HIRANUMA

Karl Fischer Titrator

Since 1972

MOICO-A19 Coulometric Karl Fischer Titrator

MOIVO-A19 Volumetric Karl Fischer Titrator

MOICO-A19

MOIVO-A19

Principle of the Karl Fischer Moisture Determination Method

Karl Fischer reaction

Water reacts with Iodine, Sulfur Dioxide, and Amine in a titration solvent containing Methanol and is titrated. Consequently, 1 mole (18g) of water (H_2O) is titrated by 1 mole (252g) of iodine (I_2).

Sample + Karl Fischer Reagent + Solvent

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

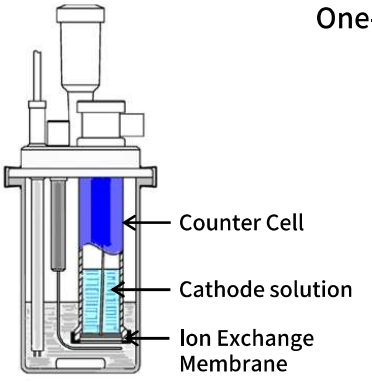
The Karl Fischer analysis has two methods
Coulometric titration, in which Iodine produced by electrolysis of the anode solution is used for titration, and Volumetric titration is based on the titration of the Karl Fischer reagent.

Comparison of Coulometric and Volumetric Titration Methods

	Coulometric titration	Volumetric titration
Principle	Iodine generated by electrolysis reacts with moisture, and the amount of moisture is calculated from the amount of electricity required to generate it.	Calculate moisture content from the volume of Karl Fischer reagent consumed.
Reagents	Anode solution (Cathode solution)	Karl Fischer reagent, Dehydrating solvent
Characteristics	- Accurately measures trace amounts of moisture. - Repeatable measurements with the same anode solution. - Titer determination is not required.	- Short measurement time for samples with high water content. - Wide range of application by selecting dehydrated solvent.
Measuring range	5μg～	0.1mg～
Sample	- Liquids, gases, solids (including powders) - Organic and inorganic substances, Petrochemical products and Raw materials, Pharmaceuticals and pharmaceutical raw materials, etc.(For samples that do not dissolve in the anode solution or dehydrated solvent, or for samples with disturbing reactions, a heating vaporization or evaporation method is required.)	

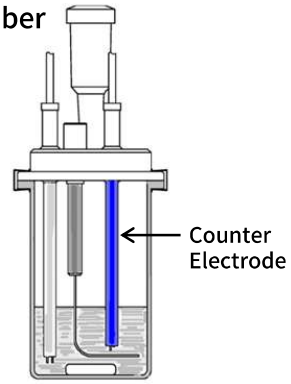
Coulometric titration methods have two types: “Two-Chamber Method" and “One-Chamber Method”.

Two-chamber



Applicable to various standards

One-chamber



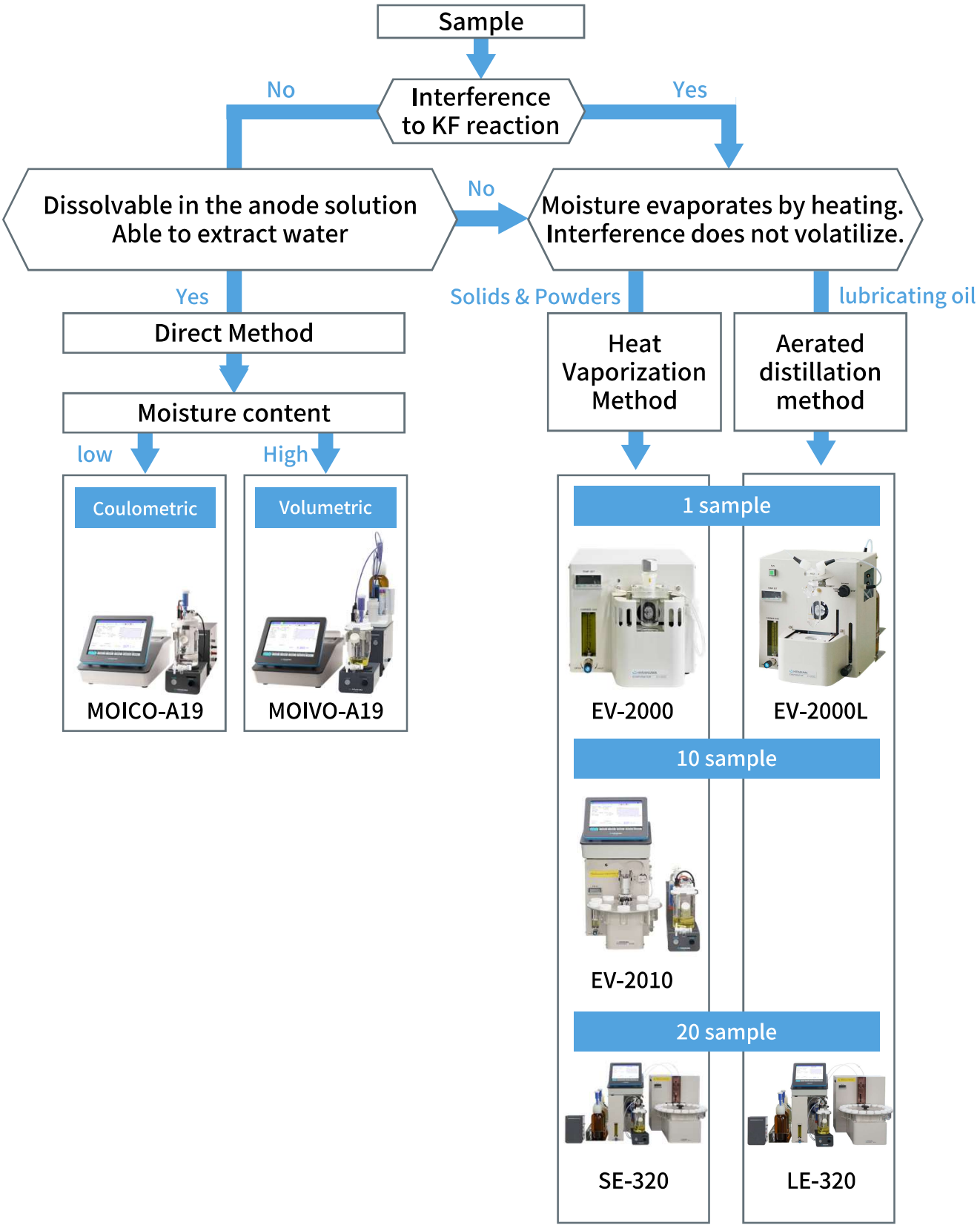
Easy maintenance with less reagent and waste liquid

Our unique technology enables the use of single-chamber electrolytic cell even with evaporators*.

*Except for small-capacity One-chamber electrolytic cells

Select the measurement method to suit samples

Depending on the moisture content and condition of the sample, moisture content of various samples can be measured in combination with Evaporators.
The following items should be used as a guide in selecting a device.



MOICO-A19　Coulometric Karl Fischer Titrator
MOIVO-A19　Volumetric Karl Fischer Titrator

Moisture measurement that is right for you.

People who use the equipment varies. And the locations where they are installed vary as well.
We want to make it easier to see, easier to use, and easier to understand.
We wish the system could be flexible to suit each user.
We have incorporated such functions.
This is a moisture measurement device for you.

problem

"The screen is too small to read ..."

↓

Large LCD

MOICO-A19

MOIVO-A19

problem

"I can't get the right angle for me..."

↓

Monitor angle adjustment

problem

"I have nowhere to put it..."

↓

Space-saving design

problem

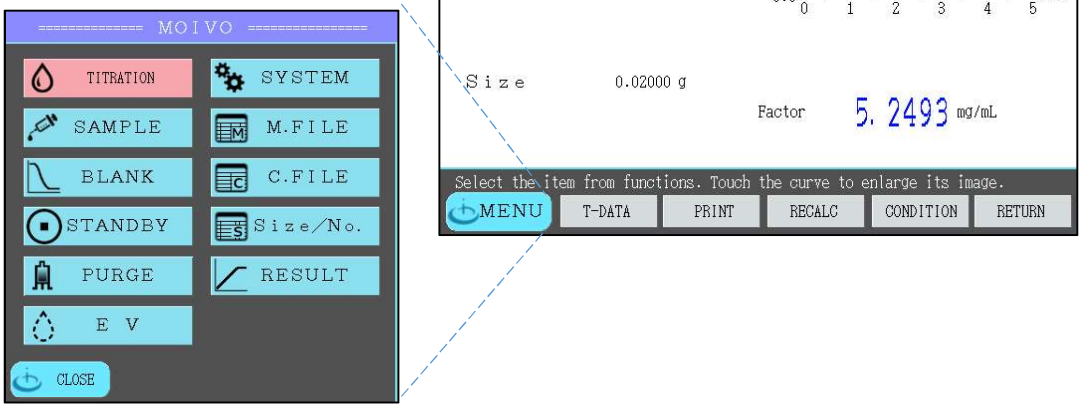
"I don't know if it's measuring or not ..."

↓

LED indication

Large Color LCD Touch Panel

A large 8.4" touch panel screen enables the user to input text easily. Selecting functions from the menu can be operated intuitively. The protective film can be replaced to protect it from scratches and wear over the long term.



LCD Display Adjustable in 16 Positions

Each user can adjust the angle as they like.
The position can be locked so that it will not move when the screen is pressed.

Four Types of Titration in Parallel

By adding a KF titrator main drive and stirrer, four types of Karl Fischer titration can be carried out in parallel.
(Potentiometric titrator can also be added)

Built-in Thermal Printer

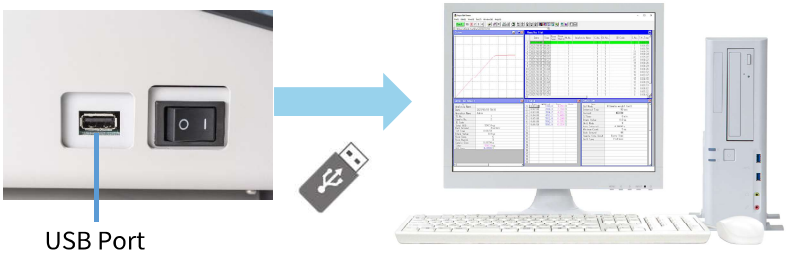
Equipped with a built-in thermal printer with a paper roll 58-mm wide, which can be set up simply by inserting the paper roll and closing the cover.

Example of measurement result printout

```
====== MOICO-A19 Result ======
Analysis Name      Installation
Date          2022/07/21 11:30
TS No.                   1
Sample No.               1
ID Code
Total H2O          2013.4 µg
Back Ground          9 µg/min
Titr. Time         0:02:26
Blank Value          0.0 µg

Size              0.00000 g
H2O               2013.4 µg
*Conc             2013.4 µg

0.0                2500.0 µg
0:02:26

T-Data

   Time      ug       H2O
------------------------------
 0:01:00  1181.7  1181.7 µg
 0:02:00  2009.8  2009.8 µg
 0:02:26  2013.4  2013.4 µg
```

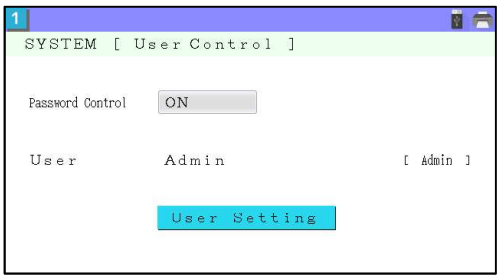
USB / LAN Port

Approximately 9,900 results can be stored on a USB memory stick. With optional software, the user can view the data on a PC or use a recalculation function. With a LAN connection, the user can also view the data on a Web browser.



User Authentication Settings

User restrictions enable the security improvement as well as the prevention of inadvertent changes to, for example, measurement conditions.



KF Titrator Main Drive

Status Indicator with 3 LED Colors

Colored lights allow the user to confirm the status of operation from a distance. The user will also be alerted to unexpected problems right away.

Ready | Titration in progress | Error

Easy Replacement of Buret Head

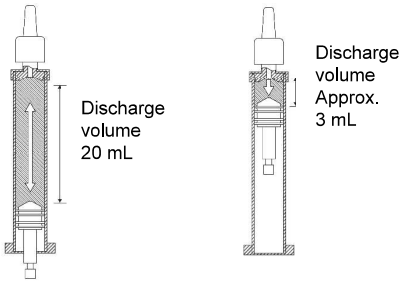
Volumetric

Simply sliding toward the user, Buret Head can be removed together with the reagent bottle just with one hand.

Economical Purge Function

Volumetric

Discharging/charging at the top end of the syringe is repeated. Reagents can be replaced automatically, which greatly reduces waste fluid. The number of economical purge cycles can be set from 1 to 99.



Full Stroke Purge | Economical Purge

Reagent return function

Volumetric

No waste of expensive Karl Fischer reagents.

Stirrer

Forty Rotation Speeds Can Be Set

Rotation can be adjusted manually in fine increments shown by LED bars—it is easy to see and understand. (Four increments per each bar)

Two-color LED display of operating status

The operating status can be checked from a distant location.

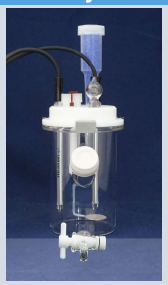
Ready | Titration in progress

Coulometric

Advantages of Single chamber electrolytic cell

- No Cathode solution and Diaphragm are required. Low waste and running costs.
- The simple structure of the electrolytic cell makes maintenance easy.
- Blanking is faster with Single chamber electrolytic cell “S” (about 1/2 shortened).
- Our unique technology enables the use of Evaporator even in Single chamber electrolytic cells. (except for Single chamber electrolytic cell “S”)

※ Some samples cannot be measured.
※ Use in the Dry-Rooms is deprecated. Due to low Background moisture content It may take some time to recover from a state below endpoint potential after measurement is completed.

Two-chamber electrolytic cell	Single chamber electrolytic cell	Single chamber electrolytic cell “S”
		
cathode solution required	No cathode solution required	No cathode solution required
anode solution 100 mL	anode solution 100 mL	anode solution 25 mL

OPTION

manual pump unit for Solvent supply and discharge

Volumetric

Advantages of Small-volume titration cell

- Usage of titration solvent is 2/3 of the conventional amount.
- Fewer reagents lead to lower effluent and running costs.
- The small surface area and volume in the cell allows for faster blank removal before measurement begins.

Titration cell complete	Titration cell complete “S”
	
solvent 30mL	solvent 20mL

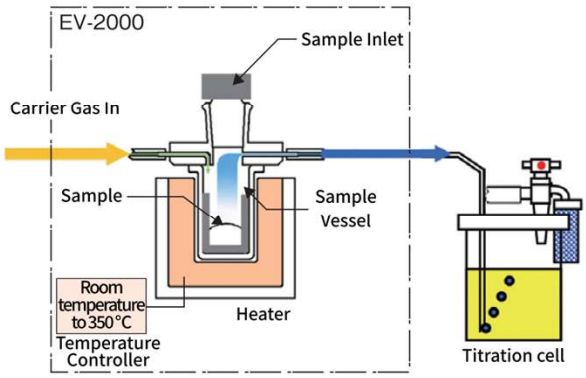
OPTION

manual pump unit for Solvent supply and discharge

EV-2000 Solid Evaporator

Simple measurement of moisture in solid and powdered samples.

Example of configuration with MOICO-A19



Examples of Uses

various resin pellets, medicines (powdered and solid), various inorganic powders and granules, copy machine toner, etc.

*Samples such as sodium bicarbonate that produce water by decomposition by heating, or samples that release substances that react with Karl Fischer reagents cannot be measured.

Standard Specifications	
Temperature control	Optional settings, automatic temperature adjustment
Temperature range	From room temperature to 350 °C
Carrier gas	N_2 gas (or dry air from an optional dry air pump) Flow rate : 0.1 to 1.0 L / min (depending on setting)
Carrier gas Desiccant	Molecular Sieves 100 g
Heater	Band heater
Sample amount	About 10 mL or less
Power supply	AC 100 - 240 V 50/60 Hz About 150 VA A power cable is not included in this product. (*1)
Dimensions / Weight	220(W) x 430(D) x 200(H) mm / Approx. 8 kg

*1: The power inlet of this product complies with IEC60320 C14.
Please prepare a power cable that can be connected to this power inlet.

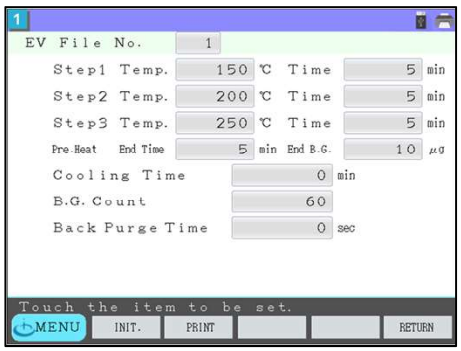
Solvents are not included.

Advantages of "sample vessel = vaporization chamber"

1) Direct heating of sample vessel → good heating response
2) Smaller vaporization chamber volume → shorter blanking time
3) Direct cooling by fan → Short cooling time
4) Easily removable vaporization chamber → Easy to clean and maintain

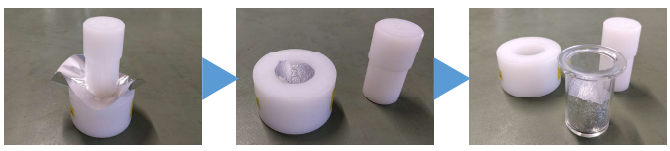
For moisture vaporizer control "EV File"

The control of the moisture vaporizer can be set with a Karl fischer Titrator.
Three-step temperature increase is possible to find the appropriate heating temperature for your sample.



Aluminum foil die-cut is included as standard

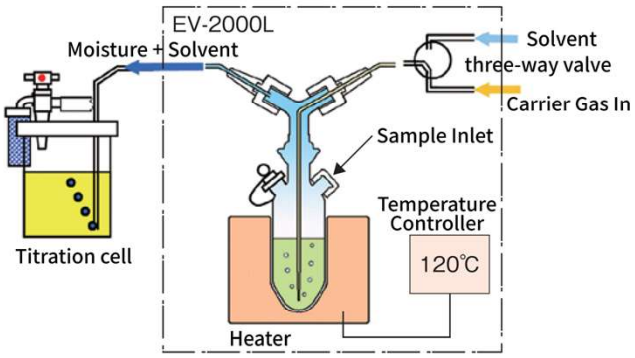
Aluminum foil can be used to prevent specimens from sticking to the vaporization chamber after heating.
A die is provided for easy molding and mounting to match the vaporization chamber.



EV-2000L Oil Evaporator

Samples which include substances which interfere with the Karl Fischer reaction such as lubricating oil and are difficult to measure the moisture of via direct methods can be measured in a short time using the azeotropic distillation method.

Example of configuration with MOICO-A19



Examples of Uses

Lubricating oils, mercaptans with relatively high boiling points (approximately 150 °C or higher*),
Samples containing ketones, inks containing dyes, etc.

*Measurement may not be possible depending on the concentration of interferences in the sample.

Standard Specifications	
Moisture Vaporization Method	Azeotropic Distillation Method (distillation while ventilating carrier gas)
Temperature control	Optional settings, automatic temperature adjustment
Temperature range	From room temperature to 200 °C
Carrier gas	N_2 gas (or dry air from an optional dry air pump) Flow rate : 30 to 300 mL / min (depending on setting)
Carrier gas Desiccant	Molecular Sieves 100 g
Heater	Band heater
Sample amount	About 10 mL or less
Distillation Solvent	Toluene, Xylene, n-Octane, etc. (volume used in each measurement: 5-10mL)
Power supply	AC 100 - 240 V 50/60 Hz About 150 VA A power cable is not included in this product. (*1)
Dimensions / Weight	220(W) x 370(D) x 265(H) mm / Approx. 7 kg

*1: The power inlet of this product complies with IEC60320 C14.
Please prepare a power cable that can be connected to this power inlet.

Solvents are not included.

Options

- Dry Air Pump （For EV-2000/2000L/2010）

Dry air can be used as the carrier gas.
*N2 gas is recommended for pyrolysis samples.

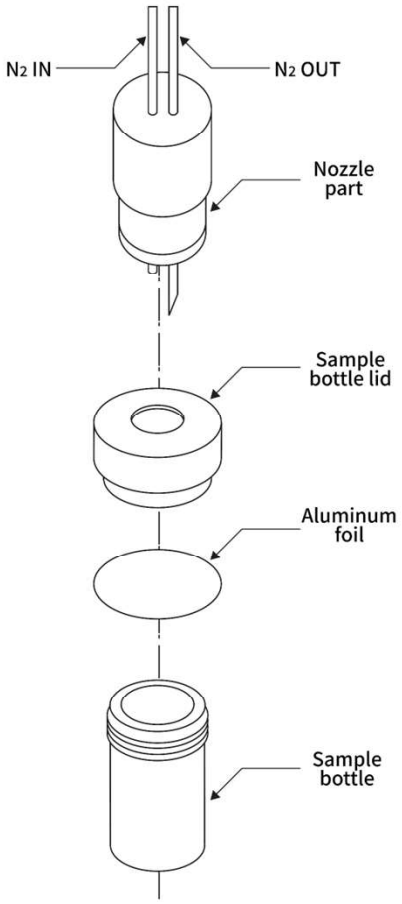
- Evaporation chamber（For EV-2000L）

Evaporation chamber A No.E323310-A	For the grease sample	
Evaporation chamber C No.E323312-A	For the liquid sample (Included in the EV-2000L)	

Automated Solid Evaporator

Example of configuration with MOICO-A19 and EV-2010

Example of configuration with MOICO-A19 and SE-320



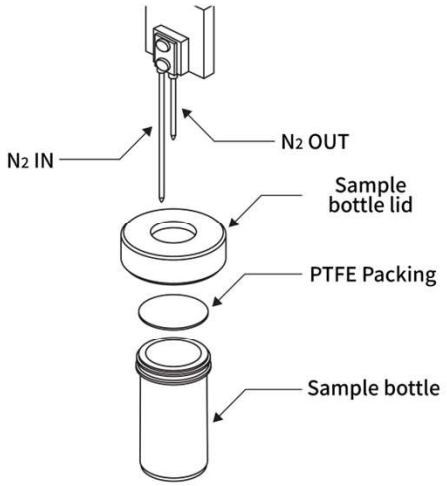
Configuration of nozzle and sample bottle

1) Multiple samples can be measured automatically for efficient moisture measurement.
2) The sample heating temperature can be set arbitrarily from room temperature to 300°C. There are 50 measurement condition files, and optimal temperature settings can be registered for each sample.
3) Up to 3 steps of temperature increase can be set for each sample.
4) Easy-to-handle sample bottles are used. The container is straight from the bottom to the mouth, making it easy to take out the dissolved sample.
5) Automatic reagent exchange function is standard. (SE-320)
   The reagent replacement can be set by the number of measurements to automatically drain and replace the anode solution.

Solvents are not included.

Automated Oil Evaporator

Example of configuration with MOICO-A19 and LE-320



Configuration of nozzle and sample bottle

1) Multiple samples can be measured automatically for efficient moisture measurement.
2) The sample heating temperature can be set arbitrarily from room temperature to 200°C. There are 50 measurement condition files, and optimal temperature settings can be registered for each sample.
3) Up to 3 steps of temperature increase can be set for each sample.
4) Easy-to-handle sample bottles are used. Since PTFE is used for the packing, there is no blank from the packing.
5) Automatic reagent exchange function is standard.
   The reagent replacement can be set by the number of measurements to automatically drain and replace the anode solution.

Solvents are not included.

Standard Specifications

	EV-2010	SE-320	LE-320
Moisture Vaporization Method	Ventilation heating vaporization method		Azeotropic Distillation Method
Sample Container	Hard glass bottle, aluminum foil packing, PTFE lid		Hard glass bottle, PTFE packing, PTFE lid
Number of sample containers	10 samples	20 samples	
Sample amount (Volume)	About 10 mL or less		About 3 mL or less
Toluene Dispensing Volume	—		About 5 mL (per measurement)
Carrier gas	N_2 gas (or dry air from an optional dry air pump) Flow rate : 30 to 300 mL / min (depending on setting)	N_2 gas Flow rate : 30 to 300 mL / min (depending on setting)	
Reagent exchange	—	Automatic exchange by setting the number of measurements	
Carrier gas Desiccant	Molecular Sieves		
Heater/Temperature Control	Band heater, PID control method		
Temperature range	From room temperature to 300 °C, Up to 3 levels can be set		From room temperature to 200 °C
End position setting	Set stop-pin to end position	When the stop pin is set to the end position or no container is detected	
Post-measurement procedures	End buzzer		
Power supply	AC 100 - 240 V 50/60 Hz About 150 VA A power cable is not included in this product. (*1)		
Dimensions	260(W) x 600(D) x 280(H) mm	Sample changer : 350(W) x 510(D) x 390(H) mm Valve BOX : 275(W) x 440(D) x 280(H) mm	
Weight	Approx. 11 kg	Sample changer : Approx. 19 kg Valve BOX : Approx. 9 kg	

*1: The power inlet of this product complies with IEC60320 C14.
Please prepare a power cable that can be connected to this power inlet.

MOICO-A19 Coulometric Karl Fischer Titrator

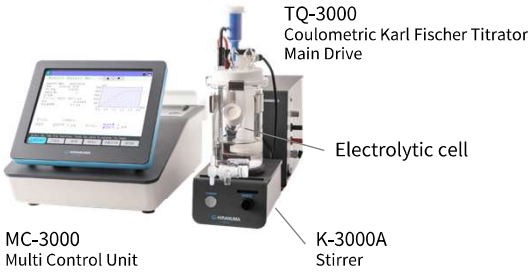
ITEM	SPECIFICATIONS
Parallel measurement	Up to four titrators are connectable. (by optional KF titrator main drive or titration station drive (and stirrer))
Titration method	Coulometric Karl Fischer Titration
Electrolysis control method	Constant-current electrolysis, intermittent electrolysis near the end point
End-point detection method	AC polarization potentiometric detection method
Measuring range	5 μg$H_2$0 – 300 mgH_2O
Displayed resolution	0.1 μg
Background correction	Automatic correction (selectable ON/OFF)
Display	8.4 inch color LCD touch panel
Display unit	μgH_2O,ppm,%
Accuracy	Within CV of 0.3 % (1 g of 1 mgH_2O/mL water-in-methanol measured 10 times)
Required measurement time	FAST : 1.8 mgH_2O/min (30 μgH_2O/sec) MEDIUM : 1.2 mgH_2O/min (20 μgH_2O/sec) SLOW : 0.6 mgH_2O/min (10 μgH_2O/sec)
Electrolysis diaphragm	Ion exchange membrane (Needed only for Two-chamber electrolytic cell)
Electrolytic cell capacity	Two-chamber electrolytic cell : 150 mL (min.usage: approx. 100 mL) Single chamber electrolytic cell : 150 mL (min.usage: approx. 100 mL) Single chamber electrolytic cell "S" : 75 mL (min.usage: approx. 25 mL)
Memory data capacity (Each titration station)	Built-in memory: 100 data points USB flash memory: (≧256 MB) Maximum capacity approx. 9,900 data points
Settings input method	Key touch input (English guide displayed)
Conditions file	51 files
Sample files	99 files
Calculation function	Concentration calculation, Recalculation, Statistics calculations
GLP-compliant function	1) Electrode control - Total electrolysis volumes, replacement dates, and replacement alarms of anode solution - Total electrolysis volumes, replacement dates, and replacement alarms of cathode solution - Ion exchange membrane replacement date - Indicator electrode replacement date 2) Measurement accuracy test 3) User control system
Printer	Built-in thermal printer (Paper roll width: 58 mm)
External input/output	RS-232C: 1 port (For balance or computer connection), LAN: 1 port, USB flash memory stick: 1 port
Power supply	AC100-240 V±10 % 50/60 Hz 60 VA (MC-3000) 50 VA (TQ-3000) A power cable is not included in this product. (*1)
Dimensions / weight	235(W) × 400(D) × 250(H) mm / Approx. 6.5 kg (MC-3000) 110(W) × 250(D) × 160(H) mm / Approx. 3.5 kg (TQ-3000) 100(W) × 165(D) × 175(H) mm / Approx. 1.5 kg (K-3000A)

*1: The power inlet of this product complies with IEC60320 C14. Please prepare a power cable that can be connected to this power inlet.

Solvents are not included.

K-3000A Stirrer

ITEM	SPECIFICATIONS
Stirring system	Magnetic stirrer
Power supply	DC12 V (supplied by titration station)



Operating Requirements for Equipment

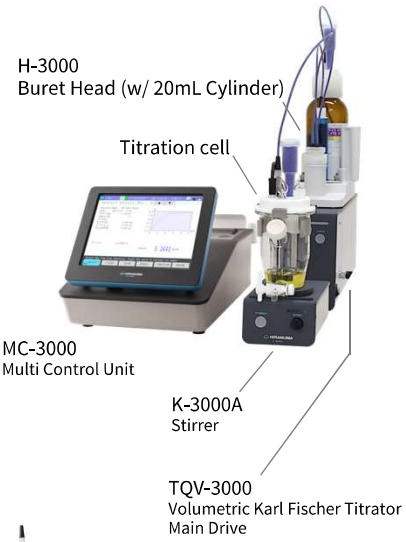
- Temperature: 5 to 35 °C
- Humidity: 85 % or less, with no condensation
- Atmosphere: No presence of acid, alkali, organic solvent gas, rare gas, or corrosive gas
- Other: No inordinately high amount of dust or particles.
  No equipment nearby that generates strong lines of magnetic force.

MOIVO-A19 Volumetric Karl Fischer Titrator

ITEM	SPECIFICATIONS
Parallel measurement	Up to four titrators are connectable. (by optional KF titrator main drive or titration station drive (and stirrer))
Titration method	Volumetric Karl Fischer Titration
Electrolysis control method	Continuous dispensing; intermittent dispensing only around the end point
End-point detection method	AC polarization current detection method/AC polarization potential difference detection method
Measuring range	0.1 mgH_2O – 500 mgH_2O (10 ppm – 100 %)
Background correction	Automatic correction (selectable ON/OFF)
Display	8.4 inch color LCD touch panel
Display unit	mL (min.display:0.001 mL), mgH_2O , %, ppm
Buret accuracy	Relative accuracy: ±0.1% or less (with full capacity discharge from 20-mL syringe at factory settings (new)) Repeat accuracy: 0.01 mL or less (with full capacity discharge from 20-mL syringe, n=6 standard deviation)
Liquid contact tube	ϕ2×ϕ3, PTFE tube
Valve change-over	Automatic switching by ceramic lapping
Min. dispensing volume	0.005 mL, 0.01 mL, 0.02 mL or 0.05 mL can be set.
Titration cell capacity	Standard : 150 mL (min.usage: approx. 30 mL) Small : 75 mL (min.usage: approx. 20 mL)
Memory data capacity (Each titration station)	Built-in memory: 100 data points USB flash memory: (≧256 MB) Maximum capacity approx. 9,900 data points
Settings input method	Key touch input (English guide displayed)
Conditions file	51 files
Sample files	99 files
Calculation function	Concentration calculation, Titer standardization calculation, Back titration calculation, Recalculation, Statistics calculations
GLP-compliant function	1) Reagent Management - Reagent remaining volume, replacement dates, and replacement alarms of regent - Total discharge volume , and operation start date of buret head - Indicator electrode replacement date 2) Measurement accuracy test 3) Buret reliability check 4) User control system
Printer	Built-in thermal printer (Paper roll width: 58 mm)
External input/output	RS-232C: 1 port (For balance or computer connection), LAN: 1 port, USB flash memory stick: 1 port
Power supply	AC100-240 V±10 % 50/60 Hz 60 VA (MC-3000) 70 VA (TQV-3000) A power cable is not included in this product. (*1)
Dimensions / weight	235(W) × 400(D) × 250(H) mm / Approx. 6.5 kg (MC-3000) 120(W) × 340(D) × 500(H) mm / Approx. 7.0 kg (TQV-3000 and H-3000) 100(W) × 165(D) × 175(H) mm / Approx. 1.5 kg (K-3000A)

*1: The power inlet of this product complies with IEC60320 C14. Please prepare a power cable that can be connected to this power inlet.

Solvents are not included.



B-3000 Buret / H-3000 Buret Head

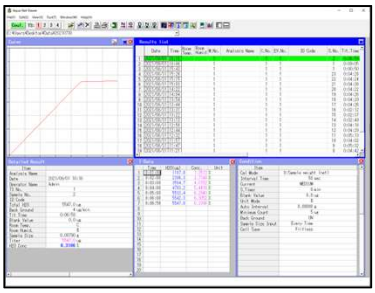
ITEM	SPECIFICATIONS
Buret capacity	20 mL transparent syringe (also 10 mL)
Wetted part material	PTFE, hard glass, ceramic
Connecting tubes	φ2 x φ3 PTFE tube
Min. dispensing volume	0.005 mL, 0.01 mL, 0.02 mL or 0.05 mL can be set.
Buret accuracy	Relative accuracy: ±0.1% or less (with full capacity discharge from 20-mL syringe at factory settings (new)) Repeat accuracy: 0.01 mL or less (with full capacity discharge from 20-mL syringe, n=6 standard deviation)
Buret attachment	Up to one B-3000 burets can be attached simultaneously
Power supply	AC100-240 V±10 % 50/60 Hz 50 VA A power cable is not included in this product. (*1)
Dimensions / weight	120(W) × 250(D) × 500(H) mm / Approx. 4.0 kg

*1: The power inlet of this product complies with IEC60320 C14.
Please prepare a power cable that can be connected to this power inlet.

H-3000
Buret Head (w/ 20mL Cylinder)
*Buret tip assembly is not supplied

B-3000
Buret Drive

PC software "Aqua-Net Viewer"



The results of measurements can be viewed, analyzed, and managed on a PC.
A USB memory device must be connected to the PC.

(1) Easy to manage measurement results.
All result information can be displayed on a single PC screen.
(List display, titration curve, measurement result, measurement condition, T data)

(2) Reanalysis of results using the original data is possible.
Recalculation and statistical calculation are available.

Titration curves and data can be copied and pasted to other application software (Word, Excel, etc.).

- Operating Environment;
  OS: Microsoft Windows 10 / 11 must be running properly.
  Memory: 4GB or more / CD-ROM drive must be installed. / USB: One port must be available.

Sales

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www.hitachi-hightech.com/global/hhs/
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1-17-1 Toranomon, Minato-ku, Tokyo 105-6409, Japan

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BJ-0215A

HSS-E033P	2024.10