KEM

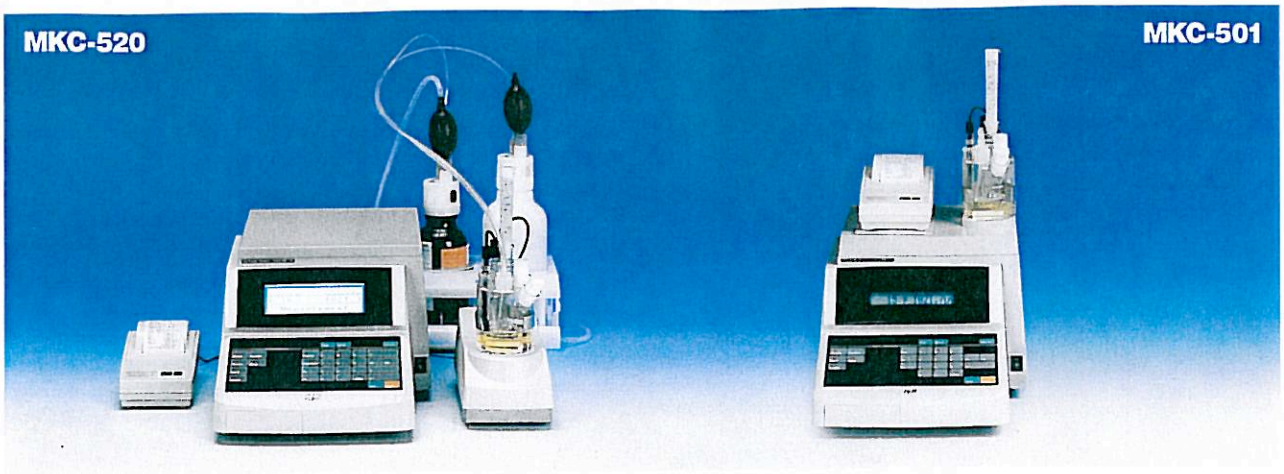
Coulometric Method

Karl Fischer Moisture Titrator

MKC-501

MKC-520

MKC-520 / MKC-501



Option:Printer IDP-100

Karl Fischer Moisture Titrator MKC-520 and MKC-501

The Karl Fischer Moisture Titrator MKC-520 and MKC-501 are the result of KEM's many years of experience. The MKC-520 and MKC-501 which combines the latest technology and advanced engineering with KEM's vast experience in instrumentation, are fine coulometric Karl Fischer titrator available today.
The MKC-520 and MKC-501 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 is used for quantitative analysis by titration for moisture in solids, liquids and gases.
The MKC-520 and MKC-501 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 reagent, the moisture evaporator 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 MKC-520.

Features

Easy to operate

Very simple operation just pressing [start] key.

Variety of standard interface

Interface for Computer, Balance and Printer is standard equipment

Displays measurement results with high repeatability

Guarantees below 0.3% of Relative Standard Deviation (RSD) in the measurement on 1mg H_2O water-methanol standard.

Dispenser for Karl Fischer reagent (MKC-520)

The reagent dispenser as standard equipment eliminates troublesome replacements.

One-component cell can be used. (MKC-520-N and MKC-501-N)

One-component cell allows for easy maintenance in replacing reagents and lower running cost.

Titration cell can be increased to 2 units. (MKC-520)

Once the optional stirrer and titration cell are added, two cells can be used alternatively.

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:

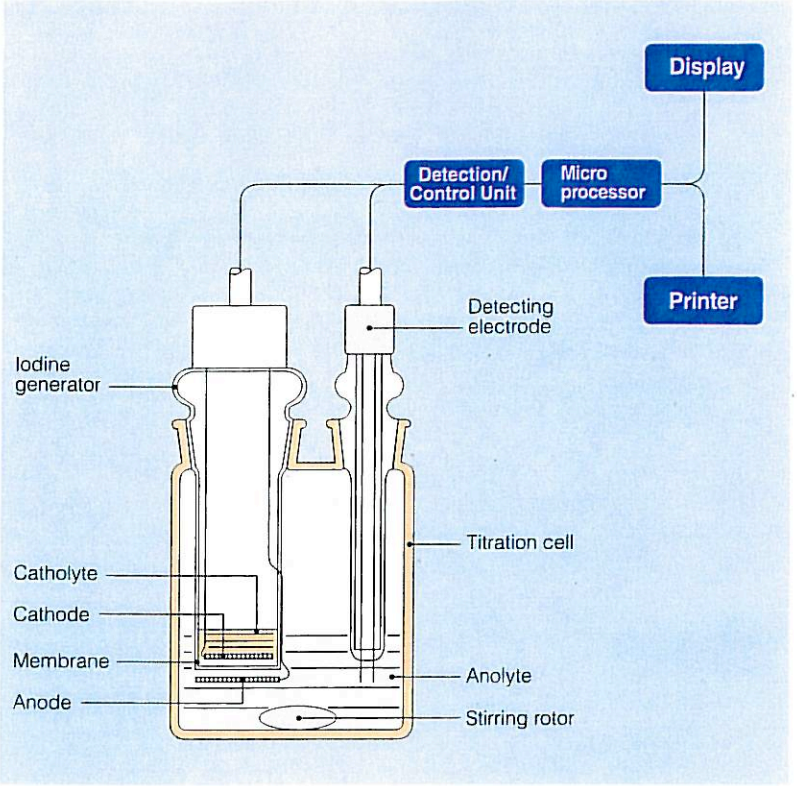
$$I_2+SO_2+3Base+RHO+H_2O \rightarrow 2Base \cdot HI+Base \cdot HSO_4R$$

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.

$$2I^- \rightarrow I_2+2e^-$$

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-520 and MKC-501 can make moisture analysis for 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:

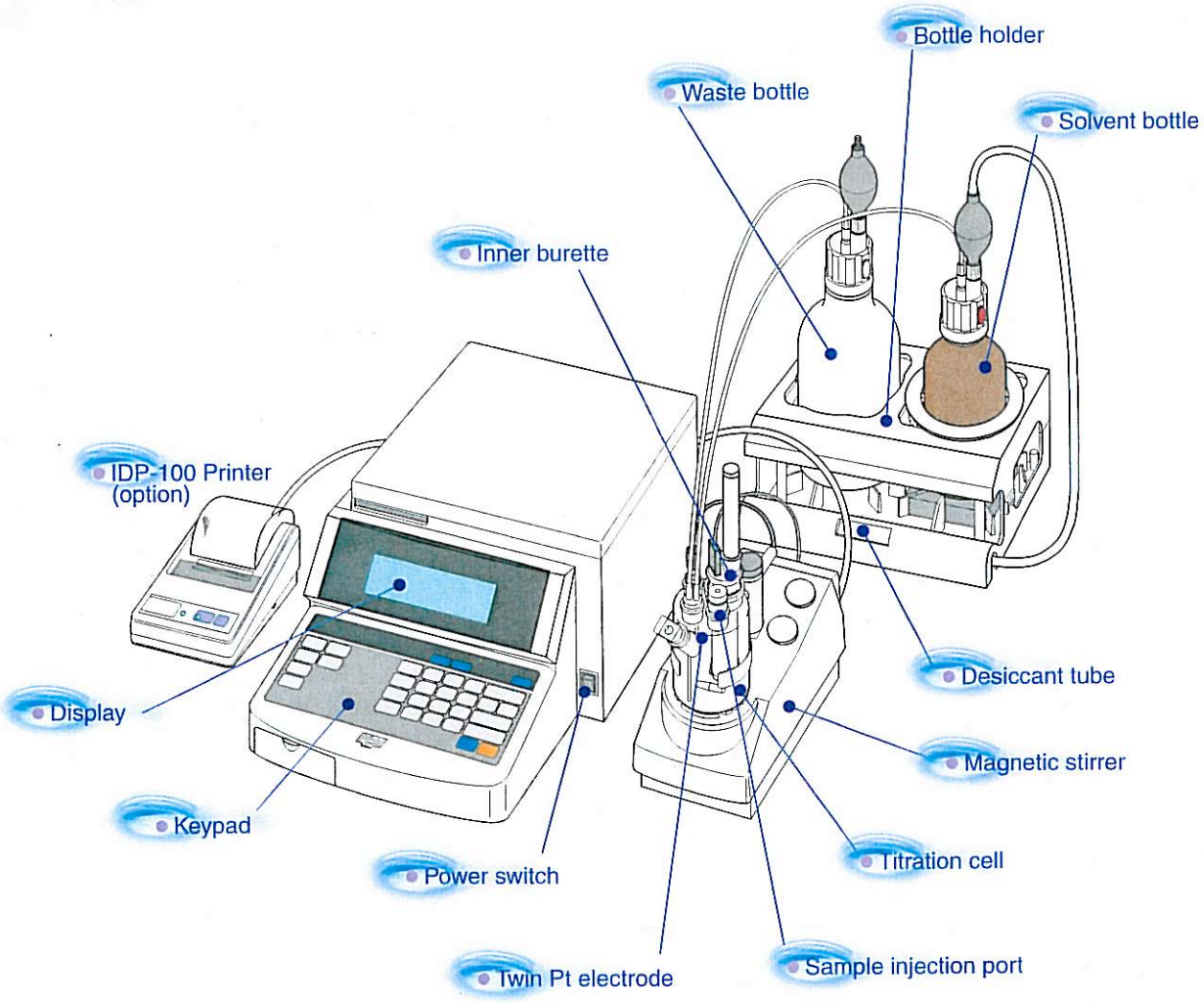
Hydrate inorganic salt / Inorganic salt / Acid anhydride / Base anhydride / Inorganic acid / Peroxide, etc.

Natural products and industrial products:

Medicines / Body tissues / Alkaloid / Capsules / Fertilizer / Agricultural chemicals / Wood / Pulp fibers / Wools / Texitiles / Leathers / Cellophane tapes / Synthetic detergents / Soaps / Cosmetics Milk / Butter / Cheese / Oils / Fats / Fatty acid / Dehydrated 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 / Viny-lchloride monomer / Plastic powder / Plastics chips / Ion-exchange resin / Rubbers / Adhesive pigments / Paints / Inks / Dyes / Carbon blacks / Toners / Liquid crystal materials / Photo materials / Ferrites / Metal powders / Explosives / Desiccants / Ores / Clays / Cements / Sulpher, etc.

MKC-520 / MKC-501

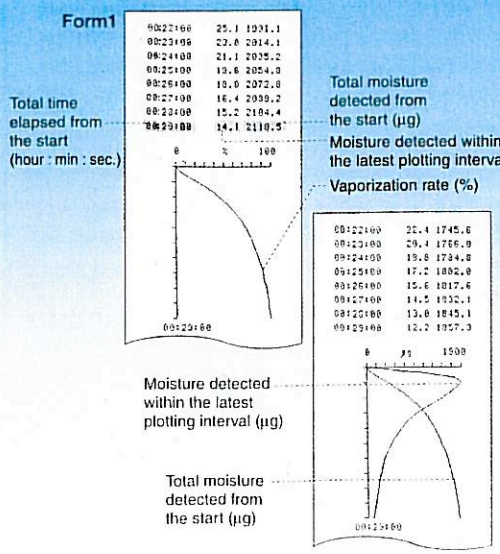
【MKC-520】



Graphic printout (MKC-520)

Moisture detected within the latest plotting interval and total moisture from the start to the end is output for printing.

Form1



Displays (MKC-520)

```
Cell-1   No. 01-01   [METHOD 1]
Drift (µg/s)   Concentration (ppm)
10. 5              1021. 7
Result
```

Display of measurement result

```
[Method 1]   100ug
 Cell-1                ①
 01-01
 D  0. 02ug/s
 C  1234. 4            ②
      ppm
<Result>          00:10:00
```

Display of vaporization curve (after measurement)

vaporization curve:
① Accumulated moisture content/ measuring time
② Accumulated moisture content per unit time /measuring time

```
<<History (Datail)   (Cell-1) >>▼
[Anode]
 No.              : 1
 Date             : 04/29/2005
 Reagent Name     : ABCD
 Lot No.          : ABCD
 Life             : 100> 100ug
```

Records of KF reagent

```
 <Periodic Check (Cell-1) >   ▲▼
No                : 1
Date              : 04/10/2005
Standard Value    :    **** ppm
Tolerance         : ±  **** ppm
Mean (n=***)      : ******* ppm
Result            : OK
```

Records of precision check

MKC-520-D
(Diaphragm cell)

MKC-520-N
(Diaphragmless cell)

MKC-501-D
(Diaphragm cell)

MKC-501-N
(Diaphragmless cell)

Method which measures moisture by weighing liquid or solid sample

$$\frac{(\text{Data} - \text{DriftXt} - \text{Blank})}{\text{Wt1} - \text{Wt2}} \times 1000(\text{ppm})$$

```
Model :MKC-520
S/N   :MAB60A91
Sample:
  ------------------
Reagent:
  ------------------
Name:
     ---------------

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

Sample No.     01-01

Date 05/02/14 15:53
Wt1          9.1893 g
Wt2          7.3356 g
Net          1.8537 g
Result        357.1 ug
             192.64 ppm
```

Method which measures moisture by measuring the volume of liquid sample

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

```
Model :MKC-520
S/N   :MAB60A91
Sample:
  ------------------
Reagent:
  ------------------
Name:
     ---------------

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

Sample No.     01-01

Date 05/02/14 13:37
V1             0.2 mL
Dens        0.9865 g/mL
Result       153.1 ug
             775.98 ppm
```

Measurement of gaseous sample

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

```
Model :MKC-520
S/N   :MAB60A91
Sample:
  ------------------
Reagent:
  ------------------
Name:
     ---------------

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

Sample No.     01-01

Date 05/02/14 13:34
V2           100.4 l
Temp.         22.5 °C
Result       165.0 ug
             717.24 ppm
```

Statistics calculation
Unit: Number of samples
SD: Standard deviation
Means: Mean value
RSD: Relative Standard Deviation

```
[Result]
 No. ugH2O Conc[ppm]
 01  469.6   253.33
 02  471.8   254.52
 03  473.6   255.49
 04  471.0   254.09
 05  474.6   256.03

<Auto Statistics>

Date 05/02/14 13:55
Sample No.(High) 01
Method          1

Results         5
Mean       254.69 ppm
SD         1.0809 ppm
RSD        0.4244 %


Name:
     ---------------
```

MKC-520 / MKC-501

Specification

Type and Model	MKC-520	MKC-501
Measuring method	Karl Fischer coulometric titration method	
Measuring range	10µg to 100mg H_2O	
Display resolution	0.1µg H_2O	
Repeatability	within 0.3%RSD (n=10)/water-methanol 1mg H_2O	
Control method	Constant current pulse time control	
Endpoint detection	AC polarization	
Display	Pre-titr (Excessive moisture state) Ready (Measurable state) Stable (Stabile drift state)	
Indication of endpoint	Electronic beep	
Stirring method	Magnetic Stirrer Stirring speed adjustable by 10 steps	
Titration Cell	100mL (Max. 150mL) 2 channel (option)	100mL (150mL Max)
Drift compensation	Automatic (cancelable with key entry)	

Type and Model	MKC-520	MKC-501
Moisture quantity display	H_2O 0.1µg to 999999µg (display at end of titration) Br_2 0.9µg to 999999µg	H_2O 0.1µg to 999999µg
Diagnostic function	Electrolysis current, Measurement value, Overtitration, Reagent life (anolyte/catholyte), Electrode contact (short/open), Parameter error, Preamplifier error, Inhibited Key entry	
External control	Printer : IDP-100 prints Date and time, Sample ID, Sample weight, H_2O content, etc. Balance : Automatic weight reading Computer : RS-232C Interface	
Ambient condition	Temperature : 5 to 35°C Humidity : below 85%RH	
Power source	AC100 / 120 / 220 / 230 / 240V, 50/60Hz	
Power consumption	Approx. 50W	
Dimension	1) Main unit 288(W)×468(D)×215(H)mm 2) Stirrer 118(W)×225(D)×330(H)mm 3) Solvent change unit 240(W)×170(D)×405(H)mm	Main unit 288(W)×468(D)×475(H)mm
Weight	Approx. 10kg	Approx. 7.5kg
CE marking	EMC : EN61326 LVD : EN61010-1 conformance	

Standard components

	MKC-520-D	MKC-520-N	MKC-501-D	MKC-501-N
Main unit	1	1	1	1
Magnetic stirrer	1	1	-	-
Titration cell unit (with 2 component cell)	1	-	1	-
Titration cell unit (with 1 component cell)	-	1	-	1
Washing bottle	1	1	1	1
Funnel	1	1	1	1
Septum	10	10	10	10
Anode adjuster	1	1	1	1
Twin platinum electrode / KF	1	1	1	1
KF grease (5g)	1	1	1	1
Power cord	1	1	1	1
Stirrer rotor (35mm)	1	1	1	1

Optional Accessories

Evaporator

ADP-511S

The model ADP-511S Evaporator can be used in conjunction with the Karl Fischer Moisture Titrator to measure the moisture concentration of plastic pellets or solid samples which are insoluble in Karl Fischer reagents or contain interfering substances. ADP-511S can heat the sample in a closed heating chamber. The vaporized moisture 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 allows the sample condition to be 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 the user's convenience.

Specification

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
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 flow	100 to 300mL/min
Connection to KF Titrator	1) When connected with Cable 980303388, MKC-520 can control ADP-511S 2) For incompatible KF titrator, evaporation can be controlled by key entry on ADP-511S
Power	AC100 to 240V, 50/60Hz, 150W
Dimension	297(W)×206(D)×230(H) mm
Weight	Approx. 7kg

Evaporator for oil sample

ADP-513

Evaporator model ADP-513 can be used for moisture measurement on consistent samples such as lubrication oils, greases, tar derivatives, paints or viscous liquids in combination with KEM Karl Fischer Moisture Titrators.

Features

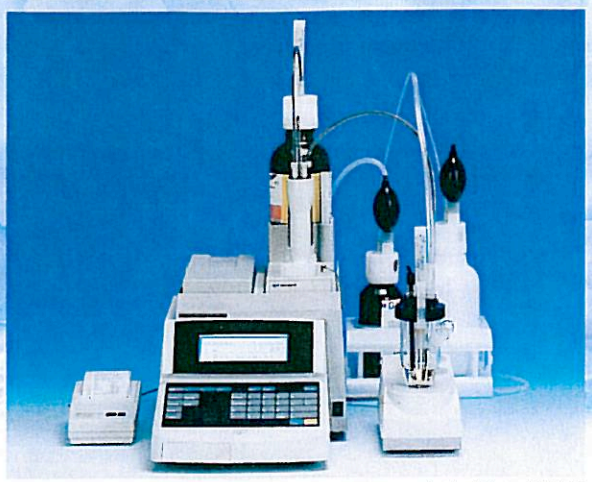
- The evaporator provides moisture titration by indirect method without the necessity of solvent, and enables consecutive measurement without discarding wastes after each run.
- Precise and stable control of temperature is assured by PID thermal control.
- The specification conforms to D6384 Standard Test Method for Determination of water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration.
- Safety measures to avoid overheating are provided by the digitally controlled temperature setting

Specification

Heating method	Cartridge base heater
Temperature range	Room temp. to 200°C Minimum step1°C
Gas flow rate	100 to 300mL/min (Typical 200mL/min)
Over heating protection	By thermal fuse
Carrier gas	Nitrogen gas (not included)
Power	AC100 to 120V or AC200 to 240V, 50/60Hz, 400W

Volumetric Karl Fischer Titrators are also available.

MKS-520



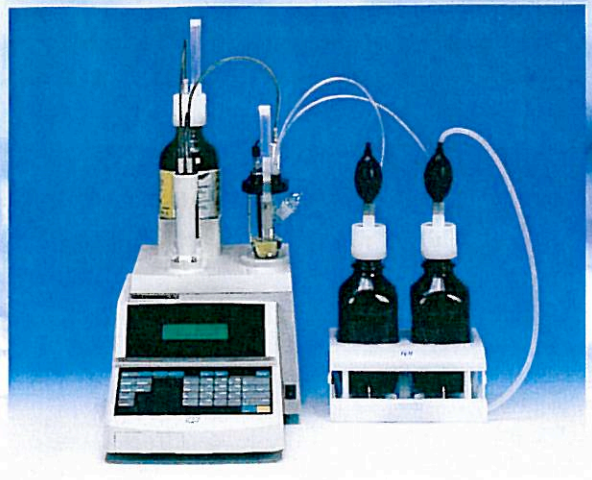
Option:Printer IDP-100

Features of MKS-520

- Large LCD screen.
- You can go on routine measurement simply by pressing [Pre-Titr] key and [Start] key.
- Can measure with the repeatability of ±0.01mL for 10mL burette.
- The built-in self diagnostic message helps you locate errors or troubles during operation and find the solution.
- Dispenser for Karl Fischer reagent is standard equipment.
- Safety and EMC features conforming to CE mark declaration.

Measuring range	1) Titration volume : 0.005 to 99.995mL 2) 0.1mg to 500mg H_2O 3) 10ppm to 100% H_2O
Endpoint detection	Polarized potential by Pt. 2-pin electrode with liquid resistance compensation
Titration form	Normal titration
Display	240X64 dots, 30 digitsX7lines LCD with backlight
Self diagnosis	Error message on erroneous key entry, excess of titration, abnormal polar potential, liquid resistance, etc.
Solvent	1) Minimum 30mL (for S-type vessel) 2) Maximum 100mL (for S-type vessel)
External control	RS-232C'S 1) for Printer 2) for Electronic balance 3) for Computer
Power source	AC100 to 120V/200 to 240V, 50/60Hz, 35W
Dimension	1) Main unit 288(W)X468(D)X629(H)mm 2) Stirrer 118(W)X225(D)X320(H)mm 3) Solvent change unit 240(W)X170(D)X405(H)mm
Weight	Approx. 12.5kg

MKS-500



Features of MKS-500

- A low cost titrator, yet offers the same accuracy as MKS-520.
- Solvent exchanger is standard equipment.
- Moisture measurement with simple and easy key operation.
- By the endpoint detection method on liquid resistance compensation, more precise measurement on various samples is possible.
- Fully GLP/GMP conforming report can be printed out by the optional printer.
- Safety and EMC features conforming to CE mark declaration.

Measuring range	1) Titration volume : 0.005mL to 100mL 2) 0.1mg to 500mg H_2O 3) 10ppm to 100% H_2O
Endpoint detection	Polarized potential by Pt. 2-pin electrode with liquid resistance compensation
Titration form	Normal titration
Display	16 digitsX2 lines LCD with backlight
Method	4(Direct, Indirect, Factor, Calib.)
Solvent	1) Minimum 30mL (for S-type vessel) 2) Maximum 100mL (for S-type vessel)
Calculation	1) Concentration, statistics (Mean, SD, RSD) 2) Recalculation 3) Factor calculation
External control	RS-232C'S 1) for Printer 2) for Electronic balance 3) for Computer
Power source	AC100 to 120V/200 to 240V, 50/60Hz, 35W
Dimension	Approx. 280(W)X450(D)X480(H) mm
Weight	Approx. 12.5kg

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