Megger

Megger KF-LAB Mk II

Moisture Meter

User Guide (v0816)

Contents

Chapter 1 Introduction

1.1 Instrument Description

The KF-LAB model has a small footprint, is easy to use, and supplied complete with a specifically designed low drift cell which is also suitable for outdoor use. The built-in battery and optional carry case, provide the versatility required by the laboratory and also the ease of use and portability required by the field engineer.

Aquamax KF reagents have been specially formulated for use with KF-LAB titrators. Reagent A (anode) is suitable for most routine applications and is especially useful for water content determination of oil samples, e.g. transformer oils, crude oils, etc. This anode reagent is supplied in “single shot” bottles of 100ml – No measuring of volumes required – No mixing of other solvents required. Reagent C (cathode) is supplied in “single shot” 5ml vials.

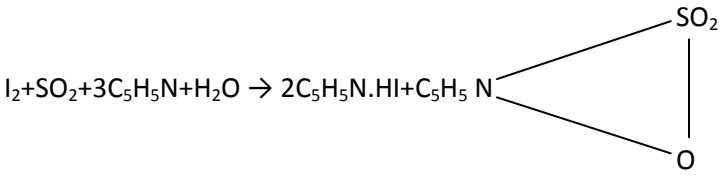
The carry case provides the portability required by the field engineer. The KF-LAB can be transported, complete with glassware assembled, ready for immediate use on arrival at destination. Power cords, syringes, etc., can all be carried inside the carry case lid which has a special compartment for this purpose.

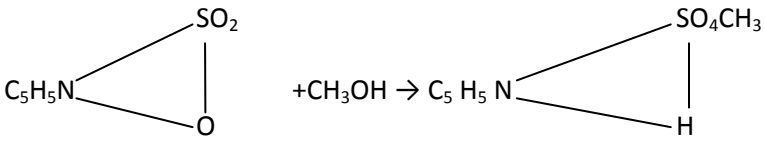
To obtain the full benefits that this instrument can offer it is recommended that you read this user manual before assembling the unit.

(All KF-LAB power supplies are double insulated units that do not need an earth (ground) connection. These units are sealed and conform to CSA(LR84459), UL listings and CE requirements. KF-LAB titrators only require a low voltage 15V input to the electronic / control circuitry. The moulded plastc casing of the instrument also provides additional insulation.)

1.2 Principle of Measurement

Karl Fischer titration is simply a means to measure water content of samples. Modern instruments, such as the Megger KF-LAB, use the Coulometric principle, whereby the water present in the sample is coulometrically titrated to a predefined end point at which there is a minute excess of free iodine present. Stoichiometrically, 1 mole of water will react with 1 mole of iodine, so that 1 milligram of water is equivalent to 10·71 coulombs of electricity. Combining the Coulometric technique with Karl Fischer titration, Megger KF Titrators determine the water content of the sample by measuring the amount of electrolysis current necessary to produce the required iodine. This is an absolute technique which does not require calibration of the reagents.

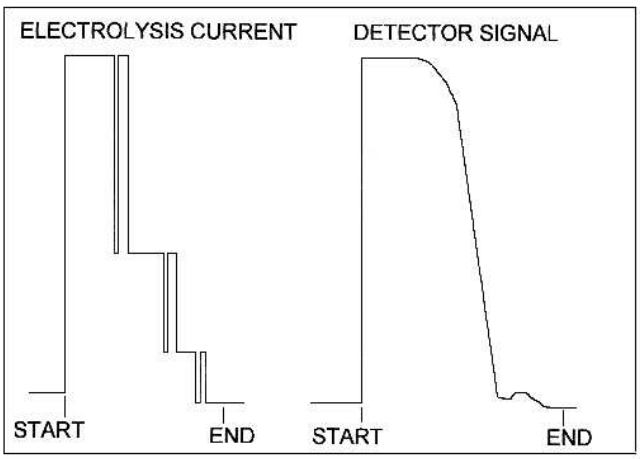




$$2l^{-} - 2e \rightarrow l_2$$

Using the latest pulse current technology and our patented “ACE” control system, (Patent No.GB2370641), the Megger KF-LAB automatically selects the appropriate titration speed dependent upon the amount of water present in the sample. The titration speed is reduced as the end point is approached, and when the titration is completed the instrument prints out and displays the results.

SCHEMATIC OF TYPICAL TITRATION



1.3 Instrument Connections

Various ports are located on the back plate of the instrument. Below is a list of ports that can be found:

(1) Power Supply Port

The power supply port is for connecting to an 18V mains power supply, using the supplied power adaptor.

(2) RS232 Port

For updating Titrator software, connecting to other equipment for remote controlling (software specific protocols to be provided).

(3) USB/A Port

For exporting results data to a Removable Flash Drive (memory stick), when running sample tests in the field or remote locations, and subsequent transfer to PC at a later date for loading onto Results Manager files.

(4) USB/B Port

For connecting directly to PC to export data to Results Manager and enable results to be saved on files for future reference. (See Results Manager User Manual section).

Chapter 2 Safety Information

2.1 General Safety Points

This product is in conformity with the EU Directives 2004/108/EC and 2006/95/EC. This is based upon the compliance of the products with the harmonised standards: BS EN 61000-6-1:2007; BS EN 61010-2-030:2010; and BS EN 61326-1:2013.

This product is manufactured in accordance to RoHS following the EU Directive 2011/65/EU; it does not contain any of the restricted substances in concentrations and applications banned by this directive.

2.2 Electrical Safety

The Megger KF-LAB Moisture Meter complies with the international standard IEC 61010. Only operate this instrument within the mains voltage supply that is specified on the back of the instrument, an incorrect mains supply can damage the instrument. Never open the housing of the instrument, only GR Scientific personnel who are trained to service the instrument can open the housing. There is risk of electrocution if live components are touched.

Always ensure the instrument is disconnected from the mains power supply when connecting or disconnecting cables from the back of the instrument, as electrostatic discharge can build up.

2.3 Solvent and Chemical Safety

When using flammable or irritant solvents and chemicals, follow suitable safety measures to protect yourself and others around. Always use the instrument in a well ventilated area, clean up spilled fluids immediately, and keep flame sources away from the work area. Always follow the safety instructions of the chemical manufacturer and apply the correct countermeasures that are required.

2.4 Recycling and Disposal

This instrument is covered by the WEEE (Waste Electronic and Electrical Equipment) Directive 2012/19/EU to prevent the negative and harmful effects on the environment and public health. For more information on how to dispose of the instrument safely, please contact your local authority, your local waste disposal company or Megger directly.

Chapter 3 Instrument Set Up

3.1 Receiving a Megger KF-LAB

3.1.1 Packaging

The Megger KF-LAB is packaged in suitable protective packaging to ensure that no damage occurs during transit, only this packaging is suitable for the safe transportation during transit. Please keep this packaging as transit of the instrument may need to occur in the future.

3.1.2 Checks

Once you have received the instrument, immediately check to make sure that there is no damage and no parts are missing. A delivery note will be included within the package to use to compare with the shipment.

Ensure that inside the shipment has a calibration certificate for the instrument, if not please request this from the manufacturer.

3.1.3 Location

Locate the instrument within the work area where it is free from excessive:

- vibrations
- direct sunlight
- contamination from chemicals
- explosive environments
- corrosive atmospheres
- major temperature fluctuations

3.2 Connecting the Power Supply

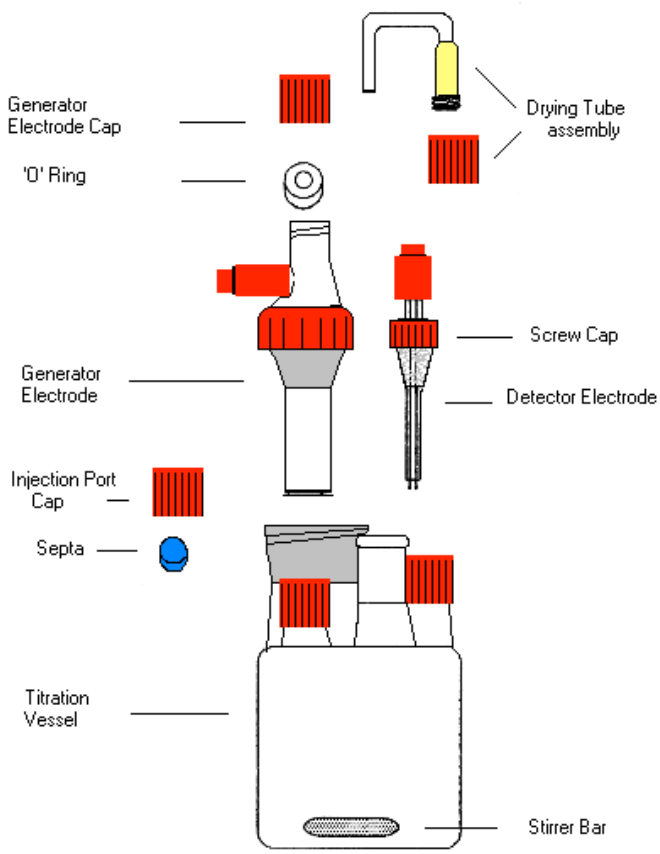
The Megger KF-LAB is powered by an external mains source, with a power pack to ensure this connection is the correct voltage of 18V DC for the instrument.
Damage may occur beyond repair and the user may be subjected to electric static shocks if the incorrect power is supplied.

Note: Refer to Chapter 2 for more safety information.

To avoid risk of electrocution, make sure the I/O switch is set to OFF before connecting the power supply.

3.3 Setting Up the Glassware

3.3.1 Glassware Assembly

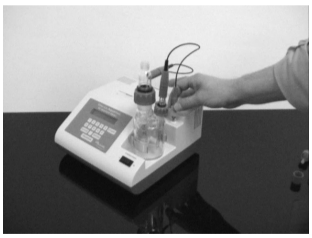


3.3.2 Connecting to the Megger-KF LAB Moisture Meter

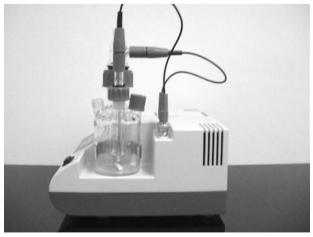
(1) Position the titration vessel on the Titrator.

(2) Position the electrodes on the titration vessel and tighten by hand.

Note: The glass joints do not require PTFE sleeves or grease. The special screw fittings seal the vessel from the atmosphere and are easily released, even after several weeks.

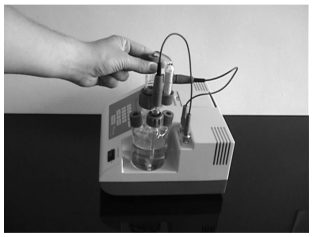


(3) Connect the generator and detector leads to the vessel and then to the BNCs.



(4) Place the stirrer bar inside the titration vessel.

(5) Fit injection septas into the injection port caps and screw tightly by hand onto the injection ports.



(6) Position the drying tube with desiccant and tighten by hand.

The assembled titration cell is now ready to be charged with reagents prior to use. Please be sure to assemble correctly every time the cell is cleaned or re-filled. It is recommended that the Titrator is **NOT** switched on until after the titration vessel has been charged with reagents. This will avoid damage being caused to the electrodes by the stirrer bar. Avoid twisting the electrode leads otherwise they may become damaged.

3.3.3 Filling and Changing Reagents

Megger KF-LAB Titrators have been designed to operate with all major Coulometric Karl Fischer reagents. For most routine applications generator electrodes with frit/diaphragm are used in conjunction with 100ml of anode reagent and 5ml of cathode reagent. We strongly recommend using Aquamax KF A and C Reagents as these have been specially formulated for oil samples.

When analysing Transformer oils, Crude oils and other petroleum products, there are specially formulated anode reagents which contain other solvents to improve sample miscibility and solubility are recommended. There are also single Coulometric reagents available for use with fritless generator electrodes. Although we do not recommend these for oil sample analysis.

Note: When analysing samples of Ketones, amines or others which may interfere with the reaction it is advisable to use specialised reagents which can be obtained from various suppliers.

Although reagents can be poured into the titration vessel whilst it is located on the Titrator, we recommend that the vessel, electrodes and electrode leads are removed from the instrument whilst this procedure is performed to avoid reagent spillage onto the instrument casing.

Note: Any spillage onto the instrument casing should be wiped off immediately to avoid damage or staining.

Remove the drying tube and injection septa. Using the funnel supplied, charge the titration vessel with 100ml anode reagent (this is approximately to the bottom line on the vessel).

Also using the funnel, charge the inner chamber of the generator electrode with 5ml of cathode reagent. (This is not required if using fritless generator electrode).

Note: It is not necessary to clean the funnel between reagents.

Reconnect the drying tube and injection septa so that the titration vessel is sealed from ingress of atmospheric moisture.

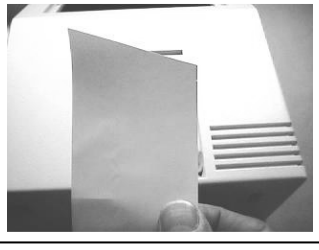
Locate the complete titration vessel onto the Titrator and connect the electrode leads onto the appropriate sockets

There are some bi-products formed in the cathode chamber which can react with the iodine in the anode chamber and this can cause longer preconditioning times. It is advisable to have the cathode reagent 2- 3mm lower than the anode reagent when first charging the titration vessel to speed up preconditioning.

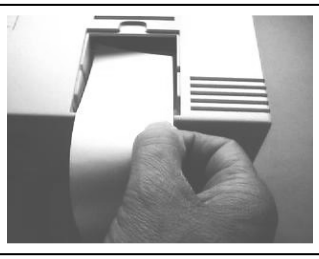
The Megger-LAB Titrator is now ready to be switched on.

3.4 Loading the Printer

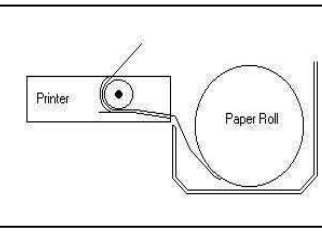
To load the paper into the printer, first open the paper roll holder lid above the print head and remove the old roll and rollers. Now fit rollers to new paper roll, load as shown and insert the paper into the slot at the rear of the print head. As soon as the printer sees the paper it will automatically load it. To avoid damage to the printer mechanism it is advisable to only use the correct part number thermal paper rolls.



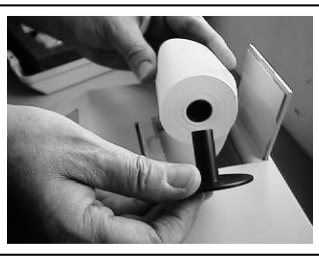
Cut the end of the paper roll at a slight angle as shown. This will make it easier to feed into the printer mechanism.



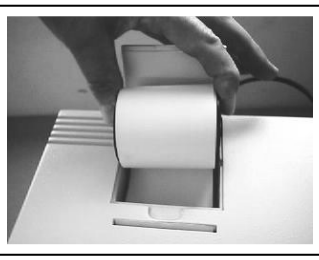
The mechanism has optical sensors which detect the paper and will auto feed.



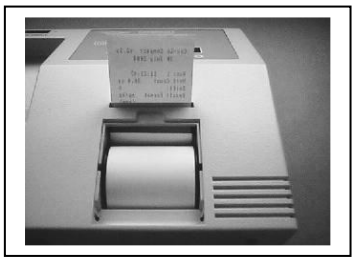
Schematic of paper feed.



Fit the paper bobbin onto both sides of paper roll.



Locate paper roll into the compartment.



3.5 Connecting a USB Device

To use the memory store, insert Flash Drive into USB port A, the Titrator will see it and a symbol will appear on the display.

The symbol will appear blacked out while the drive is being written to and then clear when idle.

The drive should only be removed when in the idle mode.

To read data saved on the drive insert it into a PC USB port. Start Results Manager, load selected file and then save in the format you require. Refer to Chapter 7 Results Manager.

Chapter 4 Basics of Operation

4.1 Switching ON and OFF

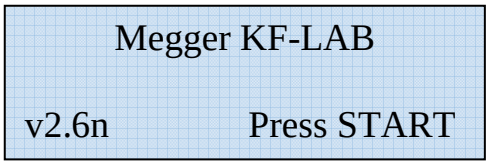
The Megger KF-LAB Moisture Meter has one I/O switch and is powered by either a mains power supply using an adaptor, or a built-in battery for power.

Note: Refer to Chapter 3.2 for power supply connections.

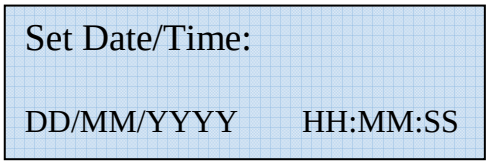
To avoid risk of electrocution, make sure the I/O switch is set to OFF before connecting the power supply from a mains source.

4.2 Setting the Date and Time

(1) Switch on the Megger KF-LAB and wait for it to display the following:



(2) Hold down the [START] key until the Megger KF-LAB displays:



(3) Use the [.] move the cursor across the screen.

(4) Use the numerical keys to set / alter the required number.

(5) When completed press the [ENTER] to save the changes and exit.

4.3 Preconditioning

(1) Assemble glassware (see Assembly Instructions)

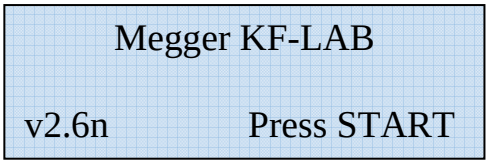
(2) Charge vessel and generator electrode with reagents (see Filling & Changing Reagents)

(3) Locate assembled titration vessel onto the Megger KF-LAB

(4) Connect the electrode leads

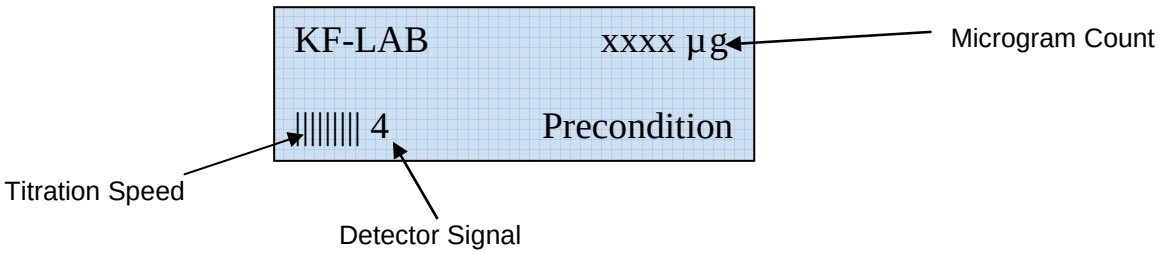
(5) Connect mains lead / power cord

(6) Switch ON (using switch on rear panel) and wait for display to show:

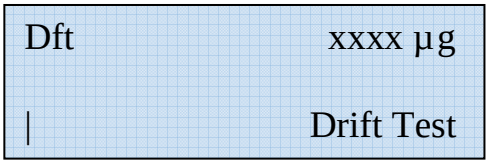


Note: If required adjust the stirrer speed using the arrow keys on the front of the instrument.

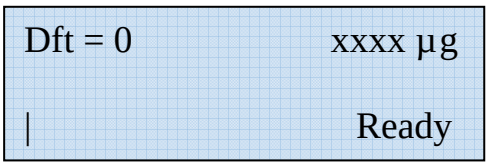
(1) Press [START] and allow the instrument to precondition (equilibrate).



At the end of the precondition period the display will show:



After the initial drift has been calculated, in micrograms of water per minute, the Megger KF-LAB is ready for operation.



The background drift value will usually slowly decrease with time as the titration vessel becomes drier and more stable. Although it is possible for the Titrator to be used at high drift values, it is advisable to wait until the drift value is below 20 µg/minute, and stable, before commencing, especially for low water content samples in the ppm ranges.

The lower and more stable the drift – the more accurate the result.

4.4 Program Functions

When the Megger KF-LAB displays Ready you can enter titration parameters, recall or edit existing methods, enter new method files, etc., by using [PROGRAM], [ENTER], [CLEAR], and [.].

KEY	FUNCTION
[PROGRAM]	Press [PROGRAM] to scroll through menus listed.
[ENTER]	Allows parameter values for the displayed menu to be entered into memory.
[CLEAR]	1. If you have finished entering data, press [CLEAR] to return to the Ready condition. 2. If you have started to enter an incorrect value, press [CLEAR] to return to the previously stored value.
[.]	Scrolls through individual parameters in each menu. When the required parameter is display, press [ENTER] to store it.

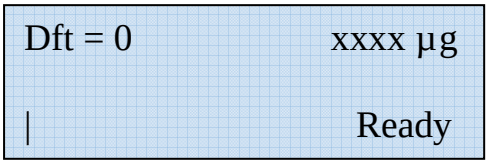
Menu List

Sample ID Number	up to 8 digits
Recall Method	method number 1 – 9
Result Format	µg, ppm, mg/kg or % water
Calculation Mode	V/SG, W/W, W/K or V/v
Sample Volume	up to 100000000ml
Specific Gravity	up to 100000000
Printer Mode	off, every result or full report
Statistics Print	up to 99 runs, will print min., max and mean.
Print Drift	on or off
Start Delay Time	up to 30 minutes
Min. Titration Time	up to 30 minutes
End Sensitivity	0 – 9 seconds
Beep Mode	off, key press, end titration or both
Language	select language
Generator Electrode	with frit, without frit
Save Method	store up to 10 methods

Note: See Chapter 4.5 Programming A Method for an explanation of each Menu List parameter.

4.5 Programming a Method

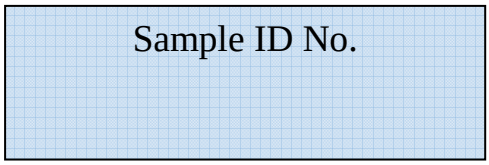
After the initial drift has been calculated, in micrograms (µg) of water per minute, the Megger KF-LAB is ready for operation. It is now possible to step through the PROGRAM parameters and enter the required calculation data.

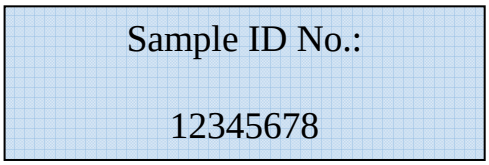


Press [PROGRAM] until the required option is displayed. Pressing [PROGRAM] will move you on to the next prompt, pressing [CLEAR] will return to Ready condition. It is not necessary to step through all of the programme functions for every method, for example, if you only require to change the Beep Mode from Off to Both – simple press [PROGRAM] until display shows Beep Mode, press the [.] until display shows “Both”, then press [ENTER] and [CLEAR] to return to Ready.

Sample ID Number

Press [PROGRAM] Display will show: Key up to 8 numbers: Press [ENTER]



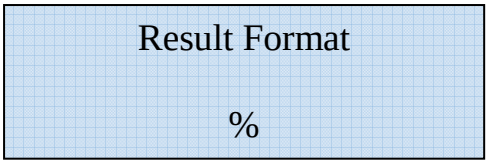


If you do not want to enter any further parameters simply press [CLEAR] to go back to the Ready condition.

Press [PROGRAM] if you want to continue entering other parameters.

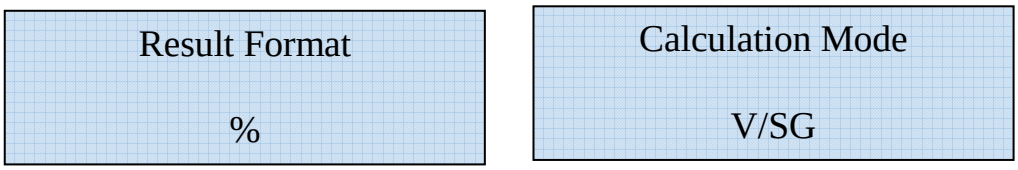
Result Format

Press [PROGRAM] Display will show:



Results can be selected in µg, ppm, mg/kg or % water.

If you want to select the format already stored in memory, and shown on the display, press [PROGRAM] and the instrument will go to the next prompt. If you want to change format to give results in ppm, mg/kg or % you can scroll through these options by pressing [.] until the required format is displayed, and then press [ENTER] to store this in memory and [PROGRAM] to move onto the next prompt. If you have selected a result format in ppm, mg/kg or % the instrument will prompt you for the necessary calculation mode and data values.



The display shows the calculated water content according to the programmed Result Format and Calculation Mode program settings, i.e. whatever has been chosen to be shown/printed at the end of the titration. The only exception to this is in the W/w mode when the Tare Weight has not yet been entered. In this case the display will show the µg count. The [PROGRAM] key can be used to enter the Tare Weight at any time during the titration; once this has been done the display will start to show the calculated result in ppm, mg/kg or % water.

Calculation Mode

Megger KF-LAB Titrators have four standard calculation modes in memory. Each of these allow the instrument to divide the microgram count by the gram weight of sample introduced so that the calculated result can be printed out in either ppm or percentage of water.

- Press [.] to scroll through the options that are available.
- Select the calculation mode required and press ENTER.
- The display will prompt you with the appropriate parameters.
- Enter the numerical value for each parameter and press ENTER.

The four standard calculations are:

1. Weight difference W/w

Note: This is the most accurate calculation and is suitable for almost all types of samples, powders, liquids, gases, etc.

$$\text{Result (ppm or \%)} = \frac{\text{microgram count}}{W - w}$$

Where: W = Total weight of sampler + sample (gm)

w = Tare weight of empty sampler (gm)

After entering the total weight (W) the instrument will return to the Ready condition. The Tare weight (w) can be entered at any time during the titration by pressing [PROGRAM], or at the end of titration. For ease of operation it is possible to enter the Total weight (W) as 0.0000gm, then place the full sampler on the balance and tare to zero.

Thereafter it is only necessary to enter the weight difference (tare weight, w) for each titration. This procedure reduces potential data entry errors.

2. Weight/Dilution ratio W/K

Note: Use this method if you need to dissolve a sample in another solvent. Suitable for samples which will not dissolve in the anode reagent or which might interfere with the KF reaction).

$$\text{Result (ppm or \%)} = \frac{\text{microgram count - bl}}{W} \times K$$

Where:

W = Weight of sample dissolved (gm)

$$K = \frac{\text{Total volume of diluent + sample}}{\text{Volume injected into Aquamax KF}}$$

bl = micrograms of water for same injected volume of diluent (µg)

e.g.
Accurately weigh approximately 2 gm of sample into a 20ml stoppered graduated flask. Make up to the volume line with suitable solvent / diluent. Using appropriate syringe inject 100µl of diluted sample into the titration cell.

Calculation parameters for this example would be:

W = 2 gm

$$K = \frac{20\text{ml}}{100\mu\text{l}} = 200$$

bl = microgram count of 100µl injected volume diluent

3. Volume / Specific Gravity V/SG

Note: The most widely used technique for liquid samples. However, care must be taken to ensure removal of all air bubbles from the syringe.

$$\text{Result (ppm or \%)} = \frac{\text{microgram count}}{V \times SG}$$

Where:

V = volume of sample (ml)

SG = specific gravity

4. Volume V/v

$$\text{Result \% volume} = \frac{\text{microgram count}}{V \times 1{\cdot}0}$$

Where:

V = volume of sample (ml)

This is essentially the same as V / SG mode, except that the sample SG is fixed at 1·0.

Printer Modes

Selecting this program allows the printer to be turned ON or OFF. It also enables you to print out the titration parameters being used at that time. Simply scroll through the options using [.] until the required mode is displayed, then press ENTER.

Options available:

Off - No result print out.

Every Result - Will print result after every titration, first result also prints all calculation input data.

Full Report - Will print results after every titration and then print out statistical data after a selected number of titrations.

Statistics Print

The Megger KF-LAB can be programmed to print out the statistical data from a series of results when using “Full Report” print mode. If no number has been selected, the instrument will automatically clear after 99 runs. If 3 or more runs have been selected the instrument will print out the minimum, maximum and mean values.

Print Drift

The Megger KF-LAB can be programmed to print out the drift value for each titration. This is a useful indicator of titration cell stability. If drift is above 25 µg / minute print will show **XX**. This is a warning that a high drift value was present at start of the titration.

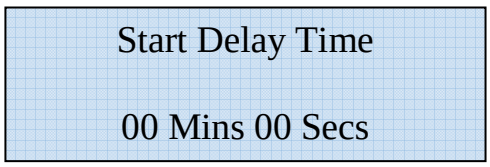
Delay Times

The Megger KF-LAB has been programmed to accept two different types of delay times, one at the start of titration and one at the end as a minimum titration time.

Start Delay Time

The Megger KF-LAB has a preset delay of five seconds which allows samples to be dispersed into the reagents before the titration starts. Some samples, particularly powders and viscous samples may need additional time to fully dissolve. By selecting the start delay program, you can increase this time by up to 30 minutes.

Display shows:



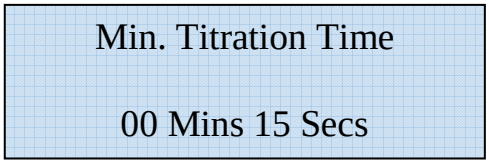
Select required time delay and press [ENTER].

Whilst a delay time is in operation, the display will show “add sample” and the clock counter will show the time remaining before the start of titration. A start delay can be overridden by simply pressing [START].

Minimum Titration Times

For some applications, such as certain gas samples or when using the Megger KF-LAB combined with an oil evaporator or solids evaporator system, it can prove useful to delay the end point of the titration. By selecting this parameter you can increase the minimum titration time by up to 30 minutes.

Display shows:



Select required minimum time and press [ENTER].

End Sensitivity

The sensitivity of detector signal as the end point is approached can be set from 0 – 9 seconds. The default value is 3 seconds and there are very few occasions when this may need to be altered.

Decreasing this value can prove useful if samples cause interference, e.g. some Lube Oil samples.

Beep Mode

Four options are available for the audible alarm (beeper) and they can be scrolled through using [.] until the required one is displayed. Then press [ENTER].

The options are:

Off	-	Beeper inactive
Key Press	-	Beep once every time a key is pressed
End Titration	-	Beep three times at the end of a titration
Both	-	Beep after every key press and three times at the end of a titration

Language

The Megger KF-LAB can be programmed to show all display prompts and print outs in various languages. Use [.] to select language then press [ENTER].

Generator Electrode

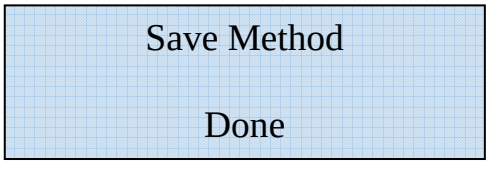
The Megger KF-LAB can be operated using generator electrodes with or without frit (diaphragm). Use [.] to select either with or without frit then press [ENTER]. The titration electrolysis current settings are automatically adjusted for each style of generator and appropriate reagents.

Save Method

If you want to save a method for future use, this can be done by pressing a numerical key, 0 - 9, and then [ENTER].

All titration parameters, printer mode, beeper mode, etc. are stored automatically.

Display then shows:



Then press [CLEAR] and the instrument will revert back to the Ready condition.

Recall Method

If any methods have been saved to memory then the first prompt (before Sample ID number) will be “Recall Method.” When this prompt is displayed, simply press the number of the method file you wish to recall and press [ENTER]. There are 10 method files available numbered from 0 to 9. The titration parameters etc. will all be automatically recalled. Press [PROGRAM] to view the recalled method parameters or press [CLEAR] and the instrument will go back to the Ready condition.

If you do not want to recall a method, press [PROGRAM] to view the next prompt.

Chapter 5 Running a Test

5.1 Example Applications

Liquid Samples

Liquid samples are usually introduced into the titration vessel by using a syringe. The greater the amount of water introduced into the titration cell will cause the titration to take longer and also consume the reagents more quickly. It is recommended that the smallest representative amount of sample be used to ensure fastest titration speed and maximum sample throughput before reagents have to be replenished. Optional gas tight syringes and luer needles are available on request. With volumes of 0.25, 1.0 and 5.0ml these are suitable for injection of oil samples and water standards. Other volume syringes are commercially available from various suppliers. Please ensure that the needle is long enough to reach into the anode reagent.

This guide may be of assistance when selecting injection volume of samples:

Expected Water Content		Suggested Sample Size	
From	**To**	**From**	**To**
1 ppm	10 ppm	1.0 ml	2.0 ml
10 ppm	100 ppm	1.0 ml	2.0 ml
100 ppm	500 ppm	0·5 ml	1.0 ml
500 ppm	1000 ppm	0·5 ml	1.0 ml
0·001 %	0.01 %	1.0 ml	2.0 ml
0·01 %	0.1 %	1.0 ml	2.0 ml
0·1 %	0.5 %	0·5 ml	1.0 ml
0·5 %	1.0 %	0·5 ml	1.0 ml
1·0 %	5.0 %	0·2 ml	0.2 ml
5·0 %	More Than	Less Than	0.1 ml

Note: These volumes are only a guide. You may wish to experiment with sample size to determine the optimum balance between repeatability, reagent depletion and speed of analysis.

Crude Oils

(IP 386 & 438, ASTM D1533, D4928, D6304, API MPMS Chapter 10.9, ISO 10337 & 12937)

Most Coulometric reagents contain Methanol as the main solvent and as such it is possible that waxy deposits from crude oils can “drop out” and contaminate the electrodes, requiring more frequent and thorough cleaning of the glassware. This problem can be reduced by using Aquamax KF Reagent OIL anode reagent which has been specially formulated for this application. The most common interference in crude oil samples is usually caused by Mercaptans or Sulphides. Samples containing alkyl groups will react stoichiometrically so that:

- 100 ppm Mercaptans would show as approximately 30 ppm water
- 100 ppm Sulphides would show as approximately 50 ppm water

In normal practice oils containing less than 500 ppm Mercaptans or sulphides are regarded as having no appreciable effect. Repeatability problems are usually caused by sampling inaccuracies or improper homogenisation of the sample.

Transformer/Insulating Oils

(ASTM D 1533, BS EN 60814, IEC 60814)

Due to the viscosity of these samples, and the fact that typical water content levels are in the range 5 – 40 ppm, it is usually necessary to inject sample volumes of 1 ml. This means that up to 50 samples would fill the titration cell. Provided that the other criteria governing reagent life, (total water titrated and reagent age), have not been reached, then it is possible to switch off the Titrator and allow the oil to separate from the reagent. The oil can then be siphoned off and the instrument switched on again. After this operation it may take up to 30 minutes before the instrument settles down to a stable baseline. If it takes longer than 30 minutes then it is advisable to clean the cell and recharge with fresh reagents.

Turbine/Lubricating Oils

For most Lube Oil applications a sample size of 1ml is sufficient. However, if it is suspected that the water content is above 1 %, then a sample size of 0·2 to 0·5 ml is suggested.

Some lubricating oils contain additives which can react with the KF reagents interfering with the chemical reaction. For these applications we suggest using the Megger KF-LAB in conjunction with an oil evaporator as per ASTM D6304.

Ketones and Amines

These can react with the Methanol present in most Coulometric reagents resulting in inaccurate results and, in extreme conditions, titration end point being unattainable. For samples containing Ketones, amines or Aldehydes the use of specially formulated Coulometric reagents for Ketone samples is recommended.

Powder Samples

One of the main advantages of the Coulometric technique is that reagents do not have to be replenished after every analysis; therefore the introduction into the titration cell of solid samples, which do not dissolve, is not recommended.

Three options available:

- Powder samples which readily dissolve in the Anode reagent can be introduced using the optional powder sampler, part no. 503069. Calculation mode W/w.
- Powder samples which cannot be dissolved in the Anode reagent should be extracted or dissolved in a suitable solvent and then an aliquot injected. Calculation mode W/K.
- If neither of above methods are suitable you may need to use a solids evaporator system in conjunction with the instrument.

Gas Samples

Gas samples can be introduced by fitting a needle onto the gas sampling cylinder and selecting Calculation mode W/w.

Alternatively, gas samples can be bubbled through the titration vessel and the passed volume measured. For this method we suggest using the gas analysis kit and a wet gas flow meter connected to the outlet of the titration vessel.

(1) Fit the gas inlet and outlet adapters in place of the injection septa.

(2) Remove the drying tube and seal the top of electrode using the injection port septa and screw cap.

(3) Connect outlet adapter to wet gas flow meter.

(4) Flush the sample lines and allow instrument to stabilise.

(5) Press [START] and allow gas sample to flow through the cell at an approximate flow rate of 0·5 litres/minute.

(6) Turn off gas flow and allow titration to reach end point.

Calculation

$$W = \frac{G \times (273 + t) \times 22{\cdot}4}{V \times 273 \times 18}$$

Where:

W	=	Moisture content
G	=	Microgram count
V	=	Gas volume, litres
t	=	Water temperature of wet gas flow meter (°C)

5.2 Water Standard Test

In principle, standardization of a Megger KF-LAB is not necessary since the water titrated is a direct function of the coulombs of electricity consumed. However it is recognised that reagent performance can deteriorate with use over time and it is recommended that the Titrator is regularly monitored by introducing a known quantity of water that is representative of the typical range of water concentrations being determined in samples. Several of the ASTM methods for water content of crude oil and petroleum products suggest injecting between 1.0 µl and 10 µl distilled water to check reagent performance.

Each of these methods requires that the result be recorded in micrograms of water, not as a calculated ppm or percentage.

5.3 How to Run a Test

Note: Read Chapter 4.4 Programming a Method before running any samples.

Example: Transformer oil sample by V/SG

Program the Megger KF-LAB with parameters for the analysis. For Transformer Oil samples, these parameters are usually:

Result Format	=	mg/kg or ppm
Calculation Mode	=	V/SG
Sample Volume	=	1.0 ml
Sample SG	=	0.875

Other parameters such as Sample ID number, Printer Mode etc. are optional.

Analysis Method

(1) Confirm that the Megger KF-LAB is in Ready mode.

(2) Flush 1.0ml syringe several times (minimum 6 times) with sample.

(3) Fit luer needle and flush through with sample.

(4) Draw sample into syringe beyond the 1.0ml marking.

(5) Invert syringe so that any air bubbles can be ejected through the needle and adjust syringe plunger to the 1.0 ml mark.

(6) Wipe off excess sample from outside of needle using a clean, dry tissue or paper towel.

(7) Pierce needle through injection septa of titration vessel (1 – 2 cm).

(8) Press START.

(9) Push needle into anode reagent and inject sample.

(10) Withdraw needle from titration vessel.

(11) Read result, in mg/kg (ppm) water, on display and printout.

(12) Repeat steps 2 – 11 if duplicate result required.

Example: Powder sample by W/w

Program the Megger KF-LAB with parameters for the analysis.

1. Analysis Method

(1) Confirm that the Megger KF-LAB is in Ready mode.

(2) Place a suitable amount of sample in the powder sampler and seal with stopper provided.

(3) Weigh sampler.

(4) Press [PROGRAM] until Calculation Mode is displayed then select W/w.

(5) Enter the sampler weight when prompted by display, then press [ENTER] / [CLEAR].

(6) Remove the injection septa port, press [START], and pour the sample inside the titration vessel ensuring that sample does not stick to the inside of the vessel wall. Replace injection septa port.

(7) Reweigh the sampler.

(8) The net weight of sampler can be entered either during the titration by pressing [PROGRAM] or waiting until the end of titration when display will prompt TARE Weight. Enter the weight then press [CLEAR].

2. Analysis Method

(1) Confirm that Megger KF-LAB is in the Ready mode.

(2) Place a suitable amount of sample in the powder sampler and seal with stopper provided.

(3) Place sampler on balance and tare to zero.

(4) Press [PROGRAM] until Calculation Mode displayed then select W/w.

(5) Enter the sample weight as 0.0 grams, then press [ENTER] / [CLEAR].

(6) Remove the injection septa port, press [START], and pour the sample inside the titration vessel ensuring that the sample does not stick to the inside of the vessel wall. Replace injection septa port.

(7) Reweigh the sampler.

(8) The weight difference of sampler can be entered either during the titration by pressing [PROGRAM] or waiting until the end of titration when display will prompt TARE Weight. Enter the weight then press [CLEAR].

5.4 Drift Rate Compensation

At the start of any titration, the drift value in the top left corner of the screen (in micrograms per minute), is stored in memory. This ensures that the displayed result is corrected for any ingress of atmospheric moisture during the titration period.

Whilst in the Ready condition, the Megger KF-LAB continually compensates for any drift caused by atmospheric moisture ingress or reagent decomposition and displays this information, which is updated every 10 seconds. If the drift value is above 30 µg /minute the display will show “Drift Warning START to continue.” This is a warning that the value is high, however the instrument can still be used by simply pressing [START] to continue.

Provided the drift rate is stable then it usually acceptable to continue operation. The Aquamax titration cell design can provide drift values down to less than 5 µg /minute but can also operate at much higher values. The maximum drift value is 60 µg /minute but we recommend operating up to a maximum of 25 whenever possible.

If the drift value is above 60 µg per minute the display will read:

“EXCESS DRIFT - SEE INSTRUCTION MANUAL”

Most common causes of excess drift are:

- Titration vessel not properly sealed (check septa & fittings)
- Reagents almost depleted (clean & recharge the cell)

- Sample introduced before pressing [START] key
- Trace moisture on cell walls

If excess drift occurs, switch the instrument off, remove titration cell from clamp, gently swirl the anode reagent around the cell walls, replace cell in clamp, switch instrument on and allow to precondition.

5.5 Overtitration

If the detector electrode senses too much Iodine in the titration cell, usually caused by instrument being left unoperated for a long period, the display will read :-

“OVERTITRATION - SEE INSTRUCTION MANUAL”

Simply add 3 - 5 microlitres of water, or a small amount of a known wet sample, until the detector signal bars on bottom left of display are activated. Then the instrument will automatically carry out its precondition.

Chapter 6 Results

6.1 Printout Explanation

The Megger KF-LAB allows you to select different print modes. If you choose to have the printer on, you will receive a hard copy of the result obtained, together with the selected parameters for that particular titration every time a titration is performed.

Options Available:

Off - No result print out

Every Result - Will print result after every titration, first result also prints all calculation input data.

Full Report - Will print results after every titration and then print out statistical data after a selected number of titrations.

The Megger KF-LAB automatically increments the next run number every time you press the start button. The run counter is reset to zero when power is switched off and back on again. A duplicate set of results can be printed out simply by holding down the start button for 3 seconds.

Results memory is cleared after duplicate print out or when power is switched off.

Print Out Examples

Example of V/SG Calculation

Megger KF LAB		
		V xxxx
Serial No.		71000
Calibrated		DD/MM/YYYY
	Run Date	
Run: 1	Run Time	F
Nett Count		0.0 µg
Drift		00
Result Format		%
Calculation Mode		V/SG
Volume		1.0000 ml
Density		1.0000
Res:		0.0000%
Run: 2	Run Time	
Nett Count		0.0 µg
Drift		00
Res:		0.0000%

- Titrator model
- Software version
- Titrator serial number
- Date Titrator calibrated
- Date sample run
- Run no. and time of analysis (F = generator with frit)
- Nett microgram count (after drift correction)
- Drift value at start of titration
- Result format selected
- Calculation mode selected
- Sample volume
- Sample density
- Calculated result water content
- Subsequent runs of the same sample and calculation parameters show run number, run time, nett count.
- Drift value and calculated result.

Example of W/w Calculation

Megger KF LAB		
		V xxxx
Serial No.		71000
Calibrated		DD/MM/YYYY
	Run Date	
Run: 1	Run Time	N
Nett Count		0.0 µg
Drift		00
Result Format		%
Calculation Mode		W/w
Total Weight		0.0000 gm
Tare Weight		0.0000 gm
Sample Weight		0.0000 gm
Res:		0.0000%

- Run number & time of analysis (N = generator no frit)
- Nett microgram count (after drift correction)
- Drift value at start of titration
- Result format selected
- Calculation mode selected
- Weight of syringe plus sample
- Weight of syringe after sample injected
- Weight of sample analysed
- Calculated result water content

Chapter 7 Results Manager

7.1 Description

Results Manager is a Windows application that allows you to view and print sets of results created by the Coulometric family of Karl Fischer Titrators. It can download results directly from the Titrators through a serial port connection, or open result files previously saved to disk.

The Coulometric family of Titrators provide a serial interface for the download of test results to our own PC software package, Results Manager, or to third party software running on any equipment with a serial port capable of running at 9600 bps in asynchronous mode. The Titrator serial port is configured as a DTE, so connection to a standard PC serial port is achieved using a crossover, or "null modem" cable. The Titrator serial port is activated by raising the DCD input pin; this would normally be carried out under control of the software package at the remote end of the link.

Data is transmitted by the Titrator in plain ASCII text, with records terminated by a Carriage Return (CR) character. Each record starts with a letter to identify the record type (e.g. Product type and version, Configuration parameter or Result data), a number to identify the exact information contained and one or more items of actual information. Records must be acknowledged by the receiver using a simple positive response record, or they will be retransmitted after a timeout delay; this allows the Titrator to move on and send the next record, and causes it to indicate that connection has been established using a special character on its display. The receiving application may also send a negative response to reset the serial interface, causing the entire current set or results to be retransmitted.

Results Manager Package Comprises of:

Software Disk

Interface Cable (connects Titrator to computer USB port)

512MB USB Flash Drive Memory Stick

7.2 Installation

When the Results Manager CD is inserted, it will automatically open an AutoPlay screen in order to install the application.

Note: PCs must have Windows 7 or higher to run the application.

Select setup from the options and follow the process to carry out the installation of the application.

Once this has completed, Results Manager will open automatically. The application can be used as many times with the CD inserted.

To use Results Manager without inserting the CD, copy all of the files from the CD to a folder in My Documents.

7.3 Running Results Manager

With the application running, five buttons across the top of the screen allows the user to carry out the functions that it provides as follows:

Connect
To establish a connection to a Titrator linked to the USB port on your PC, click the Connect button.

The first time you do this after running the application, you will be asked to choose the serial port used to make the connection. Desktop PCs will normally have COM1 and perhaps COM2 fitted, while laptops usually have only COM1 to provide functionality on machines without serial ports; these are normally installed in the range COM4 to COM8, although this may usually be changed using the Windows Device Manager. Once connection has been established, the Status display on the screen will change to "Connected" and the text on the Connect button will change to "Disconnect". Clicking it again will disconnect the Titrator from the PC.

While connected, Results Manager will download any test results it finds and display them, and will continue to load the results of any further tests that are carried out as long as it remains connected. Because the files that it uses contain single sets of results, when the user starts a new set of measurements on the Titrator (i.e. a new sample ID is entered, titration parameters are changed or the end of a fixed run is reached), Results Manager will prompt the user to save the previous set of results before discarding them and loading the new set.

Save
The Save button allows you to save the current set of results to a file on disk. It opens the standard Windows directory and file dialog box to allow you to choose the location and filename for the saved data. Files are stored in XML format (eXtensible Markup Language), which is a standard format widely used to store information in a flexible manner and provide interchange between applications. The extension .xml is used to identify XML files, and will be added automatically to the file name.

Load
The Load button allows you to load a set of results previously saved to disk using the Save button, or transferred from a Titrator through some other means. Again, it opens the standard windows directory and file dialog box to allow you to find the directory and file you require, and is configured to display files with the .xml extension. Loading a set of results from file will replace the ones currently held in **Results Manager**, so if these have not yet been saved you will be asked whether you wish to do so before loading them.

Export
Although many applications can read the XML results files, some cannot. The Export button provides the ability to save the results currently loaded as a text file that can be read by applications such as Microsoft Excel. Again, the standard directory and file dialog allows you to choose the location and name for the file; the results will be stored in CSV format (Comma Separated Values) with the .csv extension.

Print
The Print button allows the current set of results to be printed on any printer connected and supported by Windows. It will open the standard printer dialog, allowing you to choose the printer and set options such as paper type and location. The printout should scale automatically to fit the page, although obviously it has not been possible to test this on every different combination of printer and paper size.

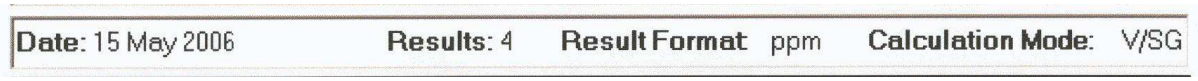
7.4 Display Explanation

Status
Titrator and computer are connected or disconnected.

Model
Manufacturer model and software version.

Serial #
Instrument serial number.

Calibrated
Last date Titrator calibrated.



Date
Date analysis recorded.

Results
Total number of results recorded.

Result Format
Selected result format:- µg, ppm, mg/kg or % water.

Calculation Mode
Selected calculation mode:- V/SG, W/w, W/K, V/v.

Results for Sample ID
Samples identification number.

Run #
Sequential count of analysis runs.

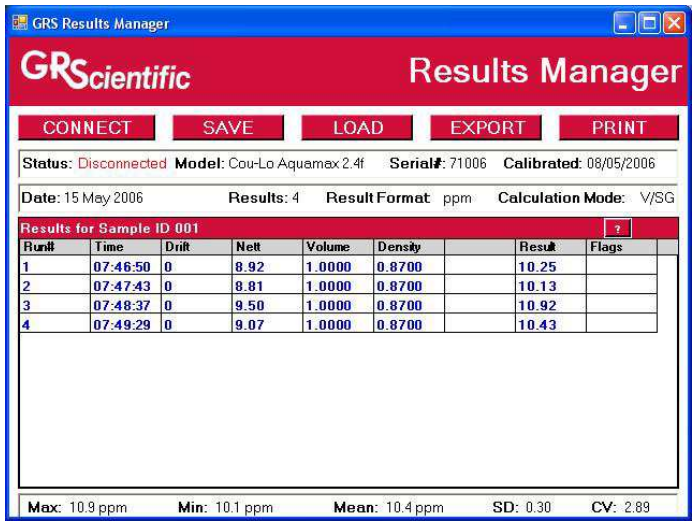
Time
Time analysis recorded.

Drift
Titrator background drift value during analysis.

Nett
The nett microgram count for analysis (after drift deducted).

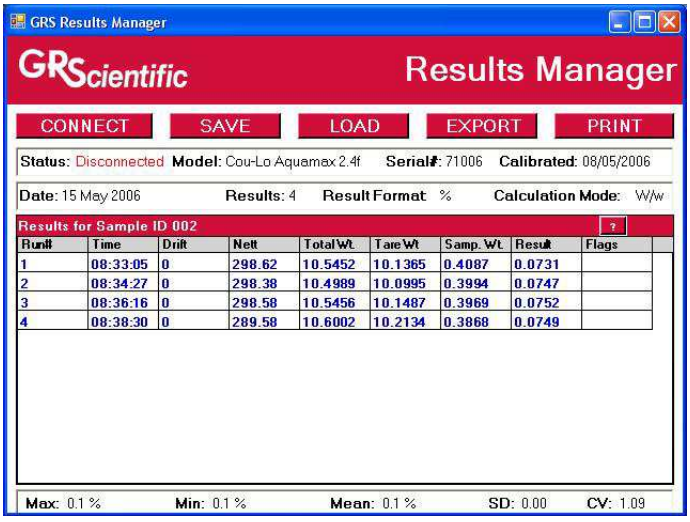
Prm1, Prm 2 & Prm 3

The sample data used for the calculation. These parameters change depending on calculation mode being used. Examples of the three main calculations are shown:



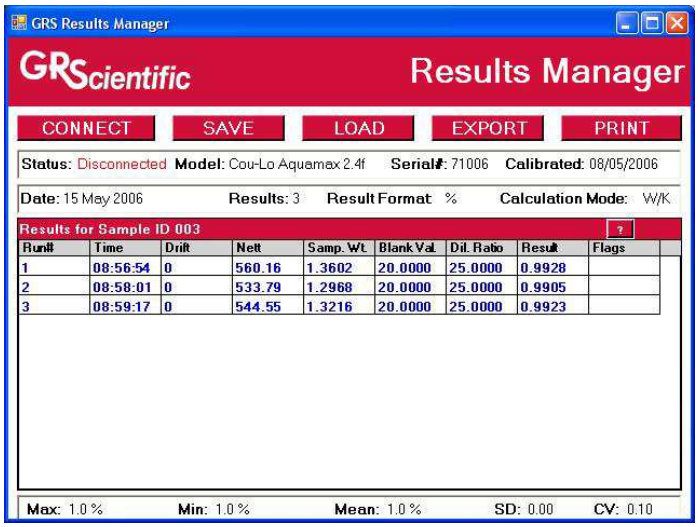
Example:

Calculation Mode **V/SG**
Prm 1 & Prm 2 columns show Volume & Density values



Example:

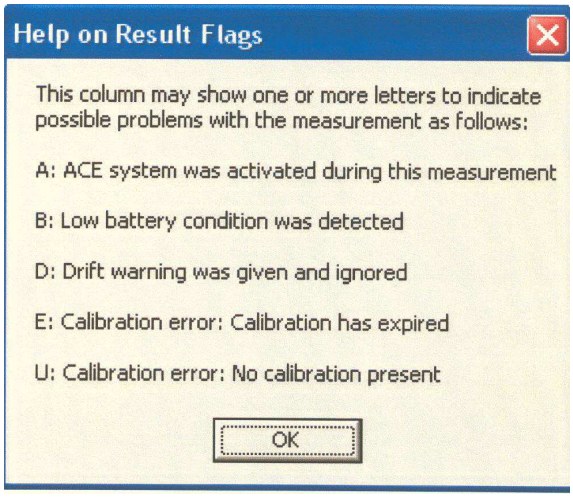
Calculation Mode **W/w**
Prm 1, Prm 2 & Prm 3 columns show Total weight, Tare weight & sample weight



Example:
Calculation Mode **W/K**
Prm 1, Prm 2 & Prm 3 columns show Sample weight, Blank value & Dilution ratio

Result
Calculated result in the selected format.

Flags
If a letter appears in this column, click the question mark **(?)** for an explanation.



7.5 Closing and Uninstalling

Closing Results Manager

The standard close button (the X in the top right corner) will close the application. If results have been downloaded but not yet saved, you will be prompted to save them before closing.

Uninstalling Results Manager

If you no longer require the application, it may be removed from your PC using the Add/Remove Programs utility in the Windows Control Panel. Scroll down the list of applications to the Results Manager entry and click the button to delete the application.

Chapter 8 Maintenance

8.1 Reagent Life

There are three main factors which govern the life of Coulometric reagents, and therefore, the frequency of cleaning and recharging the titration cell:

(1) The physical size of the titration cell allows for 50 – 60mL of sample to be added. For the analysis of most liquid samples (e.g. solvents) Megger KF-LAB Titrators normally only requires a few micro litres to be injected, therefore the maximum volume of 50 – 60mL should not become a limiting factor. (Oil samples are an exception and are dealt with elsewhere in this manual).

(2) The total amount of water that can be analysed before saturation of the reagents varies slightly from one reagent manufacturer to another. Typically a 100 ml charge of Anode reagent will analyse up to 1 gm water, whilst a 5 ml charge of Cathode reagent will analyse up to 250 mg water. Considering that the injected sample volume is normally small, and also that the analysis is usually for the determination of low levels of water, these water capacity values are not normally a limiting factor.

(3) Similar to all other Karl Fischer reagents, Coulometric reagents will deteriorate when exposed to sunlight and with increases in temperature. Placing the instrument in direct sunlight or near to a heat duct can decrease the reagent life. As reagents age, the titration speed will reduce and the drift value will increase.

8.2 Cleaning the Glassware

IMPORTANT

The platinum mesh and wires of the electrodes are fragile and can be easily bent or broken. Extreme care **MUST** be taken when disassembling, cleaning and reassembling the titration cell. The generator electrode is the most expensive part of the KF glassware.

DO NOT USE BRUSH TO CLEAN INSIDE ELECTRODE AS THIS COULD DAMAGE CONNECTIONS.

Coulometric reagents are flammable and toxic, so care should always be taken when handling them and when cleaning the glassware. Whenever possible this should be done in a safe area, e.g. inside a fume cupboard. Reagents should not be recharged while the titration cell is still attached to the Titrator.

Under normal circumstances the titration cell can be used for a large number of samples before having to replenish the reagents. The glassware only requires simple cleaning procedure, normally just rinsing with solvent, drying and then re-charging with fresh reagent. Once the reagents have been exhausted, or when the titration cell maximum volume has been reached, it should simply be necessary to:

(1) DISASSEMBLE titration cell (disconnect leads from Titrator).

(2) EMPTY the titration cell and generator electrode.

(3) RINSE all parts with methanol. Do not use brush on electrodes.

(4) DRY all parts.

(5) REASSEMBLE glassware.

(6) RECHARGE with fresh reagents.

If the cell is heavily contaminated then it may be necessary to clean it more thoroughly. For oil samples, cleaning with chloroform or xylene is suggested, whilst for salt deposits a water wash may be required. Use whichever solvent is most suited for the sample type. The titration vessel can even be cleaned with hot soapy water and a bottle-brush.

However, after cleaning with suitable solvent, all glassware parts, **MUST** be rinsed inside and out with methanol.

They can then be dried with a warm air blower, such as a domestic hair dryer, placed in a low temperature oven at 40 – 50 ° C, or left in a desiccator.

After being fully dried, reassemble the titration cell and charge with fresh reagents.

THE MORE THOROUGHLY THAT THE TITRATION CELL IS CLEANED AND DRIED, THE FASTER THE INSTRUMENT WILL STABILISE READY FOR OPERATION AFTER RECHARGING REAGENTS.

Under normal conditions, the Megger KF-LAB should be ready for operation within 5 – 10 minutes after reassembly, however it could take considerably longer before to completely stabilise if the drying procedure has not been properly carried out.

GENERATOR ELECTRODE – ACID WASH PROCEDURE

If the frit of the generator electrode has become blocked or severely stained with samples such as crude oils, then it may occasionally be necessary to use an acid wash procedure.

(1) Rinse the empty generator electrode with Xylene or other suitable solvent.

(2) Place the electrode in a 250ml conical flask, ensure the electrode is suspended and not resting on the platinum mesh. Add 10ml Xylene to the inner cathode chamber and leave to stand for 10 minutes. Remove the Xylene.

(3) Repeat using 10ml of Methanol then gently swirl to remove residual solvent and remove.

(4) Add 10ml deionised water to inner cathode chamber and allow to stand for 30 minutes.

(5) Remove any remaining water, add 10ml 50/50 HCL and allow to stand for 1 hour. Top up any loss of HCL through the frit. After 1 hour carefully pour the acid into a flowing water stream in the sink, ensuring that the breather hole midway down the side of the electrode is positioned at the top when pouring acid out.

(6) Thoroughly rinse the electrode using a wash bottle containing deionised water. Add 10ml deionised water to the inner chamber and allow to stand for 30 minutes.

(7) Remove any remaining water, add 10ml Methanol and allow to stand for 10 minutes. Ensure that the outer surfaces of the electrode do not come in contact with waste solution gathering in the bottom of the vessel.

(8) Drain remaining solvent from inner chamber and dry electrode.

Note: Wear safety goggles and protective gloves when handling acid.

Chapter 9 Technical Specifications

Titration Method:	Coulometric Karl Fischer Titration
Electrolysis Control:	Patented “ACE” Control System GB2370641
End Point Detection:	AC Polarisation
End Point Indication:	Visual Display/Print Out/Acoustic Beep
Titration Vessel:	Low Drift Cell Design, no grease or PTFE sleeves required
Measuring Range:	Possible 1µg – 200mg Water Typical 1µg – 10mg Water
Moisture Range:	1ppm – 100% Water
Max. Sensitivity:	0.1µg
Max. Titration Speed:	2.24mg per minute
Max. Current:	400ma
Drift Compensation:	Automatically Controlled
Precision:	10-100µg ± 3µg, 100µg -1mg ± 3µg, above 1mg ± 0.3%
Start Delay Time:	0-30 minutes, user selectable
End Delay Time:	0-30 minutes, user selectable
Calculation Modes:	Weight/weight (W/w) Weight/Dilution Ratio (W/K) Volume/Density (V/SG) Volume/volume (V/v) (User Programmable)
Display Format:	µg, mg/kg, ppm, %
Print Format:	µg, mg/kg, ppm, %
Statistics:	Max, Mean, Min values up to 99 runs
Method Storage:	10 User Programmable Methods
Sample ID Number:	User Programmable
Stirrer Speed:	Microprocessor Controlled – User Selectable
Languages:	Multi Languages – User Selectable
Calendar/Clock:	Analysis Time & Date Print Out
Data Outputs:	USB & RS232 Ports
Removable Data Storage:	Flash Drive (memory stick)
Data Entry:	18 Key Touchpad
Display:	40 Character Alphanumeric Backlit LCD
Printer:	42 Character High Speed Thermal Printer
Power Supply:	90-264V AC, 47-63Hz
Battery Life:	8 Hours Running Time from Fully Charged
Unit Dimensions:	250 x 245 x 120 mm
Weight:	3kg

Chapter 10 Parts List

Part No: 6111-774

All the following parts are included as standard, but can also be purchased as single items.

Results Manager Software Package
Comprises of:
- Software Disc
- Interface Cable
- 512MB USB Flash Drive Memory Stick

18V Power Adaptor

In-Car Adaptor

Glassware Set LDC Twin Port
Comprises of:
- Titration Vessel LDC
- Detector Electrode LDC
- Generator Electrode + frit LDC
- Electrode Lead x2
- Desiccant Tube LDC & Cap
- Pack Injection Septa (10 pack)
- Molecular Sieve
- Stirrer Bar
- Polypropylene Funnel
- Paper Roll (Thermal) Single
- Luer Needle 19 Gauge (Screw Fit)

Gas Tight 1.0ml Syringe

Carry Case

All the following parts are not included as standard, but can also be purchased as optional extras.

Gas Tight 0.25ml Syringe

Gas Tight 5ml Syringe

Gas Analysis Kit

Solid Analysis Kit

Powder Sampler

Chapter 11 Troubleshooting

Overtitration

Detector senses too much Iodine. Usually caused by old reagents or stirrer switched off. Check stirrer speed.
Add 3-5 micro litres of water until detector bars activate, and allow to precondition.

Excess Drift

Indicates excess moisture ingress or condensation on cell walls. Switch OFF. Remove titration cell from clamp and gently swirl anode reagent around the cell walls. Reconnect, switch ON, and allow to
Precondition.

Long Preconditioning Time

Normally caused by glassware not being sufficiently dried before assembly. Re-clean glassware and electrodes, dry thoroughly and charge with fresh reagents.

Progressively Lower Results for Same Sample

Moisture contamination of syringe. Flush syringe and needle with sample several times before beginning new test.

Poor Repeatability for Same Sample

Sample size probably too small or moisture contamination of syringe. Increase sample size and flush syringe and needle several times before beginning new test.

Warning Letters on Print Out

Warning letters will be printed after time of each analysis to signify the following:

U – Uncalibrated

E – Calibration expired

B – Battery level low

A – ACE system active

Results Manager

The serial port parameters are set automatically by Results Manager, so a failure to connect to the Titrator is most likely to be caused by selecting the wrong serial port when clicking the Connect button. Other possible causes of a connection failure are as follows:

Incorrect Titrator software. The serial port functionality is fully implemented in version 2.6a and above of Titrator software and previous versions may not work reliably or establish a connection at all. Contact Megger or your local agent in order to obtain an upgrade to your Titrator software.

Note: The software version is displayed on the Titrator immediately after the unit is switched on.

Chapter 12 Conformity and Warranty

12.1 Declaration of Conformity

This Megger product are in conformity with the EU Directives:

- 2004/108/EC Electromagnetic Compatibility Directive
- 2006/95/EC Low Voltage Directive

This is based upon the compliance of the products with the harmonised standards:

- BS EN 61000-6-1:2007 Electromagnetic Compatibility. Generic immunity standard. Residential, commercial and light industry;
- BS EN 61010-2-030:2010 Safety requirements for electrical equipment for measurement, control and laboratory use. Particular requirements for testing and measuring circuits;
- BS EN 61326-1:2013 Electrical equipment for measurement, control and laboratory use. EMC requirements. General requirements.

12.2 Quality Control

The Megger KF-LAB is adequately and professionally Quality Controlled to ensure that it is fully functional and to ensure that it meets all of the requirements that the instrument supports.

12.3 Customer Support and Service

For service requirements for Megger Instruments **contact**:

Megger Limited	or	Megger
Archcliffe Road		Valley Forge Corporate Centre
Dover		2621 Van Buren Avenue
Kent CT17 9EN		Norristown PA 19403
UK.		USA.
Tel: + 44 1304 502 243		Tel: +1 610 676 8579
Fax: + 44 1304 207 342		Fax: +1 610 676 8625

Megger operate fully traceable calibration and repair facilities, ensuring your instrument continues to provide the high standard of performance and workmanship you expect. These facilities are complemented by a worldwide network of approved repair and calibration companies to offer excellent in-service care for your Megger products.

When an instrument requires recalibration, or in the event of a repair being necessary, a Returns Authorisation (RA) number must first be obtained from one of the addresses above. You will be asked to provide the following information to enable the Service Department to prepare in advance the receipt of your instrument, and to provide the best possible service for you.

- Model, eg. S1-554
- Serial number, to be found on the rear of the instrument or on the calibration certificate.
- Reason for return, eg. Calibration required or repair.
- Details of the fault if the instrument is to be repaired.

1. Make a note of the RA number. A returns label can be emailed or faxed to you.

2. Pack the instrument carefully to prevent damage in transit.

3. Ensure the returns label is attached, or that the RA number is clearly marked on the outside of the package and on any correspondence, before sending the instrument, freight paid, to Megger. Copies of the original purchase invoice and packing note should be sent simultaneously by airmail to expedite clearance through customs. In the case of instruments requiring repair outside the warranty period, an immediate quotation can be provided when obtaining the RA number.

4. You may track the progress of your return on line at www.megger.com.

Approved Service Centres

A list of Approved Service Centres may be obtained from the UK address above, or from the Megger website www.megger.com.

12.4 Warranty

Under the conditions of our warranty, all faults which are proved to be due to material, construction or manufacturing defects, which occur within 12 months of the delivery date, will be repaired or replaced, (at our discretion), free of charge at our premises. Freight costs will be chargeable along with any inspection work which was not necessitated by manufacturing or material defects. Breakages of glassware or electrodes are not covered by this guarantee. In the event of instrument failure during the warranty period, written authorisation must be obtained from the manufacturer prior to shipping. Any unauthorised prior repair or adjustments will automatically invalidate the warranty.

12.5 Warranty Exemptions

Some parts of the instrument and the accessories cannot be replaced under warranty. These include:

- Glass Vessels - Syringes - Electrodes

Megger