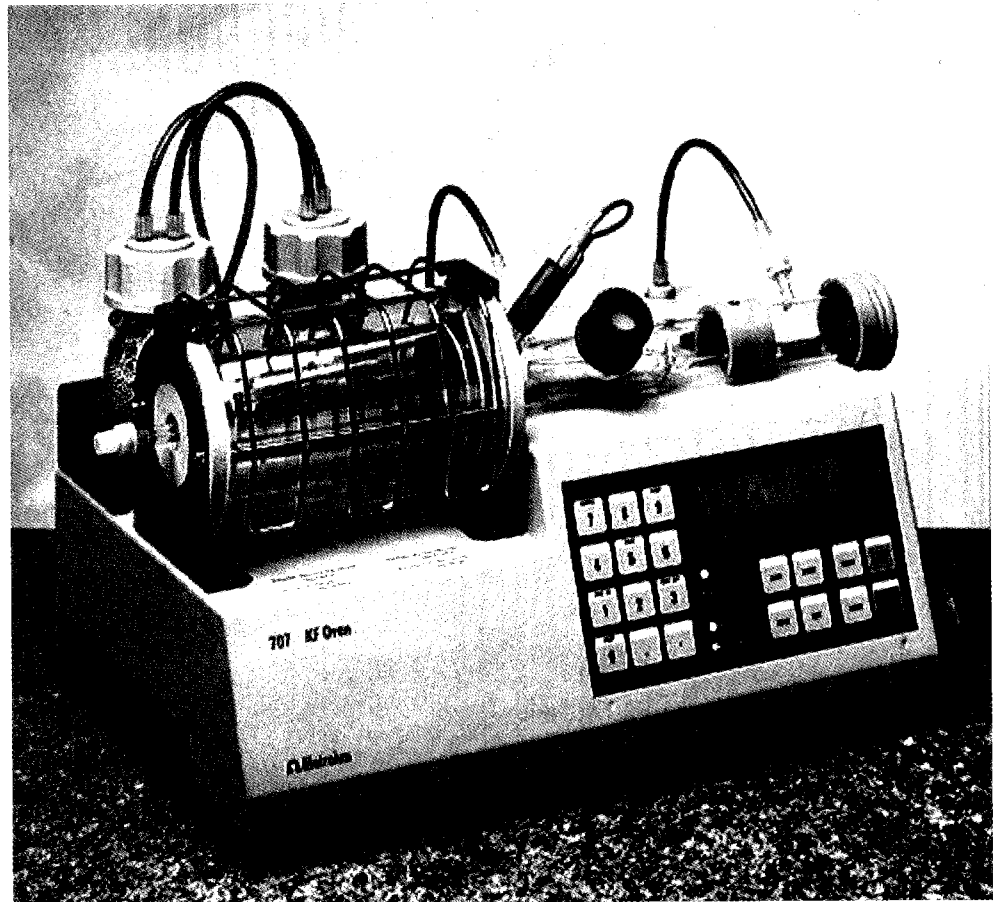


# 707 KF Oven

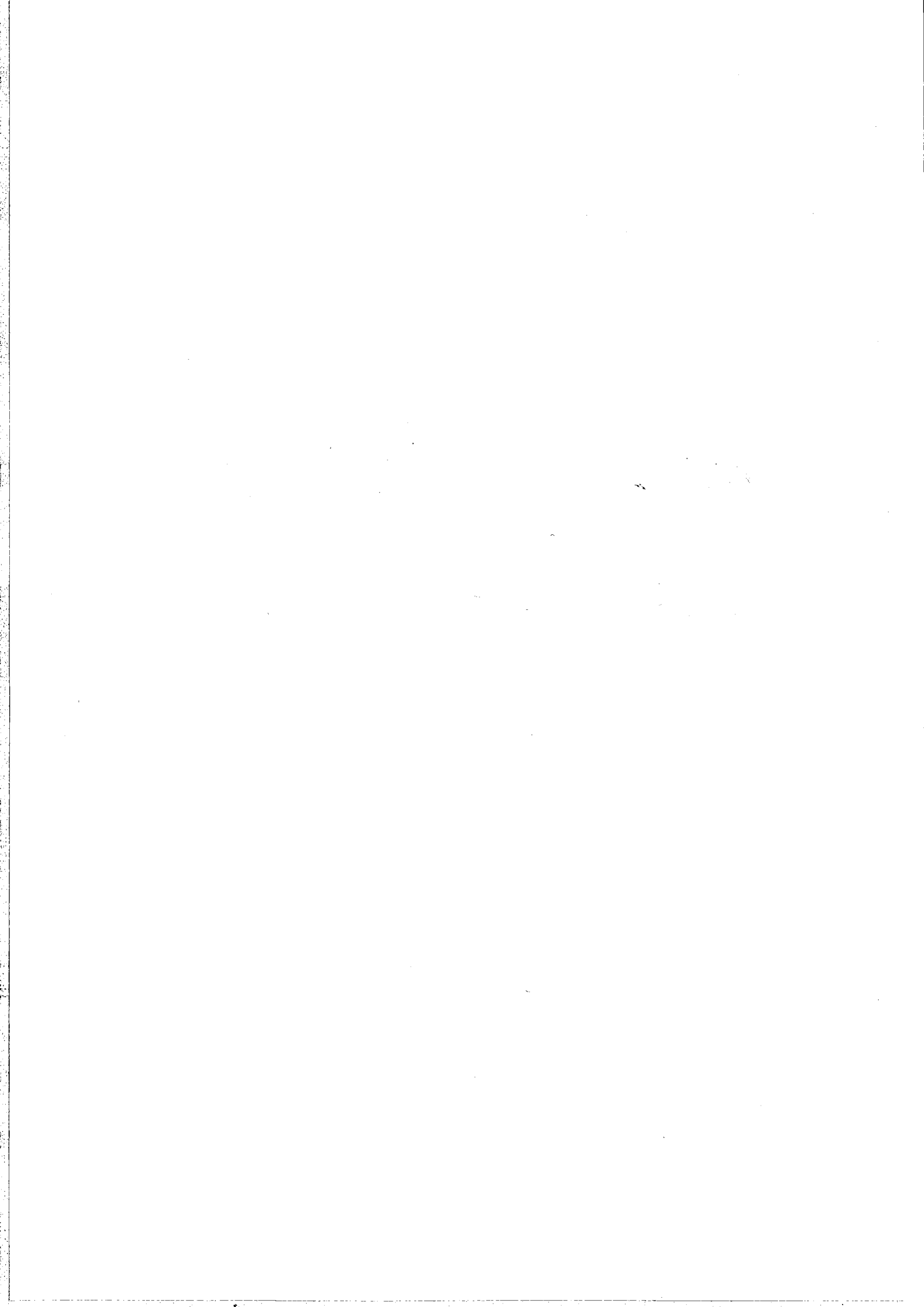


## Instructions for use

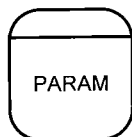
8.707.1013

 **Metrohm**  
Ion analysis

Metrohm Ltd.  
CH-9101 Herisau  
Switzerland



### Parameter



Go to next inquiry with  
<PARAM> and <ENTER>

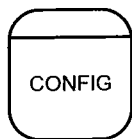
Default values are printed  
in **bold face**

Display	Meaning	Input range
temperature unit gas flow: min.gas flow gas type: factor purge time cond.time	Sample temperature. Unit for display of the gas flow. Minimum gas flow. Selection of the carrier gas type. Factor for "other" carrier gas. Wait time before start of the sample heating with valve to "purge". Wait time before start of the sample heating with valve to "transfer".	<b>50...300 °C</b> <b>mL/min, L/h</b> 0... <b>5</b> ...999 mL/min or in L/h <b>air, N2, other</b> 0.001... <b>1</b> ...9.999 <b>0...99 999 s</b>  <b>0...99 999 s</b>

### Keys for individual manual functions

Key	Meaning
<HEATER>	On/off switching of heating.
<PUMP>	On/off switching of pump. Pump off when, e.g. N <sub>2</sub> used as carrier gas.
<VALVE>	Switching of valve. The valve position is shown by the "VALVE" lamp.
<BOAT IN>	Insert sample boat. The boat moves until the key is pressed again.
<BOAT OUT>	Withdraw sample boat. The boat moves until the key is pressed again.
<PRINT>	Manual report printout.

## Configuration



Go to next inquiry with  
<CONFIG> and <ENTER>

Default values are printed  
in **bold face**

Display	Meaning	Input range
>oven settings auto preparation: valve control:  start if cond ok:  start temp.range  send to: report:	Preparation of the oven after power on. Switching of the valve at the end of the determination. Allow start of determination only if connected device is conditioned. Temperature range for start of determination. Selection of the printer (character set). Automatic report output.	ON, <b>OFF</b> ON, <b>OFF</b>  ON, <b>OFF</b>  1... <b>5</b> ...100 °C  <b>IBM</b> , Epson, Seiko, Citizen, HP ON, <b>OFF</b>
>auxiliaries dialog:  run number auto start start delay beeper device label program	Selection of the dialog language.  Current run number. Automatic start. Wait time before the start. Audio signal. Device label for call-up via remote control. Program version.	<b>english</b> , deutsch, francais, español <b>0</b> ...9999 1...9999, <b>OFF</b> <b>0</b> ...9999 1...9, <b>OFF</b> up to 8 ASCII characters no entry
>RS232 settings baud rate:  data bit: stop bit: parity: handshake:  RS control:	Baud rate.  Data bits. Stop bits. Parity. Handshake.  Receipt of commands via RS interface.	300, 600, 1200, 2400, 4800, <b>9600</b> 7, <b>8</b> 1, 2 even, odd, <b>nONE</b> <b>HWs</b> , HWf, SWline, SWChar, none ON, <b>OFF</b>

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The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This ensures transparency and allows for easy verification of the data.

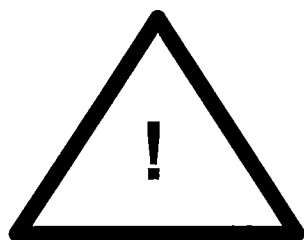
In the second section, the author details the various methods used to collect and analyze the data. This includes both primary and secondary research techniques. The primary research involved direct observation and interviews with key stakeholders. The secondary research focused on reviewing existing literature and industry reports.

The third section presents the findings of the study. It highlights several key trends and patterns observed in the data. These findings are supported by statistical analysis and visual representations such as charts and graphs. The results indicate a significant shift in consumer behavior over the period studied.

Finally, the document concludes with a series of recommendations based on the findings. These suggestions are aimed at helping organizations better understand their market and make informed decisions. The author also notes the limitations of the study and suggests areas for future research.

# 707 KF Oven

Series 05...



The following parts around the heating tube of the KF Oven can become hot:

Heating tube, lateral shielding walls of the heating tube, guard grill of the heating tube, jacket of the outlet heating.

**Caution:** Never touch these parts and ensure they never come into contact with solvents!

---

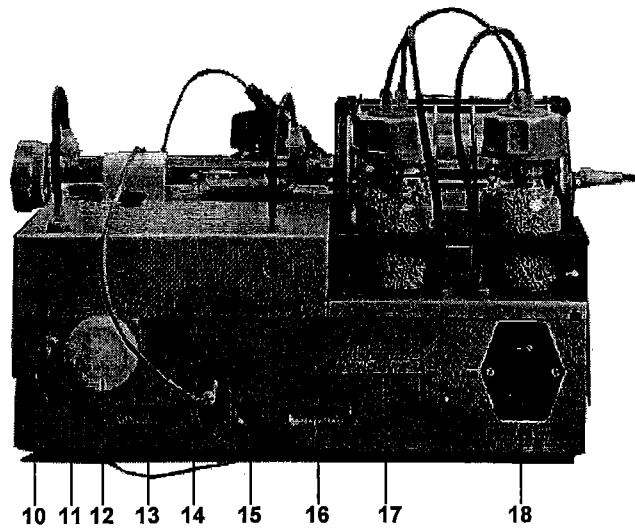
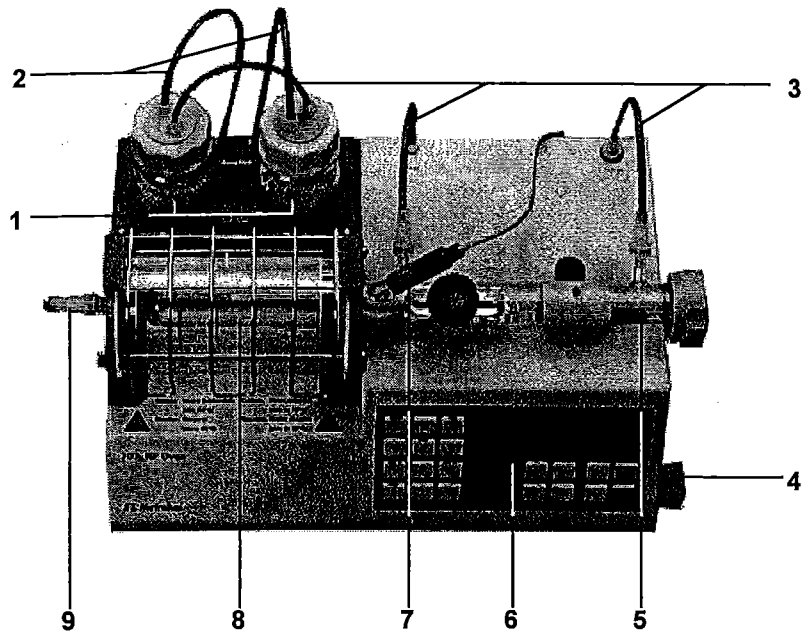
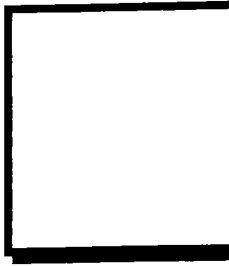
## 1. Overview

---

### Front

- 1      **Drying flasks**  
filled with molecular sieves. For drying the carrier gas.
- 2      **Tubing connections**  
with 6.1805.180 Tubing.
- 3      **Tubing connections**  
with 6.1805.080 Tubing.
- 4      **Adjustment for gas flow**
- 5      **Oven insert tube**  
contains sample boat with guide rod.
- 6      **Control panel**  
with display, keypad and status lamps.
- 7      **Temperature sensor**  
for measuring the sample temperature.
- 8      **Heating tube**  
with lateral shielding walls and guard grill.
- 9      **Outlet tubing**  
leads into titration vessel. 6.1805.070 Tubing or 6.1830.000  
Heatable Outlet Tubing (option).

Metrohm AG



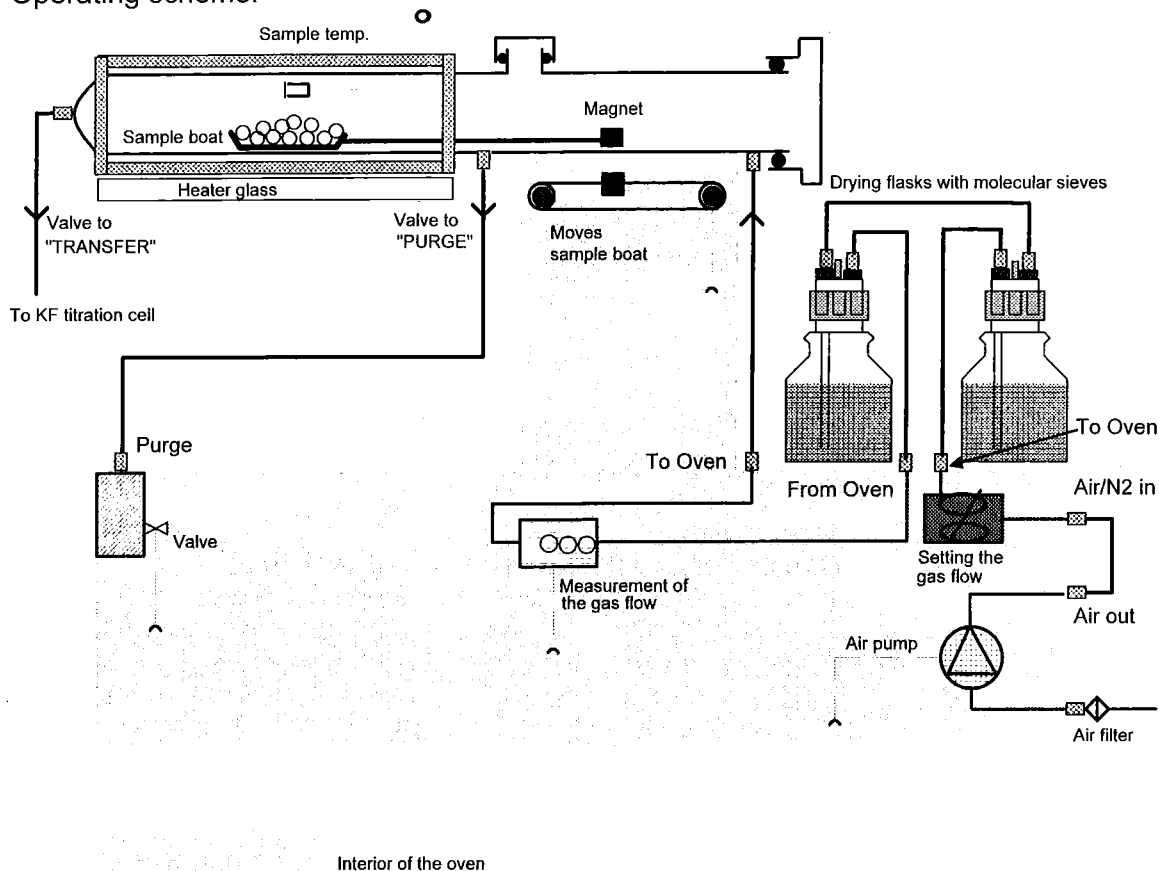


## Rear

- 10**      **Tubing connection**  
with 6.1805.040 Tubing.
- 11**      **Contrast adjustment for the display**
- 12**      **Dust filter**
- 13**      **Connection for titrators**
- 14**      **Connection for temperature sensor**  
plug the grey connector of the cable into the red socket of the KF Oven!
- 15**      **Connection for outlet heating**
- 16**      **RS232 interface**  
for connection of a printer or computer.
- 17**      **Model plate**  
with manufacturing, serial and instrument number.  
Display of the set mains voltage, the mains frequency and the power consumption. Before switching on for the first time, check that the set mains voltage matches the voltage of your power supply. If this is not the case, disconnect mains cable and change over voltage, see page 49.
- 18**      **Power supply unit**  
with mains switch and mains connection.  
With power supplies in which powerful HF disturbances are superimposed on the mains voltage, the KF Oven should be operated with an additional mains filter, e.g. METROHM model 615.

## 1.1 Operating principle

Operating scheme:



### Gas flow

If air is used as the carrier gas, work is carried out with the air pump built into the oven. The pump draws in the air through the air filter.

If a different gas is used as carrier gas, this is introduced via the connection "Air/N<sub>2</sub> in".

The gas flow is set with the valve on the side of the oven and the gas led through the drying flasks. The gas flow is measured immediately before entry into the insert tube.

If the valve is set to "PURGE", the gas flows out again through the opening "Purge". It is thus led through the cold, front part of the insert tube.

If the valve is set to "TRANSFER", the gas flows through the entire insert tube, i.e. also through the hot zone of the oven. The gas exits through the outlet at the end of the insert tube and is led to the titration cell where the moisture of the sample is determined by titration.

## 2. Operating conditions

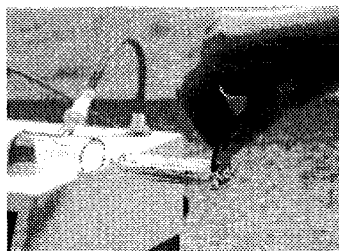
### 2.1 Handling the sample boat

Sample boat and guide rod should always be handled using the 6.2056.000 Holding Clamp to ensure the measurement results are not falsified by skin moisture adhering to the glass.

Always dry sample boat and guide rod well (hair dryer, drying oven) after cleaning. Store sample boats in a desiccator.

There is no need to clean the sample boat if the aluminium inserts (order number 6.2623.000) are used (recommended especially when the samples melt or decompose).

#### ***Inserting sample boat in the oven***

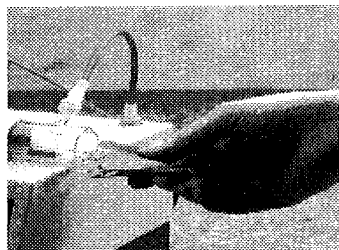


Hold boat with clamp so that the eye of the boat fits in the opening of the clamp.  
Place boat in insert tube. The eye should protrude from the tube.

Grip guide rod with the clamp. The two teeth of the clamp should be at the bottom.

Engage guide rod in the eye of the boat and slide into insert tube.

The boat can also be gripped with the guide rod and inserted in the oven as a unit "boat and guide rod".



Close insert tube with cover.  
Start determination with <START>.

#### ***Removing sample boat from the oven***

Open cover of the insert tube.

Grip guide rod with the clamp and withdraw until the end of the sample boat protrudes sufficiently out of the insert tube to be easily grasped by the clamp. Disengage guide rod from the eye of the boat and put aside, e.g. on the oven at the rear. Position so that the holding lug of the guide rod projects over the oven edge and can be easily gripped by the clamp.

Grip boat with clamp and take out.

Boat and guide rod can also be withdrawn from the oven together.

Close insert tube with cover.

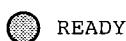
## 2.2 Automatic sequence of a determination

The automatic sequence facilitates the work when a KF Titrator is attached. After the start, all steps necessary for the determination are performed at the KF Oven.



READY

After being switching on, the oven heats up to the set temperature (when "auto preparation: on" is set in <CONFIG>). Until the set temperature is reached, the "READY" lamp flashes.



READY

Once the set temperature is in the range of the starting temperature, the "READY" lamp is on continuously.

Set the desired gas flow (e.g. 100 mL/min). Set gas flow when oven is hot!

Position the sample boat and the guide rod in the cold part of the insert tube.



START

Start the sequence at the KF Oven with the <START> key.

**purge time 13 s**

If a purge time has been entered, this is allowed to elapse.

VALVE  
TRANSFER

The valve switches from "PURGE" to "TRANSFER", i.e. the gas is now led to the titration vessel.

**cond. time 5 s**

If a conditioning time has been entered, this is allowed to elapse.

The attached titrator is tested to see whether the titration vessel is conditioned (if "start if cond ok: on" is set in <CONFIG>), the titrator is then started automatically and the sample boat moved to the hot part of the oven. The sample is heated, the evolved water led to the titration vessel with the carrier gas and there titrated.

VALVE  
PURGE

On completion of the titration and if "valve control" is ON, the valve is automatically set to "PURGE" and the sample boat moved out of the hot part.

VALVE  
TRANSFER

If "valve control" is OFF, the valve remains on "TRANSFER".

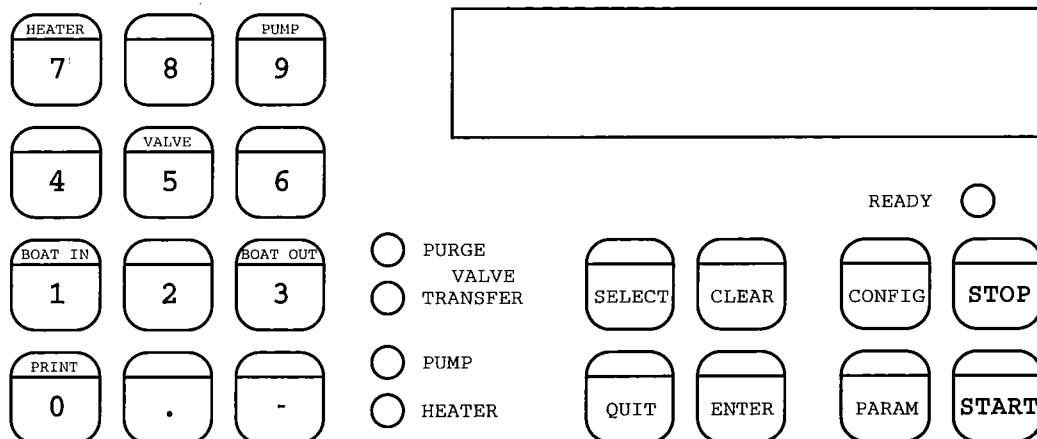


READY

When the set temperature has been reached, "READY" lights up and the oven is ready for the next determination.

## 2.3 Settings on KF Oven

### 2.3.1 Keypad



#### Keys for individual manual functions

<HEATER>

Switches heating off/on. The "HEATER" lamp lights up or flashes when the heating is switched on. (The lamp is on continuously when full heating power is used; it flashes with reduced heating power.)

**Note:**

If the heating is switched off and if the valve is on "TRANSFER", the solvent may be sucked back from the titration vessel.

<PUMP>

Switches pump off/on. The "PUMP" lamp lights up when the pump is switched on.

<VALVE>

Switches valve. The "VALVE, PURGE" and "VALVE, TRANSFER" lamps show the position of the valve. For safety reasons, the valve is always set to "PURGE" at the end of an automatic determination as well as on switching off the Oven (suck-back of solution from the titration vessel!)

<BOAT IN>

Inserts the sample boat in the hot part of the oven. The boat continues to move until the key is pressed again or until the boat reaches the inner stop.

<BOAT OUT>

Withdraws the sample boat from the hot part of the oven. The boat continues to move until the key is pressed again or the boat reaches the outer stop.

<PRINT>

Triggers report printout

Key sequence:

<PRINT><SELECT><ENTER>; press <SELECT> repeatedly until the desired report appears in the display or

<PRINT><Key X><ENTER>; Key X = PARAM or CONFIG

**Input and determination control keys**

- <SELECT>                    Used to select different input quantities. The "." character following the dialog text means that <SELECT> is used for selection of the input quantities.  
<SELECT> can also be used to select the contents of the 2nd display line: Switching from display of the gas flow to messages, to display of the oven temperature.
- <CLEAR>                    - Clearing of input values  
                              - Sets special values, e.g. "off"
- <QUIT>                     - Exits inquiries  
                              - Aborts wait times  
                              - Aborts report outputs  
                              - Exits error messages
- <ENTER>                    - Acceptance of input values  
                              - Conclusion of command sequences

**Keys with rolling inquiries**

Repeat pressing of these keys leads to next inquiry (group).

- <CONFIG>                    Configuration data, see page 9.  
                              The inquiries are divided into groups. The titles of the inquiry groups are marked with the ">" character. Entry into the inquiry groups with <ENTER>.
- <PARAM>                    Parameters for the automatic determination, see page 11.

**Keys for the automatic determination**

- <STOP>                     Stops the automatic determination.
- <START>                    Starts the automatic determination. The start is possible only when the "READY" lamp is continuously lit up, i.e. the current temperature lies in the range of the starting temperature.

2.3.2 <CONFIG> key



The inquiries are divided into groups. The titles of the inquiry groups are marked with the ">" character. Entry into the inquiry group with <ENTER>.

>oven settings

**Inquiry group: General oven settings**

- auto preparation: OFF** *Automatic preparation after switching on (ON, OFF)*  
 "ON " means: Automatic heating to the sample temperature.
- valve control: ON** *Valve control (ON, OFF)*  
 "ON" means automatic switching of the valve from "PURGE" to "TRANSFER" at the end of the determination. With "OFF", the valve remains on "TRANSFER".
- start if cond.ok: OFF** *Start possible only when the attached titrator is conditioned (ON, OFF)*  
 "ON" means: The sample boat is not moved to the hot part of the oven until the attached titrator is conditioned. If no titrator is attached, "OFF" must be set.
- start temp.range 5 °C** *Temperature range for starting (1...100 °C)*  
 Starting the determination is only possible if the current temperature is in the range of  $\pm X$  °C from the sample temperature.
- send to: IBM** *Selection of the printer type/character set (Epson, Seiko, Citizen, HP, IBM)*  
 "Epson" for Epson Mode  
 "Seiko", e.g. for DPU-411  
 "Citizen", e.g. for i560 RS  
 "HP" for HP mode  
 "IBM" for all printers with IBM character set table 437, as well as for data transmission to a computer or a data system.
- report: OFF** *Report output at the end of the automatic determination (OFF, ON)*  
 Report example:  

```
'fr
707 KF Oven          0D1/108  707.0010
run number           1
purge time            10 s
cond.time             5 s
smpl heating time    587 s
sample temp.         150 °C      Set temperature
lowest temp.         147 °C      During sample heating
highest temp.        150 °C      During sample heating
gas type:             air
gas flow              87 mL/min  Mean gas flow
=====
```

**>auxiliaries****Inquiry group: Auxiliaries**

<b>dialog:</b>	<b>english</b>	<i>Selection of the dialog language (english, deutsch, francais, español)</i>
<b>run number</b>	<b>0</b>	<i>Current run number (0...9999) The run number is set to 0 when the oven is switched on.</i>
<b>auto start</b>	<b>OFF</b>	<i>Automatic, internal apparatus start (1...9999, OFF) Number of automatic starts.</i>
<b>start delay</b>	<b>0 s</b>	<i>Start delay (0...9999 s) Delay time following the start before the automatic determination begins. The wait time can be aborted with &lt;QUIT&gt;.</i>
<b>beeper</b>	<b>1</b>	<i>Audio signal (1...9, OFF) Number of beeps when the oven is ready.</i>
<b>device label</b>		<i>Device label for the individual identification of devices in the device network (up to 8 ASCII characters)</i>
<b>program</b>	<b>707.0012</b>	<i>Display of the program version</i>

**>RS232 settings****Inquiry group: RS settings**

<b>baud rate:</b>	<b>9600</b>	<i>Baud rate (300, 600, 1200, 2400, 4800, 9600)</i>
<b>data bit:</b>	<b>8</b>	<i>Data bits (7, 8)</i>
<b>stop bit:</b>	<b>1</b>	<i>Stop bits (1, 2)</i>
<b>parity:</b>	<b>none</b>	<i>Parity (even, odd, none)</i>
<b>handshake:</b>	<b>Hws</b>	<i>Handshake (HWs, HWf, SWline, SWchar, none) see also page 29 ff.</i>
<b>RS control:</b>	<b>ON</b>	<i>Control via RS232 interface (OFF, ON) "OFF" means the receipt of commands and data via the RS232 interface is blocked. Data <u>output</u> is possible.</i>

2.3.3 <PARAM> key



Contains the parameters for the automatic determination.  
\*live means: These parameters can be edited during the automatic determination.

**temperature** 50 °C

*Sample temperature (50...300°C)*  
Temperature to which the sample is heated.

**unit gas flow:** mL/min

*Unit for display of the gas flow (mL/min, L/h)*  
All displays and entries for the gas flow depend on the selected unit.

**min. gas flow** 5 mL/min

*Minimum gas flow (0...999 mL/h or 0...59.9 L/h)*  
The automatic determination can be started only when the set minimum gas flow has been reached.

**gas type:** air

*Selection of the carrier gas type (air, N2, other) or selection of the gas for moisture determinations in gas*  
If "other" is selected, the factor for the gas flow measurement must also be entered. The following values can be used as a basis for the factor:

Ar	0.686	Air	1.000
CH <sub>4</sub>	1.392	N <sub>2</sub>	0.999
CO <sub>2</sub>	1.353	N <sub>2</sub> O	1.901
Natural gas	1.465	O <sub>2</sub>	1.006
He	0.685	Propane	2.793

**purge time** 0 s  
\*live

*Purge time (0...99 999 s)*  
Wait time before the heating time, i.e. before the boat is slid into the oven. The valve remains on "PURGE". The wait time can be aborted with <QUIT>. The purge time should be used only when the cold sample evolves moisture with difficulty.

**cond. time** 0 s  
\*live

*Conditioning time (0...99 999 s)*  
Wait time before the sample heating, i.e. before the boat is slid into the oven. The valve is switched to "TRANSFER". The wait time can be aborted with <QUIT>. The conditioning time should be used only when the cold sample evolves moisture with difficulty.

---

## 2.4 Practical tips

---

### **Sample introduction via top opening of the insert tube**

This possibility can be used if several samples can be heated in succession in the same sample boat.

Add samples to sample boat with a syringe or open screw cover.

### **Selection of the carrier gas**

N<sub>2</sub> should always be used as the carrier gas when the hot sample is sensitive to air or oxygen and evolves oxidizable substances. At temperatures above 150°C (or with plastics above 200°C), nitrogen should always be used as the carrier gas.

### **Temperature setting**

Select temperature as high as the sample allows (high temperature = shorter analysis time): The sample must evolve no oxidizable substances except water.

### **Extraction time**

An extraction time of ca. 2 min should be set on the attached titrator to prevent the titration being aborted before the sample evolves water.

### **Conditioning system**

To condition the entire system (without sample boat and without sample) before the start, the valve can be set to "TRANSFER" at the KF Oven.

### **References**

- Hydranal ® Practical Course, Riedel-deHaën, 1987
- G. Wieland, Karl Fischer Titration, GIT Verlag, Darmstadt, 1985
- Following Metrohm Application Bulletins (available free of charge):
  - No. 109 KF water determination with the KF Drying Oven
  - No. 145 Determination of low water contents in plastics
  - No. 217 KF water determinations in pharmaceutical preparations by the KF oven method.

## 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.Aux.Language "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.Aux.Language "english"**

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

**&Config.Aux.Language "english" \$Q**    Q for Query

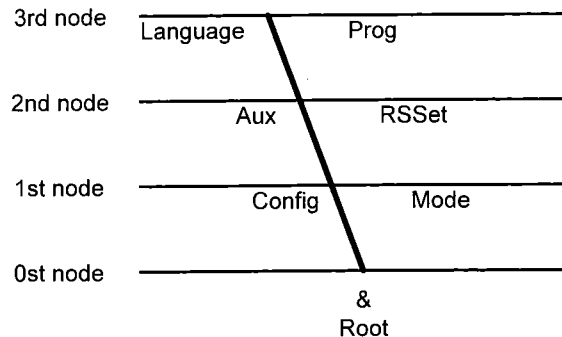
\$Q triggers the output of the value from the 707 KF Oven. Entries that are introduced with the character dollar (\$) trigger something. They are thus called **triggers** in what follows.

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

**&Config.Aux.Language "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: <b>&amp;Config.Aux.Language</b> or <b>&amp;C.A.L</b>
Upper or lowercase letters can be used.	<b>&amp;C.A.L</b> or <b>&amp;c.a.l</b>
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: <b>&amp;C.A.L"english"</b>  Correct entry of a number: <b>"0.1"</b>  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: <b>"deutsch"</b>
New objects can also be addressed relative to old objects: <b>A preceding point</b> moves one node <b>forwards</b> in the tree.	From the root to node 'Aux': <b>&amp;C.A</b> From node 'Aux' to 'Prog': <b>.P</b>
<b>More than one preceding point</b> moves one node <b>backwards</b> 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: <b>..L</b>
If a jump is to be made back to the root, a preceding & is entered.	Jump from node 'Language' via root to the node 'Mode': <b>&amp;M</b>

### 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: **&Config.RSSet.Baud \$Q**

Inquiry of all values of the node RSSet: **&Config.RSSet \$Q**

Inquiry of the path of node RSSet: **&Config.RSSet \$Q.P**

Starting a mode: **&Mode \$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 (LF missing). Sending from the instrument is therefore blocked.  
Exit: Send LF 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

<b>&amp;</b>	<b>Root</b>		
<b>Mode</b>	<b>Mode</b>	\$G, \$S	3.2.2.1
<b>.Temp</b>	Sample temperature	50...300	3.2.2.2
<b>.Gas</b>	Gas flow		
<b>.UnitFlow</b>	Unit for display	mL/min, L/h	3.2.2.3
<b>.MinFlow</b>	Minimum gas flow	0...999	3.2.2.3
<b>.Type</b>			
<b>.Select</b>	Selection of the gas type	air, N2, other	3.2.2.4
<b>.OtherFac</b>	Factor for "other" gas	0.001...9.999	3.2.2.4
<b>.PurgeTime</b>	Purge time	0...99999	3.2.2.5
<b>.CondTime</b>	Conditioning time	0...99999	3.2.2.5
<b>Config</b>	<b>Configuration</b>		
<b>.OvenSet</b>	<b>Oven settings</b>		
<b>.AutoPrep</b>	Automatic preparation	ON, OFF	3.2.2.6
<b>.ValveControl</b>	Valve control	ON, OFF	3.2.2.7
<b>.StartCond</b>	Start allowed only if cond.ok	ON, OFF	3.2.2.7
<b>.TempLimit</b>	Starting temperature range	1...100	3.2.2.7
<b>.CharSet</b>	Selection of the character set	Epson, Seiko, Citizen, HP, IBM	3.2.2.8
<b>.Report</b>	Report output at end	ON, OFF	3.2.2.9
<b>.Aux</b>	<b>Setting of various auxiliary functions</b>		
<b>.Language</b>	Selection of the dialog language	english, deutsch, francais, espanol	3.2.2.10
<b>.RunNo</b>	Current run number	0...9999	3.2.2.11
<b>.AutoStart</b>	Internal automatic start	1...9999, OFF	3.2.2.12
<b>.StartDelay</b>	Start delay	0...9999	3.2.2.12
<b>.Beeper</b>	Beep	1...9, OFF	3.2.2.13
<b>.DevName</b>	Device name	8 ASCII	3.2.2.13
<b>.Prog</b>	Program version	read only	3.2.2.14
<b>.RSSet</b>	<b>Settings for RS232\$G</b>	3.2.2.15	
<b>.Baud</b>	Baud rate	(300...9600)	3.2.2.16
<b>.DataBit</b>	Data bits	7, 8	3.2.2.16
<b>.StopBit</b>	Stop bits	1, 2	3.2.2.16
<b>.Parity</b>	Parity	even, odd, none	3.2.2.16
<b>.Handsh</b>	Handshake	HWs, HWf, SWchar, SWline, none	3.2.2.16

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

<b>&amp;</b>			
<b>Setup</b>	<b>Root</b>		
	<b>Setting the operating mode</b>		
.IdReport	Output report identification	ON, OFF	3.2.2.31
.Keycode	Key code of pressed keys	ON, OFF	3.2.2.32
.Tree	Definition of response to \$Q		
.Short	Send short path name	ON, OFF	3.2.2.33
.ChangedOnly	Only paths with changed values	ON, OFF	3.2.2.33
.Trace	Message when values change	ON, OFF	3.2.2.34
<b>.Lock</b>	<b>Lock functions</b>		
.Keyboard	Lock all keys	ON, OFF	3.2.2.35
.Config	Lock <CONFIG> key	ON, OFF	3.2.2.35
.Parameter	Lock <PARAM> key	ON, OFF	3.2.2.35
.Heater	Lock <HEATER> key	ON, OFF	3.2.2.35
.Pump	Lock <PUMP> key	ON, OFF	3.2.2.35
.Valve	Lock <VALVE> key	ON, OFF	3.2.2.35
.Boat	Lock <BOAT IN/OUT> keys	ON, OFF	3.2.2.35
.Display	Lock display operation of 707	ON, OFF	3.2.2.35
<b>.SendMeas</b>	<b>Automatic transmission of measurement data</b>		
.SendStatus	On/off switching of transmission	ON, OFF	3.2.2.36
.Interval	Time interval for transmission	1...16200	3.2.2.36
.Meas	Measured values for transmission		
.CyclNo	Cycle number	ON, OFF	3.2.2.37
.SampleTemp	Sample temperature	ON, OFF	3.2.2.37
.OvenTemp	Oven temperature	ON, OFF	3.2.2.37
.GasFlow	Gas flow	ON, OFF	3.2.2.37
<b>.AutoInfo</b>	<b>Automatic message on changes</b>		
.Status	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
<b>.PowerOn</b>	Simulation "Power on"	\$G	3.2.2.39
<b>.Initialise</b>	Set values to default	\$G	3.2.2.40
.Select	Selection	Mode,Config,All Setup,Assembly	3.2.2.40
<b>.RamInit</b>	Initialisation	\$G	3.2.2.41
<b>.InstrNo</b>	Set instrument identification	\$G	3.2.2.42
.Value	Enter instrument identification	8 ASCII	3.2.2.42
<b>.Save</b>	Store in EEPROM	\$G	3.2.2.43

### 3.2.2 Description of the remote control commands

3.2.2.1      **Mode**      \$G, \$S

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

3.2.2.2      **Mode.Temp**      50...300

Entry of the sample temperature in °C.

3.2.2.3      **Mode.Gas.UnitFlow**      mL/min, L/h  
               **Mode.Gas.MinFlow**      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      **Mode.Gas.Type.Select**      air, N2, other  
               **Mode.Gas.Type.OtherFac**      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      **Mode.Gas.PurgeTime**      0...99999  
               **Mode.Gas.CondTime**      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      **Config.OvenSet.AutoPrep**      ON, OFF

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

3.2.2.7      **Config.OvenSet.ValveControl**      ON, OFF  
               **Config.OvenSet.StartCond**      ON, OFF  
               **Config.OvenSet.TempLimit**      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  $\pm X$  °C from the sample temperature.

3.2.2.8      **Config.OvenSet.CharSet**      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      **Config.OvenSet.Report**      ON, **OFF**

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

3.2.2.10     **Config.Aux.Language**      **english**, deutsch, francais, español

Selection of the dialog language.

3.2.2.11     **Config.Aux.RunNo**      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     **Config.Aux.AutoStart**      1...9999, **OFF**  
**Config.Aux.StartDelay**      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     **Config.Aux.Beeper**      1...9, OFF  
**Config.Aux.DevName**      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     **Config.Aux.Prog**      read only

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

3.2.2.15     **Config.RSSet**      \$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	<b>Config.RSSet.Baud</b> <b>Config.RSSet.DataBit</b> <b>Config.RSSet.StopBit</b> <b>Config.RSSet.Parity</b> <b>Config.RSSet.Handsh</b>	300, 600, 1200, 2400, 4800, <b>9600</b> 7, <b>8</b> 1, 2 even, odd, <b>none</b> <b>HWs</b> , 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	<b>Info.Report</b>	\$G
----------	--------------------	-----

Output of the selected report.

3.2.2.18	<b>Info.Report.Select</b>	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	<b>Info.Results.PurgeTime</b> <b>Info.Results.CondTime</b> <b>Info.Results.SampleHeatTime</b> <b>Info.Results.LowTemp</b> <b>Info.Results.HighTemp</b> <b>Info.Results.GasFlow</b> <b>Info.Results.LowFlow</b> <b>Info.Results.HighFlow</b>	read only read only read only read only read only read only 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	<b>Info.ActualInfo.Inputs.Status</b> <b>Info.ActualInfo.Inputs.Change</b> <b>Info.ActualInfo.Inputs.Clear</b> <b>Info.ActualInfo.Outputs.Status</b> <b>Info.ActualInfo.Outputs.Change</b> <b>Info.ActualInfo.Outputs.Clear</b>	read only read only \$G read only read only \$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.

Line No.      

0	0	0	1	0	1	0	
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):

<b>Inputs:</b>	<b>Outputs:</b>
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.ActualInfo.Meas.CyclNo**      read only  
**Info.ActualInfo.Meas.SampleTemp** read only  
**Info.ActualInfo.Meas.OvenTemp** read only  
**Info.ActualInfo.Meas.GasFlow** read 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.ActualInfo.Status.BoatPos** read only  
**Info.ActualInfo.Status.Valve**    read only  
**Info.ActualInfo.Status.Pump**    read only  
**Info.ActualInfo.Status.Heating** 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.ActualInfo.Display.L1**      up to 24 ASCII characters  
**Info.ActualInfo.Display.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.Assembly.CycleTime**      read only

Inquiry of the cycle time in s.

3.2.2.25      **Assembly.Prep**      \$G, \$S

Switch heating to the sample temperature on/off.

3.2.2.26      **Assembly.Heat**      \$G  
                  **Assembly.Heat.Value**      0...50

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

3.2.2.27      **Assembly.Valve**      \$G  
                  **Assembly.Valve.Pos**      **purge**, transfer

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

3.2.2.28      **Assembly.Boat**      \$G, \$S  
                  **Assembly.Boat.Rate**      0.1...10  
                  **Assembly.Boat.Pos**      0...130.0  
                  **Assembly.Boat.SetPos.InPos**      0...130.0  
                  **Assembly.Boat.SetPos.OutPos** 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      **Assembly.Pump**      \$G, \$S

Switch pump on/off.

3.2.2.30      **Assembly.Outputs.SetLines**      \$G  
                  **Assembly.Outputs.SetLines.L1**      active, inactive, pulse, **OFF**  
                  up to .L8  
                  **Assembly.Outputs.ResetLines**      \$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      **Setup.IdReport**      **ON**, **OFF**

Switch output of the report identification on/off.

3.2.2.32      **Setup.Keycode**      **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



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	<b>Setup.AutoInfo.Status</b>	ON, OFF
	<b>Setup.AutoInfo.P</b>	ON, OFF
	<b>Setup.AutoInfo.T.G</b>	ON, OFF
	<b>Setup.AutoInfo.T.R</b>	ON, OFF
	<b>Setup.AutoInfo.T.S</b>	ON, OFF
	<b>Setup.AutoInfo.T.B</b>	ON, OFF
	<b>Setup.AutoInfo.T.F</b>	ON, OFF
	<b>Setup.AutoInfo.T.E</b>	ON, OFF
	<b>Setup.AutoInfo.I</b>	ON, OFF
	<b>Setup.AutoInfo.O</b>	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	<b>Setup.PowerOn</b>	\$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	<b>Setup.Initialise</b>	\$G
	<b>Setup.Initialise.Select</b>	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 Setup.RamInit** \$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 Setup.InstrNo** \$G  
**Setup.InstrNo.Value** 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 Setup.Save** \$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



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.

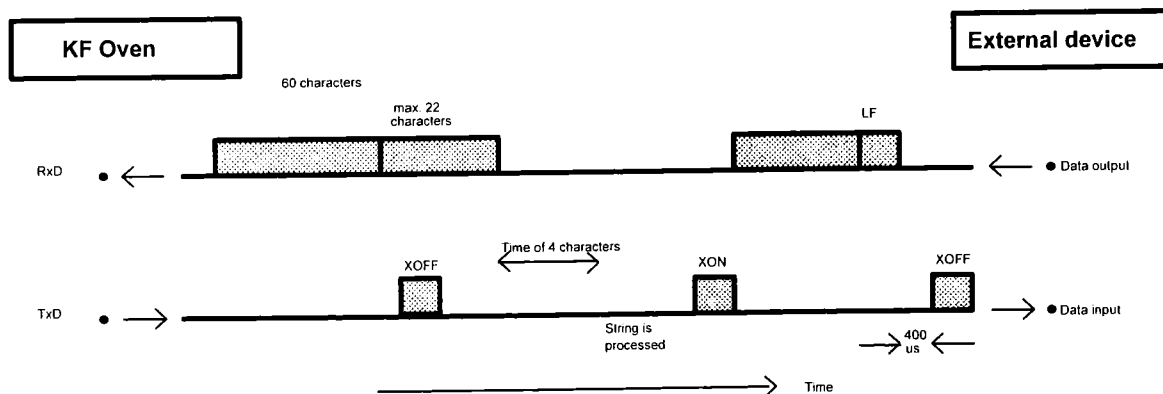
Handshake outputs (DTR, RTS) are set by the Oven.

As soon as a  $L_F$  is recognized, the Oven sends XOFF. It can then receive 6 extra characters and store them.

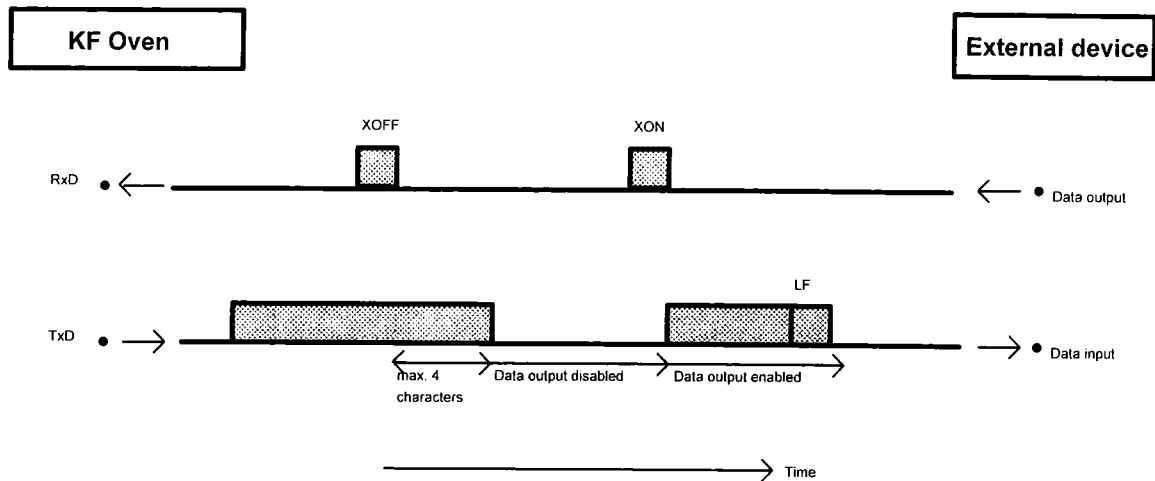
However, the Oven also sends XOFF, if its input buffer contains 60 characters. After this, it can receive maximum 22 extra characters (incl.  $L_F$ ).

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**:

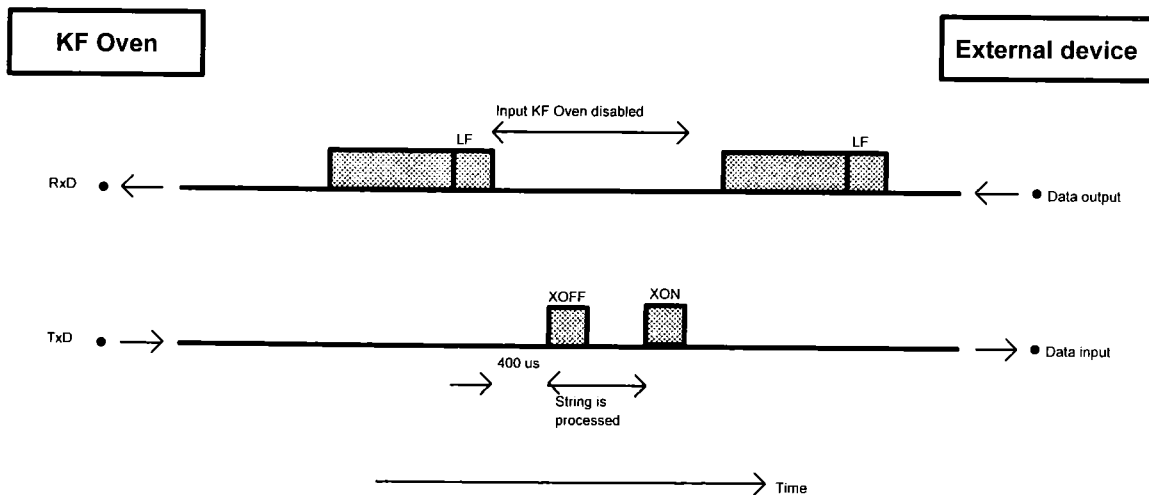


**3.3.2.2 Software Handshake, SWline**

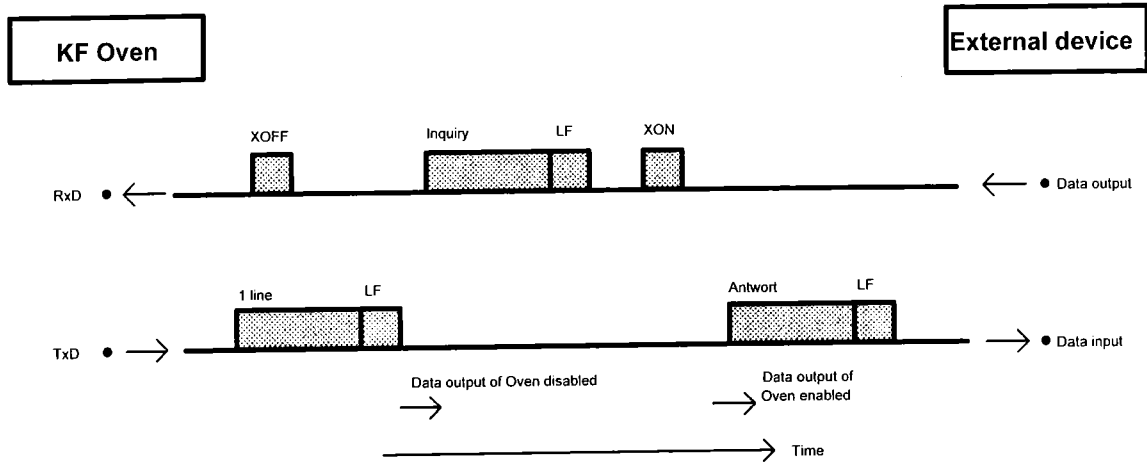
Handshake inputs at the KF Oven (CTS, DSR, DCD) are not checked. Handshake outputs (DTR, RTS) are set by the Oven.

The Oven is equipped with an input buffer that can accommodate a string of up to 80 characters +  $C_R$  LF. As soon as an LF 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**:



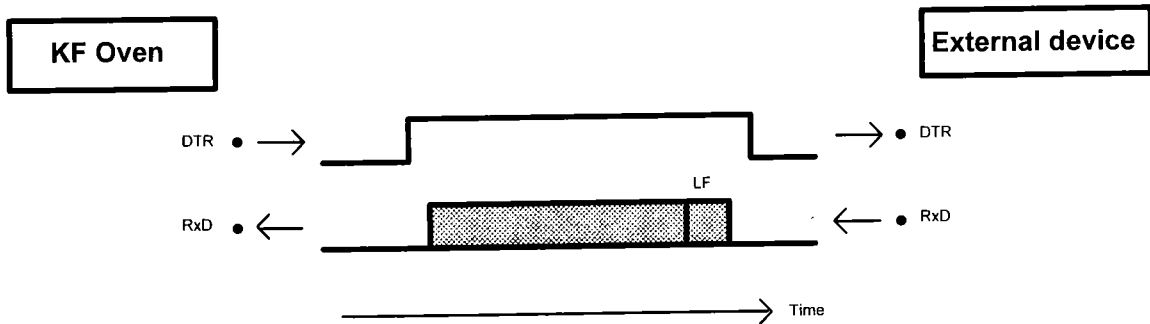
KF Oven as **sender**:



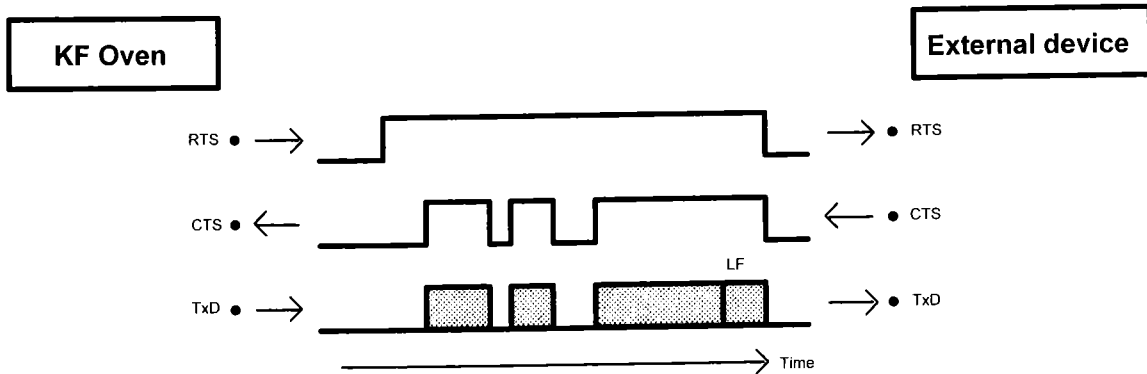
The transmission of the Oven can be stopped by the external device with XOFF. After receipt of XOFF, the Oven completes transmission of the line already started. If the data output is disabled for more than 3 s by XOFF, E43 appears in the display.

### 3.3.2.3 Hardware handshake, HWs

KF Oven as **receiver**:



KF Oven as **sender**:

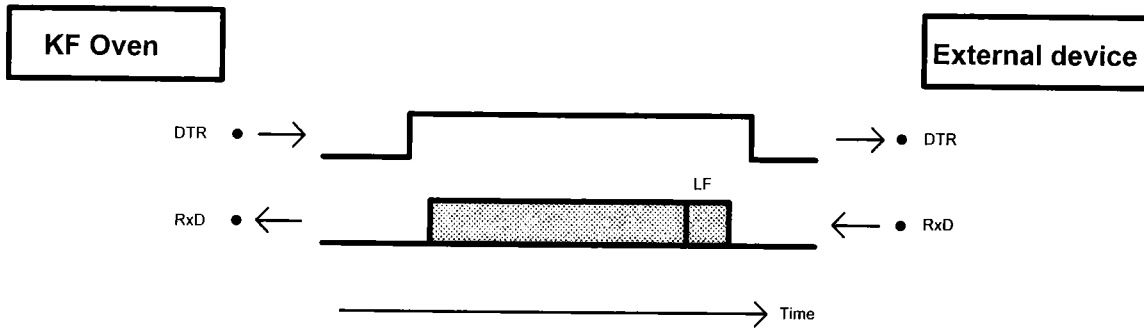


The data flow can be interrupted by deactivation of the CTS line.

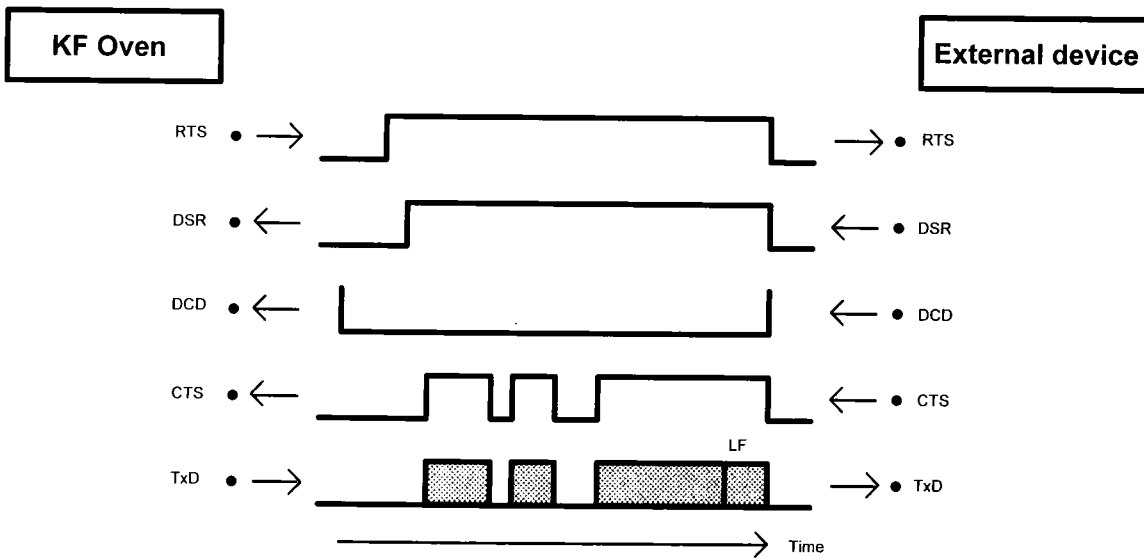
### 3.3.2.4 Hardware handshake, HWf

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

KF Oven as **receiver**:

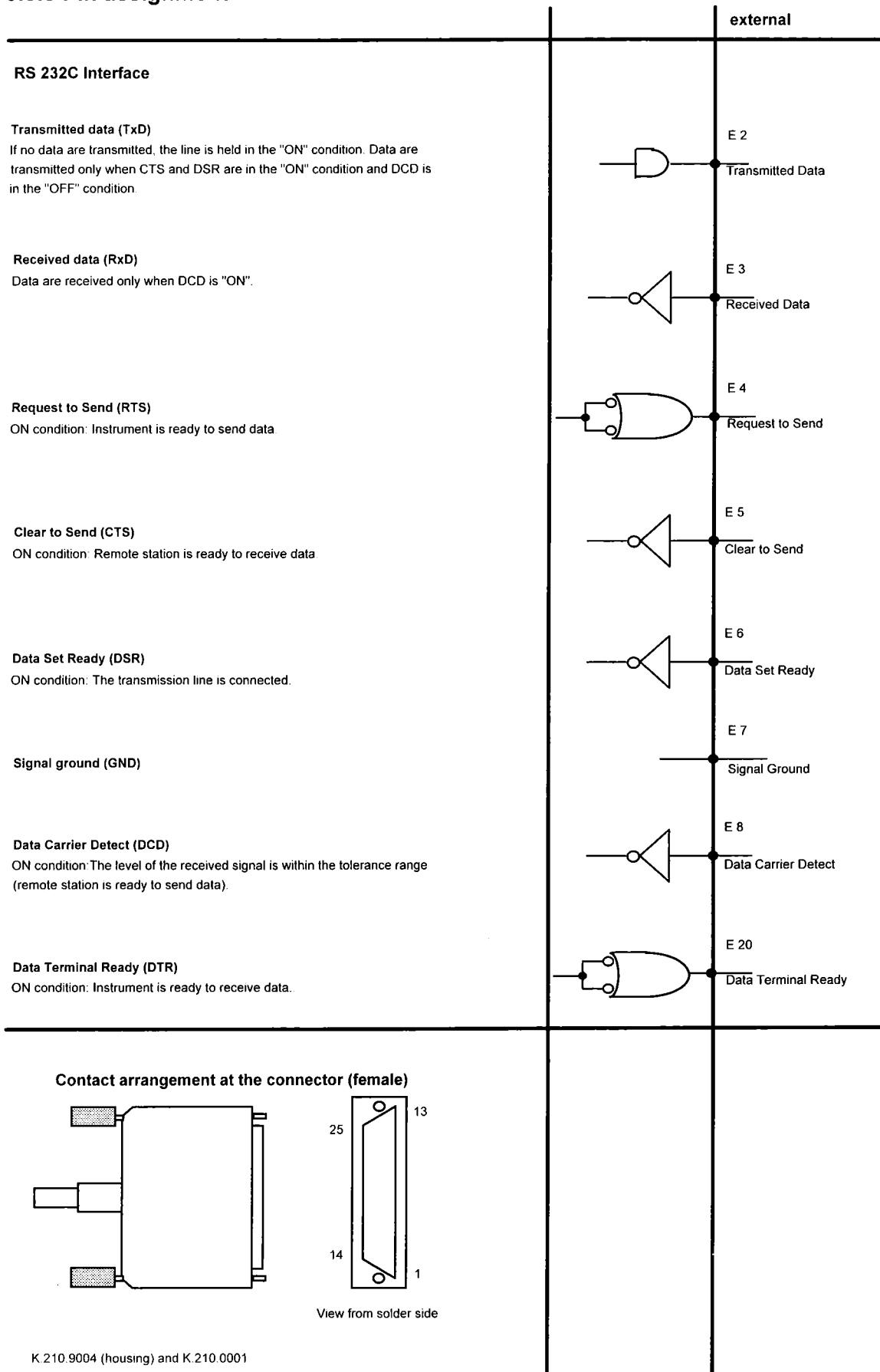


KF Oven as **sender**:



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

### 3.3.3 Pin assignment



---

**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 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.	<ul style="list-style-type: none"> <li>• Are the instruments switched on and the connection cables plugged in properly?</li> <li>• Is the printer set to "on-line" and (if necessary) to "serial"?</li> <li>• Is the handshake set properly?</li> </ul> If everything appears to be in order, try to print out a report with the key sequence <PRINT><PARAM><ENTER>. If this report is printed out correctly, check whether under the key <CONFIG>, >Oven settings, a report is preselected.
No data transmission occurs and the display of the Oven shows an error message.	<ul style="list-style-type: none"> <li>• <b>E40-42:</b> Transmission error. Is the cable properly wired and connected? Is the printer switched on and set to "on-line"?</li> <li>• <b>E43:</b> Data output of the Oven disabled for longer than 3 s by XOFF.</li> <li>• <b>E36-39:</b> Receive error. Are the RS232 settings the same for both devices?</li> </ul>
The received characters are garbled.	<ul style="list-style-type: none"> <li>• Are the data bit and parity settings the same for both devices?</li> <li>• Is the baud rate setting the same for both devices?</li> <li>• Has the correct printer been selected?</li> </ul>



## 4. Troubleshooting, rectification of malfunctions

### 4.1 Troubleshooting

Problem	Remedial action
Large scatter in the titration results.	<ul style="list-style-type: none"> <li>• Do not touch sample boat and guide rod with your fingers. Use holding clamp or fit cut rubber tubing over your fingers.</li> <li>• Dry sample boat well before use and store it in a desiccator.</li> <li>• Are the molecular sieves of the drying flasks exhausted? (If the molecular sieves in the flask to the right are still OK, this can be used as the left flask. The "freshest molecular sieves" belong in the right flask.)</li> <li>• Condensate in the outlet tubing. Increase gas flow or use 6.1830.000 Heatable Outlet Tubing.</li> <li>• Gas flow too high so that titrant solution is sprayed onto the walls of the titration vessel?</li> <li>• Grind sample before weighing and spread over sample boat as evenly as possible.</li> <li>• Has the sample given off all its moisture? Set "stricter" shut-off conditions on the titrator: Lower stop drift, higher shut-off delay time.</li> <li>• Check if all tubing connections are tight.</li> </ul>
Drift too high.	<ul style="list-style-type: none"> <li>• Are the molecular sieves of the drying flasks exhausted? (If the molecular sieves in the flask to the right are still OK, this can be used as the left flask. The "freshest molecular sieves" belong in the right flask.)</li> <li>• Are the O-rings of the titration cell still OK?</li> <li>• Is the septum in the screw cap still OK?</li> <li>• Do not touch sample boat and guide rod with your fingers. Use holding clamp or fit cut-off rubber tubing over your finger.</li> <li>• When working with the oven, reclose cover of the insert tube as quickly as possible.</li> </ul>
Titration times too long.	<ul style="list-style-type: none"> <li>• Use 6.1830.000 Heatable Outlet Tubing.</li> <li>• Grind sample before weighing and spread over sample boat as evenly as possible.</li> <li>• Increase sample temperature.</li> <li>• Increase gas flow.</li> </ul>

<b>Problem</b>	<b>Remedial action</b>
Titration times differ widely.	<ul style="list-style-type: none"><li>• Grind sample before weighing and spread over sample boat as evenly as possible.</li><li>• Position the Oven at a location where it is protected against draughts and direct sunlight.</li></ul>
The titrator does not switch off.	<ul style="list-style-type: none"><li>• Grind sample before weighing and spread over sample boat as evenly as possible.</li><li>• The sample decomposes and evolves oxidizable substances: Lower temperature, possibly use N<sub>2</sub> as carrier gas.</li></ul>
Gas does not reach titration vessel.	<ul style="list-style-type: none"><li>• Switch valve to "TRANSFER" and possibly increase gas flow.</li><li>• Are the cover of the insert tube and the sample inlet at the top closed properly?</li><li>• Are all tubing connections tight?</li></ul>
No gas flow although the pump is adjusted or another gas is connected.	<ul style="list-style-type: none"><li>• Firmly tighten all tubing connections.</li><li>• Has the tubing been connected at the rear of the oven?</li></ul>
Error message "conditioning not ok" although the attached titrator is conditioned.	<ul style="list-style-type: none"><li>• Is the connecting cable to the titrator plugged in properly? On interconnection with Titrinos, check that the cable ends have not been mixed up!</li></ul>

## 4.2 Error messages

---

check T-sensor	The temperature sensor for the sample temperature is not plugged in or is faulty or the cable is faulty. Remedial action: Rectify fault.
conditioning not ok	The connected titrator is not conditioned. The fault disappears when the conditioning message of the titrator appears (pin 12 of the "Remote" socket is active) and the determination is automatically continued. If no Metrohm titrator is connected, work should be performed with "start if cond ok: off" (<CONFIG> key, >oven settings). In the case of interconnections with Titrinos, check that the cable ends are plugged in properly.
gas flow sensor	The gas flow sensor is not OK (flow > 500 mL/min). The display shows OV (overrange) instead of the gas flow. Remedial action: Call Metrohm service. Work can be continued for a short period: Set min. gas flow to 0 mL/min (<PARAM> key).
gas flow too low	The gas flow is lower than the set minimum. Exit: <STOP>, switch on pump or open or change gas cylinder of the carrier gas. Set gas flow when the Oven is hot.
manual stop	The automatic determination has been interrupted manually with <STOP>. Exit: <QUIT>
Oven T-sensor	The oven temperature sensor is not OK. Remedial action: Call Metrohm service.
temp.above 360 °C	The oven temperature is higher than 360 °C. The heating is switched off automatically as the heating tube could be damaged. The heating is switched on automatically when the oven temperature is again <360 °C.
temperature not ok	The current temperature is outside of the starting range. Exit: <STOP> or wait until the temperature is attained. The automatic determination can be started when the "READY" lamp is on continuously. If, despite this, you wish to proceed with sample heating, work can be performed manually: Set valve to "TRANSFER", move boat into the oven with the <BOAT IN> key and start the titration.

## 4.3 Diagnosis

The 707 KF Oven is a very precise and reliable instrument. Thanks to its rugged construction it is virtually impossible for external mechanical or electrical influences to have an adverse effect on its functions.

Although the occasional fault in the instrument cannot be excluded completely, it is certainly much more likely that malfunctions are caused by wrong operation or handling or through improper connections and operation with non-Metrohm instruments.

It is thus advisable in each case to isolate the fault with the rapid and easy to perform diagnostic tests. The customer thus need not call METROHM service until there is a true fault in the instrument. In addition, with the aid of the numbering in the diagnostic program one can provide the service engineer with much more accurate information.

In inquiries always quote the manufacturing (instructions on name plate) and program number (see <CONFIG>, under ")auxiliaries") and specify possible error displays.

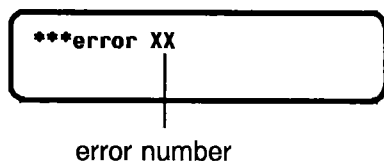
### Procedure

#### Symbol definition:

< X >                      press respective key

 information on display

- The diagnostic steps must be performed in sequence and compared with the reactions of the 707 KF ovens (indented). In the "yes" case, continue with the next instruction.
  - If the instrument does not show the expected reaction ("no" case), the appropriate test must be repeated to exclude an operating error. With repeated wrong reactions, however, there is a strong possibility that a malfunction exists.
  - For repetitions select the respective test with key <9>.
- If the instrument is in a subprogram of the diagnostic routine: Press the <QUIT> key.
- If need be, switch the power off, then enter into the diagnosis according to item 2 of the following instructions.
- If the <QUIT> key is pressed during the display of 'diagnosis >XXXXXXXX', the instrument jumps back into the user program.
  - Error display: An error is shown in the display as follows:



error number

#### Equipment required:

- Resistor switch-box, class 0.1 % (or resistor 1 k, 0.1 %)

Necessary only if external functions should also be checked:

- 3.496.8510 test plug (at 'Remote' connector)
- 3.496.8480 test plug (at 'RS 232' connector)

### 1. Prepare instrument for diagnosis

Power off

Remove all external connections (cables at rear, except power cable and Pt 1000 sensor)

Gas tubes connected, screw connections tight

*(When using air as carrier gas the tube connections "Air/N<sub>2</sub> in" and "Air out" must be connected. The drying flask may be replaced by a tube connection between the terminals "drying flask To/From".)*

Insert the sample boat into the drying tube and close the tube fixing the cover.

### 2. Switch on test and entry into diagnosis

Switch on and immediately press key <9>, holding it down until the display shows the following content:<sup>1</sup>

```
diagnose
>RAM Initialization
```

Using "Display" knob on the rear of the instrument optimize the contrast of the display.

### 3. RAM test

Non-destructive RAM test of the whole range

<9>

```
diagnose
>RAM Test
```

<ENTER>

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

<QUIT>

```
diagnose
>LCD Display Test
```

### 4. Display test

On pressing the <ENTER> key, characters will be generated, providing an optical check of the display.

Test sequence:

- All 24 digits of both lines are first overwritten with the dotted test pattern.
- Display is blanked.
- Both lines read 24 × "#", then 24 × "H" and 24 × "I".
- The full residual character set is then shown in a moving display.
- All 5 status lamps are switched on and off, firstly all together, then in sequence.

The test sequence can be stopped and started again by pressing any key except the ENTER and STOP keys.

To quit the test press the <STOP> key.

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

<sup>1</sup> An audible beep may sound at power-up.

## 5. Keyboard test

Press <9> repeatedly until

```
diagnose
>Key Test
```

<ENTER>

```
>Key Test
```

On pressing any key, the respective matrix code 0 - 22 will be displayed.  
Check the displayed code according to the table in Fig. 4-1

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

4	3	2				
10	9	8				
16	15	14	0	6	12	18
22	21	20	1	7	13	19

Fig. 4-1 Keyboard with matrix code

To quit the test, press the <STOP> key twice.

```
diagnose
>Motor Test
```

## 6. Motor test

<ENTER>

```
>Motor Test
```

The sample boat moves into the oven and out again.

The boat position is displayed.

```
>Motor Test
boat pos.      XXX mm
```

0-130 mm movement distance

<STOP>

The boat terminates the current movement cycle and stops at the 0 mm position.

```
diagnose
>Measure Test
```

## 7. Beep signal test

<9>

```
diagnose
>Beeper Test
```

<ENTER>

```
>Beeper Test
```

The audible beep signals in a 1 s rhythm.

Quit the test with <STOP>.

```
diagnose
>Instrument Adjustment
```

## 8. Flow test

Switch off instrument and after 5 s switch on again.

```
sample temp. 1)   XX °C
gas flow          YY 2)
```

1) language as set under CONFIG, > auxiliaries, dialog: XXX  
("English" in these instructions)

2) 0 mL/min or 0 L/h, depending on selected status under  
"CONFIG"

Press <9> to start the pump.

Turn gas flow control anticlockwise to give max. flow.

Flow reading min. 400 mL/min or min. 24.0 L/h.

Seal the air inlet on the rear of the instrument with a finger.

The flow reduces to 0 mL/min or 0 L/h.

Release the air inlet and stop the air flow by turning the control knob clockwise.

The display varies from max. value (see above) to 0 mL/min or 0 L/h according to the knob position.

Set flow to maximum again.

## 9. Examine valve functions

Keep pump operative according to item 8.

Pressing <5> (VALVE) select "TRANSFER".

TRANSFER lamp illuminated.

Check air flow at the outlet tubing at the end of the oven tube.

The feeble air flow must be perceivable (e.g. moisten the back of the hand with spittle and blow against it).

<5> (VALVE)

The "PURGE" pilot lamp comes on.

The air flow comes out at the PURGE outlet at the rear of the instrument.

With key <9> stop the pump again.

### 10. Pt 1000 alarm test

Disconnect Pt 1000 plug at the rear of the unit.

check T-sensor gas flow	0 XY
----------------------------	------

### 11. Pt 1000 calibration

Connect a resistor switch box ( $\pm 0.1\%$ ) instead of the Pt 1000 sensor and select  $1\text{ k}\Omega$ <sup>2</sup>; or use any fixed resistor in the range between  $1000\ \Omega$  -  $2296\ \Omega$  and determine the temperature according to the table.

Reading e.g. with 1k - resistance:  $0\ ^\circ\text{C}$  ( $\pm 1\ ^\circ\text{C}$ )

temperature in $^\circ\text{C}$	resistance in $\Omega$	temperature in $^\circ\text{C}$	resistance in $\Omega$
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

Connect Pt 1000 sensor again.

### 12. Heating check

<PARAM>

parameters temperature	XXX $^\circ\text{C}$
---------------------------	----------------------

Key in a temperature of  $150\ ^\circ\text{C}$ .

Memorize the new temperature with <ENTER> and <QUIT>.

sample temp. gas flow	XX $^\circ\text{C}$ YYY
--------------------------	----------------------------

Press <SELECT> twice until

sample temp. oven temp.	XX $^\circ\text{C}$ XX $^\circ\text{C}$
----------------------------	--

Start heating by pressing <7> (HEATER).

<sup>2</sup> or fixed resistor of  $1\text{ k}$  ( $\pm 0.1\%$ )

After max. 30 min<sup>3</sup> the sample temperature must reach 145 °C and the READY lamp must come on constantly.

With the approach to the set-temperature the "on" intervals of the HEATER lamp become shorter.

(If selected under CONFIG, reaching the set-temperature of 150 °C (±5 °C) will be signalled by the audible beep.)

<7> (HEATER)

The heating procedure will discontinue.

Lamps "READY" and "HEATER" are off.

### 13. External inputs and outputs (Remote)

This test is useful only when the 707 KF oven is used together with other equipment connected to the 'Remote' socket. Also, this test requires a test connector 3.496.8510 normally used for repairs/servicing. However, the customer can obtain this connector under the above number.

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

(If diagnosis of the external inputs and outputs is not required, continue from 14.)

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

Fig. 4-3 Pin allocation in connector 3.496.8510

Switch off the instrument and enter into the diagnosis according to item 2.

Press <9> repeatedly until

**diagnose**  
**>Input/Output Test**

<ENTER>

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

Insert connector 3.496.8510 in 'Remote' socket. (Do not switch off instrument, check connector is the right way round.)

<ENTER>

The test runs automatically. If everything is OK, there appears:

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

If not, an error message appears. (If no test connector is in place, 'io error 50' appears.)

Remove test connector.

<ENTER>

**diagnose**  
**>RS-232 Test**

<sup>3</sup> The heating procedure requires: sample temperature < selected set-temperature. If the starting temperature of the sample is 20 - 25 °C, the heating time lasts max. 30 min.

#### 14. RS 232 test

This test is useful only when the 707 KF oven is used together with other equipment connected to the 'RS 232' socket. Also, this test requires a test connector 3.496.8480 normally used for repairs/servicing. However, the customer can obtain this connector under the above number.

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

(Diagnosis is terminated here if diagnosis of the RS 232 interface is not required.)

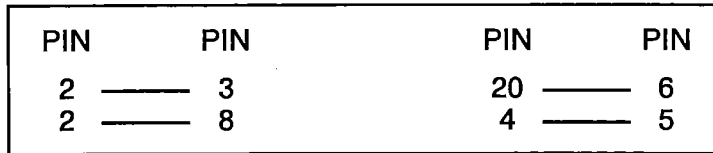


Fig. 4-4 Connections in connector 3.496.8480

If not already done, select RS 232 test:

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

<ENTER>

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

Insert connector 3.496.8480 in socket 'RS 232'.  
(Do not switch off instrument, check connector is the right way round.)

<ENTER>

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

The test runs automatically. If everything is OK, there appears

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

If not, an error message appears. (If no test connector is in place, 'rs error 68' appears.)

2x <QUIT>

The previously selected user program will be displayed.

Remove test plug.

**End of diagnosis**

## Faulty information in the RAM and possible remedy

Severe noise signals (such as power spikes or lightening) or faulty information coming from a connected PC-unit may upset the RAM section with incorrect data which affects the processor functions and thus cause a system crash.

The RAM initialization described below allows to rectify the RAM content. There are 3 possibilities:

Problem	Remedy
<ul style="list-style-type: none"> <li>- keyboard inoperative</li> <li>or</li> <li>- display inoperative or foolish reading</li> </ul>	A) Switch off instrument and after 5 s switch on again, check the unit. If needed, carry out item "SETUP" of RAM initialization.
RS 232-interface out of function	B) Switch off instrument and after 5 s switch on again, check the unit. If needed, carry out item "CONFIG" of RAM initialization.
as above, if partial RAM initialization is unsuccessful	C) Carry out item "ALL" of RAM initialization.

### A) RAM initialization, item "SETUP"

Carry out item 2 of diagnosis

```
diagnose
>RAM Initialization
```

<ENTER>

```
>RAM Initialization
Select                MODE
```

Press <SELECT> repeatedly until

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

<ENTER>

The parameters for the basic operations are set automatically.

```
diagnose
>RAM Test
```

Check the instrument by means of the diagnosis.

### B) RAM initialization, item "CONFIG"

Proceed as under A) however, press <SELECT> several times until

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

<ENTER>

The CONFIG parameters are reset automatically.

```
diagnose
>RAM Test
```

Check the instrument by means of the diagnosis.

### C) RAM initialization (total initializing)

**Caution:**

The RAM initialization **erases the user data** stored under "PARAM" and "CONFIG". Carry out the test only if needed. Note the data before starting and reenter afterwards.

Proceed as under A) however, press <SELECT> several times until

```
>RAM Initialization
Select:                A11
```

<ENTER>

The software of the unit is set to the basic conditions automatically.

```
diagnose
>RAM Test
```

Check the unit by means of diagnosis.

The data lost from the user memory must now be entered again.

#### Display "system error 3"

If the display shows 'system error 3', you can leave the instrument program with <QUIT>. The adjustment default values are then loaded automatically. This means that the instrument can still measure, but there may be a slight loss of accuracy. Metrohm Service can restore the optimum set-up. The error message 'system error 3' appears every time the instrument is switched on, until these adjustments have been made.

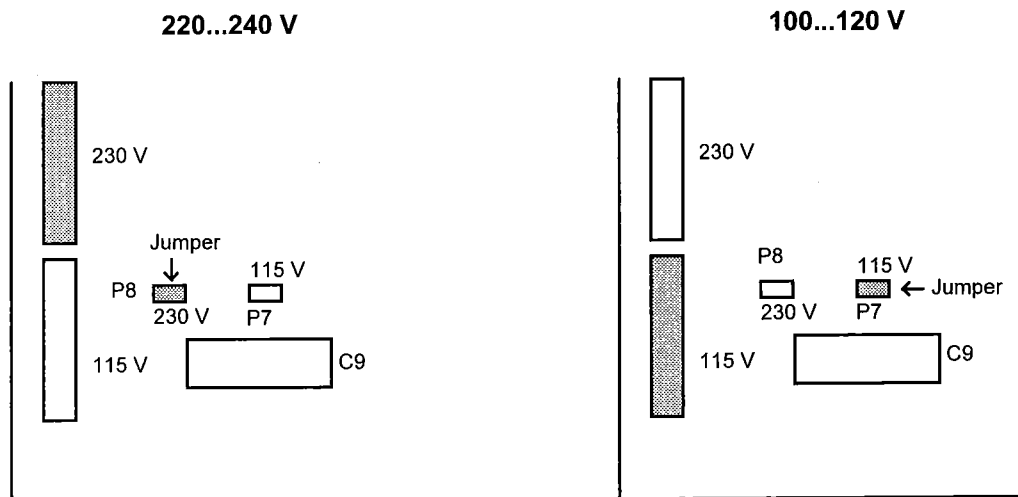
## 5. Preparations

Ensure that the set operating voltage matches the mains voltage before you switch the apparatus on.

If this is not the case, the **operating voltage** must be changed over:

1. Disconnect mains plug. Detach all tubing and cable connections to the oven. Take out drying flasks.
2. Unscrew the 3 screws at the bottom of the oven at the front.
3. Unscrew the 3 screws at the green edge at the rear of the oven.
4. Carefully lift off top part of oven and lower to the front.
5. The connectors on the board in the vicinity of the power supply unit must be plugged in as follows:

View of the board from above



The white connector on the left is plugged into the appropriate socket.

The jumpers are changed over using tweezers.

6. Close apparatus again and reconnect tubing and cables.
7. Note the new setting of the voltage on the model plate at the rear of the oven.

When the apparatus is opened or if parts are removed from it, certain components may be live if the apparatus is connected to the power supply. The mains cable must therefore always be disconnected when certain adjustments are made or parts replaced.

The mains cables supplied with the instrument are three-core and fitted with a plug with an earthing pin. Each break in the earthing inside or outside the apparatus can make it a source of danger.

Plug in or unplug connecting cables only when the apparatus is switched off.

## 5.1 Setting up the KF Oven

---

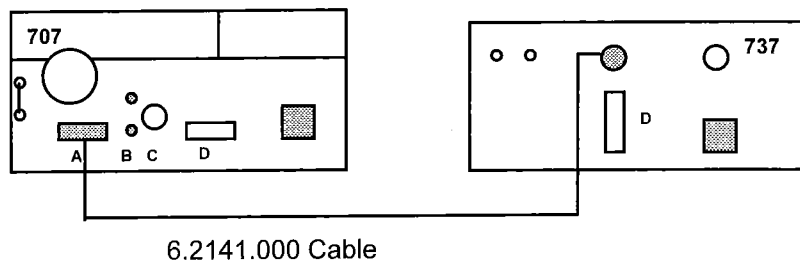
See also illustration on fold-out page 2.

Unpack Oven and remove all protective coverings.

1. Insert 6.2407.020 Insert Tube in the heating chamber of the Oven and fasten it to the Oven with the clamp (red screw). The glass protrusion on the insert tube is positioned in the slot of the clamp.
2. Screw 6.2104.080 Cable onto temperature sensor of the insert tube and connect to the Pt1000 sockets of the Oven.  
**Important:** The grey connector of the cable is plugged into the red (upper) socket of the Oven!
3. Place a 6.1448.040 Septum in the 6.2701.060 Screw Cap and screw it to the thread of the insert tube.  
Close the insert tube with the 6.2750.010 Cover.
4. Fill the 6.1608.050 Drying Flasks with molecular sieves.  
Screw the 6.1821.030 Inlet Tubes onto the 6.1602.140 Screw Cover.  
Screw covers onto drying flasks.
5. Place drying flasks in the green holder.  
Screw 6.1805.080 Tubing to the inlet tube of the left drying flask, see drawing on green holder. Screw other end of the tubing "To drying flask" at the Oven.
6. Connect the left drying flask to the right drying flask using 6.1805.180 Tubing: On the right flask, screw the tubing onto the inlet tube.
7. Connect right drying flask to the gas connection of the Oven "From drying flask" using 6.1805.080 Tubing.
8. Set up the two tubing connections of the Oven ("Purge" and "To Oven") to the insert tube with two 6.1805.180 Tubings.
9. At the rear of the oven, connect the two tubing connections "Air in" and "Air out" using the 6.1805.040 Tubing.  
When working with a gas other than air, this tubing connection is removed. The gas is introduced at tubing connection "Air/N<sub>2</sub> in" using a 6.1808.020 Tubing Connector. Tubing of 3...4 mm internal diameter can be attached to the tubing connector.
10. Plug the 6.2724.010 Dust Filter into the "Filter" connection at the rear of the oven.
11. Screw the 6.1805.070 Outlet Tubing to the insert tube and route other end to the titration vessel, see pages 51, 52.  
**Important:** Never wind insulation material around the outlet tubing when working at high sample temperatures as the connection could melt. To avoid condensation in the outlet tubing, the 6.1830.000 Heatable Outlet Tubing can be used.

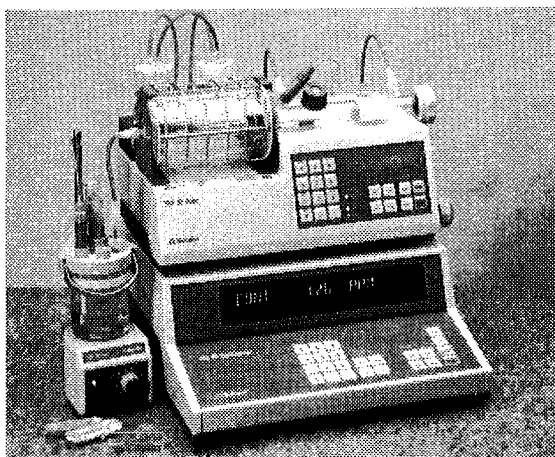
## 5.2 Connection of the KF Coulometer

The 737 KF Coulometer is connected to the 707 KF Oven as follows:



Connection of the 684 KF Coulometer is analogous to that of the 737 KF Coulometer.

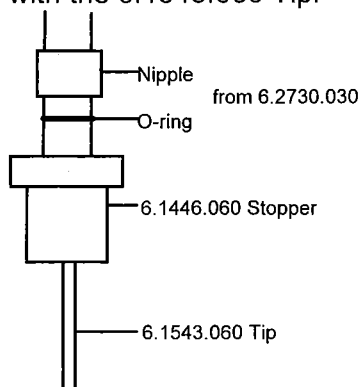
For work together with the KF Oven, the titration cell of the KF Coulometer is installed on the left and the instruments set up as follows:



Convert measuring cells for gas supply as follows:

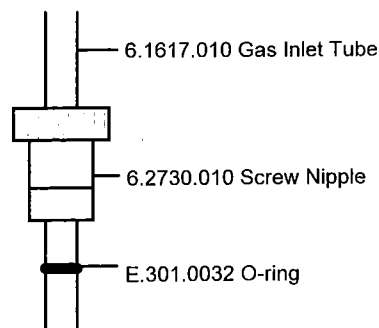
### Diaphragm-free cell

6.1446.060 Stopper with nipple and O-ring of 6.2730.030 (from the accessories of the KF Coulometer) with the 6.1543.060 Tip.



### Measuring cell with diaphragm

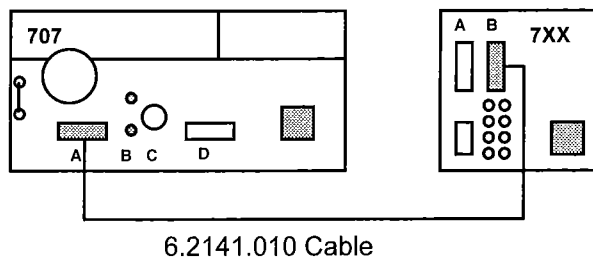
6.1617.010 Gas Inlet Tube through the 6.2730.010 Screw Nipple (from the accessories of the KF Coulometer)



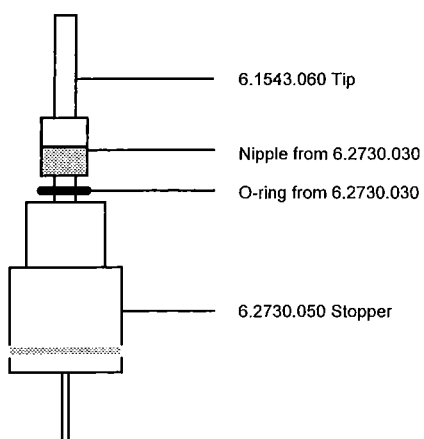
If you wish to add solvent using the 703 Ti Stand, insert a burette tip through the screw cap with an A.254.0104 sealing ring.

### 5.3 Connection of a Titrino

The Titrino is connected to the 707 KF Oven as follows (warning: plug cable ends into proper sockets):



Set up the instruments with the aid of the 6.2041.180 Instrument Bridge:



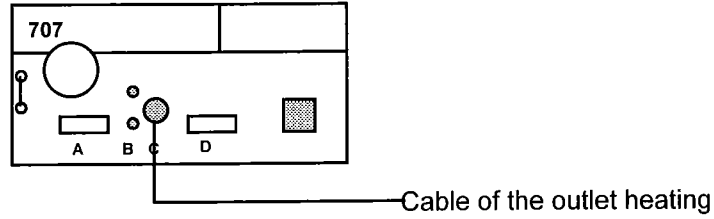
The titration vessel is converted for the gas introduction. Instead of the 6.2730.020 Septum Stopper, the 6.2730.050 Stopper with the 6.1543.060 Tip is used. (Nipple and O-ring of 6.2730.030 from accessories of the Titrino.)

## 5.4 Connection of the outlet heating

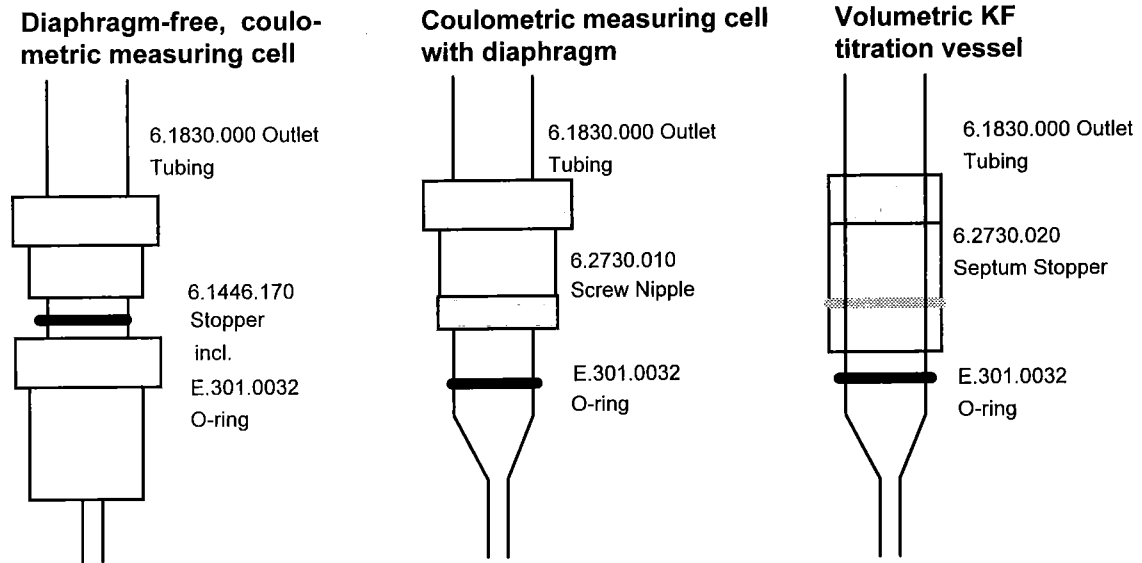
If the 6.1830.000 Heatable Outlet Tubing is used, appreciably shorter determination times are achieved.

The heatable outlet tubing should be used in all cases where problems arise with condensation water in the normal outlet tubing.

Screw tubing to the outlet connection and connect cable of the outlet heating to the KF Oven:



The heatable outlet tubing is inserted in the titration vessel as follows:



## 5.5 Connection of a printer

A variety of printers can be connected to the RS232 interface of the 707 KF Oven. If you connect a printer other than one of those mentioned below, ensure that the Epson mode is emulated or that it uses the international character set following the IBM Standard Table 437.

You may connect the KF Oven together with the Titrator at the same printer using the 2.145.0100 Auto-Switch. Connect the Metrohm instruments with 6.2125.020 cable to the Auto-Switch and use the printer cable as mentioned in the table below from the Auto-Switch to the printer.

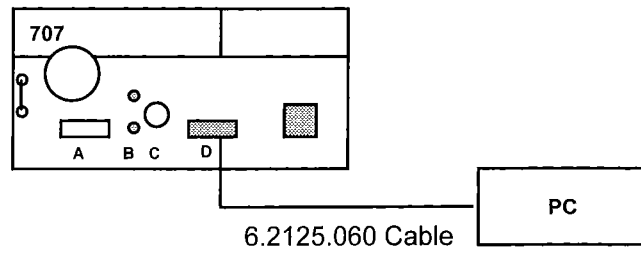
The connection of a selection of printers is facilitated by the following table:

Printer	Cable	Settings at the KF Oven	Settings at the printer
Citizen iDP560 RS	6.2125.050	baud rate: 9600 data bit: 7 stop bit: 1 parity: even handshake: HWs send to: Citizen	<b>DIP-Schalter:</b> 1 on 2 off 3 off 4 off 5 on 6 - 7 off 8 on <b>Jumpers:</b> 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 parity: even handshake: HWs send to: Seiko	<b>DIP01 switch:</b> 1 off 2 off 3 on 4 on 5 off 6 off 7 on 8 on <b>DIP02 switch:</b> 1 off 2 off 3 off 4 off 5 off 6 off

Printer	Cable	Settings at the KF Oven	Settings at the printer
Epson with 6 pin circular plug	6.2125.040	data bit: 8 stop bit: 1 parity: none handshake: HWs send to: Epson	8 bit no Parity
Epson with #8148 interface	6.2125.050	data bit: 8 stop bit: 1 parity: none handshake: HWs send to: Epson	8 bit no Parity
HP Desk Jet	6.2125.050	data bit: 8 stop bit: 1 parity: no handshake: HWs send to: HP	8 bit no Parity
Kodak Diconix 180 si	6.2125.050	data bit: 8 stop bit: 1 parity: none handshake: HWs send to: Epson	Epson Emulation 8 bit no Parity

## 5.6 Connection of a computer

The computer can be connected as follows:



For connection to the 9-pin socket, the 6.2125.010 Adapter is also needed.

Preselection on 707 KF Oven:

RS232 settings: depending on control program of computer

Send to: IBM

## 6. Appendix

---

### 6.1 Technical specifications

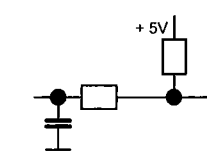
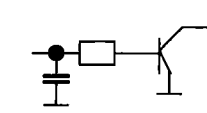
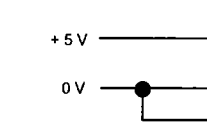
---

Sample temperature	50...300 °C (Pt1000 resistance thermometer)
Gas flow with built-in air pump	0... 15 L/h or ca. 250 mL/min
Size of the weighing boat	
Length	64 mm
Width	20 mm
Depth	12 mm
Materials	
Housing	Light metal
Membrane keypad	Polycarbonate (PC)
Display	LCD, 2 lines each of 24 characters, 5 mm character height
RS232 interface	For printer or computer connection
Conventional input/output lines and	Inputs: Cond.ok, Start, Stop, Terminate Outputs: Ready, Heat Smpl, Start, Stop, Terminate, Error
Socket for outlet heating	Output: DC 8.5 V, 3 W
Ambient temperature	
Operational range	5...40 °C
Storage, transport	-20...60 °C
Safety specifications	Construction and testing according to IEC publication 1010, Protection class I. These instructions for use contain information and warnings which must be heeded by the user if safe operation of the apparatus is to be assured.
Power supply	
Nominal voltages	100-120 V; 220-240 V ± 10% (switchable)
Frequency	50...60 Hz
Power consumption	250 VA
Fusing	Fusible cutout + 2 × 2A (TH)
Dimensions incl. accessories	
Width	380 mm
Height	250 mm
Depth	275 mm
Weight incl. accessories	ca. 7.8 kg

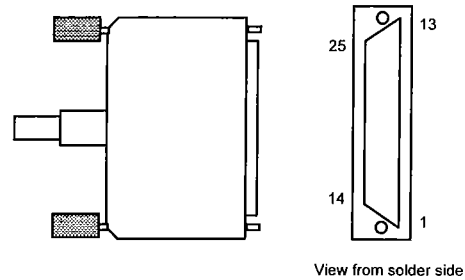
## 6.2 "Remote" socket

### 6.2.1 Pin assignment

We accept no responsibility whatsoever for damage arising from improper interconnection for the instruments.

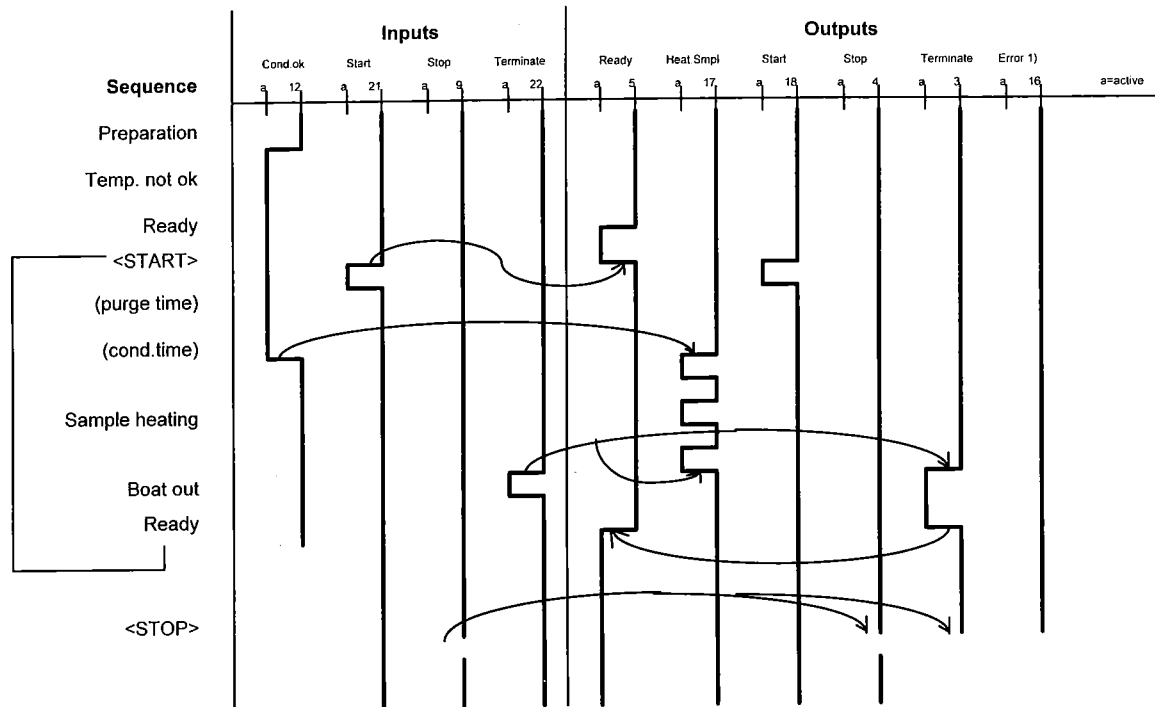
<p><b>Inputs</b></p>  <p><math>t(\text{pulse}) &gt; 100 \text{ ms}</math></p>	<table border="1"> <thead> <tr> <th>Pin</th> <th>Meaning</th> </tr> </thead> <tbody> <tr><td>21</td><td>Start</td></tr> <tr><td>9</td><td>Stop</td></tr> <tr><td>22</td><td>Terminate</td></tr> <tr><td>12</td><td>Cond.ok</td></tr> <tr><td>10</td><td>not used</td></tr> <tr><td>23</td><td>not used</td></tr> <tr><td>11</td><td>not used</td></tr> <tr><td>24</td><td>not used</td></tr> </tbody> </table>	Pin	Meaning	21	Start	9	Stop	22	Terminate	12	Cond.ok	10	not used	23	not used	11	not used	24	not used
Pin	Meaning																		
21	Start																		
9	Stop																		
22	Terminate																		
12	Cond.ok																		
10	not used																		
23	not used																		
11	not used																		
24	not used																		
<p><b>Outputs</b></p>  <p><math>V(\text{CEO}) = 40 \text{ V}</math>  <math>I(\text{C}) = 20 \text{ mA}</math>  <math>t(\text{pulse}) &gt; 100 \text{ ms}</math></p>	<table border="1"> <thead> <tr> <th>Pin</th> <th>Meaning</th> </tr> </thead> <tbody> <tr><td>5</td><td>Ready</td></tr> <tr><td>17</td><td>Heat Smp!</td></tr> <tr><td>18</td><td>Start</td></tr> <tr><td>4</td><td>Stop</td></tr> <tr><td>3</td><td>Terminate</td></tr> <tr><td>16</td><td>Error</td></tr> <tr><td>1</td><td>not used</td></tr> <tr><td>2</td><td>not used</td></tr> </tbody> </table>	Pin	Meaning	5	Ready	17	Heat Smp!	18	Start	4	Stop	3	Terminate	16	Error	1	not used	2	not used
Pin	Meaning																		
5	Ready																		
17	Heat Smp!																		
18	Start																		
4	Stop																		
3	Terminate																		
16	Error																		
1	not used																		
2	not used																		
<p><b>Voltage</b></p>  <p>+ 5 V 0 V</p>	<p><math>I \leq 75 \text{ mA}</math></p> <p>0 V: active 5 V: inactive</p>																		

Assignment of contacts at plug (male)



Ordering numbers:  
K.210.9004 (housing) and K.210.0002

### 6.2.2 Status of the lines during the automatic determination



1): The error signal is reset as soon as the fault has been rectified.

## 6.3 Warranty and certificates

---

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 orderer.

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 orderer 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.

## 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

IEC801-2/91 (level 3), NAMUR/93

IEC801-3, ENV50140/93 (level 2)

IEC801-4, IEC1000-4-4/95 (level 4)

IEC801-5, IEC1000-4-5/95 (level 2/3)

IEC801-6, IEC1000-4-6/96, ENV50141/93 (level 3)

NAMUR/93 Paragr. 3.2.2.

Radiated rf electromag.field immunity

El.fast transient requirements

"Surges" immunity

Immunity to conducted disturbances

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  
Development Manager

Ch. Buchmann  
Production and  
Quality Assurance Manager

Ionenanalytik • Analyse des ions • Ion analysis • Análisis iónico

**707 KF Oven**

Metrohm Ltd.  
 CH-9101 Herisau  
 Switzerland  
 Phone +41 71 353 85  
 85  
 Fax +41 71 353 89  
 01

## EC Declaration of Conformity

The METROHM AG company, Herisau, Switzerland hereby certifies, that the instrument:

### 707 KF Oven

meets the requirements of EC Directives 89/336/EWG and 73/23/EWG.

---

#### Source of the specifications:

EN 50081-1	Electromagnetic compatibility, basic specification Emitted Interference
EN 50082-1	Electromagnetic compatibility, basic specification Interference Immunity
EN 61010	Safety requirements for electrical laboratory measurement and control equipment

#### Description of the instrument:

Oven to heat samples. Used together with a Karl Fisher Titrator for water determinations.

---

Herisau, December 6, 1995




Dr. J. Frank

Ch. Buchmann

Development Manager

Production and  
Quality Assurance Manager

## 6.4 Accessories, standard equipment and ordering numbers

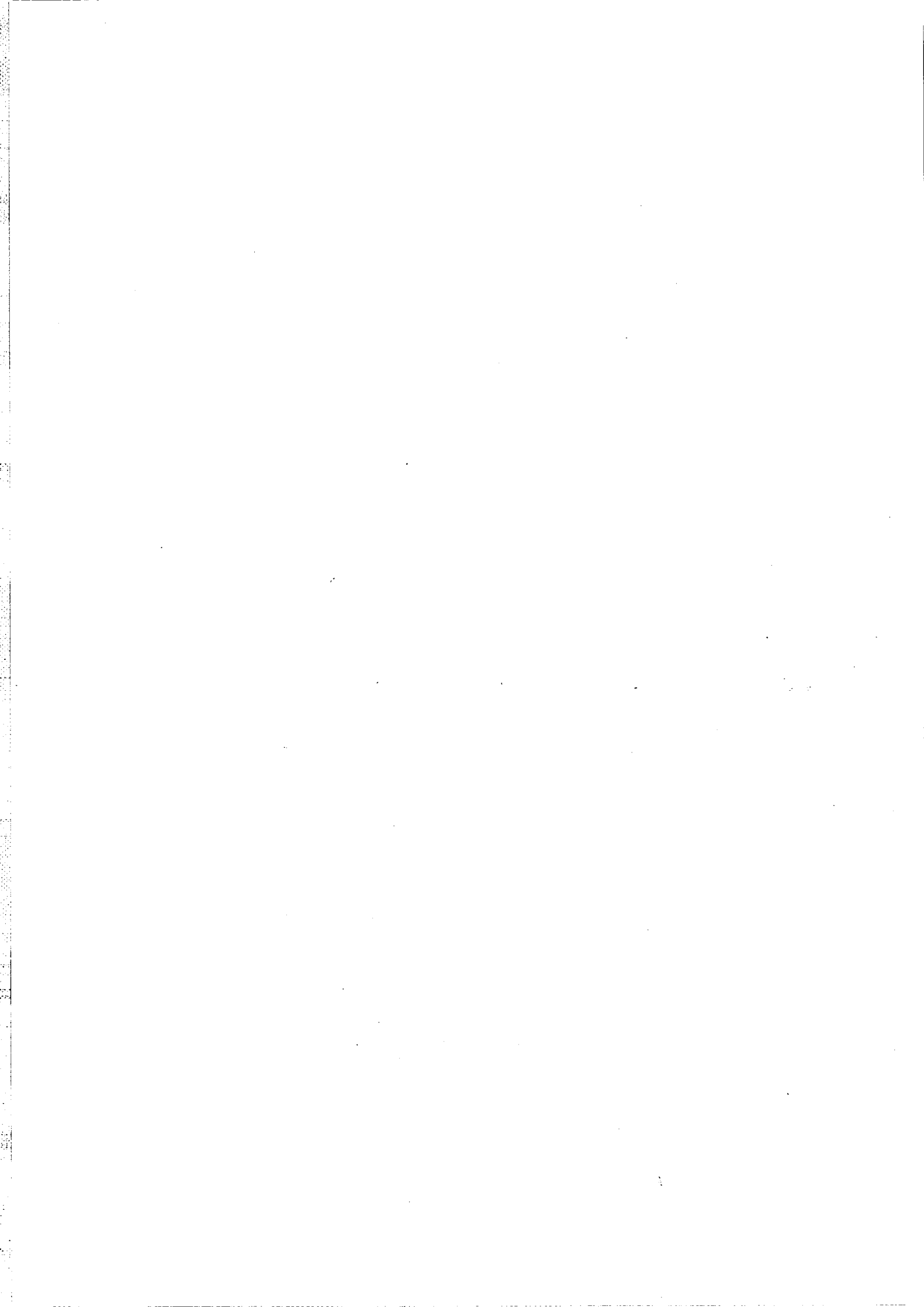
**707 KF Oven ..... 2.707.0010**

including the following accessories:

1 Set septa (5 items) for 6.2701.060 Screw Cap .....	6.1448.040
1 Tip for gas inlet .....	6.1543.060
2 Covers for drying flasks .....	6.1602.140
2 Drying flasks .....	6.1608.050
1 Tubing connection, 9 cm.....	6.1805.040
1 Tubing connection, 10.5 cm.....	6.1805.070
2 Tubing connections, 25 cm .....	6.1805.080
3 Tubing connections, 16 cm .....	6.1805.180
1 Tubing connector with thread .....	6.1808.020
2 Inlet tubes for drying flasks .....	6.1821.030
1 Holding clamp .....	6.2056.000
1 Cable for temperature sensor .....	6.2104.080
1 Oven insert tube .....	6.2407.020
3 Sample boats .....	6.2415.000
1 Guide rod .....	6.2416.010
2 Sets Al inserts (25 items per set).....	6.2623.000
1 Screw cap .....	6.2701.060
1 Dust filter .....	6.2724.010
1 Stopper for volumetric KF titration vessel .....	6.2730.050
1 Cover for oven insert tube .....	6.2750.010
1 Bottle molecular sieves, 250 g.....	6.2811.000

**Options**
**Cables and accessories**

Cable 707 KF Oven to KF Coulometer .....	6.2141.000
Cable 707 KF Oven to Titrino .....	6.2141.010
Cable 707 KF Oven to Citizen printer IDP560RS .....	6.2125.050
Cable 707 KF Oven to Seiko printer DPU-411 .....	6.2125.020
Cable 707 KF Oven to Epson printer with 6-pin round connector.....	6.2125.040
Cable 707 KF Oven to Epson printer with interface #8148.....	6.2125.050
Cable 707 KF Oven to HP DeskJet printer .....	6.2125.050
Cable 707 KF Oven to Kodak printer Diconix 180 si.....	6.2125.050
Serial Auto Switch (Oven and Titrator at the same printer) .....	2.145.0100
Cable Metrohm instrument - Serial Auto Switch .....	6.2125.020



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