



Water determination right down to trace levels – with full automation capabilities

## An innovative and comprehensive solution

The 756 KF Coulometer continues Metrohm's established line of Karl Fischer instruments for the determination of low-level water contents. Despite its compact construction this instrument leaves no wishes unfulfilled. It comes equipped with a built-in printer and two RS 232C interfaces which allow communication with a balance, external printer and/or computer. This latest addition to the Karl Fischer range guarantees accurate and reproducible results even for water contents in the lower micro range. The dialogue languages English, French, German, Spanish, Portuguese, Swedish and Italian are standard, as is the backlit screen with its graphics capabilities. The screen not only provides a clear presentation of the parameters, but also shows graphically the course of the KF determination as  $\mu\text{g}$  water versus time. This facilitates the assessment of the determination and is a great help in method development and validation.

Depending on the amount of data that are to appear on the instrument display, large or small fonts can be selected.

A user list can be entered; the name selected from this list appears in the result report, which can be freely configured by simply selecting the lines containing the desired information.

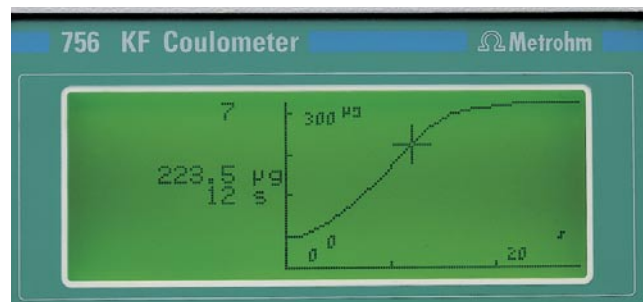
Using the optional Remote Box you can connect a barcode scanner and a PC keyboard to the 756 KF Coulometer.

## Compatible with GLP and ISO 900X, ready for the millennium change

With its built-in time clock, the eight-position date (DD-MM-YYYY) and the surveying functions, this instrument will accompany you safely well into the new millennium. You may programme GLP and ISO 900X functions such as service or validation intervals which alert the user in time to the necessary tests. The GLP mode assists you in carrying out the instrument validation. It contains the formula for calculating contents and recovery rates, the latter allowing to assess the systematic error or bias, i.e. the deviation from the reference value.

The KF reagent can be monitored with regard to the number of determinations carried out, its useful life span, drift value or capacity. Whenever the reagent has to be exchanged the corresponding request is issued automatically. To avoid mishaps of any kind there is the additional possibility of setting limits for the sample weight or volume and for the result. If one of these quantities lies outside the set limits, the corresponding warning message appears in the display and report and the «Remote» interface emits a signal.

Backup of user methods is important in a GLP-compatible lab and can be performed using the Metrodata VESUV PC programme. VESUV can moreover be used to collect results from one or more instruments and offers extensive database functions.



LCD screen of the 756 KF Coulometer with curve showing the titrated water as  $\text{m}(\text{H}_2\text{O})$  in microgrammes vs. the time in seconds



756 KF Coulometer equipped with a diaphragm cell and 728 Magnetic Stirrer after a water determination in an oil sample

## One press of a button for renewing the KF solution

If a Dosino is connected to the 756 KF Coulometer the spent solution can be siphoned off by simply pressing a button. This starts a preprogrammed sequence which runs in the background and transfers the titration vessel contents via the Dosino into the waste bottle. Subsequently, fresh reagent is added to the KF cell. As the cell does not need to be opened during this operation, no humidity enters the cell, which therefore is ready for the next determination in a very short time.

The above liquid handling steps can also be triggered manually using the 703 Titration Stand.



756 KF Coulometer with 700 Dosino for automatically aspirating the titration vessel contents and adding fresh reagent. Dosino and waste bottle are mounted on the 6.2055.100 bottle support.

### Flexible but easy to operate – no contradiction in terms!

Often it is felt that an instrument offering extensive capabilities cannot be easy to operate. The 756 KF Coulometer solves this problem by placing at your disposal an expert and a standard mode. In the standard mode only those functions are accessible that are needed in routine work. Operation in this mode requires very few keystrokes and is extremely easy. The user methods stored in the instrument ex works allow you to start your water determinations without further ado.

### Cell with or without diaphragm – the choice is yours

The 756 KF Coulometer is available with two generator cell types. The cell without diaphragm requires just one reagent and is virtually maintenance-free. It can be used for a large number of applications. The cell with diaphragm is especially recommended for determining water in aldehydes and ketones, for extremely low water contents and for samples whose conductivity is very low, for example oils.

### Method memory for many applications

Different applications demand different instrument settings. If the endpoint has to be adjusted to a different reagent or if an extraction time has to elapse before the start of the determination, the parameters can be adapted via the software and stored as a separate method. The integrated method memory holds about 100 methods. Using the Metrodata VESUV software, additional methods can be transferred to a PC via RS 232C interface and recalled at any time.



756 KF Coulometer with diaphragm-less cell and 703 Titration Stand for adding fresh reagent and aspirating the spent solution



Generator cells for the 756 KF Coulometer: left without diaphragm, right with diaphragm

### 768 KF Oven with additional features

The 768 KF Oven is used for samples that cannot be introduced directly into the KF cell. The new heating tube guarantees an optimal temperature distribution in the sample compartment. Temperature control is very accurate.

When the 768 KF Oven is used together with the 756 KF Coulometer the oven parameters are queried by the KF-Coulometer at the end of the determination and inserted into the result report. Thus, apart from the two connecting cables, no additional equipment is required to route the data to the built-in and/or a common printer.



756 KF Coulometer with 768 KF Oven

### 774 Oven Sample Processor – automation unlimited

The 774 Oven Sample Processor allows the application of the oven method to a series of liquid or solid samples. Typical samples are crude oil and oil products such as hydraulic oils, multigrade oils and used oils, as well as organic amines, toners, plastics, pharmaceuticals and freeze-dried products. Sample preparation is very easy – just seal the vial using the sealing tool. Contaminating samples present no problem as contamination is restricted to the sample vial. The instrument lets you achieve substantial savings both in reagents and time. The results are highly precise and detection limits very low.

The turntable accommodates up to 35 sealed sample vessels plus one conditioning vessel. The maximum sample volume possible with the «20 mm aluminium seal headspace vials» is approximately 3 mL. The sample to be analysed is moved to the appropriate position, lowered into the oven and the PTFE-coated septum of the sample vessel pierced by two tubes. One of these introduces dry air or an inert carrier gas into the sample vessel, the other serves to transfer the water driven off to the titration cell, which is mounted on the chassis of the 774 Oven Sample Processor together with a 728 Magnetic Stirrer.

As with the 768 KF Oven, the parameters of the 774 Oven Sample Processor can be printed out on the 756 KF Coulometer's built-in printer and/or on a common printer.



756 KF Coulometer with 774 Oven Sample Processor

The following Application Bulletins cover coulometric KF water determination:

	Application Bulletin no.
Bibliography concerning Karl Fischer water determinations	88
Karl Fischer water determinations	77
Karl Fischer water determination with the KF Drying Oven	109
Karl Fischer water determinations with the KF Coulometer	137
Analysis of edible oils and fats	141
Karl Fischer moisture determinations in gases	142
Determination of low water contents in plastics	145
Coulometric water determinations according to Karl Fischer in insulating oils, hydrocarbons and their products	209
Water determination according to Karl Fischer in pharmaceuticals, with the oven method*	217
Coulometric water determination in brake fluids according to the Karl Fischer method with automatic sample metering	236
Validation of Metrohm KF Coulometers	273

\* The volumetric KF method was used for these water determinations (701 KF Titrino). However, they can also be performed easily with a KF Coulometer provided the water content is not too high.

### Solvents

The determination of water in solvents can be carried out simply and quickly with the 756 KF Coulometer: inject the sample, read off the result, that is it! Even samples that react with the KF reagent can be determined subject to certain preconditions. For ketones and aldehydes special reagents are available on the market (only for cells with diaphragm).

Acetic acid	Liquid paraffin
Acetonitrile	Nitrobenzene
Benzene	Octanol
Chloroform	Petroleum ether
Cresols	Pyridine
Cyclohexane	Resorcinol dimethyl ether
Dioxan	Tetrahydrofuran
Ethanol	Toluene
Furan	Vinyl ether
Glycerol	Xylene
Hexane	
Isopropanol	

### Finished products

These products must be diluted or dissolved before determination. In the case of products that do not contain fats, this is done with methanol. A methanol-chloroform mixture is used for the fat-containing products. The water content of the solvent used is determined as a blank value, which is entered and deducted automatically when the result is calculated.

Aftershave lotion	Face lotion
Almond oil	Lipstick
Aperitif	Margarine
Butter	Mascara
Coffee cream	Mustard
Cognac	Sun cream
Cough syrup	Vinegar
Day moisturiser	Washing up liquid

### Industrial products, solids

These virtually always involve very low water contents. The liquid samples listed can all be injected directly. Benzoic and salicylic acid must be dissolved first. The KF Drying Oven, available as model 768 or 688, is used for determining the low water quantities in plastic granules. The KF Drying Oven is also used for water determination in other polymer products (plastic films) and solids (metal oxides and salts). Water determinations with the KF Drying Oven result in longer determination times owing to the modified procedure: The water is driven off thermally, which takes a certain time. However, thanks to the «drift stop» criterion of the 756 KF Coulometer, you can be sure that the determination is carried out as quickly as possible and supplies highly precise results.

Benzoic acid	Plastic films
Freons	Plastics granules
Gasoline	Salicylic acid
Insulating oil	Salts
Metal oxides	Silicone oil
Mineral oil	Sulphuric acid
Nitrogen	
Nonyl phenol	
Petroleum	

## Operating modes

KFC	Coulometric KF titration
KFC-B	Coulometric KF titration with blank deduction
BLANK	Blank determination
GLP	Validation of the Coulometer

## Endpoint indication

Voltametric, AC indication

$I_{pot}$  2, 5, 10, 20 or 30  $\mu$ A (adjustable)

## Iodine production

Pulses of variable length and current intensity

Current at the generator electrode

100, 200, 400 mA

## Titration rate

Max. 2.24 mg H<sub>2</sub>O/min

## Determination range

10  $\mu$ g to 200 mg H<sub>2</sub>O

## Resolution

0.1  $\mu$ g H<sub>2</sub>O

## Reproducibility

Sample: water standard from a reagent manufacturer

$10 \mu\text{g} \leq m(\text{H}_2\text{O}) \leq 1000 \mu\text{g}$   $\pm 3 \mu\text{g}$

$m(\text{H}_2\text{O}) > 1000 \mu\text{g H}_2\text{O}$   $\pm 0.3\%$  or better

## Drift compensation

Automatic, manual or none

## Materials

Housing Powder-coated metal

Keypad cover Polycarbonate (PC)

## Screen

Graphical LCD, 192 x 64 dots, backlit

Field: 100 x 37 mm

## Printer

Built-in thermal printer

Paper width 57 mm

144 pixels or 24 characters per line

## Memory

Method storage for approx. 100 methods

Silo memory for sample data and results

## Stirrer control

Switching on/off either manually or coordinated with the titration process

## RS 232 interface

2 separate interfaces, each can be configured for printer, balance or computer connection: completely controllable from external control unit

## Remote I/O lines

Connection for KF drying oven, 774 Oven Sample Processor, robot

With optional 6.2148.000 Remote Box: connection for barcode reader and PC keyboard

## Dosino connection

For automatic reagent exchange

## Ambient temperature

Nominal operation range 5 ... 40 °C

Storage -20 ... 60 °C

Transport -40 ... 60 °C

## Safety specifications

Designed and tested in accordance with IEC publication 1010, safety class I.

## Power connection

Voltage 100...240 V  $\pm$  10%

Frequency 50 ... 60 Hz

Power consumption max. 38 W

Fuse 2 x T1H 250 V (only to be replaced by Metrohm Service using the same type)

Additional electronic overload protection

## Dimensions

Width 145 mm

Height 194 mm

Depth 307 mm

## Weight, including keypad

Approx. 4.5 kg

### Ordering information

#### 756 KF Coulometer

Microprocessor-controlled Karl Fischer titrator with coulometric reagent generation for KF moisture determinations down to the lower microgram range in liquids, solids and gases. No titre determination required; with integrated printer

- Backlit LCD screen (graphical display)
- Easy to operate thanks to dialogue in English, French, German, Spanish, Italian, Portuguese, Swedish
- Internal memory for up to 100 methods
- With two bi-directional RS 232C interfaces (DB9) for balance, printer, PC
- Connection possibility for PC keyboard and barcode reader
- Option: Aspirating and adding fresh reagent by connecting a 700 Dosino

**2.756.0010** including titration cell **with diaphragm**, 728 Magnetic Stirrer and extensive accessories

**2.756.0110** including titration cell **without diaphragm** and extensive accessories (without stirrer)

The titration stand or magnetic stirrer is to be ordered separately:

**2.703.0010** Titration Stand with magnetic stirrer and pump for addition of solvents and siphoning of titration vessel contents

6.1439.010 Tube for addition or siphoning with the 703 Titration Stand (cell without diaphragm)

6.1805.200 Additional PTFE tubing with two M8 screw nipples for 703 Titration Stand

**2.728.0010** Magnetic Stirrer

### Options

#### 2.768.0010 768 KF Drying Oven

Auxiliary instrument for driving off the moisture of solid and liquid samples containing interfering or insoluble compounds. May be used with any volumetric or coulometric KF titrator. Automatic motor-driven sample transfer, built-in air pump and two gas drying flasks, external gas connection (e.g. N<sub>2</sub>), including accessories.

#### Accessories, consumables and spare parts for 768 KF Drying Oven

6.2141.010 Connecting cable for 768 KF Drying Oven (for automatic operation)

6.2125.110 Additional connecting cable for 768 KF Drying Oven (for report printout on 756 KF Coulometer)

6.1830.000 Heatable outlet tubing

6.1446.170 Stopper for heatable outlet tubing

6.1448.040 PTFE-coated silicone rubber septum (set of 5 items)

6.2415.000 Sample boat made of glass

6.2623.000 Aluminium inserts for the sample boat (set of 25 pieces)

6.2811.000 Molecular sieve, diameter 2 mm, pore dimension 0.3 nm, 250 g

6.2041.180 Instrument bridge for work with the 768 KF Drying Oven

6.5615.000 Equipment for measuring the sample temperature inside the 768 KF Drying Oven using an independent method (validation); with thermocouple, but without measuring instrument for type K thermocouples

#### 2.774.0010 774 Oven Sample Processor

Highly flexible instrument combining sample changer, oven and gas pump. Accommodates 35 sample vessels (20 mm aluminium seal headspace vials) and one conditioning vessel. Programming and manual operation via keypad equipped with a two-line LCD display. Including extensive accessories.

#### Remote Box, bottle support and connecting cables for PC, printers and balance

6.2148.000 Remote Box for connecting barcode reader and PC keyboard

6.2055.100 Support for two bottles, each max. 1 L, height adjustable; for reagent and waste bottle when using the 703 Titration Stand (not required when using the 700 Dosino and 6.5617.000 equipment, which contains the 6.2055.100 bottle support)

6.2125.110 Connecting cable for PC with 25-pin connector (DB25)

6.2134.040 Connecting cable for PC with 9-pin connector (DB9)

6.2134.050 Connecting cable for Citizen iDP56XRS, Epson LX, LQ, FX

6.2134.110 Connecting cable for Seiko DPU 414 (DB9)

6.2134.060 Connecting cable for Sartorius balances MP8 and MC1 (RS 232)

6.2125.020\* Connecting cable for Mettler balances AE 011/012 and for AND balances (use Mettler cable ME 33995 for Mettler balances AM, AT, PM and Mettler interface LC-RS25 for Mettler balances AB, AG)

6.2125.080\* Cable for Precisa balances

\* Requires 6.2125.010 adapter cable 25 pin to 9 pin

### Dosino and Dosing Unit for liquid handling (cell without diaphragm)

- 2.700.0020 Dosino**  
Burette drive with fixed connecting cable (mini DIN connector), to be mounted directly, together with the Dosing Unit, on reagent bottles with GL45 thread. Aspirates spent titrant and adds fresh reagent from the 756 KF Coulometer's cell
- 6.5617.000 Equipment for aspirating the cell contents, including 50 mL Dosing Unit and 6.2055.100 support for two bottles
- Metrodata «VESUV»**
- 6.6008.200** Metrodata «VESUV® 3.0», for up to 64 instruments
- 6.6008.500** Metrodata «VESUV® 3.0», for 2 instruments  
PC programme (Windows 95™, Windows NT™) for collecting titration data via RS 232C interface, storing of methods, printout of results, curve representation and recalculation of data. Database functions: filtering, searching and inquiries, data export (Excel, Lotus, LIMS, ...). Dialogue in English or German.
- 6.6008.205** Metrodata «VESUV® 3.0» demo version, for up to 64 instruments  
Demo versions are original versions with a time span of 100 days after installation. After the trial period you can purchase the «Hardware Dongle VESUV» to obtain unlimited user rights.
- 6.2145.050 «Hardware Dongle VESUV», for operation with 2 instruments
- 6.2145.040 «Hardware Dongle VESUV», for operation with up to 64 instruments



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