Options

Part Number	Name	Remarks
12-03265	SOFT-CAP Data Acquisition Software	Displays data on a PC display, enabling loading of the measurement results into a spreadsheet such as Excel® or saving of the data in CSV format.
12-04184	Finger Shaped Sampler	Suitable for load in solid samples and powder samples.
12-04576	Bent-type Sampler for Powder	Connected to the titration cells, enables half-rotation of the sampler to drop samples.
12-04575	Spoon Type Sampler for Viscous Sample	Suitable for load in viscous samples. Enables to inject samples with the spoon.
12-04452	Sampler for Light Weight Powder	Suitable for small- quantity of powder samples. Connected to the titration cells, the sampler enables to half-rotate the sampler to drop samples.
12-04574	Straight-type Sampler for Light Weight Powder	Suitable for small- quantity of powder samples. Vibrates to drop samples.
12-02400	Sampler for High Viscous Sample	Suitable for high-viscosity solid samples. Injected into the titration cell, the sampler presses out the samples.
12-05067	Micro Sampling Unit (phi14 1/10 Taper)	Suitable for the trace powder samples of especially high hygroscopicity. The sample is loaded with its special container in the titration cell.

Finger Shaped Sampler

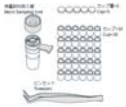
Bent-type Sampler for Powder

Spoon Type Sampler for Viscous Sample

Sampler for Light Weight Powder

Straight-type Sampler for Light Weight Powder

Sampler for High Viscous Sample



Micro Sampling Unit (phi14 1/10 Taper)

KYOTO ELECTRONICS MANUFACTURING CO.,LTD.
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Distributed by

1809-13-KT

Hybrid Karl Fischer Moisture Titrator

MKH-710

KYOTO ELECTRONICS
MANUFACTURING CO.,LTD.

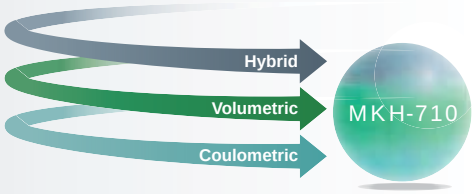
FEATURES

Measuring moisture contents of solid and liquid samples by using the Karl Fischer reaction.

Hybrid Karl Fischer Moisture Titrator has world's first original features with convenient functionality, and high-speed, high-accuracy measurement using our "Hybrid Titration Method". With our "Electrolytic Factor Measurement System", factor measurement is possible without using pure water.
This is a breakthrough product that innovates the Karl Fischer moisture titration instruments.
This product complies with official methods of analysis specified by the ASTM, JIS (Japanese Industrial Standards), and as published in the European Pharmacopoeia and the United States Pharmacopeia.

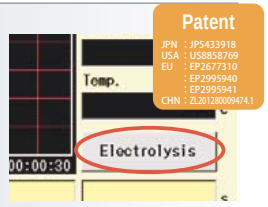
Single instrument and a single titration cell allow utilization of Volumetric/Coulometric/Hybrid Titration Methods.

Just one instrument with one titration cell is needed to perform volumetric, coulometric, and hybrid measurements.
With high operability for the volumetric method, the requisite sealability for the coulometric method has also been realized.
Integrated functionality greatly contributes to a compact installation and low maintenance requirements.



No need to inject pure water Fully automatic factor measurement

Our unique "Electrolytic Factor Measurement System" carries out factor measurement automatically.
Just the press of a button enables factor measurement, which alleviates the need for the tedious weighing or measuring of pure water.



Patent
JPN : JP5433918
USA : US8858769
EU : EP2677310
: EP2995940
: EP2995941
CHN : ZL201280009474.1

*Some reagents are not applicable.

Automatic sample injection

Hybrid titration method automatically switches the measurement methods of volumetric and coulometric according to the water content of the sample.
You can accurately and seamlessly measure samples without concern for the sample moisture content, as the instrument is capable of measuring trace or much larger quantities.

Patent
JPN : JP5433918
USA : US8858769
EU : EP2677310
: EP2995940
: EP2995941
CHN : ZL201280009474.1

*Some reagents are not applicable.

Reduced running-costs

◆Hybrid Titration Method
Compared to the coulometric titration method, running cost is almost halved.
◆Electrolytic Factor Measurement
Compared to conventional factor measurement, running cost is reduced by up to 60%.

*Under our specified conditions

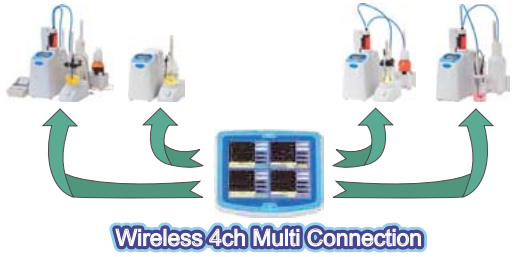
No cabled connections required between main control unit and titrator

For safe operation

With Bluetooth® adapters, there is no need to connect main control unit to titrator with cable. This offers substantial benefits in terms of safety as the main control unit can be located outside the hood when toxic samples have to be measured. The main control unit can be equipped with a battery and therefore be held in the hand. Additionally, it can be equipped with a monitor arm and therefore be located in the most suitable spot. (Arm mount: VESA standard 75mm x 75mm)

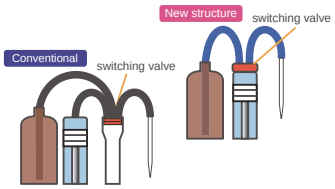
One screen for up to four titrators

One main control unit can operate up to four titrators of any type (Potentiometric and Karl Fischer moisture titrators). It is thus possible to set up a system capable of running potentiometric and Karl Fischer moisture titrations simultaneously without wasting valuable bench space for several separate displays.



New burette unit

The new burette unit has the switching valve mounted directly on top of the cylinder. Less dead space between the switching valve and the cylinder and it inside of the cylinder left less residual titrant when replacing it.



FEATURES

Titration cell stopper can be easily removed

The titration cell stopper can be removed from the titration cell for easy cleaning.
Even when the electrode is stuck at the stopper, you can still easily remove it by hand.

Diaphragm can be replaced

The new mechanism of electrolysis electrode (inner burette) allows diaphragm replacement. When the diaphragm is contaminated by the oil samples, it can be easily replaced for cleaner measurement.

Large capacity titration cell

The titration cell has approximately twice the capacity (40mL ～ 150mL) of our conventional volumetric titration cell. The frequency of injection/drain of dehydrated solvent can be reduced.

Large sample inlet

The titration cell is equipped with the large sample inlet of ϕ34 on its top side. You can now easily and correctly load samples of powder or other substances when performing volumetric titration.

Easy injection/drain of dehydrated solvent

The stirrer unit is equipped with a pump for injecting/draining dehydrated solvent. Once you set the operating time of the pump with the internal timer, the optimum quantity of the solvent is automatically injected.

Supporting proper reagent replacement

Reagent replacement or filling and cleaning of the burette can be performed according to the navigation function of Karl Fischer reagent replacement system. You can fill and drain out the solution without errors thanks to the guidance of key operation and work.

Karl Fischer reagent information stored in burette unit

Relevant titrant information is stored in an IC chip in the burette unit. Mounting the burette unit from one titrator to another does not require re-entry of the Karl Fischer reagent information. This prevents titration with incorrect titrant.

User groups and permissions

Two different user levels let you easily define the operation permissions of each operator.

An administrator (protected with password) has access to all functions whereas a normal operator can only perform burette operation, calibration, measurement, method number (sample file) change and reading of method.

No need to adjust settings for different types of solvent and samples

Volumetric Titration Method

Patent No.1896338

Our proprietary technology (endpoint detection by compensating liquid resistance, Japanese Patent No.1896338) makes it unnecessary to change the detection electrode sensitivity or endpoint voltage depending on the nature of each solvent and sample. This feature reliably prevents over titration and ensures highly accurate measurements.

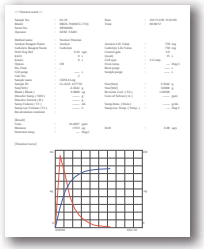
Automatic factor measurement (Timer function added)

Volumetric Titration Method

Optionally available burette unit and water-methanol standard solution enable automatic operation flow, from the pre-titration to the factor measurement just by pressing a button.
The automatic factor measurement can be preset to start; you can start measuring samples whenever you like.

Result output as PDF files

Paper saving and environmentally friendly – results no longer need to be printed.
Measurement results are converted to PDF and can be stored in a USB flash drive.



Large color TFT-LCD with touch panel

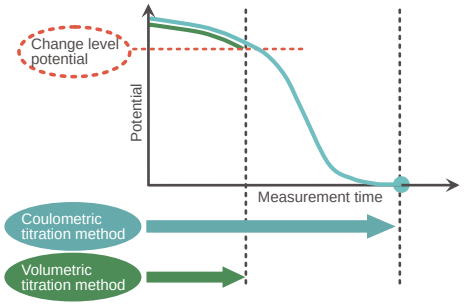
The main control unit is equipped with a large color TFT-LCD. The touch panel enables easy key entry.

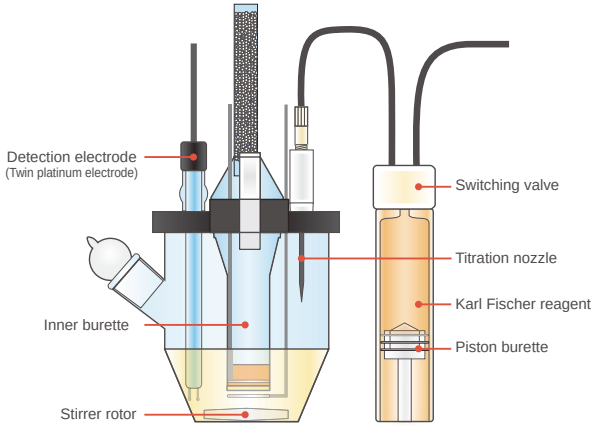
MEASUREMENT PRINCIPLE

Hybrid Titration Method

There are two Karl Fischer titration methods: volumetric titration method and coulometric titration method. Both have advantages and disadvantages. The volumetric titration method is suitable for measurement of high-moisture samples (1% or more), but not for low-moisture samples (ppm order). Meanwhile, the coulometric titration method is suitable for measurement of low-moisture samples (ppm order), but not for high-moisture samples (1% or more). This is because measurement time is rather long and if the sample quantity is reduced in order to shorten the measurement time, errors from weighing would affect the measurement results.

The hybrid titration method highlights the advantages and covers address the disadvantages of both methods.
The hybrid titration method runs both volumetric and coulometric titration methods in parallel. Once water content goes below a certain level, measurement will be performed using the coulometric titration method.
The method automatically switches from the parallel running of volumetric and coulometric titration methods to the coulometric titration method only.
The system runs the coulometric titration method when a sample includes only water content lower than the certain level.

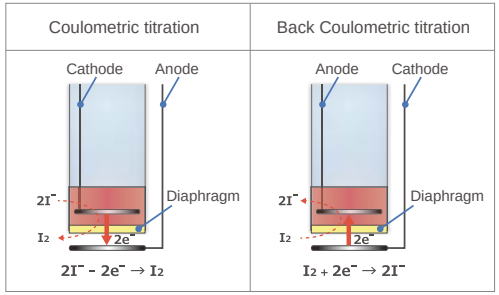




Electrolysis Factor Measurement

In Karl Fischer volumetric titration method, pure water or water standard is used for factor measurement of Karl Fisher reagents. In electrolysis factor measurement, factor measurement of Karl Fischer reagents is carried out by the electrolysis without using pure water or water standard.

The coulometric titration method measures water content by the electrolysis (coulometric titration) to generate iodine from iodide ions within the anolyte. In electrolysis factor measurement, factor measurement of Karl Fischer reagents is carried out based on the electric quantity used in the electrolysis (back coulometric titration) to generate iodide ions from iodine within the anolyte.

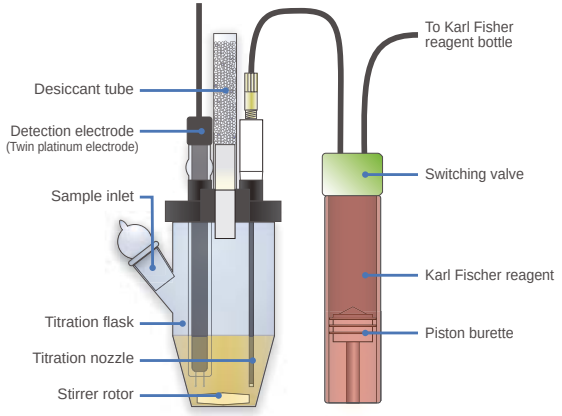


Volumetric Titration Method

In the Karl Fischer reaction, water reacts with iodine and sulfur dioxide quantitatively in the presence of base and alcohol.

$H_2O + I_2 + SO_2 + CH_3OH + 3RN \rightarrow [RNH]SO_4CH_3 + 2[RNH]I$

After dehydrated solvent is put in the titration cell and the dehydrated state is achieved by titration using Karl Fischer reagent, the sample is added into the titration cell. Water content is determined by using Karl Fischer reagent of which the factor (mgH_2O/mL) is pre-determined with the water-methanol standard etc.
Titration proceeds by controlling the titration speed while detecting the polarization of the electric potential of the detection electrode.



Coulometric Titration Method

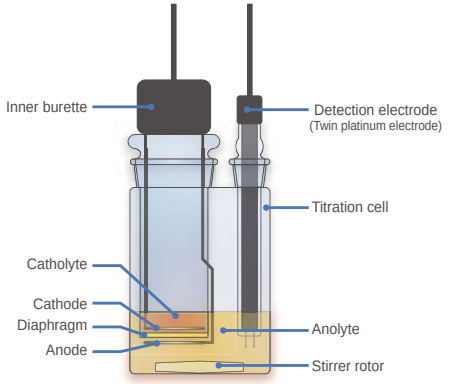
In the Karl Fischer reaction, water reacts with iodine and sulfur dioxide quantitatively in the presence of a base and alcohol.

$H_2O + I_2 + SO_2 + CH_3OH + 3RN \rightarrow [RNH]SO_4CH_3 + 2[RNH]I$ （1）

In the coulometric titration method, iodine is generated by the electrolysis of the anolyte containing iodide ions.

$2I^- \rightarrow I_2 + 2e^-$ （2）

Once the generated iodine is consumed according to equation (1), the detection electrode detects the consumption of iodine and iodine is generated again by electrolysis according to equation (2).
The generated iodine is proportional to the electric quantity according to the Faraday's law. The equation (1) shows that I_2 reacts with H_2O in the proportion of one to one.
The electric quantity required for the electrolysis based on the principle as described above is converted into water content.



SPECIFICATIONS

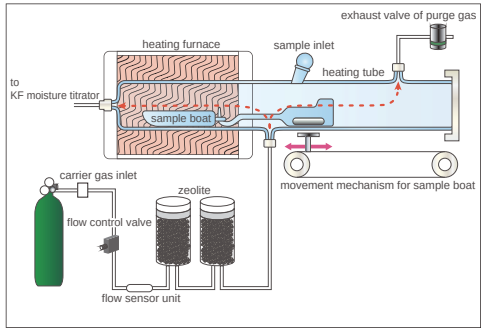
Specification			Contents
	Name		Hybrid Karl Fischer Moisture Titrator
	Model		MKH-710M
Coulometric Titration	Measurement method		Karl Fischer Coulometric Titration
	Measurement range	Water content	1μg to 300mgH_2O
		Bromine index	8μg to 300mgBr
	Precision	RSD	Less than 0.3% (n=10) (For measurements of 1mgH_2O)
		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 form		Normal titration/Back titration
	Titration cell		Two component cell
	Required reagent	Anolyte	100mL
		Catholyte	5mL
Volumetric Titration	Measurement method		Karl Fischer Volumetric Titration
	Measurement range	Water content	100μg to 500mgH_2O (Depend on Karl Fischer reagent factor)
		Concentration	1ppm to 100%H_2O
	Burette precision	Volume	10mL
		Resolution	1/20,000
		Discharge precision	±0.015mL
		Repeatability	±0.005mL
	Endpoint detection		By polarized potential level detected with a twin platinum electrode
	EP sense method		Detection of potential level maintained during End preset time End time range: 1 to 99 seconds
	Titration form		Normal titration Back titration (Add the optional additional burette unit)
	Required solvent		40 to 150mL
Hybrid Titration	Measurement method		Karl Fischer Volumetric Titration Karl Fischer Coulometric Titration
	Measurement range	Water content	1μg to 500mgH_2O
	Precision	RSD	Less than 0.3% (n=10) (for measurements of 10mgH_2O) (Karl Fischer reagents factor 3mg/mL)
		Display resolution	0.1μg
	Control method		Automatic continuous titration 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 format		Normal titration
	Required reagent	Anolyte	100mL
		Catholyte	5mL

Specification			Contents
Factor Measurement of Reagent by Electrolysis	Measurement method		Factor measurement of reagent by electrolysis
	Measuring range	Karl Fischer reagent	Reagent factor 1 to 5 (With the provisions of dose volume)
	Precision	RSD	Less than 1.0% (n=3) (Dose volume 0.5mL, Reagent factor 3mg/mL)
	Control method		Constant potential control
	Endpoint detection		Alternate current polarization method with a twin platinum electrode
	EP sense method		Drift stability
	Required reagent	Anolyte	100mL
		Catholyte	5mL
	Number of Method	Coulometric/Volumetric/Hybrid/Electrolysis	Up to 120
	Data storage	On-board memory	500 datas
		External memory	USB flash drive
	GLP conformance		Registration of operator/User group administration Titrant : Reminder of factor measurement date/Alarm to indicate remaining reagent / Reminder of piston replacement date/Reminder of reagent replacement date/ History of factor measurement/Reminder of scheduled check date Check performance : Reminder of scheduled check date/Record of check results Management of conduction time : Display of operating time
	External I/O (Measurement unit)	RS-232C	2ch COM1 : Dot matrix printer COM2 : Multiple sample changer/Evaporator
		USB	1ch (MCU-710) (USB cable for wired connection, Bluetooth adapter for wireless connection)
		SS-BUS	1ch (for APB)
	External I/O (Main Control Unit)	RS-232C	2ch (for Dot matrix printer (Only for COM1), Electric balance, PC)
		USB	1ch (USB flash drive, Thermal printer, A4 printer, Keyboard, Barcode reader, Foot switch, Bluetooth adapter, USB HUB, Measuring unit (MKH-710/2nd, AT-710, MKV-710, MKC-710)
		LAN	1ch (PC)
	Extensibility	Measuring unit	Automatic Potentiometric Titrator(AT-710), Karl Fischer Moisture Titrator (MKH-710, MKV-710, MKC-710); Three of these instruments can be added.
		Automatic piston burette	Up to 2 control burettes (including 2 built-in units)
	Display function	Main control unit	8.4inch color liquid crystal display 800 x 600 resolution
		Display (Measurement unit)	White LED-backlight LCD
		Supported languages	Four languages: English, Japanese, Chinese, Korean
	Ambient conditions	Temperature	5 to 35℃
		Humidity	Up to 85%RH or below (no condensation)
	Power supply		AC100 to 240V ± 10% 50Hz/60Hz
	Power consumption	Main unit	Approx. 50W
		Printer	Approx. 7W
	Dimensions/ Weight (Excluding tube)	MKH-710	141 (W) × 292 (D) ×377 (H)mm / Approx. 4kg
		MCU-710	225 (W) ×190 (D) ×42 (H)mm / Approx. 2kg
		Stirrer/Cell	107 (W) ×206 (D) × 322 (H)mm / Approx. 2kg
		Solvent change unit	240 (W) ×140 (D) ×400 (H)mm / Approx. 0.6kg
		Printer	106 (W) ×180 (D) × 88 (H)mm / Approx. 0.4kg
	Conformity standards		CE marking (EMC: EN 61326-1 LVD: EN 61010-1 RE Directive RoHS (II) Directive compliant) Burette unit EBU FCC Part 15 Subpart C FCC ID: 2ABSVEBU 01

Options

Evaporator ADP-611

Together with Karl Fischer moisture titrator, this evaporator allows to measure the moisture content in powders or solid samples that cause side reactions and therefore cannot be titrated directly.
The samples are heated and the vaporized moisture is carried into the titration cell by a carrier gas.
The sample boat moves in a closed tube driven by a magnet. This makes it possible to perform reliable measurements of trace moisture eliminating the risk of contamination from atmospheric moisture.
A patented scan mode automatically determines the optimal evaporation temperature based on the relation between released water and heating temperature.
The heating tube is easy to be cleaned thanks to its simple structure.



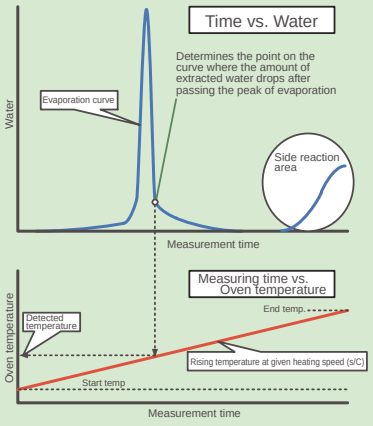
Model	Evaporator ADP-611	
Heating method	Electrically conductive clear heater glass	
Heating temperature range	50 to 300℃	
Temperature control	Setting range: 50 to 300℃(Minimum setting: 1℃) Temperature sensor: K-thermocouple (Precision: ±2℃/Setting temperature: At higher than 100℃)	
Temperature/ Flow display	LED digital 3 digits	
Heated tube	Pyrex glass tube: φ30 (O,D)mm x 335 (L)mm	
Sample boat	Pyrex glass: 68 (L) x 25 (W) x 15 (H)mm Capacity 16mL	
Carrier gas	Nitrogen gas: Not included as a standard accessory Air: Air Pump Unit (option)	
Gas dryer	Zeolite container (100g) x 2pcs	
Gas flow	100 to 300mL/min	
External control input/ output	Communication with Karl Fischer Moisture Titrator : RS232C Mini DIN 8pin	
Dimensions	370 (W) x 195 (D) x 217 (H)mm	
Power source	AC100 to 120V, 50/60Hz	AC220 to 240V, 50/60Hz (Pre-adjusted before shipment from the factory)
Power consumption	Approx. 300W	
Weight	Approx. 5kg	Approx. 7kg
Option	Stand	

※ When nitrogen gas is in use, regulator (Adjustable to 50kPa) is required.

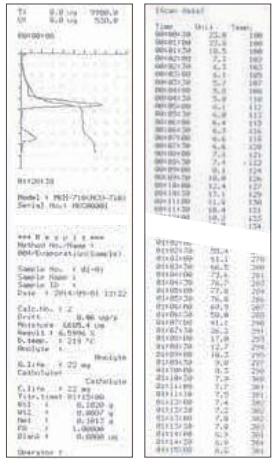
Scan mode

Japanese Patent no. 4247093

The scan mode automatically determines the optimum evaporator temperature. It is used when the vaporizing temperature of a sample is unknown or if the sample tends to thermal decomposition.
In the scan mode, the temperature in the heating furnace is increased at a constant rate and the evaporated moisture curve is analyzed. The optimum evaporator temperature is determined based on the decay observed in the evaporated moisture curve.



Printing example



Model	Name	Remarks
CHK-501	Multiple Sample Changer	Multi-sample evaporator for the coulometric titration method. Since heating temperature can be set for each sample, different kinds of samples can be set at the same time (24 samples). Connection tube (for Multiple Sample Changer) (12-05065) is required. (NON-CE)
ADP-513	Evaporator for Oil Sample	This unit heats and evaporates lubricant oil, grease, tar products, paints, and other viscous liquids. Evaporated moisture is measured using a Karl Fischer moisture titrator. (NON-CE)
ADP-512	Evaporator for Ores	This unit heats and evaporates combined water content and adherent water in iron ore, manganese ore, clay and other inorganic compounds. Evaporated moisture is measured using a Karl Fischer moisture titrator. Compliant with "JIS M 8211 iron ores - Method for determination of combined water content" (NON-CE)
ADP-512S	Evaporator for High Temperature	This unit heats and evaporates ore, metal powder, ceramics, and other solid or powder samples. Evaporates moisture is measured using a Karl Fischer moisture titrator. (Maximum heating temperature: 1000℃.) (NON-CE)
ADP-344	Heat Extractor for Sugar Sample	This unit heats the titration cell and extracts water content from chocolate, caramel, and other sugar samples using the volumetric titration method. The titration cell unit (12-02811) and the cell holder (for volumetric method) (12-05066) are required. (NON-CE)

Model	Name	Remarks
MKV-710B	Karl Fischer Moisture Titrator	Volumetric titration method Karl Fischer moisture measurement unit for expansion. Connected to main control unit MCU-710M*. Up to 4 moisture measurements can be performed at the same time.
MKC-710B	Karl Fischer Moisture Titrator	Coulometric titration method Karl Fischer moisture measurement unit for expansion which is suitable for measurement of trace water content. Connected to main control unit MCU-710M*. Up to 4 moisture measurements can be performed at the same time.
AT-710B	Automatic Potentiometric Titrator	A unit to add automatic potentiometric titrator. Various titrations such as acid-base titration, redox titration, and photometric titration can be performed by selecting electrodes and preamplifier. Connected to main control unit MCU-710M*. Up to 4 moisture measurements can be performed at the same time.
MKH-710/2nd	Hybrid Karl Fischer Moisture Titrator	Hybrid Karl Fischer moisture measurement unit for expansion. Connected to main control unit MCU-710M*. Up to 4 moisture measurements can be performed at the same time.
12-05640-13	Additional Burette MKH (10mL)	By adding to the main unit, it becomes possible to work with two burettes. Two burettes can be used without increasing space taken. Back-titration and automatic factor measurement with water-methanol becomes possible.

*Cannot connect MCU-710S

MKH-710M (Additional Burette)　MKC-710B　MKV-710B　AT-710B