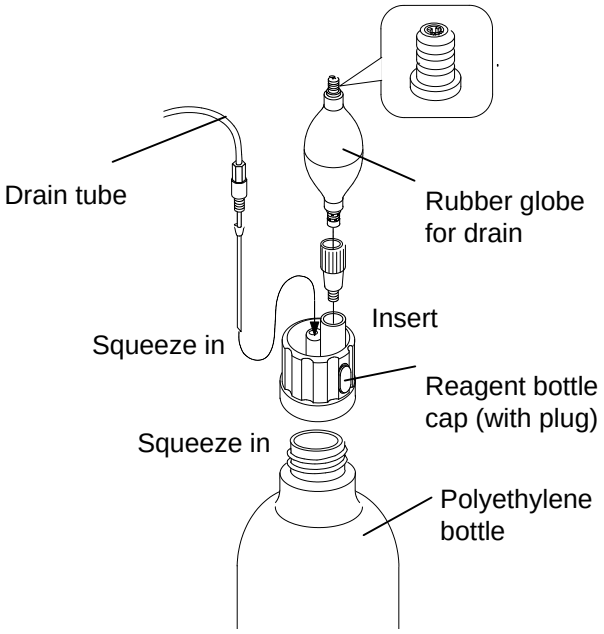
2) Place the titration cell onto the titration holder, and plug in the cable from the inner burette and the electrode. Tighten the plug screws firmly.



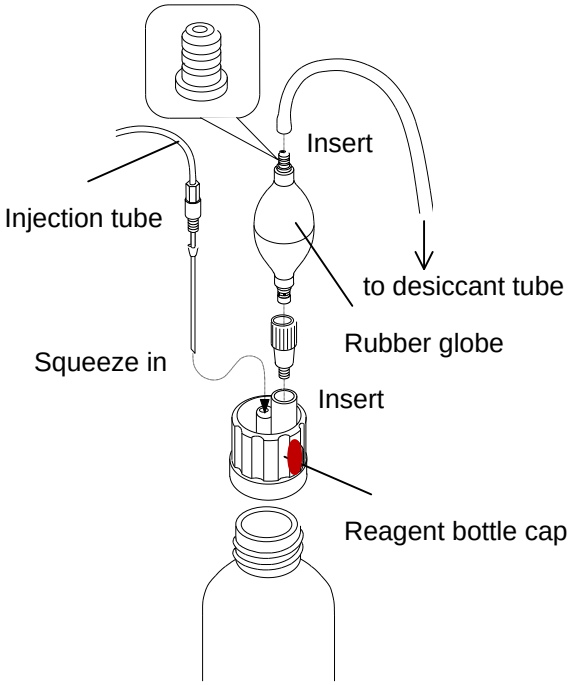
1-2-2.**Installation of Manual Solvent Change Unit**

1) Insert the rubber globe 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 globe.
5) Connect the reagent bottle to a commercially sold KF reagent bottle filled with anolyte.

< Drain side >



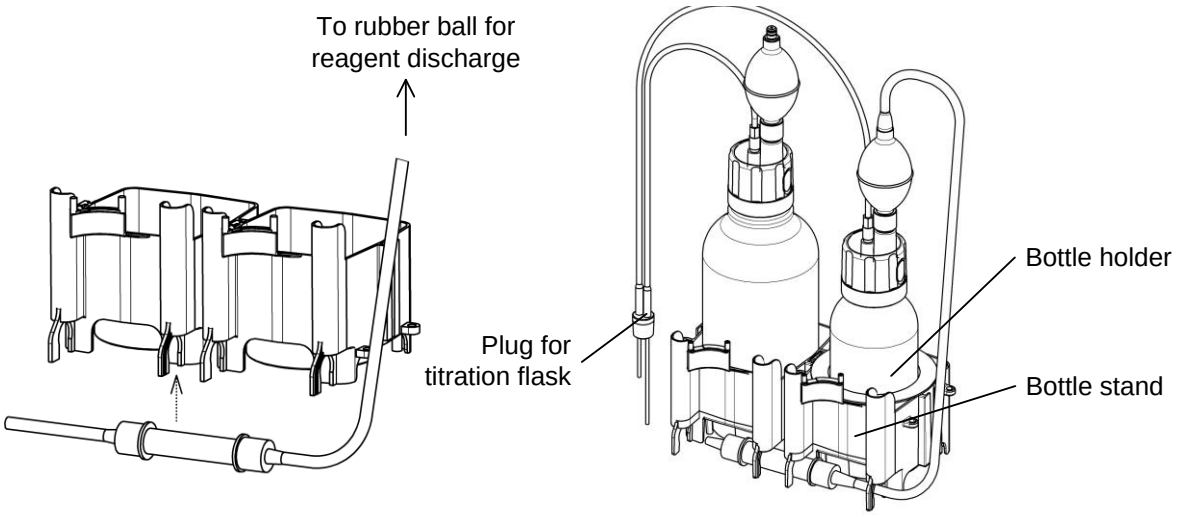
< Discharge side >



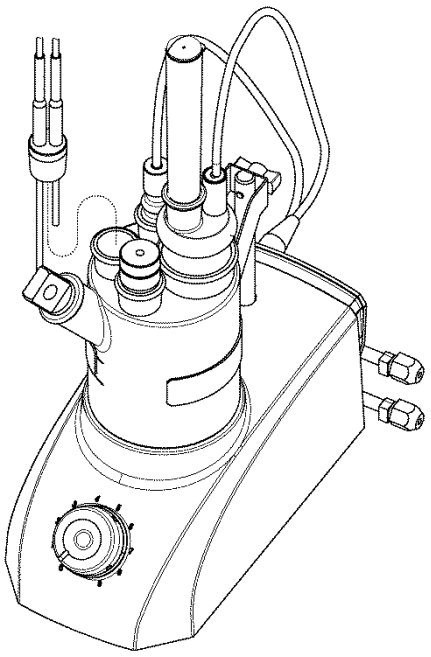
Note

If loosely squeezed it in, pressurized air may leak and it may cause malfunction of dispensing KF reagent. There are two kinds of rubber globes, 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 and bottle stand as shown below.
8) Connect the tube for drain and injection to the Plug for titration flask as shown below respectively.

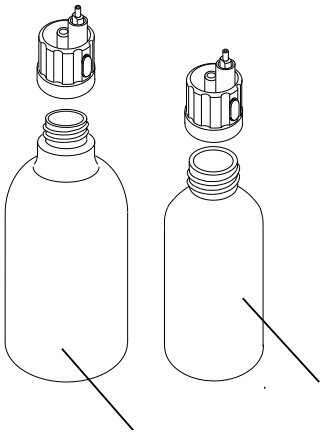


9) Insert the Plug for titration flask carefully into the titration cell. At this point, apply a small amount of KF grease on slide contact area.



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

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

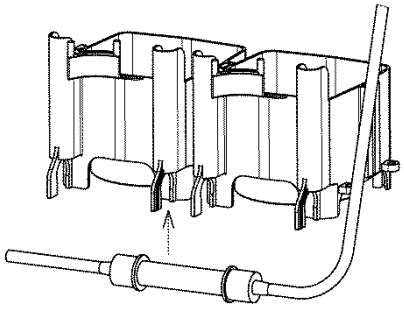


Bottle for dehydrated solvent

Waste bottle

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.

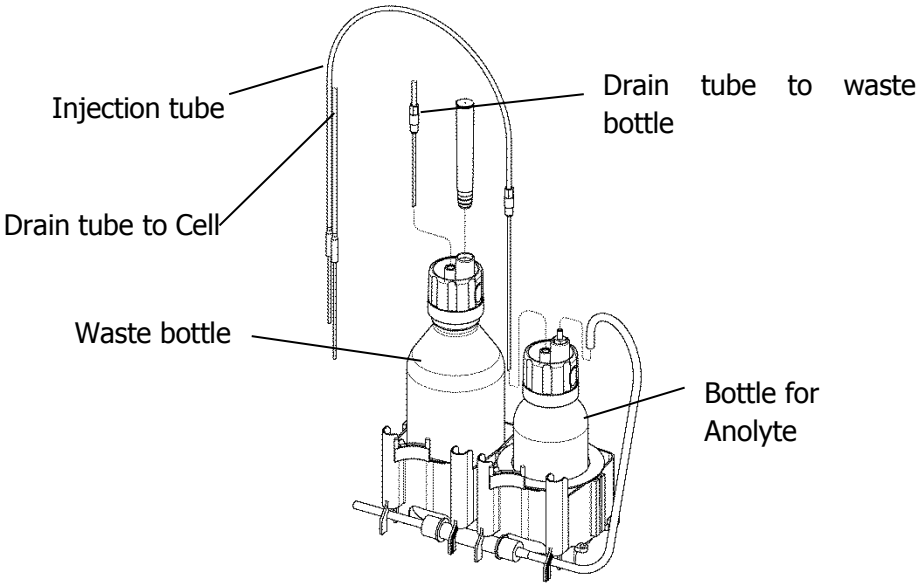
2) Connect the silicone tubes on both ends of desiccant tube, and put the tube in place as shown below



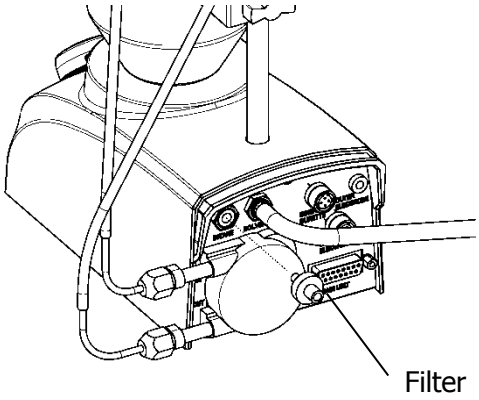
Silicone tube

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 and stand 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.



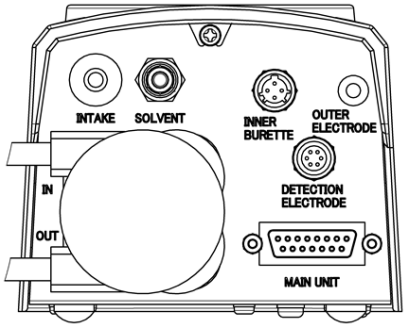
7) Connect the drain tube to waste bottle and the drain tube to Cell to magnetic stirrer back side pump.
8) Connect the silicone tube connected 2) to SOLVENT port on the rear panel of magnetic stirrer.
9) Attach a filter to INTAKE port on the rear panel of magnetic stirrer.



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.

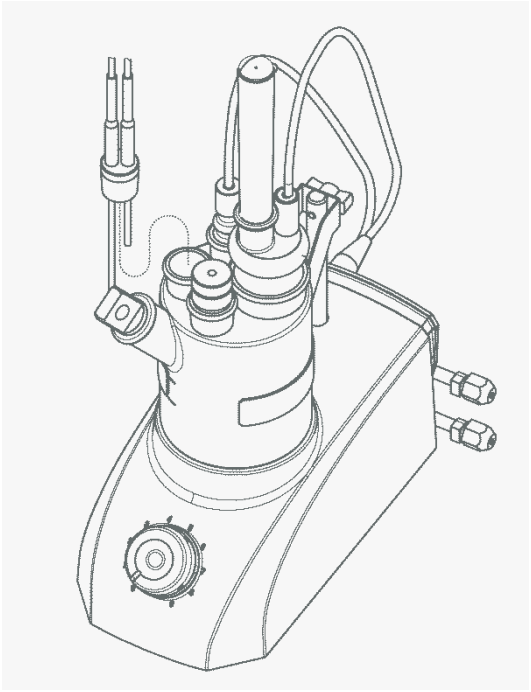
1. Preparations for measurement

< 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.**

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	Fluka（RdH）& HPC	Mitsubishi
Anolyte	AO	AK	AS

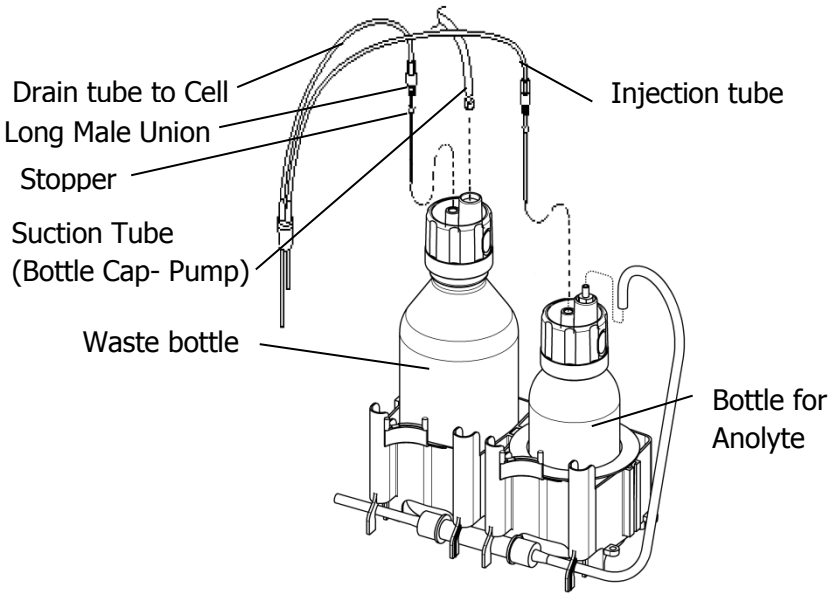
Therefore, when using such reagents or samples, change the connecting of the Auto Solvent Change Unit as follows.

<Installation (in the negative pressure)>

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.

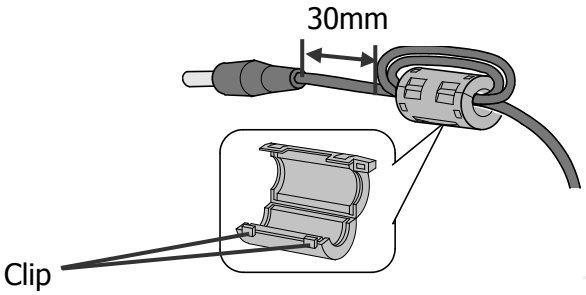


Note

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

1-2-4.**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.

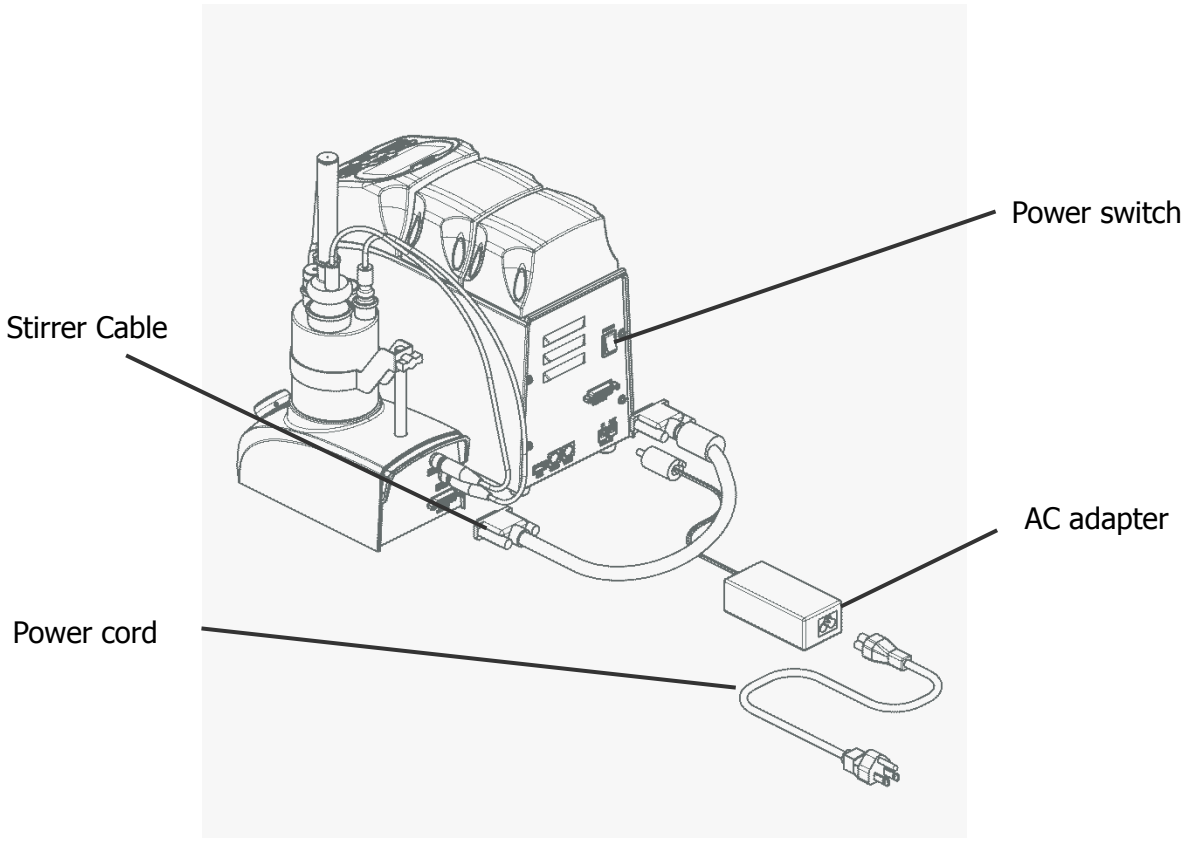


Note	Installation of the clamp filter to AC adaptor is needed to satisfy the condition of EMC standard.

1-2-5.**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.

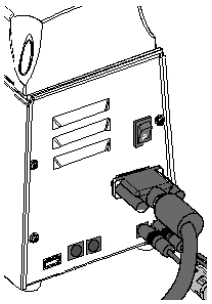


3) Connect Power cord to the power outlet.

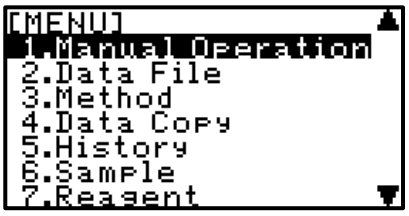
1-2-6.**MCU-710 communication settings**

Sets up communication settings to connect to the MCU-710.

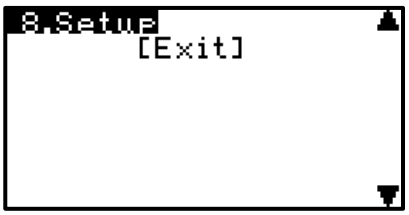
1) Turn on the measurement unit (MKC-710). Its power switch is on the backside and turn it to On(-).



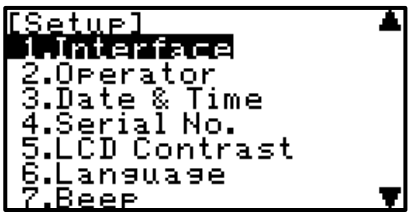
2) Press [MENU/HOME].



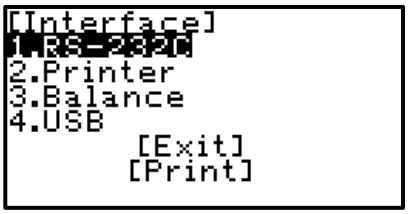
3) Press [↑] twice, select "11.Setup" and [ENTER] to confirm.



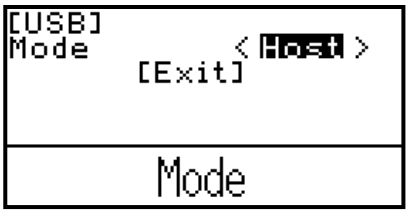
4) Press [↓], select "2.Interface" and confirm with [ENTER].



5) Press [↓] 3 times, select "4.USB" and confirm with [ENTER].



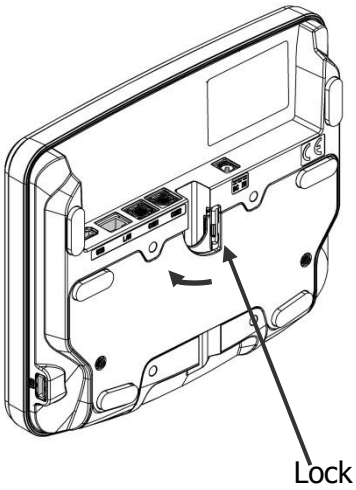
6) Select "MCU" with [←][→] keys, and press [ENTER]. When using a wireless adapter, select "Host."
7) Turn off the measurement unit (MKC-710).



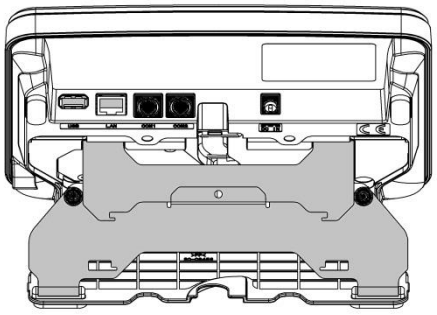
1-2-7.**Assembly of MCU-710**

The angle of the touch panel can be adjusted on three positions. Assemble the device according to your use.

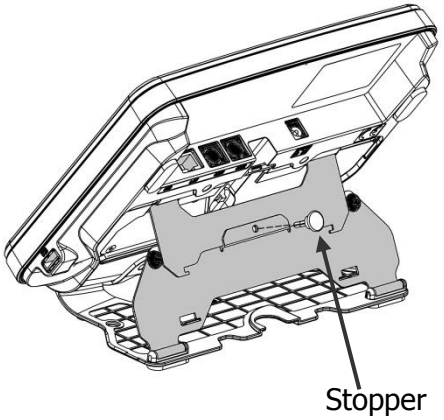
<Tilt at angle of 60°>
Installation area can be decreased because the touch panel is set at the front position of a measuring unit.
Rotate the Lock in the direction as shown in the figure.
Engage and secure the spots shown in the figure.



Engage and secure the spots shown in the figure.

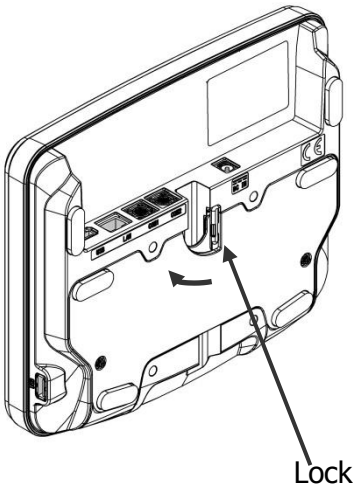


Insert the Stopper for locking the touch panel.

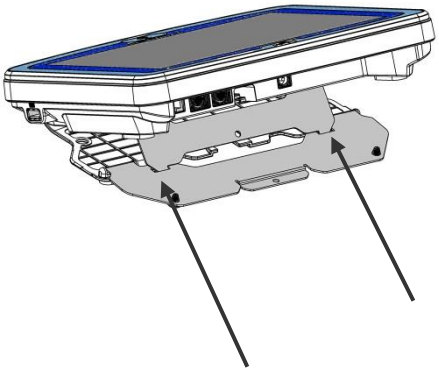


1. Preparations for measurement

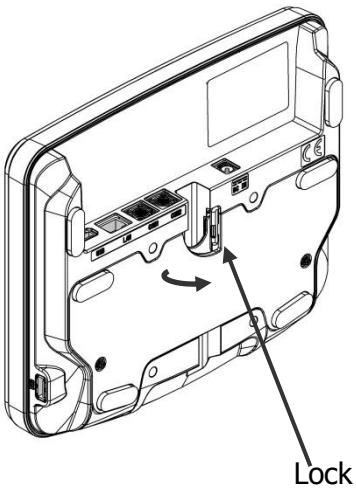
<Tilt at angle of 20°>
Tilt angle easy to operate the instrument when standing.
Rotate the Lock in the direction as shown in the figure.



Engage the two spots in the figure for securing the touch panel.

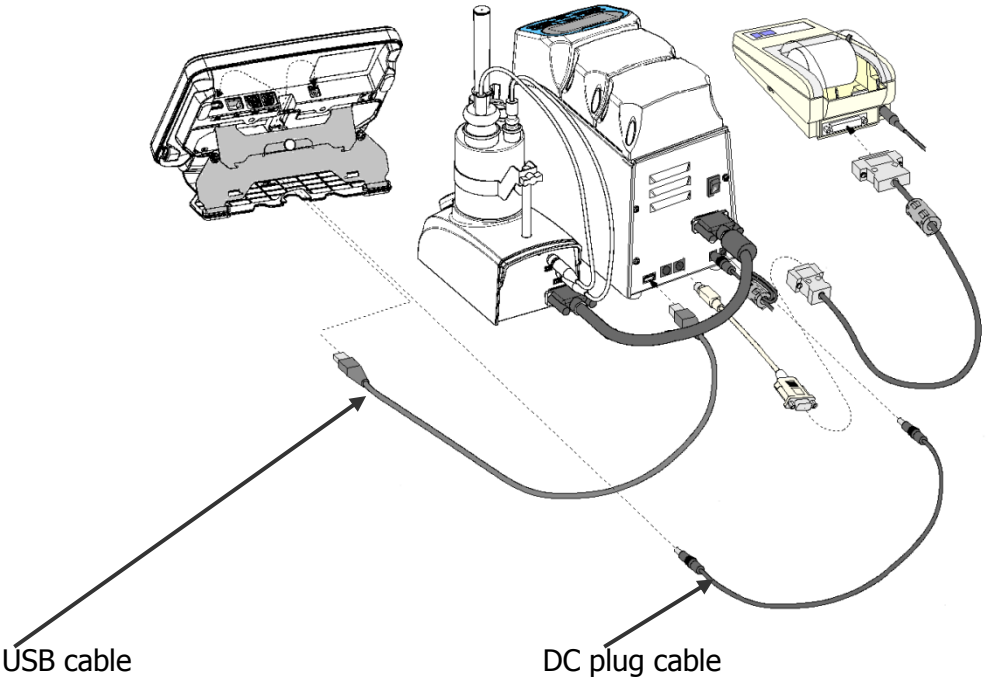


<When using the touch panel with folded back>
Applicable when hanging the instrument on the wall or the like.
Fold back the plate inward as shown in the figure.
Rotate the Lock in the direction shown in the figure for securing it.



1-2-8.**Connecting cables**

Connect the cables as shown below.
Connect "DC IN" of MCU-710 to "DC OUT" of MKC-710 using the DC cable attached to MCU-710 as shown in the figure below.
Connect the USB port on the back side of MCU-710 to the USB port of MKC-710 using the USB cable attached to MCU-710. When connecting more than one measuring unit (only MCU-710M), connect a USB hub to the USB port on the back side of MCU-710 before connecting USB cables.
Connect IDP-100 to COM1 as shown in the figure. (When printing out a plurality of units on one printer, connect the cable to COM1 on the back of MCU-710.)

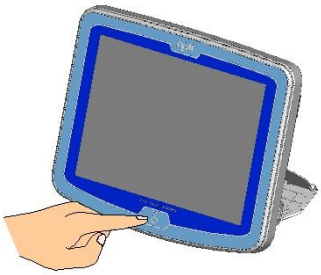


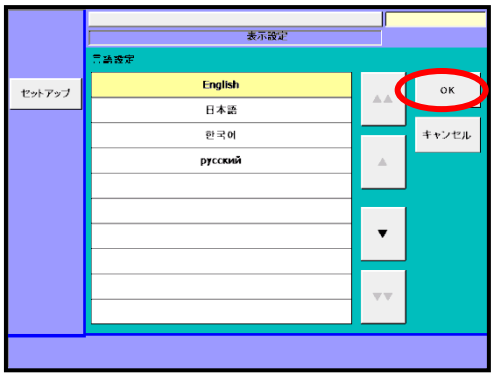
Caution **When connecting the USB cable to MCU-710, be sure to make USB setting of MKC-710 to "MCU" and cycle MKC-710, according to Section "1-2-6. MCU-710 communication settings." Failure to observe this caution may result in instrument damage.**

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

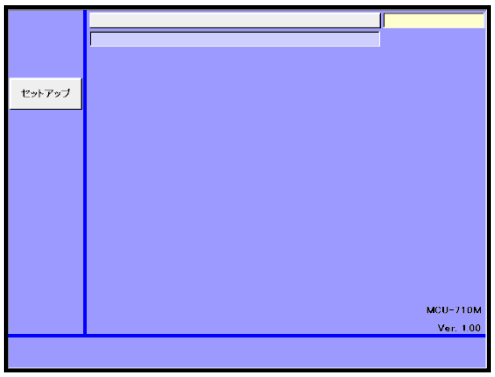
1-2-9.**Start-up**

1) Make sure the power of measuring unit (MKC-710) is off, and then turn on the power of Main control unit (MCU-710).
The screen for language option will appear. Then, choose a language and press [OK] button.

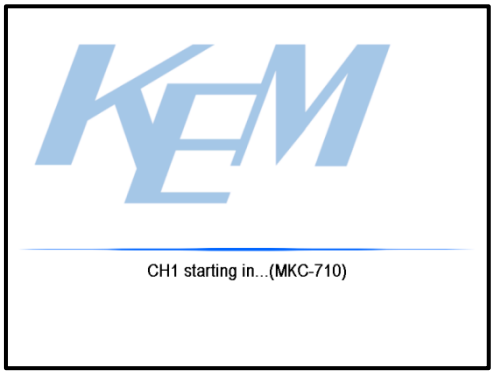




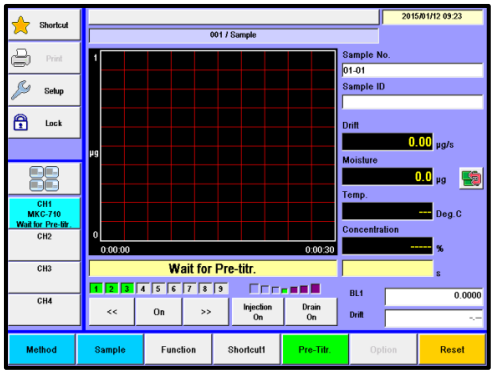
2) Choosing the language will show a screen as shown at right.



3) Turn on the power of measuring unit (MKC-710). The screen of Main control unit will show the right display.



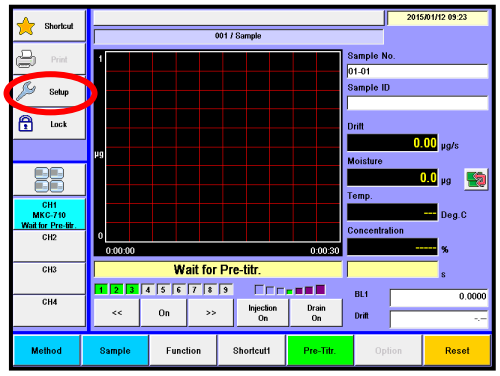
4) The screen of Main control unit will show the right display, which will first appear from the next time on.



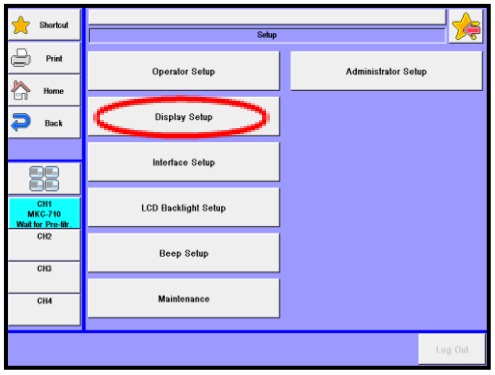
1-3. Setting date and time

Set date and time.

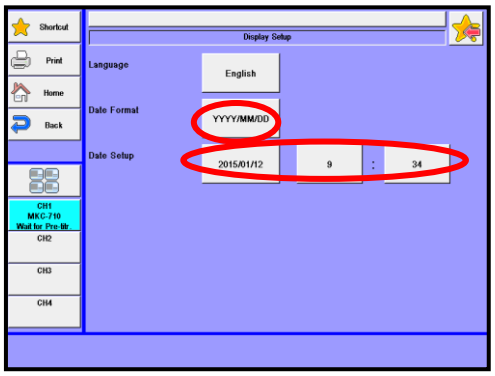
1) Press [Setup] button.



2) Press [International] button.



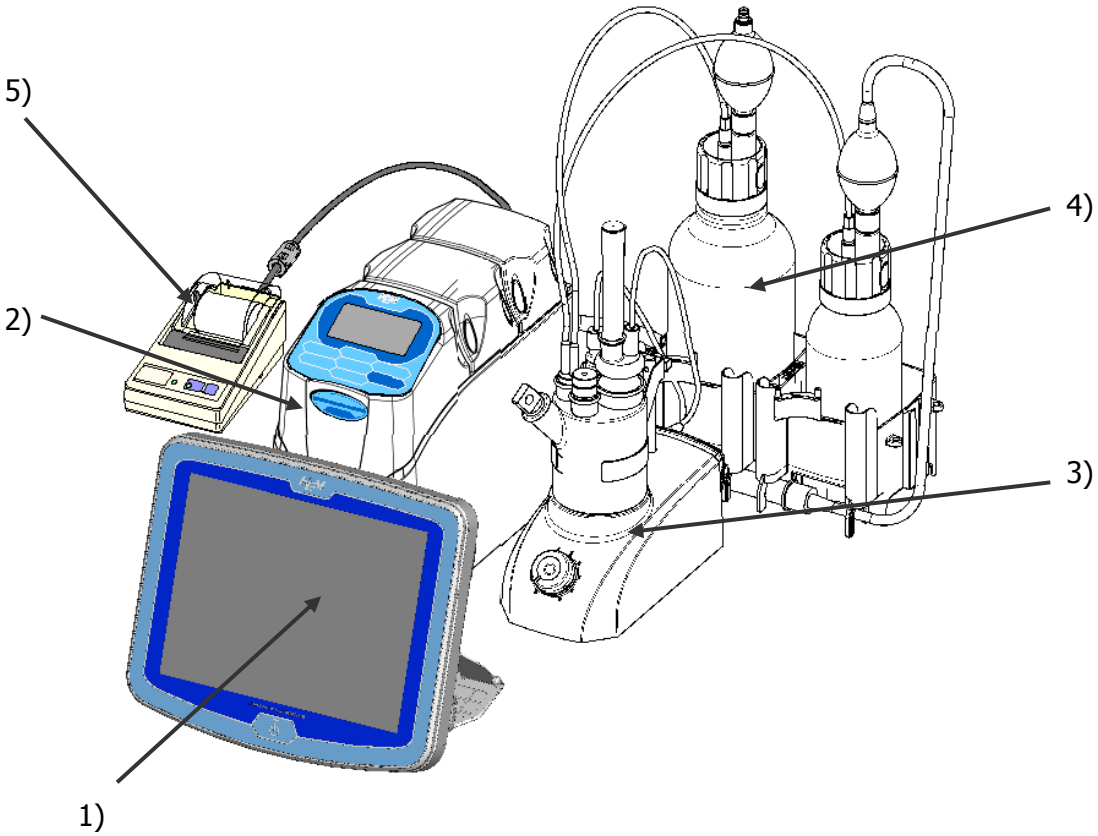
3) Press Date format button. Choose the Date format, and press [OK] button.
4) Press Date &Time button. Choose the date and time, and press [OK] button.



2. Parts configuration and each function

2-1. Appearance and Name

2-1-1.**Karl Fischer moisture titrator**



1) Main control unit (MCU-710)
   Operating unit for Karl Fischer titration.

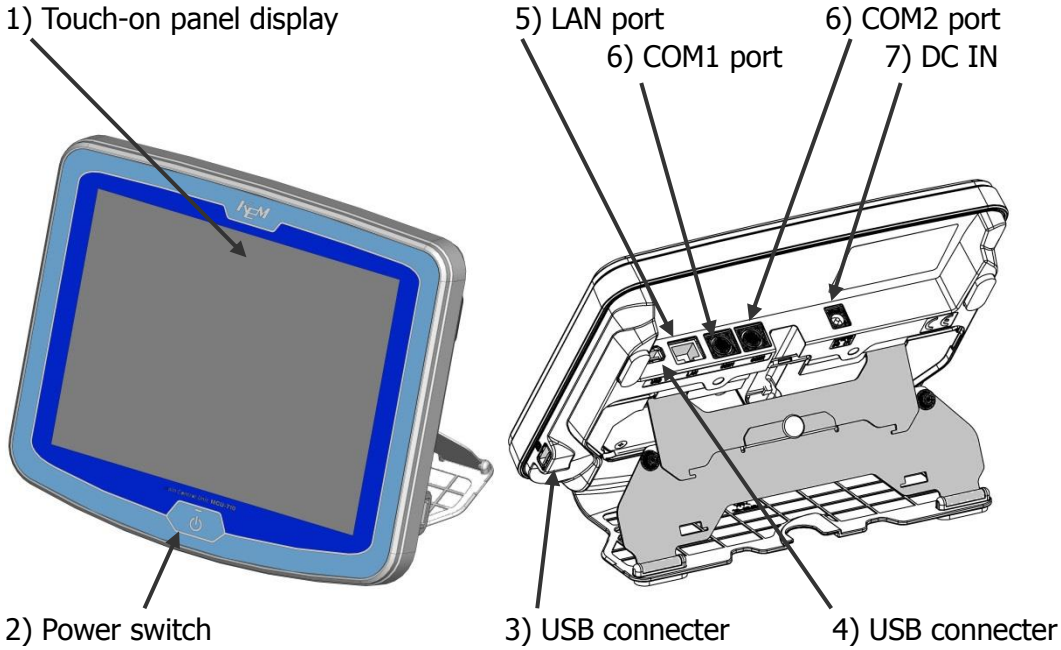
2) Measuring unit (MKC-710)
   Control unit for Karl Fischer titration.

3) Measuring unit Stirrer
   Measuring unit for Karl Fischer titration.

4) Measuring unit Manual solvent change unit
   KF reagent is supplied and drained here.

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

2-1-2.**Main control unit (MCU-710)**



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

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

3) USB connecter
   This connects USB flash drive.

4) USB connecter
   Connecting port for measuring unit.

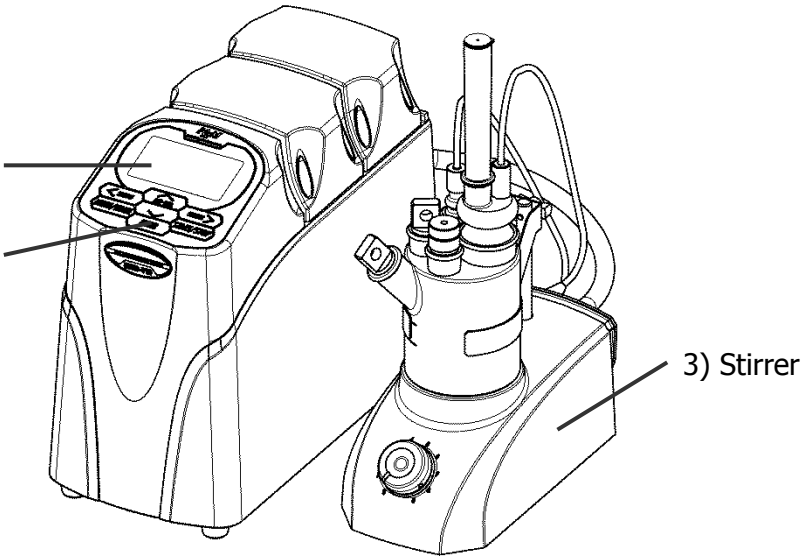
5) LAN port
   A LAN connector for establishing communication with a network. A PC command can initiate measurements or the like. This feature is available only for MKC-710M.

6) COM1 and COM2 port
   These ports are for connections to Dot printer, Balance or PC. Connecting a printer to the COM1 port of each measuring unit allows to print measurement results on the unit basis. Dot printer can be connected only COM1 port

7) DC IN
   This is for connecting the DC cable.

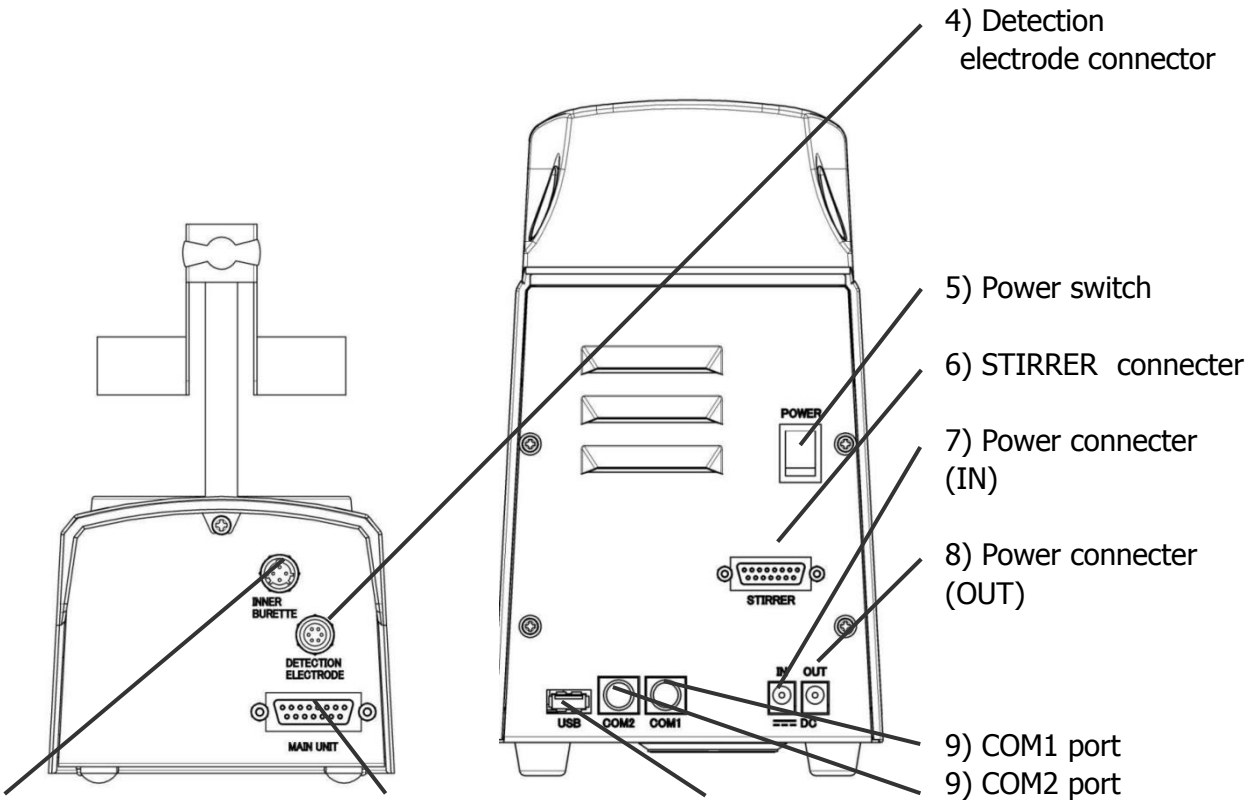
2-1-3.**Measuring unit MKC-710**

＜MKC-710 Front＞



1) Key panel
   This is for operation of the Auto Solvent Change Unit.
2) Liquid crystal display
   This displays potential.
3) Stirrer
   The stirrer spins to stir sample liquid. Use a stirrer speed control knob to adjust the stirrer rotating speed of the magnetic stirrer. 0（STOP） → 9（FAST）
   Operate On/Off of the stirrer on the main screen by pushing the [STIRRER>] key.

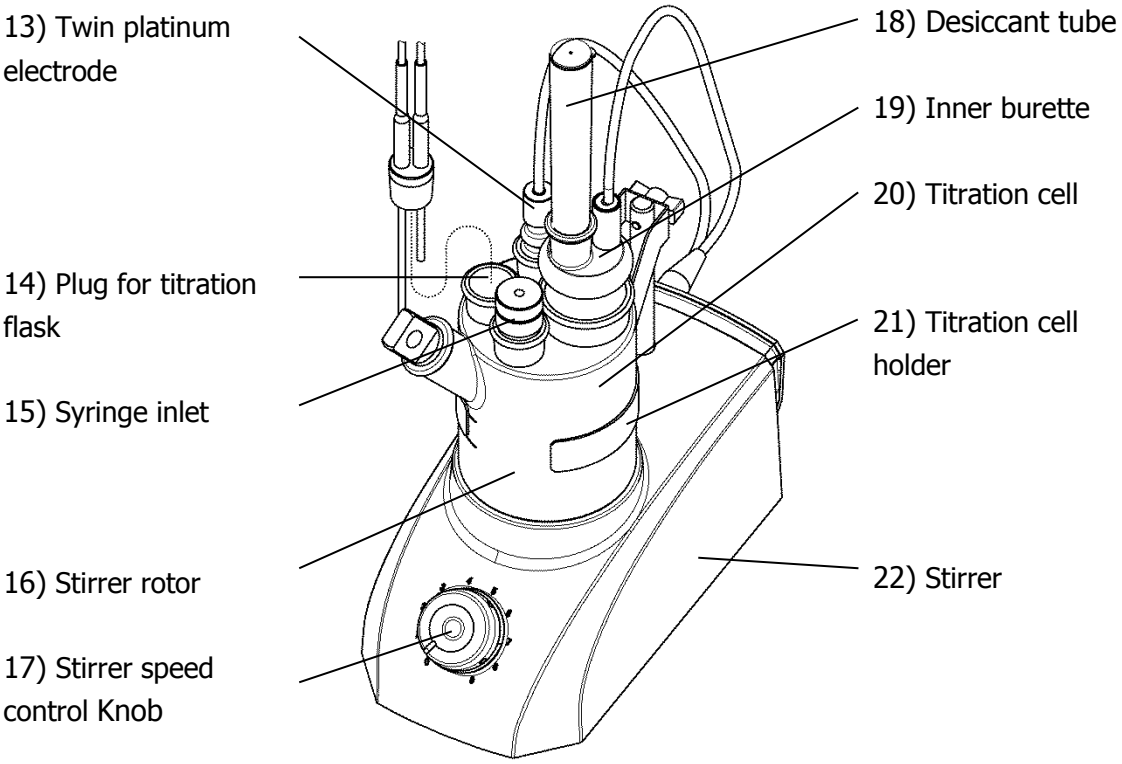
＜MKC-710 Back＞



4) Detection electrode connector
   The twin platinum electrode is connected here.
5) Power switch
   This switch turns on or off the unit
6) STIRRER connecter(to Stirrer)
   This connects the stirrer to stir sample solution.
7) Power connecter (IN)
   This is for connecting the power cable.
8) Power connecter (OUT)
   This is for connecting the power cable for MCU-710.
9) COM1 and COM2 port
   These ports are for connections to Dot printer and Evaporator. Dot printer can be connected only COM1 port. Evaporator or Multiple sample changer can be connected to COM2.
10) Inner burette connector
    The inner burette for electrolysis electrode is connected here.
11) STIRRER connecter(to MAIN UNIT)
    The connecting cable to the stirrer is plugged in here.
12) USB connecter
    This connects to the MCU-710.

2. Parts configuration and each function

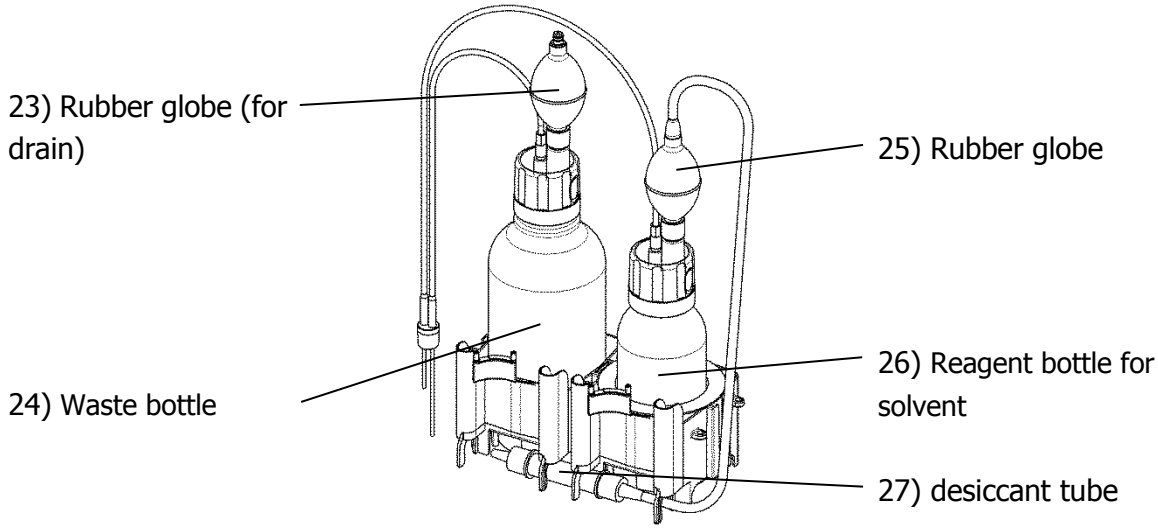
< Measuring unit MKC-710 Stirrer >



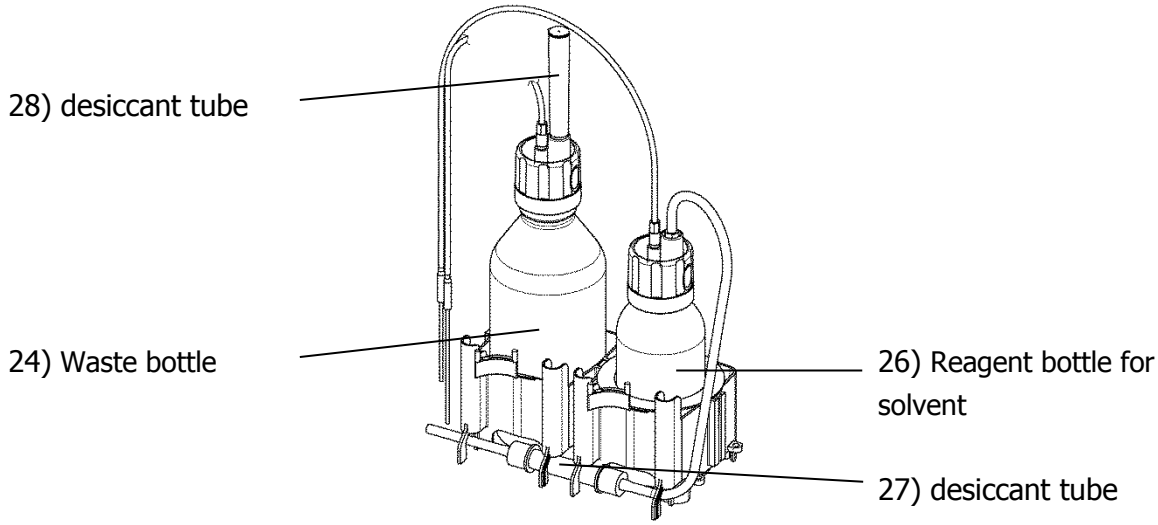
13) Twin platinum electrode
This electrode detects the potential level of the acolyte inside the titration cell.
14) Plug for titration flask
Dispensing tubes for KF reagent are inserted here.
15) syringe inlet
This is the sample inlet.
16) Stirrer rotor
The stirrer rotor spins to stir sample liquid.
17) Stirrer speed control Knob
Use this knob to adjust the stirrer rotating speed of the magnetic stirrer. Stirrer speed is adjusted by the set value of method of the titrator; however, stirrer speed can be adjusted with the stirrer speed control knob while measurement is in progress.
18) Desiccant tube
The gas fume from titration cell is exhausted through this tube.
19) Inner burette
The anode and cathode liquid reacts here for electrolysis.
20) Titration cell
The iodine generated in electrolysis and water in sample reacts here.
21) Titration cell holder
This is the lid for titration cell.
22) Stirrer
The stirrer spins to stir sample liquid.

2-1-4.**Measuring unit Solvent change unit**

< Manual Solvent Change Unit >



< Auto Solvent Change Unit (Option)>



23) Rubber globe (for drain)
This globe pumps to drain the solvent.
24) Waste bottle
This bottle keeps the used liquid after measurement.
25) Rubber globe
This globe pumps to discharge the solvent.
26) Reagent bottle for solvent
Use a commercially sold solvent bottle.
27) Desiccant tube
Absorbs moisture of solvent.
28) Desiccant tube
Absorbs moisture of waste bottle.

2-2. Displays and operating buttons

2-2-1.**Main screen**

Short cut

Call the set short cut.

Operator button

Operators name or code is changed here with the button showing currently active operator in charge.
⇒Please refer to <Function Description.>

Date and time

The built-in clock shows the present time and date here.
⇒Please refer to <Function Description.>

Print

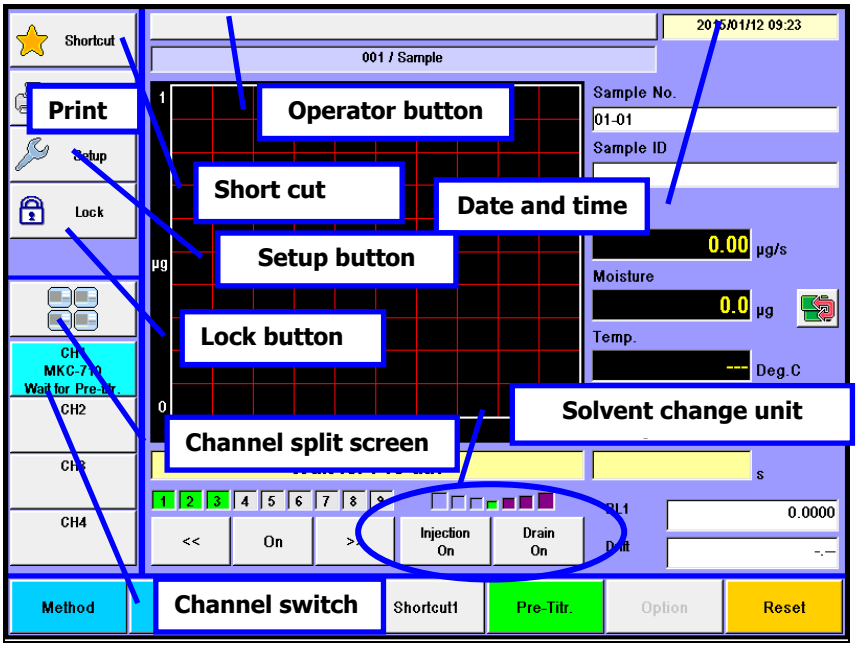
This button is for printing the parameters shown on main channel area.

Setup button

Setup functions are selected.
⇒Please refer to <Function Description.>

Lock

Locks operation of the screen. ⇒Please refer to <Function Description.>



Channel split screen

When 2 or more-channel instrument is connected, all channels can be displayed by splitting the screen. For 2-channel, the screen will be divided by two; for 3 or more-channel instrument, it will be divided by 4.

Channel switch

System configuration for channel will be displayed. The screen currently displayed will be colored. Pressing channel button will lead to switching the channel.

Solvent change unit button

A solvent can be poured in and discharged in a titration cell only by pushing a button.

Display title

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

Sample

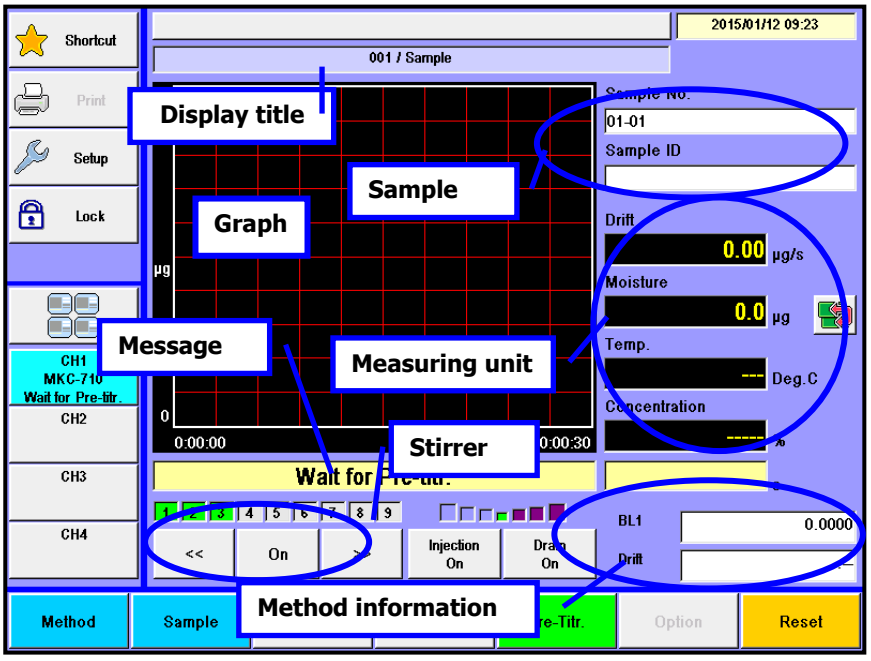
Sample number and its ID preset on sample setup are shown here.
⇒Please refer to <Function Description.>

Graph

The graphic curve is plotted in real time during titration.

Message

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



Stirrer

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

[⟨⟨] : Speed slows down by one step

[⟩⟩] : Speed goes up by one step

[On], [Off] : Turns on or off the stirrer

Method Information

When a blank or a factor is set on the calculation of the current method, a blank value or a factor value will be displayed.

Measuring unit

This box shows the volume and potential etc relayed from the measuring unit. Potential (for reference) and calculation result can be switched by button. During measurement, calculation of from titration volume to calculation 1 is used, and results will be displayed in real time.

Sample button

Sample is configured here with this button.
⇒Please refer to <Function Description.>

Function button

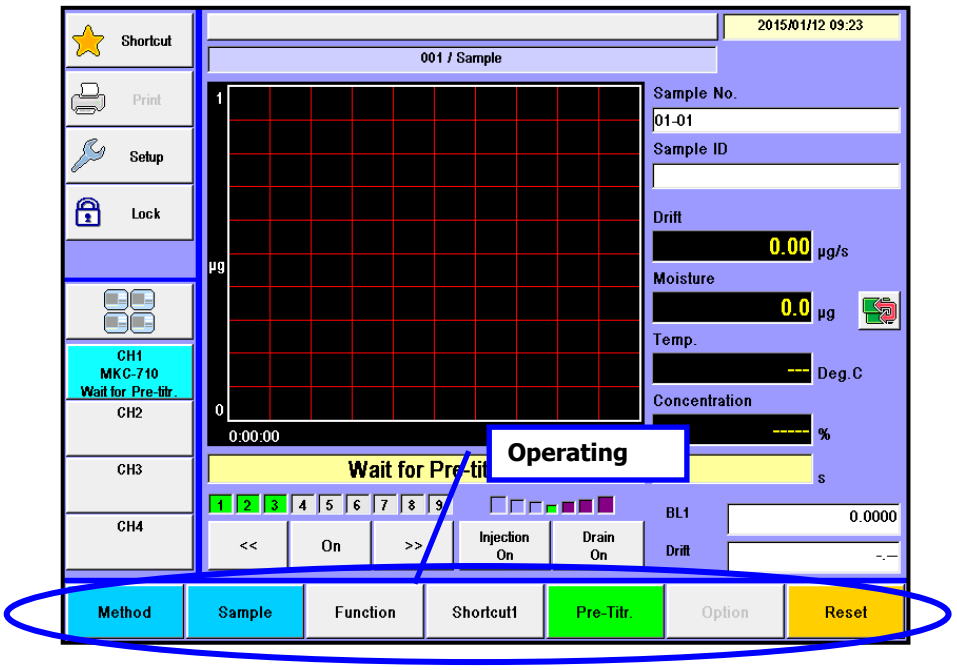
Function provides the following settings. During titration, it turns to [Titration Result] to view the data.
⇒Please refer to <Function Description.>

Method button

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

Free button (Short cut)

The most frequently-used button can be set here.



Pre-Titr. button or Start button

This button first works for pre-titration and then, switches to [Start] button. When t(stir) -Wait time before start- is set up, pressing [Start] button again after starting titration will lead to skipping the execution of "Wait time before start"

Option button

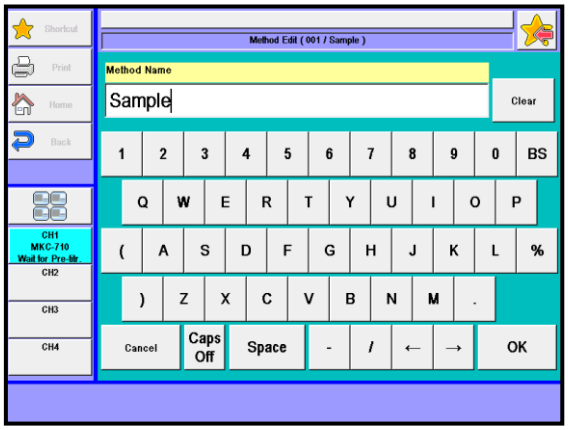
The optional peripheral is controlled here like manual operation of burette unit and oven purge of the evaporator. ⇒Please refer to <Function description.>

Reset button

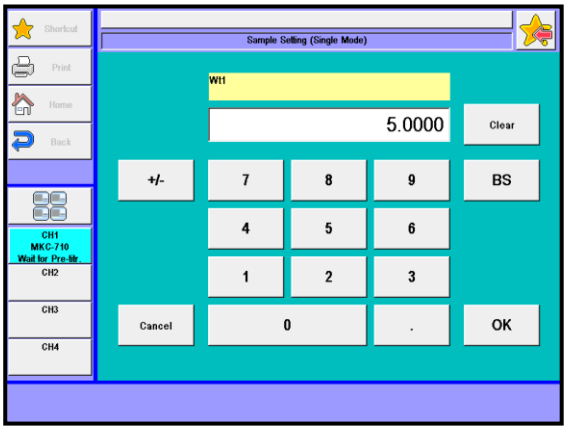
This button stops pre-titration or aborts measurement underway.

2-2-2.**Description of how to input characters and numbers, date**

Character input screen



Number input screen



[BS] button
This button erases the preceding one character.

[Cancel] button
The entered characters can be canceled with this button.

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

[Space] button
Space is inserted with this button.

[←], [→] button
This button moves the cursor position on display.

[–], [/] or [+], [*] button
These symbols can be selected with [Caps On] or [Caps Off] button.

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

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

Date

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

Year button
Display where you enter the year.

- 2010～2099 year

Month button
Display where you enter the month

- 1 (January) ~ 12 (December)

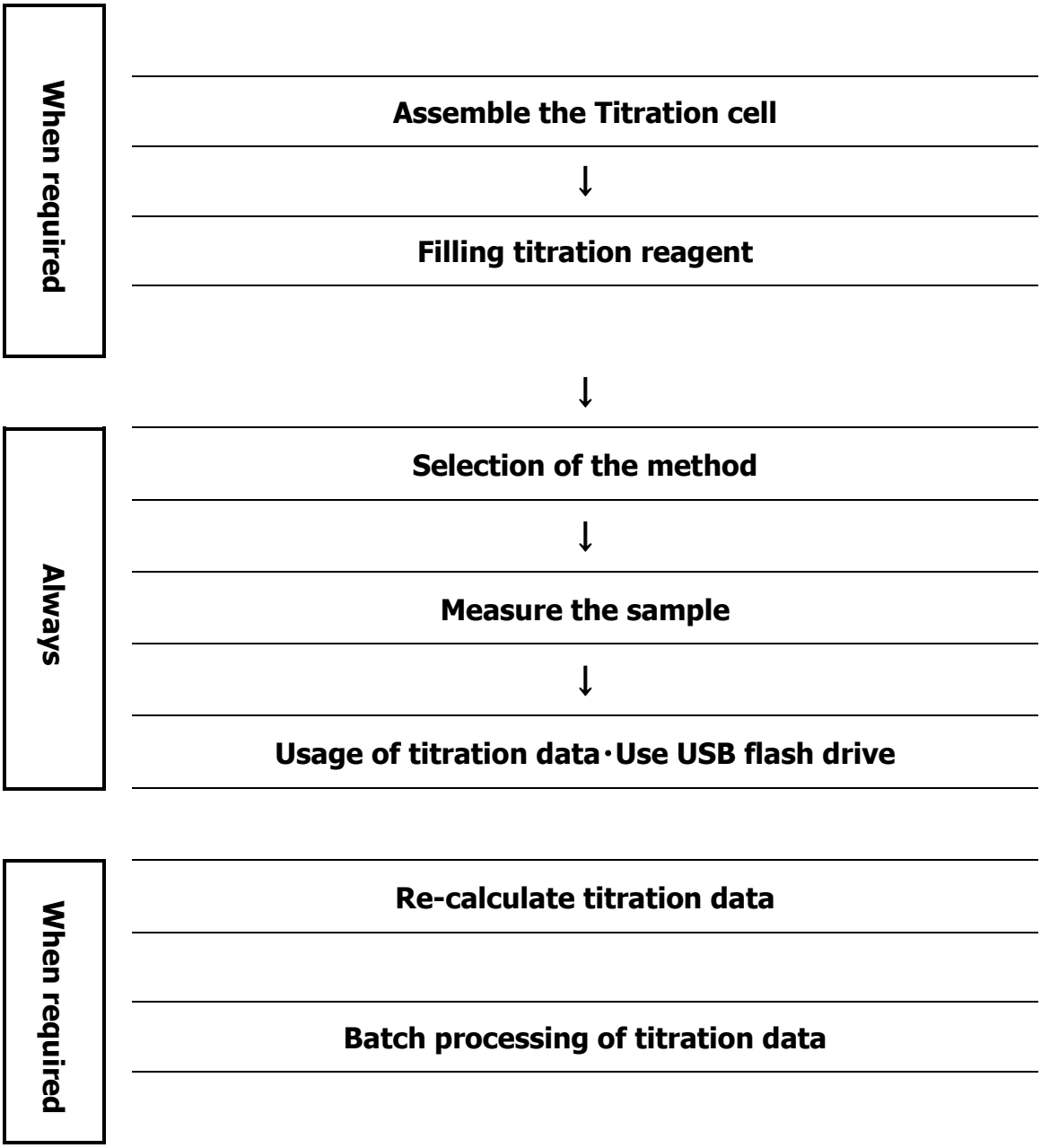
[1] ~ [31] button
This button enters the day of the month. This date will be displayed as calendar by inputting a year and a month.

[Cancel] button
This button cancels already entered configuration.

3. Preparation before measuring

Here is the description on basic measurement sequence.

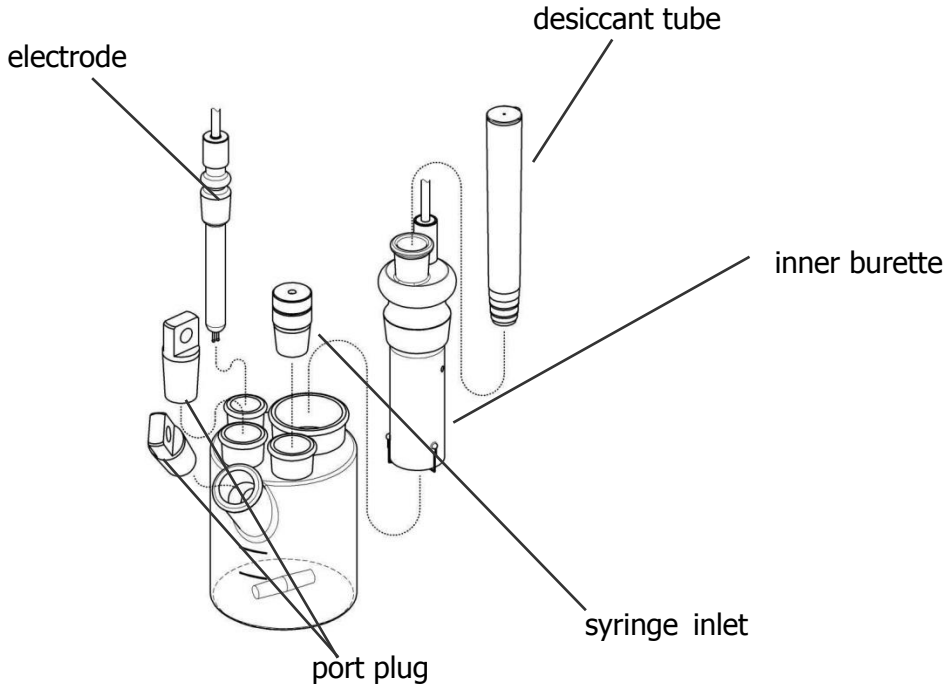
3-1. Sequence of measurement



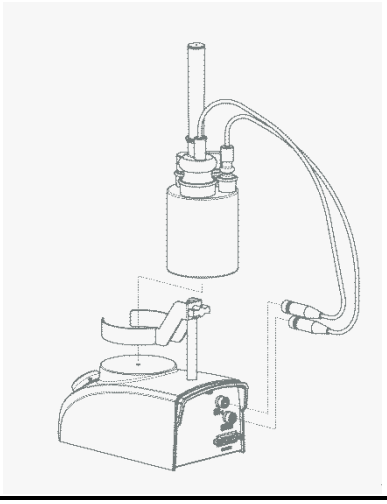
3-2. Assemble the Titration cell

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

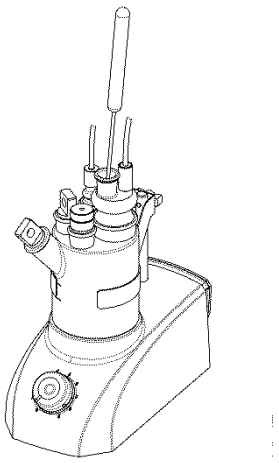
Make sure to apply KF grease around glass sliding area.

3-3. Filling reagent and draining

3-3-1.**Catholyte**

1 ＜**injection**＞

Inject 5mL catholyte into the inner burette using a syringe.

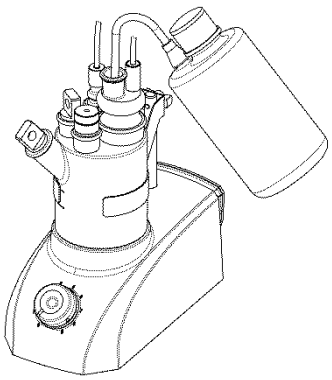


2 After changing catholyte, press [Clear] button to change the life value of catholyte to zero.

To change the life value of catholyte to zero, press [Function]→[Regent Information]→Select reagent→[Edit]→[Clear] button of current life value.

3 ＜**Drain**＞

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



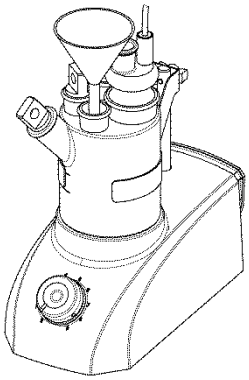
Note When one component cell is used for inner burette, catholyte is not needed

3-3-2.**Anolyte**

＜**When do not use the Solvent Change Unit** ＞

1 **＜injection＞**

With Funnel, pour a solvent into the titration cell 100mL.
(it becomes 100mL when match it with the line Lower the titration cell)

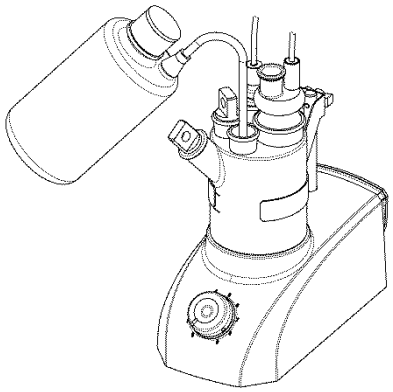


2 After changing anolyte , change the life value of anolyte to zero.

To change the life value of anolyte to zero, press [Function]→[Regent Information]→Select reagent→[Edit]→[Clear] button of current life value.

3 **＜Drain＞**

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



＜When use the Manual Solvent Change Unit ＞

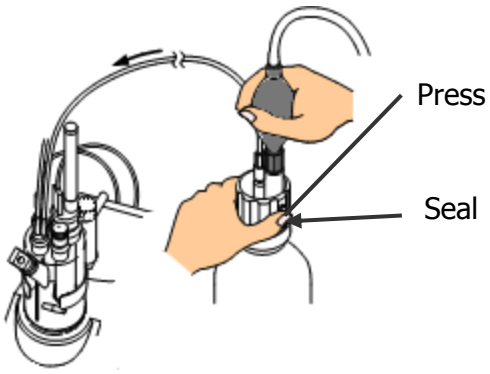
1 **＜injection＞**

To fill the reagent, pump the rubber globe 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＞

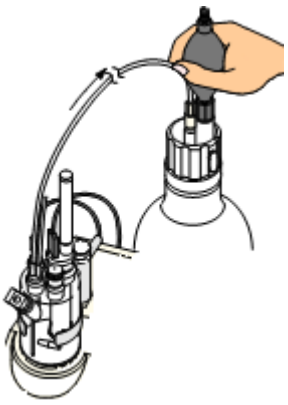
2 After changing anolyte , change the life value of anolyte to zero.

To change the life value of anolyte to zero, press [Function]→[Regent information]→Select reagent→[Edit]→[Clear] button of current life value.

3 **＜Drain＞**

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

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

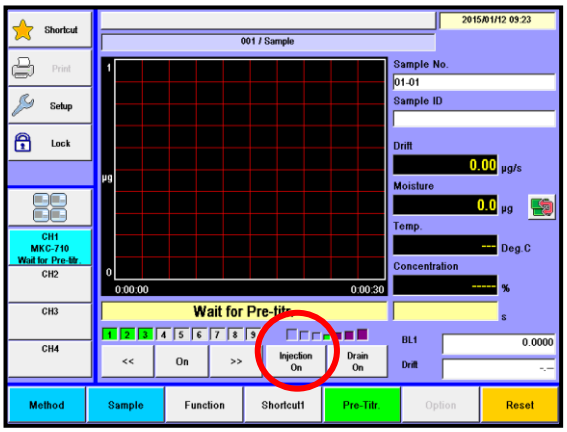


＜Drain out＞

<When use the Auto Solvent Change Unit (Option)>

1 **<injection>**

Push the infusion [On] button of the main screen and inject a solvent of approximately 100mL to a titration cell. (it becomes 100mL when match it with the line upper the titration cell).
[On] button is replaced by [Off] then. Finish infusion when push the infusion [Off] button.



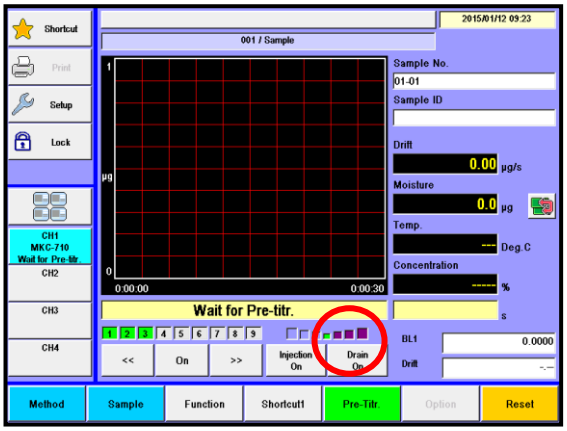
2 After changing anolyte , press [Clear] button to change the life value of anolyte to zero.

To change the life value of anolyte to zero, press [Function]→[Regent information]→Select reagent→[Edit]→[Clear] button of current life value..

3 **<Drain>**

Push the drain [On] button of the main screen and drain the waste solvent.

[On] button is replaced by [Off] then. Finish drain when push the drain [Off] button.



Note

Do not use the dispenser 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 dispenser malfunction.

Note

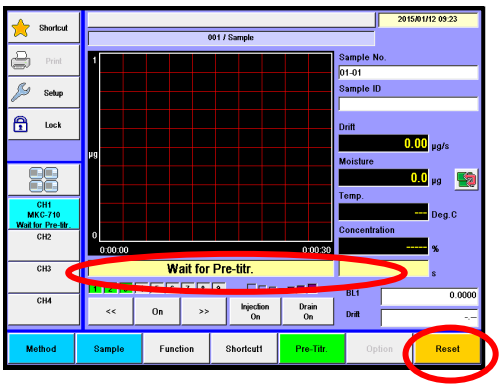
Change the connecting of the Auto Solvent Change Unit for those samples which are oily in order to avoid damage of drain tube.

After having measured injection and drain time, by entering the measured time set to automatic pump operation, press the button once, make the automatic injection and drain.

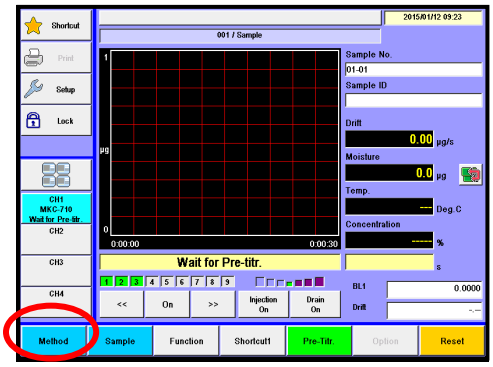
3-4. Selection of Method

In order to run a precise and timely measurement, it is necessary to preset conditions appropriate for the sample and titration method. Those conditions for measurement and concentration calculation are called a Method.

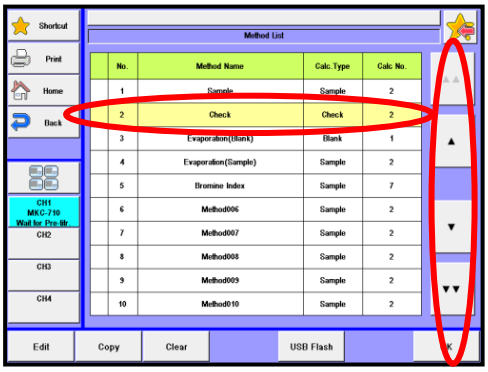
1 Press [Reset] button.
Make sure the message "Wait for Pre-Titr." appears.



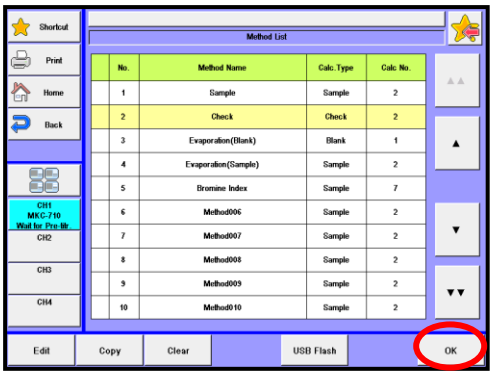
2 Press [Method] button.



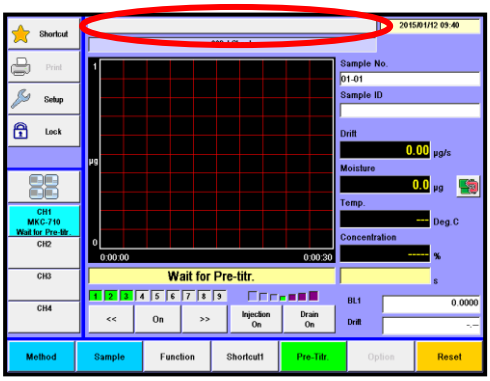
3 When "Method" dialog box appears select your desired Method for measurement with [▲][▼], [▲▲][▼▼] buttons. You can choose a Method directly with numeric buttons.



4 Press [OK] button.



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



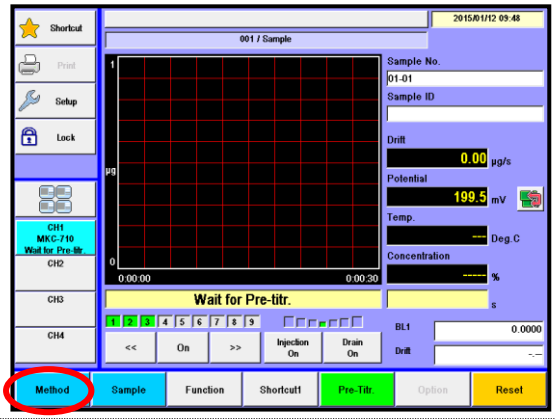
Method cannot be changed during pre-titration or measurement in progress. To change Method, press [Reset] button to set in "Wait for Pre-Titr." mode.

4. Operational procedures

4-1. Measure the sample

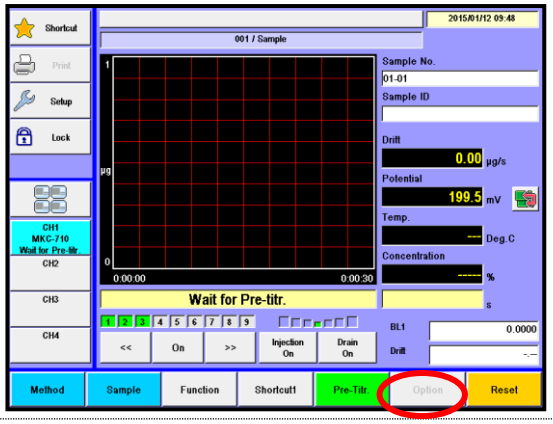
Measure the sample.

1 Press [Method] button to change it to sample measurement.

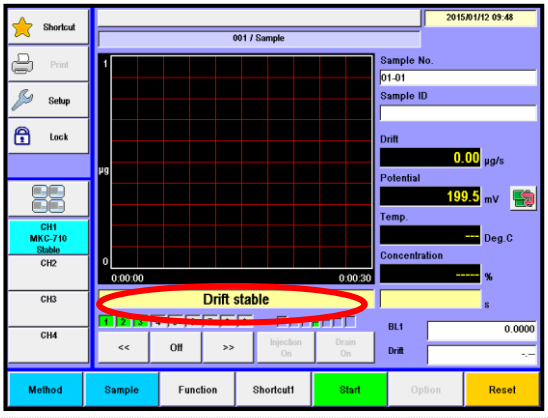


2 Press [Pretitr.] button.

When the titration cell is dehydrated, the display shows "Drift stable", and the button changes from "Pre-Titr." to "Start".



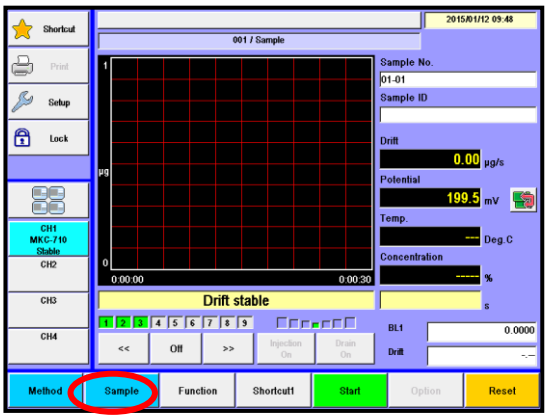
3 Make sure the display shows "Drift stable" status.



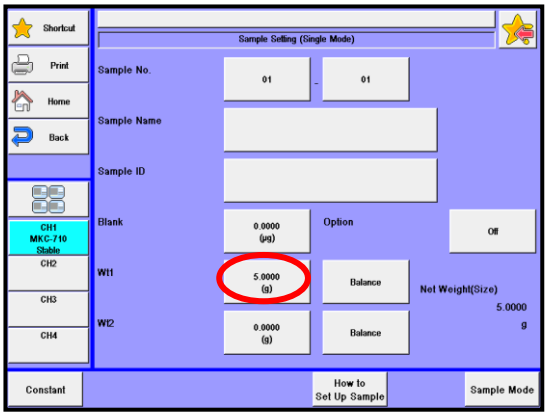
If you measure less than 0.1µg / s drift values, more precise measurement is possible.

4 Take the sample with syringe, and weigh it on an electronic balance.

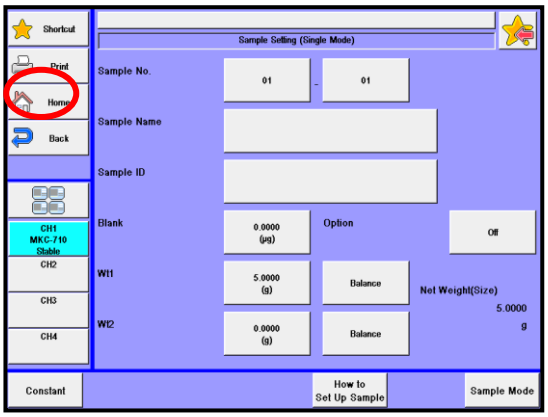
5 Press [Sample] button.



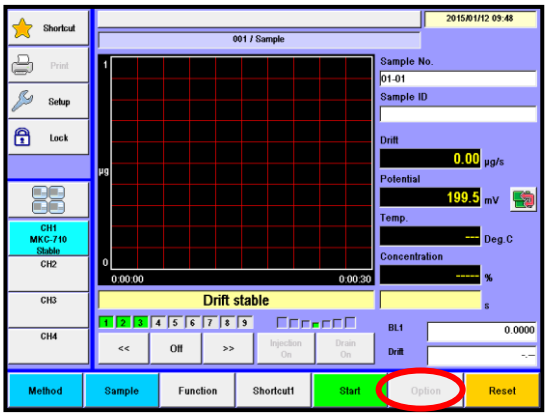
6 Press Sample size (wt1) button.
Enter the weight of the above 4 on numeric display.
Enter the sample Name and ID.



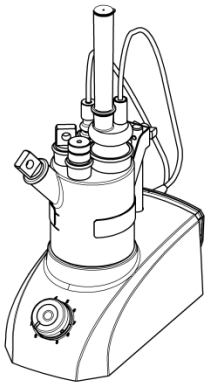
7 Press [Home] button to return to Main display.



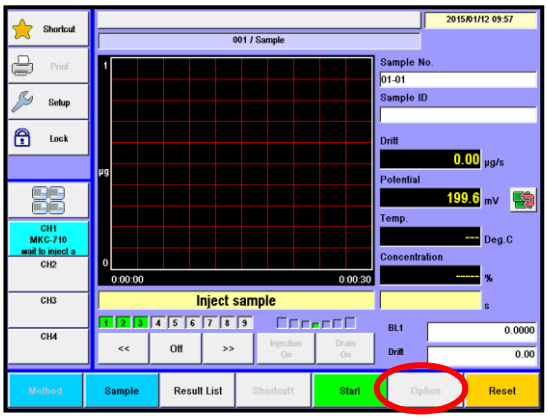
8 Press [Start] button. The message "Inject sample" and "Please press [Start] button"



9 Inject the sample into the titration cell.

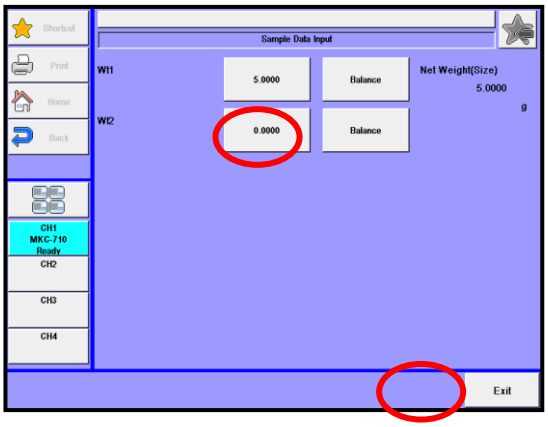


10 Press [Start] button once more. Titration starts and its curve in graphic form will appear. Press [Reset] button to abort the titration in progress halfway.



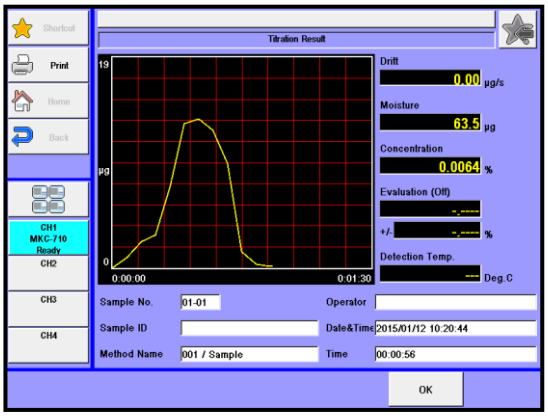
11 Weigh the syringe on the balance after the sample is injected.

After titration is over, the display prompts entry of Wt2. Enter the weight of above 11, and press [OK] button on "sample settings" dialog box.



Wt2 can be entered with [Sample] button during titration.

13 The titration results now appear on display.
When a printer is connected, the results will be printed out according to printing parameters preset in Method.



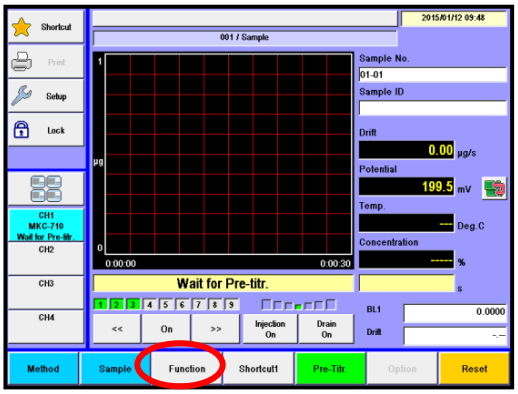
Note

A sample must be discharged into the cell only after the screen has returned to Main screen after sample conditions are configured on sample setup dialog box first.
When [Start] button is pressed, the sample setup dialog box will appear if "Yes" is chosen on "Before entry". Otherwise, it should be noted titration will not start if the sample is discharged into the cell while the sample setup dialog box is on display.

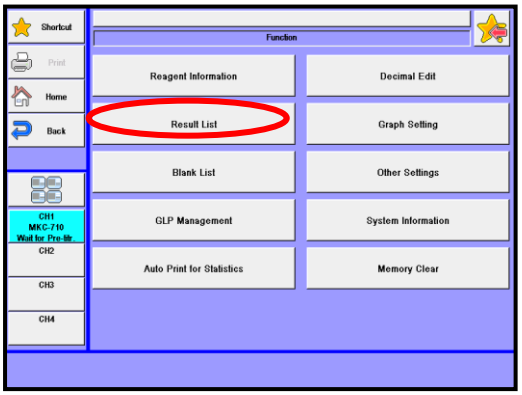
4-2. Read Data, Store in USB Flash Drive

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

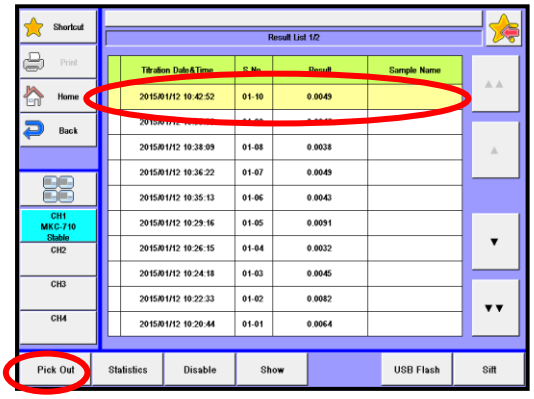
1 Press [Function] button.



2 Press [Results List] button.

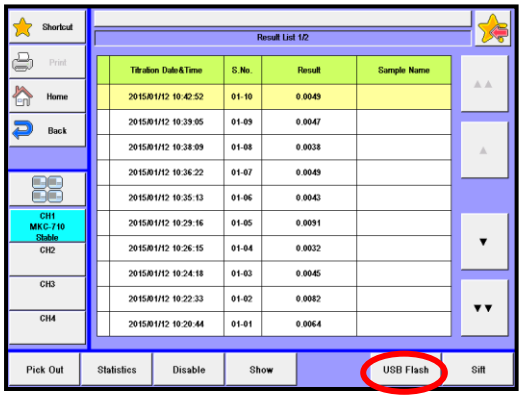


3 Picks up data you wish to save in a USB flash drive.
Press the [Pick Out] button. Set up pickup conditions, and press the [Execute] button.



4 Insert USB to the USB connector.

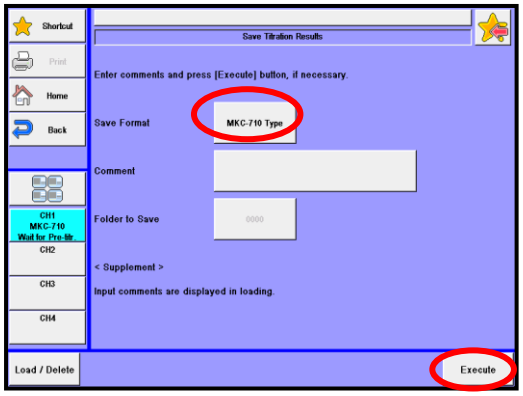
5 Press [USB Flash] button.



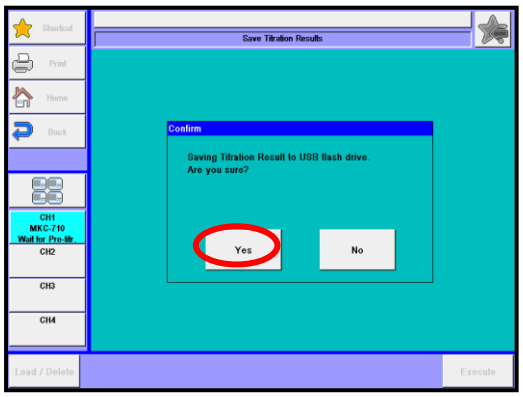
6 Select the file format to save.

There are four file formats available, "MKC-710 Type" , "PDF Type" , CSV Type "and "CSV Type(list)."

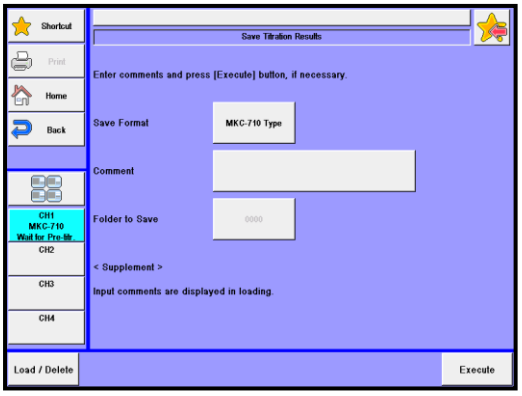
If you want to enter your comment regarding the titration results to be stored, press the comment column on display.
When saving in a CSV format, enter the folder name (input range: 0000 - 9999).
Press [Execute] button on the "Save titration results" screen display.



7 Then, the confirmation screen will be displayed and press [Yes] button.



8 When the screen display returns to "Save Titration Results" after storing them in the USB flash drive, pull out the USB flash drive.



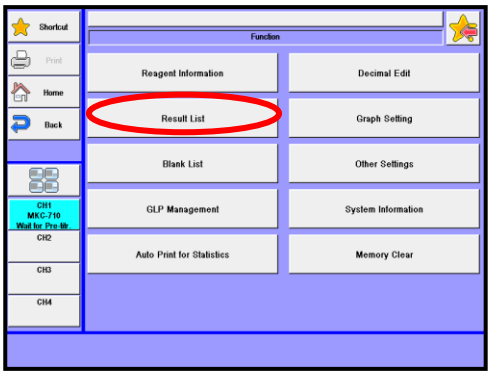
Note

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.

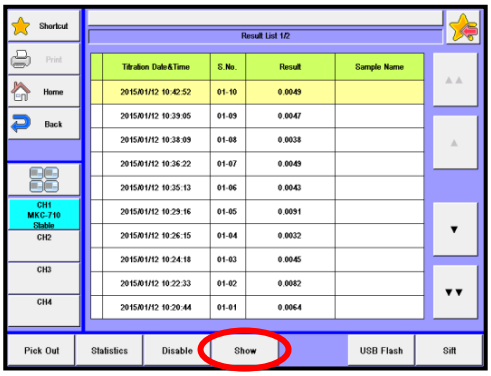
4-3. Re-calculate titration data

Result parameter and print format can be changed.

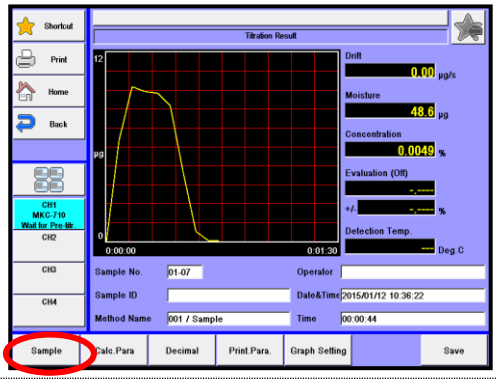
1 Press [Function] button on Main display.
Press [Result List] button.



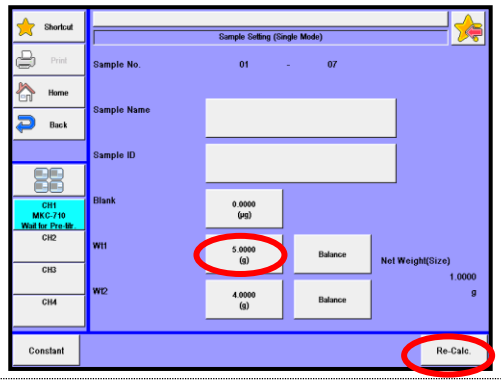
2 When "Result List" appears, point the cursor on the results data for recalculation.
Use [▲][▼], [▲▲][▼▼] buttons to move the cursor or you can choose the desired data directly by pressing the data on list.
Press [Show] button.



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

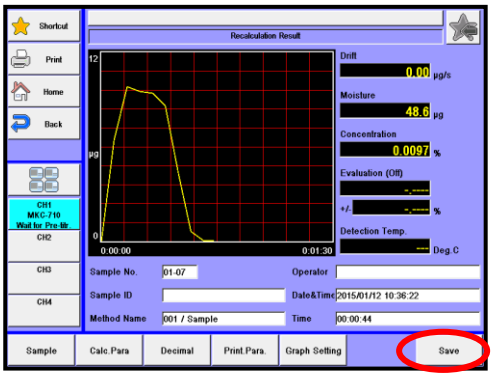


4 When "Sample setting" is displayed, press [Wt1] button. Enter the amount in volume or weight.
Press [Re-Calc.] button.



5 The screen display will turn "Recalculation Result" dialog box. Then, press [Save] button.

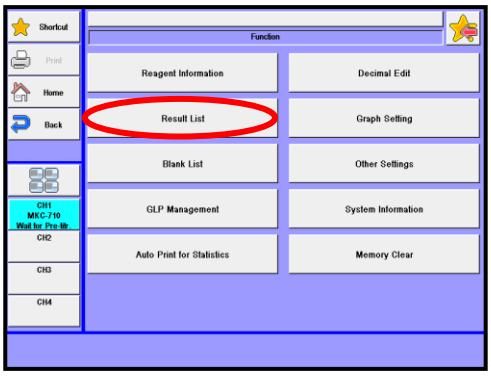
The screen for entering your comments will appear. Then, enter comments as needed and press [Save] button.



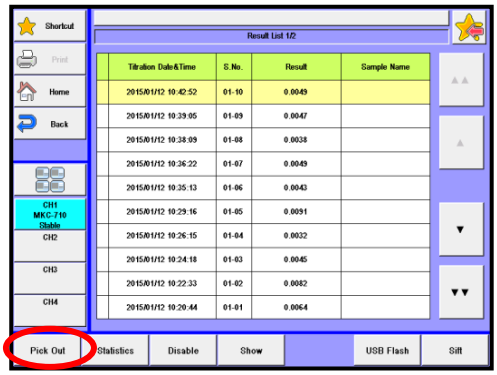
4-4. Batch processing of titration data

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

1 Press [Function] button on Main display.
Press [Result List] button.

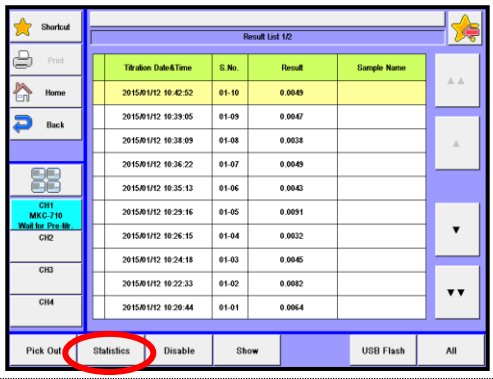


2 Press [Pick Out] button. Here you sort out the data for batch calculation.



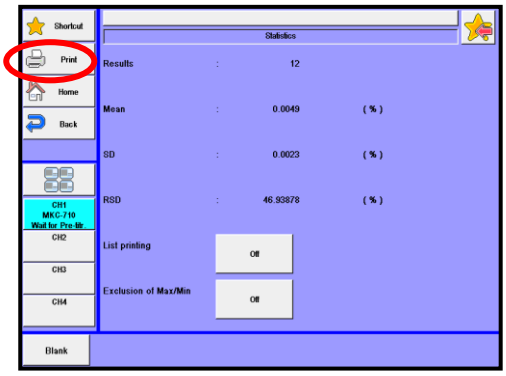
3 When "Pick out" display appears, configure parameters for selection of data, and press [Execute] button.
Example: Take data using "Titration Date" as key parameter.
Make "Titration Date" active ("On"), followed by setting the date.

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



5 The screen on the right will appear. The batch calculated results will be printed out when [Print] button is pressed.

To return to Main display, press [Home] button.



Note **For details of batch calculation, refer to Function discription"3-3-2. [Statistics]."**

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

5. Function Tools

To start with, let us learn about Menu window itself.

Please refer to <Function Description.>

5-1. Method

In order to run a precise and timely measurement, it is necessary to preset conditions appropriate for the sample and titration method. Those conditions for measurement and concentration calculation are called a Method.

Item	Description
[Titration Mode]	Settings for titration mode.
[Titration parameter]	Settings for general titration.
[Control parameter]	Settings for control of the titration.
[Calculation parameter]	Settings for calculating the result.
[Report parameter]	Settings for printing contents.
[Reagent parameter]	Settings for the reagent.
[Option parameter]	How to purge and time, set the heating temperature when connected option (such as an oven).

Method and default

Method No.	Method name	Description
1	Sample	Measurement of the sample.
2	Check	Measurement for check with standard substance.
3	Evaporation (Blank)	Measurement of the sample by back titration.
4	Evaporation (Sample)	Measurement of the sample by oven.
5	Bromine Index	Measurement of bromine number.

5-2. Sample

Setting for the sample parameters

Item	Description
[Sample No.]	Here you select a number for the sample. The numbers consist of High order number and Low order number, and the samples when grouped are numbered with High order number. Lower number represents individual sample identification. • 00 ~ 99
[Sample name]	Here each sample can be named with characters up to 20 letters.
[Sample ID]	The samples can be identified with ID or Lot number with up to 20 characters.
[Blank]	Here you enter the blank value. The blank value selected for the Blank No. in Method calculation parameter will be taken in automatically. • 0.00000 ~ 99999.99999ug
[Option]	Here you choose On if you use an optional oven or a multiple sampler. • Off : No options to be used. • ADP- : Selected when measuring combined with the Drying oven. Such device will work to the Option parameter preset on Method. • CHK- : Selected when measuring combined with the Multiple sample changer. Such device will work to the Option parameter preset on Method. • Set By Method : Specify Method to set up an drying oven.
[Wt1]	Here you enter the total weight of tare and sample. • 0.00000000 ~ 99999.99999999g
[Wt2]	Here you enter the tare weight after sample is discharged. • 0.00000000 ~ 99999.99999999g
[Balance]	Here you can enter the weight direct from an electronic balance.
[Constant]	Here you enter the constant particular to those measurements for gas or samples, which are dissolved with solvent extraction before titration. Sample constants can be setup when "Sample" is selected in the [Function] – [Other settings] – [Constant properties], settable only on the constants that are being used for the Calc. No. of the calculation parameters of presently selected method.
[How to Set UP Sample]	You define sample settings.
[Sample Mode]	You define sample mode.

5-3. Function

Function window is a convenient tool to practice exciting features of the unit.
Setting for the Function parameters

Item	Description
[Reagent information]	Here you set in the information on reagents including their names, reagent factor, shelf life, replacement date, etc.
[Result list]	You can view the list of measurement results where you can re-calculate or batch-calculate them.
[Blank list]	This is the list of blank values including 10 different ones you can store
[GLP management]	Here you set up functions to meet with GLP requirements including periodic check, advance notice of check date at intervals, etc.
[Auto statistics]	The series of measurements performed under the same conditions (Method) can be automatically printed out by this function.
[Decimal edit]	This function includes setting the number of decimal places for a sample size when printed out or displayed on screen as well as how to round off in calculation.
[Graph setting]	A graphic curve can be depicted for water content per time vs. unit time as well as integrated water amount.
[Other settings]	This includes the auto input of averaged values and the alarm function, etc.
[System information]	You can view the list of equipment presently connected to the channels in work as well as the information on software version
[Memory clear]	With this function, you can erase measurement results, methods or sample parameters selectively by individual sample.

5-4. Option

Setting for the option parameters.

Item	Description
[Exit]	Returns to Main display.
[Oven]	When the oven for evaporation is connected, ageing is necessary to purge out moisture inside the heating unit and other tube lines. Follow the below descriptions for ageing setup and ageing procedure.

5-5. Setup

You can configure system setup using the function of Setup.

Item	Description
[Regist operator]	Here the operator is defined for identification. Up to 50 operators can be registered with individual names.
[International]	Languages, date and clock time can be set.
[Interface]	Here you configure settings for your printer, output for PC, balance, LAN and the Bluetooth.
[LCD Backlight]	Here the backlight of LCD can be adjusted.
[Beep]	Beep tone for alarm can be selected on this display.
[Maintenance]	Here you can delete the information on devices that are connected to CH1 – CH4, and clear the memory. Also calibrates the touchscreen.
[Administrator Setup]	Sets up the functionality of hierarchical management for operation menus by user ID or password.

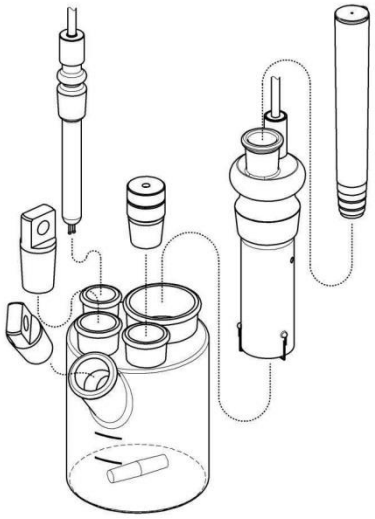
6. Maintenance

6-1. 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.

6-1-1.**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.**

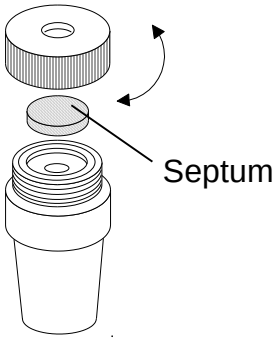
If grease on the glass contact areas becomes hard and the respective parts are difficult to separate, take the following steps;

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.**

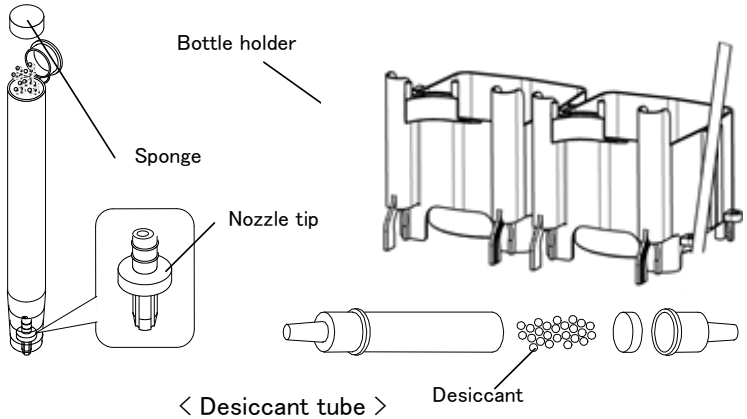
6-1-2.**Replacement of septum**

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.



6-1-3.**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.

6-1-4. **Replacement of the anolyte (anode reagent)**

＜Exchange timing＞

- When the accumulated moisture measurement (=reagent life) has reached 1000mgH2O 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

6-1-5. **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

6-1-6.**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.

6-1-7.**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.

6-1-8.**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.

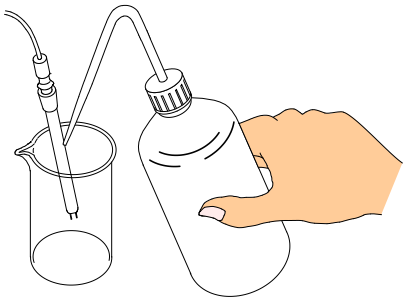
6-2. Other Maintenance

6-2-1.**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.

6-2-2.**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 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.

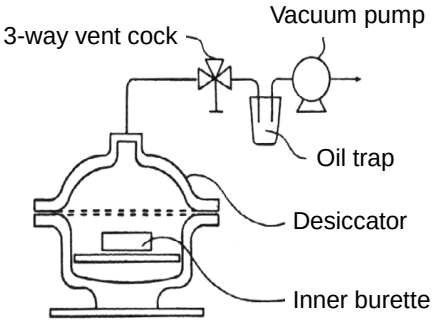
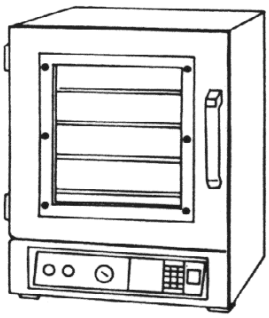


Diagram of Decompression dryer



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.

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.

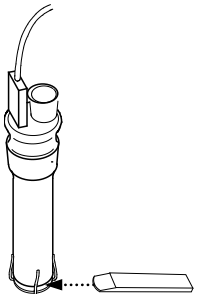
6-2-3.**Cleaning the titration cell**

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.

6-2-4. **Distance adjustment between anode electrode and diaphragm**

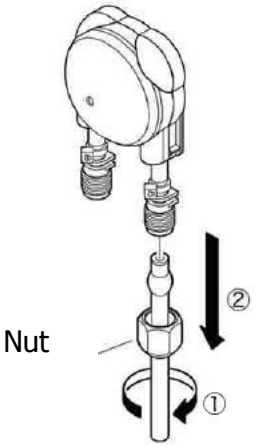
If the anode electrode in the inner burette and the diaphragm are too close together, electrolysis reaction will not run in normal condition. Use the supplied anode adjuster to adjust the distance in between.



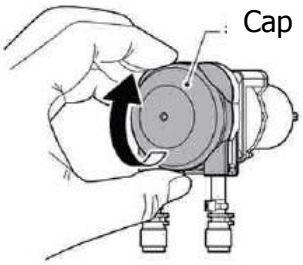
6-2-5.**Replacement of pump tube**

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.

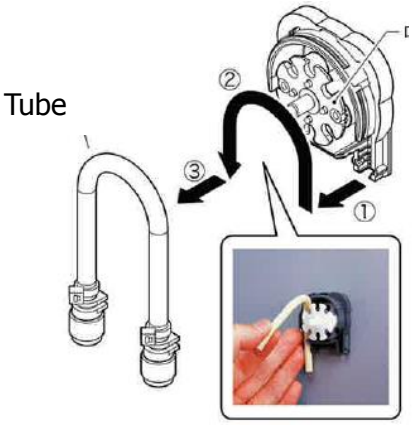
1) Remove the tubes connected to cassette.



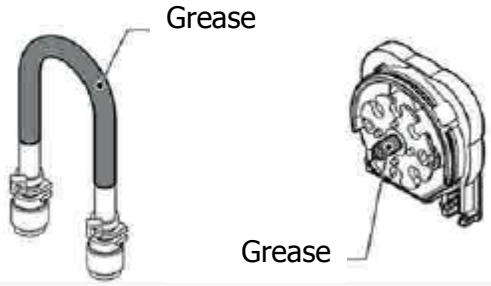
2) Remove the pump tube cap, as shown on the right.



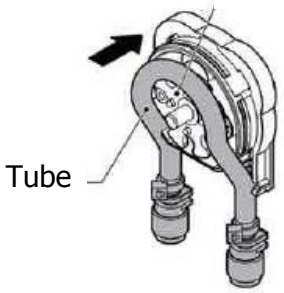
3) Remove the pump tube, as shown on the right.



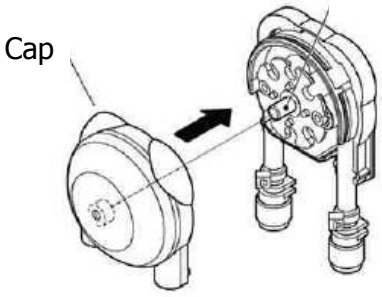
4) Apply the supplied grease around the new tube and axle of cassette.



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). And you can use the 12-03961-01 extraordinary chemical resistance pump tube (option).

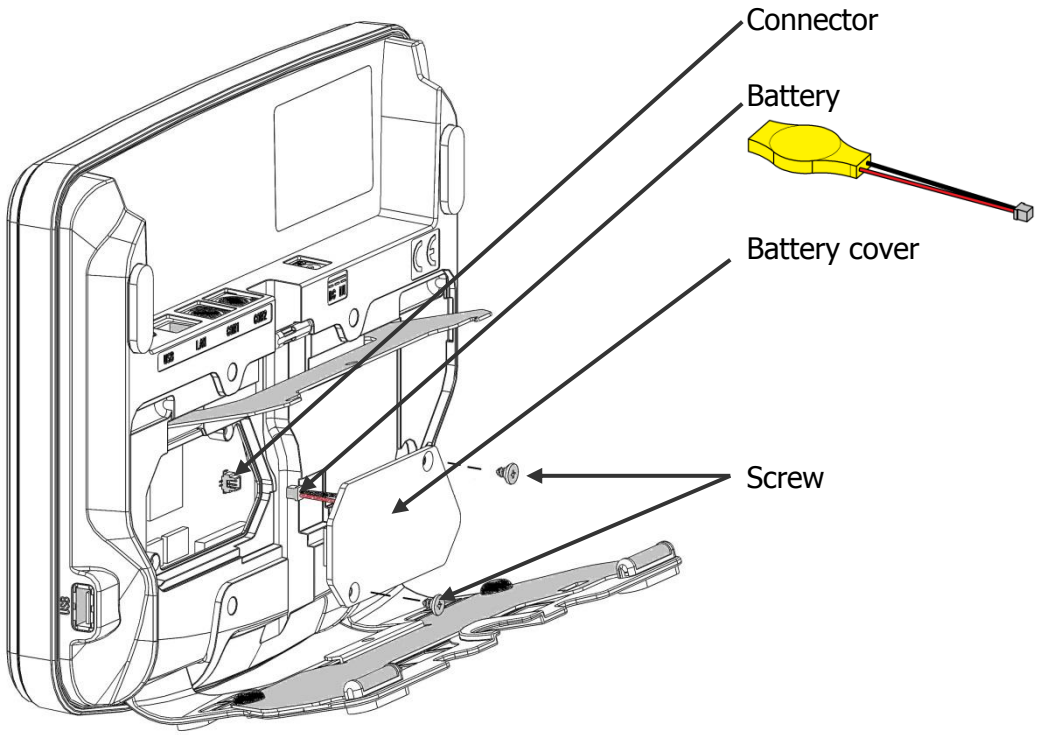
6-2-6.**Replacement of the filter**

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.

6-2-7.**Replacing the clock battery**

If the clock does not function correctly, the inside battery needs to be replaced with new one.



Remove the battery cover on the backside of the main unit with a Phillips-head screw driver.
Remove the connector of the old battery.
Peel off the battery from the battery cover.
Attach a new battery (W15 leaded CR2032) to the battery cover, and attach a connector.
Place the battery cover.

Caution	**Be sure to turn off the instrument before replacing batteries.**

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

7. Troubleshooting

7-1. Error messages and alarm messages

7-1-1. **Error messages and remedies**

Error message	Trouble	Remedies
Pot. not detected ↑↓ Check det. electrode	Connecting cable is not connected.	Check on connection between the detection electrode and stirrer.
	Electrode cable is broken or loosely connected.	Replace the electrode.
Short-circuit in det. electrode ↑↓ Check det. electrode	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 twin platinum reference electrode.
Potential Too Low ↑↓ Inject sample	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.
Beyond meas. Range ↑↓ Decrease Samp. Amt.	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.
Wrong Parameter Set ↑↓ Review settings	To use the oven is selected on parameter setup without oven.	Turn it off to use the option.
	The power for oven is turned off. Connecting cable is disconnected.	Make sure of the power turned on. Make sure of its connection.
	Connecting cable is broken.	Replace the connecting cable.

7. Troubleshooting

Error message	Trouble	Remedies
Cannot titrate ↑↓ Check inner cell	Check on electrode connection. Reduce sample size.	Check on electrode connection. Reduce sample size.
Epidemic on Preamp. ↑↓ Contact the manufacturer	Preamplifier circuit is now defective.	Contact your local dealer.
Oven won't operate ↑↓ Check connect.	The power for oven is turned off.	Make sure of the power turned on.
	Connecting cable is disconnected.	Make sure of its connection.
	Connecting cable is broken.	Replace the connecting cable.
Connect meas. unit, ↑↓ Please turn power on	When the measuring unit does not start when power is turned on. When the system fails in connecting the measuring unit.	Turn off the power of measuring unit and main control unit once, and turn on the power again.
Communication time out	・Communication failure on the device other than MCU-710 main unit.	・Check and see the connection of connectors and cables on the measuring devices, followed by touching [Reset] button. (If touching [Reset] button does not lead to the solution, i.e. the error message still stays, then) ・Reboot the system. ・After backing up titration results or parameters on USB flash drive, initialize all parameters stored on the system by selecting [Function] – [Memory Clear] – [All Parameters].
Disconnected ↑ ↓ Check connections	・Communication failure between MKC-710 and MCU-710.	・Check on connection with connecting cable between MKC-710 and MCU-710. ・When using wireless connection, ensure that there is no shielding between MKC-710 and MCU-710. Also, when communication distance is long, bring MKC-710 close to MCU-710.
Changer won't operate ↑ ↓ Check connections	With a Changer connected, its power is turned off or power cord is not connected.	・Check on connection with connecting cable between MKC-710 and Changer.

＜Parameter errors on MKC-710＞

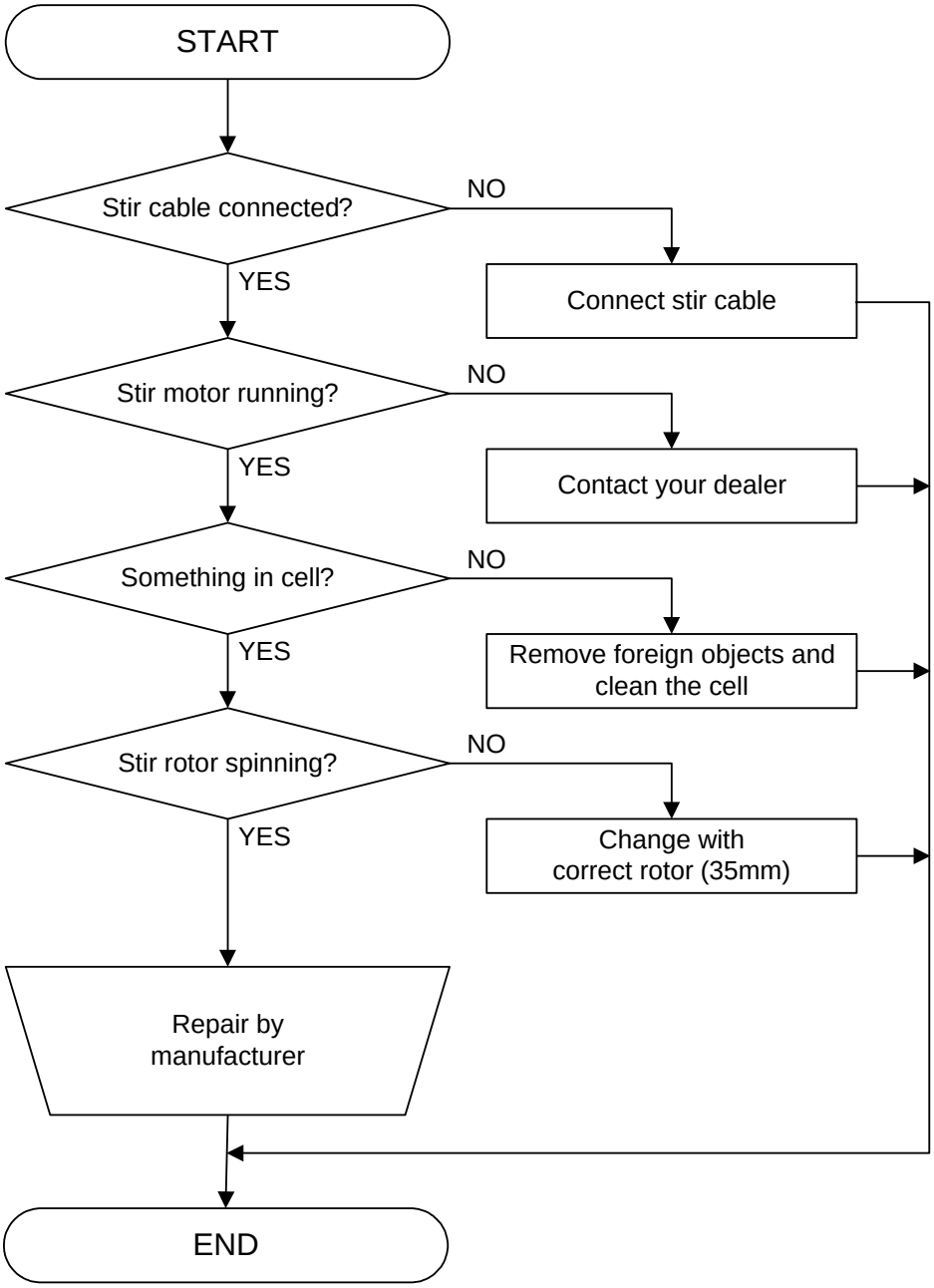
Error message	Trouble	Remedies
Parameter Err ↑↓ Please press [Reset]	・The currently used parameters are not adaptive to the method	・When parameter error occurs, it is specified in dialog box on side. Correct the parameter accordingly.

Sub-message	Trouble	Remedies
Method** Time setting error	T (max) (0s) is set in without Drift stop.	Change the setting of titration limit time and drift stop mode.

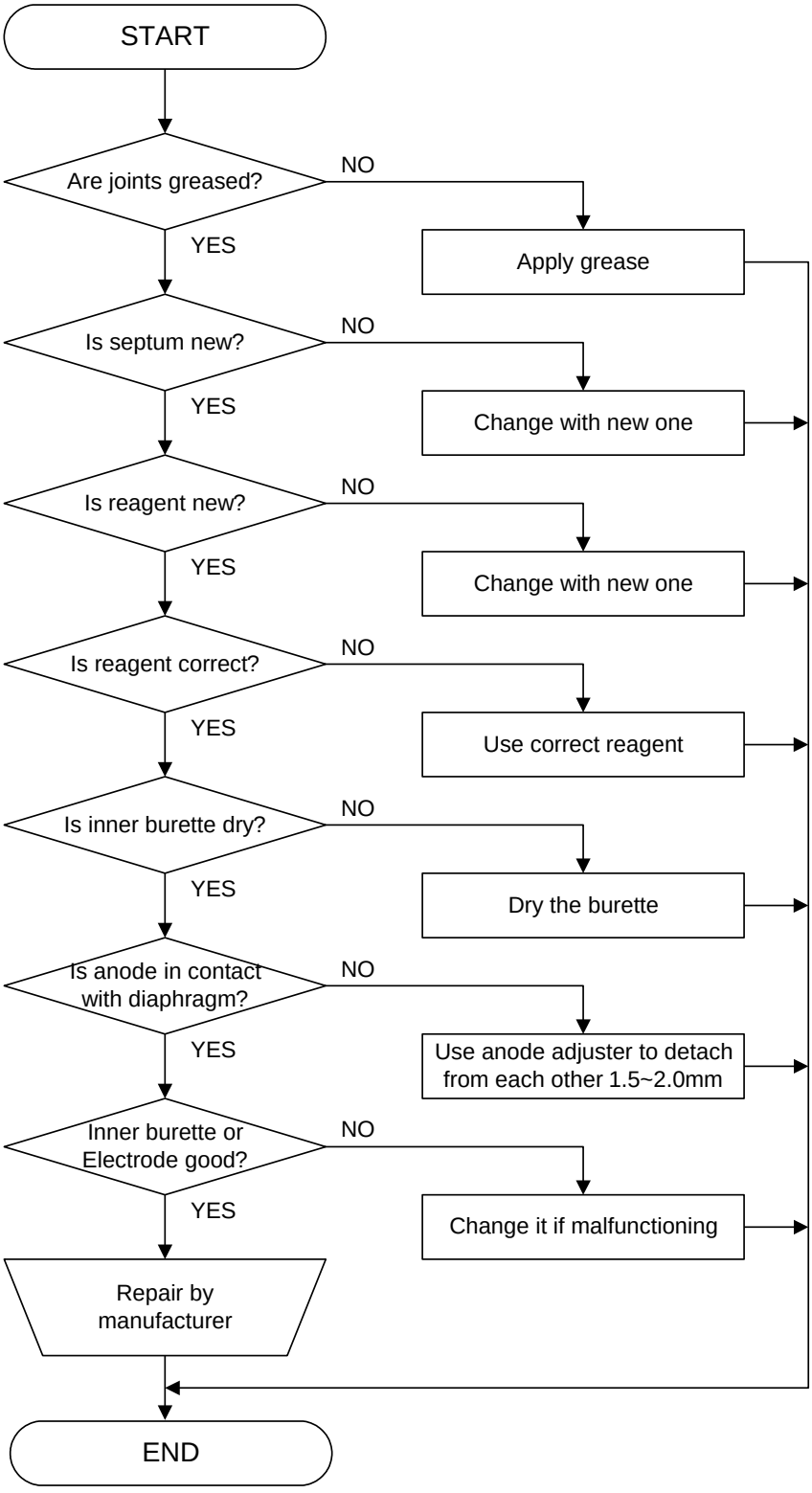
7-1-2.**Alarm message and remedies**

Alarm message	Reason	Remedies
Beyond upper limit of Anolyte life ↑↓ Replace an anolyte	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.
Beyond upper limit of Catholyte life ↑↓ Replace a catholyte	Because the total cathode reagent consumed in electrolysis exceeds the preset level.	Change the catholyte and clear the reading and reset the now life to zero.
Replacement date an anolyte ↑↓ Replace an anolyte	Because the date for changing the anolyte becomes due today.	Change the reagent and clear the due date setting.
Replacement date a catholyte ↑↓ Replace a catholyte	Because the date for changing the catholyte becomes due today.	Change the reagent and clear the due date setting.
Replacement of an anolyte overdue ↑↓ Replace an anolyte	Because the date for changing the anolyte is past.	Change the reagent and clear the due date setting.
Replacement of a catholyte ↑↓ Change Catholyte Now	Because the date for changing the catholyte is past.	Change the reagent and clear the due date setting.
Replace an anolyte in xx days	Because the preset due date to change anolyte is xx days.	Change the reagent and clear the due date setting.
Replace a catholyte in xx days	Because the preset due date to change catholyte is xx days.	Change the reagent and clear the due date setting.
Periodic check date ↑↓ Make a periodic check	Because the preset check date becomes due.	Perform the check for verification and evaluation.
Periodic check date overdue ↑↓ Make a periodic check	Because the check date is past.	Perform the check for verification and evaluation.
Periodic check in xx days	Because the preset due date to check is xx days.	Continue measurements as planned, or perform periodic check accordingly.

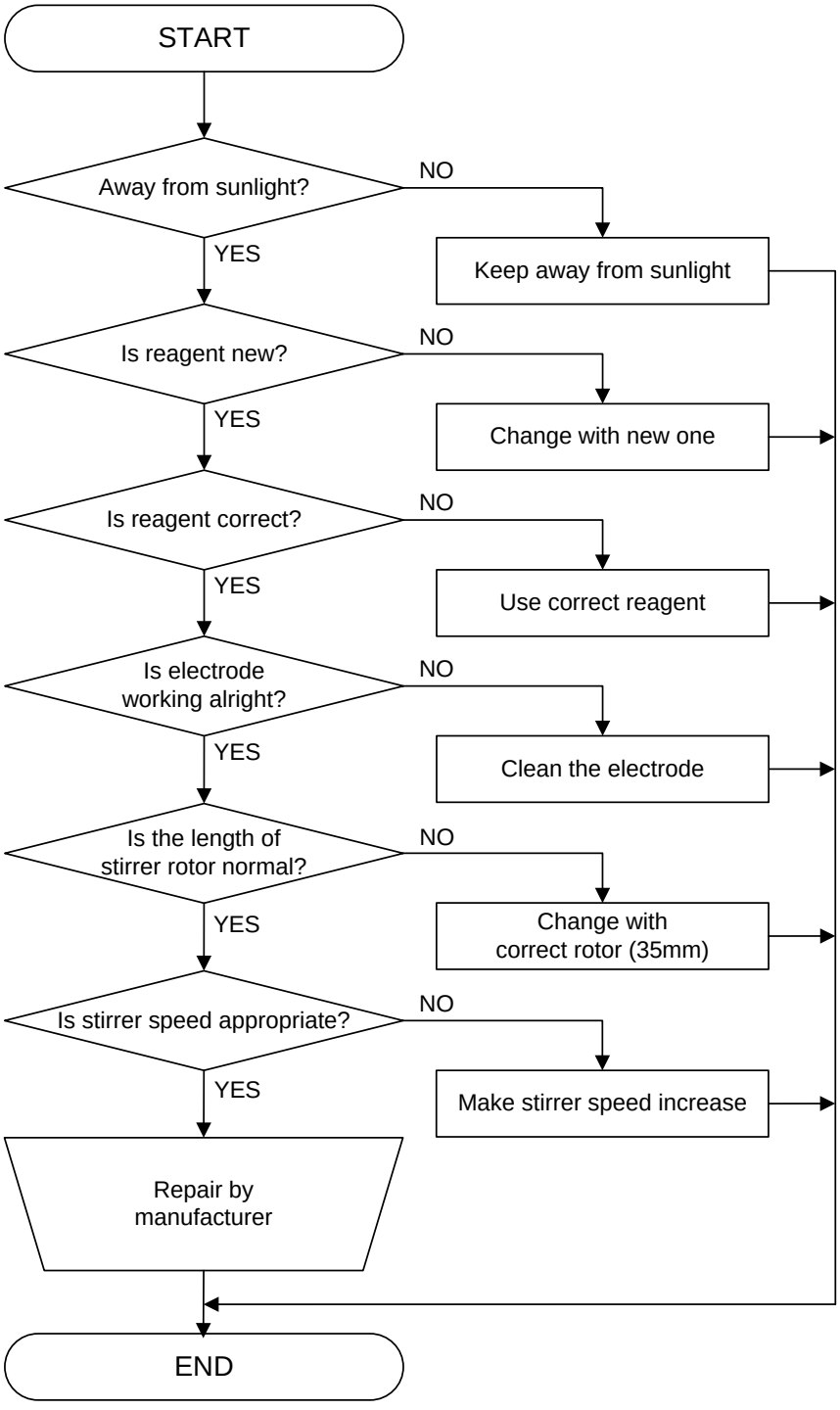
7-2. Stirrer does not work properly



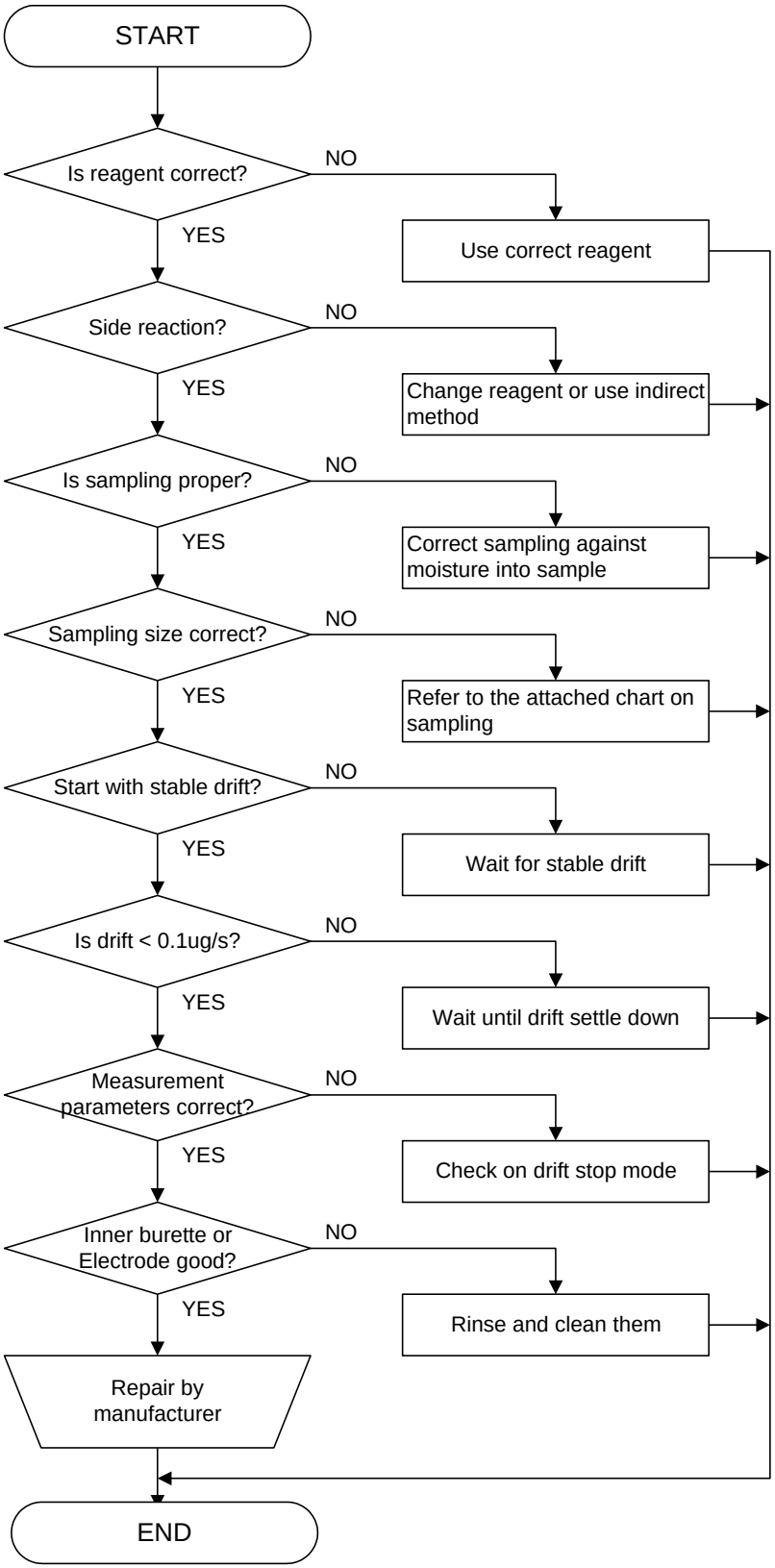
7-3. Drift level is too high



7-4. It runs into over-titration



7-5. 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

7-6. 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;

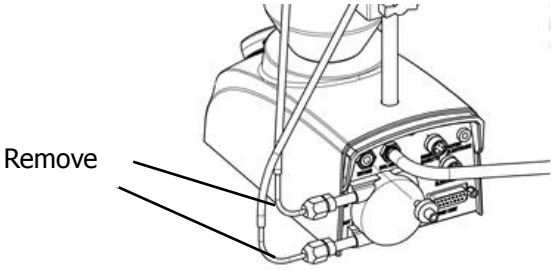
1) Discharge anolyte and catholyte.
2) When using a glass port plug, warm it up with a hair dryer or something similar to soften KF grease before removing. When using a PTFE port plug, remove it after cooling the titration flask in a freezer for about five (5) minutes.

⚠ **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.**

7-7. 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.

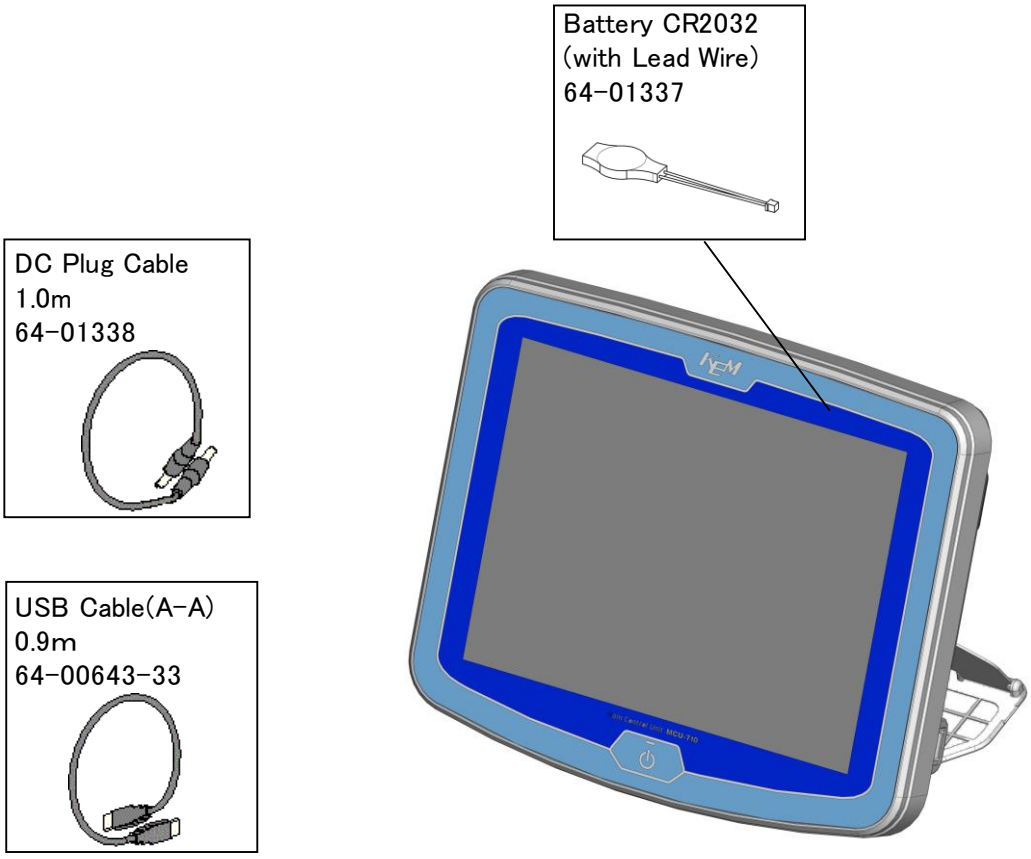
⚠ **Caution**	When removing the tube, please attach the eye protection and gloves. Please be careful because there is a possibility that the drainage jump out.

8. Others

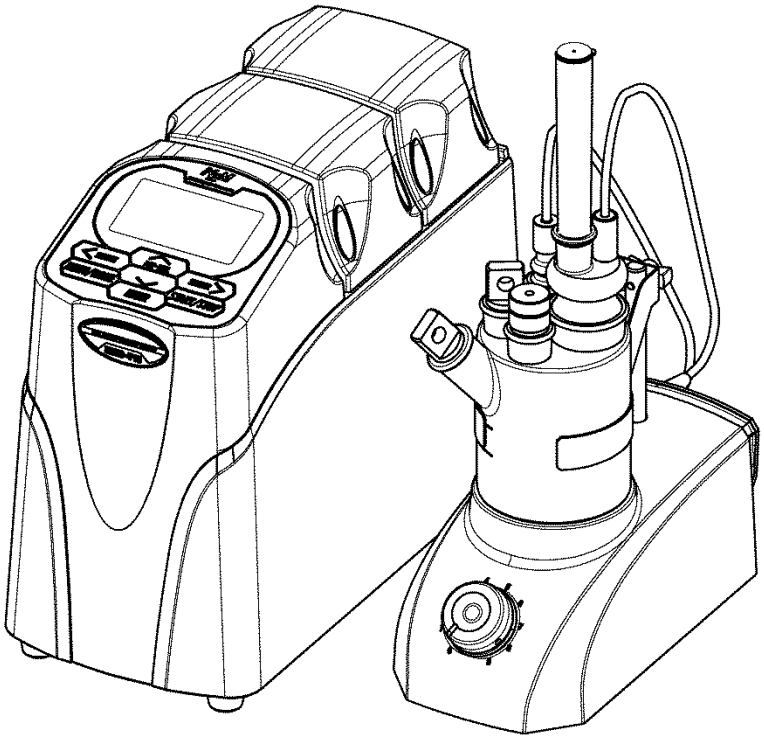
8-1. Parts list

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.

MCU-710



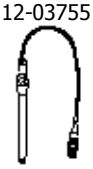
MKC-710



AC Adapter Type4 64-00898	Power Code 64-01107	Plug Adapter AC3P-2P 12-02170	Cell Holder (for Coulometric) 20-09176	Pipette 10mL 66-00071
Stirrer Cable 0.6m 64-01386	MKC-710 Operation Manual(CD-ROM) 12-05186	Anode Adjuster 20-06380-01	Washing Bottle 12-04251	Funnel 66-00141

Parts(Titration Cell)

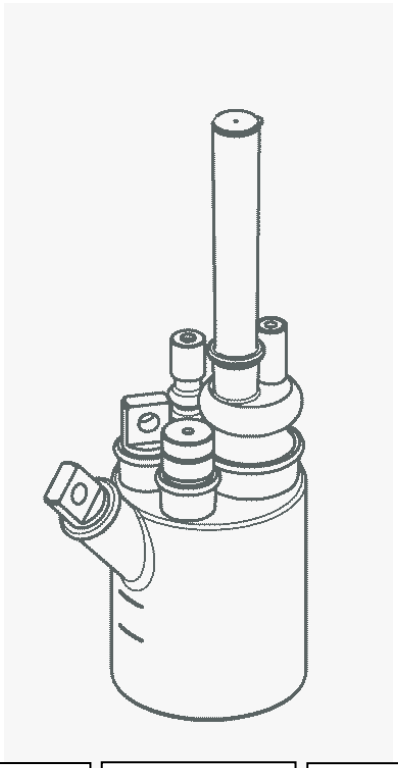
Twin Platinum Electrode / KF M-713
12-03755



Port Plug 19/25 PTFE
20-07188

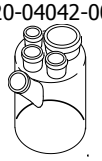
Syringe Inlet (with Septum)
12-00661-11

Septum (10pcs/set)
12-01394-10



Inner Burette
12-05195
(2Component)
12-05194
(1Component)

Titration Cell (Transparency)
20-04042-00



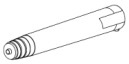
Stirrer Rotor (35mm) (5pcs/set)
12-00661-12

KF Grease (5g)
12-04232

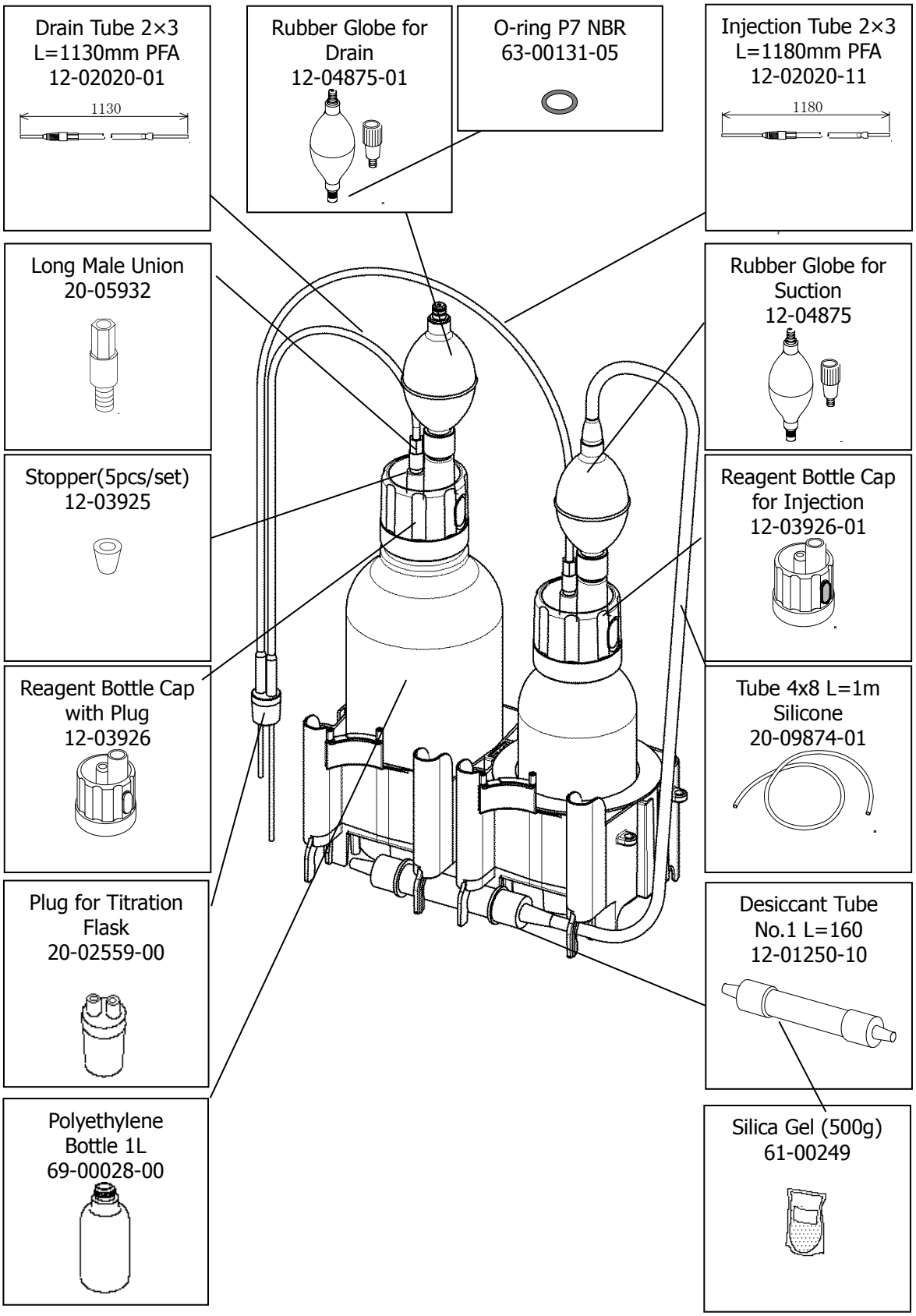
KF Grease (50g)
12-04232-01

Silica Gel (500g)
61-00249

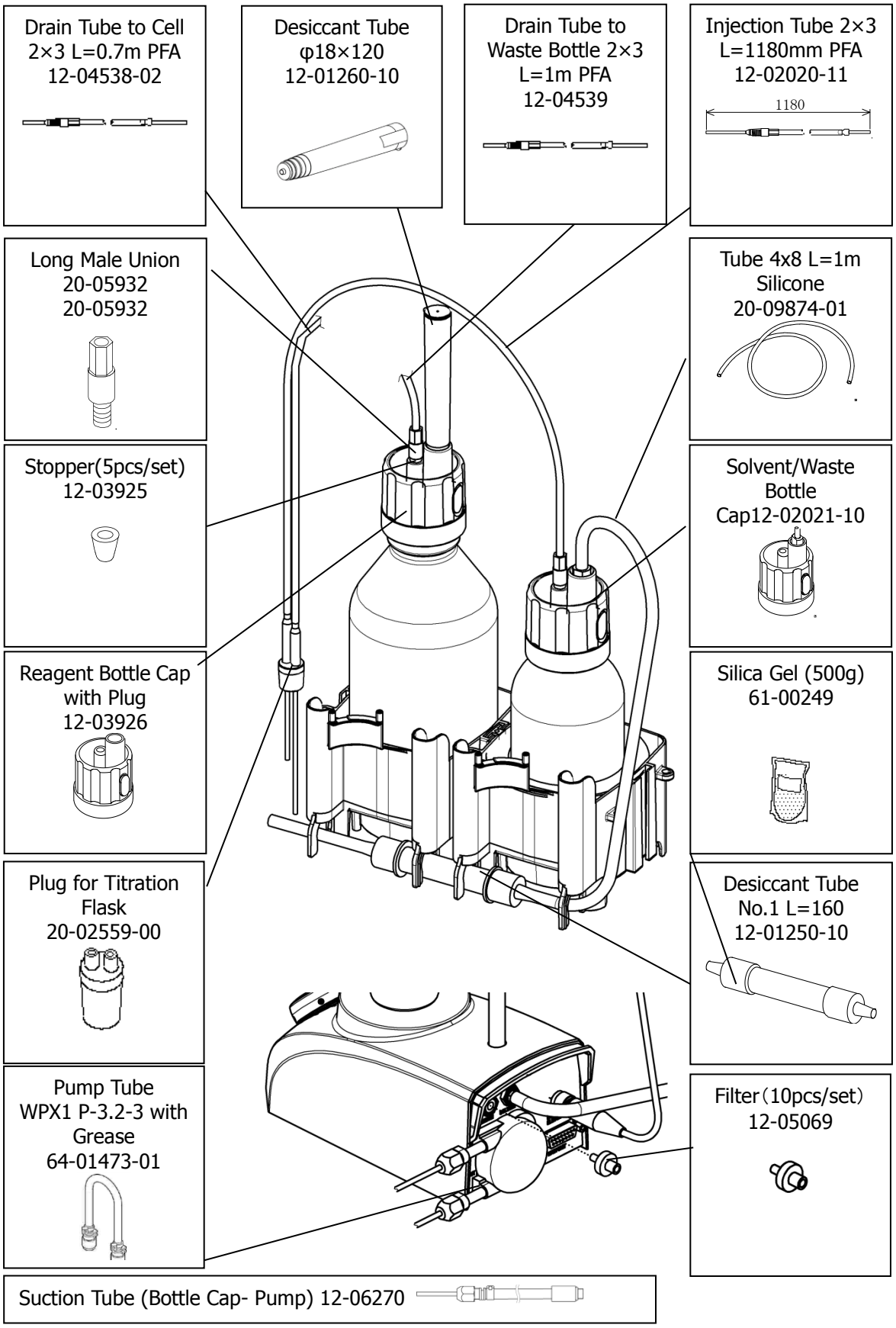
Desiccant Tube φ18x120 with Silica Gel
12-01260



Manual Solvent Change Unit

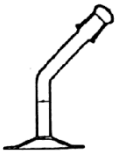
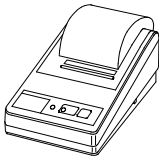
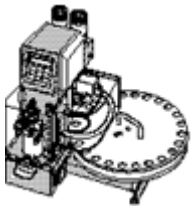
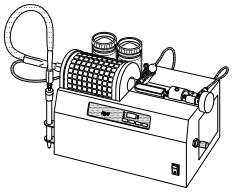


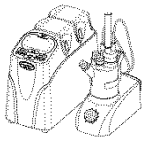
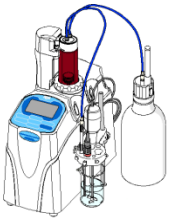
Auto Solvent Change Unit



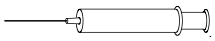
8-2. Options

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

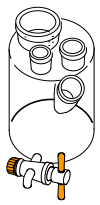
	Application		Option	
	Collect in a way that is appropriate for the sample size	⇨		Sampler
	Print out of measurement results	⇨		Printer
	Automated measurement	⇨		Multiple Sample Changer
MKH-700	Measure the moisture in the sample by Evaporator	⇨		Evaporator
	Date capture into your PC	⇨		Software

	Application		Option	
MKC-710M	Adding a Karl Fischer Moisture Titrator	⇨		Additional unit
	Adding an Automatic Potentiometric Titrator	⇨		Additional unit

Sampler

Part code	Part name	Remarks	Sketch
12-00696-10	Micro Sampling Unit (for Coulometric)		
12-05143	Liquefied gas sampler		
12-04577-02	Syringe 2mL with Needle		
12-04577-01	Syringe 20mL with Needle		
12-04577-10	Silicon rubber plug	5pcs/set	

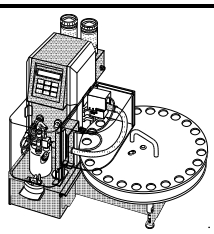
Titration cell

Part code	Part name	Remarks	Sketch
20-04042-00	Titration Cell with Drain Cock	Transparent cell with a drain cock	

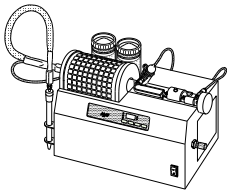
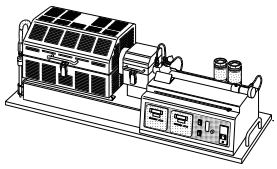
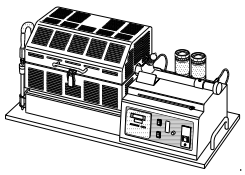
Printer

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)	

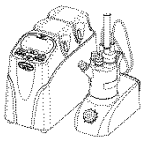
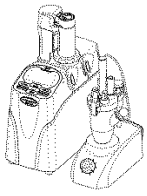
Multiple Sample Changer

Part code	Part name	Remarks	Sketch
CHK-501	Multiple Sample Changer	Non-CE	

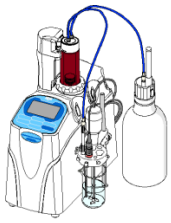
Evaporator

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	

Additional unit(Karl Fischer Moisture Titrator)

Part code	Part name	Remarks	Sketch
MKC-710	MKC-710 Karl Fisher Moisture Titrator	For Coulometric Method Connecting Cable (USB Cable (A-A) (64-00643-33)) required.	
MKV-710	MKV-710 Karl Fisher Moisture Titrator	For Volumetric Method Connecting Cable (USB Cable (A-A) (64-00643-33)) required.	

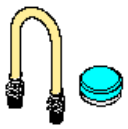
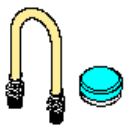
Additional unit(Automatic Potentiometric Titrator)

Part code	Part name	Remarks	Sketch
AT-710	AT-710 Automatic Potentiometric Titrator	Connecting Cable (USB Cable (A-A) (64-00643-33)) required.	

Software

Part code	Part name	Remarks	Sketch
12-03265	SOFT-CAP Data Acquisition Software	Connecting Cable (12-02012, 64-00625) required.	

Pump Tube

Part code	Part name	Remarks	Sketch
64-01473	Pump Tube WPX1 F-3.2-3 with Grease	Fluorine tube	
12-03961-01	Pump Tube (ePTFE+FKM) WP1000 C3.2-4-K-φ3with Grease	Extraordinary chemical resistance	

8-3. Specification

Specification	Contents	
Type and Model	Karl Fischer Moisture Titrator Model MKC-710M	Karl Fischer Moisture Titrator Model MKC-710S
Measuring method	Karl Fischer coulometic Titration	
Measuring range	Water content / Bromine index : 10ug to 300mg (depends on reagent)	
Measurement cell	2-Component or 1-Component	
Reproducibility	less than 0.3%CV (n=10)/water-standard 1mg$H_2$0 Per KEM standard measurement conditions and standard liquids	
Display resolution	0.1μg	
Control method	Constant current pulse time control	
Endpoint detection	Alternate current polarization method with a twin platinum electrode	
EP sense method	Selective drift stability or limit measurement time	
Titration cell	Anolyte 100mL (max 150mL) Catholyte 5mL	
Number of methods	120	
Additional features	1) Automatic adjustment of drift level 2) Auto start by sensing sample discharged in titration cell 3) Stores up to 10 blank values 4) Stirrer with an electric reagent supply-and-drain system or standard stirrer	
Key operation	Touch panel	
Displays	1) 8.4-inch color LCD 800 × 600 dots	
	2) English / Japanese / Mandarin Chinese / Korean / Russian / Spanish / German / French	
	3) Simultaneous 4-channel display (Can also display Automatic potentiometric titrator simultaneously)	4) 1-channel display
Calculation	Concentration of content, statistics data processing (mean, SD and RSD) and automatic averaging of blank value	
Data storage	500 samples	
GLP conformance	Registration of operator / User group administration Check performance with standard substance : Reminder of scheduled check date/ Record of check results Reagent life control : Reminder of expiration/ Reminder of reagent replacement date Management of conduction time : Display of operating time	

8. Others

Specification	Contents	
External I/O	RS-232C(MCU)×2 : for Dot matrix printer /Electronic balance / Data Capture Software (SOFT-CAP) RS-232C(MKC)×2 : for Dot matrix printer / Evaporator / Multiple sample changer USB(MCU)×1 : for USB flash drive, Thermal printer,A4 printer, Keyboard, Barcode reader, Foot switch, USB HUB	
	USB(MCU)×1 : for Measuring unit, Bluetooth adapter, USB HUB(4ch) USB(MKC)×1 : for MCU , Bluetooth adapter LAN×1 : for Personal computer (PC)	USB(MCU)×1 : for Measuring unit, USB(MKC)×1 : for MCU
Extensibility	Measuring instrument : Automatic Potentiometric Titrator (AT-710), Karl Fischer Moisture Titrator (MKV-710/MKC-710); Three of these instruments can be added.	
	Evaporator : ADP-611 Multiple sample changer : CHK-501	
Ambient condition	Temperature : 5 to 35°C Humidity : 85%RH or below (no condensation)	
Power source	DC24V 1.9A(Main unit) AC100-240V±10% 50Hz/60Hz(AC Adapter) DC7V 1.6A(Printer) AC100V±10% 50Hz/60Hz(AC Adapter)	
Power consumption	Main unit : Approx. 30W Printer : Approx. 7W	
Dimensions	Touch panel controller : 225(W) × 190(D) × 42(H)mm Titration unit : 141(W) × 296(D) × 367(H)mm Stirrer : 107(W)×206(D)×340(H)mm (not incl. Solvent Change Unit) Solvent Change Unit : 240(W) × 140(D) × 405(H) mm(not incl. tubing) Printer : 106(W) × 180(D) × 88(H) mm	
Weight	Touch-on panel controller : Approx. 1.5kg Titration unit : Approx. 3.0kg Stirrer : Approx. 2kg Solvent Change Unit : Approx. 0.6kg Printer : Approx. 0.4kg	
Conformity standard	CE marking EMC: EN61326-1 LVD: EN61010-1 RE Directive	

8-4. Principle of measurement

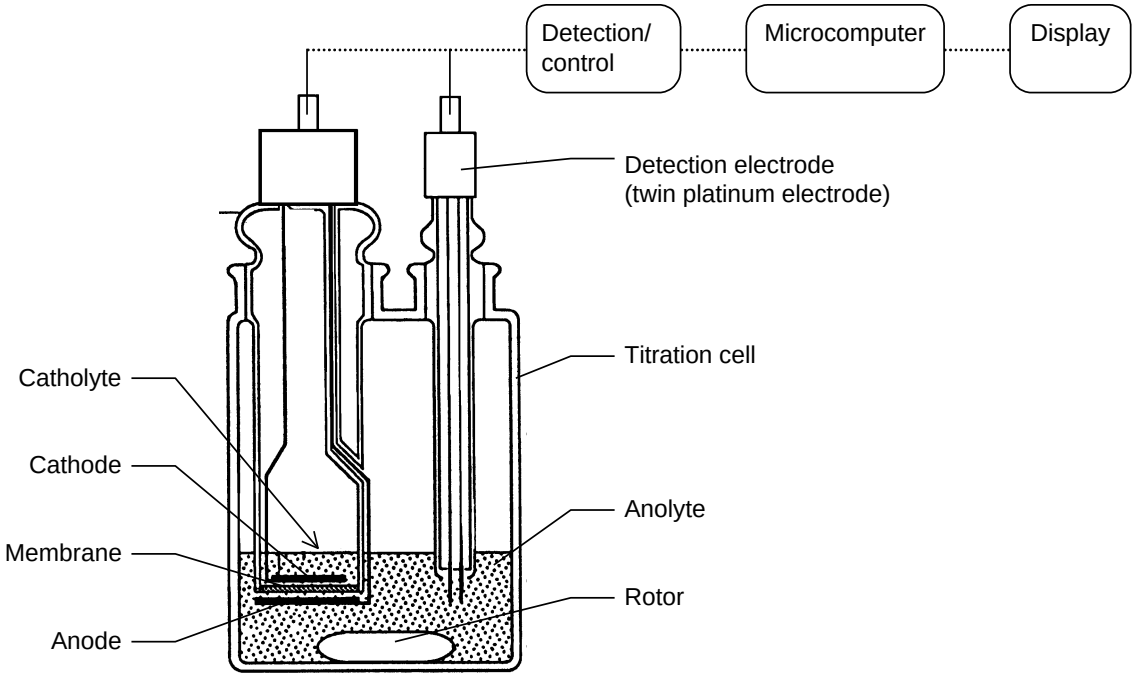
In the Karl Fisher moisture content measurement, water reacts with iodine and sulfur dioxide in the presence of base and alcohol.

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

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

$$2I^- \rightarrow I2 + 2e^- \quad \text{.....(2)}$$

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 10.72 coulombs/ 1 mg H_2O. The total amount of moisture can thus be determined by measuring the total consumption of electricity.



8-5. 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	

< Fluka（Riedel-de Haën）>

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 is non-organic chlorines.
	Catholyte	Aquamicron CXU	

8-6. 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

9. Warranty and After-sales Service

1. Warranty Period

Three (3) years 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 three (3) years from the date of receipt of this product or the date of installation by KEM service personnel or by authorized personnel. (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.