Volumetric Method

MKA-520

MKS-520

Karl Fischer Moisture Titrator

MKS-500

KYOTO ELECTRONICS

MKS-520 / MKA-520 / MKS-500

Option:Printer IDP-100

Karl Fischer Moisture Titrator MKS-520 and MKA-520

The Karl Fischer Moisture Titrator MKS-520 and MKA-520 are the results 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 can perform for quantitative analysis for moisture in solids, liquids and liquified 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 can be calculated into concentration and necessary data is printed out on the external printer.
For measurement of solid or samples which cannot directly be put into the solvent, 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 the memory of MKS-520 and MKA-520.

Features

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 operation
You can go on routine measurement simply by pressing [Pre-Titr] key and [Start] key.

Digital display of the results with high repeatability
It can measure with the repeatability of ±0.01mL for 10mL buret.

Self-diagnostics
The built-in self diagnostic message helps you locate errors or troubles in operation and find the solution.

Dispenser for Karl Fischer reagent is standard equipment.
The reagent dispenser as standard equipment eliminates troublesome replacements. The open air does not go into a titration flask at the time of reagent exchange. Therefore, the stability after reagent replacement is quick to attain.

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-520 and MKA-520 for automatic control.

Standard built-in interfaces
The interfaces for personal computer via RS-232C, for Balance and for Printer are now standard and each is built-in.

Dual-mode titration
MKA-520 is equipped with dual 10mL direct drive burette as standard. Each burette can work for normal and back titration. Titration using two Karl Fischer reagents with different factors is possible as well.

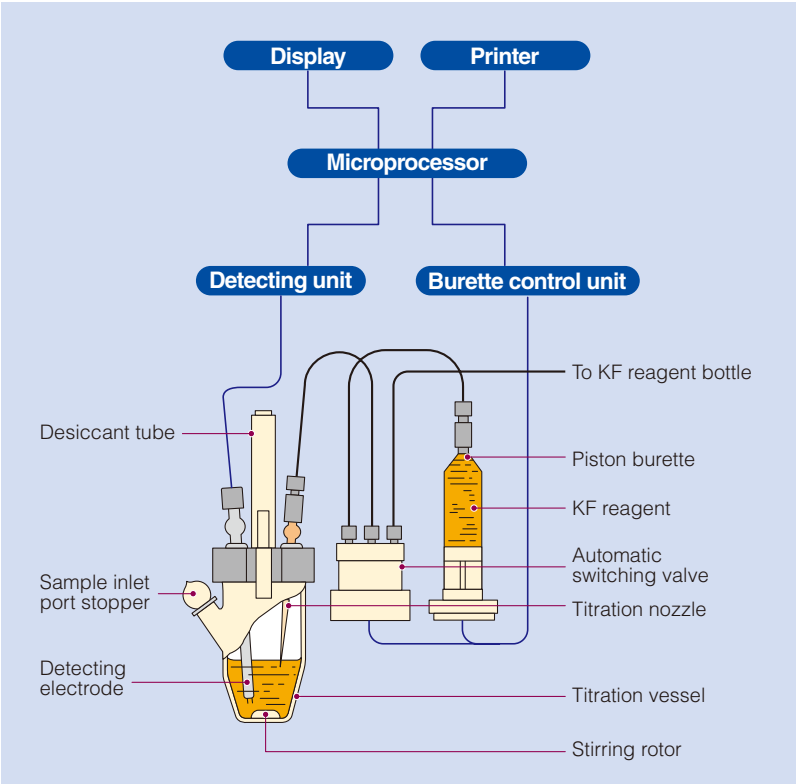
Principle of Analysis

In the Karl Fischer reaction, moisture in sample reacts with Karl Fischer reagent quantitatively. MKS-520, MKA-520 and MKS-500 can 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 cell. Titrate moisture in the solvent with Karl Fischer reagent until solvent equilibrium is reached. Add a fixed amount of sample. Titrate with Karl Fischer reagent having a known factor (mg H_2O/mL) until the endpoint is found. The Karl Fischer reagent factor can be determined using water standard or methanol standard. Then the moisture concentration of the unknown sample can be calculated.



Applications

The Karl Fischer Moisture Titrators - MKS-520, MKA-520 and MKS-500 can be 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.

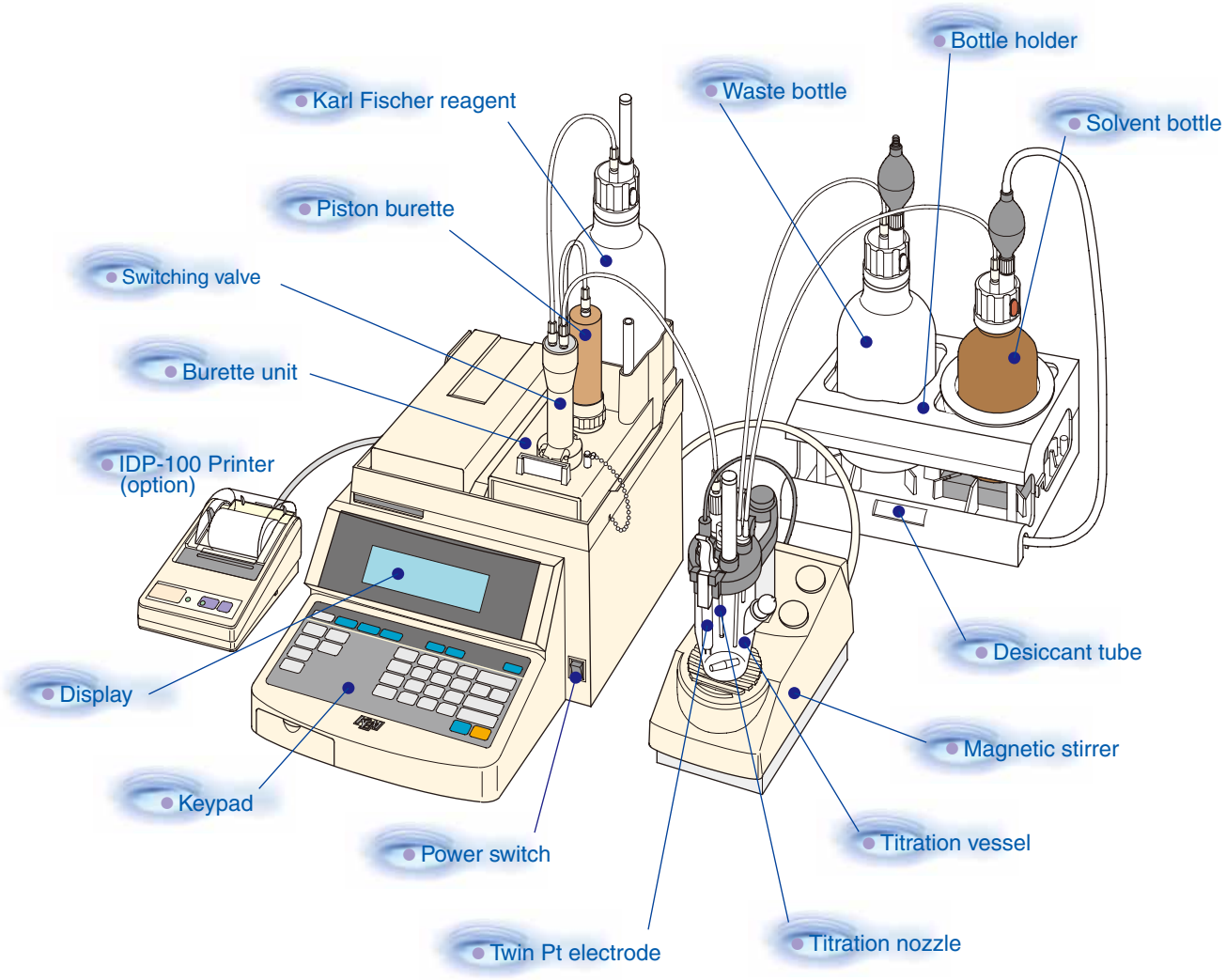
Natural products and industrial products :

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 gas / Freon gas / Vinyl-chloride monomer / Plastics powder / Plastic chips / 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:

Standard No.	Title	KEM Model
ASTM D 1533-96	Standard Test Method for Water in Insulating Liquids (Karl Fischer Reaction Method)	MKA-520/MKS-520/MKS-500
ASTM D 1744-92	Standard Test Method for Water in Liquid Petroleum Products by Karl Fischer Reagent	MKA-520/MKS-520/MKS-500
ASTM D 3277-95	Standard Test Method for Moisture Content of Oil-Impregnated Cellulosic Insulation	MKA-520/MKS-520/MKS-500
ASTM D 4377-93a	Standard Test Method for Water in Crude Oils by Potentiometric Karl Fischer Titration	MKA-520/MKS-520/MKS-500
ASTM E 203-96	Standard Test Method for Water Using Karl Fischer Reagent	MKA-520/MKS-520/MKS-500

【MKS-520】



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 :MKS-520
S/N   :MGB06C56
Sample:
  ------------------
Reagent:
  ------------------
Name:
     ---------------

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

Sample No.       01-01

Date 05/02/14 14:18
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-520	MKA-520
Model name	Karl Fischer Moisture Titrator	
Measurement method	Volumetric titration method	
Measuring range	1) Titration volume : 0.005 to 99.995mL 2) 0.1mg to 500mg H_2O 3) 10ppm to 100% H_2O	
Control method	Built-in microcomputer	
Endpoint detection	Polarized potential by Pt. 2-pin electrode with liquid resistance compensation	
Endpoint wait time	1) Select 1 to 99 seconds 2) Set up potential to maintain EP level	
Titration form	Normal titration	1) Normal titration 2) Back titration
Special functions	1) Titration speed control by 6 steps 2) Automatic start by sensing sample 3) Drift titration to maintain dehydration 4) Start delay setting : 0 to 9999 s 5) Continuous titration : 0 to 9999 s 6) Limit titration time : 0 to 9999 s 7) Cut-off titration : 0 to 9999 s	
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 file	Parameters for normal titration, evaporation by ADP-511S, manual factor measurement by standard, etc. can be stored in five different methods.	
Indication of endpoint	Beep sound and message on display	
Printer	Optional (Recommended printer : IDP-100)	
Calculation	1) Batch calculation for statistics including concentration, average, standard deviation, etc. 2) Factor computation	
Self diagnosis	Error message on erroneous key entry, excess of titration, abnormal polar potential, liquid resistance, etc.	

Automatic Piston burette	1) Burette cylinder with piston ·····1	·····2
	2) Automatic switching valve for suction/dose ·····1	·····2
	3) Backlash mechanism and its time setting function 4) Delivery speed : maximum approximately 0.5mL/second 5) Suction speed : approximately 20s/10mL or 80s/10mL two steps 6) Capacity : 10mL, cumulative titration possible up to preset maximum titrant volume. 7) Accuracy : ±0.015mL, Repeatability : ±0.005mL	
Solvent	1) Minimum 30mL (for S-type vessel) 2) Maximum 100mL (for S-type vessel)	
Additional function	Control ADP-511S Evaporator including heating temperature, aging sequence and measuring conditions with sample boat.	
External control	RS-232C 1) for Printer 2) for Electronic balance 3) for Computer	
Ambient condition	Temperature : 5 to 35°C Humidity : less than 85%RH	
Power source	AC100 to 120V/200 to 240V, 50/60Hz	
Power consumption	Approx. 35W	
Dimension	1) Main unit 288(W)×468(D)×629(H)mm 2) Stirrer 118(W)×225(D)×320(H)mm 3) Solvent change unit 240(W)×170(D)×405(H)mm	
Weight	Approx. 12.5kg	Approx. 13.5kg
Standard components and parts	(1) MKS-520 Main unit ·····1 (2) Operation manual ·····1 (3) Power cord ·····1 (4) Stirrer rotor ·····1 (5) Stirrer unit ·····1 (6) Stirrer cable ·····1 (7) Tube connector KF·····1 (8) Anti-diffusion nozzle ···1	(1) MKA-520 Main unit ·····1 (2) Operation manual ·····1 (3) Power cord ·····1 (4) Stirrer rotor ·····1 (5) Stirrer unit ·····1 (6) Stirrer cable ·····1 (7) Tube connector KF·····2 (8) Anti-diffusion nozzle ··· 2
Standard accessories	(1) Grease·····1 (2) Wrench (8mm) ·····1 (3) Piston extraction rod ·····1	

Optional Accessories

Evaporator

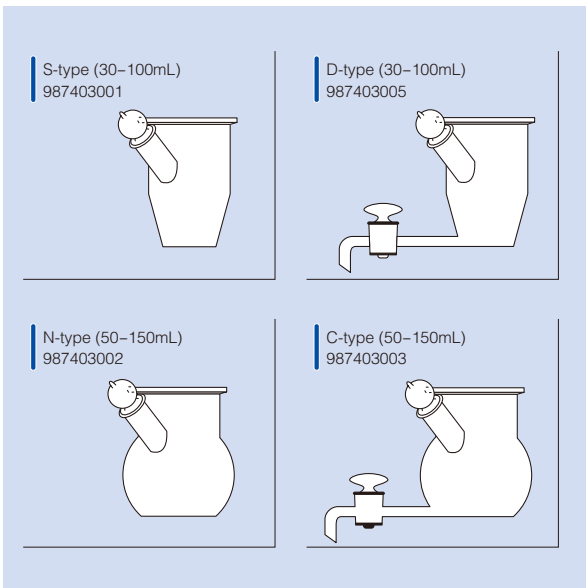
ADP-511S

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 which contain interfering substances. 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 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.

Titration vessels



Specification

Type and model name	ADP-511S 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: φ30(O.D)×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 with Cable 980303388, MKA-520/MKS-520 can control ADP-511S 2) For incompatible KF titrator, evaporation can be controlled by key entry on ADP-511S
Ambient condition	Temperature : 5 to 35°C, 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 (5) Tube(240mm) ·····2 (2) Heating unit ·····1 (6) Hose joint φ6 ·····1 (3) Desiccant tube·····1 (7) Operation manual···1 (4) Heater tube ·····1
Standard accessories	(1) Silica gel 500g ·····1 (5) Power fuse 3.15A ···4 (2) Zeolite 500g ·····1 (6) Caution sticker·····1 (3) Bubbler tube·····1 (7) Sample boat ·····3 (4) Boat pushing rod ·····1

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 on solid samples that can be dissolved in solvent as well as powder samples. When connected with the optional evaporator, water content of samples like plastic pellets or solid chemicals can also be measured.

Features

- 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 on the optional printer.
- Safety and EMC features conforming to CE marking declaration.

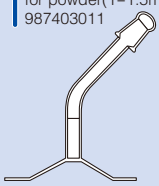
Specification

Measuring range	1) 0.1mg to 500mg H_2O , 10ppm to 100% H_2O 2) 0.005mL to 100mL	Printer	Optional (recommended printer: IDP-100)
Titration form	Normal titration	Calculation	1) Concentration, statistics (Mean, SD, RSD) 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 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

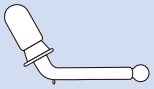
Samplers

Bent-type for powder(1–1.5mL) 987403011



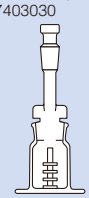
"C" bent-type for powder 987403020

Powder weighing sampler 987403025



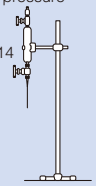
Straight-type weighing sampler 987403026

Viscous sampler 987403030

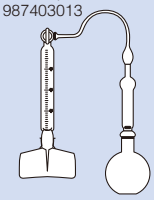


High viscous sampler 987403031

Liquified gas sampler with SUS pressure vessel (100mL) 984333014



Oil sampler 987403013



Spoon-type for Viscous 987403012

Eggplant-type for powder 987403024

Syringe (20mL) 985003225

Syringe inlet port stopper 984333407

Coulometric Karl Fischer Titrators are also available.

Coulometric Karl Fischer Titrators are also available.

MKC-520

Option:Printer IDP-100

Features of MKC-520

- Titration cell can be increased to 2 units.
- Bromine number and index can be measured.
- Fully conforms 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°C Humidity : less than 85%RH

MKC-501

Features of MKC-501

- A low cost titrator, yet offers the same accuracy as MKC-520 ; 10μgH_2O measuring range, and 0.1μgH_2O detection sensitivity.
- Electronic balance, printer and RS-232C external ports as standard.

Range	10μg - 100mg H_2O
Sensitivity	0.1μg H_2O
Display	16 digits X 1 lines 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°C Humidity : less than 85%RH

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