Karl Fischer Moisture Titrator

〈MKS-510N/MKA-510N/MKS-500〉

KYOTO ELECTRONICS

Karl Fischer Moisture Titrator

MKS-510N and MKA-510N

The Karl Fischer Moisture Titrator MKS-510N and MKA-510N are the result of KEM's many years of experience, which combines the latest technology and advanced engineering with KEM's vast experience in instrumentation, producing finest volumetric Karl Fischer titrator available today.

Karl Fischer titration is the most reliable method for determination of water content. It titrates for quantitative analysis for moisture in solids, liquids and liquid gases. Many of the international standards, such as ISO, ASTM, DIN, BS, JIS, etc., have adopted the Karl Fischer method for moisture determination.

The measurement results are calculated into concentration and necessary data is printed out by the external printer.

For measurement of solid or samples which cannot directly be put into the solvent, the moisture vaporizer ADP-511S works for it. The ADP-511S is easy to operate and maintains steady conditions while vaporizing moisture contained in a sample. The settings of sample boat maneuver, vaporizing temperature and carrier gas running duration, and other conditions for each method are controllable by storing them in memory of the MKS-510N and MKA-510N.

Features

Rigid and light resin main casing

Main casing is made of corrosion resistant resin as well as rigid and light in weight.

Large LCD screen

Large LCD screen shows easy-to-operate dialog messages as well as easy-to-read measurement results including water content and concentration.

Easy dispensing by pump/stirrer

Built-in dispensing unit is now standard, which pumps solvent in and out of the titration vessel.

Separated titration vessel

Titration vessel is now separated from main unit so that KF reagent is isolated.

KF reagent in burette unit

Factor change of KF reagent is now made easy by simplified burette unit.

Easy operation

The titration condition, calculation formula, printout format, etc. are stored in memory for each individual method so that every method selection assures optimal titration parameters. The printout items can be selected according to user's need.

Automatic control of moisture evaporator

On-line control of the ADP-511S Evaporator allows solid samples to be analyzed using the same parameters and conditions. The vaporizing temperature, carrier gas running duration, etc. can be stored in memory of MKS-510N and MKA-510N for automatic control.

Dual-mode titration

MKA-510N consists of dual 10mL direct drive burette as standard. Each burette can work for normal and back titration. Titration using two different factors of Karl Fischer reagents is possible as well.
The direct drive burette system will refill by itself if an analysis requires more than 10mL of titrant to find an endpoint.

Self-diagnostics

The built-in self diagnostic message helps to locate an error or trouble in operation and find solution.

Interface for external control

The interface for external control to connect Balance, Printer and Personal computer is now standard.

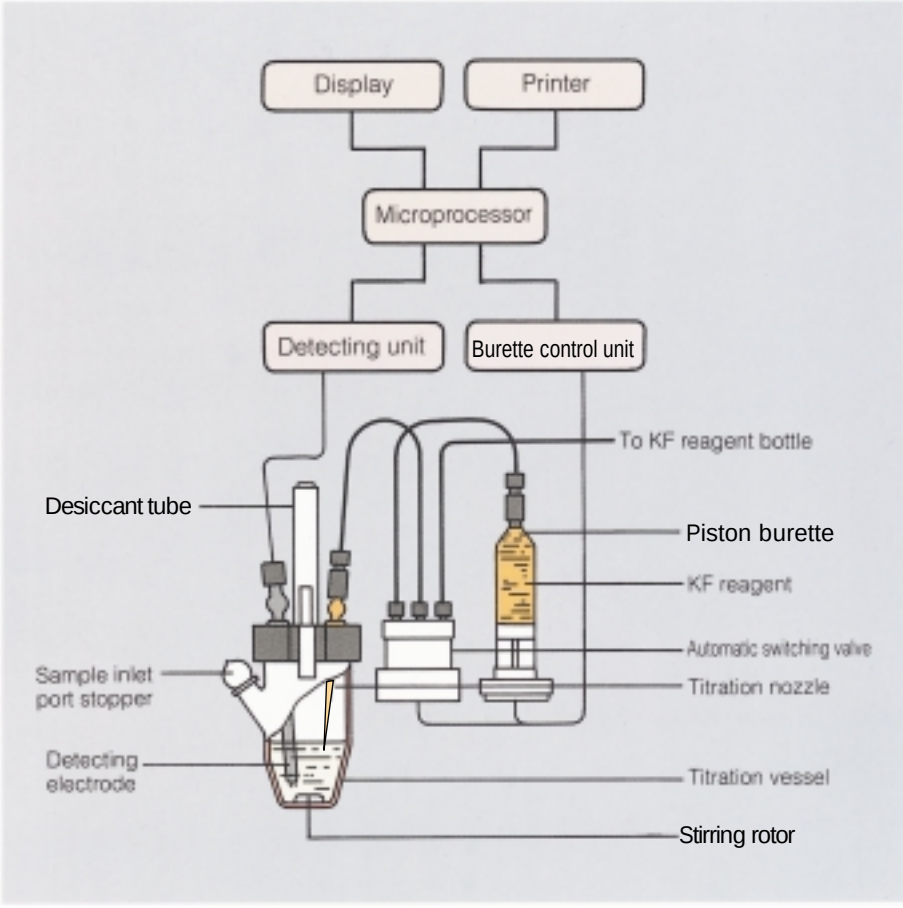
Principle of Analysis

In Karl Fischer reaction, moisture in sample reacts with Karl Fischer reagent quantitatively. MKS-510N,MKA-510N and MKS-500 make the analysis based on the following formula:

$$I_2 + SO_2 + 3\ Base + ROH + H_2O \rightarrow 2\ Base \cdot HI + Base \cdot HSO_4R$$

Base: amine, pyridine, etc.
ROH (solvent): 2-methoxyethanol, methanol, etc.

Add extracting solvent to the titration. Titrate moisture from the solvent with Karl Fischer reagent until solvent equilibrium is reached. Add a known amount of sample. Titrate with Karl Fischer reagent having a known factor (mg H_2O/mL) until the endpoint is reached. The Karl Fischer reagent factor is determined using water in standard or methanol standard. The moisture concentration of the unknown sample is then calculated.



Applications

The Karl Fischer Moisture Titrators – MKA-510N, MKS-510N and MKS-500 are used for moisture analysis with a variety of natural products, raw materials and industrial products.

Organic compounds and raw materials:

Organic acid / Alcohol / Ester / Acetal / Ether / Hydrocarbon / Acid anhydride / Acyl chloride / Acid chloride / Nitrogen compound / Halogen compound / Sulphur compound / Peroxide / Carbonyl compound / Hydrate organic salt / Organic acid, etc.

Inorganic compounds and raw materials:

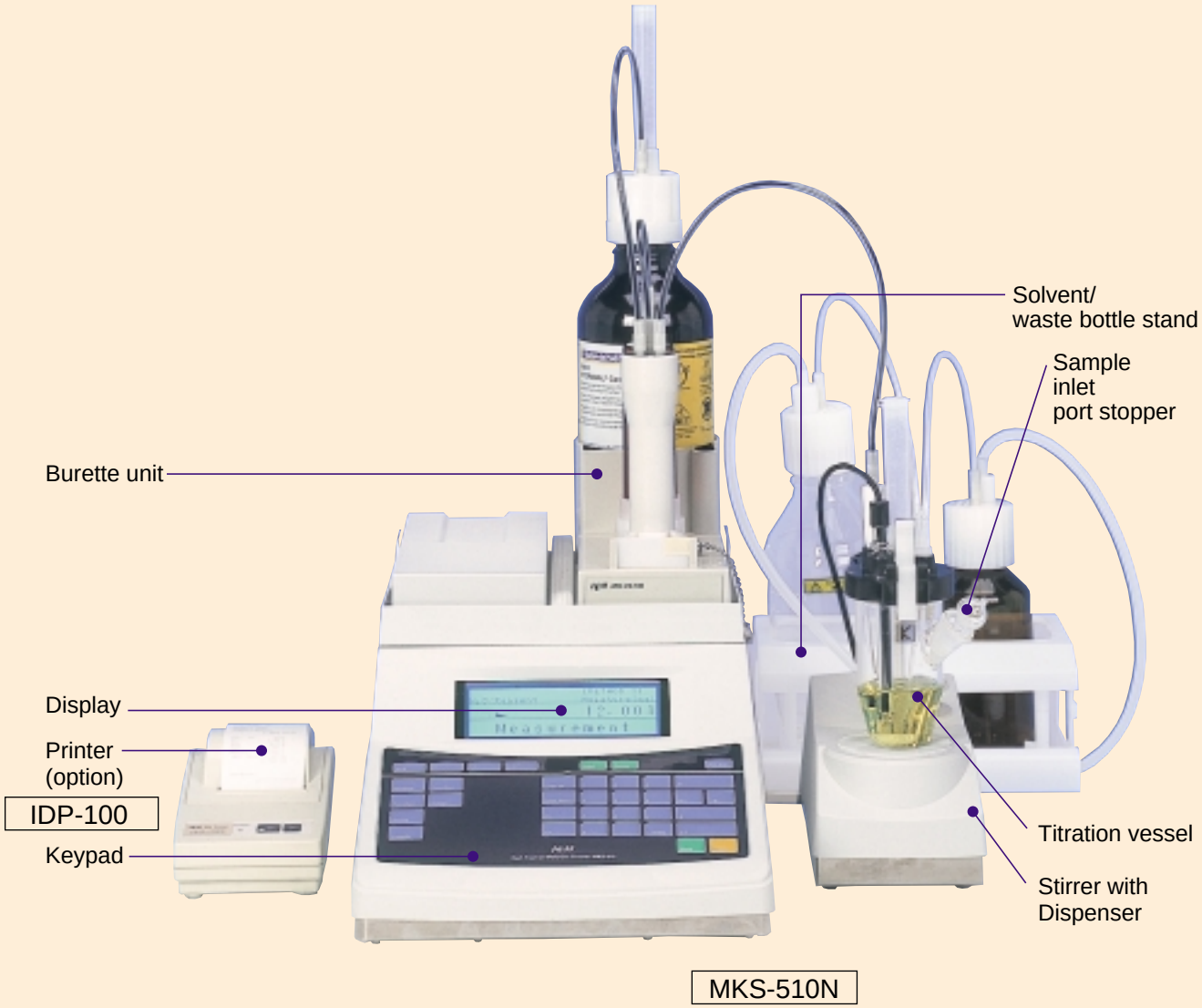
Hydrate inorganic salt / Inorganic salt / Acid anhydride / Base anhydride / Inorganic acid / Inorganic peroxide, etc.

Natural products and industrial products:

Medicines / Body tissues / Alkaloid / Capsules / Fertilizer / Agricultural chemicals / Wood / Pulp fibers / Wools / Textiles / Leathers / Cellophane tapes / Synthetic detergents / Soaps / Cosmetics milk / Butter / Cheese / Oils / Fats / Fatty acid / Dehydrated foods / Starches / Grains / Sugars / Caramels / Chocolates / Teas / Coffees / Citric powder / Spices / Gelatin / Seasonings / Alginic acid / Fish meals / Coals / Coal tars / Heavy oils / Petrol / Kerosene / Transformer oils / Lubricants / Greases / Silicon oils / Fluxes / Benzine / Gases / Liquified petroleum gases / Freon gases / Vinyl-chloride monomer / Plastics powder / Plastics chip / Ion-exchange resin / Rubbers / Adhesive pigments / Paints / Inks / Dyes / Carbon blacks / Toners / Liquid crystal materials / Photo materials / Ferrites / Metal powders / Desiccants / Ores / Clays / Cement, etc.

The ASTM standards below have adopted the Karl Fischer method for moisture determination:

ASTM D 1533-96	Standard Test Method for Water in Insulating Liquids (Karl Fischer Reaction Method)
ASTM D 1744-92	Standard Test Method for Water in Liquid Petroleum Products by Karl Fischer Reagent
ASTM D 3277-95	Standard Test Method for Moisture Content of Oil-Impregnated Cellulosic Insulation
ASTM D 4377-93a	Standard Test Method for Water in Crude Oils by Potentiometric Karl Fischer Titration
ASTM E 203-96	Standard Test Method for Water Using Karl Fischer Reagent



MKS-510N

Titration parameter setup

```
TITR.PARA

Method        1
Titr.Mode     1
End Time     30 sec
F.Vol      0.01 ml
T.Speed     Med
Detect.Mode  1
D.Time        0 sec
L.Time        0 sec
I.Time        0 sec
Blank        on
Start      manu
Max.Vol      40 ml
Oven        off
```

Measurement

```
Model :MKA-510N
S/N   :LGB06C13
Sample:
  ----------------
Reagent:
  ----------------
Name:KENTARO
  ----------------

*** R e s u l t ***

Sample No.      01-01

Date 96/12/14 13:18
Wt1          5.6874 g
Wt2          4.7082 g
Net          0.9792 g
Result       0.6418 %
 Bur. No.1   3.145 mL
             6.2843 mg
```

Automatic statistics

```
<RESULT>
 No. mgH2O Conc[ mg]
 01 10.090   10.090
 02 10.086   10.086
 03 10.091   10.091
 04 10.078   10.078
 05 10.082   10.082
 06 10.083   10.083
 07 10.092   10.092
 08 10.102   10.102
 09 10.080   10.080
 10 10.081   10.081

Statistics

Unit         10
Means   10.086 mg
SD       0.0073 mg
CV       0.0724 %
```

Specification

Type name	MKS-510N	MKA-510N
Model name	Karl Fischer Moisture Titrator	
Measurement method	Volumetric titration method	
Measuring range	1) 0.1mg to 500mg H_2O 2) 10ppm to 100% H_2O	
Detection range	1) Water content: 0.005 to 500.00mg H_2O 2) Titration volume: 0.005 to 99.995mL	
Control method	Titration control, EP detection and concentration calculation by microcomputer	
Endpoint detection	Two-pin platinum electrode detects liquid resistance compensated polarized potential	
Endpoint wait time	1) 1 to 99 sec. programmable 2) Potential stat which maintains EP status can be set up.	
Titration form	Normal titration	1) Normal titration 2) Back titration
Special functions	1) Titration speed controlled by six steps 2) Automatic start by injecting sample 3) Automatic drift off by dehydrating titration vessel 4) Start time delayed 0 to 9999 sec. 5) Cut off time 0 to 9999 sec. selected 6) Limit time 0 to 9999 sec. to finish titration	
Display	1) 240×64 dots, 30 digits×7lines LCD with backlight 2) Displays: (1) Measured water content (2) Processed data (3) Dialog messages: Pre-titration: "Pre-titr" Standby for measurement: "Ready" Stabilized drift: "stable"	
Individual method filing	Parameters for normal titration, evaporation by ADP-511S, manual factor measurement by standard, etc. can be stored in five different methods.	
Indication of endpoint	Electronic beep	
Printer	Optional (Recommended printer: IDP-100)	
Calculation	1) Concentration, statistics (mean value, RSD, SD) 2) Recalculation 3) Factor calculation	
Error messages	Erroneous key entry or settings on max. volume, abnormal polar potential or liquid resistance, etc.	

Piston burette	1) Burette cylinder with piston····· 1	····· 2
	2) Automatic switching valve for suction/dose····· 1	····· 2
	3) Backlash mechanism 4) Dispense speed: 0.5mL/sec. 5) Suction speed (2): 20sec/10mL or 80sec/10mL 6) Burette capacity: 10mL, repeat suction/dose to reach preset volume	
Solvent	1) Minimum 30mL (for S-type vessel) 2) Maximum 100mL (for S-type vessel)	
Additional function	1) Controls evaporation when ADP-511S is connected 2) Programmable stored settings including heating temperature, aging and measurement sequence	
Pump/stirrer	Built-in dispensing mechanism which pumps in/out solvent in titration vessel	
External control	RS-232C 1) for Printer 2) for Electronic balance 3) for External computer	
Ambient condition	Temperature : 5 to 35℃ Humidity : less than 85%RH	
Power	AC100 to 120V/200 to 240V, 50/60Hz, 35W	
Dimension	1) Main unit 274(W)×458(D)×575(H)mm 2) Stirrer 118(W)×225(D)×320(H)mm 3) Solvent dispenser 240(W)×170(D)×280(H)mm	
Weight	Approx. 12.5kg	Approx. 13.5kg
Standard components and parts	(1) MKS-510N Main unit·····1 (2) Operation manual····· 1 (3) RS232C Instructions 1 (4) Power cord····· 1 (5) Stirrer rotor····· 1 (6) Stirrer unit····· 1 (7) Stirrer cable····· 1 (8) Tube connector KF 1 (9) Anti-diffusion nozzle 1	(1) MKA-510N Main unit·····1 (2) Operation manual····· 1 (3) RS232C Instructions 1 (4) Power cord····· 1 (5) Stirrer rotor····· 1 (6) Stirrer unit····· 1 (7) Stirrer cable····· 1 (8) Tube connector KF 2 (9) Anti-diffusion nozzle 2
Standard accessories	(1) Grease ····· 1 (2) Wrench (8mm)····· 1 (3) Piston rod to pull out head····· 1 (4) Ground wire ····· ·····1	

Optional Accessories

Evaporator

ADP-511S

The model ADP-511S Evaporator is used in conjunction with the Karl Fischer Titrator to measure the moisture concentration of plastic pellets or solid samples which are insoluble in Karl Fischer reagents or which contain interfering substance. ADP-511S heats the sample in a closed heating chamber. The vaporized moisture is carried into the titration vessel by nitrogen gas.

Features

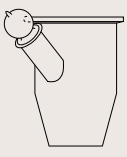
- The magnetic bar moves by remote control the sample from the sample chamber into the oven which eliminates contamination from atmospheric moisture.
- A transparent heatproof glass tube permits the sample condition monitored during vaporizing process.
- The built-in microprocessor which closely checks the vaporizing condition allows rapid rise and accurate control of heating temperature.
- The vaporizing temperature is displayed in three digits for accurate temperature set-up.
- The optional external air pump for carrier gas is available for user's convenience.

Specification

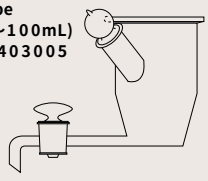
Type and model name	ADP-511S Moisture Evaporator
Heater	Electrically conductive clear heater glass
Temperature range	Room temp. to 300℃
Temperature control	1) Control method: Proportional 2) Setting range: 0 to 300℃ 3) Minimum temperature setting: 1℃ 4) Temperature precision: ±2℃ 5) Temperature sensor: Chromel-Alumel thermocouple
Display	1) LED digital 2) Temperature display: □□□℃ 3) Flow display: □□□mL/min
Heater tube	Pyrex glass tube (OD)30×270(L)mm
Sample boat	1) Pyrex glass 2) 68(L)×25(W)×15(H)mm capacity 16mL
Carrier gas	1) Nitrogen is not included in supplied parts. Nitrogen gas, governor and tubing have to be prepared by user. 2) Air pump is not included in supplied parts.
Gas dryer	1) Silica gel: 100g·····1 2) Zeolite: 100g·····1
Gas flow	100 to 300mL/min
Connection to KF Titrator	1) When connected by Cable #030-3388, MKA-510N/MKS-510N can control ADP-511S 2) For other make of KF titrator, evaporation can be controlled by key entry on ADP-511S
Ambient condition	Temperature : 5 to 35℃, Humidity : less than 85%RH
Power	AC100 to 240V, 50/60Hz
Power consumption	150W
Dimension	297(W)×206(D)×230(H)mm
Weight	Approx. 7kg
Standard components and parts	(1)ADP-511S Evaporator····· 1 (2) Heating unit····· 1 (3) Desiccant tube····· 1 (4) Heater tube·····1 (5) Tube (240mm)····· 2 (6) Hose joint φ6····· 1 (7) Operating manual····· 1
Standard accessories	(1) Silica gel 500g····· 1 (2) Zeolite 500g····· 1 (3) Bubbler tube····· 1 (4) Boat pushing rod·····1 (5) Power fuse 3.15A····· 4 (6) Cautions sticker····· 1 (7) Sample boat····· 3

■ Titration vessels

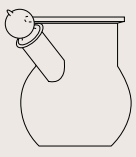
S-type
(30～100mL)
987403001



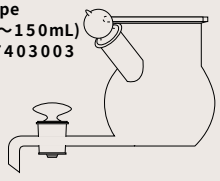
D-type
(30～100mL)
987403005



N-type
(50～150mL)
987403002



C-type
(50～150mL)
987403003



Karl Fischer Moisture Titrator

MKS-500

The MKS-500 is the simple and low cost Karl Fischer Moisture Titrator. Other than ordinary liquid sample, this new titrator can also perform moisture measurement of solid sample that can be dissolved in solvent as well as powder samples. When connected to the optional evaporator , water content of samples like plastic pellet or solid chemicals can also be measured.

Features

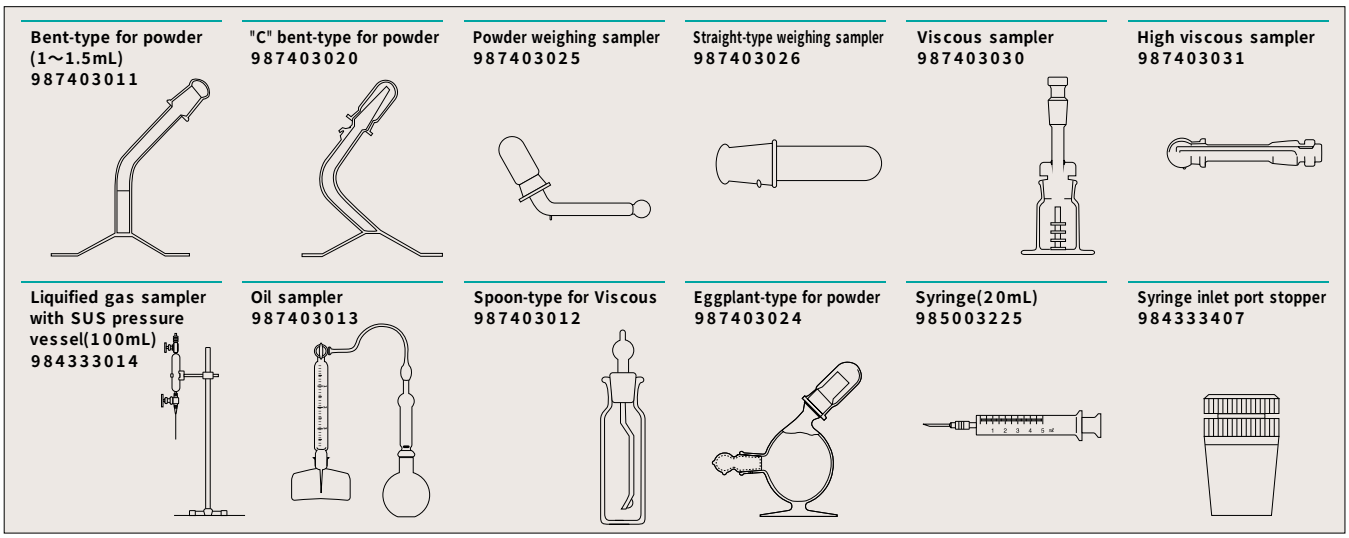
- Moisture measurement by simple and easy key operation.
- By the endpoint detection method of liquid resistance compensation, highly precise measurement of various samples is possible.
- Fully GLP/GMP conformed report can be printed out by the optional printer.
- Safety and EMC features conforming to CE marking declaration.

Specification

Measuring range	1) 0.1mg to 500mg H_2O , 10ppm to100% H_2O 2) 0.005mL to 100mL	Printer	Optional (recommended printer: IDP-100)
Titration form	Normal titration	Calculation	1) Concentration, statistics (mean value, RSD, SD) 2) Recalculation 3) Factor calculation
Display	1) 16 digits×2 lines LCD with backlight 2) Displays: (1) Measured water content (2) Processed data (3) Dialog messages	External control	RS-232C 1) for Printer 2) for Electronic balance 3) for External computer
Method	4 (Direct, Indirect, Factor, Calib.)	Power	AC100 to 120V/200 to 240V, 50/60Hz, 35W
Solvent	1) Minimum 30mL (for S-type vessel) 2) Maximum 100mL (for S-type vessel)	Dimension	Approx. 280(W)×450(D)×480(H)mm
		Weight	Approx. 12.5kg

Optional Accessories

■ Samplers



KEM's Karl Fischer Titration range consists of volumetric method (MKS-510N/MKA-510N/MKS-500) and coulometric method (MKC-510N/MKC-500).

Coulometric Karl Fischer Titrators :

MKC-510N

Features of the MKC-510N

- **Titration cell can be increased to 2 units.**
- **Bromine number and index can be measured.**
- **Fully conformed to GLP and GMP.**
- **When the evaporator is connected, vaporizing curve can be displayed.**

Range	10μg - 100mg H_2O, 89μg - 890mgBr_2
Sensitivity	0.1μg H_2O
Display	30 digits X 7 lines LCD with backlight
External I/O	* Printer via RS-232C * Balance via RS-232C * Computer via RS-232C
Output	H_2O, concentration, dialog messages
Ambient condition	Temperature : 5 - 35℃ Humidity : less than 85%RH

MKC-500

Features of the MKC-500

- **A low cost titrator, yet offers the same accuracy as the MKC-510N ; 10μgH_2O measuring range, and 0.1μgH_2O detection sensitivity.**
- **Electronic balance, printer and RS-232C external ports as standard.**

Range	10 μg - 100mg H_2O
Sensitivity	0.1 μg H_2O
Display	16 digits X 1 line LCD
External I/O	* Printer via RS-232C * Balance via RS-232C * Computer via RS-232C
Output	H_2O, concentration, dialog messages
Ambient condition	Temperature : 5 - 35℃ Humidity : less than 85%RH

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