



Karl Fischer Moisture Titrator

<MKC-510/MKC-500>



KYOTO ELECTRONICS



Karl Fischer Moisture Titrator

MKC-510 and MKC-500

The Karl Fischer Moisture Titrator MKC-510 and MKC-500 are the result of KEM's many years of experience. The MKC-510 and MKC-500 which combines the latest technology and advanced engineering with KEM's vast experience in instrumentation, are the finest coulometric Karl Fischer titrator available today.

MKC-510 and MKC-500 are widely used for Karl Fischer titration throughout the world. Karl Fischer titration is the most reliable method for the determination of moisture content. It titrates for quantitative analysis for moisture in solids, liquids and gases.

The MKC-510 and MKC-500 as a microprocessor controlled coulometric titrator are one of the best instruments to accurately measure very low levels of moisture in samples in a short span of time.

For measurement of solid sample or samples which cannot directly be put into the electrolyte, the moisture evaporator ADP-511 works for it. The ADP-511 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 MKC-510.

Features

Rigid and light resin main casing

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

Large LC display screen

Large LC display screen shows easy-to-operate dialog message as well as easy-to-read measurement results including water content and concentration.

Easy operation

The titration condition, calculation formula, printout format, etc. are saved in memory for each individual method so that every method selection assures optimal titration.

Evaporator mounted on Titrator as one unit

The ADP-511 Evaporator sits perfectly on top of MKC-510, and on-line control of ADP-511 by MKC-510 allows solid samples analysed using the same parameters and conditions. Vaporizing temperature, carrier gas running time, etc. of ADP-511 can be stored in memory of MKC-510 for automatic control.

Graphic printout of moisture vaporizing and absorption characteristics (MKC-510 only)

The moisture vaporizing and absorption characteristics are graphically printed out together with a data list to determine optimum vaporizing time.

Display of moisture concentration

The result in unit (ppm or %) is indicated on the display at the end of analysis.

Data correction

Titration data in memory can be recalled on display in order to make correction or deletion for the convenience of statistical calculation.

Selectable print format

The printout items can be selected according to user's need.

Self-diagnostics

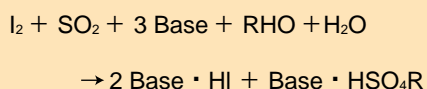
A built-in self diagnostic message helps to locate error or trouble in operation and find solution.

Interface for external control

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

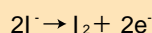
Principle of Analysis

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

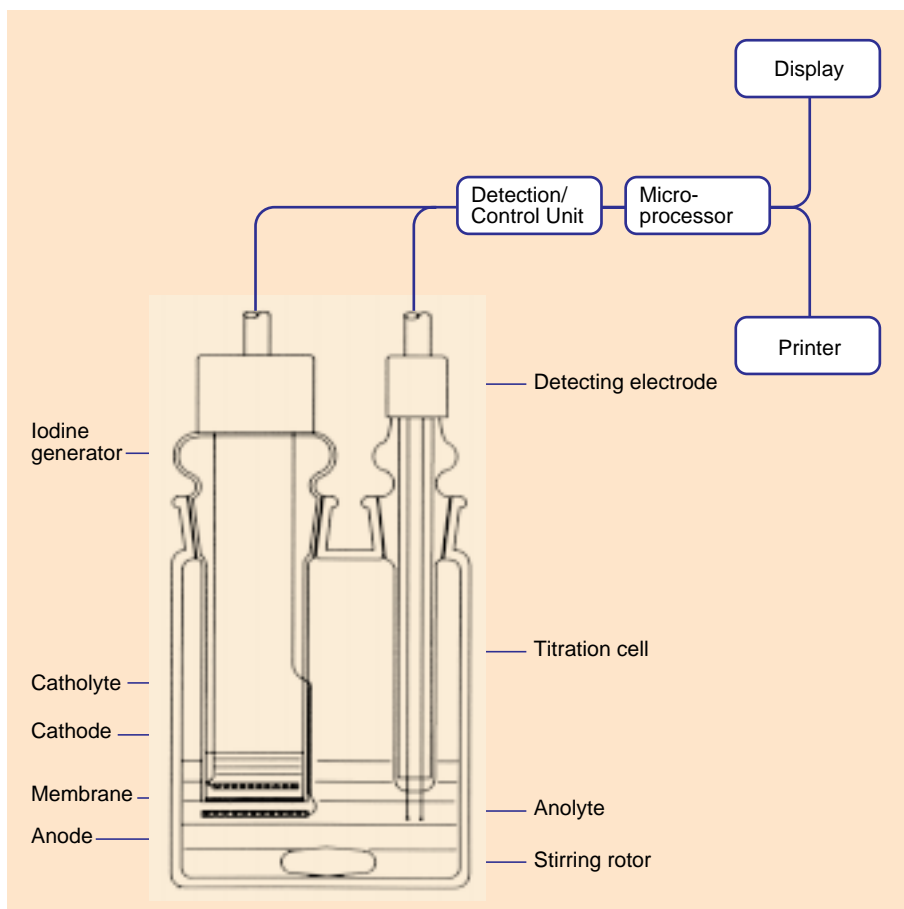


Base : amine, pyridine, etc
RHO(solvent): 2-methoxyethanol, methanol, etc.

As soon as the detector of Titrator senses decline of iodine level, it starts electrolysis to generate iodine in the anolyte to restore its equilibrium.



The amount of water in the sample is then calculated based on the current consumed for this electrolysis.



Applications

The Karl Fischer Moisture Titrator Model MKC-510 and MKC-500 titrate for moisture analysis in a variety of natural products, raw materials and industrial products.

Organic compounds and raw materials:

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

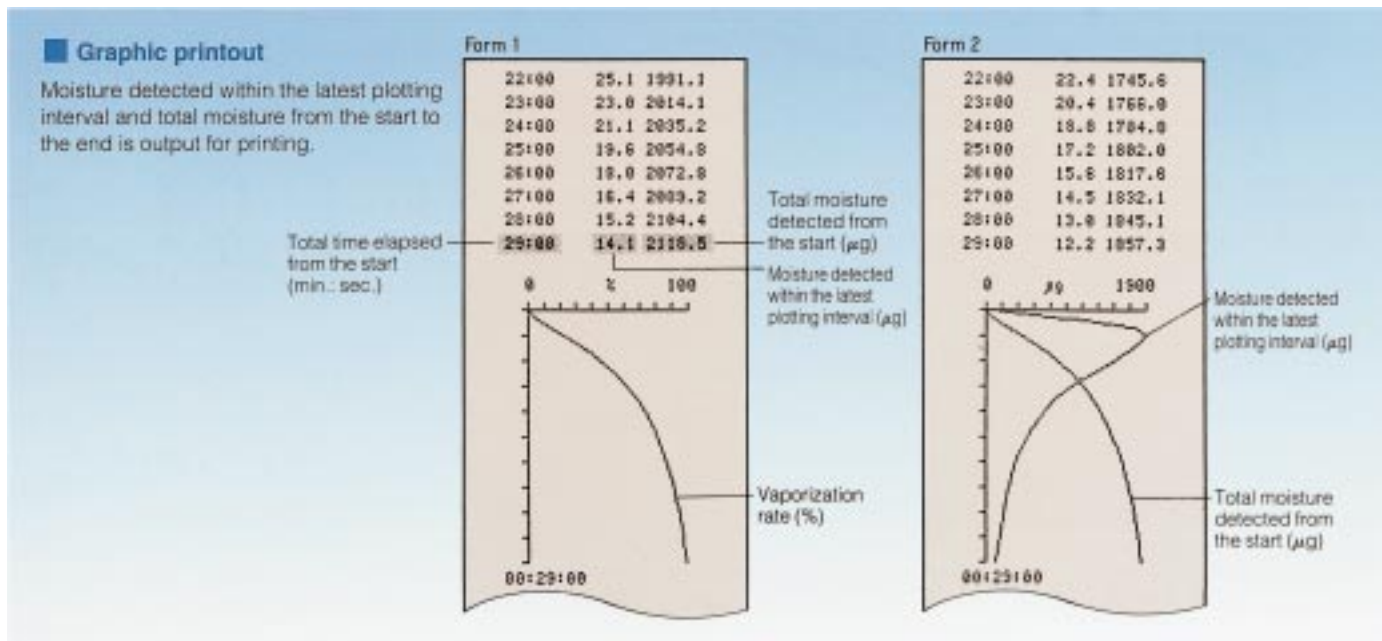
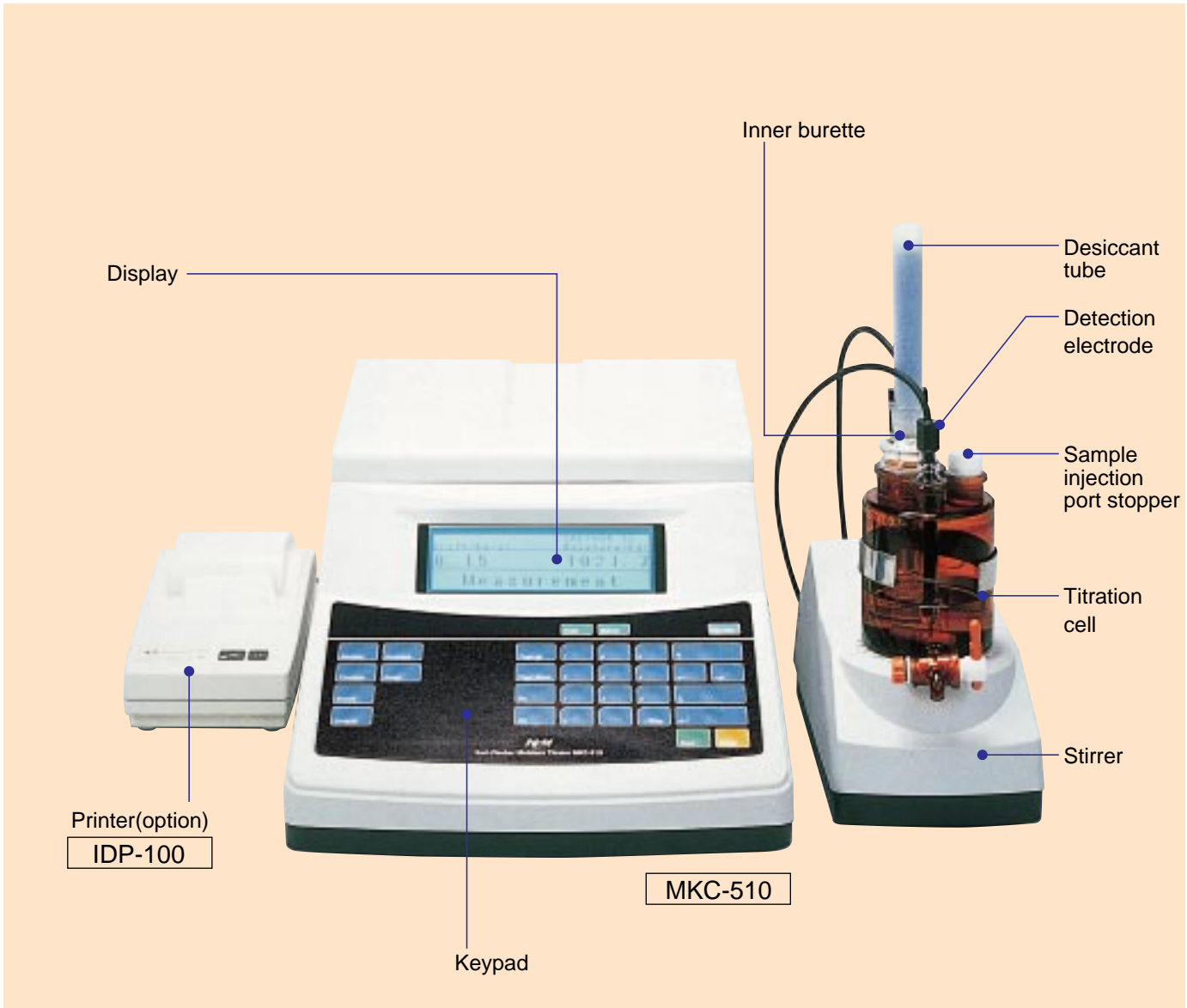
Inorganic compounds and raw materials:

Hydrate inorganic salt/Inorganic salt/Acid
anhydride/Base anhydride/Inorganic acid/
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/Dehy-
drated foods/Grains/Starches/Sugars/
Caramels/Chocolates/Teas/Coffees/Citric
powders/Spices/Seasonings/Alginic acid/
Gelatin/Fish meals/Coal/Coal tars/Heavy oils/
Petrol/Kerosene/Transformer oils/Lubricants/
Greases/Silicon oils/Flux/Benzine/Gas/
Liquified petroleum gases/Freon gases/

Vinylchloride monomer/Plastic powders/
Plastics chips/Ion-exchange resin/
Rubbers/Adhesive Pigments/Paints/Inks/
Dyes/Carbon blacks/Toners/Liquid crystal
materials/Photo mate-rials/Ferrites/Metal
powders/Explosives/Desiccants/Ores/Clays/
Cements/Sulphur, etc.



Karl Fischer Moisture Titrator

Names and Functions



- Print** Key to print out data
- Stirrer** Key to turn ON/OFF Stirrer and select stirrer speed
- Pre-Titr.** Key to pretitration
- Method** Key to select method (MKC-510 only)
- Titration** Key to set up Titration parameter
- Result** Key to set up parameter for Calculation, Report and Data list
- Sample** Key to enter Sample number, Lot number and Sample weight, etc.
- Function** Key to set up Function parameter
 0. Input reagent factor and confirmation
 1. Recalculation
 2. Auto statistics
 3. Deletion of data
 4. Auxiliary function for Sample
 5. Ageing Evaporator
 6. Factor
 7. Check measurement precision
 8. Set up Check day and review Check record
 9. Initialize stored data
- Setup** Key for Parameter setup
 0. Set up interface
 1. Set up date
 2. Register Operator's name
 3. Confirm serial number and version number
 4. Adjust brightness of LC display
 5. Set up display and selection of beep
- Page up** Key to return the ▲ marked display to the previous page (MKC-510 only)
- Page down** Key to move the ▼ marked display to the next page (MKC-510 only)
- Bs.** Key to erase the preceding character or numeral
- Clr.** Key to erase all the entered characters or numerals
- 0** ~ **9** Numeric Key
- .** Period key
Key to enter a period "." or characters in reverse order (Z, Y, X...A).
- ~/Disp.** Display Key
Key to change page on display or enter alphabetic characters (ABC...Z...) one after another. Also to enter a bar " — ".
- ↑** Key to move the cursor (MKC-510 only)
- ←** , **→** Key to move the cursor
- ↓** Key to move the cursor (MKC-510 only)
- ↵** Enter Key
Key to confirm key entry
- Start** Key to start titration
- Reset** Key to stop titration

Method which measures moisture by weighing liquid or solid sample

$$\frac{(Data - Drift) \times 10 - Blank}{W1 - W2} \times 1000 \text{ (ppm)}$$

(Input data)

W1: Sampling quantity incl. tare (g)
W2: Remaining quantity incl. tare (g)

Unit of result: ppm or %

```

*** Result ***
Sample No. 01-01
Date 96-12-14 11:55
W1 9.1893 g
W2 7.3356 g
Net 1.8537 g
Result 357.1 ug
Result 357.14 ppm
    
```

Method which measures moisture by measuring the volume of liquid sample

$$\frac{(Data - Drift) \times 10 - Blank}{V1 \times \text{Dens}} \times 1000 \text{ (ppm)}$$

(Input data)

V1: introduced quantity (mL)
Dens: density in sample (g/mL)

Unit of result: ppm or %

```

*** Result ***
Sample No. 01-01
Date 96-12-14 10:37
V1 0.2 mL
Dens 0.9685 g/mL
Result 153.1 ug
Result 775.95 ppm
    
```

Measurement of gaseous sample

$$\frac{(Data - Drift) \times 10 - Blank \times 22.4}{V2 \times 18} \times \left(1 + \frac{T}{273}\right) \times 1000 \text{ (ppm)}$$

(Input data)

V2: volume of gaseous sample (L)
T: temperature of gaseous sample (C)

Unit of result: ppm or %

```

*** Result ***
Sample No. 01-01
Date 96-12-14 10:34
V2 100.4 l
Temp. 22.5 °C
Result 145.0 ug
Result 717.24 ppm
    
```

Statistics calculation

Unit: Number of samples
SD: Standard deviation
Means: Mean value
CV: Coefficient of variation

```

<RESULT>
No. 20H2O Conc [ug]
01 1009.0 1009.0
02 1009.6 1009.6
03 1009.1 1009.1
04 1007.0 1007.0
05 1008.2 1008.2
06 1008.3 1008.3
07 1009.2 1009.2
08 1010.2 1010.2
09 1008.0 1008.0
10 1008.1 1008.1

Statistics
Unit 10
Means 1008.7 ug
SD 0.7307 ug
CV 0.0724 %
    
```


Specification

Type and model name	MKC-510	MKC-500	Stirring method	Magnetic Stirrer, Adjustable Speed by Key Entry	
Measurement method	Coulometric Method		Printer	Optional (recommended printer: IDP-100)	
Measuring range	10 μ g to 100mg H ₂ O		Calculation	1) Concentration, statistics (mean value, RSD, SD) 2) Recalculation	
Detection sensitivity	0.1 μ g H ₂ O		Error messages	Erroneous key entry, reagent life due, abnormal electrolyte current, overtitration, etc.	
Control method	Constant current pulse control		Required reagent	1) Anolyte: 100mL 2) Catholyte: 5mL	
Endpoint detection	Two-pin platinum electrode detects polar potential and endpoint is sensed by coulomb consumed for electrolysis		Evaporator ADP-511	When ADP-511 is connected, heater temperature, measurement and aging sequence are set up and stored in memory.	
Measurement precision	RSD below 0.3% when water-methanol of 1mg H ₂ O is measured 10 times.				
Titration cell	Capacity 100mL (max. 150mL)		External control	RS-232C 1) Printer (option) 2) Electronic balance (option) 3) External computer (option)	
Drift value	Constantly displayed and can be switched to auto calib./manual calib. /cancel calibration		Ambient condition	5 to 35 °C, below 85%RH	
Drift compensation	Automatic/Manual/Cancel		Power	AC100/120/220/230/240V, 50/60Hz	
Display	1) 30 characters by 7 lines LCD 2) Displays: (1) Drift value (0.1 to 2 digits μ g/s) (2) Measured water content (3) Processed data (4) Dialog message Pre-titration: "Pre-titr" Standby for measurement: "Ready" Stabilized drift: "Stable"	1) 16 characters by 1 line LCD 2) Displays: (1) Pre-titr – Excessive Moisture (2) Ready – Measurement Possible (3) Stable – Stable Drift	Power consumption	50W	
			Dimension	1) Main unit 274WX400DX200Hmm 2) Stirrer 118WX225DX330Hmm	274WX400DX235Hmm
			Weight	Approx. 10kg	Approx. 7.5kg
Moisture quantity display	0.1 μ g ~ 999999 μ g (display after measurement)		Standard components and parts	(1) MKC-510 Main unit... 1 (1) MKC-500 Main unit... 1 (2) Titration cell unit 1 (2) Titration cell unit..... 1 (3) Operating manual... 1 (3) Operation manual ... 1 (4) RS232C instruction... 1 (4) Power cord 1 (5) Power cord 1 (5) Stirrer rotor (35mm)... 1 (6) Stirrer rotor..... 1 (6) Desiccant tube (A) ... 1 (7) Stirrer..... 1 (8) Stirrer cable..... 1 (9) Dessicant tube (A)... 1 (10) Cell holder..... 1	
Individual method filing	Parameters for direct measurement, evaporation by ADP-511, etc. can be stored in five different methods.			Standard accessories	(1) Grease 1 (2) Anode electrode adjusting tool..... 1 (3) Drain bottle (Polyethylene)..... 1 (4) Funnel..... 1 (5) Power fuse (T3. 15A or T1.6A) 2 (6) Septum for syringe inlet port 10 sheets/set..... 1 (7) Ground wire..... 1
Indication of endpoint	Electronic beep				

Optional Accessories

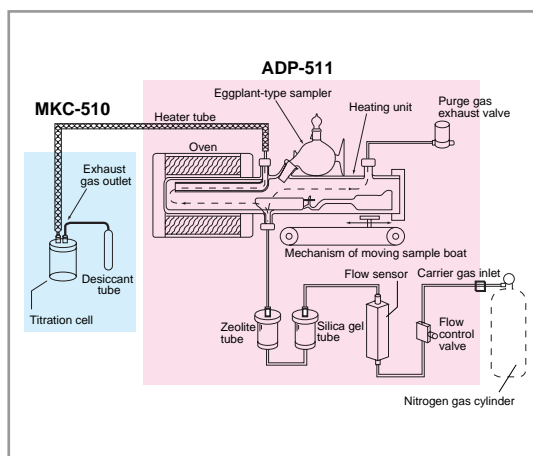
Evaporator

ADP-511

The model ADP-511 Evaporator is used in conjunction with Karl Fischer titrator to measure moisture concentration of plastic pellets or solid samples which are insoluble in Karl Fischer reagents or which contain interfering substance. ADP-511 heats the sample in closed heating chamber. The vaporized moisture in oven is carried into the titration cell 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 to be monitored during the 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-511 Moisture Evaporator
Heater	Electrically conductive clear heater glass
Temperature range	Room temp. to 300°C
Temperature control	1) Control method: proportional 2) Setting range: 0 to 300°C 3) Minimum temperature setting: 1°C 4) Temperature precision: ±2°C 5) Temperature sensor: Chromel-alumel thermocouple
Display	1) LED digital 2) Temperature display: □□□°C 3) Flow display: □□□mL/min
Heater tube	Pyrex glass tube OD30 X 270Lmm
Sample boat	1) Pyrex glass 2) 68L X 25W X 15Hmm capacity 16mL
Carrier gas	1) Nitrogen is not included in supplied parts. Nitrogen gas, governor and tubing is 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	Directly mounted on MKC-510 without cable
Ambient condition	Temperature 5 to 35°C, below 85%RH
Power	AC100/120/200/230/240V, 50/60Hz
Power consumption	150W
Dimension	297W X 206D X 200mmH(330mmH when mounted on MKC-510)
Weight	Approx. 5kg
Standard components and parts	(1)ADP-511 Evaporator.....1 (5) Tube (240mm)..... 2 (2) Heating unit.....1 (6) Hose joint φ6..... 1 (3) Desiccant tube.....1 (7) Operation manual..... 1 (4) Heater tubing.....1
Standard accessories	(1) Silica gel 500g.....1 (5) Sample boat..... 3 (2) Zeolite 500g.....1 (6) Cautions sticker..... 1 (3) Bubbler tube.....1 (4) Boat control rod..... 1



MKC-500



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