756/831 KF Coulometer

Manual
8.831.1003

Metrohm

Metrohm
Ion analysis
CH-9101 Herisau/Switzerland
E-Mail info@metrohm.com
Internet www.metrohm.com

756 KF Coulometer
831 KF Coulometer

Program version 5.756.0012 and 5.831.0011

Instructions for Use

8.831.1003 04.2003 / chs

Contents

Abbreviations:

< >		Key, e.g. <START>
date	**2003-03-23**	Display which appears in the standard operation level
run number	**1**	Display which appears in the expert operation level only

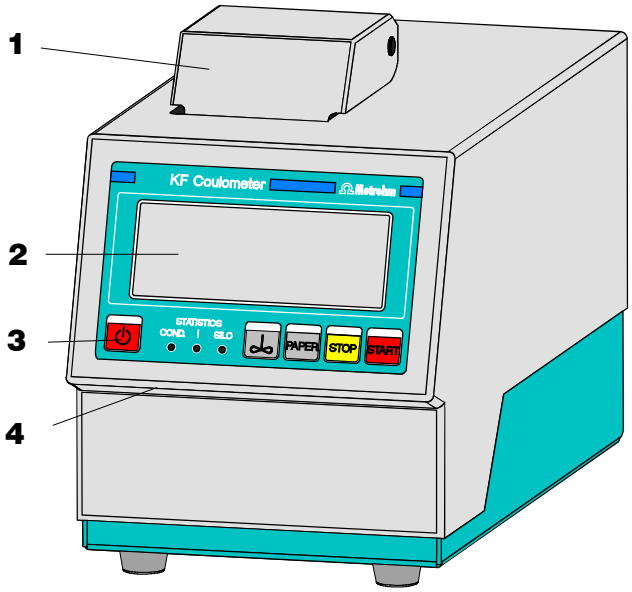
1 Introduction

These instructions provide you with a comprehensive overview of the installation, working principles and operation of the **756 KF Coulometer** and the **831 KF Coulometer**. As these two instruments are, aside from the built-in thermal printer of the 756 KF Coulometer, identical, the Instructions for Use for both have been incorporated in a single document. The report examples, mapped in this document, were generated by a 756 KF Coulometer. They are identical for a 831 KF Coulometer, except from the instrument number. Functions, which only apply on the 756 KF Coulometer are marked accordingly.

You can find a short summary of the Instructions for Use in the enclosed **756/831 KF Coulometer Quick References.**

You can request descriptions for applications involving KF Titrations in the form of **Application Notes** and **Application Bulletins** from your local Metrohm agency or download them from the Internet under **www.metrohm.com**.

1.1 Parts and controls

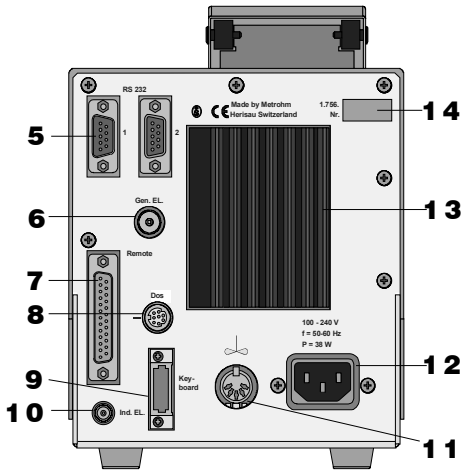


Frontview KF Coulometer

1	**Built-in thermal printer (only at 756)** Ordering number for thermal paper: 6.2237.020	**3**	**Control keys and indicator lamps on the KF Coulometer** <Paper> only at 756 KF Coulometer
2	**Display**	**4**	**Setting of display contrast**

3 Control keys and indicator lamps on the KF Coulometer

Key < ⏻ >	Switches Coulometer ON/OFF
Key < ∞ >	Switches stirrer ON/OFF
Key <PAPER>	(Only at 756 KF Coulometer) Paper feed on printer (where manually triggered reports are printed out).
Key <STOP>	Stops procedures, e.g. titration, conditioning.
Key <START>	Starts procedures, e.g. titration, conditioning. Keys <STOP> and <START> are identical with the corresponding keys of the separate keypad.
Indicator lampes:	
"COND."	Lamp flashes when conditioning is performed and the titration vessel is still wet. It is on if conditioning is OK.
"STATISTICS"	Lamp is on when the "statistics" function (calculation of mean and standard deviation) is on.
"SILO"	Lamp is on when silo memory (for sample data) is on.



Rearview KF Coulometer

5	**RS232 interfaces** 2 separate interfaces for the connection of balance, computer, printer etc.	**10**	**Connection of indicator electrode**
6	**Connection of generator electrode**	**11**	**Connection for stirrer** 728 Magnetic Stirrer or 703 Ti Stand Supply voltage: 10 VDC (I ≤ 200 mA)
7	**Remote lines** (input/output) for the connection of remote box, Oven, Sample Changer, robots etc.	**12**	**Connection for power cable** With power supplies where the voltage is subject to severe HF disturbances, the Coulometer should be operated via an additional power filter, e.g. Metrohm 615 model.
8	**Connection of Dosino** for automatic reagent exchange.	**13**	**Cooling fin**
9	**Connection for separate keypad**	**14**	**Rating plate** with fabrication, series and instrument number

2 The wet chemistry workplace

2.1 Principle of coulometric KF determinations

The coulometric Karl Fischer titration is a version of the classical water determination method developed by Karl Fischer. The traditional method utilises a methanolic solution of iodine, sulphur dioxide and a base as buffer. Several reactions run in the titration of a water-containing sample and can be summarised by the following overall equation:

$$H_2O + I_2 + [RNH]SO_3CH_3 + 2\ RN \Leftrightarrow [RNH]SO_4CH_3 + 2\ [RNH]I$$

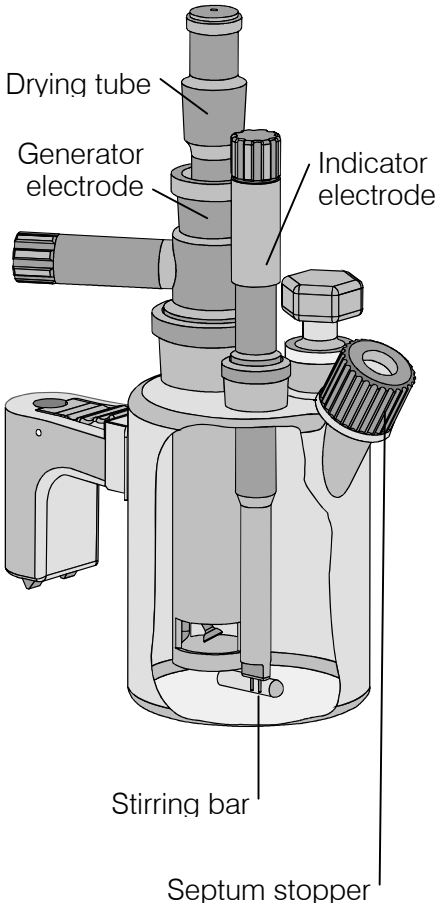
According to the above equation, I_2 reacts quantitatively with H_2O. This chemical relation forms the basis of the water determination.

The classical Karl Fischer method has undergone constant development in the past years. This further development has involved not only refinement and automation of the reagent dispensing, but also improvement of the end point indication and the reagents. Despite the progress made, the classical, volumetric Karl Fischer method suffers from the disadvantage that the reagents are not completely stable resulting in the need to redetermine the titer at intervals.

In the coulometric Karl Fischer titration, the iodine needed is generated directly in the electrolyte by electrochemical means ("electronic buret"). The rigorously quantitative relationship between the electric charge and the amount of iodine generated is used for high-precision dispensing of the iodine. As the coulometric Karl Fischer method is an absolute determination no titer need be determined. It is necessary only to ensure that the reaction which generates the iodine runs with 100% current efficiency. With the reagents available today this is always the case.

The end point is indicated voltametrically by applying an alternating current of constant strength to a double Pt electrode. This results in a voltage difference between the Pt wires of the indicator electrode which is drastically lowered in the presence of minimal quantities of free iodine. This fact is used to determine the end point of the titration.

2.2 Titration vessel setup



1. Attach titration vessel with holder to the support rod.
2. Place stirring bar in titration vessel.
3. Cut 6.2713.XXX ground joint sleeves to the correct lengths and use them for all the joints of the inserts[1)].
4. Insert indicator electrode in the left-hand joint opening, screw on 6.2104.020 electrode cable and plug it into the "Ind.El" socket of the Coulometer.
   Mark the screw head of the electrode cable so that it is impossible to confuse the indicator and generator electrodes!
5. Insert generator electrode in the central joint opening, screw on 6.2104.120 electrode cable and plug it into the "Gen.El" socket of the Coulometer.
6. Fill the drying tube with molecular sieve and insert into generator electrode.
7. Place septum in the screw cap and screw this onto the titration vessel. Only tighten it enough to ensure that it is tight. (The septum should not be deformed!)
8. Fill titration vessel with 80-100 ml reagent[2)].
9. Close last joint opening: either with glass stopper, aspiration device or gas inlet from oven (see pages 114ff).

1) When cutting the ground joint sleeves take care that no rough edges are formed. The ground joint sleeves must not project beyond the lower edge of the joint.
   If no ground joint sleeves are used then the joints must be greased. In this case the joints must be checked periodically and re-greased while otherwise problems with blocked joints could occur.

2) For the generator electrode with diaphragm: Fill the generator electrode with approx. 5 ml catholyte. Fill the titration vessel with anolyte until the anolyte level is 1-2 mm above that of the catholyte (approx. 100 ml).

2.3 Your first determination

The titration vessel has been prepared (see page 5) and the Coulometer is switched on. In the display appears

```
KFC                  ********
```

Press the <START> key.

```
KFC                      wait
drift          ⇓   53 ug/min
```

Pre-conditioning begins, i.e. the titration vessel is dried. The "COND" LED blinks. The arrow in the drift display shows the drift tendency (falling, rising, stable).
When the titration vessel is dry an acoustic signal is heard and the "COND" LED shows a steady light.

```
KFC                      ready
drift          ⇔   4.3 ug/min
```

Press <START> and inject the first sample.

```
smpl size              1.0 g
```

Enter the sample size and confirm it with <ENTER>.

During the titration you will see the curve μg H_2O against time. To the left of the curve the following measurements are displayed:
H_2O in μg
Rate in μg/min
Time in s

```
KFC                      ready
drift          ⇔   5.3 ug/min
content              38.5 ppm
```

After the titration the result is displayed and printed out by the internal printer (with the 831, a printer needs to be installed; see page 121). The titration vessel is continuously kept dry and the current drift is displayed.

If you want to determine further samples press <START> again and inject the next sample...

2.4 Generator electrode without diaphragm

The 6.0345.100 generator electrode without diaphragm poses no handling problems and is easy to clean. It only requires one reagent and is quickly ready for use (no moisture depots in the diaphragm!). The generator electrode without diaphragm is the best choice for most applications. It is particularly suitable for use with very polluting samples.

2.4.1 Reagents

Only use those reagents which are specially intended for use with generator electrodes without diaphragm; see the reagent manufacturer's documentation.

2.4.2 Cleaning

The electrolyte solution can normally be exchanged without any special cleaning of the parts being necessary. If cleaning is necessary then care should be taken that the Pt grid of the generator electrode is not damaged.

Pollutants containing oil:
Clean with a solvent (e.g. hexane) and then rinse with ethanol.

Salt-like deposits:
Clean with water and then rinse with ethanol.

Dry all parts thoroughly after cleaning. A hot-air blower can be used for this. If the parts are dried in a drying oven take care that the temperature does not exceed 70°C (plastic components!).

2.5 Generator electrode with diaphragm

The 6.0344.100 generator electrode with diaphragm should be used when your samples contain ketones and aldehydes because special reagents for aldehydes and ketones are only available for generator electrodes with diaphragms.
If your reagent has a low conductivity, e.g. if you have had to add chloroform because of the solubility of the sample then you should use the generator electrode with diaphragm as first choice.
It can also be recommended when you require very good accuracy in the lowest trace analysis ranges.

2.5.1 Reagents

Reagents for coulometric water determination with generator electrodes with diaphragms consist of an anode solution (anolyte), which is filled into the titration vessel and a cathode solution (catholyte) which is filled into the generator electrode.

Special reagents must be used for water determination in ketones and aldehydes; please refer to the reagent manufacturer's instructions.

2.5.2 Cleaning

The electrolyte solution can normally be exchanged without any special cleaning of the parts being necessary. If cleaning is necessary then care should be taken that the Pt grid of the generator electrode is not damaged.

Resinous deposits on the diaphragm:
Hang the generator electrode vertically from a support rod, fill with conc. HNO_3 and allow to stand overnight. Rinse with water followed by ethanol.

Pollutants containing oil:
Clean with a solvent (e.g. hexane) and then rinse with ethanol.

Salt-like deposits:
Clean with water and then rinse with ethanol.

Cleaning (rinsing) the diaphragm:
Fill the cathode compartment of the generator electrode with methanol and allow the filling to drain out. Repeat the process 2-3 times. This process should also be carried out when the electrode has been cleaned as described above.

Dry all parts thoroughly after cleaning. A hot-air blower can be used for this. If the parts are dried in a drying oven take care that the temperature does not exceed 70°C (plastic components!).

2.6 Tips for working with water standards

For validation of the instrument, as a fully integrated measuring system, commercial, certified water standard solutions with water contents of 1.00 ± 0.003 mg/g and/or 0.10 ± 0.005 mg/g should be applied (The 1.0 mg/g Standard is easier to handle and therefore to prefer).

Recommended initial weight range:

Liquid standard 1.0 mg/g	0.2-2.0 g
Liquid standard 0.1 mg/g	0.5-1.5 g

2.6.1 Recommendations for practice

For validation of the system very accurate handling is needed. To minimise possible measuring inaccuracies the sample preparation and handling should run accordingly to the following procedure:

1. Wear gloves (As always in KF Titration).
2. Take a fresh plastic syringe and open it.
3. Take a fresh ampoule of KF standard and shake it for 10 seconds.
4. Open the ampoule and suck 1 ml of the standard into the syringe
5. Pull the piston of the syringe up to the end and shake the syringe for a few seconds, so that the inner part of the syringe is rinsed with standard and gets rid of water contamination.
6. Splash the used standard into a waste bottle.
7. Repeat the same procedure with another ml of the standard solution.
8. Suck the whole rest of the standard into your syringe. Thereafter, verify that there is no more solution in the needle by sucking a small amount of air into the syringe.
9. Clean the needle by wiping it with a soft tissue. Close the needle with the corresponding cap.
10. Place the syringe on the balance and press TARA.
11. As soon as the drift at your Coulometer is stable, you can take the syringe, press <Start> at the Coulometer and inject around 1 ml of the standard. This can be done in two different ways:
    a. The standard is injected without dipping the needle. If a small drop keeps hanging at the needle, aspirate it back into the needle, before pulling the needle out of the septum.
    b. The standard is injected directly under the surface of the KF solution.

    Furthermore, make sure that the standard doesn't splash on the wall of the vessel or on the electrode.

12. Close the syringe and put it back on the balance.
13. Read the indicated value off the balance and feed it at your Coulometer as sample size.
14. As soon as the determination has finished and the titration cell is conditioned again, you can start with the next determination.

2.7 Sample addition

This section contains some information about sample addition. A detailed description of this topic is not possible here. You can find further information in the reagent manufacturer's documentation and in Metrohm Application Bulletins.
Metrohm Application Bulletins:
No. 142: Karl Fischer water determination in gaseous samples
No. 145: Determination of small amounts of water in plastics
No. 209: Water determination in insulating oils, hydrocarbons and their products
No. 273: Validation of KF Coulometers according to GLP/ISO 9001.

2.7.1 Sample size

The sample size should be small so that as many samples as possible can be titrated in the same electrolyte solution and the titration time kept short. However, take care that the sample contains at least 50 µg H_2O. The following table provides guidelines for the sample weight.

Content of sample	Sample weight	H_2O to be determined
100000 ppm = 10 %	50 mg	5000 µg
10000 ppm = 1 %	10 mg... 100 mg	100 µg...1000 µg
1000 ppm = 0.1 %	100 mg... 1 g	100 µg...1000 µg
100 ppm = 0.01 %	1 g	100 µg
10 ppm = 0.001 %	5 g	50 µg

2.7.2 Liquid samples

Liquid samples are added with the aid of a syringe. Either a syringe with a long needle is used with the needle being immersed beneath the surface of the reagent during injection or a short needle is used with the last drop being sucked back into the needle.
The best way of determining the actual sample weight is by weighing the syringe before and after injection.

Volatile or low-viscosity samples should be refrigerated before that sample is taken in order to prevent handling losses. In contrast, the syringe itself should not be directly refrigerated as this could cause the formation of condensate. For the same reason aspirating air into a syringe which has been cooled by taking up a refrigerated sample should be avoided.

Highly viscous samples can be warmed to lower their viscosity; the syringe must also be warmed. The same goal can also be reached by dilution with a suitable solvent. In this case the water content of the solvent must be determined and deducted as a blank value correction.

Pastes, greases can be placed in the measuring cell by using a syringe without a needle. The joint opening can be used for this purpose. If aspiration is additionally required the opening with the septum stopper can be used.
The best way of determining the actual sample weight is by weighing the syringe before and after injection.

With **samples containing a lot of water** care must be taken that the needle is not introduced into the measuring cell through the septum before <START> has been pressed as otherwise the drift and therefore the result of the analysis could be falsified.

With **samples containing only a trace of water** the syringe must be thoroughly dried beforehand. If possible the syringe should be rinsed with the sample solution by taking up the sample solution several times and then discarding it.

2.7.3 Solid samples

Whenever possible solid samples should be extracted or dissolved in a suitable solvent and the resulting solution injected; a blank value correction should be made for the solvent.

If no suitable solvent can be found for a solid sample or if the sample reacts with the Karl Fischer solution the drying oven should be used.

If solid samples have to be placed in the measuring cell directly then the generator electrode without diaphragm should be used. The sample can be added through either the joint opening or through the opening at the side. Take care that:

- The sample releases its moisture completely
- No side reaction occurs with the Karl Fischer solution
- The surface of the electrodes is not covered by the sample substance (incomplete KF reaction!)
- The Pt grid of the generator electrode is not damaged
- The Pt wires of the indicator electrode are not damaged

2.8 Optimal working conditions

If a thoroughly dry titration vessel with a generator electrode without diaphragm is used then the basic drift is reached within approx. 30 minutes. It is recommended that the titration vessel is carefully shaken several times during this time.
For generator electrodes with diaphragm a preparation period of approx. 2 hours must be expected.
If the 768 KF oven is used it is recommended that the oven is allowed to run overnight with the oven valve set to "purge".

For precise determination of amounts of water below 100 µg it may also be an advantage to condition the instrument overnight before use.

If the instrument is switched off for a longer period of time with a filled titration vessel then a certain time is required for it to become dry again after it is switched on.
During continuous operation the instrument should not be switched off overnight.

2.8.1 Drift

A constant drift of the order of about ≤ 4 µg/min is good. However, lower values are certainly possible. If higher, stable values occur then the results are normally still good as the drift can be compensated (drift correction see page 29).
The drift is shown together with the "drift trend":
⇔ constant drift and drift below the start drift, see page 32.
↑ drift increasing
↓ drift falling

A drift which remains high may be caused by water-containing depots in inaccessible locations inside the cell. In such cases a reduction in the value would be achieved by shaking the titration vessel. Take care that no drops above the level of the liquid are formed in the titration vessel.
For generator electrodes with diaphragms shaking must not be so vigorous as to cause the catholyte and anolyte to become mixed with each other.
If even after shaking the drift remains too high over longer periods of time then the electrolyte solution must be exchanged.

When working with the oven a drift ≤ 10 µg/min is good. The drift depends on the gas flow (the smaller the gas flow the lower the drift).

2.8.2 Reagent exchange

In the following cases the electrolyte solutions should be exchanged:

- When the titration vessel is too full.
- When the capacity of the reagent is exhausted.
- If the drift is too high and shaking the cell does not result in any improvement.
- If a two-phase mixture is formed in the titration vessel. In this case only the sample phase can be aspirated off, see also page 25.
- If during the determination the error message "**check generator electr.**" appears (see page 105).

Removal of the used electrolyte solutions from the cell is most easily carried out by aspiration as it is not necessary to disassemble the cell.
If strong pollution occurs the cell can be rinsed with a suitable solvent which should also be aspirated off.
A Dosino or Titration Stand 703 can be used to aspirate the electrolyte solutions, see pages 114ff.

For the generator electrode with diaphragm the catholyte should be exchanged approx. once a week. Extended use may cause darkening of the catholyte and yellow participation in the cathode compartment. An unpleasant smell indicates the need for catholyte exchange also.

2.8.3 Indicator electrode

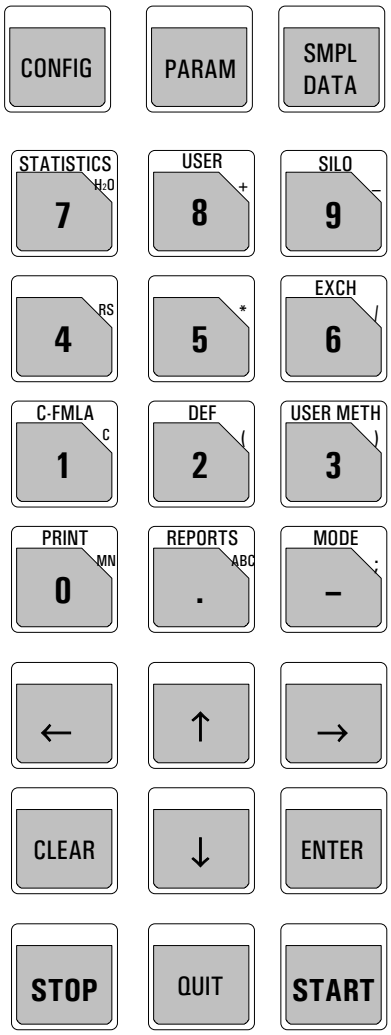
A new indicator electrode may require a certain running-in period for the formation of the surface. This may cause unusually long titration times and measurement results which are too high. These phenomena vanish after a short period of use. In order to speed up the running-in of a new indicator electrode the Coulometer can be conditioned overnight, for example.

A polluted indicator electrode can be carefully cleaned with an abrasive cleansing agent (aluminium oxide (6.2802.000 Polishing Set) or toothpaste). After cleaning it should be rinsed with ethanol.

The two Pt wires of the indicator electrode should be as parallel to one another as is possible. Check on insertion.

3 Manual operation

3.1 Keypad

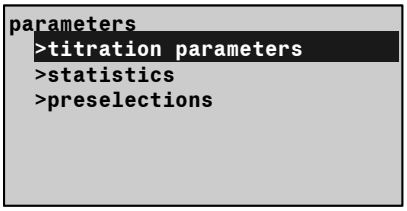


6.2130.040

CONFIG	Configuration.
PARAM	Parameters.
SMPL DATA	Sample data.
STATISTICS	ON/OFF switching of statistics calculations of consecutive determination, see page 37.
USER	User name, see page 43.
SILO	ON/OFF switching of silo memory for sample data, see page 47.
EXCH	Reagent exchange with connected Dosino, see page 25.
C-FMLA	Calculation values, see page 35.
DEF	Formulas, data output, see page 34ff.
USER METH	Management of method memory, see page 44.
PRINT	Printing of reports, see page 42.
REPORTS	Result output at the end of titration, see page 40.
MODE	Mode selection, see page 26.
←,→	Selection of special values (dialog marked with ":"), switching result/curve display
↑,↓	Cursor key for navigation.
CLEAR	Clears values, set special values.
ENTER	Stores values.
STOP	Stops methods.
QUIT	Quits inquiries, waiting times, printing, error messages.
START	Starts methods.

The third functions (inscriptions in the triangle) on the keys of the keypad are used for formula entry, see page 34.

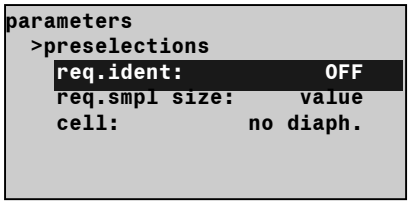
3.2 Principle of data input



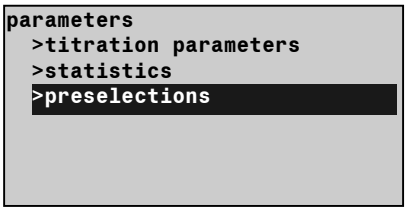
- If you press a key you will find a group of inquiries in the display.
  Example key <PARAM> (in the standard operation level):
  In the first line you see where you are: you pressed key <PARAM> and you are now in the inquiries **parameters**.

- The cursor is inverted. In our example the cursor is on the inquiry **>titration parameters**. You can move the cursor up and down with keys <↑> and <↓>.

  If a dialog text is marked with **>**, it contains a group of inquiries itself. You go to this group pressing <ENTER>.
  Move the cursor to **>preselections** and press <ENTER>:
  The first two lines indicate again where you are.
  Then you find the inquiries.
  If a dialog text of an inquiry is marked with ":", you can select a value with keys <←> and <→> (forward/backward).



- A value is stored with <ENTER> and the cursor moves to the next inquiry.

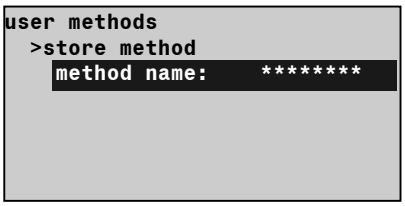


- With key <QUIT> you move one level up, in our example you go back to **>preselections**.
  If you press <QUIT> once more you quit the inquiries in **parameters** altogether.

- If you can scroll, ↓ or ↑ appear in the right lower or upper corner of the display.

3.3 Text input

Example: storing a method:

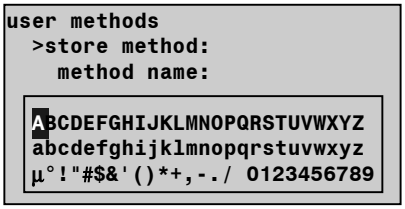


- Press key <USER METH>.
  Place the cursor to **>store method** and press <ENTER>.
  The name of the method which is currently in the working memory is displayed.

<CLEAR>

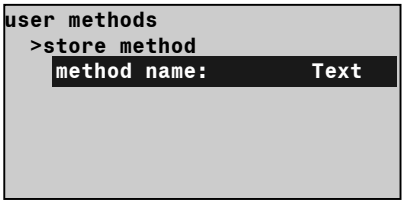
- Delete this name with <CLEAR>.

- Open the "text writing mode" with key <ABC>.
  You can now select the desired character by means of the cursor keys, then confirm this character. Select the next character...
  When you have confirmed the last character, i.e. your name is complete, you quit the text writing mode with <QUIT>.
  Now confirm the name with <ENTER>.



<QUIT>

- During text input you can correct typing errors with <CLEAR>:
  <CLEAR> deletes the characters one by one.



- If you wish to modify an existing name (e.g. if you have names like Text 1, Text 2, Text 3), do not delete the existing name before you start the text input mode. Proceed as follows:
  1. Press <USER METH>, place the cursor to **>store method** and press <ENTER>.
  2. Open the text writing mode directly: Press key <ABC>.
  3. <CLEAR> now deletes the characters one by one or you can add additional characters.
  4. If your text is complete, leave the text writing mode with <QUIT> and confirm the text with <ENTER>.

<ENTER>

You may also enter texts by means of a connected PC keyboard, see page 124.

3.4 Configuration, key <CONFIG>


```
configuration
  >monitoring
  >peripheral units
  >auxiliaries
  >RS232 settings COM1
  >RS232 settings COM2
  >report
  >common variables
```

The key <CONFIG> is used for the entry of instrument-specific data. The set values apply for all modes. All entries are only possible in the inactive basic status of the Coulometer.
Two different operating modes are available: standard mode and expert mode. Inquiries which appear in the standard mode are highlighted in gray.
Monitoring functions (only in expert mode):
Monitoring the reagent, validation interval, service interval and printout of diagnostic reports.
Peripheral units (only in expert mode):
Selection of printer, balance, PC keyboard, barcode reader, stirrer control and selection of the COMs for manual report output.
Auxiliaries:
e.g. selection of operating mode, setting dialog language, date, time.
Settings for RS-COM1 and 2 (only in expert mode):
RS parameters for the interfaces.
Report (only in expert mode):
Configuration of the report.
Common Variable (only in expert mode):
Values of the common variables.

The display texts of the Coulometer are shown to the left. The values are the default values.

```
>monitoring

   reagent:              OFF
```

Monitoring functions

Monitoring the reagent (ON, OFF)
Monitoring is carried out at the end of the titrations and when the Coulometer is switched on. If a monitoring function responds the message "change reagent" appears. The message vanishes when the reagent is changed automatically or with <EXCH>. The message can also be cleared with <CLEAR>. At the same time all counters are reset to zero.
For generator electrodes with diaphragms the katholyte normally needs to be changed more frequently than the anolyte.

	If **on** has been set:
number of determ. 1	*Monitoring according to the number of determinations carried out (1...999, OFF)* The number of determinations which can be carried out depends on the type of sample (very polluting, lowering the conductivity) and on the amount of sample which is to be injected. **OFF** means that monitoring is not active.
determ.counter 0	*Determination counter (0...999)* Counts the number of determinations carried out since the last time the counters were reset to zero.
reagent lifetime 7 d	*Monitoring according to the lifetime of the reagent (1...9999 d, OFF)* **OFF** means that monitoring is not active.
time counter 0 d	*Time counter (0...9999 d)* Counts the number of days since the last time the counters were reset to zero.
reagent capacity 1000 mg	*Monitoring the reagent capacity (1...9999 mg, OFF)* With the generator electrode without diaphragm and a filling volume of 100 ml the capacity is 1000 mg water. For the generator electrode with diaphragm the capacity of the katholyte is 300 mg (with 5 ml filling volume). **OFF** means that monitoring is not active.
capacity counter 0 mg	*Counting the capacity (0...9999 mg)* Adds the weight of water since the last time the counters were reset to zero.
drift OFF ug/min	*Monitoring of drift (0...99 ug/min, OFF)* If the current drift value is stable for 2 minutes and above the set value for drift monitoring (but not max.=2240 ug/min), the message "change reagent" appears. **OFF** means that monitoring is not active.
reagent change: OFF	*Reagent exchange (auto, man., OFF)* **auto**: the reagent is automatically exchanged by the connected Dosino when the reagent monitoring responds (see above). The reagent can also be exchanged manually at any time with <EXCH>. **man.**: the reagent can be exchanged with <EXCH>. The reagent exchange procedure is described on page 255. **OFF**: the key <EXCH> is not active.
waiting time 0 s	If "auto" or "man." has been set: *Waiting time before aspiration (0... 999 999 s)* E.g. the waiting time can be used in order to wait for the phase separation between sample and reagent when the sample is to be aspirated off.

aspirate volume 100 ml	*Aspirate volume (0...9999 ml)* Volume to be aspirated.
reagent volume 100 ml	*Reagent volume (0...9999 ml)* Volume to be added.
rinsing volume 0 ml	*Rinsing volume (0...9999 ml)* Normally rinsing is not necessary. When ≠ **0 ml** has been set
rinsing cycles 1	*Number of rinsing cycles (1...9)*
validation: OFF	*Monitoring the validation interval (ON, OFF)* Monitoring is carried out at the end of the titrations and when the Coulometer is switched on. If the monitoring responds the message **validate instrument** appears. The message vanishes with <CLEAR>. At the same time the counter is reset to zero.
time interval 365 d	If **on** has been set: *Time interval for validation (1...9999 d)* Validation can be carried out in the GLP mode, see page 133.
time counter 0 d	*Time counter (0...9999 d)* Counts the number of days since the last time the counter was reset.
service: OFF	*Monitoring the service interval (ON, OFF)* Monitoring is carried out after the Coulometer has been switched on. If the monitoring responds the message **Service is due** appears. The message vanishes with <CLEAR>.
next service YYYY-MM-DD	If **on** has been set: *Date of next service (YYYY-MM-DD)*
system test report: OFF	*System test report printout (ON, OFF)* With **on** the report of the system test is printed out after the Coulometer has been switched on, see also page 133.

>peripheral units	**Settings for peripheral units**
send to COM1: IBM **send to COM2: IBM**	*Selection of printer (Epson, Seiko, Citizen, Custom, HP, IBM) at the Coulometer COM1* **Epson**, for Epson **Seiko**, e.g. for DPU-414 **Citizen**, e.g. for iDP 562 RS, Custom DP40-S4N **HP** e.g. for Desk Jet types. Always place curves at the beginning of a page as you cannot have them over 2 pages. **IBM** for all printers with IBM character set Table 437 and IBM graphics, as well as for the data transmission to a computer or a data system.

man.reports to:
int. (only 756)
COM1
COM2

Target for the output of manually triggered reports (1, 2, 1&2 and only at 756: int., 1&int., 2&int, all)
Manually triggered reports e.g. with <PRINT> .... .
Exception <PRINT><REPORTS>: These reports are outputted at the target as defined in the method.

balance: Sartorius

Selection of balance (Sartorius, Mettler, Mettler AT, AND, Precisa)
Sartorius: Models MP8, MC1
Mettler: Models AM, PM and balances with 011, 012, and 016 interfaces
Mettler AT: Model AT
AND: Models ER-60, 120, 180, 182, FR-200, 300 and FX-200, 300, 320
Precisa: Models with RS232C interface

stirrer control: ON

Automatic switching ON/OFF of the stirrer in the titration sequence (ON, OFF)
If stirrer control is **ON**, the stirrer will be switched automatically. For stirrer control the red switch on the stirrer unit must be ON.

remote box: OFF

Connection of a remote box (on ,OFF)
To the remote socket for PC keyboard and barcode reader, see page 124.
If **on** has been set:

keyboard: US

Type of PC keyboard (US, German, French, Spanish, Swiss.)
The PC keyboard is used as an input aid, see page 125.

barcode: input

Target for barcode reader (input, method, id1, id2, id3, smpl size)
The barcode reader is used as an input aid, see page 124.
Input: The barcode string goes to the entry field in which the cursor is currently located.
Method: The barcode string goes to the entry field "Methods" in the silo memory.
Id1: The barcode string goes to the entry field "Id1". (Similar for Id2 and Id3.)
Smpl size: The barcode string goes to the entry field "smpl size".

> auxiliaries

Various auxiliary settings

dialog: english

Selection of dialog language (english, deutsch, francais, español, italiano, portugese, svenska)

date 1998-04-23

Current date (YYYY-MM-DD)
Format: year-month-day, entry with leading zeros.

time 08:13

Current time (HH-MM)
Format: hours-minutes, entry with leading zeros.

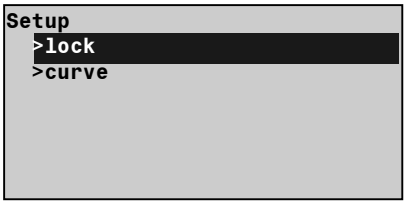
run number 0	*Current run number for result output (0...9999)* The sample number is set to 0 when the instrument is switched on and incremented on every determination.
operator level: standard	*Operating mode (standard, expert)* Determines the number of inquiries which are accessible. Operation in the standard mode contains only a few inquiries and is recommended for routine applications. Inquiries which are accessible in the standard mode are highlighted in gray in these Instructions for Use.
start delay 0 s	*Start delay (0...999 999 s)* Delay time after start of methods. Abort start delay time with <QUIT>.
result display: bold	*Type of result display at the end of the determination (bold, standard)* **bold**: the calculated results are displayed in bold characters. **standard**: displays the whole information, e.g. results, water, messages etc.
dev.label.	*Individual identification of devices (up to 8 ASCII characters). Is automatically printed in reports.*
beeps 1	*Number of beeps (1...3, OFF)* when instrument is ready (conditioning OK), end of titration and Cond.OK, reception of sample data from the balance and with sample sizes outside the limiting values.
display value: OFF	*Display of measured value (ON, OFF)* Display of U-value during conditioning and titration.
program 5.756.0010	*Display of program version. At 831: 5.831.0011 ; at 756: 5.756.0012 .*
>RS232 settings COM1	**Settings of RS232 interface** see also pages 97ff. Identical for COM2.
baud rate: 9600	*Baud rate (300, 600, 1200, 2400, 4800, 9600)*
data bit: 8	*Data bit (7, 8)*
stop bit: 1	*Stop bit (1, 2)*
parity: none	*Parity (even, odd, none)*
handshake: HWs	*Handshake (HWs, SWline, SWchar, none)* see page 97.

>report		**Configuration of the report** Printing report lines or data can be switched on and off. This means that the report can be arranged according to your requirements.
report id:	**ON**	*Prints the line "Report-Id" (ON, OFF)* e.g. 'fr. If you use Vesuv 3 the report identification is switched on automatically.
instrument id:	**ON**	*Prints the line(s) "instrument-Id" (ON, OFF)* 756 (or 831) KF Coulometer, instrument-Id and program version.
date, time:	**ON**	*Prints the line(s) "date, time" (ON, OFF)* If you use Vesuv 3 then date/time is switched on automatically.
run number:	**ON**	*Prints the sample number (ON, OFF)* The date line is printed without the sample number.
method:	**ON**	*Prints the line "Method" (ON, OFF)* e.g. KFC ********
sample:	**ON**	*Prints the line "Smpl size" (ON, OFF)*
drift:	**ON**	*Prints the line "Drift" (ON, OFF)*
titr.time:	**ON**	*Prints the line "Titr.time" (ON, OFF)*
H2O:	**ON**	*Prints the line "H2O" (ON, OFF)*
statistics:	**ON**	*Continuously prints the statistical results (ON, OFF)* With "OFF" the statistical results will only be printed out when the number n for statistics has been reached.
signature:	**OFF**	*Prints the line "Signature" (ON, OFF)*
> common variables		**Values of the common variables**
C30 **etc.**	**0.0**	*Common variables C30...C39 (0.. ±999 999)* The values of all common variables are displayed. For creating common variables see page 39.

Settings with key <CONFIG> and power ON

Proceed as follows:

1. Switch the Coulometer off.
2. Press <CONFIG> and keep it pressed during switching the Coulometer on.
   The display shows the following:



Lock:
Locking keys <CONFIG>, <PARAM> and <SMPL DATA>, <EXCH> and the functions **recall method**, **store method** and **delete method** of the method memory in the Coulometer.

Curve:
Changes the appearance of the curve printout.

```
>lock

   <configuration>:    OFF
   <parameters>:       OFF
   <smpl data>:        OFF
   <exchange>:         OFF

   recall method:      OFF
   store method:       OFF
   delete method:      OFF
```

Lock

ON means that the corresponding function is no longer accessible.

The corresponding key is locked.

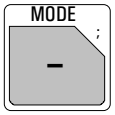
The corresponding function in the method memory of the Coulometer is locked.

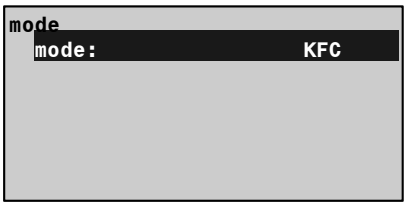
>curve		**Curve**
>Int.		The settings are similar for COM1 and COM2. If you change the printer type, the following settings are initialized according to the printer.
grid:	**ON**	*Grid drawing (ON, OFF)*
frame:	**ON**	*Frame drawing (ON, OFF)*
scaling:	**auto**	*Type of scaling (Full, Auto)* **Full**: the scaling goes from the greatest to the smallest value. **auto**: the scaling from tick to tick, e.g. the smallest/greatest values lie in between the first/last tick.
width	**0.90**	*Width (0.2...1.00)* 1 is greatest width. If you set 1 you may loose the label at the right margin.
length	**0.10**	*Length (0.01...1.00) of time axis*: Curve length 0.05 20 cm 0.1 10 cm 0.5 2 cm 1 1 cm

3.4.1 Reagent exchange procedure with Dosino

<EXCH> or Automatic exchange	Reagent exchange is automatic (if a reagent monitoring responds) or is triggered with <EXCH>. During the exchange `changing reagent` appears in the display.
Conditioning off Stirrer off	Current production and stirrer are switched off.
(Waiting time)	The waiting time is allowed to elapse. In this time it is possible to wait for the separation of e.g. a 2-phase mixture. In this way it is possible to aspirate only 1 phase (e.g. oil samples).
Aspiration volume	The given volume is aspirated. A volume slightly larger than that which is actually to be aspirated should be entered if you want to empty the titration vessel completely.
(Rinsing volume) (Rinsing cycles)	Rinsing the titration vessel. The rinsing volume is added, the stirrer switched on for 10 s, and then the rinsing volume (+3 ml) is aspirated off again. This process is repeated for each rinsing cycle. Normally rinsing is not necessary.
Reag.volume	The reagent volume is added and the tubing emptied.
Stirrer on Conditioning on	The stirrer is switched on again and the titration vessel is conditioned.
	Basically the instrument is in the same status after the reagent exchange as it was before.

3.5 Mode selection, key <MODE>





The key <MODE> is pressed repeatedly until the required mode is displayed. This is accepted with <ENTER>.

The following modes can be selected:
- KFC: coulometric KF titration.
- KFC-B: KF titration with blank value correction
- BLANK: determination of blank value
- GLP: mode for system validation

The newly loaded modes are provided with standard parameters and immediately ready for use.
The modes differ in their standard calculation formulas, see following table.

Mode	Calculation formula	Remarks
KFC	content=H2O*C01/C00/C02;1;ppm C01=1 C02=1	
KFC-B	blank=C39;1;ug content=(H2O-C39)*C01/C00/C02;1;ppm C01=1 C02=1 C39=blank	
BLANK	blank=H2O;1;ug	C39=MN1
GLP	content=H2O/C01/C00;3;mg/g recovery=RS1/C22;2; C01=1000 C22=Id2=contents information of reagent manufacturer	Limit value check for RS2 **on**:[1)] Lower limit: 0.97 Upper limit: 1.03 Inquiry of id1 and id2; text: id1: charge id2: mg/g H2O

1) The default limits for the recovery rate correspond to the information for the standard with 1000 ppm (1.00 mg/g) water. For the standard with 100 ug water the limits 0.90 and 1.10 apply.

Operands for C01 and C02 in the modes KFC and KFC-B

Result in	Sample size in	C01	C02	Result in	Sample size in	C01	C02
ppm % mg/g	g	1 1 1	1 10 000 1 000	mg/ml	ml	1	1 000
ppm % mg/g	mg	1 000 1 1	1 10 1	mg/ml	ul	1	1

3.6 Parameters, key <PARAM>

The key <PARAM> is used to enter mode-specific parameters. Values marked with **cond.** are accessible during conditioning, while ****titr**. means that these values can also be altered during the titration. In this case they will influence the run being carried out. All other values can only be altered in the inactive basic status.
Two different operating modes are available: standard mode and expert mode. Inquiries which appear in the standard mode are highlighted in gray.
The Coulometer displays are shown below at the left-hand side. The values are the default values.

```
parameters
  >control parameters
  >titration parameters
  >statistics
  >preselections
```

Control parameters (only in expert mode):
Control parameters for EP.
Titration parameters
Influence the course of the titration.
Statistics:
Mean values and standard deviations of the calculated results, see page 37.
Preselections:
Selection of various auxiliaries: Automatic inquiries after the start, etc.

```
>control parameters

   EP at U            50 mV

   dynamics           70 mV
   **titr.

   max.rate     max. ug/min
   **titr.

   min.rate       15 ug/min
   **titr.
```

Control parameters

Endpoint (0.. ±2000 mV)
The standard value should be suitable for most applications.

Control range 0...2000 mV):
Input as distance to endpoint. Outside the control range iodine will be produced continuously.

Maximum rate (1.5...2240 ug/min, max.)
<CLEAR> sets **max**.
This parameter primarily determines the rate outside the control range.

Minimum rate (0.3...999.9 ug/min, min.)
<CLEAR> sets **min**. = 0.28 ug/min.
This parameter determines primarily the rate at the beginning and at the end of the titration.

`stop crit: rel.drift` ***titr.***	*Type of stop criteria (drift, rel.drift)* Drift: the entered value corresponds to the stop drift. rel.drift: the stop drift is calculated according to the "actual drift at start of titration + entered value, see page 32.
`stop drift 5 ug/min` ***titr.***	If **`Drift`** has been set: *Switches off titration when EP and stop drift have been reached (1...999 ug/min)*
`rel.drift 5 ug/min` ***titr.***	If **`rel.drift`** has been set: *Switches off titration when EP and corresponding drift have been reached (0...999 ug/min)*
`>titration parameters`	**Titration parameters**
`pause 0 s` ***titr.***	*Pause (0...999 999 s)* Waiting period in which no iodine is produced. The pause can be terminated with <QUIT>.
`extr.time 0 s` ***titr.***	*Extraction time (0...999 999 s)* The titration takes place during this time. However, it is not stopped until the extraction time has elapsed (even when the EP has been reached). The extraction time can be terminated with <QUIT>.
`start drift 20 ug/min`	*Start Drift (1...999 ug/min)* Drift value below which the start of the titration is possible (conditioning OK), see page 32.
`I(pol): 10 uA`	*Polarization current (2, 5, 10, 20, 30 uA)*, at the indicator electrode. The set standard value should be optimal for most applications, see also page 32.
`electrode test: ON`	*Electrode test (OFF, ON)* Performed on changeover from the inactive standby state to a measurement. **`OFF`** means that the test is not performed.
`temperature 25.0 °C` ***cond.***	*Titration temperature (-170.0...500.0 °C)* for the documentation of titration conditions.
`time interval 2 s` ***cond.***	*Time interval (1...999 999 s)* Time interval for acquisition of a measured value into the measuring point list.
`max.titr.time OFF s` ***titr.***	*Maximum titration time (1...999 999 s, OFF)* Safety time for termination of the titration even when the EP has not been reached. The titration time corresponds to the time in which control is carried out, i.e. inquiries after the start without control and pause periods are **not** included in this time.

>preselections	**Preselections for the titration sequence**
drift corr: auto ***cond.***	*Type of drift correction (auto, man., OFF)* **auto**: drift value at start is valid and deducted.
drift value 0.0 ug/min ***cond.***	*Value for manual drift correction (0...99.9 ug/min)*
req.ident: OFF ***cond.***	*Request of identifications after start of titration (id1, id1&2, all, OFF)* After start, sample identifications can be requested automatically: only id1, id1 & id2; all three id's or no inquiries.
req.smpl size: value ***cond.***	*Request of sample size after start of titration (value, unit, all, OFF)* **all**: the value and the unit will be requested. The unit will be overwritten by the method-specific unit, see below.
request and titr: ON ***cond.***	If an inquiry is ≠ **OFF**: *Titrate during the requests (OFF, ON)* With **on** the titration starts during the requests after 6 s. The calculation of the result and the output of data only take place when the inquiries have been exited.
smpl unit: g ***cond.***	*Method-specific unit of sample size (g, mg, ug, ml, ul, pc, -, 5 ASCII)* At the start of the method the sample size unit is overwritten by the method-specific unit which has been preset.
limit smpl size: OFF ***cond.***	*Limiting value check for sample size (ON, OFF)* With **on** the error message **sample size out** appears if the entry is outside the set limits. The limiting values are shown in the display window. The absolute value of the limit is checked during sample size input and during the calculation of the results. If **on** has been set:
low lim. 0.0 ***cond.***	*Lower limit for sample size (0.0...999 999)*
up lim. 999999 ***cond.***	*Upper limit for sample size (0.0...999 999)*
text id1 id1 or C21	*Method-specific text for id1 (10 ASCII-characters)* Appears in the display and printout. The text is without meaning for work with the silo memory. (Similar for Id2 and Id3.)
cell: no diaph	*Type of generator electrode (no diaph., diaphragm)* For documentation of the titration conditions.

generator I: 400 mA	*Current at generator electrode (100, 200, 400 mA, auto)* see also page 33. **auto** means that the current is automatically adapted to the conductivity of the reagent and that in the region of the endpoint the current will be controlled at smaller values.
Oven: no ***cond.***	*Connected oven (COM1, COM2, no)* COM of the Coulometer to which the oven is connected. If an oven is connected via RS232 an inquiry will be made for the oven results and these will be inserted into the result report of the Coulometer. The report output on the oven must be switched OFF. Set **no** if no oven has been connected or if you have not connected the oven to Coulometer the via RS232 interface.
activate pulse: OFF ***cond.***	*Pulse output on I/O line L6 (L6, pin 1) of the remote socket (first, all, cond., OFF)* see page 132.

3.6.1 Titration sequence

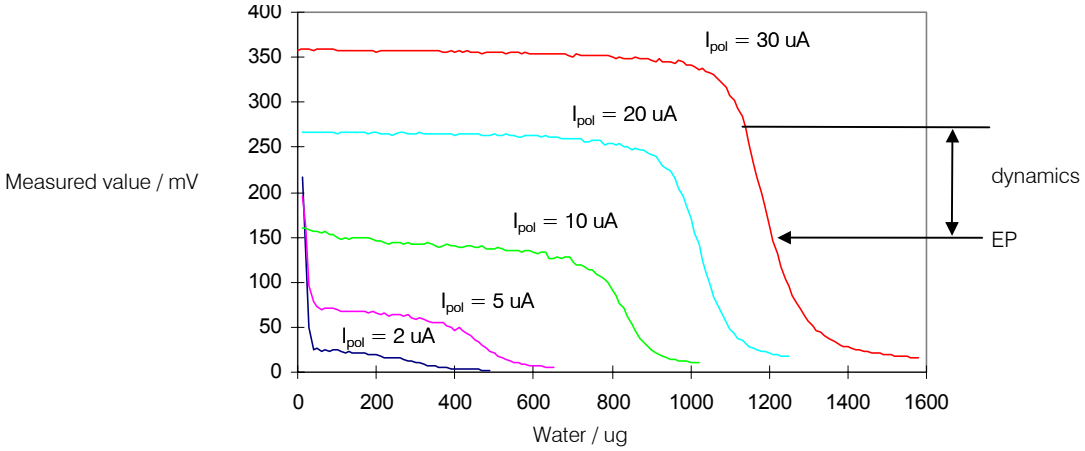
<START>	
(Activate pulse) (Stirrer ON)	After the start, the activate pulse is outputted and the stirrer switched on.
(Start delay)	The start delay time is allowed to elapse.

(Preconditioning)
(<START>
(Activate pulse)
(Start delay)
	The solution is titrated until the EP is reached. The display then shows
	`KFC wait`
	and the "COND" indicator blinks.
	If the EP has been reached, the display shows
	`KFC ready`
	`drift <=> 2.4 ug/min`
	The indicator "COND" is ON. The vessel is now conditioned. The titration can be started with <START>.

(Request ident.) (Request smpl size)	The sample identifications and the sample size are requested. Without any of these requests, the display shows for 6s `add sample` This waiting time of 6 s can be aborted with <QUIT>.
(Pause)	The pause is waited off.
(Extraction time) Titration with test of stop criterion	The titration is carried out. If the extraction time has not expired when the endpoint has been reached, the titration will only be terminated when the extraction time has elapsed.
Calculations	Calculations are carried out.
Data output	Data are outputted.
Reconditioning	Conditioning is carried out.

3.6.2 Control parameters and Ipol

The standard control parameters are optimal for most applications and should not be altered. If you nevertheless need to alter the control parameters for special reagents and/or samples take care that the polarization current of the indicator electrode, the endpoint and the control range are linked to each other.



The diagram shows KF titration curves at different polarization currents (reagent Coulomat AD). It is clear to see that the position of the endpoint varies with the polarization current. The curves have different slopes, i.e. dynamics must also be adapted. Polarization currents smaller than 10 uA are not suitable for this application. The following table gives an idea of the optimal control parameters for various polarization currents.

Ipol	10 uA	20 uA	30 uA
EP	50 mV	100 mV	150 mV
dynamics	70 mV	100 mV	120 mV

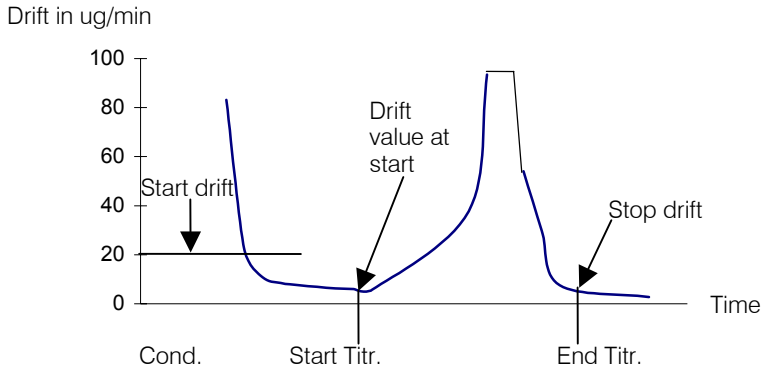
min.rate, max.rate and stop drift = standard values.

After a certain period of use in the same reagent the indicator electrode will become activated, i.e. the titration curve becomes steeper. If the titration curve is too steep then slowly varying drift values may occur during conditioning. Remedied by: setting lower EP. EP values which have been set too low can lengthen the titration time and therefore have an unfavorable influence on the measuring error.

3.6.3 Drift

Secondary reactions and the penetration of atmospheric moisture mean that a certain amount of iodine is always consumed during conditioning. This consumption is known as the drift. Drift is shown in the Coulometer display in ug H_2O per minute.

Drift is used for the start and stop criterion, as well as for the drift correction of the result:



Start drift
When the actual drift during conditioning is smaller than the start drift a titration can be started. The "COND" LED remains on all the time.

Stop drift
The titration is terminated when the EP has been reached and the stop drift is undercut. For the relative stop drift the drift value at the start of the titration + the relative drift applies.

Drift correction
If the titration vessel has a blank consumption during conditioning then it must be assumed that this blank consumption will also occur during the titration. In this case a drift correction should be made. The drift correction is calculated as follows:

Drift correction = Drift value (in ug/min) * Titration time (in min)

With automatic drift correction the drift value at the start of the titration applies. If the drift value varies greatly then a manual drift correction should be made. The drift value to be entered should correspond to the mean drift value.

3.6.4 Current at the generator electrode

The current at the generator electrode is set by the parameter "generator I" (under titration parameters). The steps 400, 200 and 100 mA are possible. With the setting "auto" the current strength will be automatically reduced in the region of the endpoint. The current strength will also be reduced if the conductivity of the reagent becomes too low.

Generator electrodes with diaphragm
Work should normally be carried out with automatic switching of the current strength.

Generator electrodes without diaphragm
For generator electrodes without diaphragm the current strength must be sufficiently high so that only hydrogen is produced at the cathode. If this is not the case then the results obtained will be too high. We therefore recommend that a fixed current strength of 400 mA is used.
If the conductivity of the fresh reagent is too low and therefore the error message "check generator electr." appears then a generator electrode with diaphragm should be used. You can also try to continue to use the generator electrode without diaphragm together with a different reagent. Ask the reagent manufacturer for more information! It may also be possible to use a lower fixed current strength, e.g. 200 mA, without obtaining high-bias results (check with a standard).

3.7 Result calculations

Formula entry, key <DEF>


```
def
  >formula
  >silo calculations
  >common variables
  >report
  >mean
```

Key <DEF> contains various inquiries for result calculations and data output. The data of this key are method-specific and they are stored in the method memory together with the method.

Formula (in expert mode only):
Formulas for result calculations.

The display texts of the Coulometer are shown to the left. The values are the default values.

```
>formula
```

Input of formulas

```
  RS?
```

Enter formula number (1...9)
You can calculate up to 9 results per method.
Enter a number 1...9.

```
  RS1=
```

Input of formula
Example:

```
  RS1=H2O*C01/C00/C02
```

RS1=H2O*C01/C00
Enter formula by means of 3rd functions of keyboard. Here you will find operands, mathematical operations and parentheses. Operands require a number as an identification. You can use the following operands:

H2O: Amount of water at the EP in ug.
RSX: Results which have already been calculated with previous formulas. X = 1...9.
CXX: Calculation constants. XX = 00...45.

Rules:
- Calculation operations are performed in the algebraic hierarchy: * and / before + and -.
- Store formula with <ENTER>.
- Calculation quantities and operands can be deleted with <CLEAR> one by one.
- To delete a complete formula press <CLEAR> repeatedly until only RSX remains in the display. Confirm with <ENTER>.

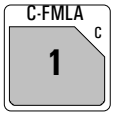
If a formula is stored with <ENTER>, result text, number of decimals, result unit and limit control for the result will be requested:

RS1 text	**RS1**	*Text for result output (up to 8 characters)* Text input see page 16.
RS1 decimal places	**2**	*Number of decimal places for result (0...5)*
RS1 unit:	**ppm**	*Selection of result unit (ppm, mg/g, mg/ml, mg, ug, mg/pc, %, no unit or up to 6 characters).*
RS1 limit control:	**OFF**	*Limit control for the result (on, off)* The limits are checked each time a result is calculated.
		If **on** has been set:
RS1 low lim.	**0.0**	*Lower limit (0.0...999 999)*
RS1 up lim.	**0.0**	*Upper limit (0.0...999 999)*
RS1 L13 output:	**OFF**	*Sets line L13 of the remote socket (OFF, active, pulse)* if the result lies outside the limits.
		Enter next formula, e.g. for RS2.

Meaning of the calculation variables CXX:

C00	Sample size, see page 46.
C01...C19	Method-specific operands, see page 36. They are stored with the method in the method memory.
C21...C23	Sample specific operands, see page 46ff.
C26, 27	Mean values from silo calculations.
C30...C39	Common variables.
C40	Initial measured value of the sample.
C41	Amount of water at the end of the titration in ug.
C42	Determination time.
C43	Drift at the start of the titration.
C44	Temperature.
C45	Amount of charge in mA·s.

Input of method-specific operands C01...C19, key <C-FMLA>

	With <C-FMLA> the operands C01...C19 can be entered. For the calculation the operands which were introduced in the formula are used. The inputs are method-specific and are stored in the method memory.

The calculation report can be printed with the key sequence
<PRINT><←/→> (press keys repeatedly until "calc" appears in the display) <ENTER>

Operands C01 and C02

The following table gives the values for the operands C01 and C02 for the standard formulas in the modes KFC and KFC-B depending on the unit in which you want the result to be expressed and the unit in which you want to enter the sample size:

Result in	Sample size in	C01	C02	Result in	Sample size in	C01	C02
ppm % mg/g	g	1 1 1	1 10 000 1 000	mg/ml	ml	1	1 000
ppm % mg/g	mg	1 000 1 1	1 10 1	mg/ml	ul	1	1

3.8 Statistics calculations

Mean values, absolute and relative standard deviations are calculated.


```
def
  >formula
  >silo calculations
  >common variables
  >report
  >mean
```

The key <DEF> is used to allocate results for statistics calculation.
The entries are specific to the method and are stored in the method memory.

Mean (in expert mode only):
Assigns values for statistics calculations.

The display texts of the Coulometer are shown to the left. The values are the default values. Inquiries which also appear in the standard operation mode are highlighted in gray.

```
>mean

   MN1=RS1
   MN2=
   :
   MN9=
```

Allocations for statistics calculations

Mean number 1...9 (RSX, H2O, CXX)
You can perform statistics calculations using up to 9 results (RSX), endpoint (H2O) or variables (CXX). For MN1, the default value RS1 is entered (for KFC-B, MN1=RS2).
Delete allocation with <CLEAR> + <ENTER>

Each mode has an inquiry group **>statistics** in key <PARAM>

```
>statistics

   status:              OFF

     mean               n=  2

     res.tab:       original

     delete             n=  1
```

Statistics calculation

Status of statistics calculation (OFF, ON)
If the statistics calculation is switched off, the following inquiries regarding the statistics do not appear.

Mean value calculation from n single results (2...20)

Result table (original, delete n, delete all)
original: The original table is used. Deleted individual results are again incorporated in the evaluation.
delete n: Deletion of single results with the index n.
delete all: The entire table is deleted.

Delete data from sample number n (1...20)
The deleted result is removed from the statistics calculation.

How do you obtain statistics calculations?

1) Enter the allocations for the statistics calculation (in expert mode only), see page 37.
2) Switch on the statistics calculations: either with <STATISTICS> or set the status under <PARAM>, **>statistics** to **ON**. The "STATISTICS" LED is on. The status of the statistics calculation is retained when a method is stored in the method memory.
3) Change the number of the individual values n under **mean n**, if necessary.
4) Perform at least 2 titrations. The statistics calculations are printed in the result report. If you just wish the statistics printout when the nominal number of single determinations is reached, configure the report as **statistics:OFF**, see page 22. With **statistics:ON**, the statistics calculations are continuously updated.
5) The statistics report can be printed with <PRINT><STATISTICS><ENTER>.

Rules:

- Recalculated results are incorporated in the statistics calculation.
- If a result of a particular titration can not be calculated, no results for this determination are incorporated in the statistics calculation. However, the sample counter is still operative, i.e. the statistics calculation starts again when the number of required individual determinations has been performed.
- If the statistics are switched off ("statistics" LED no longer on), results are no longer entered in the statistics table, but the table remains unchanged. When the statistics are switched on again, you can immediately continue working.
- If you delete results, all results of the determination with index n are removed from the statistics evaluation.
- If a method is changed the old statistics table is cleared and the statistics instructions for the new method are followed.
- Old results in the statistics table can be deleted with **delete all** (<PARAM>, **>statistics**, **res.tab:**).
  If you start a new series with the same method you should also delete all statistics results; this also resets the statistics counter.

3.9 Common variables

Common variables are used for:
- Determination of a blank value with method 1. Using this blank value in various other methods. Mode BLANK creates the common variable C39 (default setting).
- Determination of a result with method 1. Reconciliation of this result in various other methods.

You may view the values of the common variables with <CONFIG>.


```
def
  >formula
  >silo calculations
  >common variables
  >report
  >mean
```

With <DEF>, results can be allocated as common variables. The entries are specific to the method and are stored in the method memory.

Common variables (in expert mode only):
Assigns values as common variables.

The display texts of the Coulometer are shown to the left. The values are the default values.

```
>common variables

   C30=
   C31
   :
   C39=
```

Allocation for common variables

Common variable C30...C39 (RSX, H2O, CXX, MNX)
Results (RSX), endpoint (H2O), variables (CXX), and means (MNX) can be assigned.
The values of the common variables remain in force for all methods until they are overwritten or deleted. They can be viewed and entered manually under the <CONFIG> key.
Delete allocation with <CLEAR>+<ENTER>.

3.10 Data output

3.10.1 Reports for the output at the end of a determination


```
def
  >formula
  >silo calculations
  >common variables
  >report
  >mean
```

With <DEF>, the report sequence at the end of the determination is defined.
The entries are specific to the method and are stored in the method memory.

Report:
Definition of report blocks to be printed automatically at the end of the determination.

The display texts of the Coulometer are shown to the left. The values are the default values. Inquiries which also appear in the standard operation mode are highlighted in gray.

```
>report
  Only at 756:
  internal:result;
```

Report sequence

Report sequence for the internal printer (result, water crv, rate crv, meas crv, comb, mplist, param, calc, scalc full, scalc srt, ff)

Select a block with keys <←> and <→>. If you require more than one report block, set a "**;**" as a separator between the blocks.

```
  At both 756 and 831:
  COM1:Result;
  COM2:Result;
```

Identical for COM1 and COM2.

Meaning of the report blocks:

result	Result report with raw results, calculations and statistics.
water crv	Curve "mass water in ug" vs. time.
rate crv	Curve "rate in ug/min" vs. time.
meas crv	Curve measured voltage vs. time.
comb	Combined curve: mass of water and rate vs. time.
mplist	Measuring point list.
param	Parameter report.
calc	Report with formulas and operands.
scalc full	Full report of silo calculations.
scalc srt	Short report of silo calculations.
ff	Form feed on printer.

Original reports which are put out automatically at the end of the titration can be printed with recalculated values at any time. Key sequence:
<PRINT><REPORTS><ENTER>.
The target of these reports is as defined in the method.

Original reports have double dashes ==== at the end, whereas recalculations are marked by single dashes ----.

Report outputs can be stopped with <QUIT>.

Report examples:

```
 'fr
756 KF Coulometer
01109          5.756.0010
user                 Boss
date  1998-10-27        3
time  08:54
KFC               ********
smpl size          0.372 g
drift auto     3.2 ug/min
titr.time             47 s
H20                206.5 ug
content           555.1 ppm
      ============
```

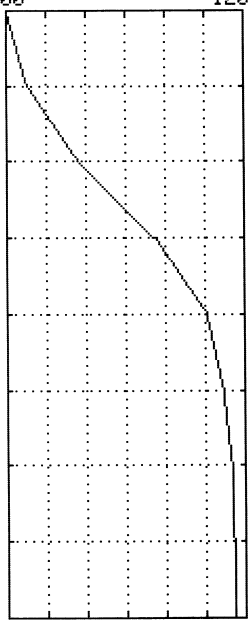
Result report:
Report identification
Instrument identification
"
User name, see page 43.

Method name

Automatic drift correction

Mass of water
Calculated result

```
 'cu
756 KF Coulometer
01109          5.756.0010
user                 Boss
date  1998-10-27        3
time  08:54
KFC               ********
5 s/div       20.0 ug/div
 0.00                120.0
```



```
      ============
```

water crv:

The following curves can also be printed out:
rate vs. time
measured voltage vs. time
combined curve water and rate vs. time

Scaling of time and "mass of water" axis

3.10.2 Additional possibilities for report outputs

In addition to the reports which are printed at the end of the titration, various other reports can be put out. There are 2 possibilities for selecting the reports:

1) <PRINT><←/→><ENTER> Cursor is pressed repeatedly until the desired report appears in the display.

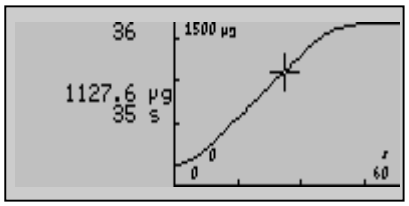
2) <PRINT><keyX><ENTER> key X is the key under which the appropriate data are entered.

Report	Display on <PRINT><→>	<Key X>
Result report	result	–
Curve water vs. time	water crv	–
Curve rate vs. time	rate crv	–
Curve measured voltage vs. time	meas crv	–
Combined curve water/rate vs. time	comb	–
Measuring point list	mplist	–
Parameter report	param	PARAM
Calculation report with formulas and calculation values	calc	–
Calculation values C01...C19	C-fmla	C-FMLA
Content of key <DEF>	def	DEF
Statistics report with the individual results	statistics	STATISTICS
Current sample data	smpl data	SMPL DATA
Sample data from silo memory	silo	SILO
Full silo calculations report	scalc full	–
Short silo calculations report	scalc srt	–
Configuration report	configuration	CONFIG
Contents of the method memory with memory requirements of the individual methods and the remaining bytes	user methods	USER METH
Complete report sequence of the last determination, as defined under the key <DEF> in the method	–	REPORTS
All possible reports	all	
Form feed for external printers	ff	

3.10.3 Display of the titration curve

After the titration, the curve can be viewed.

Switch between **curve** and **result display** with keys <←> and <→>.



You can trace the curve with keys <↑> and <↓>. In the text field to the left of the curve the index of the current measured value is displayed in the first line. In the subsequent lines, the corresponding measured values (water and time) are shown.

3.11 User name, key <USER>


```
user
  name:                Boss
  >delete
```

The key <USER> manages the user names.
User names can be entered directly or selected with the keys <←> and <→>.

Name:
Selection or input of user name.
Delete:
Delete user name.

The display texts of the Coulometer are shown below at the left. Inquiries which also appear in the standard mode are highlighted in gray.

```
   name:
```

User name (up to 10 ASCII characters)
User names can be entered directly or selected with the keys <←> and <→>.
The operator name is printed out in the report.
The operator name remains in the instrument until it is deleted (or until the RAM is initialized).
If no operator name is to be printed out the operator "blank" can be selected.

```
>delete
   name:
```

Delete user name
Enter the name directly or select it with the keys <←> and <→>. <ENTER> will delete the name from the list of user names.

3.12 Method memory, key <USER METH>


```
user methods
  >recall method
  >store method
  >delete method
```

Management of the method memory with key <USER METH>.
Select method name with keys <←> and <→> or enter names directly.

Recall method:
Loads a method from the method memory into the working memory.
Store method:
Stores the method which is in the working memory in the method memory.
Delete method:
Deletes a method from the method memory.

Inquiries which also appear in the standard operation mode are highlighted in gray.

```
>recall method

   method:
```

Recall method

Recall method from the method memory to the working memory (input of method name, which is included in the memory).
If a method identification is entered which is not found in the method memory, the selected value blinks.

```
>store method

   method:
```

Store method

Store method from the working memory to the method memory (up to 8 ASCII characters).
If a method with an identical name is already stored, you are asked if you wish to overwrite the old method. With <ENTER> it is overwritten, with <QUIT> you return to the entry.

```
>delete method

   method:
```

Delete method

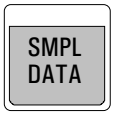
Delete method from the method memory (input of method name, which is included in the memory).
For safety, you are again asked if you really wish to delete the method. With <ENTER> it is deleted, with <QUIT> you return to the working memory.
If a method name is entered which is not found in the method memory, the selected value blinks.

The contents of the method memory can be printed with the key sequence
<PRINT><USER METH><ENTER>

```
 'um
756 KF Coulometer              5.756.0010
date  1998-11-02    time  14:27
user methods                       bytes
BLANK          Oven-Blk              164
KFC-B          Oven-Det              184
BLANK           774-Blk              168
KFC-B           774-Det              188
           remaining bytes          39266
```

Document your methods (e.g. parameter report, def report and C-fmla report)!
With a PC and the 6.6008.XXX Vesuv 3 program you should carry out a complete method backup from time to time.

3.13 Current sample data, key <SMPL DATA>




```
smpl data
  id1 or C21
  id2 or C22
  id3 or C23
  smpl size          1.0 g
  smpl unit:             g
```

The key <SMPL DATA> can be used to enter the current sample data. The contents of this key change when the silo memory is switched on, see page 47.
Instead of entering the current sample data with <SMPL DATA>, you can request these data automatically after start of determinations, see page 29.
Current sample data can be entered live during the titration.

Id1...3 or C21...C23, sample identifications:
The sample identifications can also be used as sample specific calculation variables C21...C23. The texts can be modified, see page 29.

Smpl size:
Sample size.
The limits for the sample size can be monitored, see page 29. The limits appear then in this window.

Smpl unit:
Unit of the sample size.

The display texts of the Coulometer are shown to the left. The values are the default values. Inquiries which also appear in the standard operation mode are highlighted in gray.

```
smpl data

   id1 or C21
   id2 or C22
   id3 or C23

   smpl size          1.0 g

   smpl unit:             g
```

Sample data

Sample identification 1...3 or sample specific operand C21...C23 (up to 12 ASCII characters).
Sample identifications or sample specific operands can be entered using the keypad, via a balance with a special input device or via barcode reader.

Sample size (6-digit number: ±X.XXXXX)
Entry using keypad, via a balance or via barcode reader. For calculations the absolute value is valid.

Unit of sample size (g, mg, ml, ul, pc, no unit or up to 5 characters)
The unit will be overwritten by the method-specific unit on starting, see page 28.

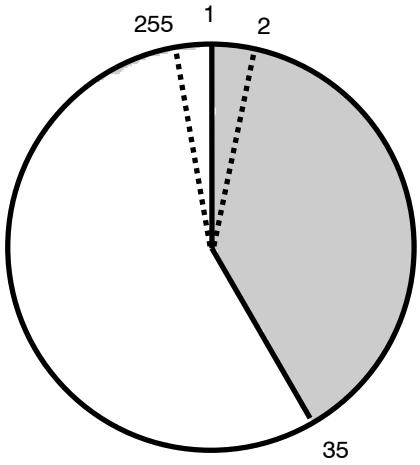
3.14 Silo memory for sample data

In the silo memory or pushup storage, sample data (method, identifications and smpl size) can be stored. This is useful, e.g. when you work with Sample Changers and other automatic sample addition systems or if you wish an overview of your determination results, see page 50.

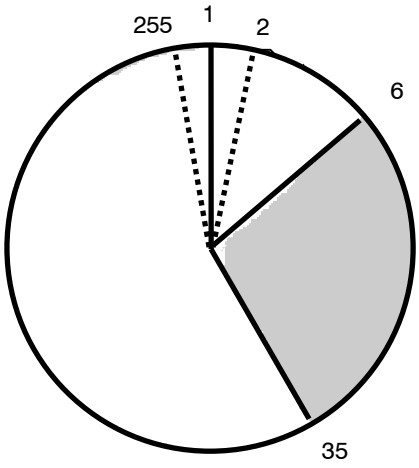
	Press the key <SILO> for working with the silo memory. The status LED "silo" is on when the silo memory is switched on. The silo memory works by the FIFO principle (First In, First Out).

If the silo memory is switched on, sample data are routed to the last free line of the silo memory. If no new value is put in, the value from the last line is automatically copied. In this manner, data can be simply taken over when they remain unchanged.
When the instrument is started, the sample data are fetched from the next silo line.

Organization of the silo memory



Silo memory contains 35 lines.
Next free line is 36



6 of the 35 lines have been processed. Free lines from 36 to 255 and from 1 to 6.

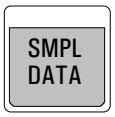
1 silo line needs between 18 and 120 bytes memory capacity.

Filling the silo memory with a connected balance

If the silo memory is filled from the balance, you must ensure that there is sufficient space in the silo memory for the required number of silo lines! The number of free bytes is given in the user memory report.

When the sample data are entered from a balance, the transfer of the sample size is taken as the end of the silo line. You should not send data from the balance and edit the silo memory at the same time.
For mixed operation, manual input of identifications and sample sizes from a balance, the values from the balance are sent into the line in which editing just takes place. Confirm the data with <ENTER> at the Coulometer.

Key <SMPL DATA> with the silo memory switched on




```
smpl data
  >edit silo lines
  >delete silo lines
  >delete all silo lines
  cycle lines:          OFF
  save lines:           OFF
```

Sample data can be entered into the silo memory with key <SMPL DATA>.

Edit silo lines:
Entering sample data into the silo memory.
Delete silo lines:
Deletes single silo lines.
Delete all silo lines:
Deletes the whole silo memory.

The display texts of the Coulometer are shown to the left. The values are the default values. Inquiries which also appear in the standard operation mode are highlighted in gray.

```
>edit silo lines
```

Input for silo memory

```
   silo line              1
```

Silo line (1...255)
The next free line is displayed automatically. Lines already occupied can be corrected.

```
   method:
```

Method with which the sample is processed (method name from the method memory)
If no method name has been entered, the sample is processed with the method in the working memory. Selection of the method with <←/→>.

```
   id1 or C21
   id2 or C22
   id3 or C23
```

Sample identification 1..3 or sample specific calculation variables C21...C23 (up to 12 characters)
Method-specific texts for id's are not valid in the silo memory.

```
   smpl size          1.0 g
```

Sample size (6-digit number: ±X.XXXXX)
Method-specific limits for the sample size are checked on start of the method.

```
   smpl unit:             g
```

Unit of sample size (g, mg, ml, ul, pc, no unit or up to 5 characters)
The unit will be overwritten on start of the method by its method specific unit, see page 28.

```
>delete silo lines
```

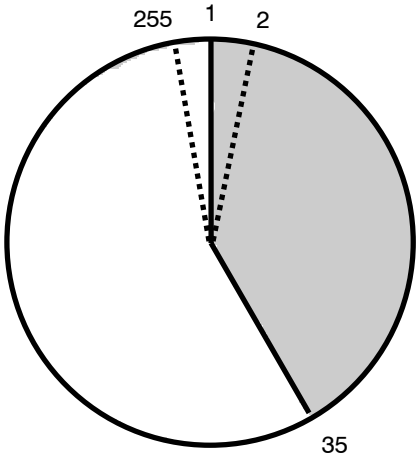
Delete individual silo lines

```
   delete line n        OFF
```

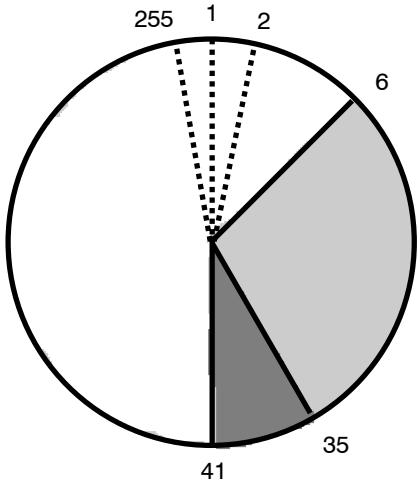
Line number of the line to be deleted(1...255, OFF)
<CLEAR> sets **OFF**.
Deleted lines remain in the silo memory. Access is blocked during the processing. To show that a line has been deleted, they are marked with *. The symbol * indicates that the line has been deleted.
Deleted lines can be reactivated if the appropriate line is re-edited.

`>delete all silo lines`	**Delete all silo lines**
`delete all: no`	*Confirmation (yes, no)* When all silo lines are deleted, the silo is completely empty: The line numbering starts again with 1.
`cycle lines: OFF`	*With* **ON**, *worked off silo lines will be copied to the highest line of the silo memory (ON, OFF)* Data cycling "on" is useful if you constantly have to process the same sample data. In such a case, the processed silo line is not deleted, but copied to the next free line, see below. If you work in this mode, you should not enter any new silo lines during the determinations.
`save lines: OFF`	*Store results in the silo memory (ON, OFF)* Determination results will be stored as C24 or C25 in the silo memory according to the allocations in the methods, see page 50. "save lines" can only be set to **OFF** if the silo is completely empty.

Silo memory with data cycling "on"



Silo memory contains 35 lines.
Next free line is 36.



6 of 35 lines have been processed.
The processed lines have been copied to the end of the silo memory: your silo is filled up to line 41.

3.15 Storing determination results and silo calculations

3.15.1 Storing determination results

If the sample-specific data of the silo memory should be kept after the determination and supplemented by results, the following entry is necessary:
In the method under <DEF>:
Assignment of the determination results to C24 and/or C25:

Assignment of determination results


```
def
  >formula
  >silo calculations
  >common variables
  >report
  >mean
```

The determination results are assigned in key <DEF>.

The display texts of the Coulometer are shown to the left. The values are the default values.

```
>silo calculations

   C24=
   C25=
```

Silo calculations

Assignment to C24 (RSX, H2O, CXX)
Calculated results (RSX), endpoint (H2O) or variables CXX can be stored as C24.
Same procedure for C25.

Important:
Ensure that there is still sufficient space for storing the results C24 and C25. (In the report <PRINT><USER METH><ENTER> the number of free bytes is shown.) Result name, value and unit are stored. The memory requirements can be estimated as follows:
Result with text (8 characters) and unit (5 characters): 32 bytes

After several samples have been processed, the silo memory report can have the following appearance (printout with <PRINT><SILO><ENTER>):

```
 'si
756 KF Coulometer   012/101  5.756.0010
date  1998-10-27   time  08:54       14
>silo
  cycle lines:           OFF
  save lines:             ON
 sl   method      id1/C21      id2/C22      id3/C23     C00           C24
+ 1     11-2         A/12     98-11-12                0.233 g       14.2 ppm
+ 2     11-2         A/13     98-11-12                0.286 g       13.8 ppm
/ 3     11-2         A/14     98-11-12                0.197 g       14.5 ppm
  4     11-2         A/15     98-11-12                0.288 g         NV
  5     11-2         A/16     98-11-12                0.263 g         NV
          ------------
```

Worked off silo lines with stored results

The silo lines can be marked as follows (at very left of report):

\+ Silo line has been processed. It cannot be edited anymore.

* A silo line not yet processed has been deleted.

\- A processed silo line has been deleted and hence removed from the silo calculations.

/ The last processed silo line. Recalculation will be considered e.g., if the sample data of this line are changed.
No marking: The silo line is awaiting processing.

For silo lines ≥100, the first digit will be overwritten by the marking.

3.15.2 Silo calculations

Mean values and standard deviations of the results available in the silo memory can subsequently be calculated for the entire series.

The following details can be entered in the method under <DEF>:

>silo calculations	**Silo calculations** (in expert mode only)
C24= **C25=**	*Assignment to C24 (RSX, H2O, CXX)* Calculated results (RSX), endpoint (H2O) and variables (CXX) can be stored as C24. Identical for C25.
match id: OFF	*Which sample identifications must match in order to combine of the results (id1, id1&2, all, OFF)* **OFF** means no matching id's, all samples which have been processed with the same method are combined, see examples below.

Starting from the following silo report:

```
 'si
756 KF Coulometer  012/101   5.756.0010
date  1998-10-27   time  08:54       14
>silo
  cycle lines:            OFF
  save lines:              ON
 sl   method      id1/C21      id2/C22      id3/C23     C00           C24
+ 1     11-2         A/12     98-11-12                 0.233 g       14.2 ppm
+ 2     0-15         A/13     98-11-12                 0.286 g       13.8 ppm
+ 3     0-15         A/13     98-11-12                 0.197 g       14.5 ppm
+ 4     11-2         A/12     98-11-12                 0.288 g       13.8 ppm
/ 5     11-2         A/15     98-11-12                 0.263 g       14.5 ppm
         ------------
```

Only C24 allocated

with "match id: off" the following silo calculation report (scalc full) is obtained:

```
:
  method      id1/C21      id2/C22     id3/C23            mean          +/-s  n
    11-2            *            *           * content    14.2 ppm      0.35  3
    0-15            *            *           * content    14.2 ppm      0.49  2
```

All samples which have been processed with the same method are combined

With "match id: id1" the following silo calculation report (scalc full) is obtained:

```
:
  method      id1/C21      id2/C22     id3/C23            mean          +/-s  n
    11-2         A/12            *           * content    14.0 ppm      0.28  2
    0-15         A/13            *           * content    14.2 ppm      0.49  2
    11-2         A/15            *           * content    14.5 ppm      0.00  1
```

Sample processed with the same method and having the same id1 are combined

The short silo calculation report contains only calculations for the current sample.

```
:
  method      id1/C21      id2/C22     id3/C23            mean          +/-s  n
    11-2         A/15            *           * content    14.5 ppm      0.00  1
```

The mean values of the silo calculations are available for further result calculations as C26 and C27 and can be used in the Coulometer in formulas.
Mean value of C24 ⇒ C26
Mean value of C25 ⇒ C27

Important:

- If work is performed with silo calculations, the method name must be entered in the silo memory.
- Results will be overwritten in the silo recalculation, as long as the silo line is marked with "/". If you do not wish such an input, e.g. because you are processing an urgent sample between a series, disconnect the silo.
- Calculations and assignments are carried out in the following order:
  1. Calculation of the results RSX
  2. Calculation of means MNX
  3. Assignment of silo results C24 and C25
  4. Silo calculations
  5. Assignment of means C26 and C27 from silo calculations
  6. Assignment of common variables C3X

4 Operation via RS232 Interface

4.1 General rules

The KF Coulometer has an extensive remote control facility that allows full control of the KF Coulometer via the RS 232 interface, i.e. the KF Coulometer can receive data from an external controller or send data to an external controller. C_R and L_F are used as terminators for the data transfer. The KF Coulometer sends 2xC_R and L_F as termination of a data block, to differentiate between a data line which has C_R and L_F as terminators. The controller terminates its commands with C_R and L_F. If more than one command per line is sent by the controller, ";" is used as a separator between the individual commands.

The data are grouped logically and easy to understand. Thus e.g., for the selection of the dialog language, the following must be sent

&**C**onfig.**A**ux.**L**anguage **"english"**

whereby it is sufficient to only transmit the boldface characters, thus:

&**C**.**A**.**L "english"**

The quantities of the commands above are:

Config	configuration data
Aux	auxiliaries, various data
Language	setting the dialog language

The data are hierarchically structured (tree form). The quantities that occur in this tree are called **objects** in the following**.** The dialog language is an object which can be called up with the

&**C**onfig.**A**ux.**L**anguage

command.

If one is in the desired location in the tree, the value of the object can be queried.

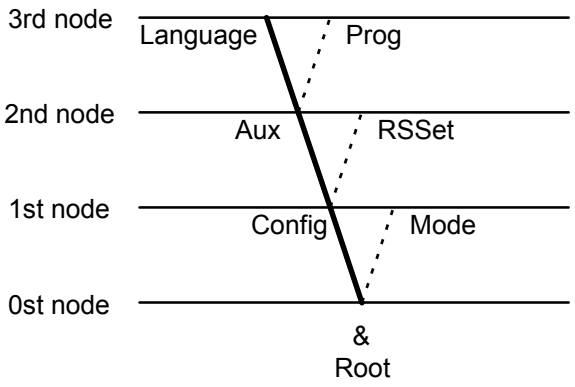
&**C**onfig.**A**ux.**L**anguage **$Q** Q means Query

The query command $Q initiates the issuing of the value on the instrument and the value emission is triggered. Entries which start with $, trigger something. They are thus called **triggers.**

Values of objects can not only be queried, they can also be modified. Values are always entered in quotes, for example:
&**C**onfig.**A**ux.**L**anguage **"english"**

4.1.1 Call up of objects

An excerpt from the object tree is represented below:



Rules	Example
The root of the tree is designated by &.	
The branches (levels) of a tree are marked with a dot (.) when calling up an object.	
When calling up an object, it is sufficient to give only as many letters as necessary to uniquely assign the object. If the call is not unequivocal, the first object in the series will be recognized.	Calling up the dialog language **&C**onfig.**A**ux.**L**anguage or **&C.A.L**
Upper- or lowercase letters may be used.	**&C.A.L** or **&c.a.l**
An object can be assigned a value. Values are signified at the beginning and end by quotes ("). They may contain up to 24 ASCII characters. Numerical values can contain up to 6 digits, a negative sign, and a decimal point. Numbers with more than 6 characters are not accepted; more than 4 decimal places are rounded off. For numbers <1, it is necessary to enter leading zeros.	Entering the dialog language: **&C.A.L"english"** correct entry of numbers: **"0.1"** incorrect entry of numbers "1,5" or "+3" or ".1"
The current object remains until a new object is called.	entry of another dialog language: **"deutsch"**
New objects can be addressed relative to the old object: **A preceding dot** leads **forwards** to the next level in the tree.	From the root to node 'Aux': **&C.A** Forward from node 'Aux' to 'Prog': **.P**
More than one preceding dot leads one level **backwards** in the tree. n node backwards require n+1 preceding dots.	Jump from node 'Prog' to node 'Aux' and select a new object 'Language' at this level: **..L**
If you must jump back to the root, enter a preceding &.	Change from node 'Language' via the root to node 'Mode': **&M**

4.1.2 Triggers

Triggers initiate an action on the KF Coulometer, for example, starting a process or sending data. Triggers are marked by the introductory symbol $.

The following triggers are possible:

$G	**G**o	Starts processes, for ex. starting the mode run or setting the RS 232 interface parameters
$S	**S**top	Stops processes
$Q	**Q**uery	Queries all information from the current node in the tree forward up to and including the values
$Q.P	**P**ath	Queries the path from the root of the tree up to the current node
$Q.H	**H**ighest Index	Queries the number of son nodes of the current node
$Q.N"i"	**N**ame	Queries the name of the son node with index i, i = 1 - n
$D	**D**etail-Info	Queries the detailed status information
$U	q**U**it	Aborts the data flow of the instrument, for example, after $Q

The triggers $G and $S are linked to particular objects, see the summary table page 60ff.

All other triggers can be used at any time and at all locations on the object tree.

Examples:

Querying the value of the baud rate: **&C**onfig**.R**SSet1**.B**aud **$Q**
Querying all values of the node "RSSet1": **&C**onfig**.R**SSet1 **$Q**
Querying the path of the node "RSSet1": **&C**onfig**.R**SSet1 **$Q.P**
Start mode: **&M**ode **$G**
Querying the detailed status: **$D**

4.1.3 Status messages

In order to have an efficient control by an external control device, it must also be possible to query status conditions; they provide information on the status of the KF Coulometer. The trigger $D initiates output of the status. Status messages consist of the global status, the detailed status and eventual error messages, e.g. $S.Mode.KFC.Inac;E26. The global status informs on the activity of the process, while the detailed status conditions show the exact activity within the process.
The status messages are identical for all modes.

The following **global status conditions** are possible:

`$G`	Go:	The KF Coulometer is executing the last command.
`$R`	Ready:	The KF Coulometer has executed the last command and is ready
`$S`	Stop:	A process has been aborted in an "unnatural manner". e.g. stopped or aborted because there was an error.

Detailed status conditions

Status conditions of the global $G:

`$G .Mode.KFC .Inac`:	Instrument at the beginning or at the end of a titration.
`.Req .Id1`:	Instrument in the KFC mode, requesting Id1 after start.
`.Id2`:	Instrument in the KFC mode, requesting Id2 after start.
`.Id3`:	Instrument in the KFC mode, requesting Id3 after start.
`.Smpl`:	Instrument in the KFC mode, requesting sample size after start.
`.Unit`:	Instrument in the KFC mode, requesting unit of sample size after start.
`.Start`:	Instrument in the KFC mode, waiting the pause.
`.ExtrTime`:	Instrument in the KFC mode, working off the extraction time.
`.Titr`:	Instrument in the KFC mode, titrating.
`$G .Mode.KFC .Cond.Ok`:	Instrument in the KFC, conditioning, endpoint reached (after the first start from the standby mode).
`.Cond.Prog`:	Instrument in the KFC mode, conditioning, endpoint not reached (Conditioning progressing).
`$G .Mode.KFC .ChangeReagent`:	Changing reagent.
`$G .Assembly.Bur .Fill`:	Buret in filling process
`.ModeDis`:	Buret in DIS mode
`$G .Prep.Active`:	Preparing buret.
`.Empty.Active`:	Emptying buret.

Status conditions of the global $R:

`$R .Mode.KFC .Inac`:	Instrument in the KFC mode, inactive.
`.Cond.Ok`:	Instrument in the KFC mode, conditioning, endpoint reached.
`.Cond.Prog`:	Instrument in the KFC mode, conditioning, endpoint not reached.
`$R .Assembly.Bur.ModeDis`:	Buret in the DIS mode, inactive.

Status conditions of the global $S:

The instrument gives the status from which it has been stopped. The detailed status information is therefore identical to for the global status $G.
Violation of monitored limits with action "end" give the status message $S.Mode.XXX.Inac;EYYY.

4.1.4 Error messages

Error messages are added to the status messages and separated from them by the sign ";".

E20 Check exchange unit.
Exit: Mount Exchange Unit (properly) or &m $S.

E21 Check electrode, short circuit.
Exit: Rectify fault or &m $S.

E22 Check electrode, break.
Exit: Rectify fault or &m $S.

E23 Division by zero.
Exit: The error message disappears on next start or on recalculation.

E24 Check drive unit.
Exit: Connect drive unit (correctly) or &m $S.

E25 Change reagent.
Exit: Error message disappears on next start or clear reagent counters &Config.Monitoring.Reagent.ClearCount $G.

E26 Manual stop.
Exit: The error message disappears on next start.

E28 Wrong object call up
Exit: Send correct path for object. Start path at root.

E29 Wrong value or no value allowed.
Exit: Send correct value or call up new object.

E30 Wrong trigger, this trigger is not allowed or carrying-out of action not possible.
Exit: Send correct trigger (exception: $D) or call up new object.

E31 Command is not possible in active status. Repeat command in inactive status.
Exit: Send new command.

E32 Command is not possible during titration. Repeat command during the conditioning phase or in inactive status.
Exit: Send new command.

E33 Value has been corrected automatically.
Exit: Send new command.

RS receive errors:

E36 Parity
Exit: <QUIT> and ensure settings of appropriate parameters at both devices are the same.

E37 Framing error
Exit: <QUIT> and ensure settings of appropriate parameters at both devices are the same.

E38 Overrun error. At least 1 character could not be read.
Exit: <QUIT>

E39 The internal working-off buffer of the KF Coulometer is full (>82 characters).
Exit: <QUIT>

RS send errors:

E42 CTS=OFF No proper handshake for more than 1 s.
Exit: <QUIT> Is the receiver switched on and ready to receive?

E43 The transmission of the KF Coulometer has been interrupted with XOFF for at least 6 s.
Exit: Send XON or <QUIT>

E45 The receive buffer of the KF Coulometer contains an incomplete command (L_F missing). Sending from the KF Coulometer is therefore blocked.
Exit: Send L_F or <QUIT>.

E120 Overrange of the measured value.
Exit: Correct error or &m $S.

E121 Measuring point list overflow (more than 500 measuring points).
Exit: The error message disappears on next start.

E123 Missing EP for calculation.
Exit: The error message disappears on next start or on recalculation.

E127 Stop time reached.
Exit: The error message disappears on next start.

E128 No new mean.
Exit: The error message disappears on next start or on recalculation.

E129 No new common variable, old value remains.
Exit: The error message disappears on next start or on recalculation.

E132 Silo empty and it has been started with open silo or empty silo has been opened.
Exit: Send a silo entry.

E133 Silo full.
Exit: Send new command.

E134 No method. A method, which is required from the silo memory, does not exist.
Exit: The error message disappears on next start.

E137 XXX Bytes are missing so that the method, the silo line could not be stored.
Exit: Send new command.

E155 No new silo result (C24 or C25).
Exit: The error message disappears on next start or on recalculation.

E176 The function &Assembly.Buret.Prep or &Assembly.Buret.Empty was interrupted manually.
Exit: The error message disappears on next start.

E190 Overtitrated. The KF Coulometer is in the Iodine range.
Exit: The error message disappears when the Coulometer is again in the water range or on next start.

E192 Check generator electrode: Not sufficient solvent in titration vessel or you are working with fixed generator current or generator electrode defective. The results of a determination may be erroneous and in the report you will find the message " work.conditions not ok".
Exit: Rectify error.

E194 Sample unfit. Sample releases oxidative agents during titration.
Exit: Rectify error or &m $S.

E196	Result is out of limits. Exit: The error message disappears on next start or on recalculation.
E197	Sample size is out of limits. Exit: The error message disappears on next start or on introduction of new sample size.
E198	Validation interval is expired. Exit: The error message disappears on next start or clear counter with &Config.Monitoring.Validation.Clear $G.
E199	Service date is reached. Exit: The error message disappears on next start or change date in &Config.Monitoring.Service.Date.
E203	No Oven parameters: Oven not (correctly) connected. Exit: The error message disappears on next start. If you don't wish oven parameters in your report, select &Mode.Parameter.Presel.Oven "no" in your method(s).
E209	Temperature in the KF Coulometer instrument too high (>60 °C). Exit: The error message disappears if the Coulometer temperature is below 60°C.
E212	Transmission error from Remote Box. Unknown characters. Exit: Rectify error and switch Coulometer off and on again.
E213	Time-out error from PC keyboard (Remote Box) Exit: Rectify error and switch Coulometer off and on again.
E214	Check Remote Box. Remote Box not (properly) connected but activated in &Config.Periph.RemoteBox. Exit: Rectify error and switch Coulometer off and on again.

4.2 Remote control commands

4.2.1 Overview

The internal object tree can be divided into the following branches:

&	**Root**
├ **M**ode	Method parameters
├ **U**serMeth	Administration of the internal user-memory for methods
├ **C**onfig	Instrument configuration
├ **S**mplData	Sample specific data
├ **H**otKey	Keys with direct access
├ **I**nfo	Current Data
├ **A**ssembly	Component data
├ **Se**tup	Setting the operating mode
└ **D**iagnose	Diagnostics program

&Mode

Object	Description	Input range	Reference
& Root			
├ **M**ode	**Mode**	$G, $S	4.2.2.1.
: ├ **.S**elect	Mode selection	**KFC**,KFC-B,BLANK,GLP	4.2.2.2.
├ .**N**ame	Name of current method	read only/read+write	4.2.2.3.
├ **.P**arameter	**Parameters of current mode**		
├ **.C**trlPara	**Control parameters**		
├ .**E**P	Endpoint	0...**50**...±2000	4.2.2.4.
├ .**C**ontrol	without meaning	content, **special**	
├ .**Conte**nt	without meaning		
├ .**S**pecial	Parameters for setting "special"		4.2.2.5.
├ .**D**yn	Dynamics	0...**70**...2000	ditto
├ .**M**axRate	Maximum rate	1.5...2240, **max.**	ditto
├ .**Mi**nRate	Minimum rate	0.3...**15**...999.9, min.	ditto
├ .**S**top	Stop criterion		
├ .**T**ype	Type of stop criterion	drift, **rel.drift**	ditto
├ .**D**rift	Stop drift	1...**5**...999	ditto
├ .**R**elDrift	Relative stop drift	0...**5**...999	ditto
├ **.T**itrPara	**Titration parameters**		
├ .**D**irection	Titration direction	+, **-**, auto	4.2.2.6.
├ .**P**ause	Waiting time before titration	**0**...999 999	4.2.2.7.
├ .**E**xtrT	Extraction time	**0**...999 999	ditto
├ .**S**tartDrift	Max.Drift for start of titration	1...**20**...999	4.2.2.8.
├ .**I**pol	Polarization current	2, 5, **10**, 20, 30	4.2.2.9.
├ .**Po**lElectrTest	Test for polarized electrodes	**ON**, OFF	ditto
├ .**T**emp	Titration temperature	-170.0...**25.0**...500.0	4.2.2.10.
├ .**TD**elta	Time interv. for meas.acquisition	1...**2**...999 999	4.2.2.11.
├ .**TM**ax	Maximal titration time	1...999 999, **OFF**	4.2.2.12.
├ **.S**tatistics	**Statistics**		
├ .**S**tatus	Status of statistics calculation	ON, **OFF**	4.2.2.13.
├ .**M**eanN	No. of individual determinations	**2**...20	ditto
├ .**R**esTab	Result table		
├ .**S**elect		**original**,delete n,delete all	ditto
├ .**D**elN	Deletion of individual results	**1**...20	ditto
.Presel	**Preselections**		
├ .**C**ond	Conditioning	**ON**, OFF	4.2.2.14.
├ .**DC**or	Drift correction		
├ .**T**ype	Type of drift acquisition	**auto**, man., OFF	ditto
├ .**V**alue	Drift value for manual drift corr.	**0.0**...99.9	ditto
├ .**I**Req	Request of Id's after start	id1, id1&2, all, **OFF**	4.2.2.15.
├ .**S**Req	Request of smpl size after start	**value**, unit, all, OFF	ditto
├ .**R**eqTitr	Titration during requests	**ON**, OFF	ditto
├ .**Sa**mpleUnit	Unit of sample size	**g**, 5 ASCII	4.2.2.16.
├ .**L**imSmplSize	Limits for sample size		4.2.2.17.
├ .**S**tatus	Status of limit control	ON, **OFF**	ditto
├ .**L**oLim	Lower limit	**0.0**...999 999	ditto
├ .**U**pLim	Upper limit	0.0...**999 999**	ditto
├ .**Id**1Text	Text instead of Id1	up to 10 ASCII char	4.2.2.18.
├ .**Id2**Text	Text instead of Id2	up to 10 ASCII char	ditto
├ .**Id3**Text	Text instead of Id3	up to 10 ASCII char	ditto
├ .**Ce**ll	Type of generator electrode	**no diaph.**,diaphragm	4.2.2.19.

.**G**enI	Switching of generator I	100, 200, **400**, auto	ditto
.**O**ven	KF Oven connected	COM1, COM2, **no**	4.2.2.20.
.**A**ctPulse	Output of a pulse	first, all, cond., **OFF**	4.2.2.21.
.Def	**Definitions for data output**		
.Formulas	**Calculation formulas**		
.1	for result 1		
.Formula	Calculation formula	special	4.2.2.22.
.TextRS	Text for result output	up to 8 ASCII char	ditto
.Decimal	Number of decimal places	0...**2**...5	ditto
.Unit	Unit for result output	up to 6 ASCII char	ditto
.Limits	Limits for result	ON, **OFF**	ditto
.Lo Lim	Lower limit	**0**...±999 999	ditto
.Up Lim	Upper limit	**0**...±999 999	ditto
.Output	Output on L13	active, pulse, **OFF**	ditto
:	up to 9 results		
.SiloCalc	**Silo calculations**		
.Assign	Assignment		
.C24	Store as variable C24	RSX,H2O,CXX	4.2.2.23.
.C25	Store as variable C25	RSX,H2O,CXX	
.MatchId	Matching of Id's	id1, id1&2, all, **OFF**	
.ComVar	**Assignment of common variables**		
.C30	for C30	RSX,H2O,CXX,MNX	4.2.2.24.
up to C39			
.Report	**Reports at the end of determination**		
.Internal	Output to internal printer (only 756)	special	4.2.2.25.
.Assign1	Output to COM1	special	
.Assign2	Output to COM 2	as COM1	
.Mean	**Assignment for mean calculation**		
.1	MN1		
.Assign	Input of variable	RSX, H2O, CXX	4.2.2.26.
:			
.CFmla	**Calculation constants**		
.1	Calculation constant C01		
.Value	Input of value	**0**...±999 999	4.2.2.27.
up to C19			

&UserMeth

Object	Description	Input range	Reference
& Root			
⋮			
⋮ ├ **U**serMeth	**Method memory**		
⋮ │ ├ **.F**reeMemory	Memory available	read only	4.2.2.28.
⋮ │ ├ **.R**ecall	Load method	$G	4.2.2.29.
⋮ │ │ ├ **.N**ame	Method name	8 ASCII characters	ditto
⋮ │ ├ **.S**tore	Save method	$G	ditto
⋮ │ │ ├ **.N**ame	Method name	8 ASCII characters	ditto
⋮ │ ├ **.D**elete	Delete method	$G	ditto
⋮ │ │ ├ **.N**ame	Method name	8 ASCII characters	ditto
⋮ │ ├ **.DelA**ll	Delete all methods	$G	ditto
⋮ │ ├ **.L**ist	List of methods		
⋮ │ │ ├ **.1**	Method 1		
⋮ │ │ │ ├ **.N**ame	Method name	read only	4.2.2.30.
⋮ │ │ │ ├ **.M**ode	Mode	read only	ditto
⋮ │ │ │ ├ **.B**ytes	Method size in bytes	read only	ditto
⋮ │ │ │ ├ **.C**hecksum	Checksum of method	read only	ditto
⋮ │ │ ├ **.2**	for each method		

&Config

Object	Description	Input range	Reference
& Root			
├ **C**onfig	**Instrument configuration**		
│ ├ **.M**onitoring	**Monitoring functions**		
│ │ ├ **.R**eagent	Monitoring of reagent		4.2.2.31.
│ │ │ ├ **.S**tatus	Status of reagent monitoring	ON, **OFF**	ditto
│ │ │ ├ **.D**eterm	Number of determinations	1...**99**...999, OFF	ditto
│ │ │ ├ **.DC**ounter	Determination counter	**0**...999	ditto
│ │ │ ├ **.M**axTime	Time monitoring	1...**7**...9999, OFF	ditto
│ │ │ ├ **.T**Counter	Time counter	**0**...9999	ditto
│ │ │ ├ **.R**eagCap	Reagent capacity monitoring	1...**1000**...9999, OFF	ditto
│ │ │ ├ **.RC**ounter	Reagent capacity counter	**0**...9999	ditto
│ │ │ ├ **.Cl**earCount	Clears all counters above	$G	ditto
│ │ │ ├ **.Dr**ift	Change if drift is above	0...99, **OFF**	ditto
│ │ ├ **.C**hange	Change of reagent	$G, $S	4.2.2.32.
│ │ │ ├ **.S**tatus	Type of reagent changing	auto, man., **OFF**	ditto
│ │ │ ├ **.W**aitTime	Waiting after switching off stirrer	**0**...999 999	ditto
│ │ │ ├ **.A**spVol	Volume to aspirate	0...**100**...9999	ditto
│ │ │ ├ **.So**lventVol	Solvent volume to add	0...**100**...9999	ditto
│ │ │ ├ **.R**inse	Rinsing volume	**0**...9999	ditto
│ │ │ ├ **.N**oRinse	Number of rinsing cycles	**1**...9	ditto
│ │ ├ **.V**alidation	Validation monitoring		4.2.2.33.
│ │ │ ├ **.S**tatus	Status of validation monitoring	ON, **OFF**	ditto
│ │ │ ├ **.I**nterval	Time interval for validation	1...**365**...9999	ditto
│ │ │ ├ **.C**ounter	Time counter	**0**...9999	ditto
│ │ │ ├ **.C**learCount	Clears the counter above	$G	ditto
│ │ ├ **.S**ervice	Monitoring of Metrohm service	$G	4.2.2.34.
│ │ │ ├ **.S**tatus	Status of service monitoring	ON, **OFF**	ditto
│ │ │ ├ **.D**ate	Date of next service	XXXX-XX-XX	ditto
│ │ ├ **.D**iagRep	Printing of system test report	ON, **OFF**	4.2.2.35.
│ ├ **.P**eriphUnit	**Selection of peripheral units**		
│ │ ├ **.C**harSet1	External printer on COM1	Epson,Seiko,Citizen **IBM**,HP	4.2.2.36.
│ │ ├ **.CharSet2**	as for CharSet1		
│ │ ├ **.R**epToComport	Output of manual reports	1, 2, 1&2. And in 756: int.,1&int.,2&int.,all	4.2.2.37.
│ │ ├ **.B**alance	Selection of balance	**Sartorius**,Mettler,Mettler AT AND,Precisa	4.2.2.38.
│ │ ├ **.S**tirrer	Stirrer control	**ON**, OFF	4.2.2.39.
│ │ ├ **.Rem**oteBox	Connected remote box		4.2.2.40.
│ │ │ ├ **.S**tatus	Status	ON, **OFF**	ditto
│ │ │ ├ **.K**eyboard	Type of keyboard	**US**, deutsch, francais, español, schweiz.	ditto
│ │ │ ├ **.B**arcode	Input of barcode reader	**input**, method, id1, id2, id3, smpl size	ditto
│ ├ **.A**ux	**Miscellaneous**		
│ │ ├ **.L**anguage	Dialog language	**english**, deutsch, francais, espanol, italiano, portugese, svenska	4.2.2.41.
│ │ ├ **.S**et	Setting of date and time	$G	4.2.2.42.
│ │ │ ├ **.D**ate	Date	XXXX-XX-XX	

.Time	Time	XX:XX	
.RunNo	Run number	**0**...9999	4.2.2.43.
.OpLevel	Operator level	**standard**, expert	4.2.2.44.
.StartDelay	Start delay time	**0**...999 999	4.2.2.45.
.ResDisplay	Result display	standard,**bold**	4.2.2.46.
.DevName	Device label	8 ASCII char.	4.2.2.47.
.Beep	Beeper	**1**...3, OFF	4.2.2.48.
.DisplayMeas	Display of measured values	ON, **OFF**	4.2.2.49.
.Prog	Program version	read only	4.2.2.50.
.RSSet1	**Settings RS232, 1**	$G	4.2.2.51.
.Baud	Baud rate	300,600,1200,2400,4800, **9600**	ditto
.DataBit	Number of data bits	7, **8**	ditto
.StopBit	Number of stop bits	**1**, 2	ditto
.Parity	Parity	even, odd, **none**	ditto
.Handsh	Handshake	**HWs**, SWchar, SWline, none	ditto
.RSSet2	as for RS1		
.Report	**Report configuration**		4.2.2.52.
.Id	Print report id	**ON**, OFF	ditto
.Instr	Print line with instrument id	**ON**, OFF	ditto
.DateTime	Print line with date/time	**ON**, OFF	ditto
.Run	Print run number	**ON**, OFF	ditto
.Method	Print line with method id	**ON**, OFF	ditto
.Sample	Print line with sample size	**ON**, OFF	ditto
.Drift	Print line with drift correction	**ON**, OFF	ditto
.TitrTime	Print line with titration time	**ON**, OFF	ditto
.EPH2O	Print line with H2O in ug	**ON**, OFF	ditto
.Statistics	Print current statistics data	**ON**, OFF	ditto
.Visum	Print line for visum	ON, **OFF**	ditto
.ComVar	**Values of common variables**		
.C30	C30	**0**... ±999 999	4.2.2.53.
up to C39		**0**... ±999 999	

&SmplData

Object	Description	Input range	Reference
& Root			
├ **S**mplData	**Sample data**		
│ ├ **.S**tatus	Status of silo memory	ON, **OFF**	4.2.2.54.
│ ├ **.O**FFSilo	Current sample data		
│ │ ├ **.I**d1	Sample identification 1	up to 12 ASCII char	4.2.2.55.
│ │ ├ **.Id2**	Sample identification 2	up to 12 ASCII char	ditto
│ │ ├ **.Id3**	Sample identification 3	up to 12 ASCII char	ditto
│ │ ├ **.V**alSmpl	Sample size	±X.XXXXX	ditto
│ │ ├ **.U**nitSmpl	Unit of sample size	up to 5 ASCII char	ditto
│ │ ├ **.L**imits	Limits of sample size	read only	ditto
│ ├ **.ON**SiloCurrent sample data			
│ │ ├ **.C**ounter	Counter of silo memory		
│ │ │ ├ **.M**axLines	Maximum lines	read only	4.2.2.56.
│ │ │ ├ **.F**irstLine	First line	read only	ditto
│ │ │ ├ **.L**astLine	Last line	read only	ditto
│ │ ├ **.E**ditLine	Editing silo lines		
│ │ │ ├ **.1**	1st silo line		
│ │ │ │ ├ **.M**ethod	Method name	up to 8 ASCII char	4.2.2.57.
│ │ │ │ ├ **.I**d1	Sample identification 1	up to 12 ASCII char	ditto
│ │ │ │ ├ **.Id2**	Sample identification 2	up to 12 ASCII char	ditto
│ │ │ │ ├ **.Id3**	Sample identification 3	up to 12 ASCII char	ditto
│ │ │ │ ├ **.V**alSmpl	Sample size	±X.XXXXX	ditto
│ │ │ │ ├ **.U**nitSmpl	Unit of sample size	up to 5 ASCII char	ditto
│ │ │ │ ├ **.C**24	Value of variable C24	read only	ditto
│ │ │ │ ├ **.C25**	Value of variable C25	read only	ditto
│ │ │ │ ├ **.Ma**rk	Mark of silo line	read only	ditto
│ │ │ ├ up to 255 lines			
│ │ ├ **.D**elLine	Delete silo line	$G	4.2.2.58.
│ │ │ ├ **.L**ineNum	Line number	1...255, **OFF**	ditto
│ │ ├ **.DelA**ll	Delete silo line	$G	4.2.2.59.
│ │ ├ **.Cy**cleLines	Cycle lines	ON, **OFF**	4.2.2.60.
│ │ ├ **.S**aveLines	Save results	ON, **OFF**	4.2.2.61.

&HotKey

Object	Description	Input range	Reference
& Root			
├ **H**otKey	**Keys with direct access**		
├ **.U**ser	User name		4.2.2.62.
├ **.N**ame	Input of user name	up to 10 ASCII char	ditto
├ **.D**elete	Delete user	$G	ditto
├ **.N**ame	Input of user name	up to 10 ASCII char	ditto
├ **.DelA**ll	Delete all users	$G	ditto
├ **.L**ist	List of users		
├ **.1**	User 1		
├ **.N**ame	Name of user	read only	ditto
├ up to 99			

&Info

Object	Description	Input range	Reference
& Root			
⋮			
├ **I**nfo	**Current data**		
⋮ ├ **.R**eport	**Transmission of formatted reports**	$G	4.2.2.63.
│ ├ **.S**elect	Report type	**result**, water crv,rate crv, meas crv, comb, mplist, param, calc, C-fmla, def, statistics, smpl data, silo, scalc full, scalc srt, config, user method, all, ff	ditto
├ **.C**hecksums	**Checksums**	$G	4.2.2.64.
│ ├ **.A**ctualMethod	Checksum of current method	read only	ditto
├ **.D**etermData	**Determination data**	$G	4.2.2.65.
│ ├ **.W**rite	Read/write for several nods	ON, **OFF**	
├ **.T**itrResults	**Titration results**		
│ ├ **.R**S	Calculated results		
│ │ ├ **.1**	1st result		
│ │ │ ├ **.V**alue	Value	read only	4.2.2.66.
│ │ ├ up to 9 results			
│ ├ **.E**P	Endpoint		
│ │ ├ **.V**	Value	read only	ditto
│ │ ├ **.M**eas	Measured value	read only	
│ ├ **.V**ar	Variables C4X		
│ │ ├ **.C**40	Start measured value	read only/read+write	ditto
│ │ ├ **.C41**	Mass of water	read only/read+write	
│ │ ├ **.C42**	Titration time	read only/read+write	
│ │ ├ **.C43**	Drift at titration start	read only/read+write	
│ │ ├ **.C44**	Titration temperature	read only/read+write	
│ │ ├ **.C45**	Total charge (mA·s)	read only/read+write	
├ **.S**tatisticsVal	**Statistics values**		
│ ├ **.A**ctN	Number of results in chart	read only	4.2.2.67.
│ ├ **.1**	1st mean		
│ │ ├ **.M**ean	Mean	read only	ditto
│ │ ├ **.S**td	Absolute standard deviation	read only	ditto
│ │ ├ **.R**elStd	Relative standard deviation	read only	ditto
│ ├ up to 9 mean values			
├ **.Si**loCalc	**Values of silo calculations**		
│ ├ **.C**24	Values of variable C24		
│ │ ├ **.N**ame	Name	read only	4.2.2.68.
│ │ ├ **.V**alue	Value	read only	ditto
│ │ ├ **.U**nit	Unit	read only	ditto
│ ├ **.C25**	as for C24		
│ ├ **.C26**	Values of variable C26		
│ │ ├ **.A**ctN	Number of single values	read only	ditto
│ │ ├ **.M**ean	Mean value	read only	ditto
│ │ ├ **.S**td	Absolute standard deviation	read only	ditto
│ │ ├ **.R**elStd	Relative standard deviation	read only	ditto
│ ├ **.C27**	as for C26		

.ActualInfo	**Current data**		
.Inputs	I/O Inputs		
.Status	Line status	read only	4.2.2.69.
.Change	Change of line status	read only	ditto
.Clear	Clear change	$G	ditto
.Outputs	as for I/O Inputs		
.Assembly	From Assembly		
.CyclNo	Cycle number	read only	4.2.2.70.
.I	Total charge (mA·s)	read only	ditto
.Meas	Measured indicator voltage	read only	ditto
.Pot	Voltage at generator electrode	read only	ditto
.IPulse	I of current pulse	read only	ditto
.Bur	Connected buret		
.V	Volume of dosing unit	read only	ditto
.Clear	Clears counters above	$G	ditto
.Titrator	From Titrator		
.CyclNo	Cycle number	read only	4.2.2.71.
.Water	Mass of water	read only	ditto
.Meas	Measured indicator voltage	read only	ditto
.dWaterdt	Drift or rate	read only	ditto
.I	Total charge (mA·s)	read only	ditto
.Pot	Voltage at generator electrode	read only	ditto
.IPulse	I of current pulse	read only	ditto
.MeasPt	Entry in measuring point list		
.Index	Index of entry	read only	4.2.2.72.
.X	X coordinate	read only	ditto
.Y	Y coordinate	read only	ditto
.Z1	Z1 coordinate	read only	ditto
.Z2	Z2 coordinate	read only	ditto
.EP	EP entry		
.Index	Index of entry	read only	ditto
.X	X coordinate	read only	ditto
.Y	Y coordinate	read only	ditto
.Oven	**Oven data**		
.HeatTime	Heating time	read only	4.2.2.73.
.SampleTemp	Sample temperature	read only	ditto
.LowTemp	Lowest temperature	read only	ditto
.HighTemp	Highest temperature	read only	ditto
.GasFlow	Gas flow	read only	ditto
.UnitFlow	Unit of gas flow	read only	ditto
.Display	**Display**		
.L1	Text line 1	up to 32 ASCII char	4.2.2.74.
up to line 8			
.DelAll	Delete display	$G	ditto
.Comport	Comport		
.Number	COM where PC is connected	read only	4.2.2.75.
.Assembly	**Assembly**		
CycleTime	Cycle time	read only	4.2.2.76.
ExV	Volume of Exchange/Dosing unit	read only	ditto
DeviceTemp	Temperature of Coulometer	read only	ditto

&Assembly

Object	Description	Input range	Reference
& Root			
⋮			
├ **A**ssembly	**Assembly control**		
├ **. G**enEl	**Generator electrode**		
├ **.P**ulse	Pulses	$G	4.2.2.77.
├ **.L**ength	Length of pulses	**0**...2000	ditto
├ **.C**urrent	Current of generator electrode	0, 100, 200, **400**	ditto
├ **. M**eas	**Measuring of indicator electrode**		
├ **.S**tatus	Status	ON, **OFF**	4.2.2.78.
├ **.I**pol	Polarization current of electrode	2, 10, **20**, 40	ditto
├ **.O**utputs	**I/O outputs**		
├ **.A**utoEOD	Automatic output of EOD	**ON**, OFF	4.2.2.79.
├ **.S**etLines	Set I/O lines	$G	ditto
├ **.L**0	Signal on L0	active,inactive,pulse,**OFF**	ditto
├ up to L13			
├ **.R**esetLines	Reset I/O lines	$G	ditto
├ **.S**tirrer	**Stirrer control**		
├ **.S**tatus	Status	**ON**, OFF	4.2.2.80.
├ **. B**ur	**Buret**		
├ **.E**mpty	Empties the buret	$G,$S,$H,$C	4.2.2.81.
├ **.P**rep	Prepares the buret	$G,$S,$H,$C	ditto
├ **.R**ates	Rates		
├ **.F**orward	Forward rate		
├ **.S**elect	Type of rate control	**digital**	4.2.2.82.
├ **.D**igital	Digital rate	0...150, **max**.	ditto
├ **.R**everse	as for forward rate		
├ **.S**elect	Type of rate control	**digital**	ditto
├ **.D**igital	Digital rate	0...150, **max**.	ditto
├ **.F**ill	Fill	$G,$H,$C	4.2.2.83.
├ **.M**odeDis	Dispensing	$G,$S,$H,$C	4.2.2.84.
├ **.S**elect	Type of dispensing control	**volume**, time	ditto
├ **.V**	Volume to be dispensed	0.0001...**0.1**...9999	ditto
├ **.T**ime	Time to dispense	0.25...**1**...86 400	ditto
├ **.VS**top	Limit volume	0.0001...9999, **OFF**	ditto
├ **.A**utoFill	Filling after each increment	ON, **OFF**	ditto

&Setup

Object	Description	Input range	Reference
& Root			
⋮			
├ **Se**tup	**Settings for the operating mode**		
├ **.C**omport	Output of automatic info	**1**,2,1&2	4.2.2.85.
├ **.K**eycode	Send key code	ON, **OFF**	4.2.2.86.
├ **.T**ree	Sending format of path info		
│ ├ **.S**hort	Short format of path	ON, **OFF**	4.2.2.87.
│ ├ **.C**hangedOnly	Paths of modified nodes only	ON, **OFF**	ditto
├ **.Tra**ce	Message on changed values	ON, **OFF**	4.2.2.88.
├ **.L**ock	**Lock key functions**		
│ ├ **.K**eyboard	Lock all keyboard keys	ON, **OFF**	4.2.2.89.
│ ├ **.C**onfig	Lock <CONFIG> key	ON, **OFF**	ditto
│ ├ **.P**arameter	Lock <PARAM> key	ON, **OFF**	ditto
│ ├ **.S**mplData	Lock <SMPL DATA> key	ON, **OFF**	ditto
│ ├ **.U**serMeth	Lock functions		
│ │ ├ **.R**ecall	Lock “loading”	ON, **OFF**	ditto
│ │ ├ **.S**tore	Lock “saving”	ON, **OFF**	ditto
│ │ ├ **.D**elete	Lock “deletion”	ON, **OFF**	ditto
│ ├ **.E**xchange	Lock <EXCH> key	ON, **OFF**	ditto
│ └ **.D**isplay	Lock display function	ON, **OFF**	ditto
├ **.M**ode	**Setting waiting intervals**		
│ ├ **.S**tartWait	Waiting time after start	ON, **OFF**	4.2.2.90.
│ ├ **.F**inWait	Waiting time after run	ON, **OFF**	ditto
├ **.S**endMeas	**Automatic sending of measured values**		
│ ├ **.S**endStatus	Connect/disconnect sending	ON, **OFF**	4.2.2.91.
│ ├ **.I**nterval	Time interval	0.4...**4**...16200, MPList	ditto
│ ├ **.Sel**ect	Selection	Assembly, **Titrator**	4.2.2.92.
│ ├ **.A**ssembly	From assembly		
│ │ ├ **.C**yclNo	Cycle number	ON, **OFF**	4.2.2.93.
│ │ ├ **.I**	Total charge (mA·s)	ON, **OFF**	ditto
│ │ ├ **.M**eas	Measured indicator voltage	ON, **OFF**	ditto
│ │ ├ **.P**ot	Voltage at generator electrode	ON, **OFF**	ditto
│ │ ├ **.IP**ulse	I of current pulse	ON, **OFF**	ditto
│ │ ├ **.B**ur	Connected buret		
│ │ │ ├ **.V**	Volume of dosing unit	ON, **OFF**	ditto
│ ├ **.T**itrator	From Titrator		
│ │ ├ **.C**yclNo	Cycle number	ON, **OFF**	4.2.2.94.
│ │ ├ **.W**ater	Mass of water	ON, **OFF**	ditto
│ │ ├ **.M**eas	Measured indicator voltage	ON, **OFF**	ditto
│ │ ├ **.d**Waterdt	Drift or rate	ON, **OFF**	ditto
│ │ ├ **.I**	Total charge (mA·s)	ON, **OFF**	ditto
│ │ ├ **.P**ot	Voltage at generator electrode	ON, **OFF**	ditto
│ │ ├ **.IP**ulse	I of current pulse	ON, **OFF**	ditto
│			

	"Setup", continuation		
.AutoInfo	**Automatic message for changes**		4.2.2.95.
.Status	Switch AutoInfo on/off	ON, **OFF**	ditto
.P	When mains is switched on	ON, **OFF**	ditto
.T	**Titrator infos**		
.R	When "ready"	ON, **OFF**	ditto
.G	When method started	ON, **OFF**	ditto
.GC	When start is initiated	ON, **OFF**	ditto
.S	When stopped	ON, **OFF**	ditto
.B	Begin of method	ON, **OFF**	ditto
.F	End of process	ON, **OFF**	ditto
.E	Error	ON, **OFF**	ditto
.O	Conditioning OK	ON, **OFF**	ditto
.N	Conditioning not OK	ON, **OFF**	ditto
.Re	Request after start	ON, **OFF**	ditto
.Si	Silo empty	ON, **OFF**	ditto
.M	Entry in measuring point list	ON, **OFF**	ditto
.EP	Entry in EP list	ON, **OFF**	ditto
.RC	Recalculation of results done	ON, **OFF**	ditto
.C	**Comport infos**		
.B1	When COM1 sends a report	ON, **OFF**	ditto
.R1	When COM1 is ready again	ON, **OFF**	ditto
.B2	When COM2 sends a report	ON, **OFF**	ditto
.R2	When COM2 is ready again	ON, **OFF**	ditto
.PR (only 756)	**Printer infos**		
.B	When internal printer is printing	ON, **OFF**	ditto
.R	When internal printer is ready again	ON, **OFF**	ditto
.I	Changing an I/O input	ON, **OFF**	ditto
.O	Changing an I/O output	ON, **OFF**	ditto
.Graphics	Changing the curve output		
.COM1	Graphic output on COM1		
.Grid	Grid on curve	**ON**, OFF	4.2.2.96.
.Frame	Frame on curve	**ON**, OFF	ditto
.Scale	Type of depending axis	Full, **Auto**	ditto
.Recorder	Length of axes		
.Right	Length of meas value axis	0.2...**0.5**...1.00	ditto
.Feed	Length of paper drive axis	0.01...**0.05**...1.00	ditto
.COM2	Graphic output on COM2		
.Int	Graphic output on internal printer		
.PowerOn	RESET (power on)	$G	4.2.2.97.
.Initialise	Set default values	$G	4.2.2.98.
.Select	Selection of branch	**ActMeth**,Config,Silo, Assembly,Setup,All	ditto
.RamInit	Initialization of working mem.	$G	4.2.2.99.
.InstrNo	Device Identification	$G	4.2.2.100.
.Value	Input of device identification	8 ASCII characters	ditto

&Diagnose

Object	Description	Input range	Reference
& Root			
⋮			
├ **D**iagnose	**Diagnose**		
├ **.R**eport	Output of adjustment parameters	$G	4.2.2.101.
├ **.S**imulation			
├ **.K**eycode	Simulation of keys	**0**...29	4.2.2.102.
├ **.Sc**reenDump	Dump of 756 screen	$G	4.2.2.103.
├ **.I**ntPrinter	**Settings for the internal printer**		
├ **.H**eatTime	Heating time	1...**4.0**...10	4.2.2.104.
├ **.M**otorSpeed	Motor Speed	2...**3.0**...9	ditto

4.2.2 Description of the remote control commands

4.2.2.1. **M**ode $G, $S

Start and stop ($G, $S) of the current method (4.2.2.3)
$G also serves to continue after inquiries of identifications and sample size after the start (see 4.2.2.15)

4.2.2.2. **M**ode.**S**elect **KFC**, KFC-B, BLANK, GLP

Selection of the standard mode.
If a method is selected from the method memory, the node &Mode.Select is overwritten with the mode of the corresponding user method.

4.2.2.3. **M**ode.**N**ame read only

Name of the current method in the working memory. $Q sends 8 ASCII characters. Standard methods carry the name ********. The node can be set read + write, see 4.2.2.66.

4.2.2.4. **M**ode.**P**arameter.**C**trlPara.**E**P 0...**50**...±2000

Setting of the EP in mV.

4.2.2.5.

Mode.**P**arameter.**C**trlPara.**C**ontrol	content, **special**
Mode.**P**arameter.**C**trlPara.**S**pecial.**D**yn	1...**70**...2000
Mode.**P**arameter.**C**trlPara.**S**pecial.**M**axRate	1.5...2240, **max.**
Mode.**P**arameter.**C**trlPara.**S**pecial.**Mi**nRate	0.3...**15**...999.9, min.
Mode.**P**arameter.**C**trlPara.**S**pecial.**S**top.**T**ype	drift, **rel.drift**
Mode.**P**arameter.**C**trlPara.**S**pecial.**S**top.**D**rift	1...**5**...999
Mode.**P**arameter.**C**trlPara.**S**pecial.**S**top.**D**rift	0...**5**...999

Parameters for setting "special" (4.2.2.5):

.Dyn:	Dynamics in mV.
.MaxRate:	Maximum allowed titration rate in ug/min. Max. means maximum possible rate.
.MinRate:	Minimum titration rate in ug/min.
.Type:	Type of stop criterion after drift or switch-off delay time.
.Drift:	Stop drift in ug/min. Applies when "drift" has been selected.
.RelDrift:	Relative stop drift in ug/min. Applies when "rel.drift" has been selected. Stops if the drift reaches the current drift at the start of the method plus the rel.drift value.

4.2.2.6. **M**ode.**P**arameter.**T**itrPara.**D**irection +, **-**, auto

Titration direction.
"auto" means the titration direction is determined automatically by the instrument.

4.2.2.7.

Mode.**P**arameter.**T**itrPara.**P**ause	**0**...999 999
Mode.**P**arameter.**T**itrPara.**E**xtrT	**0**...999 999

.Pause: Time in s. During this time, there is no generation of current.

.ExtrT: Extraction time in s. During this time controlling occurs but the titration will not be stopped.

4.2.2.8. **M**ode.**P**arameter.**T**itrPara.**S**tartDrift 1...**20**..999

StartDrift in ug/min. Drift for "conditioning ok" and start of titration possible.

4.2.2.9. **M**ode.**P**arameter.**T**itrPara.**I**pol 2, 5, **10**, 20, 30
Mode.**P**arameter.**T**itrPara.**Pol**ElectrTest **ON**, OFF

.Ipol: Selection of polarization current.

If the test for polarized electrodes is switched on, it is performed on changeover from the inactive state to an active state (titration or conditioning).

4.2.2.10. **M**ode.**P**arameter.**T**itrPara.**T**emp -170.0...**25.0**...500.0

Titration temperature in °C.

4.2.2.11. **M**ode.**P**arameter.**T**itrPara.**TD**elta 1...**2**...999 999

Time interval in s for the entry of a measurement point in the list of measured points.

4.2.2.12. **M**ode.**P**arameter.**T**itrPara.**TM**ax 1...999 999, **OFF**

Maximum titration time in s. After this time, the titration will be stopped.

4.2.2.13. **M**ode.**P**arameter.**Sta**tistics.**S**tatus ON, **OFF**
Mode.**P**arameter.**Sta**tistics.**M**eanN **2**...20
Mode.**P**arameter.**Sta**tistics.**R**esTab.**S**elected **original**, delete n, delete all
Mode.**P**arameter.**Sta**tistics.**R**esTab.**D**elN **1**...20

Entries for the statistics calculations.

.Status: On/off switching. Requirement for statistics calculations is a valid assignment, see 4.2.2.26.

.MeanN: Number of individual results for statistics calculations.

.ResTab.Select: Selection of the table for the statistics calculations.

- original: Original table. The original table is (again) set up, i.e. any individual results which have been deleted are reincorporated in the statistics calculations.
- delete n: Single result lines are removed from the statistics calculation. All results of the corresponding line in the statistics table are deleted. Specification of the line number in .ResTab.DelN.
- delete all: Clear entire statistics table. The results can not be reactivated.

.ResTab.DelN: Specification of the line number to be deleted.

4.2.2.14. **M**ode.**P**arameter.**P**resel.**C**ond **ON**, OFF
Mode.**P**arameter.**P**resel.**DC**or.**T**ype **auto**, man., OFF
Mode.**P**arameter.**P**resel.**DC**or.**V**alue **0.0**...99.9

.Cond: Conditioning ON/OFF
.DCor.Type: Type of drift take-over for the drift correction. auto: Take-over of the drift value at start.
.DCor.Value: Drift value for the manual drift correction.

4.2.2.15. **M**ode.**P**arameter.**P**resel.**I**Req id1, id1&2, all, **OFF**
Mode.**P**arameter.**P**resel.**S**Req **value**, unit, all, OFF
Mode.**P**arameter.**P**resel.**R**eqTitr **ON**, OFF
Automatic inquiries after the start of the determination. From such an inquiry, the determination continues if the requested entry/entries is/are made, e.g. &SmplData.OFFSilo.Id1 (see 4.2.2.56) or with &M $G, see 4.2.2.1.
.ReqTitr: Current generation starts during requests (with ON).

4.2.2.16. **M**ode.**P**arameter.**P**resel.**Sa**mpleUnit **g**, ...up to 5 ASCII
Method specific sample unit, i.e. when the method is loaded, the current unit of the sample size is overwritten by the unit from the method.

4.2.2.17. **M**ode.**P**arameter.**P**resel.**L**imSmplSize.**S**tatus ON, **OFF**
Mode.**P**arameter.**P**resel.**L**imSmplSize.**L**oLim **0.0**...999 999
Mode.**P**arameter.**P**resel.**L**imSmplSize.**U**pLim 0.0...**999 999**
Limit control for the sample size.

4.2.2.18. **M**ode.**P**arameter.**P**resel.**Id**1Text **id1/C21**, 10 ASCII characters
Mode.**P**arameter.**P**resel.**Id2**Text **id2/C22**, 10 ASCII characters
Mode.**P**arameter.**P**resel.**Id3**Text **id3/C23**, 10 ASCII characters
Text for sample identifications.

4.2.2.19. **M**ode.**P**arameter.**P**resel.**Ce**ll **no diaph.**, diaphragm
Mode.**P**arameter.**P**resel.**G**enI 100, 200, **400**, auto
.Cell: Type of generator electrode.
.GenI: Current at the generator electrode in mA. "auto" means that the current is switched in the course of determinations.
Default: 400 mA for cells without diaphragm, auto for cell with diaphragm.

4.2.2.20. **M**ode.**P**arameter.**P**resel.**O**ven COM1, COM2, **no**
If an Oven is connected, its results will be incorporated into the result report of the Coulometer.
If there is no Oven connected via RS232, this parameter has to be on "no".

4.2.2.21. **M**ode.**P**arameter.**P**resel.**A**ctPuls first, all, cond., **OFF**
Output of a pulse on the I/O line "Activate", see page 132.

4.2.2.22. **M**ode.**D**ef.**F**ormulas.**1.F**ormula H2O, CXX, RSX, +, -, *, /, (,)
Mode.**D**ef.**F**ormulas.**1.T**extRS 8 ASCII characters

Mode.**D**ef.**F**ormulas.**1.D**ecimal	0...**2**...5
Mode.**D**ef.**F**ormulas.**1.U**nit	6 ASCII characters
Mode.**D**ef.**F**ormulas.**1.L**imits	ON, **OFF**
Mode.**D**ef.**F**ormulas.**1.Lo**Lim	**0**...±999 999
Mode.**D**ef.**F**ormulas.**1.Up**Lim	**0**...±999 999
Mode.**D**ef.**F**ormulas.**1.O**utput	active, pulse, **OFF**
Mode.**D**ef.**F**ormulas.**2.F**ormula	
etc. up to **.9**	

Entry of formulas. Rules for formula entry, see page 34.
Example: "H2O*C01/C00"
In addition to the formula, a text for result output, the number of decimal places and a unit for the result output can be selected. "No unit" is selected with the blank string.
In place of "RSX", a result name may be entered (.TextRS). This name is outputted in the result report, scalc full and scalc srt. It is used for the result and the corresponding mean value.
The limit control for results can also be activated. If a result is out of limit, a message appears in the result report, E196 is sent, and output line L13 can be set.

4.2.2.23. **M**ode.**Def.S**iloCalc.**A**ssign.**C**24 RSX, H2O, CXX
Mode.**Def.S**iloCalc.**A**ssign.**C25** RSX, H2O, CXX
Mode.**Def.S**iloCalc.**M**atchId id1, id1&2, all, **OFF**

.Assign.C2X: Assignment to store results in the silo as C2X.
.MatchId: Indication which sample identification(s) have to match so that the results can be combined.

4.2.2.24. **M**ode.**Def.C**omVar.**C**30 RSX, MNX, H2O, CXX
Mode.**Def.C**omVar.**C31**
etc., up to **.C39**

Assignment of common variables.
The values of the common variables are to be found in &Config.ComVar. They can be viewed and entered there, see 4.2.2.54.

4.2.2.25. **M**ode.**Def.R**eport.**I**nternal (only 756) result, water crv, rate crv, meas crv, comb, mplist, param, calc, scalc full, scalc srt, ff
Mode.**Def.R**eport.**A**ssign1 ditto
Mode.**Def.R**eport.**Assign2** ditto

Definition of the report sequence, which is outputted automatically at the end of the determination. Entries of more than one block have to be separated with ";".

.Internal: Internal printer of the Coulometer. (only 756)
.Assign1: Output to COM1 of the Coulometer.
.Assign2: Output to COM2 of the Coulometer.

4.2.2.26. **M**ode.**Def.M**ean.**1.A**ssign **RS1**, RSX, H2O, CXX
Mode.**Def.M**ean.**2.A**ssign
etc., up to **.9**

Assignment of the statistics calculations. Valid assignments are a requirement for statistics calculations. In addition, the statistics calculation must be switched on, see 4.2.2.13. Rules for statistics calculations see page 37.

4.2.2.27. **M**ode.**C**Fmla
Mode.**C**Fmla.**1.V**alue **0**...±999 999
Mode.**C**Fmla.**2.V**alue
etc., up to **.19**

Calculation constants specific to a method. Stored in the method memory of the Coulometer. Operands specific to the sample (4.2.2.57 and 4.2.2.59) and values of common variables (4.2.2.55) on the other hand are not stored with the methods.

4.2.2.28. **U**serMeth.**F**reeMem read only

Memory space, available for user methods or silo lines. $Q sends the number of free bytes, e.g.
"4928".

4.2.2.29. **U**serMeth.**R**ecall $G
UserMeth.**R**ecall.**N**ame up to 8 ASCII characters
UserMeth.**S**tore $G
UserMeth.**S**tore.**N**ame up to 8 ASCII characters
UserMeth.**D**elete $G
UserMeth.**D**elete.**N**ame up to 8 ASCII characters
UserMeth.**DelA**ll $G

Management of the internal method memory: Load, store and delete methods. An action is performed if "$G" is sent to the corresponding node just after entering the name.
Do not use blank characters before and after method name!
.DelAll: Deletes all methods in the user memory.

4.2.2.30. **U**serMeth.**L**ist.**1.N**ame read only
UserMeth.**L**ist.**1.M**ode read only
UserMeth.**L**ist.**1.B**ytes read only
UserMeth.**L**ist.**1.C**hecksum read only
for each method

List of the methods in the user method memory with the following characteristics:
.Name: Name of the method
.Mode: Mode
.Bytes: Number of bytes of the user memory used by the method
.Checksum: Checksum of the method, see 4.2.2.65.

4.2.2.31. **C**onfig.**M**onitoring.**R**eagent.**S**tatus ON, **OFF**
Config.**M**onitoring.**R**eagent.**D**eterm 1...**99**...999, OFF
Config.**M**onitoring.**R**eagent.**DC**ounter **0**...999
Config.**M**onitoring.**R**eagent.**M**axTime 1...**7**...9999, OFF
Config.**M**onitoring.**R**eagent.**T**Counter **0**...9999

	Config.**M**onitoring.**R**eagent.**R**eagCap	1...**1000**...9999, OFF
	Config.**M**onitoring.**R**eagent.**RC**ounter	**0**...9999
	Config.**M**onitoring.**R**eagent.**C**learCount	$G
	Config.**M**onitoring.**R**eagent.**Dr**ift	0...99, **OFF**

Monitoring of reagent live time.
.Determ: Number of determinations.
.DCounter: Counter of determinations already carried out.
.MaxTime: Maximum live time of reagent in days.
.TCounter: Time already elapsed since last reagent change.
.ReagCap: Reagent capacity in mg water.
.RCounter: Counter of reagent capacity.
.ClearCount: Clears all above counters.
.Drift: Stable drift in ug/min.

4.2.2.32.	**C**onfig.**M**onitoring.**C**hange	$G, $S
	Config.**M**onitoring.**C**hange.**S**tatus	auto, man., **OFF**
	Config.**M**onitoring.**C**hange.**W**aitTime	**0**...999 999
	Config.**M**onitoring.**C**hange.**A**spVol	0...**100**...9999
	Config.**M**onitoring.**C**hange.**So**lventVol	0...**100**...9999
	Config.**M**onitoring.**C**hange.**R**inse	**0**...9999
	Config.**M**onitoring.**C**hange.**N**oRinse	**1**...9

Changing of reagent. With a connected Dosino, the reagent is changed with &Config.Monitoring.Change $G. The nod &Config.Monitoring.change.Status has to be ≠ OFF.
Parameters for automatic reagent change:
.WaitTime: Waiting time in s after switching off the stirrer.
.AspVol: Volume in ml of used reagent to be aspirated.
.SolventVol: Volume in ml of new reagent to be added.
.Rinse: Volume in ml of rinsing reagent.
.NoRinse: Number of rinsing cycles.

4.2.2.33.	**C**onfig.**M**onitoring.**V**alidation.**S**tatus	ON, **OFF**
	Config.**M**onitoring.**V**alidation.**I**nterval	1...**365**...9999
	Config.**M**onitoring.**V**alidation.**C**ounter	**0**...9999
	Config.**M**onitoring.**V**alidation.**Cl**earCount	$G

Monitoring of validation.
.Interval: Time interval in days for validation.
.Counter: Time counter in days since last validation.
.ClearCount: Clears the above counter.

4.2.2.34.	**C**onfig.**M**onitoring.**S**ervice.**S**tatus	ON, **OFF**
	Config.**M**onitoring.**S**ervice.**D**ate	XXXX-XX-XX

Monitoring of service interval.

4.2.2.35.	**C**onfig.**M**onitoring.**D**iagRep	ON, **OFF**

Printing of system test report after each switching on of the Coulometer.

4.2.2.36.	**C**onfig.**P**eriphUnit.**C**harSet1	Epson, Seiko, Citizen, HP, **IBM**

Config.**P**eriphUnit.**CharSet2**

Selection of the character set and the graphics control characters for COM1 resp. COM2 of the Coulometer.
IBM means the IBM character set following character set table 437 and IBM graphics control characters. Select 'IBM' for work with the computer.

4.2.2.37. **C**onfig.**P**eriphUnit.**R**epToComport 1,2,1&2. And at 756: int.,1&int., 2&int.,all**.** Selection of target for manually triggered reports.

int. Internal printer.
1: COM1
2: COM2

4.2.2.38. **C**onfig.**P**eriphUnit.**B**alance **Sartorius**,Mettler,Mettler AT, AND,Precisa

Selection of the balance type.

4.2.2.39. **C**onfig.**P**eriphUnit.**S**tirrer **ON**, OFF

Automatic stirrer control. With "ON" the stirrer will be switched on after starting of conditioning. In the inactive state, the stirrer is switched off again.

4.2.2.40. **C**onfig.**P**eriphUnit.**Rem**oteBox.**S**tatus ON, **OFF**
Config.**P**eriphUnit.**Rem**oteBox.**K**eyboard **US**, deutsch, francais, español, schweiz.
Config.**P**eriphUnit.**Rem**oteBox.**B**arcode **input**, method, id1, id2, id3, smpl size

Connections via Remote Box.
.Status: Select if a Remote Box is connected.
.Keyboard: Type of keyboard which is connected to the Remote Box.
.Barcode: Select target in Coulometer where you wish to have the string from the barcode reader. "input" means that the string comes into the field where the cursor is currently placed.

4.2.2.41. **C**onfig.**A**ux.**L**anguage **english**, deutsch, francais, espanol, italiano, portugese, svenska

Selection of the dialog language.

4.2.2.42. **C**onfig.**A**ux.**S**et $G
Config.**A**ux.**S**et.**D**ate YYYY-MM-DD
Config.**A**ux.**S**et.**T**ime HH:MM

Date and time.
Input format of the date: Year-month-day, two-digit, enter leading zeros.
Input format for the time: Hours:minutes, two-digit, enter leading zeros.
Date and time have to be set with &Config.Aux.Set $G just after entry of the value.

4.2.2.43. **C**onfig.**A**ux.**R**unNo **0**...9999

Current sample number.
Set to 0 on power on and initialization. After 9999, counting starts again at 0.

4.2.2.44. **C**onfig.**A**ux.**O**pLevel **standard**, expert
Operator level for manual operation.

4.2.2.45. **C**onfig.**A**ux.**St**artDelay **0**...999 999
Start delay time in s. During this time, the data of the preceding determination are retained.

4.2.2.46. **C**onfig.**A**ux.**Re**sDisplay **bold**, standard
Character set for the result display at the end of the determination.

4.2.2.47. **C**onfig.**A**ux.**D**evName up to 8 ASCII characters
Name of the instrument for connections with several units. It is advisable to use only the letters A...Z (ASCII No. 65...90), a...z (ASCII No. 97...122) and the numbers 0...9 (ASCII No. 48...57) when the function Setup.AutoInfo (4.2.2.97) is used at the same time.
If a name has been entered, it will be printed out in the result report (full, short).

4.2.2.48. **C**onfig.**A**ux.**B**eep **1**...3, OFF
Number of beep sounds.

4.2.2.49. **C**onfig.**A**ux.**Di**splayMeas ON, **OFF**
Display of potentials during conditioning and titration.

4.2.2.50. **C**onfig.**A**ux.**P**rog read only
Output of the program version.
The Coulometer sends "5.756.0010" on requests with $Q.

4.2.2.51. **C**onfig.**R**SSet1 $G
Config.**R**SSet1.**B**aud 300, 600, 1200, 2400, 4800, **9600**
Config.**R**SSet1.**D**ataBit 7, **8**
Config.**R**SSet1.**S**topBit **1**, 2
Config.**R**SSet1.**P**arity even, odd, **none**
Config.**R**SSet1.**H**andsh **HWs**, SWchar, SWline, none
$G sets all RS settings. The changes are performed only if the instrument is inactive. After the setting of the interface parameters, wait at least 2 s to allow the components to equilibrate.
Settings of the values for the data transmission via the RS interface: baud rate, data bit, stop bit, parity and type of handshake, see also page 97 ff.
The setting of the values must be initiated with $G immediately after entry of the values.

4.2.2.52. **C**onfig.**Re**port.**I**d **ON**, OFF
Config.**Re**port.**In**str **ON**, OFF
:

Report configuration. If a report line is switched off, the corresponding line will not be outputted in the reports.
With "Run" on "OFF", only the run number will not be outputted, date (and time) are available.

4.2.2.53. **C**onfig.**C**omVar.**C30**
with up to **.C39**, etc. 0... ±999 999

Values of the common variables from C30 up to C39. Insert the common variables directly or describe the determination results directly from the method, see 4.2.2.24.

4.2.2.54. **S**mplData.**S**tatus ON, **OFF**

On/off switching of silo memory. When the silo memory is switched on, the sample data are fetched from the lowest valid silo line.

4.2.2.55. **S**mplData.**O**FFSilo.**I**d1 up to 12 ASCII characters
SmplData.**O**FFSilo.**Id2** up to 12 ASCII characters
SmplData.**O**FFSilo.**Id3** up to 12 ASCII characters
SmplData.**O**FFSilo.**V**alSmpl 6-digits, sign and decimal point
SmplData.**O**FFSilo.**U**nitSmpl up to 5 ASCII characters
SmplData.**O**FFSilo.**L**imits read only

Current sample data.
The identifications Id1...Id3 can be used in formulas as sample-specific calculation constants C21...C23.
If "no unit" is desired for the unit of the sample size, the blank string must be entered.
.Limits: Limits of sample size of current method.

4.2.2.56. **S**mplData.**ON**Silo.**C**ounter.**M**axLines read only
SmplData.**ON**Silo.**C**ounter.**F**irstLine read only
SmplData.**ON**Silo.**C**ounter.**L**astLine read only

Information on silo memory.
.MaxLines: Maximum possible number of silo lines.
.FirstLine: Lowest valid silo line.
.LastLine: Last occupied silo line.

4.2.2.57. **S**mplData.**ON**Silo.**E**ditLine.**1.M**ethod up to 8 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.I**d1 up to 12 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.Id2** up to 12 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.Id3** up to 12 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.V**alSmpl 6-digits, sign and dec.point
SmplData.**ON**Silo.**E**ditLine.**1.U**nitSmpl up to 5 ASCII characters
SmplData.**ON**Silo.**E**ditLine.**1.C**24 read only
SmplData.**ON**Silo.**E**ditLine.**1.C25** read only

SmplData.**ON**Silo.**E**ditLine.**1.Ma**rk read only
etc., up to **.255**

Contents of a silo line.

.Method: Method used to process the sample, from the method memory or from the card.

.Id: The identifications Id1...Id3 can also be used as sample-specific calculation constants C21...C23 in formulas.

.UnitSmpl: If "no unit" is desired for the sample size, the blank string must be entered.

.C24, .C25: Results which have been assigned to C24 and C25.

.Mark: Mark of the silo line: "*"=deleted line, "+"=line which is worked off, "-"= line which is worked off and not valid for silo calculations (deleted), "/" last worked-off line, where recalculation can still be done. Silo lines which have been worked off are "read only".

4.2.2.58. **S**mplData.**ON**Silo.**D**elLine $G
SmplData.**ON**Silo.**D**elLine.**L**ineNum 1...255, **OFF**

Deletion of a silo line. The line # is deleted with &SmplData.ONSilo.DelLine $G. If a formerly deleted line is edited again, it becomes valid (function "undelete").

4.2.2.59. **S**mplData.**ON**Silo.**DelA**ll $G

Deletes the entire silo memory. Must be triggered with $G.

4.2.2.60. **S**mplData.**ON**Silo.**Cy**cleLines ON, **OFF**

Silo data cycling.
With "ON", executed lines are copied to the next free silo lines, see page 49.
Exercise caution if you edit the silo memory during the determinations!

4.2.2.61. **S**mplData.**ON**Silo.**S**aveLines ON, **OFF**

Silo lines are not deleted when they are worked off. Assigned results are stored as C24 and C25. "Save lines" can only be set to "ON" if the silo is completely empty. Delete the silo, see 4.2.2.60.

4.2.2.62. **H**otKey.**U**ser.**N**ame up to 10 ASCII characters
HotKey.**U**ser.**D**elete $G
HotKey.**U**ser.**D**elete.**N**ame up to 10 ASCII characters
HotKey.**U**ser.**DelA**ll $G
HotKey.**U**ser.**L**ist.**1.N**ame read only

Management of user names.

.Name: Input of user names.

.Delete,Name: Deletes selected user name with &HotKey.User.Delete $G.

.List: List of all user names.

4.2.2.63. **I**nfo.**R**eport $G
Info.**R**eport.**S**elect **result**, water crv, rate crv, meas crv, comb,

mplist, param, calc, C-fmla, def, statistics, smpl data, silo, scalc full, scalc srt, config, user method, all, ff

$G sends the selected report to the COM which is set in &Config.PeriphUnit.RepToComport:

result: Result report of the last completed determination.
water crv: Mass of water in ug vs. time
rate crv: Rate in ug/min vs. time
meas crv: Potential vs. Time
comb: Mass of water in ug & rate in ug/min vs. time
mplist: Measuring point list of the running determination.
param: Parameter report of the current method. During a running determination only "live"-parameters are accessible.
calc: Calculation report of the current method.
C-fmla: Contents of the <C-fmla> key.
def: Contents of the <def> key.
statistics: Statistics table with the individual results.
smpl data: Current sample data.
silo: Contents of the silo memory.
scalc full: Full report of the silo calculations.
scalc srt: Short report of the silo calculations.
config: Configuration report.
user method: Contents of the method memory.
all: All reports.
ff: Form feed on printer.

Reports which are sent from the Coulometer are marked with space (ASCII 32) and ' at the beginning. Then an individual identifier for each report follows.

4.2.2.64. **I**nfo.**Ch**ecksums $G
Info.**Ch**ecksums.**A**ctualMethod read only

The checksums can be used to identify the content of a file unequivocally, e.g. files with identical content have identical results of the checksums. An empty file has checksum "0". The calculation of the checksums is triggered with $G.

.ActualMethod: Result of the checksum of the current method in the working memory. Identical methods with different method names have the same results of the checksum.

4.2.2.65. **I**nfo.**D**etermData $G
Info.**D**etermData.**W**rite ON, **OFF**

Determination data in hexadecimal format.

.Write: With "ON", the following nodes can be overwritten: &Info.TitrResults.Var.C4X (X = 0...5) and &Mode.Name.

4.2.2.66. **I**nfo.**T**itrResults.**RS**.**1.V**alue read only
etc., up to **.9**
Info.**T**itrResults.**EP**.**V** read only
Info.**T**itrResults.**EP**.**M**eas read only
Info.**T**itrResults.**V**ar.**C**40 read only/read+write
etc., up to **.C45**

.RS: Values of the calculated results.

.EP: Endpoint:
Mass coordinate in ug, e.g. "10.3"
Potential coordinate in mV e.g. "43.7".
.Var: Various variables. You may overwrite the variables C40...C45, see 4.2.2.66.
C40: Initial measured value in mV, e.g. "226".
C41: Mass of water in ug, e.g. "126.5"
C42: Time from start of titration to end in s, e.g. "26".
C43: Drift at titration start in ug/min, e.g. "5.1".
C44: Titration temperature in °C, e.g. "25.0"
C45: Total charge in mA·s, e.g. "1355.5"

4.2.2.67. **I**nfo.**S**tatisticsVal.**A**ctN read only
Info.**S**tatistics.**1.M**ean read only
Info.**S**tatistics.**1.S**td read only
Info.**S**tatistics.**1.R**elStd read only
etc. up to **.9**

The current values of the statistics calculation.
$Q sends, e.g.

ActN: Current value of the individual results	"3"
Data for MN1:	
Mean: Mean value (decimal places as in result)	"3.421"
Std: Standard deviation (1 decimal place more than in result)	"0.0231"
RelStd: Relative standard deviation (in %, 2 decimal places)	"0.14"

4.2.2.68. **I**nfo.**S**iloCalc.**C**24.**N**ame read only
Info.**S**iloCalc.**C**24.**V**alue read only
Info.**S**iloCalc.**C**24.**U**nit read only
for **.C25** as for .C24
Info.**S**iloCalc.**C26.A**ctN read only
Info.**S**iloCalc.**C26.M**ean read only
Info.**S**iloCalc.**C26.S**td read only
Info.**S**iloCalc.**C26.R**elStd read only
for **.C27** as for .C26

The current values from the silo calculations. C26 is the mean value out of the C24 variables; C27 comes from C25.
$Q sends:

C24.Name: Name of the assigned value	"RS1"
C24.Value: Value	"2.222"
C24.Unit: Unit of the assigned value	"%"
C26.ActN: Number of single results	"3"
C26.Mean: Mean (decimal places as for the result itself)	"3.421"
C26.Std: Standard deviation (decimal places as for the result + 1)	"0.0231"
C26.RelStd: Relative standard deviation (in %, 2 decimal places)	"0.14"

4.2.2.69. **I**nfo.**A**ctualInfo.**I**nputs.**S**tatus read only
Info.**A**ctualInfo.**I**nputs.**C**hange read only
Info.**A**ctualInfo.**I**nputs.**Cl**ear $G
Info.**A**ctualInfo.**O**utputs.**S**tatus read only
Info.**A**ctualInfo.**O**utputs.**C**hange read only

Info.**A**ctualInfo.**O**utputs.**Cl**ear $G

Status sends the current status of the I/O lines, Change sends the information regarding whether a change in status of a line has taken place since the last clearing, Clear clears the change information. For the output, there is a conversion from binary to decimal, e.g.

	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Line No.	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Output: $2^1 + 2^3 =$ "10"

1 means ON or change; 0 means OFF or no change.

The lines are assigned as follows (see also page 131):

Inputs:

0	Start (pin 21)
1	Stop (pin 9)
2	Enter (pin 22)
3	pin 10
4	pin 23
5	pin 11
6	pin 24
7	pin 12

Outputs:

0	Ready (pin 5)
1	Cond. ok (pin 18)
2	Titration (pin 4)
3	EOD (pin 17)
4	not used (pin 3)
5	Error (pin 16)
6	Activate, line L6 (pin 1)
7	Pulse for recorder (pin 2)
8	Connected remote box (pin 6)
9	not used (pin 7)
10	not used (pin 8)
11	Change reagent (pin 13)
12	Smpl size out (pin 19)
13	Result out (pin 20)

4.2.2.70. **I**nfo.**A**ctualInfo.**A**ssembly.**C**yclNo read only
Info.**A**ctualInfo.**A**ssembly.**I** read only
Info.**A**ctualInfo.**A**ssembly.**M**eas read only
Info.**A**ctualInfo.**A**ssembly.**P**ot read only
Info.**A**ctualInfo.**A**ssembly.**IP**ulse read only
Info.**A**ctualInfo.**A**ssembly.**B**ur.**V** read only
Info.**A**ctualInfo.**A**ssembly.**B**ur.**C**lear $G

$Q sends the current values.

.CyclNo: Cycle number of the voltage measurement cycle, e.g. "127". From the cycle number and the cycle time (see 4.2.2.77), a time frame can be set up. The cycle number is set to 0 on switching on the instrument and on every start. It is incremented as long as the instrument remains switched on.

.I: Total charge in mA·s, e.g. "667.48".

.Meas: Measured value in mV at the indicator electrode, e.g. "104.2".

.Pot: Voltage at generator electrode.
0 means "undefined", 1 means <14 V, 2 means 14...28 V, 3 means >28 V.

.IPulse: Current of actual pulse.
1 means 100 mA, 2 means 200 mA, 3 means 400 mA.

.Bur.V: Dosed volume of connected Dosino in ml, e.g. "5.234".

.Bur.Clear: $G clears the volume counter.

4.2.2.71. **I**nfo.**A**ctualInfo.**T**itrator.**C**yclNo read only
Info.**A**ctualInfo.**T**itrator.**W**ater read only

	Info.**A**ctualInfo.**T**itrator.**M**eas	read only
	Info.**A**ctualInfo.**T**itrator.**d**Waterdt	read only
	Info.**A**ctualInfo.**T**itrator.**I**	read only
	Info.**A**ctualInfo.**T**itrator.**P**ot	read only
	Info.**A**ctualInfo.**T**itrator.**IP**ulse	read only

$Q sends the current values.

.CyclNo: Cycle number of the voltage measurement cycle, e.g. "127". From the cycle number and the cycle time (see 4.2.2.77), a time frame can be set up. The cycle number is set to 0 on switching on the instrument and on every start. It is incremented as long as the instrument remains switched on.

.Water: Total water in ug, e.g. "62.313"

.Meas: Measured value in mV at the indicator electrode, e.g. "104.2".

.dWaterdt: Rate or drift in ug/min, e.g. "23.0".

.I: Total charge in mA·s, e.g. "667.48".

.Pot: Voltage at generator electrode.
0 means "undefined", 1 means <14 V, 2 means 14...28 V, 3 means >28 V.

.IPulse: Current of actual pulse.
1 means 100 mA, 2 means 200 mA, 3 means 400 mA.

OV will be sent for "overrange".

4.2.2.72.

	Info.**A**ctualInfo.**M**easPt.**I**ndex	read only
	Info.**A**ctualInfo.**M**easPt.**X**	read only
	Info.**A**ctualInfo.**M**easPt.**Y**	read only
	Info.**A**ctualInfo.**M**easPt.**Z**1	read only
	Info.**A**ctualInfo.**M**easPt.**Z2**	read only
	Info.**A**ctualInfo.**E**P.**I**ndex	read only
	Info.**A**ctualInfo.**E**P.**X**	read only
	Info.**A**ctualInfo.**E**P.**Y**	read only

$Q sends the last entry into the measuring point list (.MeasPt) or the last entry into the list of EP.

.MeasPt.X Time in s, e.g. "14".

.MeasPt.Y Water in ug, e.g. "27.5".

.MeasPt.Z1 Measured value in mV, e.g. "160.3".

.MeasPt.Z2 Rate in ug/min, e.g. "100.5".

.EP.X Water in ug, e.g. "26.6".

.EP.Y Measured value in mV, e.g. "98.6".

4.2.2.73.

	Info.**A**ctualInfo.**Ov**en.**H**eatTime	read only
	Info.**A**ctualInfo.**Ov**en.**S**ampleTemp	read only
	Info.**A**ctualInfo.**Ov**en.**L**owTemp	read only
	Info.**A**ctualInfo.**Ov**en.**H**ighTemp	read only
	Info.**A**ctualInfo.**Ov**en.**G**asFlow	read only
	Info.**A**ctualInfo.**Ov**en.**U**nitFlow	read only

$Q sends the current values from a connected KF Oven. If no Oven is connected, the values are empty.

.HeatTime: Heating time of sample in s.

.SampleTemp: Nominal sample temperature in °C.

.LowTemp: Lowest temperature during the sample heating time in °C.

.HighTemp: Highest temperature during the sample heating time in °C.

.GasFlow: Average gas flow during sample heating time.
.UnitFlow: Unit of gas flow.

4.2.2.74. **I**nfo.**A**ctualInfo.**D**isplay.**L**1 up to 32 ASCII characters
Info.**A**ctualInfo.**D**isplay.**L8** up to 32 ASCII characters
Info.**A**ctualInfo.**D**isplay.**D**elAll $G

Lines of the display. The display can be written to from the computer. Proceed as follows:

1. Lock the display, see 4.2.2.90.
2. Delete the whole display (.DelAll).
3. For writing onto the display, the standard character set will be used.
4. Unlock the display, see 4.2.2.90
5. Delete the whole display (.DelAll).
6. Send a value to nod &Config.Aux.ResDisplay (see 4.2.2.47) to refresh the display.

$Q sends the contents of the corresponding display line.

4.2.2.75. **I**nfo.**A**ctualInfo.**C**omport.**N**umber read only

$Q sends the comport number of the Coulometer where the PC is connected.

4.2.2.76. **I**nfo.**As**sembly.**C**ycleTime read only
Info.**As**sembly.**E**xV read only
Info.**As**sembly.**D**eviceTemp read only

Inquiries regarding basic variables of the assembly.
.Cycle time: Time of measuring cycles in s (0.4).
.ExV: Volume of the Dosing Unit of the connected Dosino in mL.
.DeviceTemp: Internal temperature of Coulometer in °C.

4.2.2.77. **A**ssembly.**G**enEl.**P**ulse $G
Assembly.**G**enEl.**P**ulse.**L**ength **0**...2000
Assembly.**G**enEl.**P**ulse.**C**urrent 0, 100, 200, **400**

Control of the generator electrode. The pulse will be generated with &A.G.P$G.
.Length: Length of pulse in 2000 steps. 2000 means a pulse of 400 ms (e.g. a pulse of 150 ms would mean 750 steps).
.Current: Current for pulse in mA.

4.2.2.78. **A**ssembly.**M**eas.**S**tatus ON, **OFF**
Assembly.**M**eas.**I**pol 2, 10, **20**, 40

Control of the indicator electrode. When the measuring function is switched on, no method can be started at the Coulometer.
.Ipol: Polarization current in uA.

4.2.2.79. **A**ssembly.**O**utputs.**A**utoEOD **ON**, OFF
Assembly.**O**utputs.**S**etLines $G
Assembly.**O**utputs.**S**etLines.**L**0 active, inactive, pulse, **OFF**
up to .L13

Assembly.**O**utputs.**R**esetLines $G

Setting the I/O output lines.

.AutoEOD: The automatic output of the EOD (End of Determination) at the end of the determination can be switched off. Thus, for example, in conjunction with a Coulometer several determinations can be performed in the same beaker. Before AutoEOD is switched on, line 3 must be set to "OFF".

.SetLines: With $G, all lines are set.

.SetLines.LX: Set the line LX. "active" means setting of a static signal, "inactive" means resetting of the signal, "pulse" means output of a pulse of app. 150 ms, "OFF" means the line is not operated, see also page 131.

Warnings:

- If you have "AutoEOD" to "ON", an active line 3 is set to "inactive" by the EOD pulse.
- L6 is the line of the activate pulse. An active line 6 is set to "inactive" by the activate pulse.
- L5 is the error line. It is continuously controlled by the Coulometer program and can therefore not be set freely.

Line assignments in Coulometer program:

L0	Ready, inactive state
L1	Conditioning OK
L2	Titration in progress
L3	EOD (End Of Determination)
L4	---
L5	Error
L6	Activate pulse + can be set in TIP
L7	Pulses for recorder
L8	Connected remote box
L9,10	---
L11	Change reagent
L12	Sample size out of limits
L13	Result out of limits

.ResetLines: Lines are set to the inactive status (= high).

4.2.2.80. **A**ssembly.**S**tirrer.**S**tatus ON, **OFF**

Switching stirrer ON/OFF.

4.2.2.81. **A**ssembly.**B**ur.**E**mpty $G, $S, $H, $C
Assembly.**P**rep $G, $S, $H, $C

Starts the function "empty" and "preparation" resp. on the connected Dosino.

4.2.2.82. **A**ssembly.**B**ur.**R**ates.**F**orward.**S**elected **digital**
Assembly.**B**ur.**R**ates.**F**orward.**D**igital 0...150, **max.**
Assembly.**B**ur.**R**ates.**R**everse.**S**elected **digital**
Assembly.**B**ur.**R**ates.**R**everse.**D**igital 0...150, **max.**

Expelling and aspirating rate in mL/min. "max." means maximum possible rate with the Exchange Unit in current use.

4.2.2.83. **A**ssembly.**B**ur.**F**ill $G, $H, $C

$G starts the 'FILL' mode of the connected Dosino.

4.2.2.84. **A**ssembly.**B**ur.**M**odeDis $G, $S, $H, $C
Assembly.**B**ur.**M**odeDis.**S**elected **volume**, time
Assembly.**B**ur.**M**odeDis.**V** 0.0001...**0.1**...9999
Assembly.**B**ur.**M**odeDis.**T**ime 0.25...**1**...86400
Assembly.**B**ur.**M**odeDis.**VS**top 0.0001...9999, **OFF**
Assembly.**B**ur.**M**odeDis.**A**utoFill ON, **OFF**

Dispensing mode for the connected Dosino. The dispensing mode can only be started and stopped via the RS Control. During a running dosification, no method can be started at the Coulometer.
.Selected: Dispensing of volume increments or during a preset time.
.Volume, .Time: Size of the volume increments or entry of time.
.VStop: Limit volume for the dispensing.
.AutoFill: ON means automatic filling after every dispensing.

4.2.2.85. **Se**tup.**C**omport **1**, 2, 1&2

Selects the Coulometer COM for the output of automatic info:
&Setup.Keycode
&Setup.Trace
&Setup.SendMeas
&Setup.AutoInfo

4.2.2.86. **Se**tup.**K**eycode ON, **OFF**

ON means the key code of a key pressed on the Coulometer is outputted. The key code comprises 2 ASCII characters; table of the keys with their code, see page 96. A keystroke of key 11 is sent as follows:

#11

The beginning of the message is marked by a space (ASCII 32).

4.2.2.87. **Se**tup.**T**ree.**S**hort ON, **OFF**
Setup.**T**ree.**C**hangedOnly ON, **OFF**

Definition of the type of answer to $Q.
.Short: With "ON", each path is sent with only the necessary amount of characters in order to be unequivocal (printed in bold in this manual). A combination of .Short and .ChangedOnly is not possible.
.ChangedOnly: Sends only the changed values, i.e. values which have been edited. All paths are sent absolute, i.e. from the root.

4.2.2.88. **Se**tup.**Tra**ce ON, **OFF**

The Coulometer automatically reports when a value has been confirmed with <ENTER> at the Coulometer. Message, e.g.:

&SmplData.OFFSilo.Id1"Trace"

The beginning of the message is marked by a space (ASCII 32).

4.2.2.89. **S**etup.**L**ock.**K**eyboard ON, **OFF**
Setup.**L**ock.**C**onfig ON, **OFF**
Setup.**L**ock.**P**arameter ON, **OFF**
Setup.**L**ock.**S**mplData ON, **OFF**
Setup.**L**ock.**U**serMeth.**R**ecall ON, **OFF**
Setup.**L**ock.**U**serMeth.**S**tore ON, **OFF**
Setup.**L**ock.**U**serMeth.**D**elete ON, **OFF**
Setup.**L**ock.**E**xchange ON, **OFF**
Setup.**L**ock.**D**isplay ON, **OFF**

ON means disable the corresponding function:
.Keyboard: Disable all keys of the Coulometer
.Config: Disable the <CONFIG> key
.Parameter: Disable the <PARAM> key
.SmplData: Disable the <SMPL DATA> key
.UserMeth.Recall: Disable "recall" in <USER METH> key
.UserMeth.Store: Disable "store" in < USER METH > key
.UserMeth.Delete: Disable "delete" in < USER METH > key
.Exchange: Disable the <EXCH> key
.Display: Disable the display, i.e. it will not be written to by the device program of the Coulometer and can be operated from the computer.

4.2.2.90. **Se**tup.**M**ode.**S**tartWait ON, **OFF**
Setup.**M**ode.**F**inWait ON, **OFF**

Holding points in the method sequence. If they are "ON", the sequence stops until "OFF" is sent. Switching the instrument on sets both nodes to OFF:
.StartWait: Holding point right after starting a method (holding point after AutoInfo !".T.GC").
.FinWait: Holding point at the end a method (holding point after AutoInfo !".T.F").

4.2.2.91. **Se**tup.**S**endMeas.**S**endStatus ON, **OFF**
Setup.**S**endMeas.**I**nterval 0.4...**4**...16200, MPList

.SendStatus: ON means the automatic transmission of measured values (see 4.2.2.94 and 4.2.2.95) in the inputted interval is active.
.Interval: Time interval (in s) for the automatic transmission of associated measured values defined under points 4.2.2.95 and 4.2.2.96. The inputted value is rounded off to a multiple of 0.4. The smallest possible time interval depends on the number of measured values which have to be sent, on the baud rate, on the load on the interface and on the type of device connection. With "MPList" the measured values are sent at the time of their entry into the measured point list.

The automatic transmission is switched on/off with 'SendStatus'.

4.2.2.92. **Se**tup.**S**endMeas.**Sel**ect Assembly, **Titrator**

Selection of the unit of which the measured values should be sent (4.2.2.95 or 4.2.2.96).

4.2.2.93. **Se**tup.**S**endMeas.**A**ssembly.**C**yclNo ON, **OFF**
Setup.**S**endMeas.**A**ssembly.**I** ON, **OFF**
Setup.**S**endMeas.**A**ssembly.**M**eas ON, **OFF**
Setup.**S**endMeas.**A**ssembly.**P**ot ON, **OFF**
Setup.**S**endMeas.**A**ssembly.**IP**ulse ON, **OFF**
Setup.**S**endMeas.**A**ssembly.**B**ur.**V** ON, **OFF**

Selection of the values from Assembly for the output in the set time interval (see 4.2.2.92):

.CyclNo: Cycle number of the potential measurement. Together with the cycle time (4.2.2.77), a time frame can be set up.
The cycle number is set to 0 on switching on the instrument and it is always incremented as long as the instrument remains switched on.

.I: Total charge in mA·s associated to the cycle number, e.g. "667.48".

.Meas: Measured value in mV associated to the cycle number, e.g. "104.2".

.Pot: Voltage at generator electrode associated to the cycle number. 0 means "undefined", 1 means <14 V, 2 means 14...28 V, 3 means >28 V.

.IPulse: Current of pulse associated to the cycle number.
1 means 100 mA, 2 means 200 mA, 3 means 400 mA.

.Bur.V: Dosed volume of connected Dosino in ml, e.g. "5.234".

The unit "assembly" must be preset (see 4.2.2.92).

4.2.2.94. **Se**tup.**S**endMeas.**T**itrator.**C**yclNo ON, **OFF**
Setup.**S**endMeas.**T**itrator.**W**ater ON, **OFF**
Setup.**S**endMeas.**T**itrator.**M**eas ON, **OFF**
Setup.**S**endMeas.**T**itrator.**d**Waterdt ON, **OFF**
Setup.**S**endMeas.**T**itrator.**I** ON, **OFF**
Setup.**S**endMeas.**T**itrator.**P**ot ON, **OFF**
Setup.**S**endMeas.**T**itrator.**IP**ulse ON, **OFF**

Selection of the values from the titrator which are sent in the set time interval (see 4.2.2.91):

.CyclNo: Cycle number. Together with the cycle time (4.2.2.78), a time frame can be set up. The other data belong to the corresponding cycle number. The cycle number is set to 0 at the start of a method and it is incremented until the end of the method.

.Water: Total water associated to the cycle number in ug, e.g. "62.313"

.Meas: Measured value in mV at the indicator electrode associated to the cycle number, e.g. "104.2".

.dWaterdt: Rate or drift associated to the cycle number in ug/min, e.g. "23.0".

.I: Total charge in mA·s associated to the cycle number, e.g. "667.48".

.Pot: Voltage at generator electrode associated to the cycle number. 0 means "undefined", 1 means <14 V, 2 means 14...28 V, 3 means >28 V.

.IPulse: Current of actual pulse associated to the cycle number.
1 means 100 mA, 2 means 200 mA, 3 means 400 mA.

OV will be sent for "overrange".

The unit "titrator" must be preset (see 4.2.2.92).

4.2.2.95. **Se**tup.**A**utoInfo.**S**tatus **ON**, OFF
Setup.**A**utoInfo.**P** ON, **OFF**
Setup.**A**utoInfo.**T.R** ON, **OFF**
Setup.**A**utoInfo.**T.G** ON, **OFF**
Setup.**A**utoInfo.**T.GC** ON, **OFF**
Setup.**A**utoInfo.**T.S** ON, **OFF**
Setup.**A**utoInfo.**T.B** ON, **OFF**
Setup.**A**utoInfo.**T.F** ON, **OFF**
Setup.**A**utoInfo.**T.E** ON, **OFF**
Setup.**A**utoInfo.**T.O** ON, **OFF**
Setup.**A**utoInfo.**T.N** ON, **OFF**
Setup.**A**utoInfo.**T.Re** ON, **OFF**
Setup.**A**utoInfo.**T.Si** ON, **OFF**
Setup.**A**utoInfo.**T.M** ON, **OFF**
Setup.**A**utoInfo.**T.EP** ON, **OFF**
Setup.**A**utoInfo.**T.RC** ON, **OFF**
Setup.**A**utoInfo.**C.B**1 ON, **OFF**
Setup.**A**utoInfo.**C.R**1 ON, **OFF**
Setup.**A**utoInfo.**C.B2** ON, **OFF**
Setup.**A**utoInfo.**C.R2** ON, **OFF**
Setup.**A**utoInfo.**PR.B** (only at 756) ON, **OFF**
Setup.**A**utoInfo.**PR.R** (only at 756) ON, **OFF**
Setup.**A**utoInfo.**I** ON, **OFF**
Setup.**A**utoInfo.**O** ON, **OFF**

ON means that the Coulometer reports automatically the moment the corresponding change occurs.

.Status: Global switch for all set AutoInfo.
.P PowerOn: Simulation of power on (4.2.2.99). Not from mains.

Messages from node .T, Titrator:

.T.R Ready: Status 'Ready' has been reached.
.T.G Go: Instrument has been started.
.T.GC GoCommand: Instrument has received a go command.
.T.S Stop: Status 'Stop' has been reached.
.T.B Begin of method.
.T.F Final: End of determination, the final steps will be carried out.
.T.E Error. Message together with error number, see page 56ff.
.T.O Conditioning OK: EP reached.
.T.N Conditioning Not OK: EP not reached.
.T.Re Request: In the inquiry of an identification or the sample size after start of titration.
.T.Si SiloEmpty: Silo empty, i.e. the last line has been removed from the silo memory.
.T.M MeasList: Entry in the measuring point list.
.T.EP EPList: Entry into EP list.
.T.RC Results have been recalculated.

Messages from node .C, Comport:

.C.B1 COM1: A report is outputted on COM1. During this time, COM2 will be blocked. COM2 is generally blocked, if COM1 is busy.
.C.R1 COM1 is ready again. (Comes also when you <QUIT> an error.)
.C.B2, .R2 Identical for COM2.

Messages from node .PR, internal printer (only at 756):

.PR.B A report is outputted on the internal printer. During this time, COM1 and COM2 are blocked.
.PR.R The COM's are ready again. (Comes also when you <QUIT> an error.)

Messages for changes in the I/O lines. If the changes are made simultaneously, there is 1 message. Pulses receive 2 messages: one message each for line active and inactive.

.I Input: Change of an input line.
.O Output: Change of an output line (except 7, pin 2, for recorder pulses).

If a change occurs that requires a message, the Coulometer sends space (ASCII 32) and ! as an introducer. This is followed by the name of the device (see 4.2.2.48). Special ASCII characters in the device name are ignored. If no device name has been entered, only ! is sent. Finally the Coulometer sends the information which node has triggered the message.
Example: !John".T.Si": The message was triggered from instrument "John", node .T.Si

4.2.2.96. **Se**tup.**G**raphics.**C**OM1.**G**rid **ON**, OFF
Setup.**G**raphics.**C**OM1.**F**rame **ON**, OFF
Setup.**G**raphics.**C**OM1.**S**cale Full, **Auto**
Setup.**G**raphics.**C**OM1.**R**ecorder.**R**ight 0.2...**0.5**...1.00
Setup.**G**raphics.**C**OM1.**R**ecorder.**F**eed 0.01...**0.05**...1.00

Change in the appearance and the format of the curve for the output on COM1. Accordingly for COM2 and .Int (internal printer; only at 756).

.Grid: On/off switching of grid over curve.
.Frame: On/off switching of frame surrounding the curve. If grid and frame are switched off, the curve is printed faster as the printing head does not have to move to the end of the paper.
.Scale: Type of scaling of the measured value axis: "full" means that the scale runs from the smallest up to the greatest measured point. With "auto", the smallest measured value is taken and the next smaller tick defines the beginning of the scale; the next greater tick to the greatest measured value is the end of the scale.
.Right: Relative specification of the width of the output medium (e.g. paper width) for the length of the measured value axis. 1 means the measured value axis is plotted over the entire width of the paper (largest possible width). In extreme cases, the writing of the right tick may lie outside.
.Feed: Length of the time axis:

0.01 means app.	100 cm
0.1	10 cm
0.5	2 cm
1	1 cm

4.2.2.97. **Se**tup.**P**owerOn $G

Simulation of 'power on'. The device has the same status as after power on: The cylinder of a connected Dosino is filled, error messages are deleted and the current sample number is set to 0. The method last used is ready for operation.
Command only possible in the inactive state of the Coulometer.

4.2.2.98. **Se**tup.**I**nitialise $G
Setup.**I**nitialise.**S**elect **ActMeth**, Config, Silo, Assembly, Setup, All

Setting of default values for the following areas:
ActMeth: Current method. Parameters, calculations, and assignments for the data output, operands C01...C19.
Config: All values under &Config.
Silo: The silo memory is deleted. Same function as delete entire silo.
Assembly: All values under &Assembly.
Setup: All values under &Setup.
All: Values of the entire tree (except silo and method memory).
The action must be triggered with &Setup.Initalise $G.

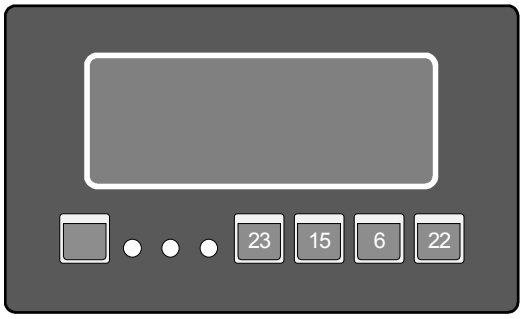
4.2.2.99. **Se**tup.**R**amInit $G
Initializes instrument, see page 110. All parameters are set to their default value and error messages are cleared. The user and silo memories will be deleted.
Command only possible in the inactive state of the Coulometer.

4.2.2.100. **Se**tup.**Ins**trNo $G
Setup.**Ins**trNo.**V**alue **serial number**, 8 ASCII characters
Instrument identification for report output.
Set the value with &Setup.InstrNo $G .

4.2.2.101. **D**iagnose.**R**eport $G
Output of the report containing the adjustment parameters. The Coulometer has to be in its inactive basic state.

4.2.2.102. **D**iagnose.**S**imulation.**K**eycode **0**...29

Entering a keycode is like pressing the corresponding key. The keys have the following keycodes:



4.2.2.103. **D**iagnose.**Sc**reenDump $G

The content of the 756 Screen will be dumped to the COM which is given for manual reports (key <CONFIG>, >peripheral units). A screen dump onto the internal printer is not possible.

4.2.2.104. **D**iagnose.**I**ntPrinter.**H**eatTime 1...**4.0**...10
Diagnose.**I**ntPrinter.**M**otorSpeed 2...**3.0**...9

Settings for the internal printer.
.HeatTime: Heating time for the dots in ms. Input in steps of 0.5 ms. Longer heating times give darker printouts.
.MotorSpeed in ms per step (6 steps = 1 dot). Small numbers give high printing speed.
If you wish to speed up the internal printer, set low heating times as a first measure, then low motor speed.

4.3 Properties of the RS 232 Interface

Data Transfer Protocol

The Coulometer is configured as DTE (Data Terminal Equipment).

The RS 232 interface has the following technical specifications:

- Data interface according to the RS 232C standard, adjustable transfer parameters, see page 21.
- Max. line length: 512 characters
- Control characters: C_R (ASCII DEC 13)
  L_F (ASCII DEC 10)
  XON (ASCII DEC 17)
  XOFF (ASCII DEC 19)
- Cable length: max. approx. 15 m

Start	7 or 8 Data Bit	Parity Bit	1 or 2 Stop Bit

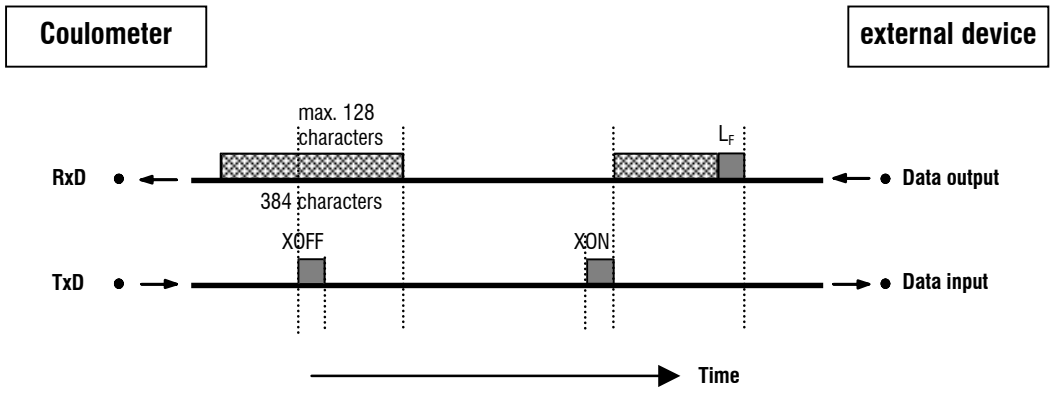
Only a shielded data cable (for example, METROHM D.104.0201) may be used to couple the Coulometer with foreign devices. The cable shield must be properly grounded on both instruments (pay attention to current loops; always ground in a star-head formation). Only plugs with sufficient shielding may be used (for example, METROHM K.210.0381 with K.210.9045).

4.3.1 Handshake

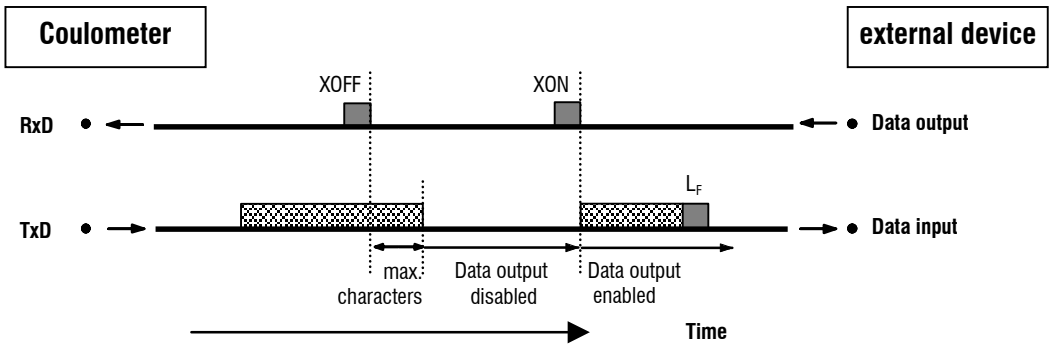
Software-Handshake, SWchar

Handshake inputs on the Coulometer (CTS) are not checked.
Handshake outputs (DTR, RTS) are set by the Coulometer.
The Coulometer sends XOFF when its input buffer contains 384 characters.
After this it can receive 128 extra characters (including L_F).

Coulometer as Receiver :



Coulometer as Sender :

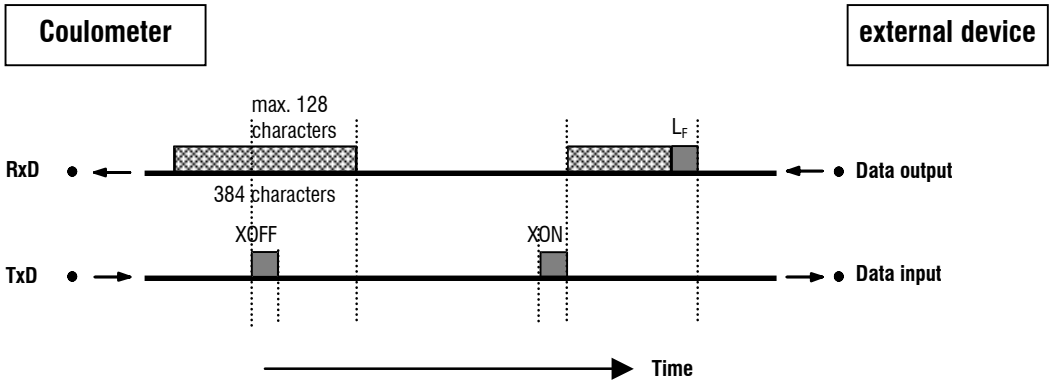


max. characters: 2 characters at 300...9600 baud
16 characters at ≥ 19200 baud

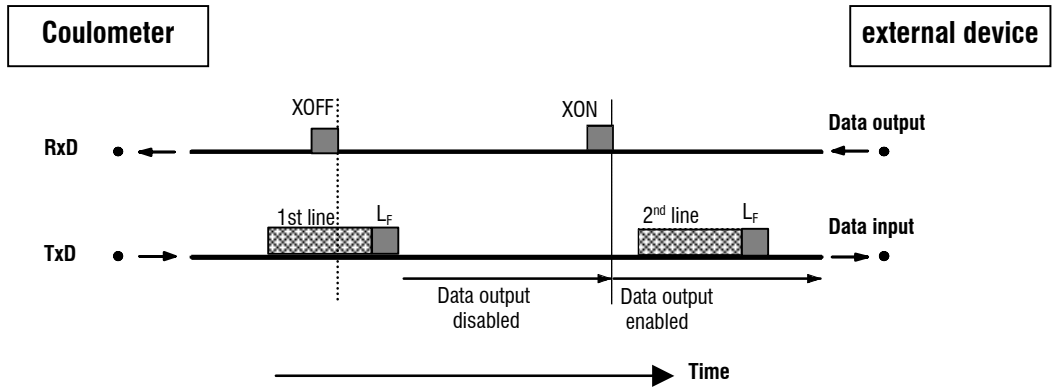
Software-Handshake, SWline

Handshake input ports on the Coulometer (CTS) are not checked.
Handshake output ports (DTR, RTS) are set by the Coulometer.
The Coulometer has an input buffer which can accept up to 512 characters.

Coulometer as Receiver :



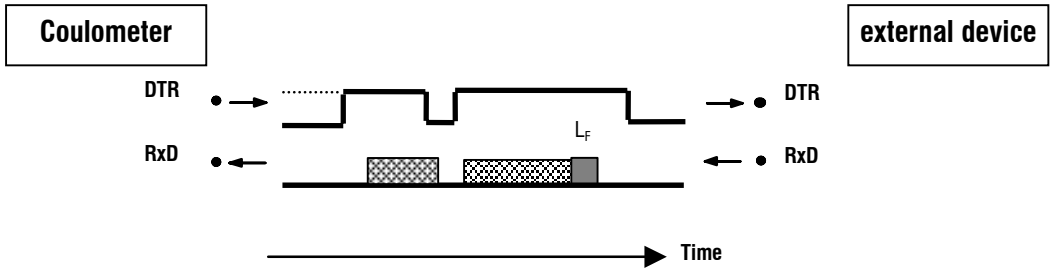
Coulometer as Sender:



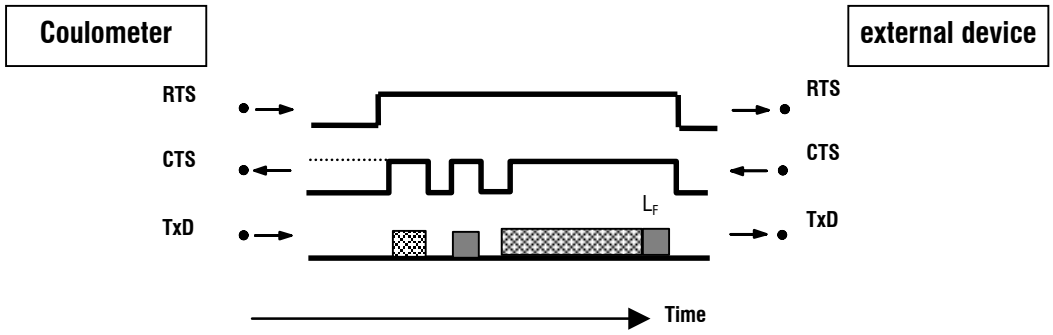
Coulometer transmission can be stopped by external instruments with XOFF. After XOFF is received the Coulometer completes sending the line already started. If data output is disabled for more than 6 s by XOFF, E43 appears in the display.

Hardware-Handshake, HWs

Coulometer as Receiver :



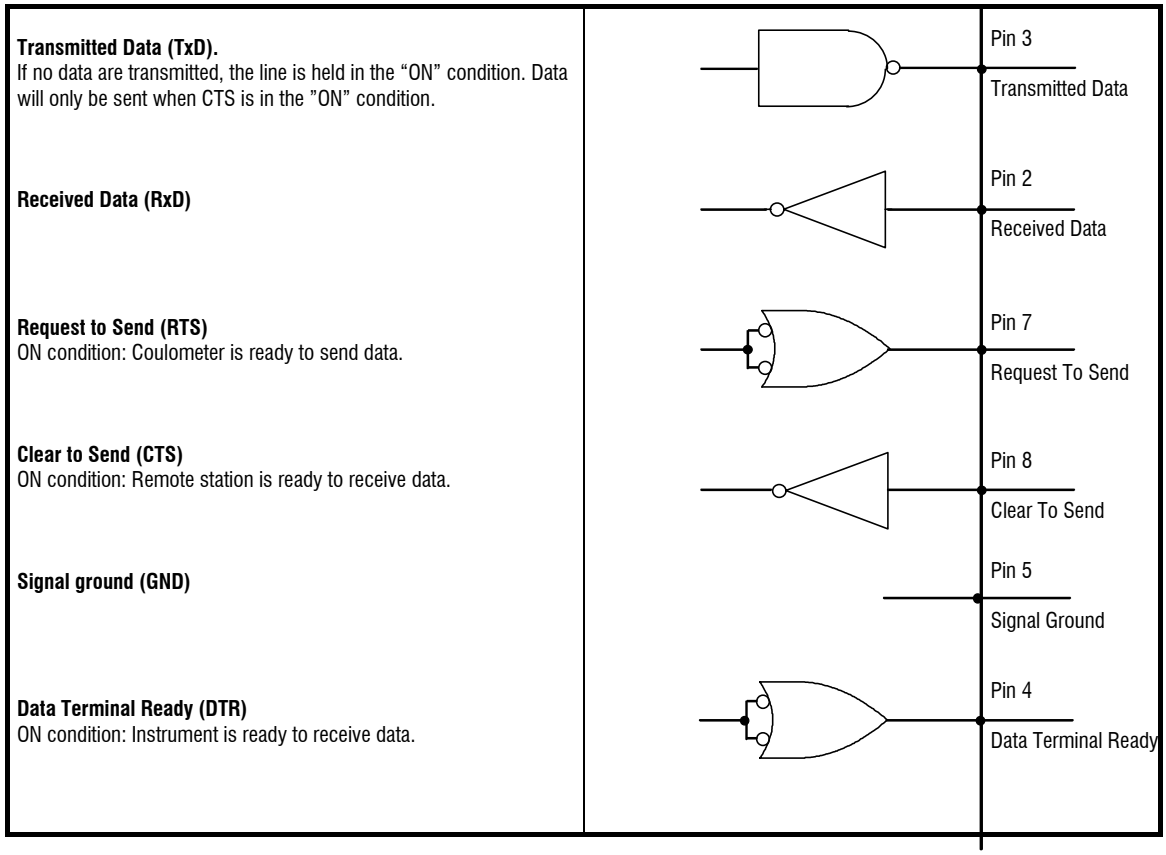
Coulometer as Sender:



The data flow can be interrupted by deactivating the CTS line.

4.3.2 Pin Assignment

RS232C Interface



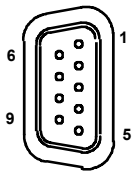
Protective earthing
Direct connection from cable plug to the protective ground of the instrument.

Polarity allocation of the signals
- Data lines (TxD, RxD)
  voltage negative (<-3 V): signal state ”ON”
  voltage positive (>+3 V): signal state ”ZERO”
- control or message lines (CTS, RTS, DTR)
  voltage negative (<-3 V): OFF state
  voltage positive (>+3 V): ON state

In the transitional range from +3 V to -3 V the signal state is undefined.

Driver 14C88 according to EIA RS 232C specification
Receiver 14C89 " "

Contact arrangement at plug (female) for RS 232C socket (male)



View of soldered side of plug

Ordering numbers:
K.210.0381 and K.210.9045

No liability whatsoever will be accepted for damage or injury caused by improper interconnection of instruments.

5 Error messages, troubleshooting

5.1 Troubleshooting

The determination of the free water is easily done as far as the specifications of the reagent manufacturer regarding the "water capacity" of the reagents are concerned. Problems may occur with specific sample matrices. The relevant literature contains many precise analysis instructions. In the following table we attempt to show you solutions concerned more with the instrument.

Problem	Possible causes and remedies
Drift too high	• Depots containing water in the titration vessel: Shake titration vessel. • Reagent exhausted or contaminated ⇒ exchange. • Moisture penetrating into titration vessel: . molecular sieve exhausted? . septum pierced? . seals not OK? . ground joint sleeves not smooth? • Generator electrode diaphragm polluted or moist. • Sample matrix consumes iodine. Change reagent more often. • When working with Oven/Oven Sample Processor: . molecular sieve of Oven/Oven Sample Processor exhausted? . gas flow too high? . allow to run overnight. . screw seals tight?
Drift unstable	• Poor stirring: Stir so that mixing is efficient, but without the formation of air bubbles. • Reset the control parameters to standard values.
Oven parameters wrong in Coulometer report	Switch off the report output at the oven.
Result too high	• Titration vessel not properly conditioned: Shake and wait until drift has stabilized. • With the generator electrode without diaphragm: Set generator current to 400 mA, see also page 33. • Sample contains substances which can be oxidized. • Set stop drift higher. • Drift correction too small, e.g. with unstable drift or with manual drift correction.

Problem	Possible causes and remedies
Result too low	• Drift correction too large, i.e. the drift was too high at the start or unstable drift. • Stop drift too high. • Min.rate too low • Sample releases iodine.
Results widely scattered	• Inhomogeneous sample? Poor reproducibility of sample addition? • Drift unstable.
Titration times too long	• Wait until drift during conditioning becomes stable. • Amount of water too large, see sample size guidelines on page 10. • Set stop drift higher. • Set control range smaller, set max.rate higher.

5.2 Error and special messages

blinking value — The value entered lies outside the permitted range of entries.

Error messages appear in the display as soon as the error has been recognized.

XXX bytes missing — For the storage of a method or a silo line XXX bytes are missing.
Remedy: <QUIT>. Delete methods no longer needed or use fewer silo lines.

changing reagent — The reagent monitoring has responded.
Exit: <EXCH> or <CLEAR>. The reagent monitoring counters are reset to zero.

check drive unit! — The buret is not connected (correctly) or is defective.
Remedy: Rectify fault or <STOP>.

check electrode — The supply to the indicator electrode is interrupted or there is a short circuit. Possible causes and remedies:
- The electrode is not plugged in ⇒ plug it in
- Too much iodine in titration vessel: Add methanol, exchange reagent if necessary.
- The electrode is not immersed ⇒ immerse it
- The electrode is broken ⇒ use new electrode
- The electrode cable is broken ⇒ use new cable

The electrode test can be switched off under the key <PARAM>, >titration parameters.
Exit: Rectify fault or <STOP>.

check exchange unit — The Dosing Unit is not mounted (properly).
Exit: Mount Dosing Unit (properly) so that the coupling engages or <STOP>.

check generator electr. — There is too high a resistance at the generator electrode:
- Not enough reagent in the titration vessel.
- Gas bubbles when working with the oven: set smaller gas flow at the oven.
- Reagent exhausted ⇒ exchange.
- The conductivity of the reagent is too low:
  Work with a generator electrode with diaphragm and automatic current switching (<PARAM>, >preselections, generator I), see also page 33.
- Generator electrode or its cable faulty

Exit: Rectify the fault.

check remote box — The Remote Box is not (correctly) connected or the Remote Box is connected but not activated under the <CONFIG> key.
Exit: Connect Remote Box (correctly) and set **Remote Box: ON** under <CONFIG>, >peripheral units. Switch the Coulometer off/on.

D1 overload — The motor of the dosino has reached its limits.
Remedy:
- Clean the dosing unit and check mobility
- Check dosino motor. To do it, install the housing of the dosing unit and check functionality.

division by zero	The result could not be calculated as a divisor in the formula was equal to zero. Exit: Enter appropriate value.
initializing Dosino	When the Coulometer is switched on the connected Dosino is initialized.
instr.temp.too high	The temperature in the Coulometer is too high (≥ 60 °C). Exit: Wait until temperature is <60 °C.
manual stop	The determination has been manually stopped.
meas.pt list overflow	Maximum 500 measured points can be stored. Exit: Select larger time interval.
missing EP	An EP needed for calculation in a formula is missing.
no method	The method required by the sample data from the silo memory is not available in the method memory. Exit: <CLEAR>.
no new com.var.	The common variable could not be assigned as the result or the mean value could not be calculated. The old value remains in force.
no new mean	No new mean value has been calculated as at least one quantity stipulated for mean value calculations could not be calculated.
no oven param.	The oven could not be found at the given COM. Remedy: connect the oven to the given RS-interface of the Coulometer or set the following in your method under <PARAM>, >preselections, **Oven: no**.
no titration data	No curve can be printed as no data are available.
not valid	A value is not available.
overrange	The measuring range of ±2 V has been exceeded. Overrange replaces the corresponding measured value. Exit: Rectify error or <STOP>.
overtitrated	In iodine range. The message can also appear after switching on. Add methanol. If the message appears again: - Check whether the cables of the indicator and generator electrodes have been interchanged. - Improve stirring. - Exchange reagent. Exit: Rectify fault or <STOP>.
result out of limits	The result lies outside the limits which were defined in the method, see page 35. Exit: Calculate result again or new start.
sample size out	The sample size is outside the limits which are defined in the method, see page 29. Exit: Enter new sample size.
sample unfit	The EP has been "overshot" during the titration. The sample may release an oxidizing agent or the control parameters have not been set correctly. The result could be incorrect.
service is due	The service interval has elapsed. Contact Metrohm service so that the Coulometer can be serviced. This message will ap-

	pear each time the Coulometer is switched on. Exit: New start.
silo empty	The silo memory is switched on but is empty and a titration has been started. Corrective action: Fill at least the first 1 silo line before starting the first titration. Exit: <CLEAR>.
silo full	The silo memory is full (255 lines). Exit: <CLEAR>.
stop time reached	The titration has been stopped as the max.titration time has been reached.
system error 3	The instrument adjustment data have been overwritten. Exit: <CLEAR>. Default adjustment data are set. The error message appears each time the instrument is switched on until it has been readjusted (Metrohm service).
system error 14	No communication between the Coulometer and the connected Remote Box. Possible causes: - The Remote Box was connected when the Coulometer was running - Coulometer has a fault. - Remote Box has a fault. Remedy: Set under <CONFIG>, **>peripheral units**, **Remote Box: OFF**, switch off Coulometer, take away Remote Box and switch on Coulometer. Contact Metrohm service.
time-out PC keyboard	A connected PC keyboard has been used to call up an address (e.g. <F12>) and the connection has then been interrupted. Possible causes: - Remote Box has a fault. - PC keyboard has a fault. Exit: Correct fault and switch Coulometer off/on.
transmission error	With a Remote Box connected characters are received which cannot be interpreted. Possible causes: - Wrong key combination has been pressed. - Wrong PC keyboard has been selected. - The barcode reader supplies garbled characters. - The Remote Box has a fault. Exit: Rectify fault and switch Coulometer off/on.
validate instrument	Validation interval has elapsed. Exit: <CLEAR> or new start.
work.conditions not ok	During the titration there was too high a resistance at the generator electrode. The result could be incorrect. Reasons: - Not enough reagent in the titration vessel. - Gas bubbles when working with the oven: Set smaller gas flow at the oven.

- Reagent exhausted ⇒ exchange.
- Conductivity of the reagent is too low:
  work with a generator electrode with diaphragm and automatic current switching (<PARAM>, >preselections generator I), see also page 33.
- Generator electrode or its cable faulty

Exit: Rectify the fault.

Error messages in connection with the data transfer

Receive errors:

error 36 Parity
Exit: <QUIT> and set corresponding quantity the same on both instruments

error 37 Framing error.
Exit: <QUIT> and set corresponding quantity the same on both instruments

error 38 Overrun error. At least 1 character could not be read.
Exit: <QUIT>

error 39 Overflow of the receive buffer of the Coulometer (>128 characters).
Exit: <QUIT>

Send errors:

error 42 CTS=OFF
Handshake unsatisfactory for more than 1 s.
Exit: <QUIT>. Is the receiver switched on and ready to receive?

error 43 The transmission of the Coulometer has been interrupted with XOFF for at least 6 s.
Exit: <QUIT>.

error 45 The receive buffer of the Coulometer contains an incomplete string (missing L_F). Transmission of the Coulometer is thus blocked.
Exit: Send L_F or <QUIT>.

5.3 Problem with an external printer

Problem	Questions for remedial action
No characters can be received on a connected printer.	• Are the instruments switched on and cables plugged in correctly? • Is the printer set to ”on-line”? • Are baud rate, data bit and parity the same on both instruments? • Is the handshake set properly? If everything seems to be OK, try to print a report with the key sequence <PRINT><SMPL DATA><ENTER>. If this report is printed out correctly, check if reports are defined in key <DEF>.
No data transmission and the display of the Coulometer shows an error message.	error 42: Transmission error. Is the printer set to "on-line"? Is the connection cable properly wired?
The received characters are garbled.	• Are the RS settings the same on both devices? • Has the correct printer been selected? • Data transfer has been interrupted on the hardware side during the printout of a curve. Re-establish connections and switch printer off/on.
Wrong line spacing.	The printer does not emulate completely the preset mode. Usually these problems arise with the IBM mode. Set the printer to a different mode (e.g. Epson).
Printout of titration curve is not OK. Other reports are printed OK.	Handshake is necessary for the printout of curves. • Is your cable correctly wired? (The DTR of the printer has to be connected to the CTS of the Coulometer.) • Set "HWs" for the handshake of the Coulometer. Configure the printer such that its DTR is set (possibly with DIP switches).

5.4 Initialize KF Coulometer

In rare cases the RAM of the Coulometer may need to be initialized. This causes the deletion of all methods, silo data and results. Whenever possible you should first make a method backup with the aid of a PC and the 6.6008.200 or 6.6008.500 Vesuv 3 Software and print out your configuration data (<PRINT><CONFIG><ENTER>).

Initialize RAM

1. Switch off Coulometer
2. Switch on Coulometer and press key <9> at the same time. The display shows:

   ```
   diagnose press key 0...9
   ```

3. Press key <8>. The display shows:

   ```
   RAM init.
   ```

4. Press key <ENTER>. Initialization will be carried out. The display then shows:

   ```
   RAM init. passed
   ```

5. Exit the display with <CLEAR>.
6. Re-enter your configuration data and load your methods into the instrument again.

5.5 Testing the measuring input

With the aid of the "767.0010 Calibrated Reference for mV, pH, Ω, uS, °C" you can check the measuring input "Ipol" and the indicator electrode cable.

If a Remote Box is connected:
Deactivate the Remote Box (key <Config>, **>peripheral units**, **Remote Box: off**). Switch the Coulometer off and screw off the Remote Box. Switch the Coulometer on again (so that the new configuration will be recognized).

Procedure:
1. Switch off Coulometer.
2. Screw off indicator electrode cable and insert in socket 5 of the 767. The cover remains closed on the 767.
3. Switch on Coulometer and press key <9> at the same time. The display shows:
   diagnose press key 0...9
4. Press key <6>. The display shows:
   pol/ADC test press 1..3
5. Press key <3>. The display shows:
   polarizer test
6. Press <ENTER> on the Coulometer. The display shows:
   dummy resistor 10.0 k ?
   Press <ENTER> and enter the resistance from the cover of the 767 (Ω-value 5). The display shows:
   polarizer test *
   When the test has been completed the display shows:
   polarizer test o.k.
7. Exit the diagnostic program with 3 times <CLEAR>.
8. Make the Coulometer ready for work again:
   . Screw the cable back on to the indicator electrode.
   . Plug in the cable of the generator electrode.

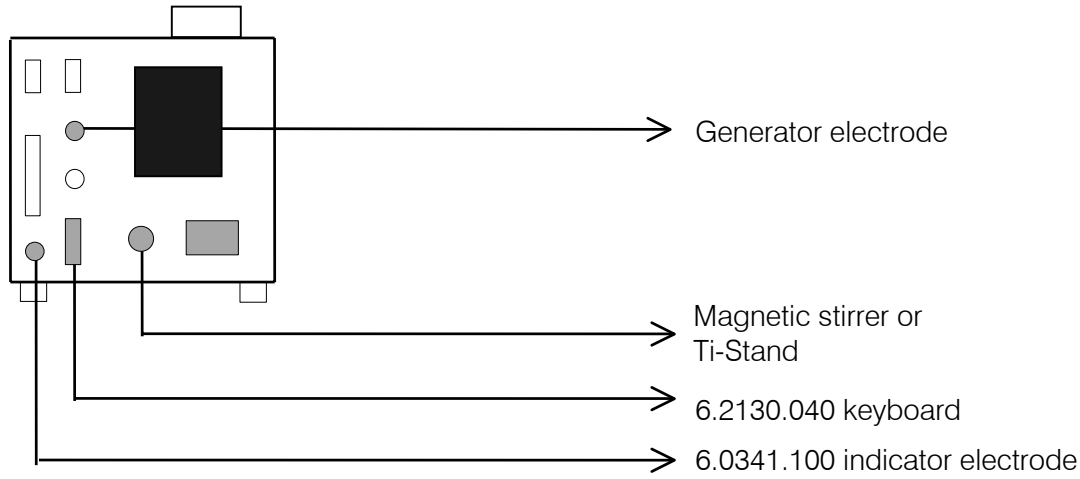
The measuring input and cable have now been checked.

6 Preparations

The mains cables supplied with the instrument are three-core and equipped with a plug with an earthing pin. If a different plug has to be fitted, the yellow/green lead must be connected to the protective earth. Each break in the earthing inside or outside the instrument can make it a hazard.
When the instrument is opened or if parts of it are removed, certain components may be live if the instrument is connected to the mains. The mains cable must therefore always be unplugged when certain adjustments are made or parts replaced.
The cable should only be plugged in and unplugged when the instruments are switched off.

6.1 Coulometer setup

6.1.1 Connecting a Stirrer or Ti Stand



Screw 6.2101.050 stand console onto the base of the Coulometer (always use the screws provided) and insert the support rod into the console. The adjusting ring on the support rod can be used to fix the position of the titration vessel holder.
Fasten the stirrer or Ti-Stand to the support rod and make the necessary cable connections.

6.1.2 Insert paper into built-in thermal printer (only at 756)

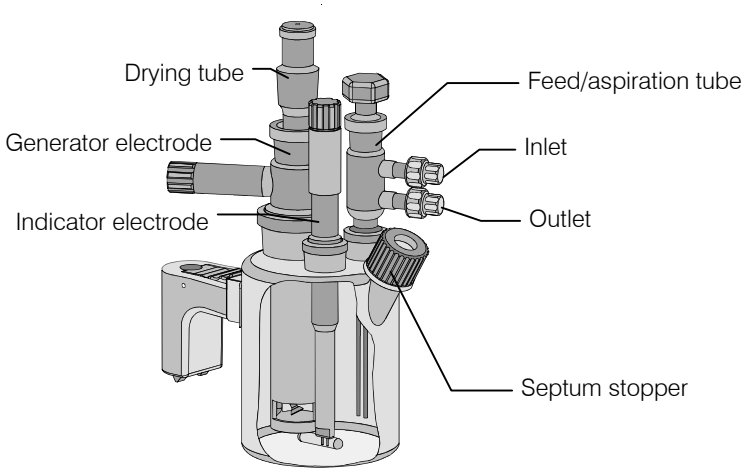
Insert the paper with the Coulometer switched on.

1. Remove old paper strips with the key <PAPER>. If the key <PAPER> does not trigger a paper feed, make the following setting: <CONFIG>, **>peripheral units man.reports to COM:int**.
2. Open cover, take out the spindle and remove the cardboard part of the old paper roll.
3. Cut a straight edge on the new paper roll. Insert this under the transport roller and press the key <PAPER> on the Coulometer. Keep the key pressed down until sufficient of the paper strip projects.
4. Insert the metal spindle through the new roll of paper.
5. Place the metal spindle in the notches at the side of the paper compartment in the Coulometer and close the cover.

Notes

- Always operate the key <PAPER> to obtain a paper feed. Never pull the paper with your hands as this could damage the printer.
- Thermal paper has a limited shelf life: Protect it from light! Do not store it in plastic folders (plasticizers make the printing illegible)!
- Never operate the printer without paper!
- Use only original 6.2237.020 thermal paper! The printer head could otherwise be damaged.
- If the printer no longer prints out correctly it is possible that the printer head is dirty. It can be cleaned by inserting a sufficiently long strip of printer paper **the wrong way round** in the printer and "printing" a few reports on it.

6.1.3 Titration vessel setup with Ti Stand

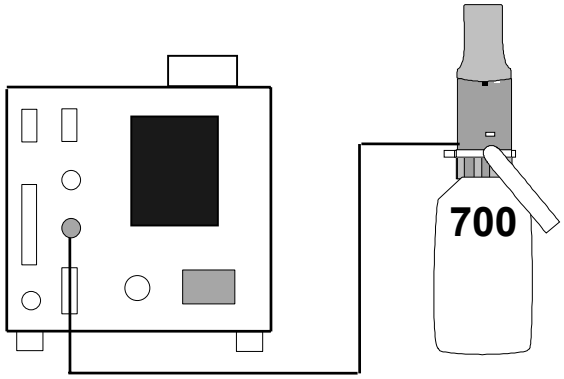


1. Attach titration vessel with holder to the support rod.
2. Place stirring bar in titration vessel.
3. Cut 6.2713.XXX ground joint sleeves to the correct length and use for all the joints of the inserts[1)].
4. Insert indicator electrode in the left-hand joint opening, screw on 6.2104.020 electrode cable and plug it into the "Ind.El" socket of the Coulometer.
5. Insert generator electrode in the central joint opening, screw on 6.2104.120 electrode cable and plug it into the "Gen.El" socket of the Coulometer.
6. Fill the drying tube with molecular sieve and insert into generator electrode.
7. Place septum in the screw cap and screw this onto the titration vessel. Only tighten it enough to ensure that it is tight. (The septum should not be deformed!)
8. Insert 6.1439.010 feed/aspiration tube (order separately) in the last joint opening and connect the aspiration and feed tubing of the Ti-Stand. Close the top of the tube with a glass stopper.

1) When cutting the ground joint sleeves take care that no rough edges are formed. The ground joint sleeves must not project beyond the lower edge of the joint.
If no ground joint sleeves are used then the joints must be greased. In this case the joints must be checked periodically and re-greased while otherwise problems with blocked joints could occur.

6.2 Connecting Coulometer to Dosino

Automatic reagent exchange is possible with the Dosino.
The inquiry **reagent change** under <CONFIG>, **>monitoring** must be set to **auto** or "man.".
The key <EXCH> is then used to carry out a reagent exchange.
With reagent change **auto** the reagent change is carried out automatically as soon as the reagent monitoring has responded.



The 2.700.0020 Dosino can be connected directly. If you want to connect a 2.700.0010 Dosino then you require the 6.2134.020 adapter cable.

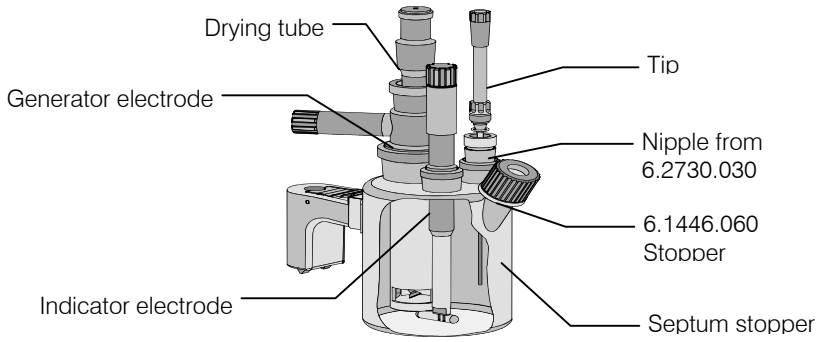
For aspiration it is an advantage to use the 6.5617.000 aspiration equipment (including 50 ml dosing unit; order Dosino separately).
For aspirating oily samples, where only the sample is to be aspirated and not the whole reagent, a 20 ml dosing unit or, for very viscous samples, a 10 ml cylinder should be used; see page 146ff for accessories.

6.2.1 Setup with aspiration equipment

1. Screw 6.1829.010 tube into the threaded opening below the dosing unit. It may be necessary to cut the tube to the correct length.
2. Screw the dosing unit onto the reagent bottle and insert the reagent bottle from above at an angle into the bottle holder. Fill the small adsorber tube with molecular sieve and attach it to the dosing unit. Place the Dosino on the dosing unit.

3. Screw 6.1602.105 bottle attachment onto the waste bottle, fill adsorber tube with molecular sieve and place it in the bottle attachment. Close the larger threaded opening of the bottle attachment with 6.1446.080 stopper.
4. Place the waste bottle in the bottle holder. Connect the bottle attachment and Port 3 of the dosing unit with 6.1805.080 tubing.
5. Equip the titration vessel with the aspiration equipment, see below. The aspiration equipment consists of 6.1543.070 tip, nipple from 6.2730.030 (use E.301.0022 O-ring instead of the thin O-ring of the nipple) and 6.1446.060 stopper.
6. Connect the aspiration tip and Port 1 of the dosing unit with 6.1805.060 tubing.

6.2.2 Equipping the titration vessel for aspiration



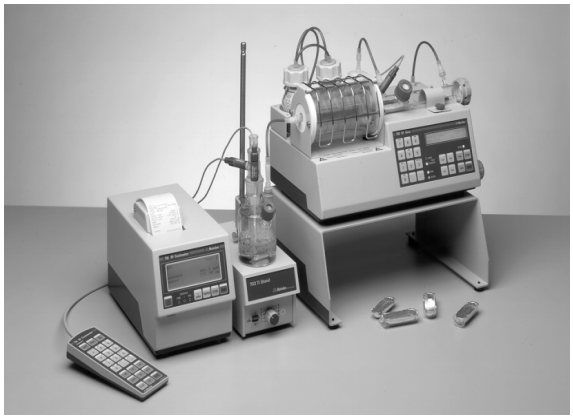
1. Attach titration vessel with holder to the support rod.
2. Place stirring bar in titration vessel.
3. Cut 6.2713.XXX ground joint sleeves to the correct length and use for all the joints of the inserts[1)].
4. Insert indicator electrode in the left-hand joint opening, screw on 6.2104.020 electrode cable and plug it into the "Ind.El" socket of the Coulometer.
5. Insert generator electrode in the central joint opening, screw on 6.2104.120 electrode cable and plug it into the "Gen.El" socket of the Coulometer.
6. Fill the drying tube with molecular sieve and insert into generator electrode.
7. Place septum in the screw cap and screw this onto the titration vessel. Only tighten it enough to ensure that it is tight. (The septum should not be deformed!)
8. Screw tip with the nipple and O-ring from 6.2730.030 into 6.1446.060 stopper and insert this into the last joint opening.
9. Connect the tip to Dosino Port 1.
10. Connect Dosino Port 3 to the waste bottle.

1) When cutting the ground joint sleeves take care that no rough edges are formed. The ground joint sleeves must not project beyond the lower edge of the joint.
If no ground joint sleeves are used then the joints must be greased. In this case the joints must be checked periodically and re-greased while otherwise problems with blocked joints could occur.

6.3 Connecting the 768 KF Oven

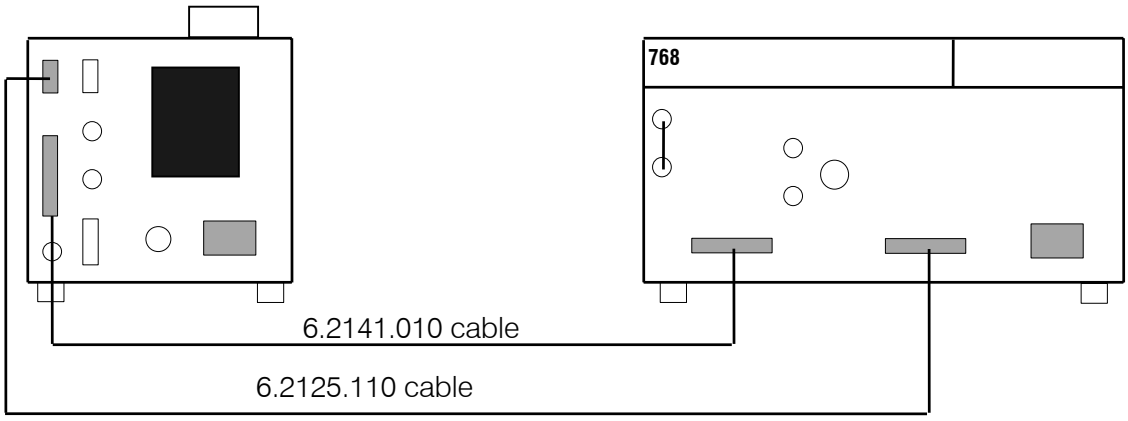
It is expedient to place the oven on 6.2041.180 instrument bridge. Take care that the gas outlet of the oven enters the titration vessel as directly as is possible to prevent the formation of condensed water in the outlet tubing.

Instrument setup:



Oven on 6.2041.180 instrument bridge

Connecting the instruments:



Connection of both RS interfaces (cable 6.2125.110) is only necessary when you require the oven results in the Coulometer report. Make sure there is no report output from the oven!
When the RS interfaces are not connected then the following setting must be made at the Coulometer: <PARAM>, **>preselections**, **Oven: no**.

If you enter one of the COMs of the Coulometer for this parameter then your Coulometer result report will contain the oven data "heating time", "sample temp.", "lowest temp.", "highest temp." and "gas flow".

The start is triggered at the oven. When the Coulometer titration vessel has been conditioned the oven automatically starts the titration.

The 707 KF Oven can also be connected instead of the 768 KF Oven.

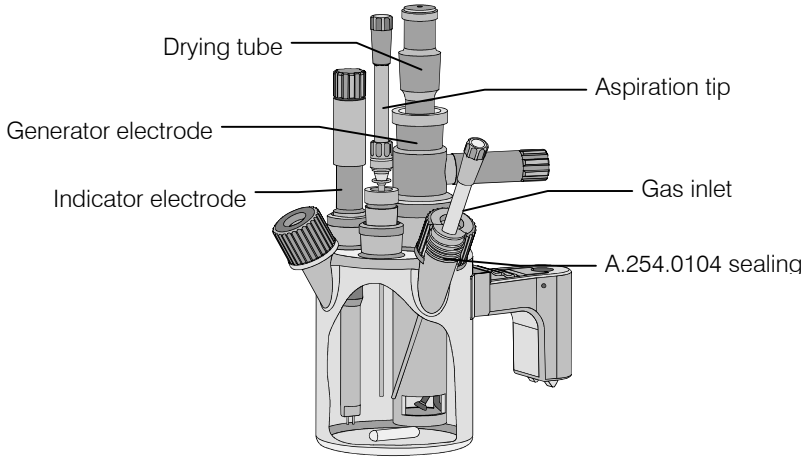
6.3.1 Equipping the titration vessel with an oven

The titration vessel is equipped in a similar way to that for aspiration with a Dosino, see page 116. The gas outlet of the oven is connected to the tip. Take care that connection between the oven outlet and the titration vessel is short, as otherwise condensed water may form in the tubing!

If you use the 6.1830.000 heatable outlet tubing then you require 6.1446.170 stopper for the inlet tip.

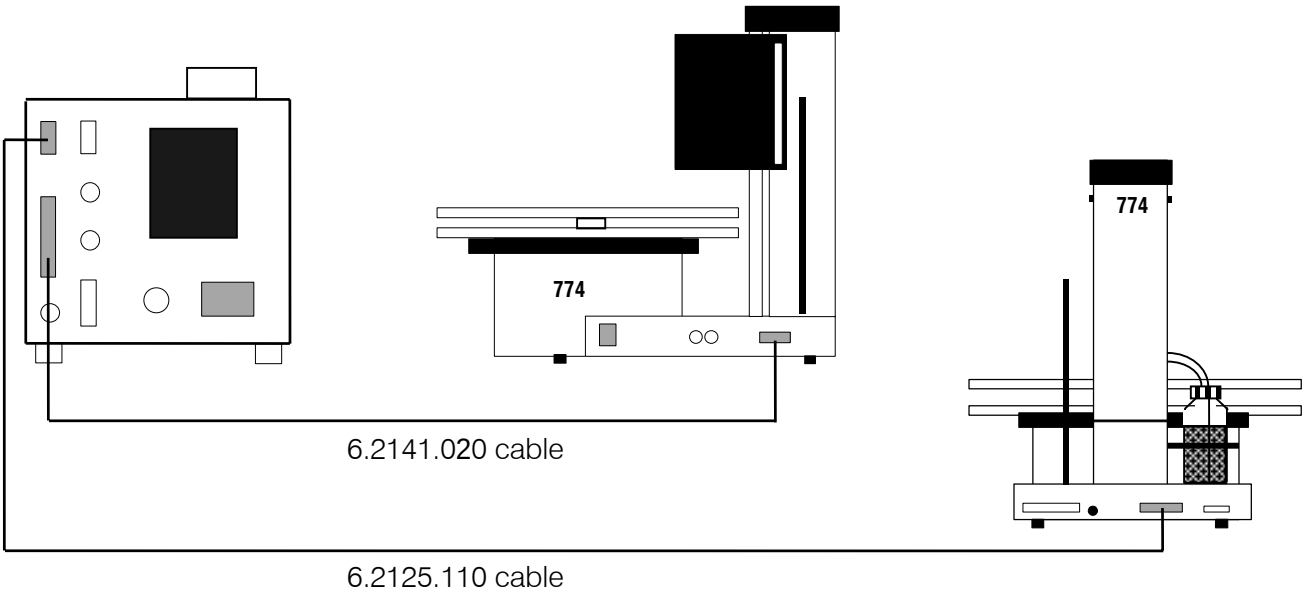
If in addition to the gas inlet from the oven you want to use a Dosino for aspiration then the aspiration tip is inserted on the joint opening and the gas inlet is fitted with A.254.0104 seal which is placed in the screw cap instead of the septum; the screw cap is then screwed down; see below.
If you use the 6.1830.000 heatable outlet tubing then you should use A.254.0102 seal (instead of A.254.0104) for the gas inlet.

If you require an additional opening for injections then 6.1465.320 titration vessel is available; it has two side-mounted screw threaded openings.



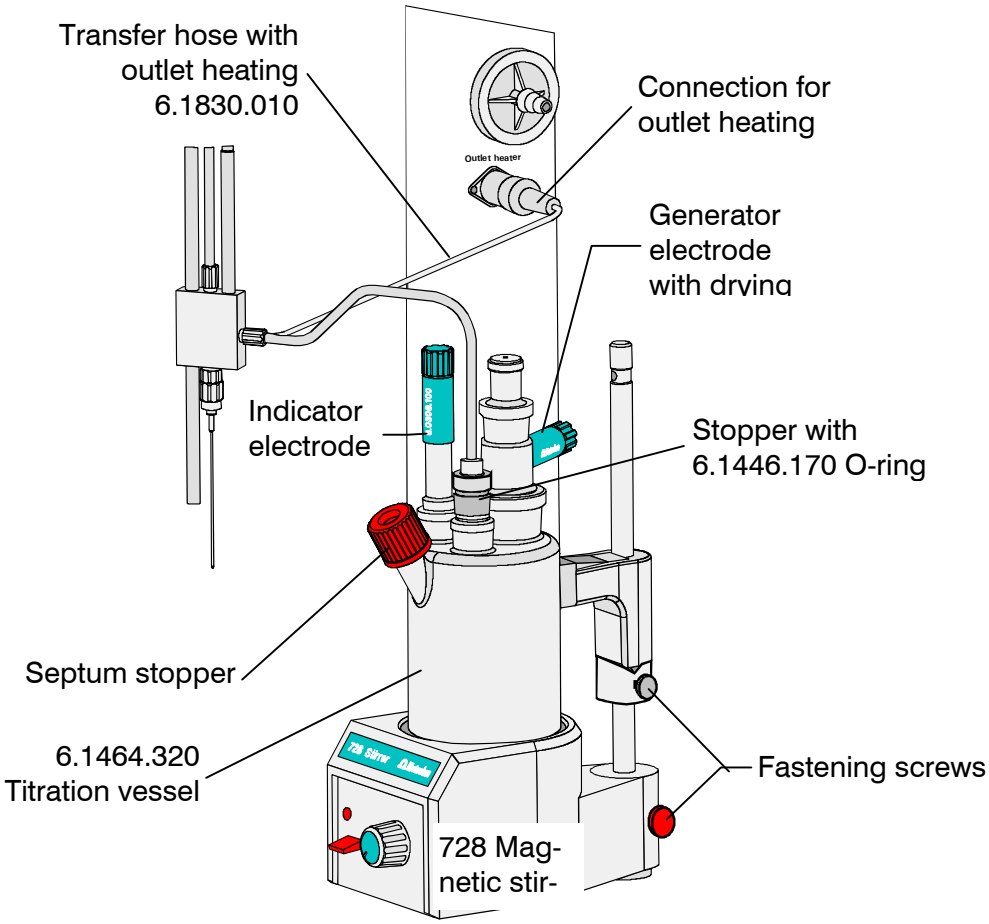
6.4 Connecting the 774 Oven Sample Processor

The Oven Sample Processor heats the sample and transfers the moisture from the sample to the titration vessel of the Coulometer. Coulometer and Oven Sample Processor are connected via the remote sockets (cable 6.2141.020) as well as via the RS interfaces (cable 6.2125.110):



6.4.1 Equipping the titration vessel with the Oven Sample Processor

Lead the tip of 6.1830.010 heatable outlet tube into the titration vessel with the aid of 6.1446.170 stopper.

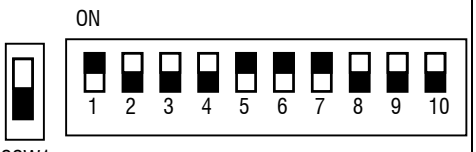
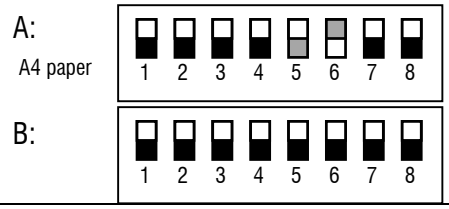


If in addition a Dosino is to be used for aspiration then the aspiration tip is inserted into the joint opening and the gas inlet is fitted with A.254.0102 seal which is placed in the screw cap instead of the septum; the screw cap is then screwed down; see illustration on page 118.

If you require an additional opening for injections then 6.1465.320 titration vessel is available; it has two side-mounted screw threaded openings.

6.5 Connecting an external printer

A variety of printers can be connected to the RS232 interface of the Coulometer. If you connect a printer other than one of those mentioned below, ensure that the Epson mode is emulated or that it uses the international character set following the IBM Standard Table 437 and IBM-compatible graphics control characters.
If a balance is connected at the same COM of the Coulometer as a printer, you need the 6.2125.010 + 6.2125.030 Adapters.

Printer	Cable	Settings on Coulometer	Settings on Printer
Seiko DPU-414 DPU-411	6.2134.110 6.2125.010 6.2125.020	baud rate: 9600 data bit: 8 stop bit: 1 parity: none handshake: HWs send to: Seiko	none
Citizen iDP562 RS	6.2134.050	baud rate: 9600 data bit: 8 stop bit: 1 parity none handshake: HWs send to: Citizen	
Epson LX-300	6.2134.050	as above	see printer manual
HP Desk Jet with serial interface	6.2134.050	baud rate: 9600 data bit: 8 stop bit: 1 parity none handshake: HWs send to: HP	
HP Desk Jet with parallel interface	6.2125.020 + 6.2125.010 + 2.145.0300 Parallel-Serial-Converter	baud rate: 9600 data bit: 8 stop bit: 1 parity none handshake: HWs send to: HP	see printer manual

6.6 Connecting a balance

The following balances can be connected to the RS232 output of the Coulometer:

Balance	Cable
Sartorius MP8, MC1	6.2134.060
Mettler AB, AG (LC-RS25)	in the scope of delivery of the balance
Mettler AM, PM	6.2146.020 + 6.2125.010 additionally from Mettler: ME 47473 Adapter and ME 42500 hand switch or ME 46278 foot switch
Mettler interface 016	Cable in scope of delivery of interface 016: red lead to pin 3, white lead to pin 7 of the 25-pin connector + 6.2125.010 25-pole/9-pole adapter
Mettler interface 011 or 012	6.2125.020 + 6.2125.010
Mettler AT	6.2146.020 + 6.2125.010
Mettler PG	6.2134.110
AND Models ER-60, 120, 180, 182 Models FR-200, 300 Models FX-200, 300, 320 with RS232 interface (OP-03)	6.2125.020 + 6.2125.010
Precisa, balances with RS232C-interface	6.2125.080 + 6.2125.010

The balance type must be preselected at the Coulometer with the <CONFIG> key.
The weight is transferred as a number with up to 6 digits, sign and decimal point. Units and control characters sent by the balance are not transmitted.
With the aid of a special input unit supplied by the balance manufacturer identifications and methods can be inputted from the balance in addition to the weight. For this, the address of the identifications and method must each be preselected on the input unit.

Balance	Method	Id1	Id2	Id3
Sartorius	METH or 27	ID.1 or 26	ID.2 or 24	C-20 or 23
Mettler (AT)	D (Mthd)	C (ID#1)	B (ID#2)	A (c20)

If balance and printer are connected at the same Coulometer COM you need the 6.2125.010 and 6.2125.030 Adapters.
If the balance works only with 7 bit and the printer with 8 bit and if they are at the same Coulometer COM, the balance has to be set to "space parity" and Coulometer/printer to 8 bit, "no parity".

6.7 Connecting a PC

Cable:
Coulometer-PC, 9/9-pole 6.2134.040
Coulometer-PC, 9/25-pole 6.2125.110

Settings at the Coulometer:
RS settings: ..... according to program
<CONFIG>, **>peripheral units**, **send to:** ..... IBM

PC programs:
Vesuv 3, program for data management and method backup.
for up to 64 devices 6.6008.200
for 2 devices 6.6008.500

6.8 Connecting a Remote Box

A barcode reader and/or a PC keyboard can be connected to 6.2148.000 Remote Box. The barcode reader and PC keyboard are used as input aids.

Only plug in and unplug the Remote Box when the Coulometer is switched off! The Remote Box is screwed onto the "Remote" socket of the Coulometer. The remote lines of the Coulometer are then accessible at the "Remote" socket of the Remote Box.

6.8.1 Connecting a barcode reader

Barcode readers with a 5-pole DIN plug can be connected to 6.2148.000 Remote Box. A precondition is that the barcode reader can emulate a PC keyboard. If a barcode reader and a PC keyboard are to be connected at the same time then the barcode reader must have a T-connection plug. The PC keyboard will then be plugged into this barcode reader connection.

Settings at the Coulometer:

Under key <CONFIG>, **`>peripheral units`**, **`Remote Box: on`**

Barcode:

`input` The barcode string goes to the entry field in which the cursor is currently located.

`method` If the silo memory is switched on the barcode string always goes to the method. The cursor position has no effect.
If the silo memory is switched off the input has no meaning.

`id1` The barcode string always goes to Id1. The cursor position has no effect.

`id2, id3` As for id1.

`smpl size` The barcode string always goes to the sample size. The cursor position has no effect. If the silo memory is switched on the silo line will be concluded with the sample size and the cursor moves to the next silo line.

Settings at the barcode reader:

Plug the barcode reader into the Remote Box. The barcode reader instruction manual contains the codes which you must enter.

1. Bring the barcode reader into the programming mode.
2. Make the necessary setting for emulating a PC keyboard (may be country-specific). Select <ENTER> or "CR + LF" as termination sign.
3. Exit the programming mode.

Notes:

- If longer characters chains than are permitted by the corresponding input are transmitted then the first n characters will be accepted; the last characters will be cut off.
- If the silo memory is switched on and the settings "barcode: method" or "barcode: idX" are operative, the first silo line will be created when the string is received. Higher silo lines than 1 are only created and concluded with the sample size.

6.8.2 Connecting a PC keyboard

PC keyboards with a 5-pole DIN plug can be connected to 6.2148.000 Remote Box. For keyboards with a PS/2 plug an adapter PS/2→DIN is available in PC shops.

Settings at the Coulometer:
Under key <CONFIG>, >peripheral units, "Remote Box: on"
Keyboard:
Select the country-specific keyboard layout of your PC keyboard.
If the Coulometer does not support your keyboard you should select a keyboard which has the closest possible layout (for example check the 2nd occupancy of the numerical keys). Country-specific special characters will probably not be converted correctly.

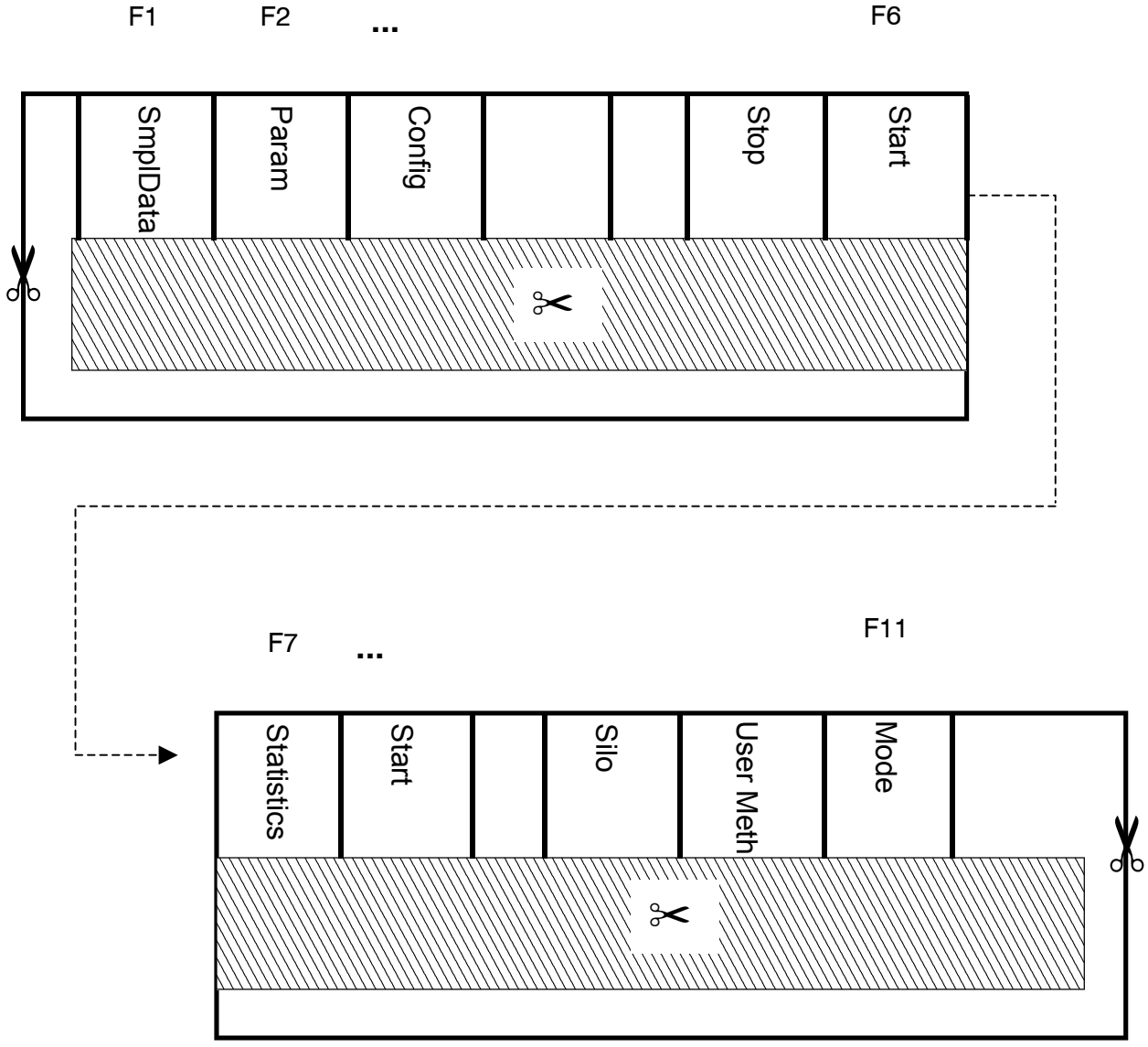
Operating via a PC keyboard:
The Coulometer can be operated from the PC keyboard. The Coulometer functions are called up as follows:

Coulometer function	Key combination on PC keyboard	Remarks
<C-FMLA>	Alt F	
<CLEAR>	F5	
<CONFIG>	F10	
Cursor ↑ ↓	Cursor ↑ ↓	Navigation
Cursor → ←	Cursor → ←	Selection of inputs
<DEF>	Alt D	
DEF: formula input, common variable, mean value: H2O (EP) RS MN C	 E R M C	Input of corresponding quantity or variable together with the numerical address, e.g. R1 gives RS1.
<ENTER>	enter	
<EXCH>	Alt E	
<MODE>	F2	
<PARAM>	F11	
<PRINT>	Alt P	Report selection with → ←
<QUIT>	ESC	
<REPORTS>	Alt O	Printout reports: Alt P + Alt O
<SILO>	F4	on/off
<SMPL DATA>	F12	
<START>	F7	
<STATISTICS>	F6	on/off
<STOP>	F8	
<USER METH>	F3	
<USER>	Alt U	

The numerical block (with NumLock) and the number keys on the PC keyboard simulate the functions of the numerical keys on the Coulometer. For example, entering <7> in the basic state of the Coulometer switches the statistics on.

Keys which are used for setting an accent (e.g. ^, ´) are converted immediately. If you try to enter ê the Coulometer will display ^e instead.

The occupancy of the PC function keys (F1 till F12) is shown to the right as an overlay. You can copy this diagram, cut out the hatched part and place it above the function keys of your PC keyboard.



7 Appendix

7.1 Technical specifications

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 Ipol: 2, 5, 10, 20 or 30 uA adjustable
Iodine production	Pulse with variable current strength and length Current at the generator electrode: 100, 200, 400 mA
Titration speed	max. 2.24 mg H_2O/min
Determination range	10 ug to 200 mg H_2O
Resolution	0.1 ug H_2O
Reproducibility	Sample: Reagent manufacturer's standard. With 10 ug...1000 ug H_2O: ± 3 ug With >1000 ug H_2O: 0.3% or better
Drift compensation	automatic, manual or none
Materials	
Housing	Metal, powder coated
Keypad cover	Polycarbonate (PC)
Display	Graphical LCD, 192 x 64 dots Field: 100 x 37 mm LED back-lit
Printer (only at 756)	Built-in thermal printer Paper width 57 mm 144 pixel or 24 characters per line
Memory	Method storage for approx. 100 methods Silo memory for sample data and results
Stirrer control	On/off switch manual and coordinated with the titration process
RS232 interface	2 separate interfaces, each can be configured for printer, balance or computer connection: Completely controllable from external control unit

Remote Input/Output-lines	Connection for Oven, Oven Sample Processor, robot. With optional Remote Box: Connection for barcode reader and PC keyboard
Dosino connection	For automatic reagent exchange

Ambient temperature

Nom. operation range	5 ... 40 °C
Storage	– 20 ... 60 °C
Transport	– 40 ... 60 °C

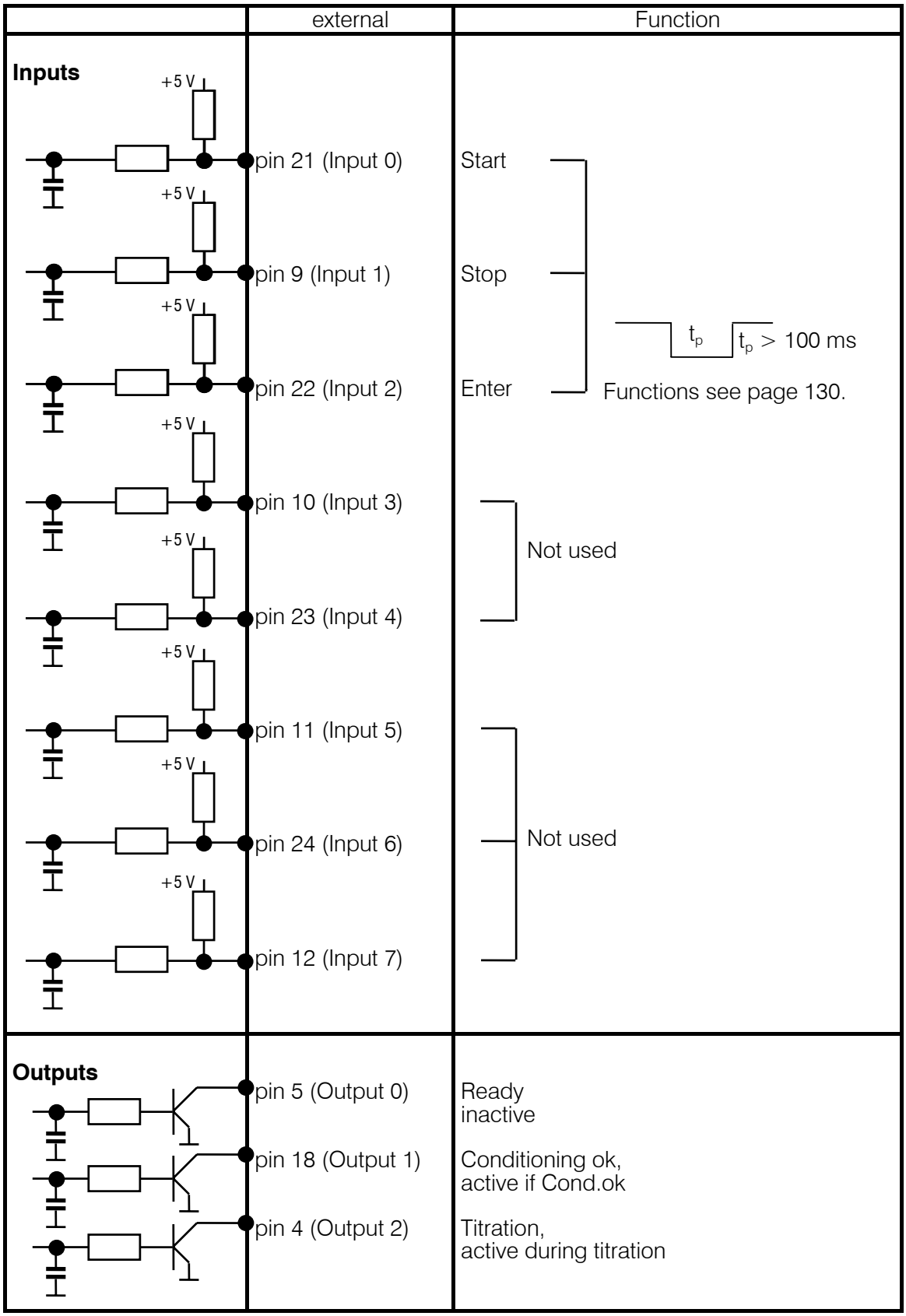
Safety specifications	Designed and tested in accordance to IEC publication 1010, safety class I. This manual contains information and warnings which have to be followed by the user to ensure safe operation and to retain the apparatus in safe condition.

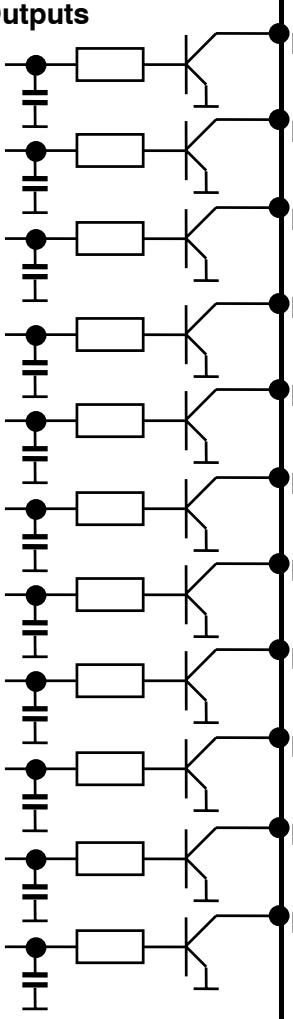
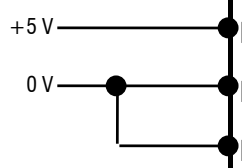
Mains connection

Voltage	100...240 V ± 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	**At 756**	**At 831**
Width	145 mm	145 mm
Height	194 mm	169 mm
Depth	307 mm	307 mm
Weight, including keypad	approx. 4.5 kg	approx. 3.8 kg

7.2 Pin assignment of the "Remote" socket

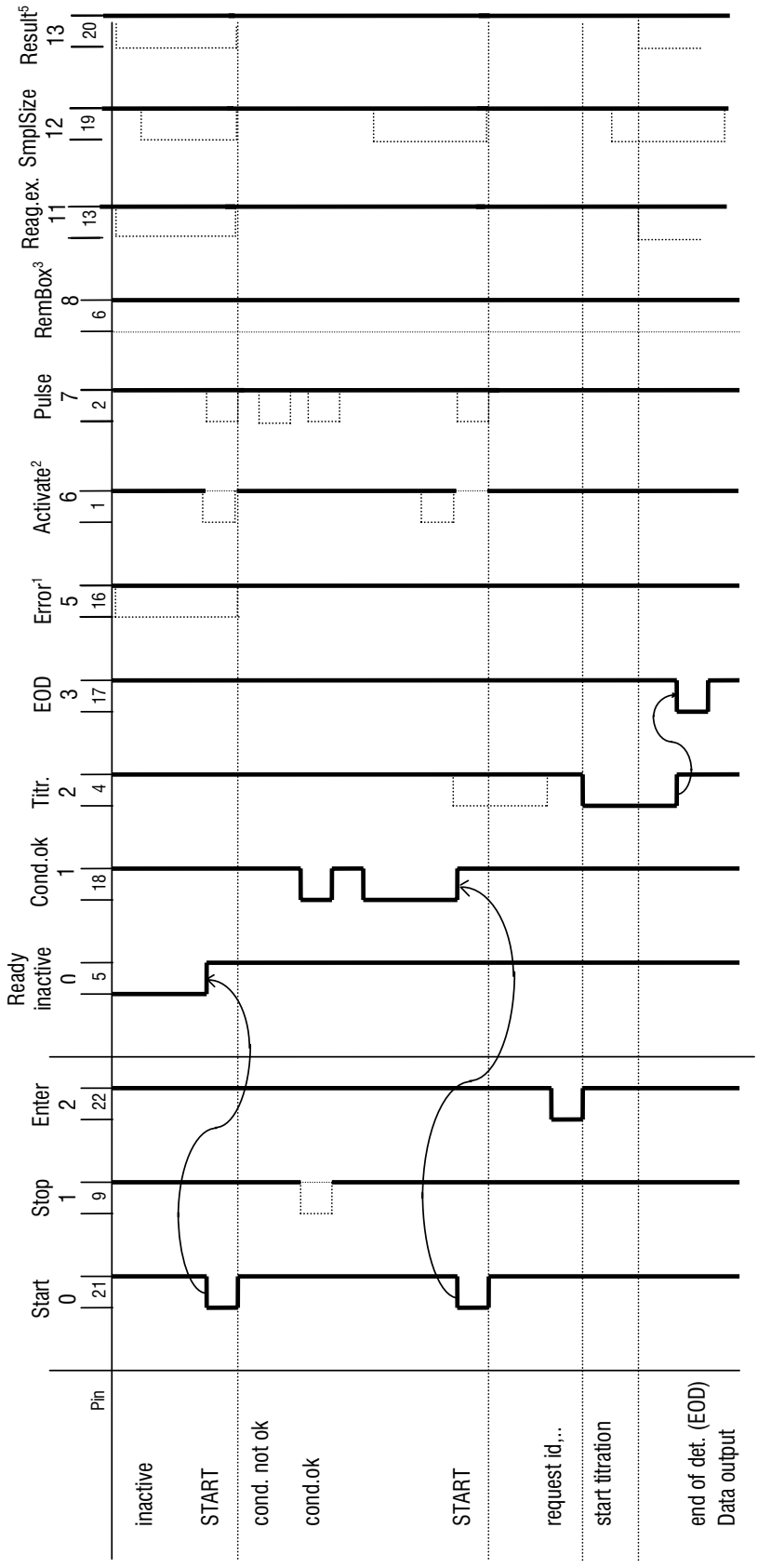


Outputs 	pin 17 (Output 3)	End of determination EOD
	pin 3 (Output 4)	not used
	pin 16 (Output 5)	Error, active on errors
	pin 1 (Output 6)	Activate pulse, see also page 132.
	pin 2 (Output 7)	Pulses for recorder (t_p=150 µs)
	pin 6 (Output 8)	Remote box activated
	pin 7 (Output 9)	not used
	pin 8 (Output 10)	
	pin 13 (Output 11)	Reagent exchange
	pin 19 (Output 12)	Sample size out of limits
	pin 20 (Output 13)	Result out of limits (adjustable, see page 35) **For all outputs**: V_{CE0} = 40 V I_C = 20 mA t_{Pulse} > 100 ms Functions see page 131.
Voltage 	pin 15	I ≤ 200 mA
	pin 14	0 V: active 5 V: inactive
	pin 25	

Ordering numbers for plug:
K.210.9004 (shell) and K.210.002

No liability whatsoever will be accepted for damage caused by improper interconnection of instruments.

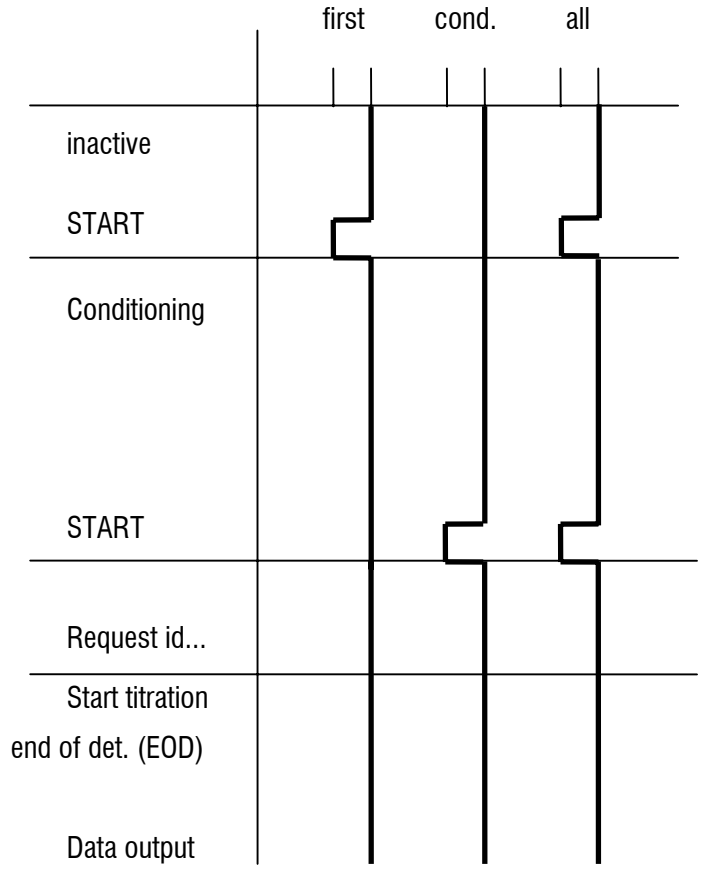
7.2.1 Lines of socket "Remote"



1: The error line is reset if the error is rectified.
2: Activate pulse according to setting, see page 132.
3: Line is active if a remote box is connected, see page 20.
4: Line is active if sample size is out of limits, see page 29.
5: Line is active if result is out of limits, see page 35.

7.2.2 Activate pulse

An activate pulse may be set in key <PARAM>, >preselections, "activate pulse:". These settings will be carried out as follows:



7.3 Coulometer validation, GLP mode

Checking and maintenance of the Coulometer is carried out in 3 steps:
1. Testing the electronic components when the Coulometer is switched on.
2. Wet-chemistry validation of the whole coulometric analysis setup
3. Maintenance and adjustment of the Coulometer by Metrohm service.

7.3.1 Electronic tests

When the Coulometer is switched on electronic tests are carried out. During this period **system tests** appears in the display.
The tests are documented in the system test report, which can be printed out when the Coulometer is switched on (see page 19):

```
 'di
756 KF Coulometer
01109          5.756.0010
user                 Boss
date  1998-10-27
time  08:54
RAM test               OK
real time clock        OK
A/D converter          OK
LCD display            OK
COMPorts               OK
EPROM test             OK
      ============
```

Contact Metrohm service if one of these tests is "not OK". If the "real time clock" test is not ok, you can try to set date and time again. If the test is OK afterwards you should check whether your stored methods have remained unchanged.

7.3.2 Wet tests

GLP (Good Laboratory Practice) requires the periodic validation of the analytical instruments. The reproducibility and accuracy of the instruments are checked.
An annual repetition of the procedure appears to be sensible. Depending on the requirements a more frequent check may be indicated, e.g. every 3 or 6 months.
Guidelines for the testing regulations (SOP, Standard Operating Procedure) are given in Metrohm Application Bulletin
No. 273: Validation of KF Coulometers according to GLP/ISO 9001.

The validation interval can be checked by the Coulometer (set under <CONFIG>, monitoring). If the interval has elapsed the Coulometer displays the message **validate instrument**.

The GLP mode can be used in order to carry out the validation. It contains the appropriate calculation formulas:
1. content = H2O/C01/C00;3;mg/g
2. recovery = RS1/C22;2;
where
C01=1000
C22=id2= content according to the reagent manufacturer in mg/g

The second formula calculates the recovery rate and is therefore a measure of the accuracy. The limit control for the second result is switched on and the limits are 0.97...1.03. These values apply for a 1.00 mg/g standard.
For a 0.10 mg/g standard the limits should be set to 0.90...1.10.

7.3.3 Maintenance and adjustment of the Coulometer

The Coulometer should be serviced and adjusted by Metrohm service at regular intervals. The Coulometer can check the date of the next service with the help of the monitoring function "Service" under <CONFIG>, monitoring. If this date has been passed then the Coulometer will display the message **service is due**.

7.4 User methods

The methods can be modified and overwritten. The following methods are available:

```
 'um
756 KF Coulometer             5.756.0010
date  1998-11-02    time  14:27
user methods                     bytes
BLANK          Oven-Blk            164
KFC-B          Oven-Det            184
BLANK           774-Blk            168
KFC-B           774-Det            188
           remaining bytes       39266
```

If you want to have the results in units other than ppm, you must alter the operands and possibly also the formula, see page 36.
If you use the Vesuv 3 PC program, you should select at least the following reports on COM1 or COM2: "result;calc;mplist".

7.4.1 Working with the KF Oven

When working with the KF oven an extraction period is required in order to prevent the titration being switched off prematurely.
The RS interface of the 768 KF oven is connected to COM1 of the Coulometer (cable 6.2125.110). If you do not make this connection or you work with the 832 Thermoprep, the parameter **oven** under **preselections** must be set to **off** (no oven data in the Coulometer report).

Determination method, parameters:

```
 'pa
756 KF Coulometer             5.756.0010
date  1998-11-19    time  17:55        0
KFC-B           Oven-Det
parameters
>control parameters
  EP at U                   50 mV
  dynamics                  70 mV
  max.rate                max. ug/min
  min.rate                  15 ug/min
  stop crit:         rel.drift
  rel.drift                  5 ug/min
>titration parameters
  pause                      0 s
  extr.time                300 s
  start drift               20 ug/min
  I(pol):                   10 uA
  electrode test:           ON
  temperature             25.0 °C
  time interval              2 s
  max.titr.time            OFF s
>statistics
  status:                  OFF
>preselections
  drift corr:             auto
  req.ident:               OFF
  req.smpl size:           OFF
  smpl unit:                 g
  limit smpl size:         OFF
  text id1          id1 or C21
  text id2          id2 or C22
  text id3          id3 or C23
  cell:              no diaph.
  generator I:             400 mA
  oven:                   COM1
  activate pulse:          OFF
          ------------
```

Blank value method, parameters:

```
 'pa
756 KF Coulometer             5.756.0010
date  1997-11-19    time  17:51        0
BLANK           Oven-Blk
parameters
>control parameters
  EP at U                    50 mV
  dynamics                   70 mV
  max.rate                max. ug/min
  min.rate                   15 ug/min
  stop crit:         rel.drift
  rel.drift                   5 ug/min
>titration parameters
  pause                       0 s
  extr.time                 300 s
  start drift                20 ug/min
  I(pol):                    10 uA
  electrode test:            ON
  temperature              25.0 °C
  time interval               2 s
  max.titr.time             OFF s
>statistics
  status:                    ON
  mean                n=     3
  res.tab:            original
>preselections
  drift corr:              auto
  req.ident:                OFF
  req.smpl size:            OFF
  smpl unit:                  g
  limit smpl size:          OFF
  text id1          id1 or C21
  text id2          id2 or C22
  text id3          id3 or C23
  cell:              no diaph.
  generator I:              400 mA
  oven:                    COM1
  activate pulse:           OFF
          ------------
```

7.4.2 Working with the 774 Oven Sample Processor

When working with the 774 Oven Sample Processor an extraction period is required in order to prevent the titration being switched off prematurely.
The RS interface of the Oven Sample Processor is connected to COM1 of the Coulometer (cable 6.2125.110). If you do not make this connection then the parameter **oven** under **preselections** must be set to **off** (no oven data in the Coulometer report).

Determination method, parameters:

```
 'pa
756 KF Coulometer              5.756.0010
date  1997-11-19    time  17:56        0
KFC-B            774-Det
parameters
>control parameters
  EP at U                    50 mV
  dynamics                   70 mV
  max.rate                max. ug/min
  min.rate                   15 ug/min
  stop crit:         rel.drift
  rel.drift                   5 ug/min
>titration parameters
  pause                       0 s
  extr.time                 180 s
  start drift                10 ug/min
  I(pol):                    10 uA
  electrode test:            ON
  temperature              25.0 °C
  time interval               2 s
  max.titr.time             OFF s
>statistics
  status:                   OFF
>preselections
  drift corr:              auto
  req.ident:                OFF
  req.smpl size:            OFF
  smpl unit:                  g
  limit smpl size:          OFF
  text id1          id1 or C21
  text id2          id2 or C22
  text id3          id3 or C23
  cell:              no diaph.
  generator I:              400 mA
  oven:                    COM1
  activate pulse:           OFF
          ------------
```

Blank value method, parameters:

```
 'pa
756 KF Coulometer              5.756.0010
date  1997-11-19    time  17:56        0
BLANK            774-Blk
parameters
>control parameters
  EP at U                    50 mV
  dynamics                   70 mV
  max.rate                max. ug/min
  min.rate                   15 ug/min
  stop crit:         rel.drift
  rel.drift                   5 ug/min
>titration parameters
  pause                       0 s
  extr.time                 180 s
  start drift                10 ug/min
  I(pol):                    10 uA
  electrode test:            ON
  temperature              25.0 °C
  time interval               2 s
  max.titr.time             OFF s
>statistics
  status:                    ON
  mean                n=     3
  res.tab:            original
>preselections
  drift corr:              auto
  req.ident:                OFF
  req.smpl size:            OFF
  smpl unit:                  g
  limit smpl size:          OFF
  text id1          id1 or C21
  text id2          id2 or C22
  text id3          id3 or C23
  cell:              no diaph.
  generator I:              400 mA
  oven:                    COM1
  activate pulse:           OFF
          ------------
```

7.5 Warranty and certificates

7.5.1 Warranty

The warranty regarding our products is limited to rectification free of charge in our workshops of defects that can be proved to be due to material, design or manufacturing faults which appear within 12 months from the day of delivery. Transport costs are chargeable to the purchaser.
For day and night operation, the warranty is valid for 6 months.
Glass breakage in the case of electrodes or other glass parts is not covered by the warranty. Checks which are not a result of material or manufacturing faults are also charged during the warranty period.
For parts of outside manufacture insofar as these constitute an appreciable part of our instrument, the warranty stipulations of the manufacturer in question apply.
With regard to the guarantee of accuracy, the technical specifications in the Instructions for Use are authoritative.
Concerning defects in material, construction or design as well as the absence of guaranteed features, the purchaser has no rights or claims except those mentioned above.
If damage of the packaging is evident on receipt of a consignment or if the goods show signs of transport damage after unpacking, the carrier must be informed immediately and a written damage report demanded. Lack of an official damage report releases METROHM from any liability to pay compensation.
If any instruments and parts have to be returned, the original packaging should be used if at all possible. This applies above all to instruments, electrodes, buret cylinders and PTFE pistons. Before embedding in wood shavings or similar material, the parts must be packed in a dustproof package (for instruments, use of a plastic bag is imperative). If open assemblies are enclosed in the scope of delivery that are sensitive to electromagnetic voltages (e.g. data interfaces etc.) these must be returned in the associated original protective packaging (e.g. conductive protective bag). (Exception: assemblies with built-in voltage source belong in a non-conductive protective packaging). For damage which arises as a result of non-compliance with these instructions, no warranty responsibility whatsoever will be accepted by METROHM.

7.5.2 Certificate of Conformity and System Validation: 756 KF Coulometer

Certificate of Conformity and System Validation

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

Name of commodity:	756 KF Coulometer
System software:	Stored in ROMs
Name of manufacturer:	Metrohm Ltd., Herisau, Switzerland

This Metrohm instrument has been built and has undergone final type testing according to the standards:

Electromagnetic compatibility: Emission
IEC 61326, EN 55022 / CISPR 22

Electromagnetic compatibility: Immunity
IEC 61326, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-11

Safety specifications
IEC 61010-1, UL3101-1

It has also been certified by the Swiss Electrotechnical Association (SEV), which is member of the International Certification Body (CB/IEC).

The technical specifications are documented in the instruction manual.

The system software, stored in Read Only Memories (ROMs) has been validated in connection with standard operating procedures in respect to functionality and performance.

Metrohm Ltd. is holder of the SQS-certificate of the quality system ISO 9001 for quality assurance in design/development, production, installation and servicing.

Herisau, May 07, 2002

Dr. J. Frank	Ch. Buchmann
Development Manager	Production and Quality Assurance Manager

7.5.3 EU Declaration of Conformity: 756 KF Coulometer

CE

EU Declaration of Conformity

The company Metrohm AG, Herisau, Switzerland, certifies herewith, that the following instrument:

756 KF Coulometer

meets the CE mark requirements of EU Directives 89/336/EEC and 73/23/EEC.

Source of specifications:

EN 61326	Electrical equipment for measurement, control and laboratory use – EMC requirements
EN 61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use

Description of apparatus:

Coulometer for water determinations according to Karl Fischer with LCD display and internal thermal printer.

Herisau, May 07, 2002

Dr. J. Frank	Ch. Buchmann
Development Manager	Production and Quality Assurance Manager

7.5.4 Certificate of Conformity and System Validation: 831 KF Coulometer

Certificate of Conformity and System Validation

This is to certify the conformity to the standard specifications for electrical appliances and accessories, as well as to the standard specifications for security and to system validation issued by the manufacturing company.

Name of commodity:	831 KF Coulometer
System software:	Stored in ROMs
Name of manufacturer:	Metrohm Ltd., Herisau, Switzerland

This Metrohm instrument has been built and has undergone final type testing according to the standards:

Electromagnetic compatibility: Emission
IEC 61326, EN 55022 / CISPR 22

Electromagnetic compatibility: Immunity
IEC 61326, IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-11

Safety specifications
IEC 61010-1, UL3101-1

It has also been certified by the Swiss Electrotechnical Association (SEV), which is member of the International Certification Body (CB/IEC).

The technical specifications are documented in the instruction manual.

The system software, stored in Read Only Memories (ROMs) has been validated in connection with standard operating procedures in respect to functionality and performance.

Metrohm Ltd. is holder of the SQS-certificate of the quality system ISO 9001 for quality assurance in design/development, production, installation and servicing.

Herisau, May 07, 2002

Dr. J. Frank	Ch. Buchmann
Development Manager	Production and Quality Assurance Manager

7.5.5 EU Declaration of Conformity: 831 KF Coulometer

CE

EU Declaration of Conformity

The company Metrohm AG, Herisau, Switzerland, certifies herewith, that the following instrument:

831 KF Coulometer

meets the CE mark requirements of EU Directives 89/336/EEC and 73/23/EEC.

Source of specifications:

EN 61326	Electrical equipment for measurement, control and laboratory use – EMC requirements
EN 61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use

Description of apparatus:

Coulometer for water determinations according to Karl Fischer with LCD display.

Herisau, May 07, 2002

Dr. J. Frank	Ch. Buchmann
Development Manager	Production and Quality Assurance Manager

7.6 Scope of delivery and ordering designations

756 KF Coulometer, generator electrode without diaphragm.....2.756.0110
including the following accessories

1 Indicator electrode, double Pt 6.0341.100
1 Generator electrode without diaphragm 6.0345.100
1 Drying tube 6.1403.030
1 Glass stopper, SGJ14/15 ..... 6.1437.000
1 Stopper SGJ14/15→thread M10 ..... 6.1446.060
2 Sets of septa, 5 items each 6.1448.020
1 Titration vessel, 250 ml 6.1464.320
1 PTFE stirring bar 6.1903.030
1 Stand console for mounting Stirrer or Ti Stand 6.2001.050
1 Adjusting ring 6.2013.010
1 Support rod, length 25 cm 6.2016.030
1 Titration vessel holder 6.2047.020
1 Electrode cable for indicator electrode 6.2104.020
1 Electrode cable for generator electrode 6.2104.120
1 Keypad for 756 KF Coulometer 6.2130.040
3 Rolls of thermal paper 6.2237.020
1 Spindle for thermal paper roll 6.2241.030
1 Screw cap, thread GL18 ..... 6.2701.040
3 PTFE joint sleeves SGJ14 ..... 6.2713.000
1 PTFE joint sleeve SGJ 29 ..... 6.2713.010
1 PTFE joint sleeve SGJ 19 ..... 6.2713.020
1 Stopper with nipple 6.2730.030
1 Funnel 6.2738.000
1 Bottle of molecular sieve, 250 g 6.2811.000
1 Syringe, 1 ml 6.2816.000
1 Needle for syringe 6.2816.010
1 Mains cable with cable socket type CEE(22), V
Cable plug to customer's specifications
Type SEV 12 (Switzerland...) 6.2122.020
Type CEE(7), VII (Germany...) 6.2122.040
Type NEMA/ASA (USA...) 6.2122.070
1 Instructions for use for 756/831 KF Coulometer 8.831.1003
1 Quick references for 756/831 KF Coulometer 8.831.1013

756 KF Coulometer, generator electrode with diaphragm 2.756.0010
including the following accessories

1 Magnetic stirrer 1.728.0010
1 Indicator electrode, double Pt 6.0341.100
1 Generator electrode with diaphragm 6.0344.100
1 Drying tube 6.1403.030
1 Glass stopper, SGJ14/15 ..... 6.1437.000
1 Stopper SGJ14/15→thread M10 ..... 6.1446.060
2 Sets of septa, 5 items each 6.1448.020
1 Titration vessel, 250 ml 6.1464.320
1 PTFE stirring bar 6.1903.030
1 Stand console for mounting Stirrer or Ti Stand 6.2001.050
1 Adjusting ring 6.2013.010
1 Support rod, length 25 cm 6.2016.030
1 Titration vessel holder 6.2047.020
1 Electrode cable for indicator electrode 6.2104.020
1 Electrode cable for generator electrode 6.2104.120
1 Keypad for 756 KF Coulometer 6.2130.040
3 Rolls of thermal paper 6.2237.020
1 Spindle for thermal paper roll 6.2241.030
1 Screw cap, thread GL18 ..... 6.2701.040
3 PTFE joint sleeves SGJ14 ..... 6.2713.000
1 PTFE joint sleeve SGJ 29 ..... 6.2713.010
1 PTFE joint sleeve SGJ 19 ..... 6.2713.020
1 Stopper with nipple 6.2730.030
1 Funnel 6.2738.000
1 Bottle of molecular sieve, 250 g 6.2811.000
1 Syringe, 1 ml 6.2816.000
1 Needle for syringe 6.2816.010
1 Mains cable with cable socket type CEE(22), V
Cable plug to customer's specifications
Type SEV 12 (Switzerland...) 6.2122.020
Type CEE(7), VII (Germany...) 6.2122.040
Type NEMA/ASA (USA...) 6.2122.070
1 Instructions for use for 756/831 KF Coulometer 8.831.1003
1 Quick references for 756/831 KF Coulometer 8.831.1013
1 Instructions for use for 728 Magnetic Stirrer 8.728.1006

831 KF Coulometer, generator electrode without diaphragm.....2.831.0110
including the following accessories

1 Indicator electrode, double Pt 6.0341.100
1 Generator electrode without diaphragm 6.0345.100
1 Drying tube 6.1403.030
1 Glass stopper, SGJ14/15 ..... 6.1437.000
1 Stopper SGJ14/15→thread M10 ..... 6.1446.060
2 Sets of septa, 5 items each 6.1448.020
1 Titration vessel, 250 ml 6.1464.320
1 PTFE stirring bar 6.1903.030
1 Stand console for mounting Stirrer or Ti Stand 6.2001.050
1 Adjusting ring 6.2013.010
1 Support rod, length 25 cm 6.2016.030
1 Titration vessel holder 6.2047.020
1 Electrode cable for indicator electrode 6.2104.020
1 Electrode cable for generator electrode 6.2104.120
1 Keypad for 831 KF Coulometer 6.2130.090
1 Screw cap, thread GL18 ..... 6.2701.040
3 PTFE joint sleeves SGJ14 ..... 6.2713.000
1 PTFE joint sleeve SGJ 29 ..... 6.2713.010
1 PTFE joint sleeve SGJ 19 ..... 6.2713.020
1 Stopper with nipple 6.2730.030
1 Funnel 6.2738.000
1 Bottle of molecular sieve, 250 g 6.2811.000
1 Syringe, 1 ml 6.2816.000
1 Needle for syringe 6.2816.010
1 Mains cable with cable socket type CEE(22), V
Cable plug to customer's specifications
Type SEV 12 (Switzerland...) 6.2122.020
Type CEE(7), VII (Germany...) 6.2122.040
Type NEMA/ASA (USA...) 6.2122.070
1 Instructions for use for 756/831 KF Coulometer 8.831.1003
1 Quick references for 756/831 KF Coulometer 8.831.1013

831 KF Coulometer, generator electrode with diaphragm 2.831.0010
including the following accessories

1 Magnetic stirrer 1.728.0010
1 Indicator electrode, double Pt 6.0341.100
1 Generator electrode with diaphragm 6.0344.100
1 Drying tube 6.1403.030
1 Glass stopper, SGJ14/15 ..... 6.1437.000
1 Stopper SGJ14/15→thread M10 ..... 6.1446.060
2 Sets of septa, 5 items each 6.1448.020
1 Titration vessel, 250 ml 6.1464.320
1 PTFE stirring bar 6.1903.030
1 Stand console for mounting Stirrer or Ti Stand 6.2001.050
1 Adjusting ring 6.2013.010
1 Support rod, length 25 cm 6.2016.030
1 Titration vessel holder 6.2047.020
1 Electrode cable for indicator electrode 6.2104.020
1 Electrode cable for generator electrode 6.2104.120
1 Keypad for 756/831 KF Coulometer 6.2130.090
1 Screw cap, thread GL18 ..... 6.2701.040
3 PTFE joint sleeves SGJ14 ..... 6.2713.000
1 PTFE joint sleeve SGJ 29 ..... 6.2713.010
1 PTFE joint sleeve SGJ 19 ..... 6.2713.020
1 Stopper with nipple 6.2730.030
1 Funnel 6.2738.000
1 Bottle of molecular sieve, 250 g 6.2811.000
1 Syringe, 1 ml 6.2816.000
1 Needle for syringe 6.2816.010
1 Mains cable with cable socket type CEE(22), V
Cable plug to customer's specifications
Type SEV 12 (Switzerland...) 6.2122.020
Type CEE(7), VII (Germany...) 6.2122.040
Type NEMA/ASA (USA...) 6.2122.070
1 Instructions for use for 756/831 KF Coulometer 8.831.1003
1 Quick references for 756/831 KF Coulometer 8.831.1013
1 Instructions for use for 728 Magnetic Stirrer 8.728.1006

Options
Accessories to separate order and on payment of extra charge:

Stirrers, Ti Stands
728 Magnetic Stirrer 2.728.0010
Stirring bars, length
12 mm 6.1903.010
16 mm 6.1903.020
25 mm 6.1903.030
703 Ti Stand for aspiration and addition of solvent 2.703.0010
Aspirating/feeding tube for working with 703 Ti Stand 6.1439.010

Aspiration with Dosino
700 Dosino 2.700.0020
Complete aspiration equipment, incl. 50 mL Dosing Unit 6.5617.000
If you wish a smaller Dosing Unit to aspirate sample solution, order parts separately:
20 mL Dosing Unit 6.1570.220
10 mL Dosing Unit 6.1570.210
FEP tube for Dosing Unit 6.1829.010
Adsorbing tube for Dosing Unit 6.1619.000
Tubing 60 cm 6.1805.060
Tubing 25 cm 6.1805.080
Stopper for aspiration tip 6.1446.060
Nipple for aspiration tip 6.2730.030
O-ring for nipple E.301.0022
Aspiration tip 6.1543.070
Waste bottle 1L 6.1608.030
Bottle attachment for waste bottle 6.1602.105
Adsorber tube for waste bottle 6.1609.000
SGJ clip for adsorber tube 6.2023.020
Thread stopper M8 ..... 6.1446.080
Double bottle holder 6.2055.100

Titration equipment
Titration vessel, amber glass, V=250 ml 6.1464.323
Titration vessel with 2 lateral apertures, glass, V=250 ml 6.1465.320
Generator electrode with diaphragm 6.0344.100
Generator electrode without diaphragm 6.0345.100
O-ring for nipple from 6.2730.030 ..... E.301.0022

KF Oven
768 KF Oven with automatic control of sample boat 2.768.0010
Instrument bridge 6.2041.180
Sealing ring for lateral gas inlet tip A.254.0104
Stopper for gas inlet from heatable outlet tube 6.1446.170
Sealing ring for lateral gas inlet from heatable outlet tube A.254.0102
Control cable Oven – Coulometer 6.2141.010
Data cable Oven – Coulometer 6.2125.110

Oven Sample Processor

774 Oven Sample Processor 2.774.0010
Stopper for gas inlet.....6.1446.170
Control cable Oven Sample Processor – Coulometer 6.2141.020
Data cable Oven Sample Processor – Coulometer 6.2125.110

Balances

For Mettler cables you need an adapter 9/25 pins 6.2125.010
Cable Sartorius – balances MP8, MC1 (9/25 pins) 6.2134.060
Mettler AB, AG balances (interface LC-RS25) ..... cable with balance
Mettler AT balance ..... 6.2146.020+6.2125.010
Mettler AM, PM balance.....6.2146.020+6.2125.010+accessories from Mettler
Mettler balances with interface 016..... cable from Mettler
Mettler balances with interface 011 or 012 ..... 6.2125.020+6.2125.010
Mettler PG 6.2134.110
AND balances (with RS232 interface OP-03)..... 6.2125.020+6.2125.010
Precisa balances..... 6.2125.080+6.2125.010
Adapter for connection of printer/balance at the same COM..... 6.2125.010+6.2125.030

Connection of PC keyboard and/or barcode reader

Remote Box..... 6.2148.000

Printers

Citizen printer iDP562 RS, 230 V..... 2.140.0024
Citizen printer iDP562 RS, 115 V..... 2.140.0025
Cable Coulometer – Citizen printer iDP562 RS (9/25 pins)..... 6.2134.050
Cable Coulometer – Seiko DPU-414..... 6.2134.110
Cable Coulometer – EPSON (6 pin plug)..... 6.2125.040+6.2125.010
Cable Coulometer – EPSON (interface #8148) (9/25 pins)..... 6.2134.050
Cable Coulometer – EPSON LX300 (9/25 pins)..... 6.2134.050
Cable Coulometer – HP Desk Jet (serial interface) (9/25 pins) 6.2134.050
Cable Coulometer – HP Desk/Laser Jet (parallel interface)
.....6.2125.020+6.2125.010+2.145.0300
Adapter for connection of printer/balance at the same COM..... 6.2125.010+6.2125.030

PC connection

Cable Coulometer – PC (9/9 pins) 6.2134.040
Cable Coulometer – PC (9/25 pins) 6.2125.110
RS232 C extension cable (25/25 pins)..... 6.2125.020
RS232 C extension cable (9/9 pins)..... 6.2134.110
Vesuv 3.0, PC program for data acquisition and method backup
for up to 64 devices 6.6008.200
for 2 devices..... 6.6008.500

Index

Keys are marked with < >, **display texts** are in bold characters, and pages concerning the green part are printed in *italic*. Page number + ff means this and following pages.

E

F

G

H

I

K

L

M

N

O

P

Q

R

S

T

U

V

W