Metrohm

Instructions for use

INS/5033

737 KF Coulometer

Series 01+

Metrohm
ion analysis

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8.737.1003

Parameters

PARAM

Go to next inquiry with <PARAM> and <ENTER>.
▽ means selection with <SELECT>.

Initial values are printed in **bold face.**

Display	Meaning	Input range
ID.REQ▽	Request of identifications after start of titration.	ID1, ID1 2, ALL, **OFF**
SMPL.REQ▽	Request of sample size after start of titration.	ON, **OFF**
CONF.START▽	Additional start confirmation, e.g. after transfer of sample size from a connected balance.	ON, **OFF**
D.START	Start drift as a threshold. Above this value, the titration can not be started.	0...**98** ug/min
EXTR.	Extraction time. Positive: Iodine is generated during the extraction time. Negative: Waiting time before titration.	-63999...**0**...63999 s
STOP DRIFT▽	Selection of type of stop drift. With "AUTO", the drift value at the beginning of the titration is valid.	**AUTO**, MAN
DRIFT	Drift value for **manual** drift stop.	0...**20**...98 ug/min
DELAY TIME	Titration stops if the signal stays below the endpoint voltage during the delay time.	0...**3**...99 s
REPORT▽	Type of report output at the end of the titration.	FULL, SHORT, **OFF**

Calculations

CALC DATA

Go to next inquiry with <CALC DATA> and <ENTER>.
▽ means selection with <SELECT>.

Initial values are printed in **bold face.**

Display	Meaning	Input range
BLANK	Blank.	**0**...63999 ug
DRIFT CORR▽	Type of drift correction of the result. With "AUTO", the drift value at the beginning of the titration is valid.	**AUTO**, MAN
DRIFT	Drift value for **manual** drift correction.	**0**...98 ug/min

Calculation formula

$$\text{CONT–B} = \frac{\text{WATER} - \text{BLANK}}{\text{SMPL}} * F$$

F = 10^3 for ppm
10^{-1} for %

Servei Tècnic MASSÓ (Pere Llorc): 284.08.84

SMPL DATA

Sample Data

Go to next inquiry with <SMPL DATA> and <ENTER>.

Initial values are printed in **bold face.**

Display	Meaning	Input range
SMPL	Sample size in mg. If sample size is = 0, content will not be calculated.	-63999...**0**...63999 mg
ID1 ID2 ID3	Sample identifications.	bis 8 ASCII Zeichen

CONFIG

Configuration

Go to next inquiry with <CONFIG> and <ENTER>.
▽ means selection with <SELECT>.

Initial values are printed in **bold face.**

Disaplay	Meaning	Input range
--AUXILIARIES--	Go to the inquiries of block "AUXILIARIES" with <ENTER>.	
MP.LIST▽	Printout of a measuring point list "water vs. time" during the titration.	ON, **OFF**
TIME INTER.	Time interval for printout of measuring points.	**1**...9999 s
BALANCE▽	Selection of balance type.	SARTORI, METTLER, AT-METT, AND, PRECISA
PERIPH.▽	Peripheral instruments, at socket "Remote"	**OVEN**, SAMPLER
BEEP	Beeper.	**ON**, OFF
LABEL	Device label to identify instrument for remote control.	bis 8 ASCII Zeichen
PROGRAM	Program version.	keine Eingabe
--RS SETTINGS--	Go to the inquiries of block "RS SETTINGS" with <ENTER>.	
BAUD RATE▽	Baud rate.	**9600**, 4800, 2400, 1200, 600, 300
DATA BIT▽	Data bit.	7, **8**
STOP BIT▽	Stop bit.	**1**, 2
PARITY▽	Parity.	EVEN, ODD, **NONE**
HANDSHAKE▽	Handshake.	**HWS**, HWF, SWLINE, SWCHAR, NONE
RS CONTROL▽	Receiving commands via RS; "OFF" means no	**ON**, OFF

METROHM LTD. CH-9101 Herisau (Switzerland)

KF Coulometer

737

Series 01 ...

8.737.1003

94.07 Ti/gg

737 KF Coulometer Instructions for use

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1. Coulometric KF titration, what is it?

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:

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

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 burette"). The rigorously quantitative relation between the electric charge and the amount of iodine generated is used for highly precise 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.

The following books provide an excellent overview of the KF titrations:
- E. Scholz, Karl Fischer Titration, Springer-Verlag, Berlin, 1984.
- G. Wieland, Karl Fischer Titration, GIT Verlag, Darmstadt, 1985

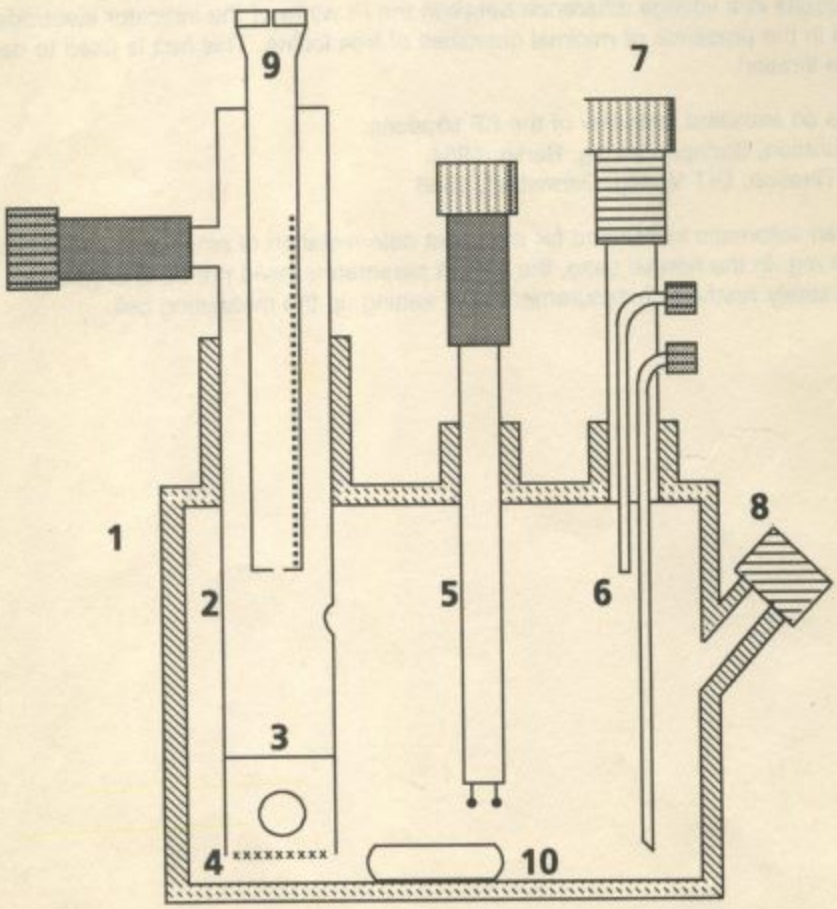
The 737 KF Coulometer is an automatic instrument for the exact determination of small amounts of water in the range 10 µg ... 10 mg. In the normal case, the default parameters need not be changed so that the instrument is immediately ready for measurement after setting up the measuring cell.

2. Handling the measuring cell

2.1 Measuring cell without diaphragm

2.1.1 Setting up the measuring cell

1. Fasten titration cell in holder to the stand rod with the clamping ring.
2. Place stirring bar in titration cell.
3. Cut ground joint sleeves to correct lengths at the narrower end and fit to all ground-glass joints.
4. Insert indicator electrode (**5**) in titration cell.
5. Screw electrode cable with the smaller plug (6.2104.020) to the indicator electrode and attach to the "Ind.El" socket at the rear of the KF Coulometer.
6. Insert generator electrode (**2**) in titration cell.
7. Fill drying tube (**9**) with molecular sieves and insert in the generator electrode.
8. Screw electrode cable with the larger plug (6.2104.120) to the generator electrode and attach to the "Gen.El." socket at the rear of the of the KF Coulometer.
   Warning: The two electrode cables must not be mixed up! Mark the cables and the corresponding electrode socket to avoid errors.
9. Insert a septum in screw cap (**8**) and screw this onto the glass fitting.
10. Fill cell with reagent up to the bottom edge of the article number (ca. 80-90 mL).
11. Close the last ground-glass opening with ground-glass stopper (**7**) or continue with point 12.



1 Titration cell
2 Generator electrode
3 Cathode
4 Anode
5 Indicator electrode
6 Dispensing/aspirating tube
7 Ground-glass stopper
8 Screw cap with septum
9 Drying tube with molecular sieves
10 PTFE stirring bar

Dry all parts well before setting up!

Fig. 2-1: Assembly of the measuring cell without diaphragm

Setting up the measuring cell together with the 703 Ti Stand

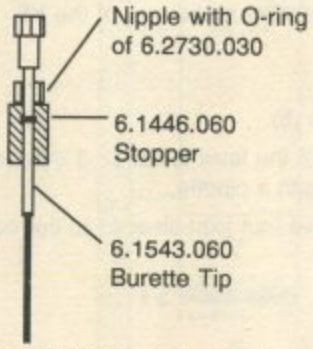
The dispensing/aspirating tube (**6**) is used in place of the ground-glass stopper (**7**). Proceed as follows:

12. Mount ground-glass stopper (**7**) on dispensing/aspirating tube (**6**) and insert this in the titration cell.
13. Screw on aspirating and dispensing tubing. (The aspirating tubing is attached to the long tube, bottom connection.)
14. If the pump is temporarily not connected, the two stoppers with thread M8 (6.1446.080) are used to close the tubing fittings of the dispensing/aspirating tube.

If a drop remains in the tube following addition of electrolyte solution, this can be expelled by briefly pressing the dispensing button of the pump several times.

If the dispensing/aspirating tube is temporarily not inserted in the measuring cell, it can be stored in the 6.1228.000 Holder.

Gas supply to the measuring cell, e.g. for work with KF Oven



1. Screw nipple with O-ring of 6.2730.030 into 6.1446.060 Stopper.
2. Insert 6.1543.060 Burette Tip from the accessories of the oven through the nipple
3. Screw 6.1805.070 Tubing to the burette tip and connect to outlet of oven.
4. Insert in the measuring cell in place of the dispensing/aspirating tube (**6**) or the ground-glass stopper (**7**).

Fig. 2-2: Gas supply, e.g. for work with the KF Oven

2.1.2 Cleaning the measuring cell

The electrolyte solution can usually be changed without the cell having to be cleaned. Cleaning is necessary only when the cell is highly contaminated. The platinum gauze of the generator electrode must not be damaged during cleaning.

Oil-containing contamination: Clean with solvent (e.g. hexane), then rinse with ethanol.

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

Generator electrode has black spots on Pt gauze: Clean with conc. nitric acid and with water, then rinse with ethanol. The electrolyte solution should be changed more frequently.

After cleaning, dry all parts thoroughly. A hair dryer can be used for this. If the parts need to be dried in a drying oven, ensure the temperature is not greater than 70°C (plastic parts!).

2.1.3 Reagents

Use reagents which are specially intended for use with a measuring cell without diaphragm.

For the water determination in ketones and aldehydes, to date no special reagents are on the market for measuring cells without diapragm. However, the anolyte of the ketone reagent for cells with diaphragm can frequently be used. This reagent should be changed every week.

2.2 Measuring cell with diaphragm

2.2.1 Setting up the measuring cell

Tighten screw fittings firmly, but without using force.

1. Place blue sealing ring (from 6.1454.000 Sealing Set; ordering number for separate order 6.1454.030) on underside of titration cell top half.
2. Fasten locking screw and titration cell top half to stand rod.
3. Place stirring bar in titration vessel, fit the retaining ring to the vessel. Press top and bottom halves together powerfully with the clamp.
4. Roll O-ring carefully over the platinum gauze at the bottom end of the generator electrode. Ensure compliance with the distance of 1-2 mm between the diaphragm and the Pt gauze.
   Care: Handle platinum gauze only when necessary and then proceed with extreme caution as the gauze can break off.
5. Screw in generator electrode (**3**). The supply cable should point outwards. Plug electrode cable into the "Gen.El." socket at the rear of the KF Coulometer.
6. Insert indicator electrode (**4**) in opening.
   Screw on electrode cable (6.2104.020) and plug into the "Ind.El" socket at the rear of the KF Coulometer.
7. Add anolyte solution up to the lower edge of the article number.
8. Close the two remaining openings with a screw nipple and septum (**5**).
9. Add catholyte to the interior of the generator electrode (funnel) until the level is ca. 2...3 mm below the anolyte (ca. 5 mL). Siphon off any excess catholyte, e.g. with a pipette.
10. Fill drying tube with molecular sieves, fit it with a ground joint sleeve (cut joint sleeves to correct lengths at narrower end) and insert in the generator electrode.

Gas supply to measuring cell, e.g. for work with the KF oven

Use 6.1617.010 Gas Inlet Tube. Check that the O-ring is fitted to the gas inlet tube.

If temporarily not in use, close gas inlet tube with 6.1446.040 Dummy Stopper.

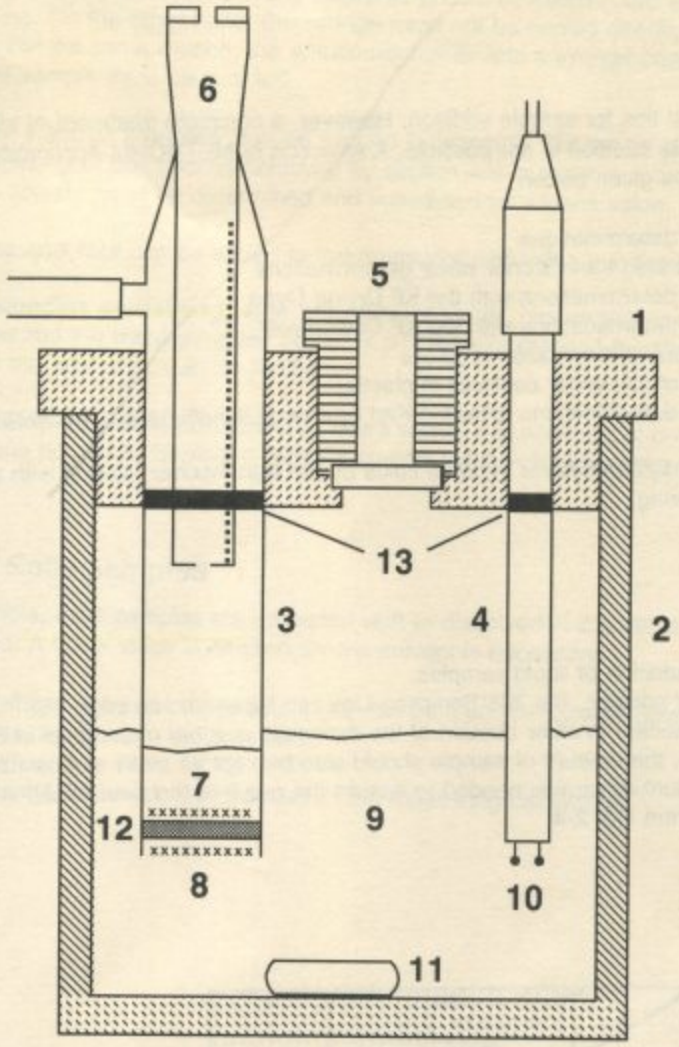
2.2.2 Cleaning the measuring cell

The electrolyte solution can usually be changed without the cell having to be cleaned. Cleaning is necessary only when the cell is highly contaminated. The platinum gauze of the generator electrode must not be damaged during cleaning.
If resinous deposits are observed on the diaphragm of the generator electrode, they can be removed with conc. HNO_3: Suspend generator vertically from a stand rod, fill with conc. HNO_3 and allow to stand overnight. Rinse with dist. water, then with ethanol.

Oil-containing contamination: Clean with solvent (e.g. hexane), then rinse with ethanol.

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

After cleaning, dry all parts thoroughly. A hair dryer can be used for this. If the parts need to be dried in a drying oven, ensure the temperature is not greater than 70°C (plastic parts!).



1 Titration cell upper half with 6.1454.030 Seal
2 Titration cell lower half
3 Generator electrode
4 Indicator electrode
5 Screw nipple with septum (second screw nipple not shown)
6 Drying tube with 3 Å molecular sieves (0,3 nm)
7 Cathode compartment with catholyte and cathode
8 Anode of the generator electrode
9 Anode compartment with anolyte
10 Pt pins of indicator electrode
11 PTFE stirring bar
12 Diaphragm
13 O-rings

Fig. 2-3: Assembly of the measuring cell with diaphragm

2.2.3 Reagents

Reagents for the coulometric water determination with measuring cells with diaphragm comprise the anode solution (anolyte), added to the measuring cell (anode compartment), and the cathode solution (catholyte), which is added to the generator electrode (cathode compartment).

For the determination of water in aldehydes and ketones, special reagents are used, see documentation of the reagent producers. These reagents (anolyte and catholyte) should be changed every week.

2.3 Sample addition

General remarks

In what follows, you will find several tips for sample addition. However, a complete treatment of all problems in connection with the sample addition is not possible. A selection of METROHM Application Bulletins (available free of charge) is given below:

No. 77: Karl Fischer water determinations
No. 88: Bibliography concerning Karl Fischer water determinations
No. 109: Karl Fischer water determinations with the KF Drying Oven
No. 137: Karl Fischer water determinations with the KF Coulometer
No. 142: Karl Fischer moisture determination in gases
No. 145: The determination of low water contents in plastics
No. 209: Coulometric water determinations following Karl Fischer in insulating oils, hydrocarbons and their products
No. 236: Coulometric water determinations in brake fluids by the Karl Fischer method with automatic sample metering

2.3.1 Liquid samples

Syringes are used for the manual addition of liquid samples.
For automatic sample metering and addition, the 708 Sampling Unit can be used, see page 56.
A low sample volume should be selected to allow titration of the maximum number of samples in the same electrolyte solution. However, the amount of sample should also be kept as small as possible to shorten the analysis time. The amount of sample needed to ensure the result of the determination lies in the desired range can be seen from Fig. 2-4.

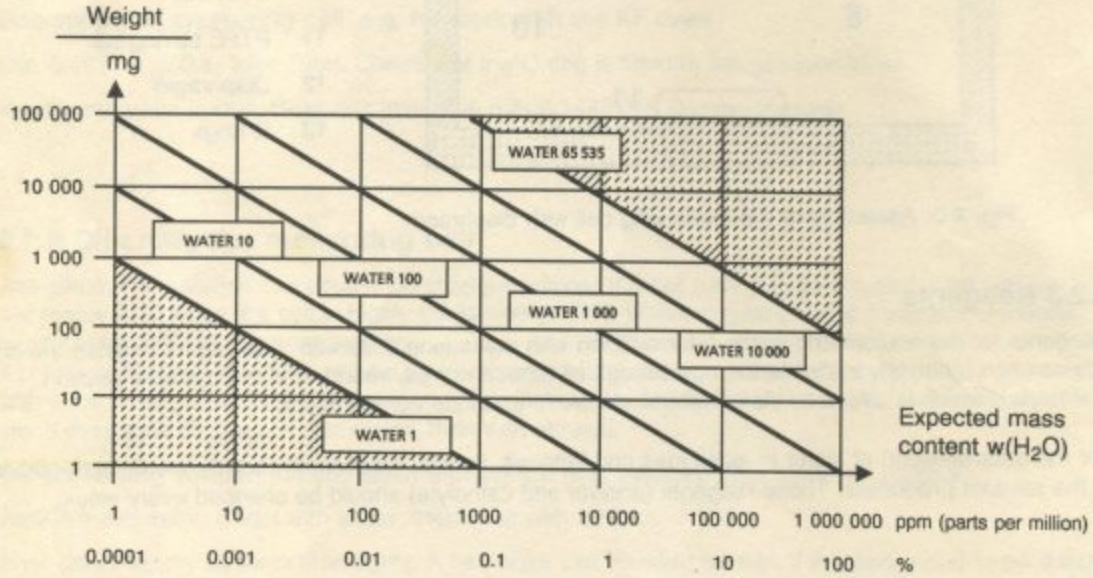


Fig. 2-4: Guide values for the sample size

Highly volatile or low-viscosity samples should be cooled before sampling to avoid losses during handling. On the other hand, the syringe must not be cooled directly as water of condensation can form. For the same reason, the entrainment of air into a syringe cooled by siphoning off an aliquot of cooled sample must be avoided.

Highly viscous samples can be thinned by warming, but the tip of the syringe must also be warmed. The same goal can also be achieved by dilution with a suitable solvent. In this case, the water content of the solvent must be determined and subtracted as a blank value.

Pastes and fats can be added to the measuring cell using a syringe without needle.

With **samples containing large amounts of water**, ensure that the needle is not inserted through the septum into the measuring cell before <START> is pressed as otherwise the drift and hence the result of the analysis could be falsified.

With **samples which contain only trace water**, it is essential to predry the syringe thoroughly. If possible, the tip should be rinsed with the sample solution by siphoning off and discarding solution several times.

2.3.2 Solid samples

If possible, solid samples are extracted with or dissolved in a suitable solvent and the resulting solution injected. A blank value correction for the solvent is necessary.

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

Solid samples should not be added to the measuring cell directly.

2.4 Optimum working conditions

Drift

A constant drift in the range 4 ... 12 µg/min is good. Lower values are, however, entirely possible. When work is started with a measuring cell which has been well predried, the background drift is attained within a few minutes. Measuring cells without diaphragm are usually in operational readiness quicker than measuring cells with diaphragm.

For precise determinations of water quantities less than 10 µg, it can be an advantage to condition the instrument overnight before use.

A permanently high drift can be caused by water-containing deposits at inaccessible positions in the cell. In such cases, shaking the measuring cell lowers the value. With measuring cells with diaphragm, never shake so hard that the catholyte and anolyte mix. If the drift remains high for a lengthy period after shaking the cell, the electrolyte solution should be changed.

If a filled measuring cell remains unconditioned for a relatively long time, it takes a certain time until the cell is dry. This time can be shortened by shaking the cell once or twice. It is advisable to precondition the measuring cell overnight after lengthy breaks in operation. When the instrument is in continuous use, it should not be switched off overnight.

If the drift is frequently negative, the end point voltage should be set lower with the potentiometer "EP voltage" at the rear of the Coulometer. If, however, the end point voltage is too low, the titration times increase.

Drift fluctuations when attached devices (printer, balance, PC) are switched on and off indicate earth loops. In this case, these devices should be attached to the Coulometer via an optocoupler.

Changing the electrolyte solution

The electrolyte solutions must be changed in the following cases:

1) If the titration cell can hold no more samples.
2) If the error message /GEN ELECTRODE / appears during the determinations (see page 36). In the case of the measuring cell with diaphragm, it is often sufficient to change just the cathode solution.
3) If the drift is too high and no improvement can be achieved by shaking the cell (see above).
4) If a two-phase mixture forms in the titration cell.
5) Change the special reagents for the water determination in aldehydes and ketones every week.

The simplest way to remove exhausted electrolyte solutions from the cell is to siphon them off. The cell need not then be disassembled.

With severe contamination, the cell can be rinsed with a suitable solvent, which is also siphoned off.

To siphon off the electrolyte solutions, the siphoning device available as an option can be used, see page 55.

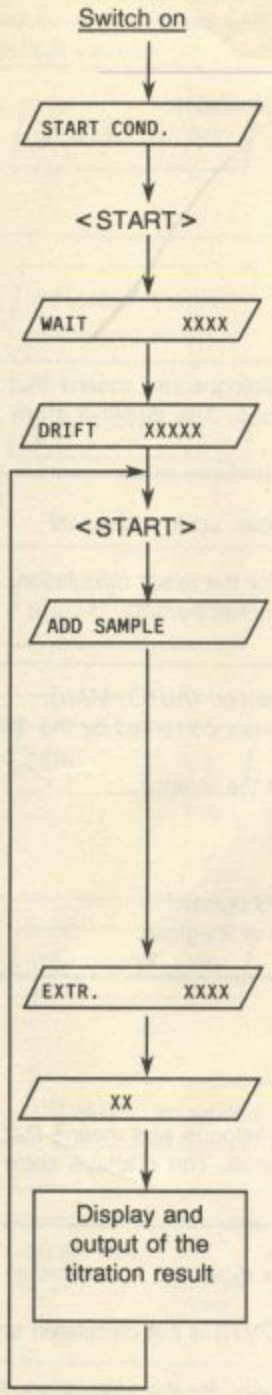
Indicator electrode

A new indicator electrode may need a certain conditioning time for formation of the surface. This can lead to unusually long titration times and to high measurement results. However, these phenomena disappear after a short period of use. To promote the conditioning of a new indicator electrode, leave the electrode immersed in the electrolyte solution with the instrument switched off, e.g. overnight. In obstinate cases, the indicator electrode can be carefully cleaned with a scouring agent and then rinsed with ethanol.

The two Pt wires of the indicator electrode must be as parallel as possible. Check when installing.

3. Operation

3.1 Titration sequence



Prompt to start drying of the measuring cell, i.e. conditioning.

Press the <START> key.

The measuring cell is conditioned and is still wet... The lamp "COND" flashes.

The measuring cell is now dry. The lamp "COND" is continuously on. The drift is displayed. The drift is the consumption of I_2 as water in ug/min. This consumption is not zero as some (atmospheric) moisture can always penetrate the cell.

Prepare a sample and press the <START> key.

Inject the sample, the titration starts after 6 s automatically.
Depending on your initial settings, the following displays can appear in place of the display "ADD SAMPLE":
/ID1 /: You have set the automatic request of the identifications ID.REQ.
/SMPL XXXXX MG/: You have set the automatic request of the sample size SMPL.REQ. to ON.
/CONFIRM START /:You have set CONF.START to ON.
With these displays, you can enter a value <ENTER> or simply proceed with <START> or <QUIT>.

If an extraction time has been entered, a countdown of the remaining time follows. Terminate the extraction time with <QUIT>.

During the titration, the mass of titrated water is shown in ug.

Depending on the sample size, the following display appears:
/WATER XXXX/: Mass of titrated water, m(H_2O), in µg (SMPL = 0)
/CONT. XXXX PPM/: Water content of the sample (content), w(H_2O), in ppm or %
If a blank value has been subtracted, this is shown by "-B".

The measuring cell is conditioned constantly. Parameters can be entered, calculations repeated and the drift (<DRIFT> key) shown.

The <STOP> key aborts the titration and conditioning and leads to the inactive standby mode.

3.2 Calculations, sample data

The titration results are calculated by the following formula:

$$\text{CONT} - \text{B} = \frac{m(H_2O) - \text{blank}}{|\text{sample}|} \cdot f$$

$m(H_2O)$	Mass of the water found in µg, corrected by the drift
blank	Mass of the water in the blank value in µg
sample	Sample size in mg. The absolute value is used for the calculation.
f	Factor $f = 10^3$ if the result is outputted in ppm $f = 10^{-1}$ if the result is outputted in % Switching between ppm and % is automatic.

3.2.1 <CALC DATA> key

The <CALC DATA> key contains data for the result calculation.
Enter values and switch to next inquiry with <ENTER>. ∇ following the dialogue text means that the values are selected with <SELECT>. <QUIT> ends the inquiry sequence. The displays show the default values.

BLANK 0 ug	*Blank value (0...63 999 ug, 5 significant digits, up to 1 decimal place)* If a blank value is set ≠0, it will be used for the result calculation. If a blank value has been subtracted, this is noted by "-B".
DRIFT CORR∇ AUTO	*Type of drift value transfer for the drift correction (AUTO, MAN)* The mass of the water $m(H_2O)$ is continuously corrected by the drift during the titration. AUTO: The drift value is stored on start of the titration. MAN: The drift value is entered manually. With "MAN", the following inquiry appears:
DRIFT 0 UG/MIN	*Drift value for manual drift correction (0...98 ug/min)* 0 means no drift correction. Entry in steps of 2 ug/min.

3.2.2 <SMPL DATA> key

The <SMPL DATA> key contains sample data.
Enter values and switch to next inquiry with <ENTER>. ∇ following the dialogue text means that the values are selected with <SELECT>. <QUIT> ends the inquiry sequence. The displays show the default values.

SMPL 0 MG ¶ive	*Sample size (0... ±63 999 ug, 5 significant digits, up to 1 decimal place)* If the sample size is zero, the content (CONT.) is not calculated and the result is outputted in ug water. The absolute value of the sample size is used for the calculation. A negative sample size shows, e.g. a backweighing.
ID1 ¶ive	*Sample identification (up to 8 characters)* Up to 3 sample identifications Id1...Id3 can be entered.

3.3 Parameters

3.3.1 <PARAM> key

The <PARAM> key contains the titration parameters.
Enter values and switch to next inquiry with <ENTER>. ∇ following the dialogue text means that the values are selected with <SELECT>. <QUIT> ends the inquiry sequence. The displays show the default values.

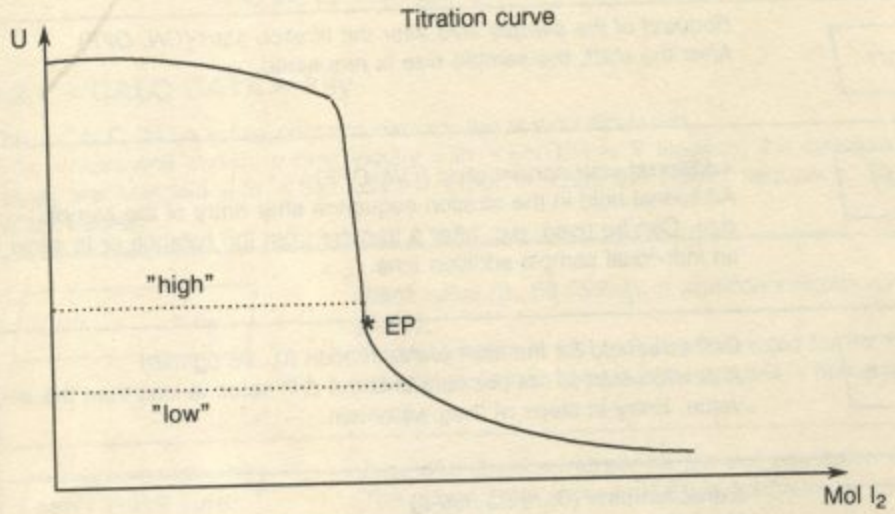
ID.REQ∇ OFF	*Request of sample identifications after the titration start (ID1, ID1 2, ALL, OFF)* After the start, the corresponding identifications are requested.
SMPL.REQ∇ OFF	*Request of the sample size after the titration start (ON, OFF)* After the start, the sample size is requested.
CONF.START∇ OFF	*Additional start confirmation (ON, OFF)* Additional hold in the titration sequence after entry of the sample size. Can be used, e.g. after a transfer from the balance or to allow an individual sample addition time.
D.START 98 UG/MIN	*Drift threshold for the start of the titration (0...98 ug/min)* A titration start is not possible until the drift value is less than the set value. Entry in steps of 2 ug water/min.
EXTR. 0 S *live	*Extraction time (0... ±63 999 s)* **Negative** extraction time: Wait time during which no I_2 is generated. **Positive** extraction time: I_2 is generated, but the titration will not be terminated during elapse of the extraction time. Used, e.g. in work with the KF oven.
STOP DRIFT∇ AUTO DRIFT 20 UG/MIN *live	*Type of drift value transfer for the stop drift (AUTO, MAN)* The stop drift is a necessary criterion for the automatic stop of the titration: The EP voltage and the stop drift must be reached. AUTO: The drift value is stored at the start of the titration. MAN: The drift value is entered manually. If "MAN", the following inquiry appears: *Drift value for the manual stop drift (0...98 ug/min)* Entry in steps of 2 ug water/min.
DELAY TIME 3 S *live	*Switch-off delay time (0...99 s)* During the switch-off delay time, the indication signal must be in the EP voltage range and the value less than the stop drift for the titration to be ended.
REPORT∇ OFF	*Selection of the automatic result output at the end of the titration (FULL, SHORT, OFF)*

3.3.2 End point voltage

The preset end point voltage can be varied, e.g. with a screwdriver at the potentiometer at the rear of the KF Coulometer.

EP Voltage (high ... low)

Variable adjustment of the end point voltage between the extreme values "high" (high end point voltage, in other words EP lies in the steep region of the titration curve) and "low" (low electrode voltage, in other words EP lies in the flatter region) is possible.



The indicator electrode is activated after a certain period of use in the same reagent, i.e. the titration curve becomes steeper. If the titration curve is too steep, the titration controller can oscillate leading to slowly fluctuating drift values during the conditioning. Corrective action: Set EP voltage lower.
End point voltages set too low can, however, prolong the titration and hence have an unfavourable influence on the measurement error.

3.4 Configuration

The <CONFIG> key contains the instrument configuration values.
The inquiries are divided into two groups: —AUXILIARIES— and —RS SETTINGS—. The individual inquires of the groups are reached with <ENTER>. Enter values and switch to next inquiry with <ENTER>. ∇ following the dialogue text means that the values are selected with <SELECT>. <QUIT> ends the inquiry sequence and leads to the title of the group. Pressing <QUIT> again ends the inquiries of the <CONFIG> key. The displays show the default values.

--AUXILIARIES--	**Inquires of the group AUXILIARIES**
MP.LIST∇ OFF	*Printout of the list of measured points (ON, OFF)* List of measured points water/ug vs time/s during the titration
TIME INTER. 1 S	If set to "ON", inquiry: *Time interval for the output of the measured points (1...9999 s)*
BALANCE∇ SARTORI	*Selection of the balance type (SARTORI, METTLER, AT-METT, AND, PRECISA)* Sartorius: Types MP8, MC1 Mettler: Types AM, PM and balances with interfaces 011, 012 and 016 Mettler AT: AT model AND: Types ER-60, 120, 180, 182, FR-200, 300 and FX-200, 300, 320 Precisa: Types with RS232C interface
PERIPH.∇ OVEN	*Selection of the peripheral device at the "Remote" socket (OVEN, SAMPLER)*
BEEP∇ ON	*Beep (ON, OFF)* Audio signal after the titration and when the KF Coulometer is ready for start after preconditioning.
LABEL	*Instrument designation for individual identification in the instrument network (up to 8 ASCII characters)* for remote control via RS232.
PROGRAM 737.0010	*Display of the program version*

--RS SETTINGS--	**Inquires of the group RS SETTINGS**
BAUD RATE∇ 9600	*Baud rate (300, 600, 1200, 2400, 4800, 9600)*
DATA BIT∇ 8	*Data bits (7, 8)*
STOP BIT∇ 1	*Stop bits (1, 2)*
PARITY∇ NONE	*Parity (EVEN, ODD, NONE)*
HANDSHAKE∇ HWS	*Handshake (HWS, HWF, SWCHAR, SWLINE, NONE)* see page 28
RS CONTROL∇ ON	*Control via RS232 interface (ON, OFF)* OFF means that the receipt of commands via the RS interface is blocked. Data output is always possible. Must be set to ON for data transfer from a balance.

3.5 Display of the drift

The drift is displayed in ug water/min. It is a measure of the blank consumption of iodine, e.g. by ingress of atmospheric moisture or slow, side-reactions in the KF reagent itself or in the sample matrix which consume iodine.
The drift can be displayed during the conditioning:
Press the <DRIFT> key.

If you wish to show the titration result again, press <DRIFT> once more.

3.6 Data output

3.6.1 <PRINT> key

In addition to the reports printed out at the end of the titration, various other reports can be outputted. There are 2 possibilities to select the reports:

1) <PRINT> <SELECT> <ENTER> — <SELECT> 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.

The following list provides an overview of the report possibilities:

Report	Display with <PRINT> <SELECT>	<Key X>
Full result report	FULL	–
Short result report	SHORT	–
Configuration report	CONFIG	CONFIG
Parameter report	PARAM	PARAM
Calculation data	CALC DATA	CALC DATA
Sample data	SMPL DATA	SMPL DATA
All reports	ALL	–

Example of a full result report:

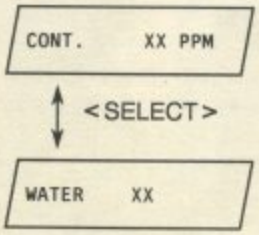
```
 'fr
737 KF Coulometer      OP1/108   737.0010
                                      23
  smpl                     32 mg
  id1                 94-05-23
  drift                     8 ug/min
  titr.time                42 s
  water                   237 ug
  content               0.7406 %
          ===========
```

- identification of report type (fr = full report)
- instrument, serial number, program version
- current value of sample counter
- sample size
- sample identification
- drift value
- titr. time, i.e. time during which I_2 was generated
- titrated water
- calculated content
- double dashed line = original report.

Original reports printed out directly following the end of the titration have a double dashed line (= = = = =),whereas recalculated reports are ended with a single dashed line (-----).

3.6.2 Switching the result display

The <SELECT> key can be used to switch the display between



CONT .(= content in ppm or %)

and

WATER (= water in ug)

4. Operation via RS232 interface

4.1 General rules

The Coulometer has an extensive remote control facility that allows full control of the titrator via the RS232 interface, i.e. the titrator can receive data from an external controller or it can send data to an external controller. The 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 terminator. The controller terminates its commands with C_R and L_F. If the controller sends more than one command per line, the character ';' is used as separator between the commands.

The commands are grouped logically and are simple to understand. Thus, e.g. for the selection of the report the command

&Mode.**P**arameter.**R**eport **"FULL"**

must be sent, but only the boldface characters need be inputted, thus

&M.P.R"FULL" .

All quantities of the Coulometer are collected in groups. For example, the entries for the configuration are in the group

&Config

The "Config" group contains subgroups, e.g. for the setting of the RS interface parameters (RS Settings)

&Config.**R**SSet

This subgroup in turn contains the individual inquiries for the settings, e.g. the inquiry regarding the baud rate

&Config.**R**SSet.**B**aud

or regarding the setting of the parity

&Config.**R**SSet.**P**arity

The commands have a hierarchial structure (tree structure). The quantities that appear in this tree are called **objects** in what follows. The baud rate is an object that is called up with the command

&Config.**R**SSet.**B**aud

If one is at the desired location in the tree, the value of the appropriate object can be queried, e.g. in the case of the inquiry regarding the baud rate:

&Config.**R**SSet.**B**aud **$Q** Q for Query

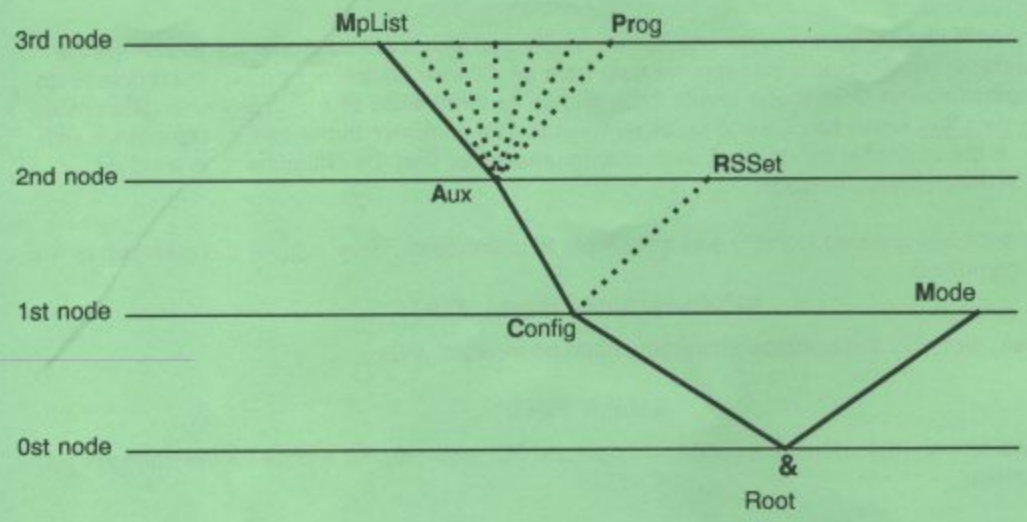
$Q triggers the output of the value from the Coulometer. Entries that are introduced with the character dollar ($) trigger something. They are thus called **triggers** in what follows.

Values of objects can not only be requested, however, they can also be modified. Values are always entered in quotation marks ("), e.g.

&Config.**R**SSet.**B**aud **"9600"**

4.1.1 Call up of objects

All objects of the Coulometer are grouped hierarchically. They have a tree structure. A section of this tree is shown below:



Rules

- The root of the tree is designated with &.
- For the call up of an object the nodes (levels) of the tree are marked with a point (.).
- The call up of the objects requires as many letters as necessary to ensure unequivocal assignment of the object. If the call is not unequivocal, the first object in the series is recognised.
- Upper- or lowercase letters can be used
- An object can be assigned a value. Each value is marked at the beginning and end with quotation marks ("). A value can contain up to 8 ASCII characters. Numeric values can include up to 5 digits, a negative sign and a decimal point. Numbers with more than 5 digits will not be accepted. With numbers < 1, it isnecessary to enter leading zeros.
- If a new object is not called up, the old object remains current.

Examples:

Call up of the Beep:
&Config.**A**ux.**Be**ep
or **&C.A.Be**

&C.A.BE or **&c.a.be**

Entry of "OFF" for the beep
&C.A.BE "OFF"

Correct entries of numbers:
"–31227"
"0.1"
incorrect entries:
"1,5" or " +3" or ".1"

- New objects can also be addressed relative to old objects:
  A preceding point moves one node **forwards** in the tree.

  More than one preceding point moves one node **backwards** in the tree. n nodes backwards require n + 1 preceding points.

- If a jump is to be made back to the root, a preceding & is entered.

From the root to the node 'Aux': **&C.A**
Forwards from the node 'Aux' to 'MpList': **.M**

Jump from 'MpList' onto the node 'Aux' and selection of a new object at this node 'Prog': **..Pr**
Jump from the object 'Prog' over the node 'Aux' to the node 'Config' and to the new node 'RSSet': **...R**

Change from the node 'RSSet' via the root into the node 'Mode': **&M**

4.1.2 Triggers

Triggers initiate an action at the Coulometer, e.g. starting of a mode or sending of data. Triggers are marked with the introducer: **$**

The following triggers are possible:

$G	Go:	Starts operations, e.g. start of the titration or setting of the RS232 interface parameters
$S	Stop:	Stops operations, e.g. titration
$Q	Query:	Used for inquiry of all information from the current node in the tree upwards up to and including the values
$Q.P	Path:	Used for inquiry of the path from the root of the tree up to the current node
$Q.H	Highest Index:	Used for inquiry of the number of son nodes of the current node
$Q.N"i"	Name:	Used for inquiry of the name of the son node with index i, i = 1...n
$D	Detaillierte Info:	Used for inquiry of the detailed status
$U	qUit:	Used to abort the data flow of the Coulometer, e.g. after $Q

The triggers $G and $S are linked to objects, see overview table, pages 22ff.

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

Examples:
Inquiry of the value of the baud rate: **&C**onfig.**RS**Set.**B**aud **$Q**
Inquiry of all values of the node 'RSSet': **&C**onfig.**RS**Set **$Q**
Inquiry of the path of the node 'RSSet': **&C**onfig.**RS**Set **$Q.P**
Start of the current mode: **&M**ode **$G**
Inquiry of the detailed status: **$D**

4.1.3 Status and error 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 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.Titr.ExtrTime;E20. The global status informs on the activity of the process, while the detailed status conditions show the exact activity within the process.

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

$G	Go:	The Coulometer is executing the last command.
$R	Ready:	The Coulometer has executed the last command and is ready
$S	Stop:	A process has been stopped in an "unnatural manner".

Detailed status conditions

Status conditions of the global $G:

$G .Mode.Cond	.Prog	Instrument is conditioning, wet or with negative drift.
	.Ok	Instrument is conditioning, dry.
$G .Mode.Titr	.AddSmpl	Instrument is titrating, display "ADD SAMPLE".
	.Req.Id1	Instrument is titrating, requesting Id1.
	.Req.Id2	Instrument is titrating, requesting Id2.
	.Req.Id3	Instrument is titrating, requesting Id3.
	.Req.Smpl	Instrument is titrating, requesting sample size.
	.Req.Conf	Instrument is titrating, waiting for start confirmation.
	.ExtrTime	Instrument is titrating, extraction time.
$G .Mode.Titr		Instrument is titrating.

Status conditions of the global $R:

$R. Mode.Inac		Instrument in inactive state.
$R. Mode.Cond	.Ok	Instrument is conditioning, dry.
$R. Mode.Cond	.Prog	Instrument is conditioning, got wet

Status conditions of the global $S:

The instrument gives the status from which it has been stopped. The detailed status information is therefore identical as for the global status $G or $R.

Error messages, errors:

Error messages are appended to the status messages and separated from these by a ";".

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

E190 Add Water. The EP has been exceeded.
Exit: Add water or &m $S.

E191 Blank Error. The blank value is larger than the titrated water mass.
Exit: Enter new blank or &m $G.

E192 Generator Electrode.
Exit: Rectify fault or &m $S.

E193 Indicator electrode.
Exit: Rectify fault or &m $S.

E194 Water R. Mass of titrated water larger than 65 535 ug.
Exit: &m $G.

E195 Sample Unfit: Overshooting of the EP during the titration.
Exit: Disappears when OK again.

RS receive errors:

E36 Parity
E37 Stop Bit
} Exit: <QUIT> and set appropriate parameter on the two devices to the same value.

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

E39 Overflow of the internal receive buffer of the Coulometer (> 82 characters).
Exit: <QUIT>

RS send errors

E40 DSR = OFF
E41 DCD = ON
E42 CTS = OFF
} Handshake was not satisfactory for longer than 1 s.
Exit: <QUIT>
Is the receiver switched on and ready to receive?

E43 Transmission by the Coulometer was interrupted with XOFF for at least 3 s.
Exit: Send XON or <QUIT>.

E44 The RS interface parameters are no longer the same for both devices. Reset.

E45 The receive buffer of the Coulometer contains an incomplete character string (L_F missing). Transmission of the Coulometer is therefore blocked.
Exit: Send L_F or <QUIT>.

4.2 Remote control commands

4.2.1 Overview

Object	Function	Input range	see...
&	**Root**		
Mode	**Mode**	$G, $S	4.2.2.1
.DriftDisp	Drift display	$G, $S	4.2.2.2
.Parameter	**Parameters**		
.IReq	Request of Ids after the start	id1, id1&2, all, OFF	4.2.2.3
.SReq	Request of sample size after the start	ON, OFF	4.2.2.3
.ConfStart	Start confirmation	ON, OFF	4.2.2.3
.DriftStart	Drift threshold for start	0...98	4.2.2.4
.ExtrT	Extraction time	0... ±63999	4.2.2.5
.StopDrift	Stop drift		
.Select	Type of drift value transfer	auto, man	4.2.2.6
.Drift	Drift value on manual transfer	0...98	4.2.2.6
.TimeDelay	Switch-off delay time	0...99	4.2.2.7
.Report	Report output at end of titration	full, short, OFF	4.2.2.8
.CalcData	**Data for result calculation**		
.Blank	Blank value	0...63999	4.2.2.9
.DCor	Drift correction		
.Select	Type of drift value transfer	auto, man	4.2.2.10
.Drift	Drift value on manual transfer	0...98	4.2.2.10
Config	**Configuration**		
.Aux	**Setting of various auxiliary functions**		
.MpList	Mp list during the titration		
.Select	Selection	ON, OFF	4.2.2.11
.Interval	Time interval for the output	1...9999	4.2.2.11
.Balance	Selection of the balance	Sartorius, Mettler, Mettler AT, AND, Precisa	4.2.2.12
.Periph	Peripheral at the "Remote" socket	Oven, Sampler	4.2.2.13
.Beep	Audio signal	ON, OFF	4.2.2.14
.DevName	Device name	8 ASCII Char	4.2.2.15
.Prog	Program version	read only	4.2.2.16
.RSSet	**Settings for RS232**	$G	4.2.2.17
.Baud	Baud rate	special (300...9600)	4.2.2.18
.DataBit	Data bits	7,8	4.2.2.18
.StopBit	Stop bits	1,2	4.2.2.18
.Parity	Parity	even, odd, none	4.2.2.18
.Handsh	Handshake	HWs, HWf, SWchar, SWline, none	4.2.2.18
SmplData	**Sample data**		
.SmplSize	Sample size	0... ±63999	4.2.2.19
.Id1	Sample identification 1	up to 8 ASCII characters	4.2.2.19
.Id2	Sample identification 2	up to 8 ASCII characters	4.2.2.19
.Id3	Sample identification 3	up to 8 ASCII characters	4.2.2.19

Object	Function	Input range	see...
&	**Root**		
Info	**Information**		
.Report	**Send formatted reports**	$G	4.2.2.20
.Select	Selection of the reports	configuration, parameters, smpl data, calc, full, short, all	4.2.2.20
.TitrResults	**Results of the determination**		
.RunNo	Sample counter	read only	4.2.2.21
.Content	Calculated water content	read only	4.2.2.21
.UnitContent	Unit of water content	read only	4.2.2.21
.Water	Mass of titrated water	read only	4.2.2.21
.TitrTime	Titration time	read only	4.2.2.21
.StartDrift	Drift value	read only	4.2.2.21
Setup	**Setting the operating mode**		
.IdReport	Output of report identification	ON, OFF	4.2.2.22
.Mode	Settings for the sequence		
.StartWait	Hold directly after start	ON, OFF	4.2.2.23
.AutoInfo	**Automatic information on changes**		
.R	If instrument in "Ready" condition	ON,OFF	4.2.2.24
.G	If instrument has been started	ON,OFF	4.2.2.24
.S	If instrument in "Stop" condition	ON,OFF	4.2.2.24
.B	Start of the actual titration	ON,OFF	4.2.2.24
.F	End of the determination	ON,OFF	4.2.2.24
.E	On error message	ON,OFF	4.2.2.24
.O	Conditioning OK	ON,OFF	4.2.2.24
.N	Conditioning Not OK	ON,OFF	4.2.2.24
.Re	If in request after titration start	ON,OFF	4.2.2.24
.RC	Recalculation of results	ON,OFF	4.2.2.24
.GC	Go Command	ON, OFF	4.2.2.24
.PowerOn	Simulation "Power on"	$G	4.2.2.25
.Initialise	Set values to default	$G	4.2.2.26
.Select	Selection	Mode, Config, Setup SmplData	4.2.2.26
.InstrNo	Instrument identification	$G	4.2.2.27
.Value	Entry	up to 8 ASCII characters	4.2.2.27
.RamInit	Initialisation, see pages 43, 44	$G	4.2.2.28

4.2.2 Description of the remote control commands

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

Start or stop ($G, $S). $G starts the preconditioning or the titration. $S always leads to the inactive state. In requests for identification and the sample mass after the titration start, $G is also used to continue to next step (see 4.2.2.3).

4.2.2.2 **M**ode.**D**riftDisp $G, $S

Switch display of the drift during the conditioning on/off. Corresponds to the <DRIFT> key.

4.2.2.3 **M**ode.**P**arameter.**I**Req id1, id1&id2, all, **OFF**
Mode.**P**arameter.**S**Req ON, **OFF**
Mode.**P**arameter.**C**onfStart ON, **OFF**

Automatic requests after the start of the titration. Advance of the titration by entry of the requested values or with &M $G, see 4.2.2.1.

4.2.2.4 **M**ode.**P**arameter.**D**riftStart 0...98

Drift threshold for the start of the titration in ug/min. Entry in steps of 2 ug/min.
If the drift is above the set value, the titration can not be started and start commands are ignored (status message $R.Mode.Cond.Prog).

4.2.2.5 **M**ode.**P**arameter.**E**xtrT 0... ± 63 999

Extraction time in s.
A negative extraction time corresponds to a wait time before the titration.
During the positive extraction time, I_2 is generated, but the titration will not be ended during the extraction time.

4.2.2.6 **M**ode.**P**arameter.**S**topDrift.**S**elect man, **auto**
Mode.**P**arameter.**S**topDrift.**D**rift 0...**20**...98

Drift threshold for termination of the titration in ug/min.
.Select: Type of drift value acquisition. With "auto", the drift value at the start of the titration is valid. The drift value can be viewed in node &Info.TitrResults.StartDrift (4.2.2.21).
.Drift: Drift value for "man". Entry in steps of 2 ug/min.

4.2.2.7 **M**ode.**P**arameter.**T**imeDelay 0...**3**...99

Switch-off delay time in s.

4.2.2.8 **M**ode.**P**arameter.**R**eport full, short, **OFF**

Type of report output at the end of the titration. OFF means no report output.

4.2.2.9 **M**ode.**C**alcData.**B**lank **0**...63 999, 5 significant digits, up to 1 decimal place

Blank value in ug.

4.2.2.10 **M**ode.**C**alcData.**D**Cor.**S**elect man, **auto**
Mode.**C**alcData.**D**Cor.**D**rift **0**...98

Drift correction in ug/min. The drift correction is continuously performed during the titration.
.Select: Type of drift value acquisition. With "auto", the drift value at the start of the titration is valid. The drift value can be viewed in node &Info.TitrResults.StartDrift (4.2.2.21).
.Drift: Drift value for "man". Entry in steps of 2 ug/min.

4.2.2.11 **C**onfig.**A**ux.**M**pList.**S**elect ON, **OFF**
Config.**A**ux.**M**pList.**I**nterval **1**...9999

Output of a list of measured points water/ug versus time/s during the titration.
.Interval: Time interval in s for output of the list of measured points.

4.2.2.12 **C**onfig.**A**ux.**B**alance **Sartorius**, Mettler, Mettler AT, AND, Precisa

Selection of the balance type.

4.2.2.13 **C**onfig.**A**ux.**P**eriph **Oven**, Sampler

Selection of the peripheral device at the "Remote" socket.
With "Oven", the "ready (= end)" signal is static and a pulse is sent on stopping the Coulometer (see page 51).

4.2.2.14 **C**onfig.**A**ux.**B**eep **ON**, OFF

Switch audio signal on/off.

4.2.2.15 **C**onfig.**A**ux.**D**evName up to 8 ASCII characters

Name of the device for interconnections with several units. It is advisable to use only the characters A...Z (ASCII No. 65...90), a...z (ASCII No. 97...122) and 0...9 (ASCII No. 48...57) when the Setup.AutoInfo function (4.2.2.24) is used at the same time.

4.2.2.16 **C**onfig.**A**ux.**P**rog read only

Output of the program version.
On receipt of $Q, the Coulometer sends: "737.0010".

4.2.2.17 **C**onfig.**R**SSet $G

$G sets all RS settings. After the setting of the interface parameters, wait at least 2 s for the components to stabilise.

4.2.2.18 **C**onfig.**RS**Set.**B**aud — 300, 600, 1200, 2400, 4800, **9600**
Config.**RS**Set.**D**ataBit — 7, **8**
Config.**RS**Set.**S**topBit — **1**, 2
Config.**RS**Set.**P**arity — even, odd, **none**
Config.**RS**Set.**H**andsh — **HWs**, HWf, SWchar, SWline, none

Setting of the values for data transfer via RS interface.: Baud rate, data bits, stop bits, parity and type of handshake, see also page 28 ff.
Setting of the values must be initiated with $G immediately after entry of the values, see 4.2.2.17.

4.2.2.19 **S**mplData.**S**mplSize — -63999...**0**...63 999, 5 significant digits, up to 1 decimal place
SmplData.**Id**1 — up to 8 ASCII characters
SmplData.**Id**2 — up to 8 ASCII characters
SmplData.**Id**3 — up to 8 ASCII characters

Sample data.
.SmplSize: Sample size in mg.

4.2.2.20 **I**nfo.**R**eport — $G
Info.**R**eport.**S**elect — configuration, parameters, smpl data, calc, full, short, all

$G sends the selected report.
configuration: Configurations report. Not accessible during a titration.
parameters: Parameter report of the current method. Only "live" parameters during a titration.
smpl data: Sample data.
calc: Calculation data.
full: Full result report of the last titration.
short: Short result report of the last titration.
all: All reports.
Reports sent automatically by the Coulometer start with a space (ASCII 32) and '. This is followed by an individual identification for each report. Reports requested via RS232 ($G) have the same individual identification of the report blocks, but are started with ' only (no preceding space).

4.2.2.21 **I**nfo.**T**itrResults.**R**unNo — read only
Info.**T**itrResults.**C**ontent — read only
Info.**T**itrResults.**U**nitCont — read only
Info.**T**itrResults.**W**ater — read only
Info.**T**itrResults.**T**itrTime — read only
Info.**T**itrResults.**S**tartDrift — read only

Request for the current titration results:
.RunNo: Current status of the sample counter.
.Content: Calculated water content.
.UnitCont: Unit of the calculated water content (% or ppm)
.Water: Titrated water mass in ug.
.TitrTime: Titration time in s.
.StartDrift: Drift value at start of titration in ug/min.

4.2.2.22 **Se**tup.**I**dReport — **ON**, OFF

Switch output of the report identification of the formatted reports on/off.

4.2.2.23 **Se**tup.**M**ode.**S**tartWait — ON, **OFF**

Wait time after the start. The data of the last titration are retained during this time.
Is set to OFF when switching on the Coulometer.

4.2.2.24 **Se**tup.**A**utoInfo.**R** ON, **OFF**
Setup.**A**utoInfo.**G** ON, **OFF**
Setup.**A**utoInfo.**S** ON, **OFF**
Setup.**A**utoInfo.**B** ON, **OFF**
Setup.**A**utoInfo.**F** ON, **OFF**
Setup.**A**utoInfo.**E** ON, **OFF**
Setup.**A**utoInfo.**O** ON, **OFF**
Setup.**A**utoInfo.**N** ON, **OFF**
Setup.**A**utoInfo.**Re** ON, **OFF**
Setup.**A**utoInfo.**RC** ON, **OFF**
Setup.**A**utoInfo.**GC** ON, **OFF**

ON means the Coulometer reports automatically when the corresponding change starts.

.R	Ready: 'Ready' state has been reached.
.G	Go: Instrument has been started.
.S	Stop: 'Stop' state has been reached.
.B	Begin: Start of the titration (after requests).
.F	Final: End of the determination, the closing steps are being performed.
.E	Error. Message together with error number, see page 21.
.O	Conditioning OK, dry.
.N	Conditioning Not OK, wet
.Re	Request: Request of the sample identification, the sample size after titration start or "Confirm Start".
.RC	Recalculation: Recalculation
.GC	Go Command: The Coulometer has received a start command.

If a change occurs which requires a message, the Coulometer sends space (ASCII 32) and ! as introducers. The name of the device is then sent (see 4.2.2.15). Special ASCII characters in the device name are ignored. If no device name has been entered, only ! is sent. Finally, the 737 sends information regarding the node which initiated the message.
Example: !Otto".R": With device "Otto", node .R initiated the message.

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

Simulation of 'Power on'. The device is in the same condition as after power on: Error messages are cleared, StartWait (see 4.2.2.23) is set to OFF and the current sample number to 0.

4.2.2.26 **Se**tup.**In**itialise $G
Setup.**In**itialise.**S**elect **Mode**, Config, Setup, SmplData

Setting of default values for the following groups:

Mode:	All values under tree section &Mode.
Config:	All values under tree section &Config.
Setup:	All values under tree section &SetUp.
SmplData:	All values under tree section &SmplData.

The action must be initiated with &SetUp.Initialise $G.

4.2.2.27 **Se**tup.**Ins**trNo $G
Setup.**Ins**trNo.**V**alue up to 8 ASCII characters

Device identification for output in the reports.
The value must be written in with &SetUp.InstrNo $G.

4.2.2.28 **Se**tup.**R**amInit $G

Initialised instrument as in the diagnostic test, see pages 43 and 44: All parameters are set to their default value and error messages are cleared.

Save

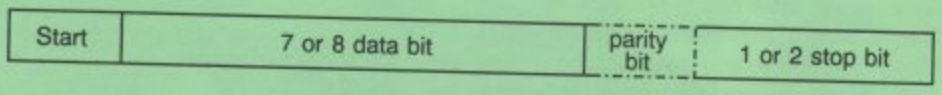
4.3. Characteristics of the RS232 interface

4.3.1 Data transfer protocol

The Coulometer is configured as DTE (Data Terminal Equipment).
The RS232 interface has the following technical specifications:

Data interface in accordance with the RS 232C standard. Data transfer parameters can be selected.

Max. line length:	80 characters + C_R L_F
Control characters:	C_R (ASCII DEC 13)
	L_F (ASCII DEC 10)
	XON (ASCII DEC 17)
	XOFF (ASCII DEC 19)
Cable length:	max. ca. 15 m



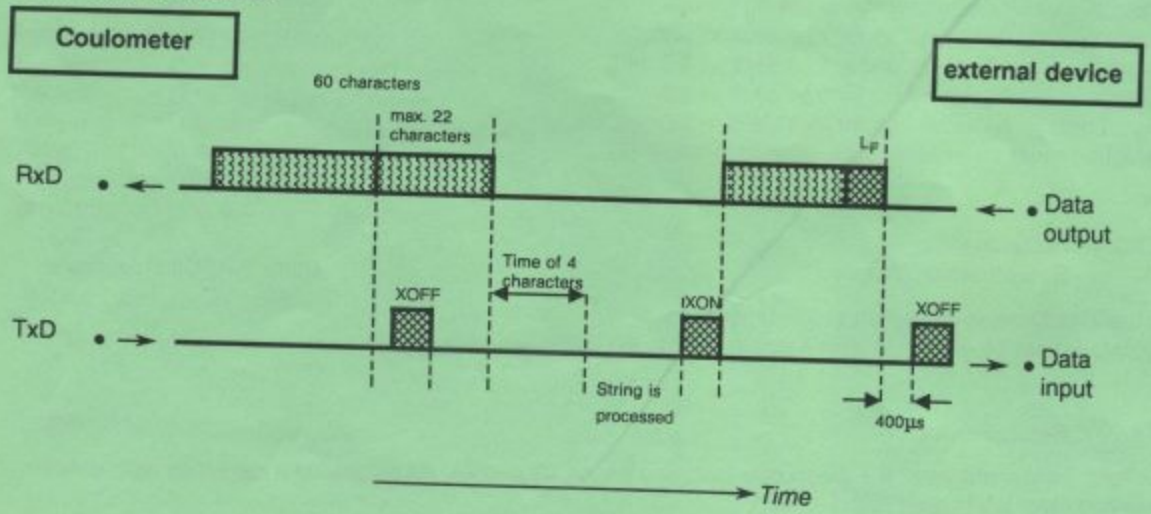
For interconnections of the Coulometer with non-Metrohm units, only a shielded data cable (e.g. METROHM D.104.0201) may be used. The cable shielding must be faultlessly earthed at both units (pay attention to current loops; always use star-head earthing). Only connectors with adequate shielding may be used (e.g. METROHM K.210.0001 with K.210.9004).

4.3.2 Handshake

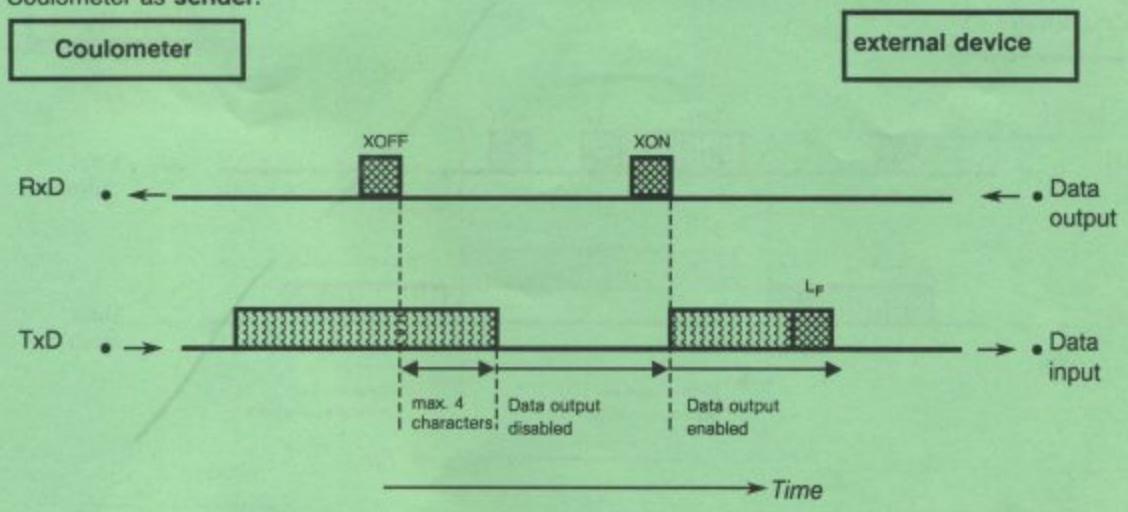
4.3.2.1 Software-Handshake , SWChar

Handshake inputs at the Coulometer (CTS, DSR, DCD) are not checked.
Handshake outputs (DTR, RTS) are set by the Coulometer.
As soon as a L_F is recognised, the Coulometer sends XOFF. It can then receive 6 extra characters and store them.
However, the Coulometer also sends XOFF if its input buffer contains 60 characters. After this, it can receive maximum 22 extra characters (incl. L_F).
If the transmission is interrupted for the time of 4 characters after the Coulometer has sent XOFF, the string received earlier is processed even if no L_F has been sent.

Coulometer as **receiver**:



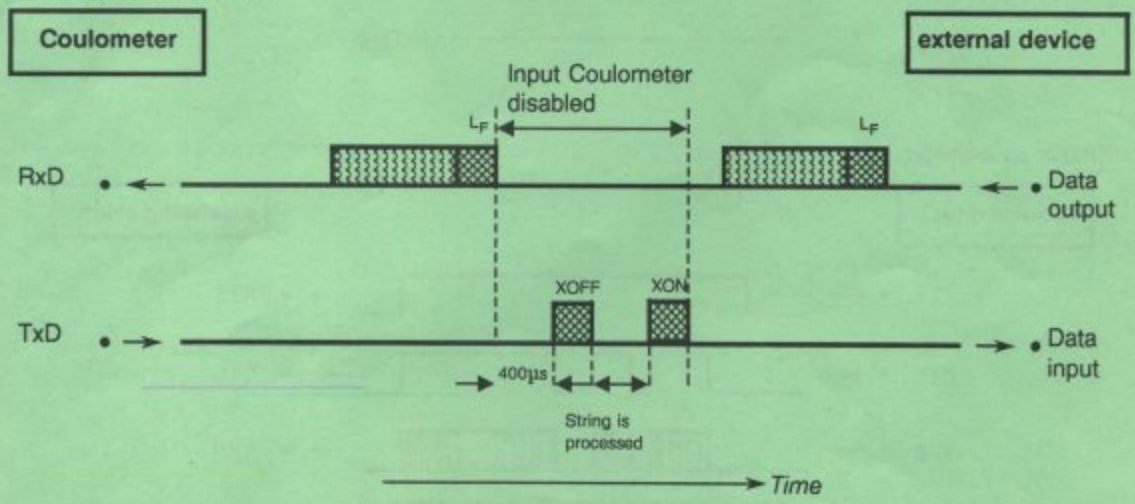
Coulometer as **sender**:



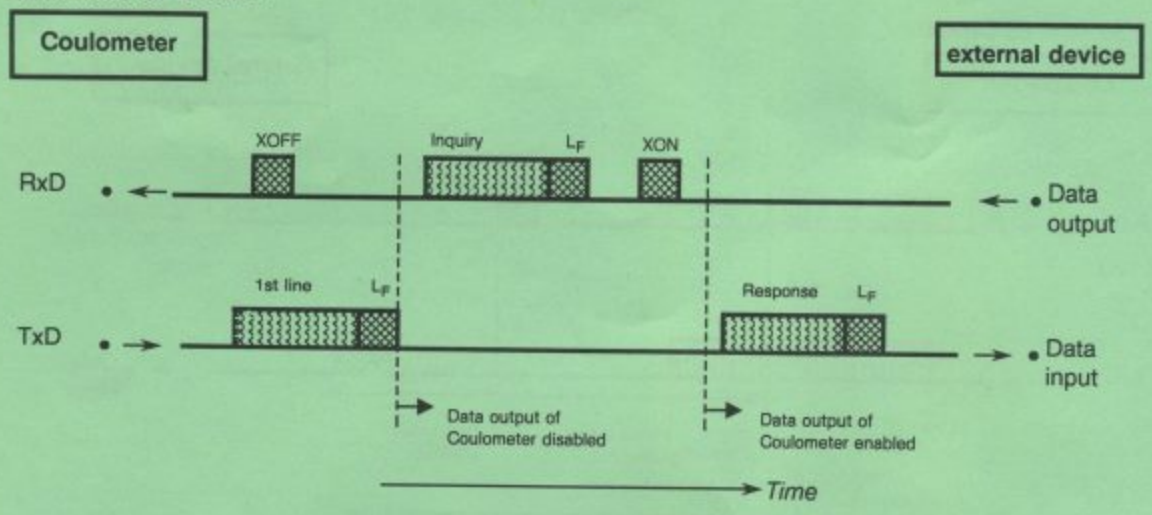
4.3.2.2 Software-Handshake , SWline

Handshake inputs at the Coulometer (CTS, DSR, DCD) are not checked.
Handshake outputs (DTR, RTS) are set by the Coulometer.
The Coulometer is equipped with an input buffer that can accommodate a string of up to 80 characters + $C_R L_F$. As soon as an L_F is recognised, the Coulometer sends XOFF. After this, it can receive maximum 6 extra characters and store them. The string sent previously is now processed by the Coulometer. Afterwards, the Coulometer sends XON and is again ready to receive.

Coulometer as **receiver**:



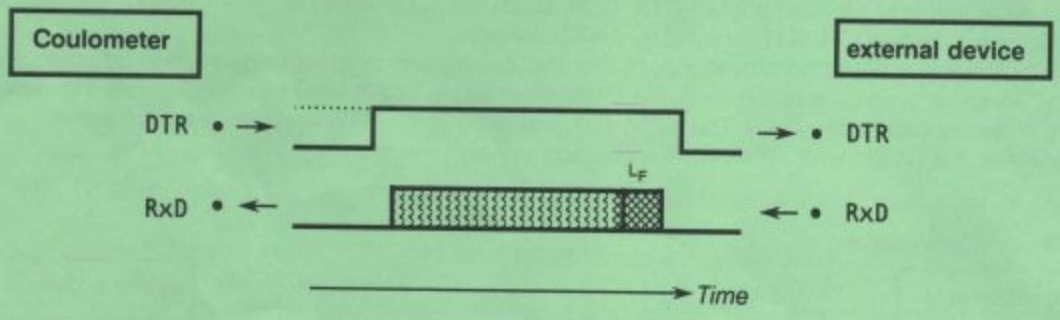
Coulometer as **sender:**



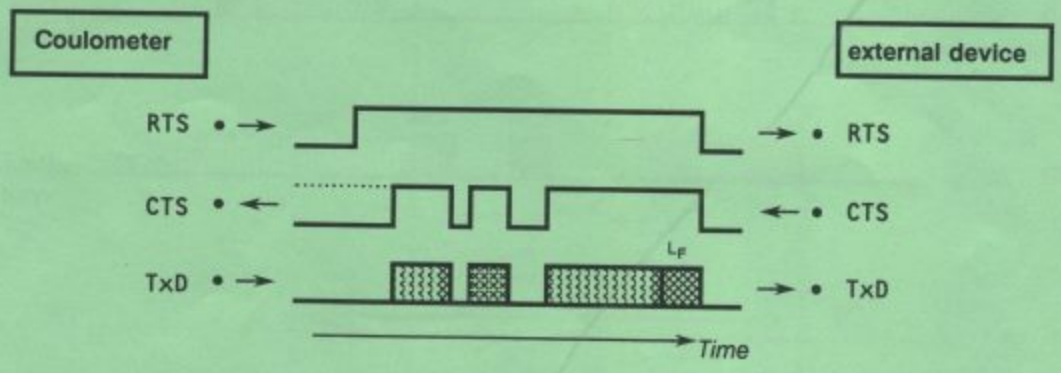
The transmission of the Coulometer can be stopped by the external device with XOFF. After receipt of XOFF, the Coulometer completes transmission of the line already started. If the data output is disabled for more than 3 s by XOFF, E43 appears in the display.

4.3.2.3 Hardware-Handshake, HWs

Coulometer as **receiver:**



Coulometer as **sender:**

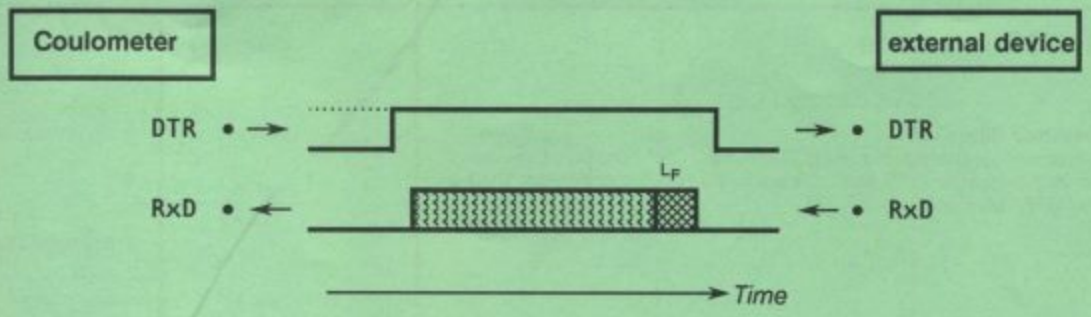


The data flow can be interrupted by deactivation of the CTS line.

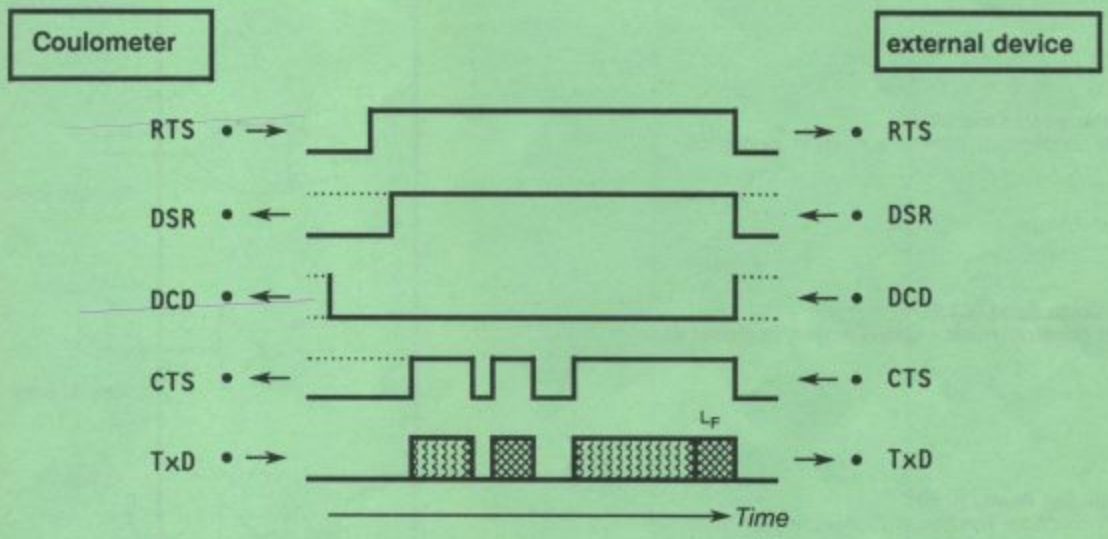
Hardware-Handshake, HWf

All handshake inputs are checked at the Coulometer, handshake outputs are set.

Coulometer as **receiver**:

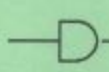
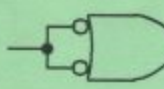
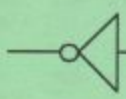
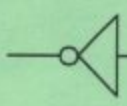
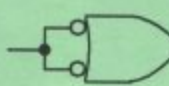


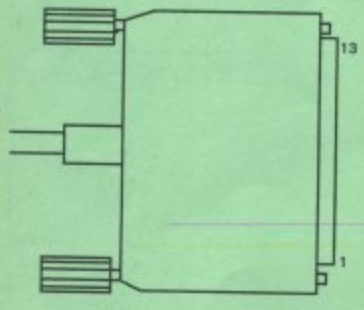
Coulometer as **sender**:



The data flow can be interrupted by deactivation of the CTS line.

4.3.3 Pin assignment

		external
RS 232C Interface		
Transmitted data (TxD). If no data are transmitted, the line is held in the "ON" condition. Data are transmitted only when CTS and DSR are in the "ON" condition and DCD is in the "OFF" condition.		E 2 Transmitted Data
Received data (RxD) Data are received only when DCD is "ON".		E 3 Received Data
Request to Send (RTS) ON condition: Coulometer is ready to send data.		E 4 Request to Send
Clear to Send (CTS) ON condition: Remote station is ready to receive data.		E 5 Clear to Send
Data Set Ready (DSR) ON condition: The transmission line is connected.		E 6 Data Set Ready
Signal Ground (GND)		E 7 Signal Ground
Data Carrier Detect (DCD) ON condition: The level of the received signal is within the tolerance range (remote station is ready to send data).		E 8 Data Carrier Detect
Data Terminal Ready (DTR) ON condition: Coulometer is ready to receive data.		E 20 Data Terminal Ready

		external
RS 232C (continued) **Protective earth** Direct connection from cable connector to protective earth of instrument. **Polarity allocation of the signals** – Data lines (TxD, RxD) Voltage negative (< –3 V): signal status "ONE" Voltage positive (> +3 V): signal status "ZERO" – Control or message lines (CTS, DSR, DCD, RTS, DTR) Voltage negative (< –3 V): OFF status Voltage positive (> +3 V): ON status In the transition region from +3 V to - 3 V the signal status is undefined. Driver 14C88 Receiver 14C89 } in compliance with EIA RS 232C specification **Contact arrangement at connector (female) for RS 232 C socket (male)**  Ordering numbers: K.210.9004 und K.210.0001 View from solder side of connector		

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

4.4 What can you do if the data transfer does not work?

Problem	Questions for remedial action
No characters can be received on a connected printer	– Are the instruments and the connection cables plugged in properly? – Is the printer set to "on-line" and receipt with serial interface? – Are baud rate, data bit and parity settings the same for both devices? – Is the handshake set properly? If everything appears to be in order, try to print out a report with the key sequence <PRINT><SMPL DATA><ENTER>. If this report is printed out correctly, check whether under the key <PARAM>, >report a report is preselected.
No data transmission occurs and the display of the Coulometer shows an error message	– **E40-42**: Transmission error. Is the cable properly wired and connected? Is the printer switched on and set to "on-line"? – **E43**: Data output of the Coulometer disabled for longer than 3 s by XOFF. – **E36-39**: Receive error. Are the settings of the RS232 data transmission parameters the same for both devices?
The received characters are garbled	– Are the data bit and the parity settings the same for both devices? – Is the baud rate setting the same for both devices?

5. Error messages, rectification of malfunctions

5.1 Titration problems, troubleshooting

Problem	Corrective action
Printing not possible	See measures, page 34.
Drift too high	– Water-containing deposits in the measuring cell: shake measuring cell. – Reagent exhausted: Change reagent. – Moisture ingress into measuring cell: . Molecular sieves exhausted? . Septum still OK? . Seals still OK (measuring cell with diaphragm)? – Diaphragm contaminated or not dry (measuring cell with diaphragm), see page 4. – Sample matrix consumes iodine. Change reagent more frequently or extract water of sample so that sample need not be added to the measuring cell. – In work with KF oven: . Gas flow too high? . Screw fittings tight?
Drift frequently negative	Add water and check whether the drift becomes negative again. – Stir somewhat faster (iodine clouds). – Activate indicator electrode, see page 8. – Set end point voltage lower, see page 12.
Fluctuating drift	– Moisture penetrates measuring cell: . Molecular sieves exhausted? . Septum still OK? . Seals still OK (measuring cell with diaphragm)? – Set end point voltage lower, see page 12.
Measurement result too high	– Measuring cell not yet conditioned well: Shake measuring cell and wait until drift is stable. – The indicator electrode is passivated. Clean electrode, see page 8. – Set stop drift higher, see page 11. – Set switch-off delay time lower, see page 11.
Titration times too long	– Check whether drift is stable during conditioning; if not, take same measures as for drift problem. – Water quantity too high. Guide values for the sample size, see page 6. – Set stop drift higher, see page 11. – Set switch-off delay time lower, see page 11. – Set end point voltage higher, see page 12.

5.2 Error and special messages

ADD WATER
The electrolyte solution is in the excess iodine range.
Exit: Add water.

BATTERY
The battery is low and must be replaced. Call Metrohm Service.
In the mean time you may continue as follows:
- Initialize RAM (press key <9> right after switching on the Coulometer, then press <ENTER>, then <QUIT>).
- Enter your configuration data, your parameters and sample data.

The error message will reappear if you switch the Coulometer off and on again.

BLANK ERROR
The blank value is larger than the mass of the titrated water.
Exit: Enter new BLANK.

GEN ELECTRODE
The voltage drop across the generator system is too high.
Possible causes:
- Wrong or exhausted electrolyte
- With measuring cells with diaphragm: Clogged diaphragm or bubbles between platinum gauze and diaphragm
- Stirring too fast, bubbles remain in the generator electrode
- With diaphragm-free measuring cells: Too much solvent was added to the electrolyte resulting in a conductivity that is too low. → Change solution.
- Generator electrode not connected, faulty or break in the connecting cable.

Exit: Rectify fault

IND ELECTRODE
The voltage at the indicator electrode is too high.
Possible causes:
- Wrong electrolyte
- Indicator electrode not connected, faulty or break in the connecting cable

Exit: Rectify fault

MANUAL STOP
A titration or the conditioning was terminated manually.
Exit: <START>

PROM ERROR
Checksum error.
Corrective action: Call Metrohm service.

SAMPLE UNFIT
Possible causes and corrective action:
- Stirring too slow: stir faster
- End point voltage too high for the fast reagent used: Set end point voltage lower using the potentiometer at the rear of the instrument.
- Sample releases iodine: Change solution; the sample is not suitable for the KF titration.

WATER R
Mass of titrated water exceeds 65 535 µg.
(The mass of water effectively present is thus the sum of the displayed value and 65 535 µg.)

Error messages in connection with the data transfer

If neither a computer nor a printer is attached, the report output at the end of the titration must be switched off.

Receive error:

E36	Parity	Exit:	<QUIT> and set corresponding parameter on both devices to the same value.
E37	Stop bit		

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

E39 Overflow of the receive buffer of the Coulometer (> 82 characters).
Exit: <QUIT>

Send errors:

E40	DSR = OFF	Handshake was not satisfied for longer than 1 s.	
E41	DCD = ON	Exit:	<QUIT>
E42	CTS = OFF		Is the receiver switched on and ready to receive?

E43 Transmission by the Coulometer was interrupted with XOFF for at least 3 s.
Exit: <QUIT>

E44 The RS interface parameters are no longer the same for both devices. Set them equally.

E45 The receive buffer of the Coulometer contains an incomplete character string (L_F missing). Transmission by the Coulometer is thus blocked.
Exit: Send L_F or <QUIT>.

5.3 Diagnostic test

Virtually all faults on the 737 Coulometer arise through faulty operation and handling of the instrument, the electrodes, the solutions, etc. Many of these faults are shown in the display of the KF Coulometer or can be recognised in the result.

If there are valid reasons for suspecting a malfunction of the 737 Coulometer, the diagnostic test is simple to perform and will help isolate the cause.

Required aids

- Ready to use generator electrode
  (or short circuit "Gen.El" input with Service Cable 3.496.5080 [1])
- Cable with suitable connector for "Ind.El." input[2] (e.g. 3.496.5070 Service Cable)[1]
- Resistance decade for values 1 200 Ω, 1 850 Ω, ¼ W. If no decade is available, individual resistors can be used. See page 39.
- perhaps test plug 3.496.8480 (see point 8)

Procedure

- Perform the diagnostic steps in the order given and compare with the reactions of the Coulometer (indented). On agreement, proceed to the next instruction.
- If the instrument does not show the expected reaction, it is first advisable to repeat the diagnostic test as an operating error could have occurred. However, several wrong reactions indicate a malfunction.
- If repetitions are necessary for more accurate observations, a return to the next re-entry point marked by ⩾ must be effected. Possibly restart the diagnosis from the beginning, see point 3.
- If any of the points 9 - 12 need be repeated, repeat the whole block 9 - 12.
- On inquiries, always specify the serial number of the instrument and if applicable the No. of the faulty diagnostic step.
- Corrective actions in the opened instrument may be undertaken only by METROHM service!

Preparations

The generator electrode remains attached and immersed in the anolyte solution or short-circuit Gen. El input with service cable 3.496.5080.

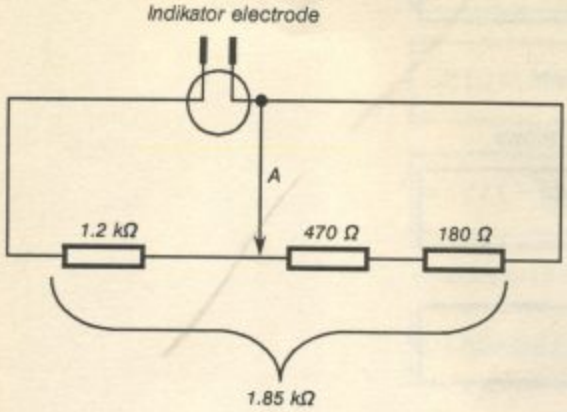
The indicator electrode is withdrawn and a resistance decade attached in its place using a cable with a suitable connector[2] (e.g. 3.496.5070[1]). If no decade is available, see arrangement overlief.

[1] Not part of the standard equipment of the 737.
Can possibly be prepared from a faulty electrode.

[2] If no suitable cable is available:
Take indicator electrode out of cell. Carefully attach decade or resistor combination with laboratory cable and test clips to the platinum wires of the indicator electrode.
(Warning: Do not bend platinum wires!)

Note only if no resistance decade is available:

All required resistance values can be produced with 3 individual resistors of 1 200 Ω, 470 Ω and 180 Ω (accuracy class 1%, ¼ W) and appropriate connecting cables (laboratory cable and connector clips). However, when switching to other values at the electrode input, ***no interruption*** *(R ≠ Ω) must occur. This is possible by proceeding according to the following arrangement.*



Arrangement for point 9	*Bridge A closed*
Arrangement for point 10	*Bridge A open*
Arrangement for point 11	*Bridge A closed*
Arrangement for point 12	*Bridge A open*

Fig. 1 Replacement circuit for resistor switch-box

1. Check switch-on routine

Switch on instrument and observe switch-on routine.

```
8888888888888888
XXXXXXXXXXXXXXXX
I. I. I. I. I. I. I. I. I. I. I. I. I. I. I. I.
START COND.
```

2. Test NOVRAM

Press <PARAM> possibly several times until display shows

```
DELAY TIME  XX X
```

Enter the delay "10 s" with the numeric keys and press <ENTER>.

```
REPORT▽     XXXX
```

X = selected report

Switch off instrument.

After 5 s switch on instrument and wait for startup routine to end.

Press <PARAM> possibly several times until display shows

```
DELAY TIME  10 S
```

The display of the delay must be 10 s.

➢ 3. Select diagnosis

Switch off instrument then after about 5 s switch on again and immediately press the <9> key (press briefly only after switching on).

```
DIAGNOSIS▽  INIT
```

➢ 4. RAM testen

Press <SELECT> possibly several times until display shows

```
DIAGNOSIS▽   RAM
```

<ENTER>

```
RAM TEST OK
```

<QUIT>

```
DIAGNOSIS▽   RAM
```

➢ 5. Timer test

Press <SELECT> possibly several times until display shows

```
DIAGNOSIS▽ TIMER
```

<ENTER>

```
TIMER TEST OK
```

<QUIT>.

```
DIAGNOSIS▽ TIMER
```

➢ 6. Display test

Press <SELECT> possibly several times until display shows

```
DIAGNOSIS▽ DISPL
```

<ENTER>

The display test starts and the display is filled in the following sequence:

```
8888888888888888
```

```
XXXXXXXXXXXXXXXX
```

```
I. I. I. I. I. I. I. I. I. I. I. I. I. I. I. I.
```

```
0123456789ABCDEF
```

```
GHIJKLMNOPQRSTUV
```

```
WXYZ[\]*+-/<=>%▽
```

At the end of the test, the following appears:

```
DIAGNOSIS▽ DISPL
```

7. Keypad + LED test

Press <SELECT> possibly several times until display shows

```
DIAGNOSIS▽ KEYB
```

<ENTER>

The LED "COND" lights up.

```
LED COND ON
```

<ENTER>

The LED "COND" goes out.

```
LED COND OFF
```

<ENTER>

```
CONTINUE TEST
```

Finally, check all keys except QUIT.

The pressed key is shown in the display,

<QUIT>

```
DIAGNOSIS▽ KEYB
```

No	Key
1	7
2	4
3	1
4	0
5	8
6	5
7	2
8	.
9	9
10	6
11	3
12	-
13	ENTER
14	CLEAR
15	SELECT
17	PARAM
18	CONFIG
19	CALC/DATA
20	SMPL/DATA
21	DRIFT
22	PRINT
23	STOP
24	START

8. RS 232 test

This test is meaningful only if the 737 KF Coulometer is used interconnected with other instruments via the 'RS 232' connection. In addition, a 3.496.8480 Test Plug normally used in the repair service is required for this test. However, this plug can also be purchased by customers under the above number.

For the sake of completeness, the procedure is described here.

(If a diagnostic test of the RS232 interface is not required, continue with point 9.)

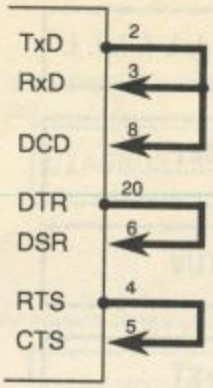


Fig. 2 Connections in the 3.496.8480 Plug

Press <SELECT> possibly several times until display shows

```
DIAGNOSIS▽ RS232
```

<ENTER>

```
RS CONNECTOR
```

Insert 3.496.8480 Plug in 'RS 232' port (do not switch off instrument, pay attention to alignment of the plug!).

<ENTER>

The test runs automatically. If no error is found, 'RS TESTED' appears after ca. 3 s. Otherwise, an error message is shown. If no test plug is connected,'ERROR RS' appears.

Remove test plug.

<QUIT>

```
DIAGNOSIS▽ RS232
```

9. Check function "start readiness"

Switch test decade to 1.2 k. *If no decade available, see replacement circuit, page 39: bridge A closed.*

Mark current position of potentiometer 'EP Voltage' (rear of instrument) and set it to the left stop (to "low").

<START>

```
ADD WATER
```

10. Funtion check 'value less than end point before start'

Switch test decade to 1.85 k *(or replacement circuit: A open).*

counts forward

```
WAIT 00XXX
```

positive value

The LED "COND" flashes.

If display shows 'GEN ELEKTRODE' or 'IND ELEKTRODE', please check the corresponding connections.

11. Check switch-off point

With existing settings, switch test decade to 1.2 k *(or replacement circuit: A closed).*

The beep sounds briefly after ca. 5 s.

The LED "COND" is continuously on.

DRIFT 0000X

positive vlaue

12. Check on the calibration

With existing settings, switch test decade to 1.85 k *(or replacement circuit: A closed).*

DRIFT 00XXX

The numeric value must be 00324...00338.

13. Check alarm "no indicator electrode"

With existing settings, switch test decade to ∞ or disconnect cable.

IND ELECTRODE

Reset test decade to 1.85 k.

DRIFT 00XXX

The numeric value must be 00324...00338.
Please consider tolerance of decade.

14. Check alarm "no generator electrode"

Disconnect "Gen.El".

GEN ELECTRODE

End of test. Switch off instrument.

Reset potentiometer 'EP Voltage' to the original setting and remove marking.

Initialise RAM (carry out only in an emergency!)

On the odd occasion, large interference signals (e.g. power spikes, lightning) may have an adverse effect on the processor functions and hence lead to a system crash. After a system crash, the RAM area must be initialised. Although the basic instrument data are retained, the RAM initialisation should be performed only if necessary as the stored user data (electrode calibration data, selected buffers, configurations, etc.) are cleared.

Procedure

Switch on instrument and then immediately press the <9> key briefly.

```
DIAGNOSIS▽  INIT
```

<ENTER>

```
DIAGNOSIS▽  INIT
```

Switch off instrument.

Note for error case

If, despite a positive diagnostic test, proper functioning of the instrument should be in doubt, there are 2 more error possibilities namely

a) faulty generator electrode or

b) faulty generator electrode current, i.e. fault in instrument.

Information on this is provided by repeating your determination with a different, good electrode.

If no second electrode is available, an electrical specialist (electronic engineer or service electrician) can check the electrode current, as follows.

Aids required (to check the electrode current):

- 3.496.5080 Service Cable or 2 normal laboratory cables with clips for attachment to "Gen.El" socket in the interior of the instrument after removal of the cover plate (2 M4 screws).
- Universal unit or ammeter for measured value 357 mA dc

Procedure

- Attach measuring instrument using cable (see above) to "Gen.El", select dc current range.
- Power on and select diagnosis by pressing key <9>.
- Press <SELECT> possibly several times until display shows

```
DIAGNOSIS▽    IO
```

- Press <ENTER> possibly several times until display shows

```
IG ON
```

The ammeter records a constant current of 357 mA (± 1 mA; take tolerance of measuring instrument into account)
Correct current flow (on wrong result) points to an error in the generator electrode.

6. Interconnections with other devices

Ensure that the set operating voltage matches the mains voltage before you switch on the instrument. The mains cables supplied with the instrument are three core and fitted with a plug with an earthing pin. If another plug has to be fitted, the yellow/green conductor must be connected to the protective earth. If no socket with earthing is available, the instrument must be connected to a perfect earth conductor via the earthing socket. Each break in the earthing inside or outside the instrument can make this a hazard. If the instrument is opened or if parts are removed from it, certain components can be live if the instrument is connected to the mains.
The mains cable must therefore always be disconnected when certain settings are made or parts replaced.

6.1 Coulometer with work stand

The base of the stand can be mounted on the left or right.
For work with the 707 KF Oven, the work stand must be on the left of the Coulometer. It is advisable to fix the stand in the rear position.

The instruments are setup and connected as shown in Fig. 6-1.

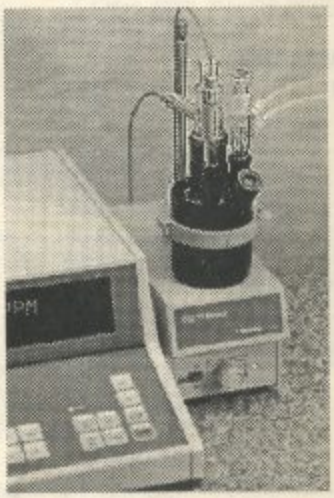


Fig. 6-1 a: With 703 Ti Stand

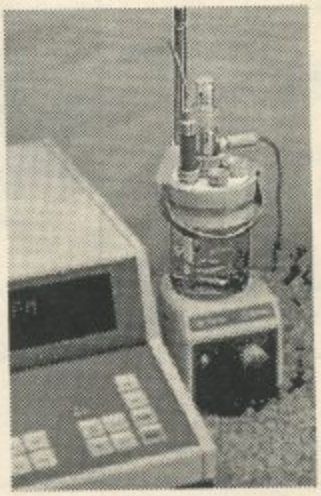


Fig. 6-1 b: With 728 Stirrer

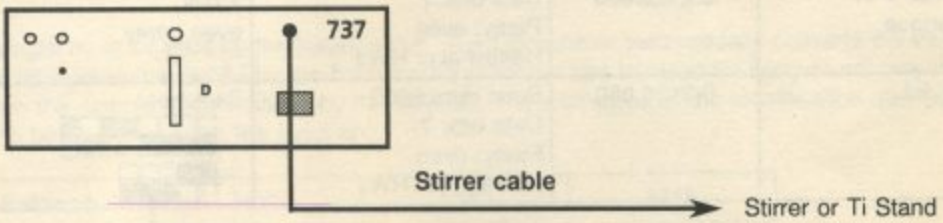


Fig. 6-1: Setting up the Coulometer and attaching the work stand

6.2 Connection of a printer

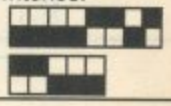
Any printer with an RS232 interface can be connected to the RS232 interface of the Coulometer.

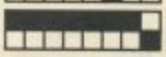
If a **balance** has to be attached at the same time as a printer, the 6.2125.030 Socket-Outlet Adapter must be used. The printer must be plugged into the "data out" receptacle of the socket-outlet adapter. It can be operated only with the simple hardware handshake (HWs) or without a handshake.

The following Table services to facilitate the connection of several printers:

Printer	Cable	Settings on Coulometer	Settings on printer
Citizen iDP560 RS	6.2125.050	Baud rate: 9600 Data bits: 7 Stop bits: 1 Parity: even Handshake: HWs	**Dip switches** 1 on 2 off } 9600 baud 3 off 4 off 5 on 7 bits 6 – 7 off } even 8 on parity Set printer on-line with <sel> **Jumpers:** 1 open } charact. 2 **closed** set d. 3 open 4 open 5 **closed**
Seiko DPU–411	6.2125.020	Baud rate: 9600 Data bits: 7 Stop bits: 1 Parity: even Handshake: HWs	**Dip switches:** **DIP01** 1 off serial 2 off no auto LF 3 on 40 characters 4 on character type 5 off zero represent. 6 off 7 on } USA 8 on -character set Set printer on-lone **DIP02** 1 off 7 bits 2 off } even 3 off parity 4 off 5 off } 9600 baud 6 off

Other printers can be attached:

Printer	Cable	Settings on 737	Settings on printer
Epson printer with 6-pin round connector[1])	6.2125.040	Data bits: 8 Parity: none Handshake: HWs	8 bits no parity
Epson printer with #8148 interface	6.2125.050	Data bits: 7 Parity: even Handshake: HWs	7 bits even parity
HP: Think Jet	6.2125.050	Baud rate: 9600 Data bits: 7 Parity: even Handshake: HWs	Switches: 

Printer	Cable	Settings on 737	Settings on printer
HP: Deskjet[1)]	6.2125.050	Baud rate: 9600 Data bits: 8 Parity: none Handshake: HWs	A: B: 
Kodak Diconix 180 si	6.2125.050	Baud rate: 9600 Data bits: 7 Parity: even Handshake: HWs	Epson emulation 7 bits even parity

1): On simultaneous connection of a balance which can operate only with 7 bits, "parity space" should be set on the balance, whereas printer and Coulometer operate with 8 bits, no parity.

6.3 Connection of a balance

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

Balance		Cables
Sartorius	MP8, MC1	6.2125.070
Mettler	AM, PM	from Mettler: ME 33995: Green wire to pin 2, brown to pin 3, white to pin 7, yellow to pin 20 of the 25-pin connector.
	Interface 016:	Cable part of standard equipment of interface 016: Red wire to pin 3, white wire to pin 7 of the 25-pin connector
	Interface 011 or 012	6.2125.020
Mettler AT		from Mettler: ME 33995: Green wire to pin 2, brown to pin 3, white to pin 7, yellow to pin 20 of the 25-pin connector.
AND	Types ER-60, 120, 180, 182	6.2125.020
	Types FR-200, 300	6.2125.020
	Types FX-200, 300, 320 with RS232 interface (OP-03)	6.2125.020
Precisa	Balances with RS232 interface	6.2125.080

The balance type must be preselected on the Coulometer with the <CONFIG> key.
Balance and printer can be attached simultaneously using the 6.2125.030 Socket-Outlet Adapter. The balance must then be plugged into the "data in" receptacle of the socket-outlet adapter.

The weight must be sent by the balance in g. The Coulometer automatically converts the value into mg. A special input unit supplied by the balance manufacturer can be used for entry of not only the weight but also the sample identifications by the balance. The addresses of the identification may possibly have to be preselected on the input unit.

Balance	Id#1	Id#2	Id#3
Sartorius	ID.1 or 26	ID.2 or 24	C-20 or 23
Mettler (AT)	C (ID#1)	B (ID#2)	A (c20)

6.4 Connection of the 707 KF Oven

The oven is connected as follows:

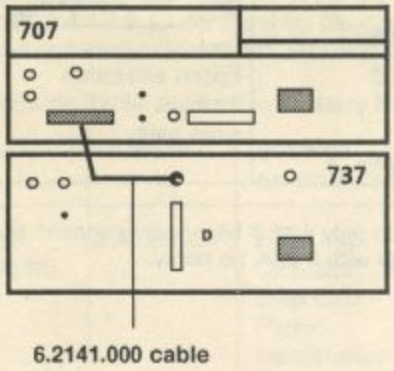


Fig. 6-2: Connection of the 707 KF Oven

For work with the 707 KF Oven, the work stand must be mounted on the left of the instrument.

Setting up the instruments:

Fig. 6-3 a: Measuring cell without diaphrgam

Fig. 6-3 b: Measuring cell with diaphragm

Fig. 6-3: Setting up the Coulometer with 707 KF Oven

6.5 Connection of a computer

The computer is connected as follows:

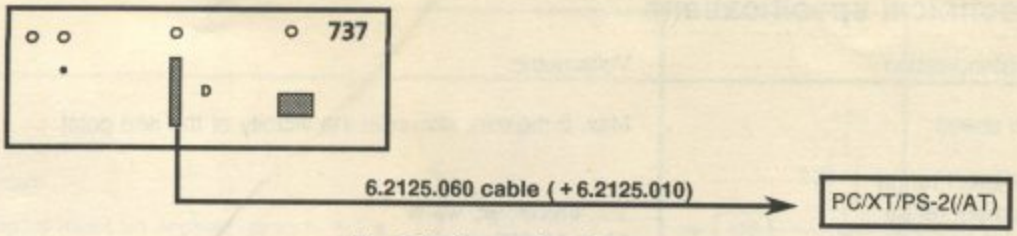


Fig. 6-4: Connection of a computer

For the attachment of IBM® AT computers, the 6.2125.010 Adapter is also needed.

Preselection on Coulometer:
RS232 settings: depending on control program of the computer

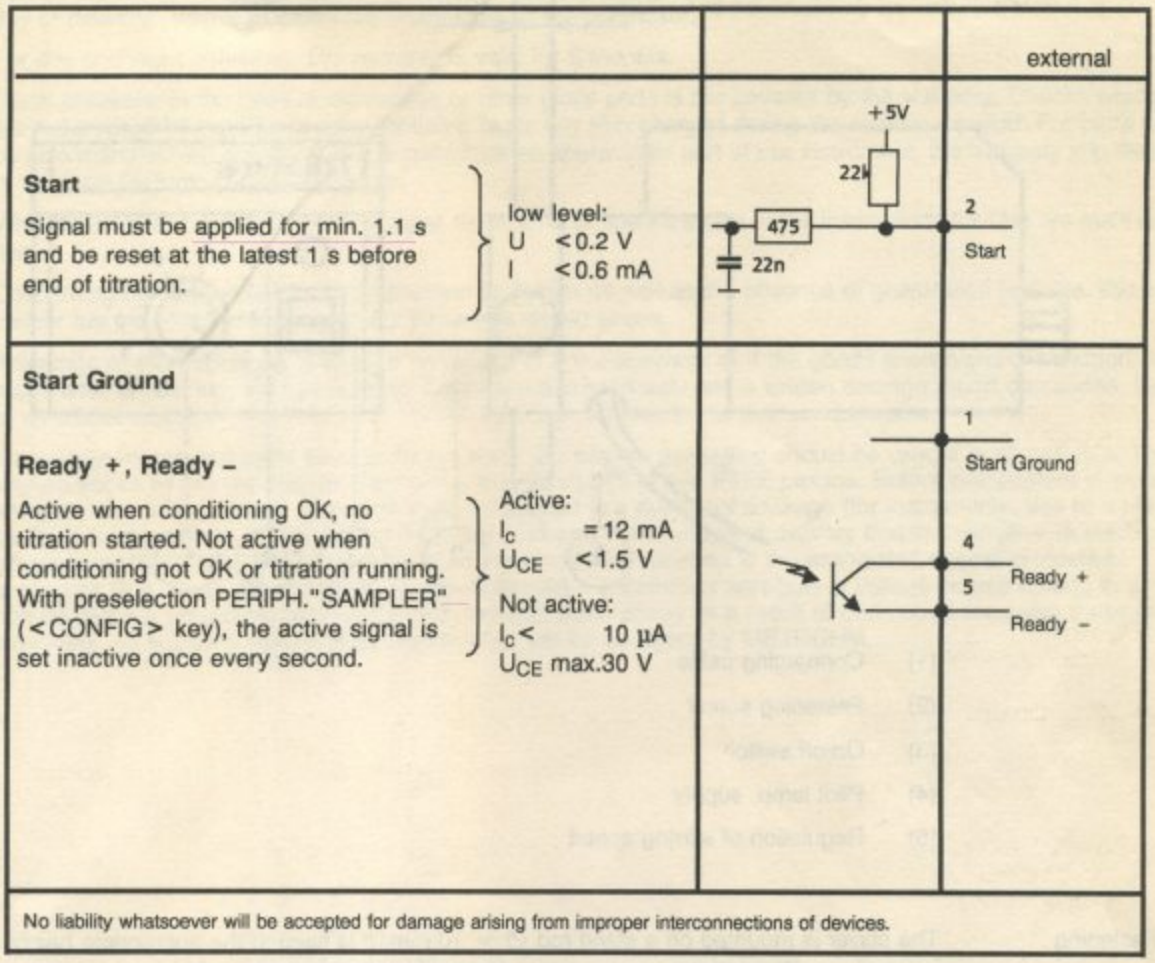
Program package for the data transfer Coulometer↔computer,
3½" Diskette 6.6020.000

7. Appendix

7.1 Technical specifications

End point indication	Voltametric
Titration speed	Max. 2 mg/min, slower in the vicinity of the end point
Determination range	
Instrument range	1 ... 65 535 µg water
Usual in practice	10 ... 10 000 µg water
Resolution	
$m(H_2O) \leq 99{,}9$ µg	0,1 µg
$m(H_2O) \geq 100$ µg	1 µg
Measurement error	
$m(H_2O) \leq 1000$ µg	≤ ca. 5 µg
$m(H_2O) \geq 1000$ µg	≤ ca. ± 0,5%
Materials	
Housing	Light metal injection moulding, multicoat stove enamel
Keypad covers	Polycarbonate (PC)
Display	Vacuum fluorescent display, 16 characters
Character height	17 mm
RS232 interface	For printer and balance connection or computer connection: full remote control by external control device
"Remote" socket	For oven or sample changer connection
Input signals	Start
Output signals	Ready/conditioning OK
Ambient temperature	
Nominal operational range	5 ... 40 °C
Storage, tansport	– 20 ... 60 °C
Safety specifications	Construction and testing in accordance with IEC publication 1010, protection class I. These Instructions for Use contain information and warnings which must be heeded and complied with by the user to ensure safe operation of the instrument.
Mains connection	
Voltage	100, 117, 220, 240 V ± 10%, switchable; for 230 V set to 240 V
Frequency	50 or 60 Hz
Power consumption	ca. 40 VA
Fuses	0,4 A (slow-blow) for 100 and 117 V 0,2 A (slow-blow) for 220 and 240 V
Dimensions w × h × d	570 mm × 290 mm × 520 mm
Weight	ca. 8,5 kg

7.2 Pin assignment of the "Remote" socket



Start

Signal must be applied for min. 1.1 s and be reset at the latest 1 s before end of titration.

low level:
U <0.2 V
I <0.6 mA

Start Ground

Ready +, Ready –

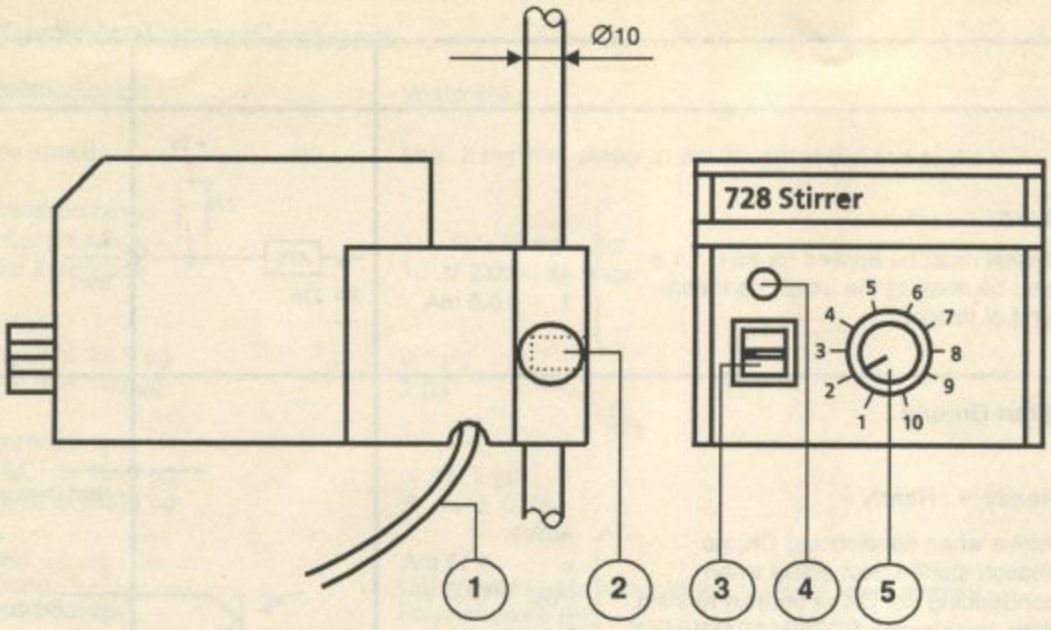
Active when conditioning OK, no titration started. Not active when conditioning not OK or titration running. With preselection PERIPH."SAMPLER" (<CONFIG> key), the active signal is set inactive once every second.

Active:
I_C = 12 mA
U_{CE} <1.5 V

Not active:
I_C < 10 µA
U_{CE} max.30 V

No liability whatsoever will be accepted for damage arising from improper interconnections of devices.

7.3 Instructions for Use for 728 Magnetic Stirrer



(1) Connecting cable
(2) Fastening screw
(3) On/off switch
(4) Pilot lamp, supply
(5) Regulation of stirring speed

Fastening — The stirrer is mounted on a stand rod Ø = 10 mm. It is fixed at the appropriate height using screw (2) so that it can be swung out to the left or right from the working position.

Power supply — $U_{DC} \approx 8$ V

Stirring speed — stabilised, $n \approx 200$ ..... 1900 min^{-1} (without load)

Stirring bar — PTFE coating, magnetic core

	Length	Dimensions	Shape
6.1903.000	8 mm	Ø = 4 mm	O
6.1903.010	12 mm	Ø = 4 mm	O
6.1903.020	16 mm	Ø = 4 mm	O
6.1903.030	25 mm	Ø = 5 mm	O
6.1906.000	42 mm	-	Δ
6.1906.010	25 mm	-	Δ
6.1906.020	26 mm	-	oval

7.4 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, burette cylinders and PTFE pistons. Before embedment 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 Standard equipment and ordering designations

7.5.1 737 KF Coulometer

KF Coulometer with **measuring cell without diaphragm**, 50 Hz **2.737.0112**
including the following accessories:

1	Double Pt electrode with SGJ 14/15	6.0341.100
1	Generator electrode with SGJ 29/22	6.0342.100
1	Drying tube with SGJ 19/17	6.1403.030
1	Glass stopper with SGJ 14/15	6.1437.000
1	Dispensing/aspirating tube with SGJ 14/15	6.1439.010
1	Stopper SGJ 14/M10 for work with the KF Oven	6.1446.060
2	Threaded stoppers M8 for work with a pump	6.1446.080
2	Sets of septa (5 per set)	6.1448.020
1	Titration vessel, 200 mL, brown glass with SGJ	6.1455.313
1	Tubing connection M6, 10.5 cm, for work with the KF Oven	6.1805.070
1	Tubing connection M8, 50 cm, for work with a pump	6.1805.200
1	Stirring bar, 25 mm	6.1903.030
1	Titration vessel holder	6.2047.000
1	Electrode cable, connector F, 1 m, for indicator electrode	6.2104.020
1	Electrode cable, connector H, 1 m, for generator electrode	6.2104.120
1	Screw cap	6.2701.040
3	PTFE ground joint sleeves SGJ 14	6.2713.000
1	PTFE ground joint sleeve SGJ 29	6.2713.010
1	PTFE ground joint sleeve SGJ 19	6.2713.020
1	Stopper with nipple M10, nipple for work with the KF Oven	6.2730.030
1	Funnel	6.2738.000
1	Bottle molecular sieves, 250 g	6.2811.000
1	Syringe, 1 mL	6.2816.000
1	Needle for syringe	6.2816.010
1	Mains cable, cable plug to customer's specifications	
	Type SEV 12 (Switzerland ...)	6.2122.010
	Type CEE(7),VII (Germany...)	6.2122.030
	Type NEMA/ASA (USA...)	6.2122.060
1	Dust cover	6.2723.250
1	Set Instructions for Use for 737 KF Coulometer	8.737.1003

KF Coulometer with **diaphragm-free measuring cell**, 60 Hz **2.737.0113**
Accessories as above.

KF Coulometer with **measuring cell with diaphragm**, 50 Hz **2.737.0012**
including the following accessories:

1	Magnetic stirrer	1.728.0010
1	Double Pt electrode	6.0338.100
1	Generator electrode	6.0339.000
1	Drying tube	6.1403.030
1	Titration vessel upper half	6.1414.040
1	Titration vessel lower half, 200 mL	6.1415.310
1	Threaded stopper for closing the gas inlet tube	6.1446.040
2	Sets septa (5 per set)	6.1448.010
1	Set seals for titration vessel upper half	6.1454.000
1	Gas inlet tube	6.1617.010
1	PTFE tubing connection, 10.5 cm	6.1805.070
1	Stirring bar, 16 mm	6.1903.020
1	Stirring bar, 25 mm	6.1903.030
1	Stand support	6.2001.040
1	Clamping ring, 10 cm	6.2013.010
1	Stand rod, 25 cm	6.2016.030
1	Electrode cable, connector F, 1 m, for indicator electrode	6.2104.020
1	Extension cable for magnetic stirrer	6.2108.100
1	PTFE ground joint sleeve, SGJ 19	6.2713.020
3	Screw nipples	6.2730.010
1	Funnel	6.2738.000
1	Bottle molecular sieves, 250 g	6.2811.000
1	Syringe, 1 m	6.2816.000
1	Needle for syringe	6.2816.010
1	Mains cable, cable plug to customer's specifications	
	Type SEV 12 (Switzerland...)	6.2122.010
	Type CEE(7), VII (Germany...)	6.2122.030
	Type NEMA/ASA (USA...)	6.2122.060
1	Dust cover	6.2723.250
1	Set Instructions for Use	8.737.1003

KF Coulometer with **measuring cell with diaphragm**, 60 Hz **2.737.0013**
Accessories as above.

7.5.2 Options

Ti Stand; compact titration stand with built-in stirrer and pump for the addition of fresh solution and for siphoning off waste solution 2.703.0010

Measuring cell

Measuring cell without diaphragm, complete	6.5405.000
Sealing ring for measuring cell with diaphragm	6.1454.030
Magnetic stirring bar, length	
12 mm	6.1903.010
16 mm	6.1903.020
25 mm	6.1903.030

KF Oven

707 KF Oven with automatic drive of the weighing boat and built-in air pump	2.707.0010
Connecting cable	6.2141.000
688 KF oven	
Mains with 220...240 V	2.688.0014
Mains with 100...120 V	2.688.0015

Automatic sample metering and addition	
708 Sampling Unit for sample metering	2.708.0010
698 Autosampler, sample changer	2.698.0010
Cable 737 KF Coulometer – 698 Autosampler	6.2128.050
Cable 708 Sampling Unit – 698 Autosampler	6.2128.040
Printers	
Citizen printer iDP560 RS	2.140.0014
Cable 737 KF Coulometer – Citizen printer iDP560 RS	6.2125.050
Seiko printer DPU-411, 220 V	2.141.0014
Seiko printer DPU-411, 120 V	2.141.0015
Cable 737 KF Coulometer – Seiko printer DPU-411	6.2125.020
Cable 737 KF Coulometer – EPSON printer with 6-pin round connector	6.2125.040
Cable 737 KF Coulometer – EPSON printer with RS interface #8148	6.2125.050
Cable 737 KF Coulometer – HP Think Jet, HP Desk Jet	6.2125.050
Cable 737 KF Coulometer – Kodak Diconix 180 si	6.2125.050
Socket-outlet adapter for simultaneous attachment of a balance	6.2125.030
Balance connection	
Sartorius balances MP8, connecting cable	6.2125.070
Mettler AT, PM balances and balances with interface 016	Cables from Mettler
Mettler balances with interface 011 or 012	6.2125.020
AND balances (with RS232 interface OP-3), connecting cable	6.2125.020
Precisa balances, connecting cable	6.2125.080
Socket-outlet adapter for simultaneous attachment of a printer	6.2125.030
Computer connection, control via RS232 C interface	
Cable 737 KF Coulometer – IBM® PC/XT/PS-2 or compatibles	6.2125.060
Cable 737 KF Coulometer – IBM® AT	6.2125.060 + 6.2125.010
RS232 C extension cable	6.2125.020
Program package for data transfer 737 KF Coulometer – IBM® PC or compatibles, 3½" diskette	6.6020.000

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INS/5033

Horno KF 707

Instrucciones para el uso

8.707.1015

Metrohm
Análisis iónico
Metrohm Ltd.
CH-9010 Herisau
Suiza

Parámetros

Siga la consulta con <PARAM> y <ENTER>

Los valores iniciales están **impresos en negrita**

Pantalla	Significado	Gama de entradas
temperatura	Temperatura de la muestra.	**50**...300 °C
un.flujo gas:	Unidad para la indicación del flujo de gas.	**mL/min**, L/h
flujo gas min.	Flujo mínimo de gas.	0...**5**...999 mL/min o en L/h
tipo de gas:	Selección del tipo de gas portante.	**aire**, N2, otro
factor	Factor para "otro" gas portante.	0.001...**1**...9.999
tiempo de purga	Tiempo de espera antes del comienzo del calentamiento con la válvula en "purge".	**0**...99 999 s
tiempo de acond.	Tiempo de espera antes del comienzo del calentamiento con la válvula en "transfer".	**0**...99 999 s

Teclas para las funciones individuales manuales

Tecla	Significado
<HEATER>	Calefacción conexión/desconexión.
<PUMP>	Bomba conexión/desconexión. Desconexión de la bomba cuando se utiliza N2 como gas portante.
<VALVE>	Conmutación de la válvula. La posición de la válvula se observa en el piloto "VALVE".
<BOAT IN>	Entrada de la navecilla; se mueve hasta que se vuelva a pulsar la tecla.
<BOAT OUT>	Salida de la navecilla; se mueve hasta que se vuelva a pulsar la tecla.
<PRINT>	Activa la impresión manual.

Configuración

Siga la consulta con <CONFIG> y <ENTER>

Los valores iniciales están **impresos en negrita**

Pantalla	Significado	Gama de entradas
>ajustes del horno		
preparación auto:	Preparación del horno tras conectar red.	sí, **no**
ajustar válvula:	Ajuste la válvula después del desarrollo.	**sí**, no
start si acond.ok:	Comienza el desarrollo sólo si el aparato conectado está acondicionado.	sí, **no**
límite temp.start	Comienza el desarrollo sólo si la temperatura está en la gama.	1...**5**...100 °C
transmisión a:	Selección de la impresora (juego de carácteres)	**IBM**, Epson, Seiko, Citizen, HP
impresión:	Impresión automática.	sí, **no**
>ajustes varios		
diálogo:	Selección de la lengua del diálogo.	**english**, deutsch, francais, español
n.de muestra	Número correlativo de la muestra.	**0**...9999
comienzo auto	Comienzos automáticos.	1...9999, **no**
t(espera)	Tiempo de espera antes del comienzo.	**0**...9999
aviso acústico	Aviso acústico.	**1**...9, no
dirección	Designación del instrumento para llamada vía control remoto.	hasta 8 caracteres ASCII
programa	Versión del programa.	ninguna entrada
>ajustes para RS232		
baud rate:	Baud Rate.	300, 600, 1200, 2400, 4800, **9600**
data bit:	Data Bit.	7, **8**
stop bit:	Stop Bit.	**1**, 2
paridad:	Paridad.	par, impar, **ninguna**
handshake:	Handshake.	**HWs**, HWc, SWlinea, SWcar, ninguno
control RS:	Recepción de órdenes por medio del interfase RS.	**sí**, no

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Metrohm AG

CH-9101 Herisau (Suiza)

Horno KF 707

Serie 05...

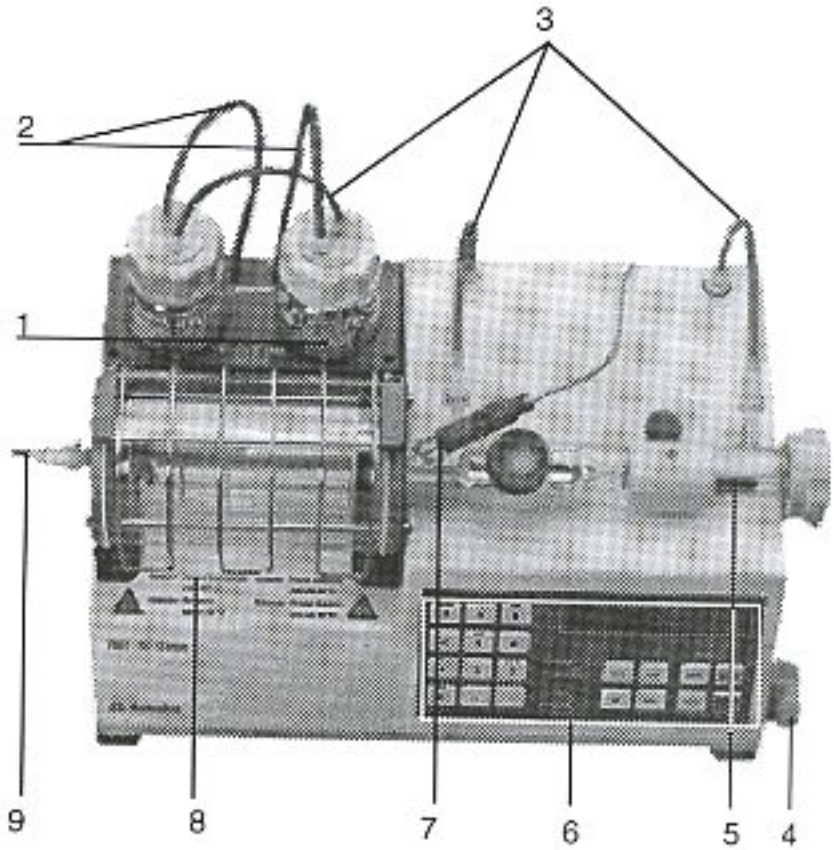
Los siguientes componentes alrededor del tubo hervidor del Horno KF pueden estar calientes:
Tubo hervidor, paredes laterales del blindaje del tubo, rejilla protectora del tubo, cubierta de la calefacción de salida.
Cuidado: No toque estas piezas ni las ponga en contacto con un disolvente.

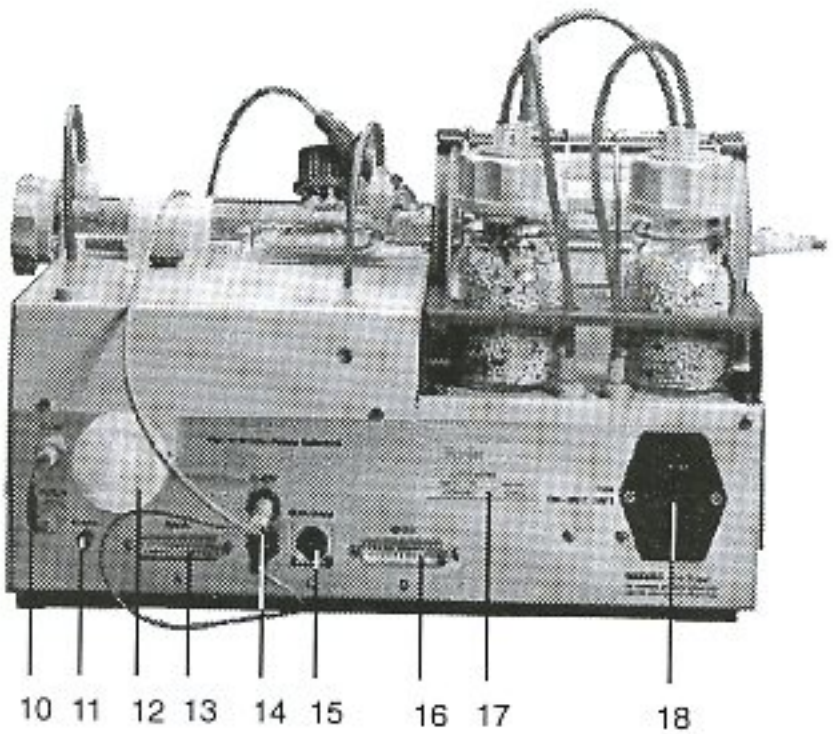
97.02 Ti

8.707.1015

Metrohm AG

Horno K





1. Vista general

Parte anterior

1 **Botella de secado**
llena de cribas moleculares. Para secar el gas portante.

2 **Conexiones del tubo**
con tubo 6.1805.180.

3 **Conexiones del tubo**
con tubo 6.1805.080.

4 **Válvula de ajuste para el flujo de gas**

5 **Tubo insertado del horno**
contiene navecilla de muestras con vara de conducción.

6 **Panel de servicio**
con pantalla, teclado y pilotos de estado.

7 **Termosonda**
para medir la temperatura de la muestra.

8 **Tubo de calentamiento**
con paredes laterales blindadas y rejilla protectora.

9 **Tubo de salida**
conduce al recipiente de titración. Tubo 6.1805.070 o tubo de salida calentable 6.1830.000 (opcional).

Parte posterior

10 **Conexión del tubo**
con tubo 6.1805.040.

11 **Ajustes del contraste para la pantalla**

12 **Filtro del aire**

13 **Conexión para titradores**

14 **Conexión para termosondas**
conecte el enchufe gris del cable a la ficha roja del horno

15 **Conexión para la calefacción de salida**

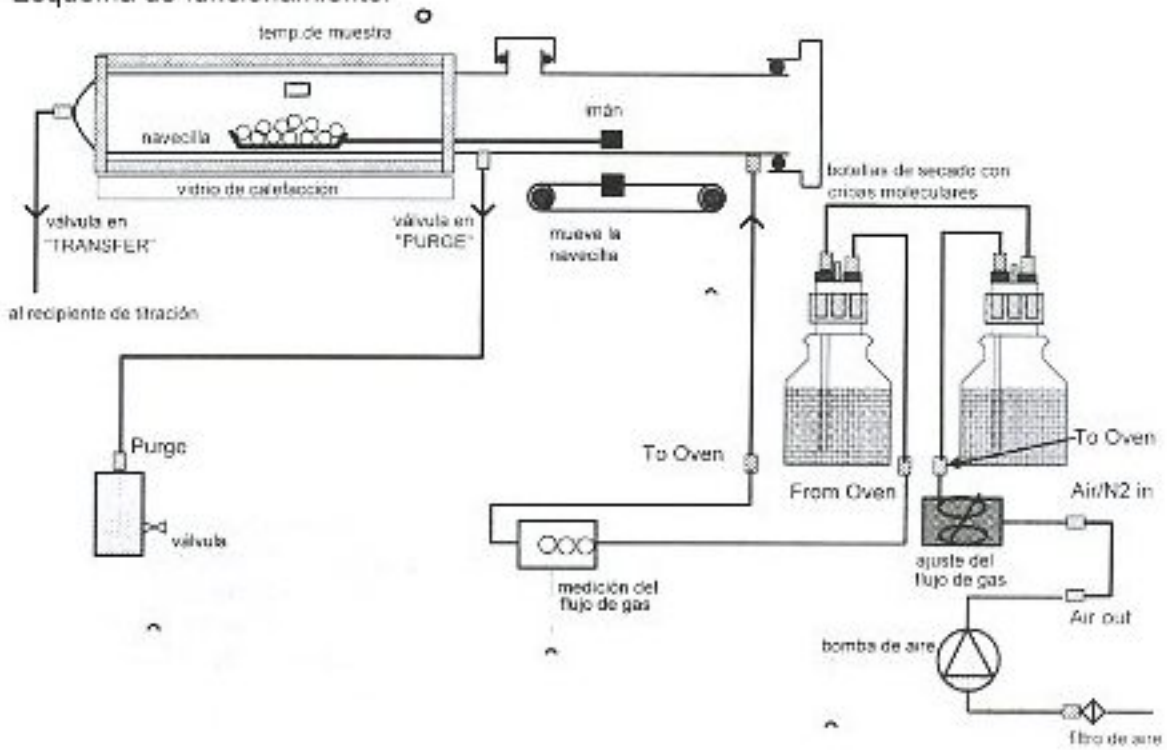
16 **Interfase RS232**
para la conexión de una impresora u ordenador

17 **Placa indicadora de tipo**
con número de fabricación, serie e instrumento.
Indicación del voltaje ajustado en la red, la frecuencia de la red y la energia absorbida. Antes de la primera conexión compruebe si el voltaje ajustado coincide con el de su red eléctrica. Si éste no fuera el caso, desconecte el cable de la red y cambie el voltaje, vea página 49.

18 **Equipo de alimentación**
con interruptor y conexión a la red.
En el caso de redes en las que haya un voltaje con fuertes interferencias HF, hay que equipar el horno KF con un filtro adicional de la red, por ejemplo, el modelo de Metrohm 615.

1.1 Modo de funcionamiento

Esquema de funcionamiento:



Flujo de gas:
Si se utiliza aire como gas portante, se trabaja con la bomba de aire incorporada en el horno. La bomba aspira el aire a través del filtro a tal efecto.
Si se utiliza otro tipo de gas como gas portante, se introduce éste por el manguito "Air/N_2 in".

El flujo de gas se ajusta con la válvula situada en la parte lateral del horno y es conducido por medio de la botella de secado. La medición del flujo de gas se realiza inmediatamente antes de la entrada en el tubo insertado.

Si la válvula está en "PURGE", la corriente de gas fluye por la abertura "Purge". De este modo se conduce sólo por la parte fría y anterior del tubo insertado.
Si la válvula está en "TRANSFER", el gas fluye por todo el tubo insertado, es decir, también por la zona caliente del horno. La salida del gas se origina al final del tubo insertado donde el gas es conducido a la célula de titración KF y se titra la humedad de la muestra.

2. Condiciones de trabajo

2.1 Manejo de la navecilla de muestras

La navecilla de muestras y la vara de conducción se han de utilizar siempre con la abrazadera de sujeción 6.2056.000 para poder, así, evitar que el resultado de la medición sea erróneo debido a la humedad del piel adherida al vidrio.
Tanto la navecilla de muestras como la vara de conducción han de secarse bien después de su limpieza (secador, horno de secado) y almacenarse en un desecador.
La limpieza de la navecilla de muestras no es necesaria si se utilizan las inserciones de aluminio (número de pedido 6.2623.000) (especialmente aconsejable si las muestras se funden o descomponen).

Introducción de la navecilla de muestras en el horno:

Sujete la navecilla con la abrazadera de modo que el anillo de la navecilla ajuste en la abertura de la abrazadera. Coloque la navecilla en el tubo insertado. El anillo debe sobresalir aún.

Sujete la vara de conducción con la abrazadera. Los dos dientes de la abrazadera han de quedarse por debajo. Enganche la vara de conducción al anillo de la navecilla y hágalo entrar en el tubo insertado.
La navecilla también se puede sujetar con la vara de conducción e introducir, como unidad "Navecilla y vara de conducción", en el horno.

Cierre el tubo insertado con la tapa.
Ponga en marcha con <START>.

Para sacar la navecilla de muestras del horno:

Abra la tapa del tubo insertado.
Sujete la vara de conducción con la abrazadera y sáquela hasta que el final de la navecilla de muestras desde el tubo insertado se pueda sujetar bien con la abrazadera.
Desenganche la vara de conducción del anillo de la navecilla y depositelo, por ejemplo, detrás del horno. Déjelo de tal forma que la agarradera de la vara de conducción sobresalga por encima del canto superior del horno y se pueda sujetar fácilmente con la abrazadera.
Sujete la navecilla con la abrazadera y sáquela.

La nevecilla y la vara de conducción también se pueden sacar juntas del horno.

Cierre de nuevo el tubo insertado con la tapa.

2.2 Desarrollo automático de una determinación

La automatización de la secuencia facilita la labor cuando hay un Titrador KF conectado. Una vez comenzada la secuencia se efectuarán en el horno todos los pasos necesarios para la determinación.

Una vez conectado, el horno se calienta a la temperatura nominal (si en <CONFIG> está ajustado a "preparación auto: si"). Si la temperatura nominal aún no se ha alcanzado, "READY" aparece intermitente.

Si se alcanza la temperatura nominal (en la gama preseleccionada), se ilumina "READY" permanentemente.

Ajuste el flujo de gas que desee (por ej.: 100 mL/min). Efectúe el ajuste con el horno en caliente.

Pase la navecilla de muestras y la vara de conducción a la parte fría del tubo insertado.

Comience la secuencia en el horno KF con la tecla <START>.

tiempo de purga 13 s

Si se ha introducido un tiempo de purga, se esperará a que éste haya transcurrido.

La válvula cambia de "PURGE" a "TRANSFER", es decir, el flujo de gas se conduce ahora al recipiente de titración.

tiempo de acond. 5 s

Si se ha introducido un tiempo de acondicionamiento, se esperará a que éste haya transcurrido.

Se comprueba el Titrador conectado, si el recipiente de titración está acondicionado (si <CONFIG> "start si acond.ok: sí" está conectado), entonces se desencadena automáticamente el Titrador y la navecilla de muestras se desplaza a la parte caliente del horno. La muestra se calienta, el agua de la muestra se conduce junto con el gas portante en el recipiente de titración y allí se titra.

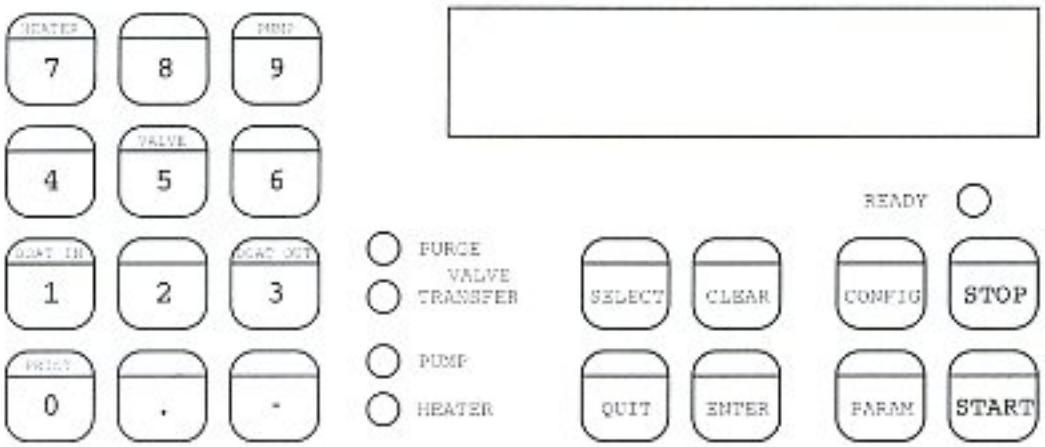
ó

Cuando la titración se acaba y con "ajustar válvula: sí>", la válvula se ajusta automáticamente a "PURGE" (lavado) y la navecilla de muestras sale de la zona caliente.
Con "ajustar válvula: no" la válvula se deja a "TRANSFER".

Si la temperatura nominal está en orden, se ilumina "READY" y el horno está preparado para la siguiente determinación.

2.3 Ajustes en el Horno KF

2.3.1 Teclado



Teclas para las funciones manuales individuales:

<HEATER> Conexión/desconexión de la calefacción. "HEATER" se ilumina o aparece intermitente si la calefacción está conectada. (El piloto se ilumina constantemente si se calienta al máximo; aparece intermitente si funciona a un nivel más reducido).
Nota:
Si se desconecta la calefacción y se deja la válvula a "TRANSFER" se puede aspirar solución del recipiente de titración.

<PUMP> Conexión/desconexión de la bomba. "PUMP" se ilumina si la bomba está conectada.

<VALVE> Conmutación de la válvula. "VALVE, PURGE" y "VALVE, TRANSFER" muestran la posición de la válvula.
Por motivos de seguridad la válvula pasa a "PURGE" al final de cada determinación automática y con el aparato desconectado (aspiración de la solución del recipiente de titración).

<BOAT IN> La navecilla de muestras pasa a la parte caliente del horno y continúa hasta que se pulse de nuevo la tecla o hasta llegar al tope interior.

<BOAT OUT> La navecilla sale de la parte caliente del horno y continúa hasta que se vuelva a pulsar la tecla o hasta llegar al tope exterior.

<PRINT> Se produce la impresión del informe.
Secuencia de las teclas:
<PRINT><SELECT><ENTER>; pulse <SELECT> tantas veces como sea necesario hasta que aparezca en la pantalla el informe deseado
o
<PRINT><Tecla X><ENTER>; Tecla X = PARAM o CONFIG

Teclas de control de entradas y de la secuencia:

<SELECT>	Sirve para elegir las diferentes entradas. El signo ":" después del texto del diálogo indica que se utiliza <SELECT> para la selección de las entradas. Con <SELECT> se puede también elegir la ocupación de la segunda línea de la pantalla: Conmutación de la indicación del flujo de gas a mensajes, a la indicación de la temperatura del horno y al flujo de gas nuevamente.
<CLEAR>	- Borra los valores de entrada - Ajusta los valores especiales, por ej.: "no"
<QUIT>	- Salida de las consultas - Parada de los tiempos de espera - Parada de la impresión - Salida de los mensajes de errores
<ENTER>	- Recepción de valores de entrada - Cierre de las secuencias de órdenes

Teclas con consultas rotatorias:

Pulsar repetidamente estas teclas conlleva al siguiente (grupo de) consulta.

<CONFIG>	Datos de la configuración, vea pág. 9. Las consultas están distribuidas en grupos. Los títulos de los grupos de preguntas están señalizados con ">". Con <ENTER> se entra en el grupo de consultas.
<PARAM>	Parametros para la secuencia automática, vea pág.11.

Teclas para la secuencia automática:

<STOP>	Detiene la secuencia automática.
<START>	Comienza la secuencia automática. El comienzo es sólo posible, si "READY" está permanentemente encendido, es decir, la temperatura nominal está en la gama preseleccionada por "límite temp.start".

2.3.2 Tecla <CONFIG>

Las consultas están dispuestas en grupos. El título de dichos grupos está señalizado con ">". Para entrar en los grupos de preguntas utilice <ENTER>.

>ajustes del horno — **Grupo de consultas: Ajustes generales del horno**

preparación auto: no — *Preparación automática después de la conexión (sí, no)*
"sí" significa: Calentamiento automático a la temperatura de la muestra.

ajustar válvula: sí — *Ajuste automáticamente la válvula (sí, no)*
"sí" significa: Al final del desarrollo la válvula está ajustada a "PURGE". Con "no", la válvula se deja a "TRANSFER".

start si acond.ok: no — *Sólo es posible comenzar si el instrumento de titración conectado está acondicionado (sí, no)*
"sí" significa: La navecilla de muestras pasará a la parte caliente del horno cuando el instrumento de titración conectado esté acondicionado.
Si no hay ningún instrumento de titración conectado hay que ajustarlo a "no".

límite temp.start 5 °C — *Sólo es posible comenzar si la temperatura está en la gama preseleccionada con respecto a la temperatura nominal (1...100 °C)*

transmisión a: IBM — *Selección del tipo de impresora/juego de caracteres (Epson, Seiko, Citizen, HP, IBM)*
"Epson" para modo Epson
"Seiko" por ej.: para DPU-411
"Citizen" por ej.: para iDP 560 RS
"HP" para modo HP
"IBM" para todas las impresoras con tablas de juego de caracteres IBM 437, así como para la transmisión de datos a un ordenador o sistema de datos.

impresión no — *Impresión al final del desarrollo automático (sí, no)*
Ejemplo de impresión:

```
 'fr
707 KF Oven            CD1/108  707.0010
  n.de muestra                1
  tiempo de purga          10 s
  tiempo de acond.          5 s
  tempo de cal.           567 s
  temp.muestra            150 °C     Temp. nominal
  temp.mínima             147 °C     durante el calent.
  temp.máxima             150 °C     durante el calent.
  tipo de gas:           aire
  flujo de gas             87 mL/min  flujo medio
                ==============
```

>ajustes varios		Grupo de consultas: Ajustes varios
diálogo:	english	*Selección de la lengua del diálogo (english, deutsch, francais, español)*
n.de muestra	0	*Número correlativo de la muestra (0...9999)* El número de la muestra se ajusta a 0 en la conexión.
comienzo auto	no	*Comienzos automáticos internos (1...9999, no)* Número de los comienzos automáticos.
t(espera)	0 s	*Tiempo de espera (0...9999 s)* Tiempo de espera después del comienzo y antes de que empiece el desarrollo automático. el tiempo de espera se puede interrumpir con <QUIT>.
aviso acústico	1	*Aviso acústico (1...9, no)* Número de avisos acústicos cuando el aparato está preparado.
dirección		*Designación del instrumento para el reconocimiento individual en la agrupación de aparatos (hasta 8 caracteres ASCII)*
programa	707.0012	*Indicación de la versión del programa*

>ajustes para RS232		Grupo de consultas: Ajustes RS232
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)*
paridad:	ninguna	*Paridad (par, impar, ninguna)*
handshake:	HWs	*Handshake (HWs, HWc, SWlinea, SWcar, ninguno)* vea también páginas 29ff.
control RS:	sí	*Control via interfase RS232 (no, sí)* "no" significa: La recepción de órdenes y datos por medio del interfase RS232 está cerrada. La emisión de datos es posible.

2.3.3 Tecla <PARAM>

Contiene los parámetros para el desarrollo automático.
*live significa: Este parámetro se puede editar durante el desarrollo automático.

temperatura 50 °C

Temperatura de la muestra (50...300 °C)
Temperatura a la que hay que calentar la muestra.

un.flujo gas: mL/min

Unidad para la indicación del flujo de gas (mL/min, L/h)
Todas las indicaciones y entradas para el flujo de gas se ajustan según la unidad elegida.

flujo gas min. 5 mL/min

Flujo mínimo de gas (0...999 mL/h o 0...59.9 L/h)
El desarrollo automático se puede efectuar sólo cuando se haya alcanzado el flujo mínimo de gas.

tipo de gas: aire

Selección del tipo de gas portante (aire, N2, otro) o selección del gas para la determinación de humedad en el gas.
Si se elige "otro", hay que introducir adicionalmente el factor para la medición del flujo de gas. Como punto de referencia para el factor puede observar los siguientes valores

Ar	0.686	Aire	1.000
CH_4	1.392	N_2	0.999
CO_2	1.353	N_2O	1.901
Gas natural	1.465	O_2	1.006
He	0.685	Propano	2.793

tiempo de purga 0 s
*live

Tiempo de purga (0...99 999 s)
Tiempo de espera antes del calentamiento, es decir, entes de que la navecilla pase al horno. La válvula permanece en "PURGE".
El tiempo de espera se puede interrumpir con <QUIT>.
El tiempo de purga sólo se debe aplicar cuando la muestra fría cede con dificultad la humedad.

tiempo de acond. 0 s
*live

Tiempo de acondicionamiento (0...99 999 s)
Tiempo de espera antes del calentamiento, es decir, antes de que la navecilla pase al horno. La válvula cambia a "TRANSFER".
El tiempo de espera se puede interrumpir con <QUIT>.
El tiempo de acondicionamiento sólo se debe aplicar cuando la muestra fría cede con dificultad la humedad.

2.4 Instrucciones prácticas

Introducción de muestras por la abertura superior del tubo insertado
Si se van a calentar varias muestras consecutivamente en la misma navecilla, se puede realizar de este modo.
Introduzca las muestras en la navecilla con una jeringa o abra la tapa roscada.

Selección del gas portante
Se debería elegir N_2 como gas portante siempre que la muestra caliente sea sensible al aire o al oxígeno y ceda sustancias oxidables. Con temperaturas superiores a los 150 °C (o los 200 °C en caso de sustancias sintéticas) se debería utilizar N_2 como gas portante.

Ajuste de temperatura
La temperatura hay que ajustarla a la mayor altura que permita la muestra (alta temperatura = corto tiempo de análisis): La muestra puede desprender agua, pero no sustancias oxidables.

Tiempo de extracción
Hay que ajustar un tiempo de extracción de 2 minutos, aproximadamente, en el titrador conectado, con el fin de evitar que la titración se detenga antes de que la muestra desprenda el agua.

Acondicionamiento del sistema
Para acondicionar el sistema total antes del comienzo (sin navecilla de muestras y sin muestras), se puede ajustar la válvula del horno KF a "TRANSFER".

Literatura
- Hydranal ® Praktikum, Riedel-deHaën, 1987 (en inglés)
- G. Wieland, Karl Fischer Titration, GIT Verlag, Darmstadt, 1985 (en inglés o francés)
- Los siguientes boletines de aplicación de Metrohm (se pueden encargar de forma gratuita, en inglés o francés):
No. 109 Karl Fischer water determinations with the KF Ofen
Nr. 145 Determination of low water contents in plastics
Nr. 217 KF water determinations in pharmaceutics

3. Operation via RS232 interface

3.1 General rules

The 707 KF Oven has an extensive remote control facility that allows full control via the RS232 interface, i.e. the instrument can receive data from an external controller or it can send data to an external controller. C_R and L_F are used as terminators for the data transfer. The 707 KF Oven 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 terminator. The controller terminates its commands with C_R and L_F. If the controller sends more than one command per line, the character ';' is used as separator between the commands.

The commands are grouped logically and are simple to understand. Thus, e.g. for the selection of the dialog language the command

&Config.**A**ux.**L**anguage **"english"**

must be sent, but only the boldface characters need be inputted, thus

&C.A.L "english" .

The data groups of this order are:

Config	Entries for the configuration
Aux	Auxiliaries, various subjects
Language	Dialog language

The commands have a hierarchial structure (tree structure). The quantities that appear in this tree are called **objects** in what follows. The dialog language is an object that is called up with the command

&Config.**A**ux.**L**anguage **"english"**

If one is at the desired location in the tree, the value of the appropriate object can be queried:

&Config.**A**ux.**L**anguage **"english" $Q** Q for Query

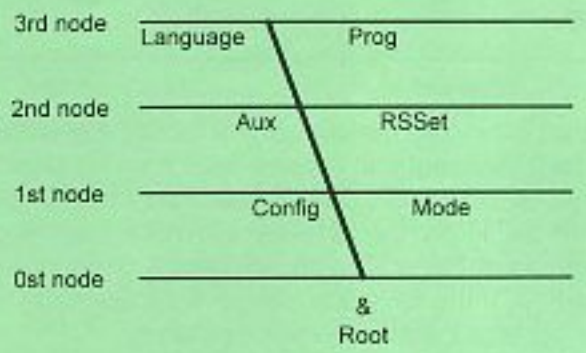
$Q triggers the output of the value from the 707 KF Oven. Entries that are introduced with the character dollar ($) trigger something. They are thus called **triggers** in what follows.

Values of objects can not only be requested, however, they can also be modified. Values are always entered in quotation marks ("), e.g.

&Config.**A**ux.**L**anguage **"english"**

3.1.1 Call up of objects

All objects are grouped hierarchically. They have a tree structure. A section of this tree is shown below:



Rules	Example
The root of the tree is designated with &.	
For the call up of an object the nodes (levels) of the tree are marked with a point (.).	
The call up of the objects requires as many letters as necessary to ensure unequivocal the object. If the call is not unequivocal, the first object in the series is recognized.	Call up of dialog language: **&Config.Aux.Language** or **&C.A.L**
Upper or lowercase letters can be used.	**&C.A.L** or **&c.a.l**
An object can be assigned a value. Each value is marked at the beginning and end with quotation marks ("). A value can contain up to 24 characters. Numeric values can include up to 6 digits, a negative sign and a decimal point. Numbers with more than 6 digits will not be accepted; more than 4 decimal places are rounded off. With numbers <1, it is necessary to enter leading zeros.	Input of dialog language: **&C.A.L"english"** Correct entry of a number: **"0.1"** Incorrect entry: "1,5" or "+3" or ".1"
If a new object is not called up, the old object remains current.	Input of a different dialog language: **"deutsch"**
New objects can also be addressed relative to old objects: **A preceding point** moves one node **forwards** in the tree.	From the root to node 'Aux': **&C.A** From node 'Aux' to 'Prog': **.P**
More than one preceding point moves one node **backwards** in the tree. n nodes backwards require n + 1 preceding points.	Jump from node 'Prog' to node 'Aux' and selection of a new object at this node: **..L**
If a jump is to be made back to the root, a preceeding & is entered.	Jump from node 'Language' via root to the node 'Mode': **&M**

3.1.2 Triggers

Triggers initiate an action at the KF Oven, e.g. starting of a mode or sending of data. Triggers are marked with the introducer: **$**

The following triggers are possible:

$G	Go:	Starts operations, e.g. start of the automatic determination or setting of the RS232 interface parameters
$S	Stop:	Stops operations
$Q	Query:	Used for inquiry of all information from the current node in the tree upwards up to and including the values
$Q.P	Path:	Used for inquiry of the path from the root of the tree up to the current node
$Q.H	Highest index:	Used for inquiry of the number of son nodes of the current node
$Q.N"i"	Name:	Used for inquiry of the name of the son node with index i, i = 1...n
$D	Detailed Info:	Used for inquiry of the detailed status
$U	qUit:	Used to abort the data flow of the 707 KF Oven, e.g. after $Q

The triggers $ G and $S are linked to objects, see overview table, pages 18ff.

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

Examples:
Inquiry of baud rate: **&C**onfig.**RS**Set.**B**aud **$Q**
Inquiry of all values of the node RSSet: **&C**onfig.**RS**Set **$Q**
Inquiry of the path of node RSSet: **&C**onfig.**RS**Set **$Q.P**
Starting a mode: **&M**ode **$G**
Inquiry of the detailed status: **$D**

3.1.3 Status and error messages

Detailed status conditions

Status conditions of the global $G:

$G.Mode	.Inac	Waiting during start delay
	.PurgeTime	Waiting during purge time
	.CondTime	Waiting during cond.time
	.HeatSmpl	Heating the sample
	.Terminate	Carrying out the terminating steps
$G.Assembly	.Prep.Wait	Heating the oven to the set temperature
	.Boat	The sample boat has been manually moved

Status conditions of the global $R:

$R.Mode .Ready	Inactive: Ready to start an automatic determination
$R.Assembly.Ready	An Assembly step has been carried out. Ready to carry out another Assembly step (&Mode $G will trigger error message E31).

Status conditions of the global $S:

The instrument gives the status from which it has been stopped. The detailed status information is therefore identical as for the global status $G.

Error messages

	RS receive errors:
E36	Parity error Exit: <QUIT> and set parity at both devices the same.
E37	Stop Bit Exit: <QUIT> and set stop bit at both devices the same.
E38	Overrun error. At least 1 character could not be read. Exit: <QUIT>.
E39	The internal receive buffer is full (>82 characters). Exit: <QUIT>.

RS send errors:

E40	DSR=OFF. No proper handshake for more than 1 s. Exit: <QUIT>. Is the receiver switched on and ready to receive?
E41	DCD=ON. No proper handshake for more than 1 s. Exit: <QUIT>. Is the receiver switched on and ready to receive?
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 has been interrupted with XOFF for at least 3 s. Exit: Send XON or <QUIT>.
E44	The RS parameters are no longer the same for both devices. Reset.
E45	The receive buffer contains an incomplete command (L_F missing). Sending from the instrument is therefore blocked. Exit: Send L_F or <QUIT>.

Device-specific errors:

E26	Manual stop. Exit: The error message disappears on the next start.
E135	Check temperature sensor of sample temperature. Exit: Rectify fault.
E154	Sample temperature not OK. Exit: The error message disappears when the fault is rectified or &M $S.
E163	Gas flow too low. Exit: The error message disappears when the fault is rectified or &M $S.
E164	The attached titrator is not conditioned. Exit: The error message disappears when the fault is rectified or &M $S.
E165	The oven temperature is higher than 360 °C. Exit: The error message disappears when the fault is rectified.
E168	The temperature sensor for the oven temperature is not OK. Exit: Rectify fault.
E169	The gas flow sensor is not OK (flow >500 mL/min). Exit: Rectify fault. Continuation is possible only when the minimum gas flow is set to 0 mL/min.

3.2 Remote control commands

3.2.1 Overview

&	**Root**		
Mode	**Mode**	$G, $S	3.2.2.1
.**T**emp	Sample temperature	50...300	3.2.2.2
.**G**as	Gas flow		
.**U**nitFlow	Unit for display	mL/min, L/h	3.2.2.3
.**M**inFlow	Minimum gas flow	0...999	3.2.2.3
.**T**ype			
.**S**elect	Selection of the gas type	air, N2, other	3.2.2.4
.**O**therFac	Factor for "other" gas	0.001...9.999	3.2.2.4
.**P**urgeTime	Purge time	0...99999	3.2.2.5
.**C**ondTime	Conditioning time	0...99999	3.2.2.5
Config	**Configuration**		
.**O**venSet	**Oven settings**		
.**A**utoPrep	Automatic preparation	ON, OFF	3.2.2.6
.**V**alveControl	Valve control	ON, OFF	3.2.2.7
.**S**tartCond	Start allowed only if cond.ok	ON, OFF	3.2.2.7
.TempLimit	Starting temperature range	1...100	3.2.2.7
.**C**harSet	Selection of the character set	Epson, Seiko, Citizen, HP, IBM	3.2.2.8
.**R**eport	Report output at end	ON, OFF	3.2.2.9
.**A**ux	**Setting of various auxiliary functions**		
.**L**anguage	Selection of the dialog language	english, deutsch, francais, espanol	3.2.2.10
.**R**unNo	Current run number	0...9999	3.2.2.11
.**A**utoStart	Internal automatic start	1...9999,OFF	3.2.2.12
.**S**tartDelay	Start delay	0...9999	3.2.2.12
.**B**eeper	Beep	1...9, OFF	3.2.2.13
.**D**evName	Device name	8 ASCIII	3.2.2.13
.**P**rog	Program version	read only	3.2.2.14
.**R**SSet	**Settings for RS232$G**	3.2.2.15	
.**B**aud	Baud rate	(300...9600)	3.2.2.16
.**D**ataBit	Data bits	7, 8	3.2.2.16
.**S**topBit	Stop bits	1, 2	3.2.2.16
.**P**arity	Parity	even, odd, none	3.2.2.16
.**H**andsh	Handshake	HWs, HWf, SWchar, SWline, none	3.2.2.16

&	**Root**		
Info	**Information**		
.Report	**Sending of formatted reports**	$G	3.2.2.17
.Select	Selection of the report	configuration, parameters, result	3.2.2.18
.Results	**Results of the determination**		
.PurgeTime	Purge time	read only	3.2.2.19
.CondTime	Conditioning time	read only	3.2.2.19
.SmplHeatTime	Sample heating time	read only	3.2.2.19
.LowTemp	Lowest temp. during heating	read only	3.2.2.19
.HighTemp	Highest temp. during heating	read only	3.2.2.19
.GasFlow	Mean gas flow	read only	3.2.2.19
.LowFlow	Lowest flow during heating	read only	3.2.2.19
.HighFlow	Highest flow during heating	read only	3.2.2.19
.ActualInfo	**Current information**		
.Inputs	I/O lines, inputs		
.Status	Status of the lines	read only	3.2.2.20
.Change	Change in the status of the lines	read only	3.2.2.20
.Clear	Clears the change byte	read only	3.2.2.20
.Outputs	I/O lines, outputs		
.Status	Status of the lines	read only	3.2.2.20
.Change	Changing the status of the lines	read only	3.2.2.20
.Clear	Clears the change byte	read only	3.2.2.20
.Meas	Measured values		
.CyclNo	Cycle number	read only	3.2.2.21
.SampleTemp	Sample temperature	read only	3.2.2.21
.OvenTemp	Oven temperature	read only	3.2.2.21
.GasFlow	Gas flow	read only	3.2.2.21
.Status	Status of the assemblies		
.BoatPos	Position of the sample boat	read only	3.2.2.22
.Valve	Valve position	read only	3.2.2.22
.Pump	Pump	read only	3.2.2.22
.Heating	Heating power level	read only	3.2.2.22
.Display	Display		
.L1	1st line	24 ASCII	3.2.2.23
.L2	2nd line	24 ASCII	3.2.2.23
.Assembly	**Assembly**		
.CycleTime	Cycle time	read only	3.2.2.24
Assembly	**Basic components of the assembly**		
.Prep	Perform preparations	$G, $S	3.2.2.25
.Heat	Heating on	$G	3.2.2.26
.Value	Heating power level	0...50	3.2.2.26
.Valve	Set valve position	$G	3.2.2.27
.Pos	Preselect position	purge, transfer	3.2.2.27
.Boat	Move sample boat	$G, $S	3.2.2.28
.Rate	Moving rate	0.1...10	3.2.2.28
.Pos	Go to position	0...130.0	3.2.2.28
.SetPos	Set stop points		
.InPos	Inner stop	0...130.0	3.2.2.28
.OutPos	Outer stop	0...130.0v	3.2.2.28
.Pump	Switch pump on/off	$G, $S	3.2.2.29
.Outputs	I/O lines, outputs		
.SetLines	Set lines	$G	3.2.2.30
.L1	Line 1	active, inactive	
:		pulse, OFF	3.2.2.30
.L8	All lines as L1		
.ResetLines	Set all lines inactive	$G	3.2.2.30

&	**Root**		
Setup	**Setting the operating mode**		
.IdReport	Output report identification	ON, OFF	3.2.2.31
.**K**eycode	Key code of pressed keys	ON, OFF	3.2.2.32
.Tree	Definition of response to $Q		
.**S**hort	Send short path name	ON, OFF	3.2.2.33
.ChangedOnly	Only paths with changed values	ON, OFF	3.2.2.33
.**Tra**ce	Message when values change	ON, OFF	3.2.2.34
.**L**ock	**Lock functions**		
.**K**eyboard	Lock all keys	ON, OFF	3.2.2.35
.**C**onfig	Lock <CONFIG> key	ON, OFF	3.2.2.35
.**P**arameter	Lock <PARAM> key	ON, OFF	3.2.2.35
.**H**eater	Lock <HEATER> key	ON, OFF	3.2.2.35
.**P**ump	Lock <PUMP> key	ON, OFF	3.2.2.35
.**V**alve	Lock <VALVE> key	ON, OFF	3.2.2.35
.**B**oat	Lock <BOAT IN/OUT> keys	ON, OFF	3.2.2.35
.**D**isplay	Lock display operation of 707	ON, OFF	3.2.2.35
.**S**endMeas	**Automatic transmission of measurement data**		
.**S**endStatus	On/off switching of transmission	ON, OFF	3.2.2.36
.**I**nterval	Time interval for transmission	1...16200	3.2.2.36
.**M**eas	Measured values for transmission		
.**C**yclNo	Cycle number	ON, OFF	3.2.2.37
.**S**ampleTemp	Sample temperature	ON, OFF	3.2.2.37
.**O**venTemp	Oven temperature	ON, OFF	3.2.2.37
.**G**asFlow	Gas flow	ON, OFF	3.2.2.37
.**A**utoInfo	**Automatic message on changes**		
.**S**tatus	On/off of all set messages	ON, OFF	3.2.2.38
.**P**	When power is switched on	ON, OFF	3.2.2.38
.T	Messages of automatic determination		
.**G**	Status becomes "Go"	ON, OFF	3.2.2.38
.**R**	Status becomes "Ready"	ON, OFF	3.2.2.38
.**S**	Status becomes "Stop"	ON, OFF	3.2.2.38
.**B**	Beginning of sample heating	ON, OFF	3.2.2.38
.**F**	Finish of sample heating	ON, OFF	3.2.2.38
.**E**	Error message	ON, OFF	3.2.2.38
.I	Change of an I/O input	ON, OFF	3.2.2.38
.**O**	Change of an I/O output	ON, OFF	3.2.2.38
.**P**owerOn	Simulation "Power on"	$G	3.2.2.39
.**I**nitialise	Set values to default	$G	3.2.2.40
.**S**elect	Selection	Mode,Config,All Setup,Assembly	3.2.2.40
.**R**amInit	Initialisation	$G	3.2.2.41
.**I**nstrNo	Set instrument identification	$G	3.2.2.42
.**V**alue	Enter instrument identification	8 ASCII	3.2.2.42
.**S**ave	Store in EEPROM	$G	3.2.2.43

3.2.2 Description of the remote control commands

3.2.2.1 **M**ode $G, $S

Start and stop ($G, $S) of the automatic determination.

3.2.2.2 **M**ode.**T**emp **50**...300

Entry of the sample temperature in °C.

3.2.2.3 **M**ode.**G**as.**U**nitFlow **mL/min**, L/h
Mode.**G**as.**M**inFlow 0...**5**...999

.UnitFlow: Selection of the unit for display of the gas flow.
.MinFlow: Setting of the minimum gas flow in the unit selected above. If the flow is less than the minimum gas flow, error E163 appears (gas flow too low).

3.2.2.4 **M**ode.**G**as.**T**ype.**S**elect **air**, N2, other
Mode.**G**as.**T**ype.**O**therFac 0.001...**1**...9999

.Select: Selection of the gas.
.Factor: If "other" has been selected above, setting of the factor for measurement of the gas flow, factors see page 11.

3.2.2.5 **M**ode.**G**as.**P**urgeTime **0**...99999
Mode.**G**as.**C**ondTime **0**...99999

.PurgeTime: Purge time with valve to "Purge". Entry in s.
.CondTime: Conditioning time with valve to "Transfer". Entry in s.

3.2.2.6 **C**onfig.**O**venSet.**A**utoPrep ON, **OFF**

ON means: Automatic heating and preparation of the oven after switching on.

3.2.2.7 **C**onfig.**O**venSet.**V**alveControl **ON**, OFF
Config.**O**venSet.**S**tartCond ON, **OFF**
Config.**O**venSet.**T**empLimit 1...**5**...100

- ValveControl:
  ON means automatic switching of the valve from PURGE to TRANSFER at the end of the determination.
- StartCond:
  ON means: Insert sample boat during automatic determination only if the connected device is conditioned (input line pin 12 of the socket "Remote" active).
- TempLimit:
  Starting a determination is possible only if the current temperature is in the range of ±X °C from the sample temperature.

3.2.2.8 **C**onfig.**O**venSet.**C**harSet — Epson, Seiko, Citizen, HP, **IBM**

Selection of the character set.
IBM means IBM character set according to character set table 437. Select "IBM" for work with the computer.

3.2.2.9 **C**onfig.**O**venSet.**R**eport — ON, **OFF**

ON means: Output of a report at the end of the automatic determination.

3.2.2.10 **C**onfig.**A**ux.**L**anguage — **english**, deutsch, francais, español

Selection of the dialog language.

3.2.2.11 **C**onfig.**A**ux.**R**unNo — **0**...9999

Current run number.
Is set to 0 on power on and on initialisation. Counting starts again at 1 after 9999 has been reached.

3.2.2.12 **C**onfig.**A**ux.**A**utoStart — 1...9999, **OFF**
Config.**A**ux.**S**tartDelay — **0**...9999

.AutoStart: Number of automatic, internal starts for automatic determinations.
.StartDelay: Start delay time in s. During this time, the data of the preceding determination are retained.

3.2.2.13 **C**onfig.**A**ux.**B**eeper — **1**...9, OFF
Config.**A**ux.**D**evName — up to 8 ASCII characters

Number of beeps if the Oven is ready and after the determinations.
Name of the device for interconnections with several devices. It is advisable to use only the characters A...Z (ASCII No. 65...90), a...z (ASCII No. 97...122) and 0...9 (ASCII No. 48...57) if the Setup.AutoInfo function (see 3.2.2.38) has been activated at the same time.

3.2.2.14 **C**onfig.**A**ux.**P**rog — read only

Output of the program version.
In response to $Q, the KF Oven sends: "707.0010".

3.2.2.15 **C**onfig.**RS**Set — $G

$G sets all RS settings. After setting the interface parameters, wait at least 2 s to allow the components to equilibrate.

3.2.2.16	**C**onfig.**RS**Set.**B**aud	300, 600, 1200, 2400, 4800, **9600**
	Config.**RS**Set.**D**ataBit	7, **8**
	Config.**RS**Set.**S**topBit	**1**, 2
	Config.**RS**Set.**P**arity	even, odd, **none**
	Config.**RS**Set.**H**andsh	**HWs**, HWf, SWchar, SWline, none

Setting of the RS interface parameters: Baud rate, data bits, stop bits, parity and type of handshake, see also page 29.
Setting of the values must be initiated immediately following the entry with &Config.RSSet $G, see 3.2.2.15.

3.2.2.17 **I**nfo.**R**eport $G

Output of the selected report.

3.2.2.18 **I**nfo.**R**eport.**S**elect configuration, parameters, result

Selection of the report.
configuration: Configuration report. Not accessible when a determination is running.
parameters: Parameter report. Only "live" parameters when a determination is running.
result: Result report of the last completed determination.

The report output must be triggered with &Info.Report $G, see 3.2.2.17.
Reports which are sent automatically by the KF Oven start with a space (ASCII 32) and '. This is followed by the individual identification for each report. Reports which are requested via RS232 ($G) have the same individual identification of the report blocks, but are started with ' only (no preceding space).

3.2.2.19	**I**nfo.**Res**ults.**P**urgeTime	read only
	Info.**Res**ults.**C**ondTime	read only
	Info.**Res**ults.**S**ampleHeatTime	read only
	Info.**Res**ults.**L**owTemp	read only
	Info.**Res**ults.**H**ighTemp	read only
	Info.**Res**ults.**G**asFlow	read only
	Info.**Res**ults.**LowF**low	read only
	Info.**Res**ults.**HighF**low	read only

Inquiry of the current results.
.PurgeTime: Purge time.
.CondTime: Conditioning time.
.SampleHeatTime: Time during which the sample has been heated.
.LowTemp: Lowest temperature during the sample heating.
.HighTemp: Highest temperature during the sample heating.
.GasFlow: Mean gas flow during the sample heating.
.LowFlow: Lowest gas flow during the sample heating.
.HighFlow: Highest gas flow during the sample heating.

3.2.2.20	**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 information regarding whether a change in the status of a line has taken place since it was last cleared. Clear clears the byte of Change.

For the output, the byte is converted to binary, e.g.

	|0|0|0|0|1|0|1|0|
Line No.	|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 pages 58, 59):

Inputs:	**Outputs:**
0 Start (Pin 21)	0 Ready (Pin 5)
1 Stop (Pin 9)	1 Start (Pin 18)
2 Terminate (Pin 22)	2 Stop (Pin 4)
3 Pin 10	3 HeatSmpl (Pin 17)
4 Pin 23	4 Terminate (Pin 3)
5 Pin 11	5 Error (Pin 16)
6 Pin 24	6 Pin 1
7 Cond.ok (Pin 12)	7 Pin 2

3.2.2.21 Info.**A**ctualInfo.**M**eas.**C**yclNo read only
Info.**A**ctualInfo.**M**eas.**S**ampleTempread only
Info.**A**ctualInfo.**M**eas.**O**venTempread only
Info.**A**ctualInfo.**M**eas.**G**asFlowread only

Inquiry of the current values.
NV: Not Valid.
If the measured value is exceeded, OV (overrange) is sent.

A time frame can be generated from the cycle number and the cycle time (see 3.2.2.24).
The cycle number is always zeroed on start and on termination of an automatic determination.

3.2.2.22 Info.**A**ctualInfo.**S**tatus.**B**oatPosread only
Info.**A**ctualInfo.**S**tatus.**V**alve read only
Info.**A**ctualInfo.**S**tatus.**P**ump read only
Info.**A**ctualInfo.**S**tatus.**H**eating read only

Status inquiry of the individual assemblies in the following format (examples):

.BoatPos	Position of the sample boat	23 mm
.Valve	Position of the valve	"purge" or "transfer"
.Pump	Status of the pump	"ON" or "OFF"
.Heating	Heating level	20

3.2.2.23 Info.**A**ctualInfo.**D**isplay.**L1** up to 24 ASCII characters
Info.**A**ctualInfo.**D**isplay.**L2** up to 24 ASCII characters

1st and 2nd line of the display. The display can be written to.
The display is not operated by the KF oven if &Setup.Lock.Display is set to ON, see 3.2.2.35.
$Q sends the contents of the corresponding display line.

3.2.2.24 Info.**A**ssembly.**C**ycleTime read only

Inquiry of the cycle time in s.

3.2.2.25 **A**ssembly.**P**rep $G, $S

Switch heating to the sample temperature on/off.

3.2.2.26 **A**ssembly.**H**eat $G
Assembly.**H**eat.**V**alue **0**...50

Control heating. The set heating power level is started with &Assembly.Heat $G.
0 means switch off heating.

3.2.2.27 **A**ssembly.**V**alve $G
Assembly.**V**alve.**P**os **purge**, transfer

Set valve. The selected position is set with &Assembly.Valve $G.

3.2.2.28 **A**ssembly.**B**oat $G, $S
Assembly.**B**oat.**R**ate 0.1...**10**
Assembly.**B**oat.**P**os **0**...130.0
Assembly.**B**oat.**S**etPos.InPos 0...**130.0**
Assembly.**B**oat.**S**etPos.**O**utPos**0**...130.0

The movements of the sample boat are initiated with &Assembly.Boat $G.
.Rate: Rate in mm/s
.Pos: Position moved to with &Assembly.Boat $G, in mm. The inputted position is moved to irrespective of the limits set in &Assembly.Boat.SetPos.
.SetPos: Limits for the movement of the boat in automatic determinations and for manual operation.
.InPos: Inner stop in mm.
.OutPos: Outer stop in mm.

3.2.2.29 **A**ssembly.**P**ump $G, $S

Switch pump on/off.

3.2.2.30 **A**ssembly.**O**utputs.**S**etLines $G
Assembly.**O**utputs.**S**etLines.L1 active, inactive, pulse, **OFF**
up to .L8
Assembly.**O**utputs.**R**esetLines $G

Setting of the output lines of the "Remote" socket.
.SetLines: All lines are set with $G.
.SetLines.L1: Setting of line 1. "active" sets a static signal (0 V), "inactive" resets the signal (+5 V) , "pulse" means a pulse of length of ca. 150 ms and with "OFF" the corresponding line is not controlled.
Assignment of the lines, see 3.2.2.20.
up to .L8
.ResetLines: Lines L1...L8 are set to the inactive condition (+5 V).

3.2.2.31 **S**etup.**I**dReport **ON**, OFF

Switch output of the report identification on/off.

3.2.2.32 **S**etup.**K**eycode ON, **OFF**

With ON the key code of a key pressed on the KF Oven is outputted. The key code comprises 2 ASCII characters; table of the keys with their code, see page 42. Space (ASCII 32) and # are sent as introducers.
Example : #11

3.2.2.33 **S**etup.Tree.**S**hort ON, **OFF**
Setup.Tree.**C**hangedOnly ON, **OFF**

Definition of the response to an inquiry with $Q.
.Short: With ON all path names are sent, but only with the requisite number of characters. Requisite number of characters means the path is unequivocally characterised (characters printed in boldface in the instructions for use).
.ChangedOnly: Sends only those paths and their values which have once been edited. All path names are sent in absolute terms, i.e. from the root.

3.2.2.34 **S**etup.**T**race ON, **OFF**

The KF Oven reports when a value has been confirmed with <ENTER> at the KF Oven. Space (ASCII 32) and & are sent as introducers.
Example: &Mode.Temp"100"

3.2.2.35 **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.**H**eater ON, **OFF**
Setup.**L**ock.**P**ump ON, **OFF**
Setup.**L**ock.**V**alve ON, **OFF**
Setup.**L**ock.**B**oat ON, **OFF**
Setup.**L**ock.**D**isplay ON, **OFF**

ON means locking of the corresponding function:
.Keyboard: Locking all keys at the KF Oven.
.Config: Locking the <CONFIG> key.
.Parameter: Locking the <PARAM> key.
.Heater: Locking the <HEATER> key.
.Pump: Locking the <PUMP> key.
.Valve: Locking the <VALVE> key.
.Boat: Locking the <BOAT IN> and <BOAT OUT> keys.
.Display: Locking the display, it is not operated by the device program of the KF Oven and can be written to by the computer.

3.2.2.36 **S**etup.**S**endMeas.**S**endStatus ON, **OFF**
Setup.**S**endMeas.Interval 1...**4**...16200

.SendStatus: ON means automatic transmission of measured values (see 3.2.2.37) at the inputted time interval.
.Interval: Time interval for the transmission of associated measured values defined under 3.2.2.37.

3.2.2.37 **S**etup.**S**endMeas.**M**eas.**C**yclNoON, **OFF**
Setup.**S**endMeas.**M**eas.**S**ampleTemp ON, **OFF**
Setup.**S**endMeas.**M**eas.**O**venTemp ON, **OFF**
Setup.**S**endMeas.**M**eas.**G**asFlowON, **OFF**

Selection of the values which are transmitted at the set time interval.
.CyclNo: Cycle number. Together with the cycle time (3.2.2.24), a time frame can be generated. The other data are part of the corresponding cycle number. The cycle number is always zeroed at the start and termination of the automatic determination.
.SampleTemp: Associated sample temperature.
.OvenTemp: Associated oven temperature.
.GasFlow: Associated gas flow.

Format of the transmitted values (examples):

.CyclNo	Cycle number	127
.SampleTemp	Sample temperature in °C	150.0
.OvenTemp	Oven temperature in °C	170.0
.GasFlow	Gas flow in mL/min or L/h	100.5

NV: Not Valid.
If the measured value is exceeded, OV (overrange) is sent.
The associated values are sent on 1 line separated by a space (ASCII 32).

3.2.2.38	**S**etup.**A**utoInfo.**S**tatus	**ON**, OFF
	Setup.**A**utoInfo.**P**	ON, **OFF**
	Setup.**A**utoInfo.**T.G**	ON, **OFF**
	Setup.**A**utoInfo.**T.R**	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.**I**	ON, **OFF**
	Setup.**A**utoInfo.**O**	ON, **OFF**

Automatic message as soon as a change appears.

.Status:	Switches all set AutoInfos on/off.
.P:	PowerOn: Simulation PowerOn has been performed (3.2.2.39). No message on power on.
.T.G:	Go: Automatic determination has been started.
.T.R:	Ready: Automatic determination has been ended.
.T.S:	Stop: An automatic determination has been stopped.
.T.B:	Begin: In the automatic determination, the sample heating begins.
.T.F:	Final: End of the sample heating in the automatic determination.
.T.E:	Error: Message together with error number.
.I:	Change in an input line of the "Remote" socket.
.O:	Change in an output line of the "Remote" socket.

Each message is sent with space (ASCII 32) and ! as introducers. The name of the device is then sent (3.2.2.13). Special ASCII characters in the device name are ignored. If no device name has been entered, only ! is sent.
This is followed by information regarding the node which initiated the message. In the case of errors, the error number is sent.
Examples:

!Otto".T.G"	Device Otto has been started.
!".T.E;E26"	Device without a name has error E26.

3.2.2.39 **S**etup.**P**owerOn $G

Simulation of power on. The device has the same status as after power on: The boat is in position 0 and the sample number on 0.

3.2.2.40	**S**etup.**I**nitialise	$G
	Setup.**I**nitialise.**S**elect	**Mode**, Config, All, Setup, Assembly

Sets default values for the following areas:

Mode:	Branch Mode.
Config:	Branch Config.
All:	Values of the entire tree.
Setup:	Branch Setup.
Assembly:	Branch Assembly.

The action is initiated with &Setup.Initialise $G.

3.2.2.41 **S**etup.**R**amInit $G

Initialises the device as in the diagnostic test, see page 47: All parameters are set to the default value and error messages are cleared.

3.2.2.42 **S**etup.**Ins**trNo $G
Setup.**Ins**trNo.**V**alue up to 8 ASCII

Device identification outputted in the report. The serial number and manufacturing number are entered here in the factory as an unequivocal identification.

3.2.2.43 **S**etup.**Sa**ve $G

All entries made via RS232 must be saved with &Setup.Save $G before the instrument is switched off to avoid losses.

3 Characteristics of the RS232 interface

3.3.1 Data transfer protocol

The KF Oven is configured as DTE (Data Terminal Equipment).

The RS232 interface has the following technical specifications:

Data interface in accordance with the RS232C standard, with selectable parameters.

Max. line length:	80 characters + C_R + L_F
Control characters:	C_R (ASCII DEC 13)
	L_F (ASCII DEC 10)
	XON (ASCII DEC 17)
	XOFF (ASCII DEC 19)
Cable length:	max. ca. 15 m

Start	7 or 8 data bits	Parit.bit	1 or 2 stop bit(s)

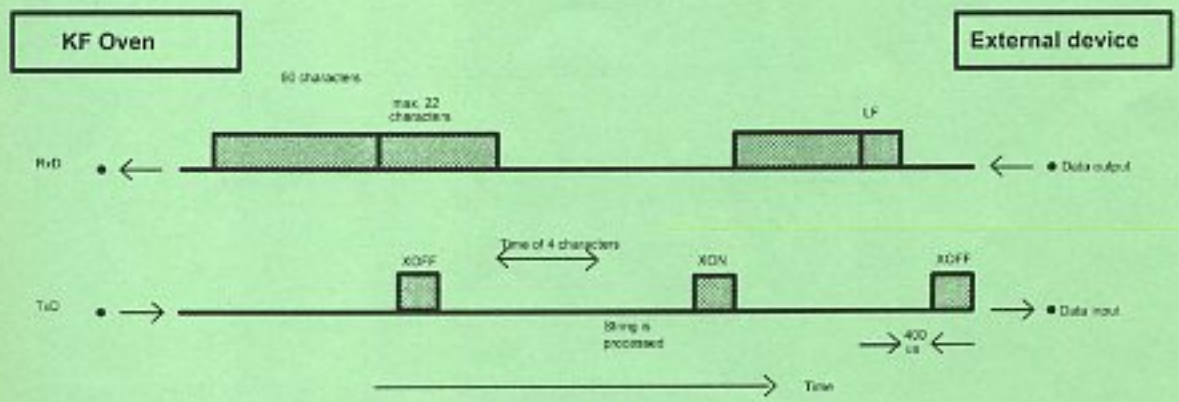
For interconnections of the 707 KF Oven with non-Metrohm units, only a shielded data cable (e.g. METROHM D.104.0201) may be used. The cable shielding must be faultlessly earthed at both units (pay attention to current loops; always use star-head earthing). Only connectors with adequate shielding may be used (e.g. METROHM K.210.0001 with K.210.9004).

3.3.2 Handshake

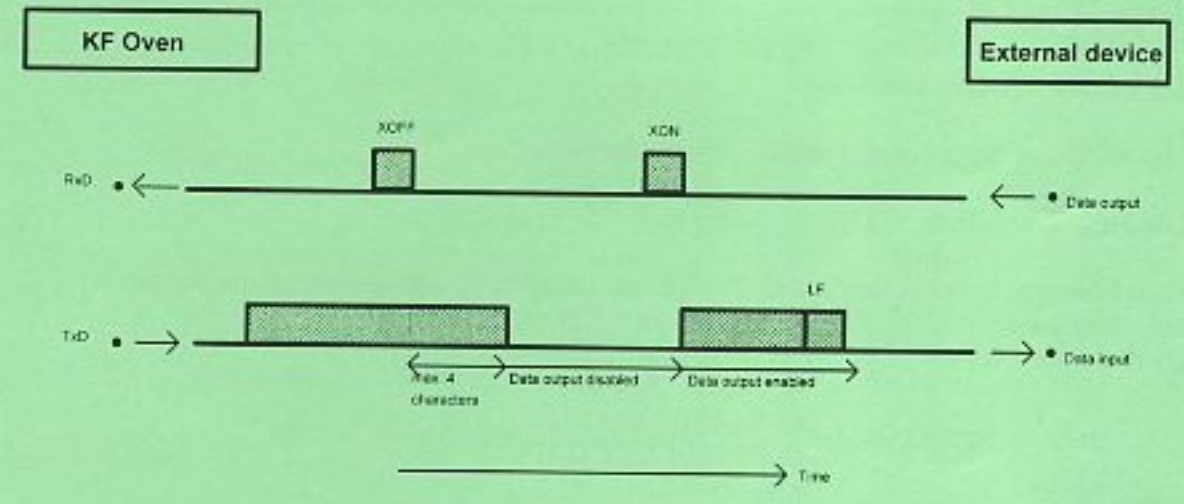
3.3.2.1 Software handshake, SWChar

Handshake inputs at the Oven (CTS, DSR, DCD) are not checked.
Handshake outputs (DTR, RTS) are set by the Oven.
As soon as a L_F is recognized, the Oven sends XOFF. It can then receive 6 extra characters and store them.
However, the Oven also sends XOFF, if its input buffer contains 60 characters. After this, it can receive maximum 22 extra characters (incl. L_F).
If the transmission is interrupted for the time of 4 characters after the Oven has sent XOFF, the string received earlier is processed even if no L_F has been sent.

Oven as **receiver**:



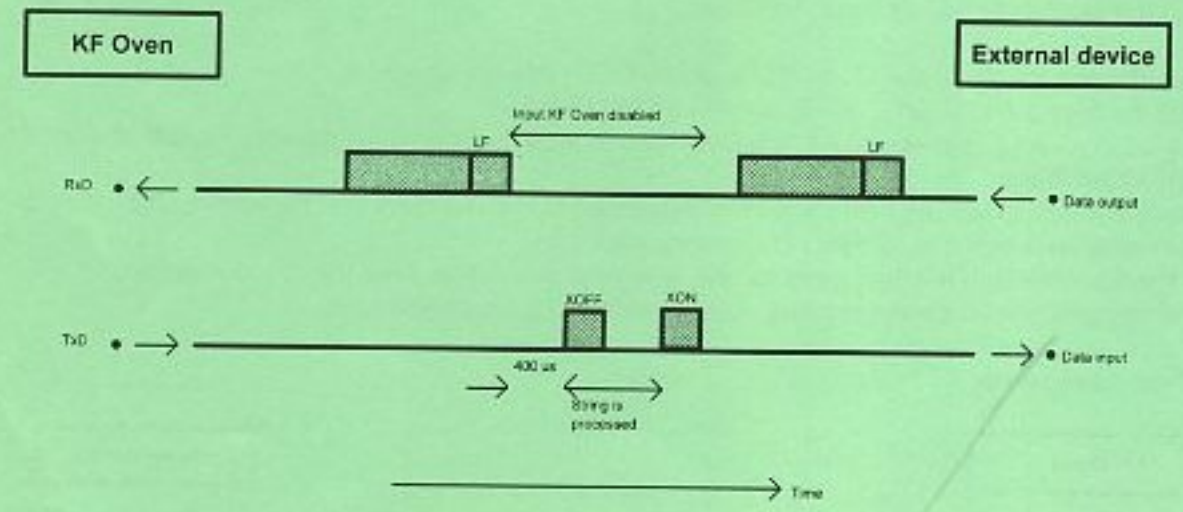
KF Oven as **sender**:



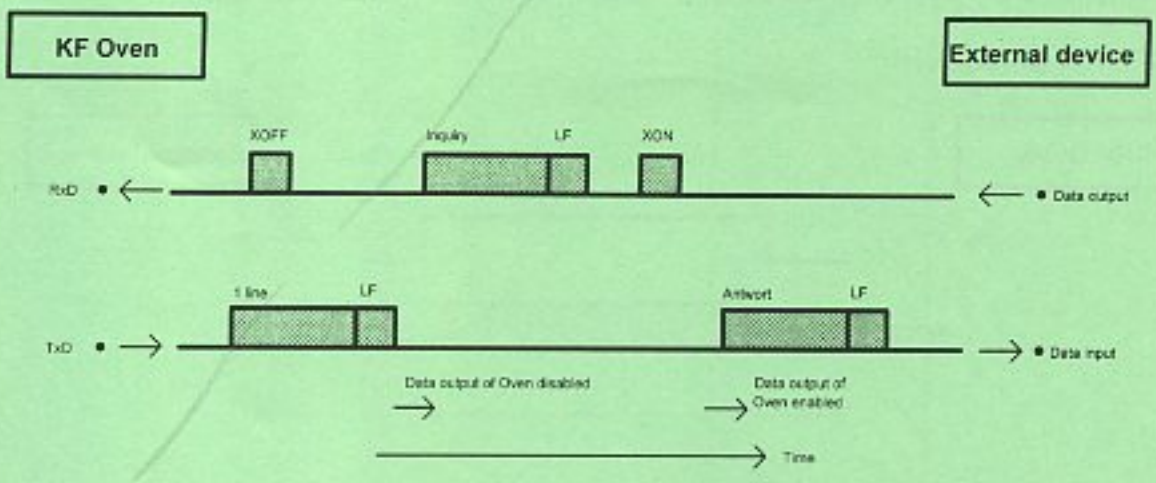
3.3.2.2 Software Handshake, SWline

Handshake inputs at the KF Oven (CTS, DSR, DCD) are not checked.
Handshake outputs (DTR, RTS) are set by the Oven.
The Oven is equipped with an input buffer that can accommodate a string of up to 80 characters + C_R L_F. As soon as an L_F is recognized, the Oven sends XOFF. After this, it can receive maximum 6 extra characters and store them. The string sent previously is now processed by the Oven. Afterwards, the Oven sends XON and is again ready to receive.

KF Oven as **receiver**:



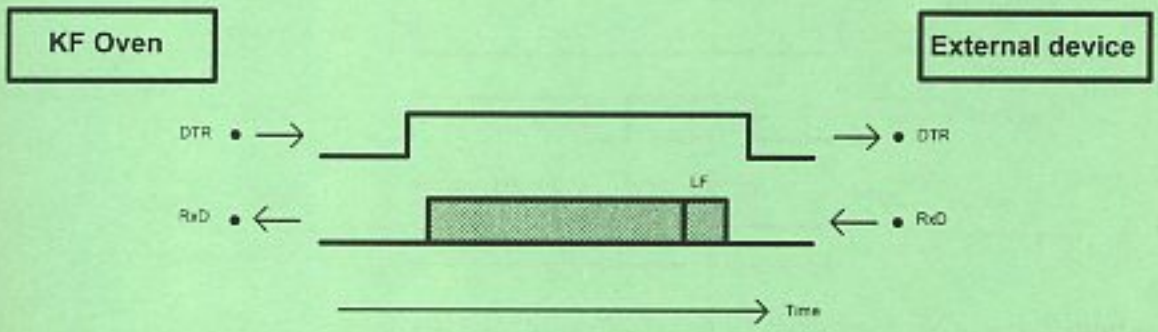
KF Oven as **sender**:



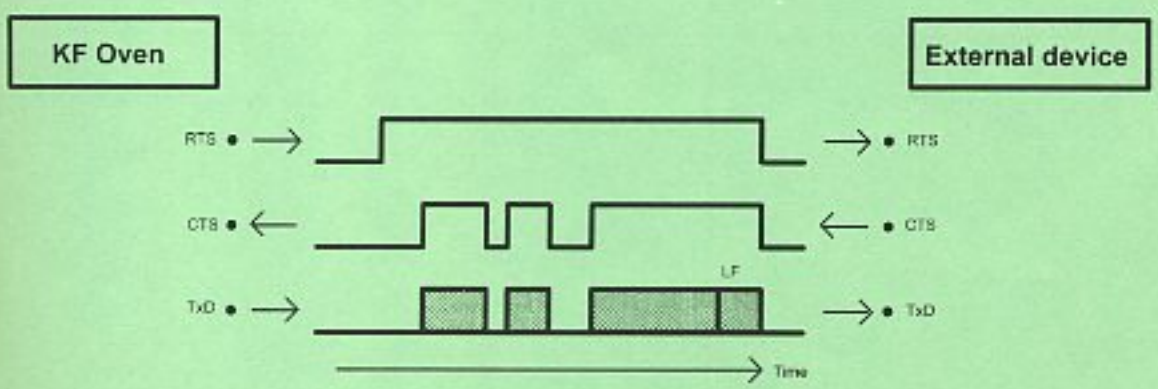
The transmission of the Oven can be stopped by the external device with XOFF. After receipt of XOFF, the Oven completes transmission of the line already started. If the data output is disabled for more than 3 s by XOFF, E43 appears in the display.

3.3.2.3 Hardware handshake, HWs

KF Oven as **receiver**:



KF Oven as **sender**:

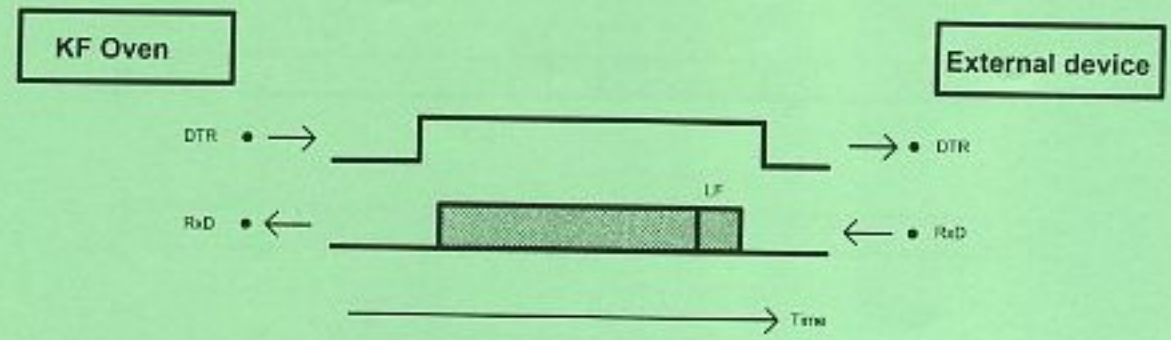


The data flow can be interrupted by deactivation of the CTS line.

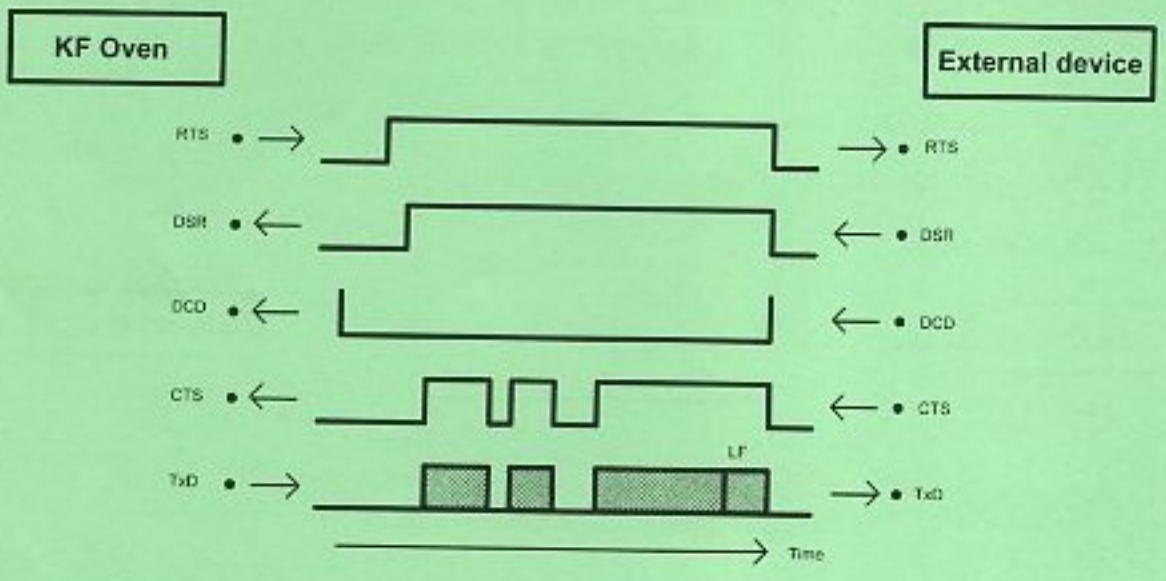
3.3.2.4 Hardware handshake, HWf

All handshake inputs are checked at the Oven, handshake outputs are set.

KF Oven as **receiver**:



KF Oven as **sender**:



The data flow can be interrupted by deactivation of the CTS line.

3.3.3 Pin assignment

external

RS 232C Interface

Transmitted data (TxD)
If no data are transmitted, the line is held in the "ON" condition. Data are transmitted only when CTS and DSR are in the "ON" condition and DCD is in the "OFF" condition.

E 2 — Transmitted Data

Received data (RxD)
Data are received only when DCD is "ON".

E 3 — Received Data

Request to Send (RTS)
ON condition: Instrument is ready to send data.

E 4 — Request to Send

Clear to Send (CTS)
ON condition: Remote station is ready to receive data.

E 5 — Clear to Send

Data Set Ready (DSR)
ON condition: The transmission line is connected.

E 6 — Data Set Ready

Signal ground (GND)

E 7 — Signal Ground

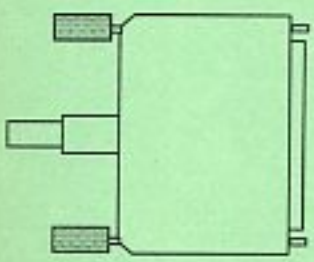
Data Carrier Detect (DCD)
ON condition: The level of the received signal is within the tolerance range (remote station is ready to send data)

E 8 — Data Carrier Detect

Data Terminal Ready (DTR)
ON condition: Instrument is ready to receive data.

E 20 — Data Terminal Ready

Contact arrangement at the connector (female)



View from solder side

K.210.9004 (housing) and K.210.0001

Protective earth
Direct connection from cable connector to protective earth of instrument.

Polarity allocation of the signals

- Data lines (TxD, RxD)
  Voltage negative (<-3 V): Signal status "ONE"
  Voltage positive (>+3 V): Signal status "ZERO"
- Control or message lines (CTS, DSR, DCD, RTS, DTR)
  Voltage negative (<-3 V): OFF status
  Voltage positive (>+3 V): ON status

In the transition region from +3 V to -3 V the signal status is undefined.

14C88 Driver, 14C89 Receiver, in compliance with EIA RS232C specifications.

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

3.4 ¿Qué hacer si la transmisión de datos no funciona?

Problema	Preguntas para resolver el problema
No se reciben caracteres en una impresora conectada.	• ¿Están los aparatos y los cables que los unen correctamente conectados? • ¿Está la impresora en "on-line"? • ¿Se ha puesto el handshake correctamente? Si todo está en orden, intente hacer una impresión pulsando sucesivamente las teclas <PRINT> <PARAM> <ENTER>. Si esta impresión se realiza correctamente, compruebe si por medio de la tecla <CONFIG>, >ajustes del horno, se ha preseleccionado un informe.
No hay transmisión de datos y en la pantalla del Horno aparece un mensaje de error.	• **E40-42**: Error en la transmisión. ¿Está el cable correctamente cableado y conectado? ¿Está la impresora conectada y ajustada en "on-line"? • **E43**: La transmisión de datos del Horno está bloqueada por XOFF durante más de 3 s. • **E36-39**: Error en la recepción. ¿Están los parámetros de la transmisión de datos del RS232 ajustados iguales en los dos aparatos?
Los caracteres recibidos están mutilados.	• ¿Están igualmente ajustados data bit y paridad en ambos aparatos? • ¿Está el baud rate en ambos aparatos ajustado por igual? • ¿Ha elegido la impresora adecuada?

4. Mensajes de errores, localización de averías

4.1 Localización de averías

Problema	Solución
Los resultados de las titraciones varian mucho.	• No toque con los dedos la navecilla de muestras ni la vara de conducción. Utilice la abrazadera de sujeción o meta los dedos en un tubo de goma cortado. • Seque bien la navecilla de muestras antes de utilizarla y consérvela en el desecador. • ¿Está la criba molecular de la botella de secado agotada? (Si la criba molecular de la botella derecha aún está bien, se puede utilizar ésta en lugar de la de la botella izquierda. La criba "más fresca" ha de estar en la botella derecha.) • Agua condensada en el tubo de salida. Suba el flujo del gas o utilice el tubo de salida 6.1830.000 calentable. • ¿Está el flujo del gas tan alto que el medio de titración salpica a las paredes del recipiente de titración? • Triture la muestra antes de pesarla y repártala, si es posible, en la navecilla de muestras. • ¿Ha soltado ya la muestra toda la humedad? Ajuste "más fuerte" las condiciones de parada en el aparato de titración: la deriva de parada más baja, tiempo de espera de conmutación más alto. • Compruebe si las conexiones son herméticas.
La deriva está demasiado alta.	• ¿Está agotada la criba molecular de la botella de secado? (Si la criba de la botella derecha está en condiciones, se puede utilizar ésta como botella izquierda. La criba molecular "más fresca" debe estar en la botella derecha.) • ¿Están los anillos 0 de la célula de titración en orden? • ¿Está el septo de la caperuza roscada en buenas condiciones? • No toque la navecilla de muestras ni la vara de conducción con los dedos. Utilice la abrazadera de sujeción o meta los dedos en un tubo de goma cortado. • Cuando esté trabajando vuelva a cerrar lo más rápidamente posible la tapa del tubo de conducción.
Los tiempos de titración son muy largos.	• Utilice el tubo de salida calentable 6.1830.000. • Triture la muestra antes de pesarla y distribúyala en la navecilla de muestras si es posible. • Eleve la temperatura de la muestra. • Aumente el flujo del gas.

Problema	Solución
Los tiempos de la titración son muy diferentes.	• Triture la muestra antes de pesarla y extiéndala si es posible en la navecilla de muestras. • Coloque el horno en un lugar en donde esté protegido de la corriente de aire y de los rayos solares.
El titrador no se desconecta.	• Triture la muestra antes de la pesarla y distribúyala, si es posible, en la navecilla de muestras. • La muestra se descompone y desprende sustancias oxidantes: disminuya la temperatura o utilice N2 como gas portante.
El gas no entra en el recipiente de titración.	• Cambie la válvula a "TRANSFER" y, en caso necesario, aumente el flujo de gas. • ¿Están las tapas del tubo de conducción y de entrada de muestras bien cerradas? • ¿Están herméticos todas las conexiones de tubos?
No hay flujo de gas, a pesar de estar la bomba conectada o haber un gas extraño.	• Apriete bien todas las conexiones de los tubos. • ¿Se han efectuado todas las conexiones de los tubos en la parte posterior del horno?
Mensaje de error "acond.no ok" aunque el titrador conectado está acondicionado.	• ¿Está bien enchufado el cable de conexión con el titrador? Si hay una conexión con Titrinos compruebe que el extremo del cable no se ha confundido.

4.2 Mensajes de errores

`acond.no correcto`	El aparato de titración conectado no está acondicionado. El error desaparece cuando viene desde el Titrador el mensaje de acondicionamiento (borne 12 de la ficha "Remote" está activado) y la secuencia se desarrolla automáticamente. Si no hay conectado ningún instrumento Metrohm se ha de trabajar con "start si acond: no" (tecla <CONFIG>, >ajustes del horno. Si hay algún Titrino enchufado compruebe si el cable está correctamente conectado.
`flujo de gas demas.bajo`	El flujo de gas es menor que el mínimo establecido. Salida: <STOP>, conecte la bomba o abra la botella del gas portante o cámbiela. Ajuste el flujo de gas con el horno caliente.
`parada manual`	El desarrollo automático se interrumpe manualmente con <STOP>. Salida: <QUIT>
`revise termosonda`	La termosonda para la temperatura de la muestra no está conectada o está defectuosa o el cable tiene defecto. Salida: Corrija la falta.
`sonda flujo de gas`	La sonda del flujo de gas no está en orden (flujo > 500 mL/min). En la pantalla aparece OV (overrange) en lugar del flujo de gas. Salida: llame al servicio Metrohm. Se puede trabajar provisionalmente: Ajuste el flujo mínimo de gas a 0 mL/min (tecla <PARAM>).
`temp.más de 360°C`	La temperatura del horno es mayor de 360 °C. La calefacción se desconecta automáticamente, ya que el tubo de calefacción podría resultar dañado. La calefacción se conecta, de nuevo, automáticamente cuando la temperatura del horno sea <360 °C.
`temperatura no ok`	La temperatura de la muestra está por fuera del límite preseleccionado de la temperatura nominal . Salida: <STOP> o espere a que la temperatura se haya alcanzado. El desarrollo automático se puede empezar cuando el piloto "READY" esté iluminado permanentemente. Si a pesar de todo se desea calentar una muestra, se puede trabajar manualmente: Ajuste la válvula a "TRANSFER", lleve la navecilla de muestras al horno con la tecla <BOAT IN>, active el Titrador.
`termosonda del Horno`	La termosonda del horno no está en orden. Salida: Llame al servicio Metrohm.

4.3 Diagnóstico

El Horno KF 707 es un instrumento de gran precisión y fiabilidad. Gracias a su fuerte construcción es prácticamente imposible que sus funciones no se vean alteradas por causas mecánicas o eléctricas.

Aunque no se puede descartar por completo de que surja una avería en el aparato, es mayor la posibilidad de que el fallo se deba a un error en el manejo o tratamiento inadecuado del instrumento, o a una conexión y funcionamiento incorrectos con otros aparatos externos.

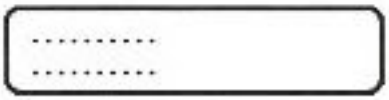
En cada caso es aconsejable aislar el error con el sencillo diagnóstico. El cliente sólo necesita avisar al servicio METROHM cuando haya realmente un defecto en el instrumento en sí. Además, con la numeración del programa de diagnóstico puede informar con gran exactitud al servicio METROHM.

Para cualquier consulta indique siempre el número de fabricación (grabado en la placa de identificación) y el de programa (vea <CONFIG>, bajo ">ajustes varios") y si es posible la indicación del error.

Procedimiento

Explicación de los símbolos:

< X > pulse la tecla correspondiente

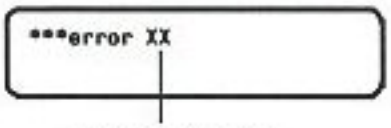


información en la pantalla

- Los pasos del diagnóstico se han de realizar en sucesión y observando la reacción del Horno KF 707 (sangrado). En caso "sí" hay que continuar con la siguiente instrucción.
- Si el instrumento no reacciona del modo esperado (caso "no"), hay que repetir la prueba con el fin de descartar un error operacional. Si el aparato reacciona incorrectamente repetidas veces se puede pensar en una avería.
- En las repeticiones hay que seleccionar la prueba querida con la tecla <9>.

  Si el instrumento se encuentra en un subprograma del diagnóstico pulse la tecla <QUIT>.

  En caso necesario desconecte la red y entre en el diagnóstico nuevamente según el punto 2.
- Si se pulsa la tecla <QUIT> mientras se muestra en la pantalla 'diagnose >XXXXXXXX', el instrumento regresa otra vez al programa del usuario.
- Indicación de error: En la pantalla se muestra un error del modo siguiente:



Número del error

Instrumentos necesarios:
- Década de resistencia, clase 0.1 % (o resistencia individual 1 k, 0,1 %)

Sólo necesario si se han de comprobar funciones externas:
- Ficha de prueba 3.496.8510 (al borne 'Remote')
- Ficha de prueba 3.496.8480 (al borne 'RS 232')

1. **Preparación del instrumento para el diagnóstico**

   Desconecte la red

   Quite toda conexión externa (cable de la parte posterior, excepto cable exterior de la red y conexión de Pt 1000)

   Conducción de gas conectada, conexiones de los tubos, si están herméticos

   (Si se utiliza aire como gas portante, han de estar unidas las conexiones tubulares "Air/N_2 in" y "Air out". Las botellas de secado se pueden cambiar por medio de una unión tubular entre las conexiones "drying flask To/From".)

   Introduzca la nave de muestras en el tubo de aplicación y ponga el tapo al tubo.

2. **Prueba de conexión y entrada en el diagnóstico**

   Conecte la red, pulse inmediatamente la tecla <9> y manténgala pulsada hasta que aparezca en la pantalla el siguiente contenido:[1]

   ```
   diagnose
   >RAM Initialization
   ```

   Ajuste lo mejor posible el contraste de la pantalla mediante el botón de la parte posterior del instrumento.

3. **Prueba RAM**

   Prueba RAM no destructor de la gama total

   <9>

   ```
   diagnose
   >RAM Test
   ```

   <ENTER>

   ```
   >RAM Test
    ram test ok
   ```

   <QUIT>

   ```
   diagnose
   >LCD Display Test
   ```

4. **Prueba de la pantalla**

   Después de pulsar la tecla <ENTER> se generan caracteres para el control visual de la pantalla.

   Secuencia de la prueba:

   - En primer lugar se sobreescriben los 24 lugares de las dos líneas con una muestra de puntos.
   - Se borra la indicación.
   - En las dos líneas aparece 24× "#" a continuación 24× "H" y 24× "I".
   - Después se muestra el resto de los caracteres como una indicación en movimiento.
   - Se conectan y se desconectan primero juntos los 5 pilotos de estado, a continuación uno tras otro.

   A excepción de ENTER y STOP, la secuencia de la prueba se puede detener con la tecla que desee y proseguir nuevamente.

   Con <STOP> se acaba la prueba.

   ```
   diagnose
   >Input/Output Test
   ```

[1] Durante la conexión es posible oír un aviso acústico.

5. **Prueba del teclado**

Pulse <9> varias veces hasta

```
diagnose
>Key Test
```

<ENTER>

```
>Key Test
```

Si se pulsa sólo una tecla determinada aparece en la pantalla el código de la matriz correspondiente, según la figura 4-1. Compruebe el código mostrado.

```
>Key Test
code: XX
```

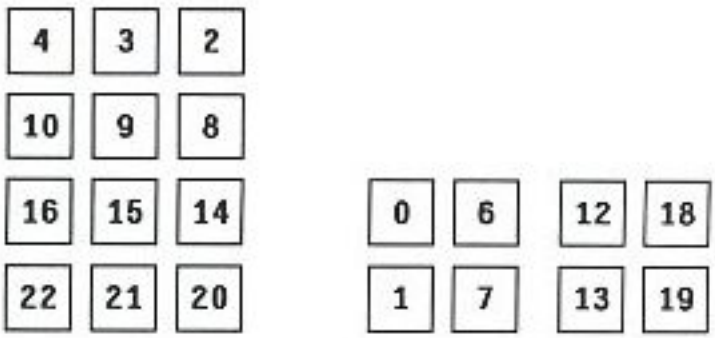


Fig. 4-1 Teclado con código de la matriz

La prueba se deja pulsando dos veces la tecla <STOP>.

```
diagnose
>Motor Test
```

6. **Prueba del motor**

<ENTER>

```
>Motor Test
```

La navecilla de muestras se introduce en el horno y luego sale.

Se muestra la posición de la nave.

```
>Motor Test
Schiff Pos.      XXX
```

profundidad de entrada 0-130 mm

<STOP>

La navecilla se para una vez acabado el ciclo de recorrido a 0 mm.

```
diagnose
>Measure Test
```

7. **Prueba del aviso acústico**

<9>

```
diagnose
>Beeper Test
```

<ENTER>

```
>Beeper Test
```

El tono se oye durante 1 s, aproximadamente.

Con <STOP> se acaba la prueba.

```
diagnose
>Instrument Adjustment
```

8. **Prueba del fluido**

Desconecte el instrumento y vuelva a conectarlo después de 5 s.

```
Temp. muestra 1)    XX °C
Flujo de gas        YY 2)
```

1) *Lengua del ajuste correspondiente bajo CONFIG, >ajustes varios, diálogo: XXX (en estas instrucciones "español")*

2) *0 mL/min o 0 L/h, según el estado bajo "CONFIG"*

Conecte la bomba con la tecla <9>.

Gire al máximo el regulador del fluido de gas en sentido contrario a las manecillas del reloj.

Indicación del fluido 400 mL/min o 24.0 L/h como mínimo.

Cubra con un dedo la entrada de aire de la parte posterior del instrumento.

La indicación del fluido cambia a 0 mL/min o 0 L/h.

Deje libre de nuevo la entrada de aire y gire el regulador de aire.

La indicación del fluido cambia con la posición del regulador desde el valor máximo (vea arriba) hasta 0 mL/min, o 0 L/h.

Gire el regulador de fluido de gas al máximo.

9. **Control del cambio de la válvula**

Conecte la bomba según el punto 8.

Cambie a "TRANSFER" con la tecla <5> (Valve).

Piloto TRANSFER encendido

Compruebe el flujo de aire en el tubo de salida al final del tubo de inserción.

Ha de notarse la corriente suave de aire (por ejemplo, poniendo en la salida el dorso de la mano humedecido con saliva).

<5> (VALVE)

La indicación iluminada cambia a "PURGE".

La corriente de aire sale por la parte posterior del instrumento a través de la salida PURGE.

Desconecte la bomba nuevamente con la tecla <9>.

10. **Prueba de la alarma Pt 1000**

Quite la ficha de Pt 1000 de la parte posterior del instrumento.Chequee la pantalla:

```
revise termosonda
flujo de gas          0 XY
```

11. **Prueba de calibración Pt 1000**

En lugar de la termosonda Pt 1000 conecte una década de resistencia (± 0.1%) y ajústela a 1 kΩ[1]; o utilice la década que desee en la gama 1000 Ω - 2296 Ω y calcule el valor de derivación exigido según la tabla.

Indicación, por ejemplo, con una resistencia de 1 k: 0 °C (±1 °C)

Temperatura en °C	Resistencia en Ω	Temperatura en °C	Resistencia en Ω
0	1000,0	180	1684,62
10	1039,0	190	1721,55
20	1077,9	200	1758,37
30	1116,7	210	1795,06
40	1155,3	220	1831,65
50	1193,95	230	1868,11
60	1232,39	240	1904,46
70	1270,71	250	1940,70
80	1308,92	260	1976,81
90	1347,02	270	2012,81
100	1384,99	280	2048,70
110	1422,85	290	2084,47
120	1460,60	300	2120,12
130	1498,22	310	2155,66
140	1535,74	320	2191,08
150	1573,13	330	2226,38
160	1610,41	340	2261,57
170	1647,57	350	2296,64

Fig. 4-2

Conecte nuevamente la termosonda Pt 1000.

12. **Control del calentador**

<PARAM>

```
parámetros
temperatura         XXX °C
```

Introduzca por medio del teclado una temperatura de 150 °C.

Memorice la entrada con <ENTER> y <QUIT>.

```
temp. muestra       XX °C
flujo de gas          YYY
```

Pulse dos veces <SELECT> hasta que aparezca en la pantalla

```
temp. muestra       XX °C
temp. horno         XX °C
```

Empiece el proceso de calentamiento con la tecla <7> (HEATER).

[1] o utilice una resistencia individual de 1 k (± 0.1%).

Después de un máximo de 30 min[3], en cuanto la temperatura de la muestra haya alcanzado los 145 °C, el piloto READY ha de iluminarse permanentemente.

El piloto HEATER se ilumina o aparece intermitente cuando disminuye la necesidad de calor.

(Si se elige bajo CONFIG, al alcanzar la temperatura nominal los 150 °C (±5 °C) hay un aviso acústico.)

<7> (HEATER)

Se acaba el proceso de calentamiento.

Los pilotos "READY" y "HEATER" están apagados.

13. Entradas y salidas externas (remote)

Esta prueba es sólo necesaria si el Horno KF 707 está conectado a otros instrumentos por medio del interfase 'Remote'. Para esta prueba se necesita, además, una ficha 3.496.8510, la cual se utiliza en el servicio de reparaciones. El cliente también puede encargar esta ficha indicando el número anteriormente citado.
Por razones de integridad se describe aquí el proceso total.
(En caso de no desear el diagnóstico de la entrada y salida externa, continúe con el punto 14.)

PIN		PIN	PIN		PIN
1	——	24	5	——	21
2	——	12	9	——	18
3	——	23	10	——	17
4	——	22	11	——	16

Fig. 4-3 Conexiones en la ficha 3.496.8510

Desconecte el instrumento y entre en el diagnóstico según el punto 2.

Pulse <9> varias veces hasta

```
diagnose
>Input/Output Test
```

<ENTER>

```
>Input/Output Test
 io connector ?
```

Conecte la ficha 3.496.8510 al borne 'Remote'. (No desconecte el instrumento, preste atención a la asignación del enchufe).

<ENTER>

La prueba se sucede automáticamente. Si no hay errores, aparece:

```
>Input/Output Test
 io test ok
```

En caso contrario aparece un mensaje de errores. (Si no se ha conectado ninguna ficha de prueba, aparece 'io error 50'.)

Quite la ficha de prueba.

<ENTER>

```
diagnose
>RS-232 Test
```

[3] Requisito del proceso de calentamiento: temperatura de la muestra < temperatura nominal elegida. Con una temperatura inicial de 20 - 25 °C el tiempo de calentamiento dura un máximo de 30 min.

14. Prueba RS 232

Esta prueba es sólo necesaria si el Horno KF 707 está conectado a otros instrumentos por medio del interfase 'RS 232'. Para esta prueba se necesita, además, una ficha 3.496.8480, la cual se utiliza en el servicio de reparaciones. El cliente también puede encargar esta ficha indicando el número anteriormente citado.

Por razones de integridad se describe aquí el proceso total.

(Si no se desea el diagnóstico del interfase RS 232, se acaba aquí el diagnóstico.)

Fig. 4-4 Conexiones en la ficha de prueba 3.496.8480

Si aún no lo ha hecho, elija la prueba RS 232:

```
diagnose
>RS 232 Test
```

<ENTER>

```
>RS 232 Test
 rs connector ?
```

Introduzca la ficha 3.496.8480 en el borne 'RS 232'.
(No desconecte el instrumento, preste atención a la asignación del enchufe.)

<ENTER>

```
>RS 232 Test
 rs testing
```

La prueba se realiza automáticamente. Si no se encuentra ningún error aparece:

```
>RS-232 Test
 rs test ok
```

En caso contrario aparece un mensaje de error. (Si no se ha conectado una ficha de prueba, aparece 'rs error 68'.)

<QUIT> dos veces

Aparece el programa del usuario anteriormente seleccionado.

Quite la ficha de prueba.

Final del diagnóstico.

Información de los errores en la memoria de trabajo y su eliminación

La gama puede recibir datos erróneos debido a grandes interferencias (por ejemplo, picas en la red o relampagos) o por información de faltas introducida desde un ordenador conectado, lo cual produce perturbaciones en las funciones del procesador que, a su vez, produzcan un fallo del sistema

Por medio de la inicialización RAM que a continuación describimos se puede corregir de nuevo el contenido RAM. Para ello hay 3 posibilidades:

Cuadro del error	Corrección
– El teclado no funciona o – la pantalla no funciona, o no tiene sentido la indicación	A) Desconecte el instrumento y vuelva a conectarlo tras 5 s, contrólelo. En caso necesario, de la inicialización RAM, efectúe la parte "SETUP".
El interfase RS 232 no funciona	B) Desconecte el instrumento y vuelva a conecterlo tras 5 s, contrólelo. En caso necesario, de la inicialización RAM, efectúe la parte "CONFIG".
como arriba, una parte de la inicialización RAM no conduce al objetivo	C) Efectúe parte "ALL" de la inicialización RAM.

A) Inicialización RAM, parte "SETUP"

Efectúe el punto 2 del diagnóstico

```
diagnose
>RAM Initialization
```

<ENTER>

```
>RAM Initialization
Select                MODE
```

pulse <SELECT> varias veces hasta

```
>RAM Initialization
Select:               SETUP
```

<ENTER>

Se ajustan automáticamente los parámetros de las diferentes funciones básicas.

```
diagnose
>RAM Test
```

Compruebe el instrumento por medio del diagnóstico.

B) Inicialización RAM, parte "CONFIG"

Proceda como en A), pero pulse varias veces <SELECT> hasta

```
>RAM Initialization
Select:               CONFIG
```

<ENTER>

Los parámetros CONFIG se vuelven a ajustar automáticamente.

```
diagnose
>RAM Test
```

Compruebe el instrumento por medio del diagnóstico.

C) **Inicialización RAM (inicialización total)**

Atención:
Esta inicialización RAM **borra todos los datos del usuario** bajo "PARAM" y "CONFIG", por lo que se ha de realizar cuando sea realmente necesario. Anote los datos primero y después vuelva a introducirlos.

Proceda como en A), pero pulse, además, <SELECT> varias veces hasta

```
>RAM Initialization
Select:              All
```

<ENTER>

Se produce el estado básico software del instrumento automáticamente.

```
diagnose
>RAM Test
```

Compruebe el aparato por medio del diagnóstico.

Los datos perdidos de la memoria del usuario han de ser de nuevo introducidos.

Indicación "system error 3"

En caso de que aparezca en la pantalla la indicación 'system error 3', se puede salir al programa del instrumento con <QUIT>. Se cargan automáticamente los valores básicos de compensación. El instrumento es, de este modo, capaz de medir. En cualquier caso hay que contar con una mínima inexactitud. El servicio Metrohm podrá efectuar un reajuste optimo. El mensaje de error 'system error 3' aparece siempre después de conectar el instrumento hasta que se haya realizado el reajuste.

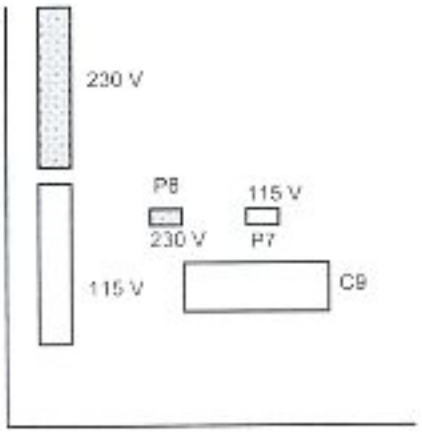
5. Preparaciones

Antes de efectuar la conexión asegúrese de que la tensión de la red coincide con la ajustada en su instrumento.
Si éste no fuera el caso habria que cambiar la **tensión de servicio**:

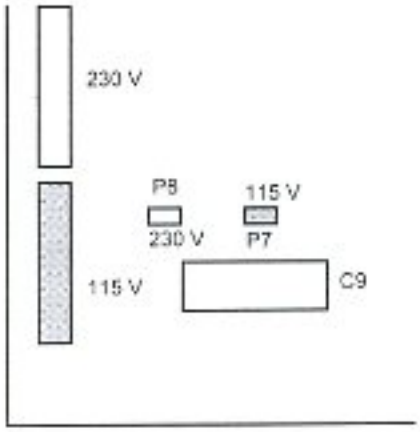
1. Quite el enchufe de la red. Suelte todas las conexiones de los tubos y cables que van al horno. Saque las botellas de secado.
2. Suelte los tres tornillos del borde anterior de la parte inferior del horno.
3. Suelte los tres tornillos del borde gris de la parte posterior del horno.
4. Levante la parte superior del horno cuidadosamente y colóquela hacia delante.
5. En el Print cerca del equipo de alimentación hay que conectar el enchufe del siguiente modo:

Ilustración del print visto desde arriba

220...240 V



100...120 V



El enchufe blanco se transpondrá a la izquierda.
El jumper se cambiará con unas pinzas.

6. Cierre el instrumento y efectúe de nuevo todas las conexiones de tubos y cables.
7. Anote el voltaje ajustado en la placa indicadora de tipo fijada en la parte posterior del horno.

Si se abre el instrumento o si hay que quitar alguno de sus componentes, se ha de tener cuidado, ya que puede haber partes que se encuentren bajo tensión, en caso de que el aparato esté conectado a la red. Por ello ha de estar el cable de conexión a la red siempre desconectado si desea realizar determinados ajustes o cambiar algunos componentes.

Los cables de conexión a la red que se reciben con el pedido del aparato son trifilares y están equipados con un enchufe con una clavija de toma de tierra. Cada interrupción de la toma de tierra dentro o fuera del instrumento puede hacerle a éste peligroso.

Conexión / desconexión de los cables sólo estando el aparato desenchufado.

5.1 Instalación del Horno KF

Vea también la ilustración de la página solapada 2.

Desembale el horno y quitele todas las cubiertas protectoras.

1. Introduzca el tubo insertado 6.2407.020 en la cámara de calefacción del horno y sujételo bien al horno con la garra de sujeción (tornillo rojo). El botón de vidrio del tubo insertado ha de estar en la entalladura de la garra.

2. Atornille el cable 6.2104.080 a la termosonda del tubo insertado e introdúzcalo en la ficha Pt1000 del horno.
   Importante: El enchufe gris del cable ha de estar en la ficha roja (inferior) del horno.

3. Coloque un septo 6.1448.040 en la caperuza roscada 6.2701.060 y atornille ésta en la rosca del tubo insertado.
   Cierre el tubo insertado con la tapa 6.2750.010.

4. Llene las botellas de secado 6.1608.050 con cribas moleculares.
   Atornille los tubos de conducción 6.1821.030 en las tapas roscadas 6.1602.140.
   Atornille las tapas en las botellas de secado.

5. Coloque las botellas de secado en el soporte verde.
   Atornille el tubo 6.1805.080 en la botella izquierda en el lugar donde se encuentra el tubo de conducción, vea el dibujo en el soporte verde. Enrosque el otro extremo del tubo en "To drying flask" del horno.

6. Conecte la botella izquierda a la botella derecha con el tubo 6.1805.180: Atornille el tubo en la botella derecha donde se encuentra el tubo de conducción.

7. Conecte la botella derecha de secado a la conexión de gas "From drying flask" del horno por medio del tubo 6.1805.080.

8. Una las dos conexiones del tubo del horno ("Purge" y "To Oven") al tubo insertado por medio de 2 tubos 6.1805.180.

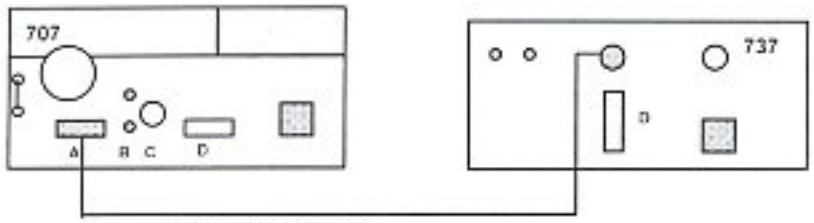
9. Una las dos conexiones del tubo ("Air in" y "Air out") localizadas en la parte posterior del horno con el tubo 6.1805.040.
   Si trabaja con otro gas que no sea el aire hay que quitar esta conexión de tubos. El gas se introducirá en la conexión "Air/N_2 in" con el cabo 6.1808.020. Los tubos de entre 3 y 4 mm de diámetro interior se pueden conectar al cabo.

10. Introduzca el filtro de aire 6.2724.010 en la conexión "Filter" de la parte posterior del horno.

11. Enrosque el tubo de salida 6.1805.070 en el tubo insertado e introdúzcalo en el recipiente de titración, vea páginas 51, 52.
    Importante: No envuelva con material aislante el tubo de salida en caso de altas temperaturas de las muestras, ya que la conexión se podría fundir. Para evitar la condensación en el tubo de salida se puede utilizar el tubo calentable 6.1830.000.

5.2 Conexión del Coulómetro KF

El Coulómetro KF 737 se conecta al Horno KF 707 del siguiente modo:



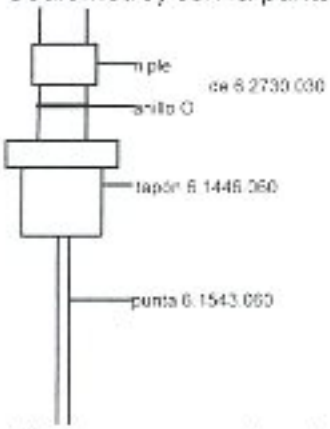
Cable 6.2141.000

La conexión del Coulómetro KF 684 es análoga a la del Coulómetro KF 737.

Para trabajar junto con un Horno KF se monta la célula de titración a la izquierda del Coulómetro y se instalan los instrumentos como se muestra a continuación:

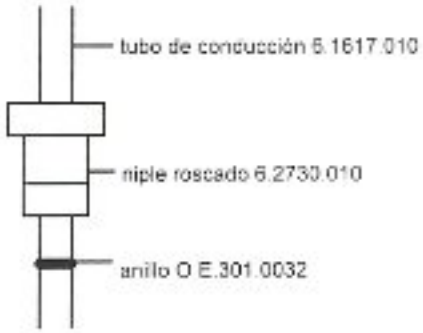
Equipamiento de las células de medición para la conducción de gas.

Células sin diafragma:
Tapón 6.1446.060 con niple y anillo O de 6.2730.030 (de los accesorios del Coulómetro) con la punta 6.1543.060.



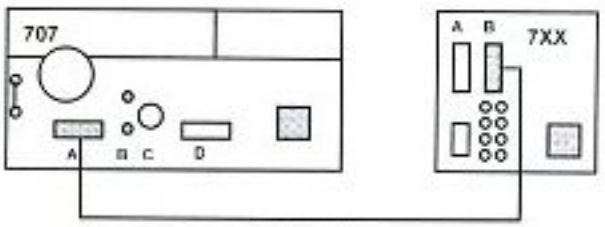
Introduzca una punta a través el anillo A.254.0104 para la adición de solvente con el Ti Stand 703.

Células de medición con diafragma:
Tubo de conducción de gas 6.1617.010 a través del niple roscado 6.2730.010 (de los accesorios del Coulómetro KF)



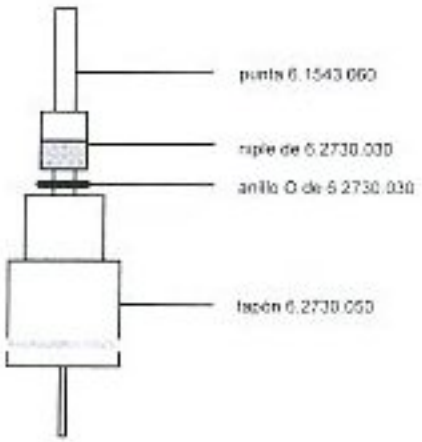
5.3 Conexión de un Titrino

El Titrino se conecta al Horno KF 707 del modo siguiente. (Atención: Conecte los extremos de los cables en el lugar adecuado):



Cable 6.2141.010

Instalación de los instrumentos con la ayuda del puente de instrumentos 6.2041.180:

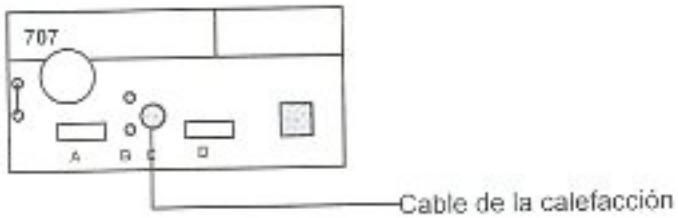


El recipiente de titración es equipado para la conducción de gas: En lugar del tapón septo 6.2730.020 se utiliza el tapón 6.2730.050 con la punta 6.1543.060. (Niple y anillo 0 de 6.2730.030 de los accesorios del Titrino.)

5.4 Conexión de la calefacción de salida

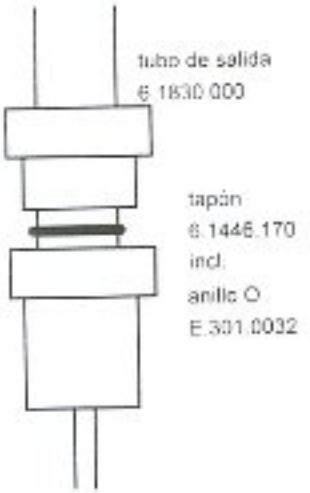
Si se utiliza el tubo de salida calentable 6.1830.000, se alcanzan tiempos más breves de determinaciones.
El tubo de salida calentable se debe utilizar siempre que surjan problemas de agua condensada en tubos normales de salida.

Enrosque el tubo en el manguito de salida y conecte el cable de la calefacción de salida al Horno KF:

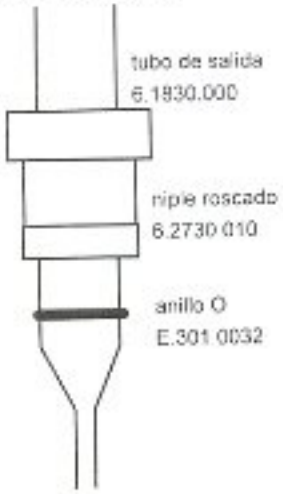


El tubo de salida calentable se introduce en el recipiente de titración como se muestra a continuación:

Célula coulométrica sin diafragma



Célula coulométrica con diafragma



Recipiente de titración volumétrico

5.5 Conexión de una impresora

Se pueden conectar diversas impresoras al horno por medio del interfase RS232. Si conecta otra impresora que no sea ninguna de las citadas a continuación, tenga en cuenta que se emule el modo Epson o utilice el juego de caracteres internacional según la tabla standard IBM 437. De este modo obtiene impresiones correctas, con los caracteres propios de su lengua.

El Horno KF 707 y un Titrador se pueden conectar a la misma impresora por medio del Serial-Auto-Switch 2.145.0100. Conecte los aparatos Metrohm con cable 6.2125.020 al Auto-Switch y utilize el cable correspondiente a la impresora, vea tabla siguiente.

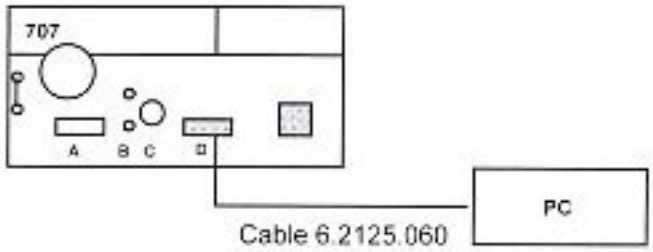
La conexión de algunas impresoras se facilita con la siguiente tabla:

Impresora	**Cable**	**Ajustes en el horno**	**Ajustes en la impresora**
Citizen iDP560 RS	6.2125.050	Baud Rate: 9600 Data Bit: 7 Stop Bit: 1 Paridad: par Handshake: HWs Transm.a: Citizen	**Interruptor DIP:** 1 on 2 off 3 off 4 off 5 on 6 - 7 off 8 on **Jumpers:** 1 open 2 open 3 open 4 open 5 **closed**
Seiko DPU-411	6.2125.020	Baud Rate: 9600 Data Bit: 7 Stop Bit: 1 Paridad: par Handshake: HWs Transm.a: Seiko	**Interruptor DIP1:** 1 off 2 off 3 on 4 on 5 off 6 off 7 on 8 on **Interruptor DIP2:** 1 off 2 off 3 off 4 off 5 off 6 off

Impresora	Cable	Ajustes en el horno	Ajustes en la impresora
Epson con enchufe cilíndrico de 6 tomas	6.2125.040	Data Bit: 8 Stop Bit: 1 Paridad: ninguna Handshake: HWs Tarnsm.a: Epson	8 bit ninguna paridad
Epson con interfase #8148	6.2125.050	Data Bit: 8 Stop Bit: 1 Paridad: ninguna Handshake: HWs Transm.a: Epson	8 bit ninguna paridad
HP Desk Jet	6.2125.050	Data Bit: 8 Stop Bit: 1 Paridad: ninguna Handshake: HWs Transm.a: HP	8 bit ninguna paridad
Kodak Diconix 180 si	6.2125.050	Data Bit: 8 Stop Bit: 1 Paridad: ninguna Handshake: HWs Transm.a: Epson	Emulation Epson 8 bit ninguna paridad

5.6 Conexión de un ordenador

El ordenador se conecta del modo siguiente:



Para la conexión en los enchufes de 9 tomas es necesario el adaptador adicional 6.2125.010.

Seleccione en el Horno KF 707:
Ajustes RS232: según el programa en el ordenador sobre el manejo
Enviar a: IBM

6.Apéndice

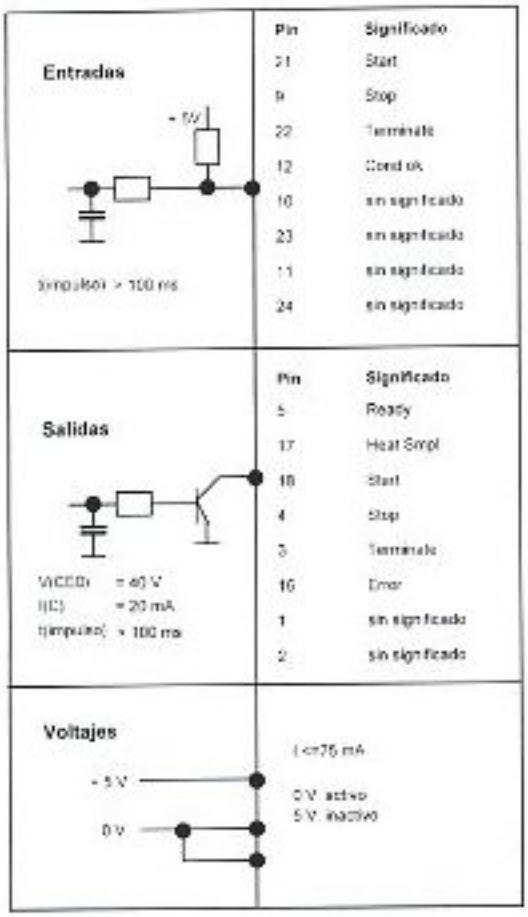
6.1 Características técnicas

Temperatura de la muestra	50...300 °C (Termómetro de resistencia Pt 1000)
Flujo de gas con bomba de aire incorporada	0... 15 L/h o 250 mL/min, aprox.
Dimensiones de la navecilla	
Longitud	64 mm
Anchura	20 mm
Profundidad	12 mm
Materiales	
Caja	Metal ligero
Cubierta del teclado	Policarbonato (PC)
Pantalla	LCD, 2 líneas de 24 caracteres cada una, altura de los caracteres 5 mm
Interfase RS232	para la conexión de impresora u ordenador
Líneas convencionales de entradas/salidas	Entradas: Cond.ok, Start, Stop, Terminate Outputs: Ready, Heat Smpl, Start, Stop, Terminate, Error
Calefacción de salida	Salida: DC 8.5 V, 3 W
Temperatura ambiental	
Gama funcional	5...40 °C
Almacenamiento, transporte	-20...60 °C
Especificaciones de seguridad	Construcción y control según la publicación IEC 1010, clase de seguridad I. Estas instrucciones para el uso contienen información y consejos que el usuario ha de seguir con exactitud para asegurarse de un perfecto y seguro funcionamiento del instrumento.
Conexión a la red	
Voltaje nominal	100-120 V, 220-240 V ± 10% (conmutable)
Frecuencia	50...60 Hz
Absorción de energía	250 VA
Fusible	Termofusible + 2 × 2 A (TH)
Dimensiones incluidos accesorios	
Anchura	380 mm
Altura	250 mm
Profundidad	275 mm
Peso incluidos accesorios	7.8 kg, aprox.

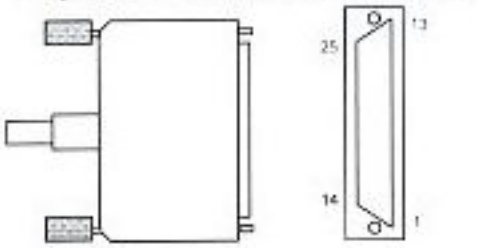
6.2 Ficha "Remote"

6.2.1 Asignaciones de la ficha

No nos hacemos responsables de un posible daño causado por una indebida conexión de instrumentos.



Asignación de los contactos al enchufe (macho)



Visto desde la parte soldada del enchufe

Números de pedido
K.210.0004 (caja) y K.210.0002

6.3 Garantía y certificados

La garantía METROHM cubre cualquier defecto de fabricación o material que pueda tener el aparato durante 12 meses, a partir de la fecha de entrega, y se reparará gratuitamente en nuestro taller. Sólo el transporte correrá a cargo del cliente.

En el caso de un servicio diurno y nocturno la garantía sólo es válida hasta los 6 meses.

Cualquier control que no sea debido a defecto de material o fabricación deberá ser abonado, incluso durante el período que dure la garantía. En productos con componentes de fabricación externa, si dichos componentes constituyen la mayor parte del aparato, las condiciones de garantía dependen del fabricante exterior.

Para poder garantizar el funcionamiento y la exactitud es necesario seguir las instrucciones de uso dadas.

Con respecto a defectos en el material, construcción o diseño, el cliente no tiene derecho a una garantía, excepto en los casos mencionados arriba.

Si en el momento de la entrega el paquete está visiblemente deteriorado, o si al desempaquetar el aparato se observan anomalías debido al transporte, se debe informar inmediatamente a la agencia de transportes o la oficina de correos responsable y redactar un acta de los daños. En ausencia de un informe oficial de los daños, no nos hacemos responsables del pago de una indemnización.

Cuando se envíe el paquete y sus accesorios para realizar un servicio, se deberá utilizar el embalaje original siempre que sea posible. Antes de ser colocado entre virutas u otro material semejante, hay que envolver cada una de las partes para protegerlas del polvo (es necesario utilizar una bolsa de plástico para instrumentos y partes de aparatos). Si con el pedido se recibe algún componente abierto que sea sensible a tensiones electro-magnéticas (por ej.: interfase de datos, etc.) éstos se deben devolver en su embalaje original de protección (por ej.: bolsa conductora de protección). (Excepción: los componentes con fuente de tensión incorporada han de tener un embalaje de protección no conductor.) La garantía no cubre los daños ocasionados por un embalaje inadecuado o descuidado.

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:	707 KF Oven
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
EN50081-1/92, EN55022 / class B, EN55011 / class B

Electromagnetic compatibility: Immunity

EN50082-1/92	Immunity
IEC801-2/91 (level 3), NAMUR/93	Static discharge
IEC801-3, ENV50140/93 (level 2)	Radiated rf electromag field immunity
IEC801-4, IEC1000-4-4/95 (level 4)	El.fast transient requirements
IEC801-5, IEC1000-4-5/95 (level 2/3)	'Surges' immunity
IEC801-6, IEC1000-4-6/96, ENV50141/93 (level 3)	Immunity to conducted disturbances
NAMUR/93 Paragr. 3.2.2.	Voltage dips, short interruptions

Security specifications
IEC1010 class1, EN61010 class1, UL3101-1, EN60947:IP20

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.
The features of the system software are documented in the instruction manual.

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, december 6, 1995

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

Ionenanalytik • Analyse des ions • Ion analysis • Análisis iónico

707 Horno KF

CE

Declaración de Conformidad UE

La sociedad Metrohm SA, Herisau, Suiza, certifica por la presente que el equipo:

707 Horno KF

cumple los requisitos de las directivas 89/336/CEE y 72/23/CEE de la UE.

Normas consultadas:

EN 50081-1	Compatibilidad electromagnética, norma básica, emisión perturbadora
EN 50082-1	Compatibilidad electromagnética, norma básica, resistencia a las perturbaciones
EN 61010	Requerimientos de seguridad para equipos eléctricos de medida y control para laboratorio

Descripción del aparato:

Horno para vaporizar la humedad de las muestras. Sirve juntos con un Titrador KF para determinar agua.

Herisau, 6 de diciembre de 1995

Dr. J. Frank	Ch. Buchmann
Director Técnico	Director de producción y responsable del aseguramiento de la calidad

6.4 Accesorios, referencias de pedido,

Horno KF 707 ..... 2.707.0010
incluyendo los siguientes accesorios:

1 Juego de tapones septo (5 piezas) para la caperuza roscada 6.2701.060 ..... 6.1448.040
1 Punta para la conducción de gas 6.1543.060
2 Tapones para las botellas de secado 6.1602.140
2 Botellas de secado 6.1608.050
1 Tubo de conexión, 9 cm 6.1805.040
1 Tubo de conexión, 10.5 cm 6.1805.070
2 Tubos de conexión, 25 cm 6.1805.080
3 Tubos de conexión, 16 cm 6.1805.180
1 Cabo de tubo con rosca 6.1808.020
2 Tubo de introducción para las botellas de secado 6.1821.030
1 Abrazadera de sujeción 6.2056.000
1 Cable para la termosonda 6.2104.080
1 Tubo insertado 6.2407.020
3 Navecillas para las muestras 6.2415.000
1 Vara de conducción 6.2416.010
2 Juegos de inserciones de Al (de 25 piezas) 6.2623.000
1 Caperuza roscada 6.2701.060
1 Filtro de aire 6.2724.010
1 Tapón para los recipientes de titración volumétrica KF 6.2730.050
1 Tapa para el tubo insertado 6.2750.010
1 Botella de cribas moleculares, 250 g 6.2811.000

Opciones

Cables y accesorios
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Cable Horno KF 707 al Titrino 6.2141.010
Cable Horno KF a la Impresora Citizen iDP560RS 6.2125.050
Cable Horno KF 707 KF a la Impresora Seiko DPU-411 ..... 6.2125.020
Cable Horno KF 707 a la Impresora Epson con enchufe redondo de 6 tomas 6.2125.040
Cable Horno KF 707 a la Impresora Epson con interfase #8148 ..... 6.2125.050
Cable Horno KF 707 a la Impresora HP Desk Jet 6.2125.050
Cable Horno KF 707 a la Impresora Kodak Diconix 180 si 6.2125.050
Serial Auto Switch (Horno y Titrador en la misma impresora) 2.145.0100
Cable aparato Metrohm - Serial Auto Switch 6.2125.020

Accesorios para células de titración

Calefacción de salida calentable 6.1830.000

Células coulométricas sin diafragma:

Tapón para punta de conducción de gas 6.1446.060
Niple y anillo 0 de 6.2730.030
Tapón para la calefacción de salida calentable 6.1446.170

Células coulométricas con diafragma:

Tubo de conducción de gas 6.1617.010
Niple roscado 6.2730.010
Anillo O E.301.0032

Células volumétricas de titración:

Niple y anillo O de 6.2730.030

General

Puente para las combinaciones de instrumentos, por ej.: con Titrinos 6.2041.080

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