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787 KF Titrino

Program version 5.787.0010

Instructions for Use

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Table of contents

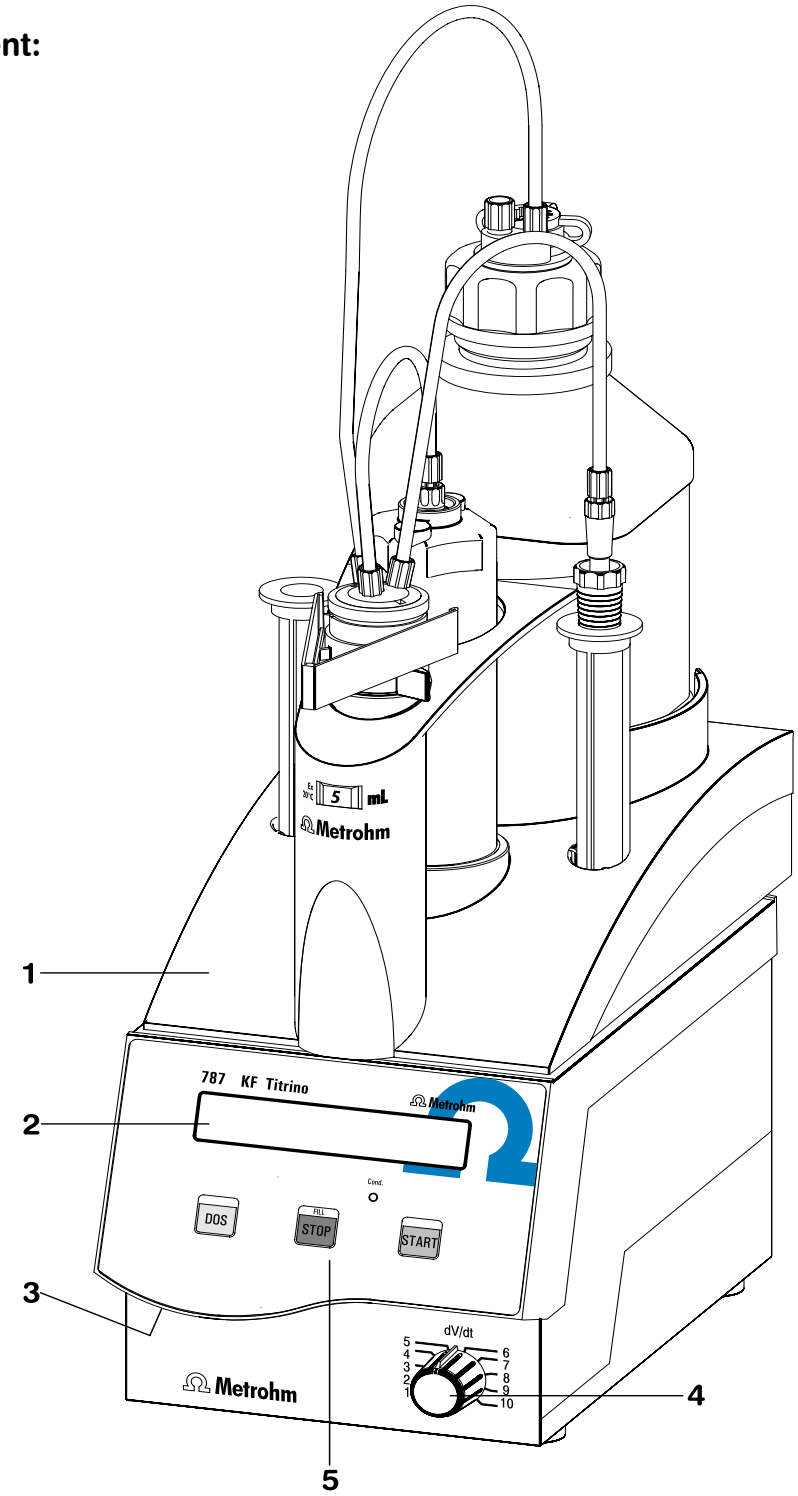
1 Introduction

1.1 Instrument description

The 787 KF Titrino is a fast and precise titrator for the water determination according to Karl Fischer.
With the Metrodata VESUV Software determination data can be saved on a PC.

1.2 Controls and parts

Front view of instrument:



1 Exchange Unit

2 Display

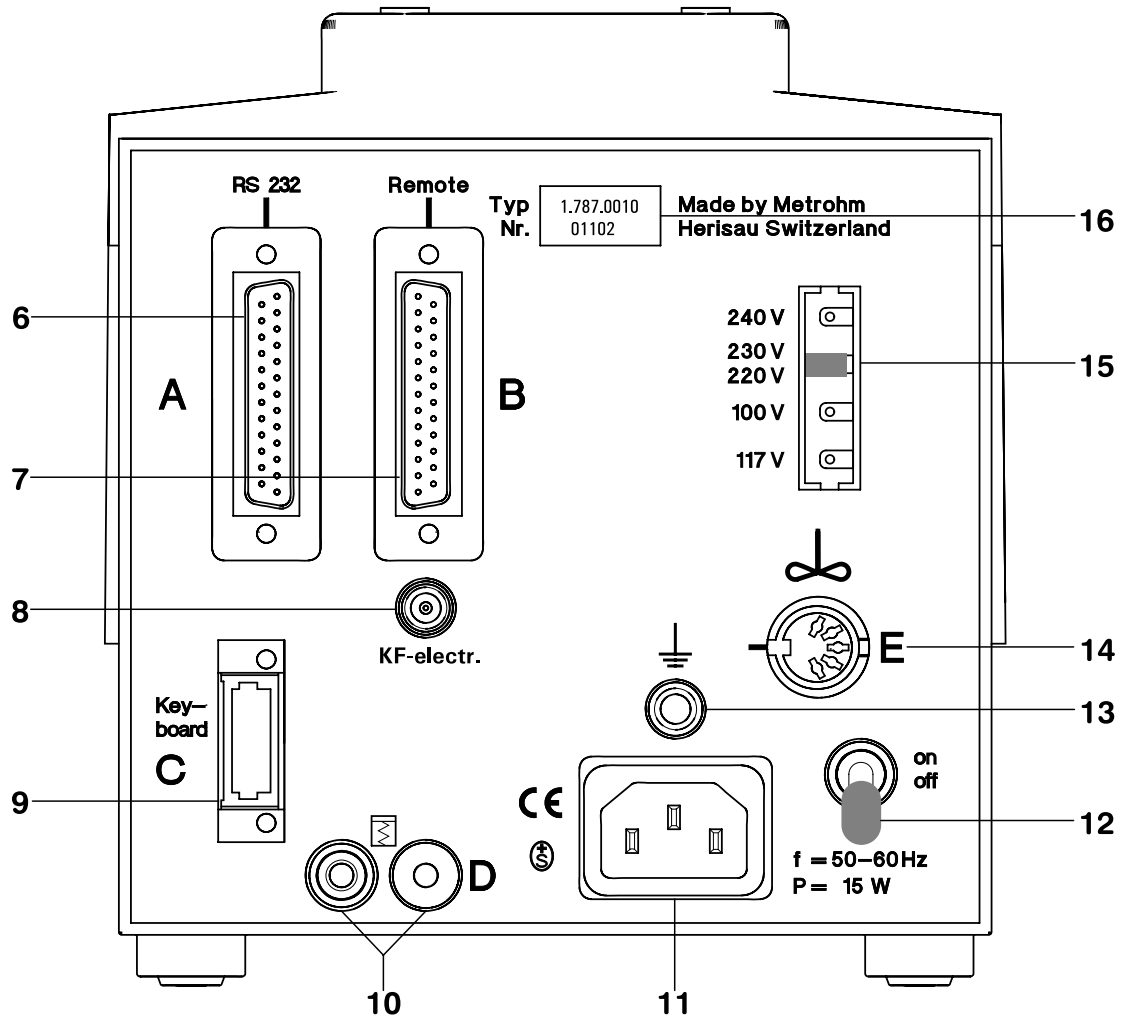
3 Setting of display contrast

4 Controls the dosing rate during manual dosing with <DOS> and subsequent filling

5 Control keys and indicator lamps on the Titrino

Key <DOS>	Dosing key. Dispensing is performed as long as <DOS> is being pressed. Used e.g. to prepare the Exchange Unit. The dispensing rate can be set with potentiometer (**4**).
Key <STOP/FILL>	- Stops procedures, e.g. titrations, conditioning. - Filling after manual dosing with <DOS>.
Key <START>	Starts procedures, e.g. titrations, conditioning. Identical with key <START> of the separate keypad.
Indicator lamp: "Cond."	Lamp flashes during conditioning. Lamp is on when the titration cell is conditioned.

Rear view of instrument:



6 **RS232 interface**
for the connection of printer, balance or a computer

7 **Remote lines**
(input/output)
for the connection of Sample Changers, robots etc.

8 **Connection for the KF electrode**

9 **Connection for separate keypad**

10 **Analog output for the connection of a recorder**

11 **Connection for power cable**
With power supplies where the voltage is subject to severe HF disturbances, the Titrino should be operated via an additional power filter, e.g. Metrohm 615 model.

12 **Mains switch**

13 **Earthing socket**

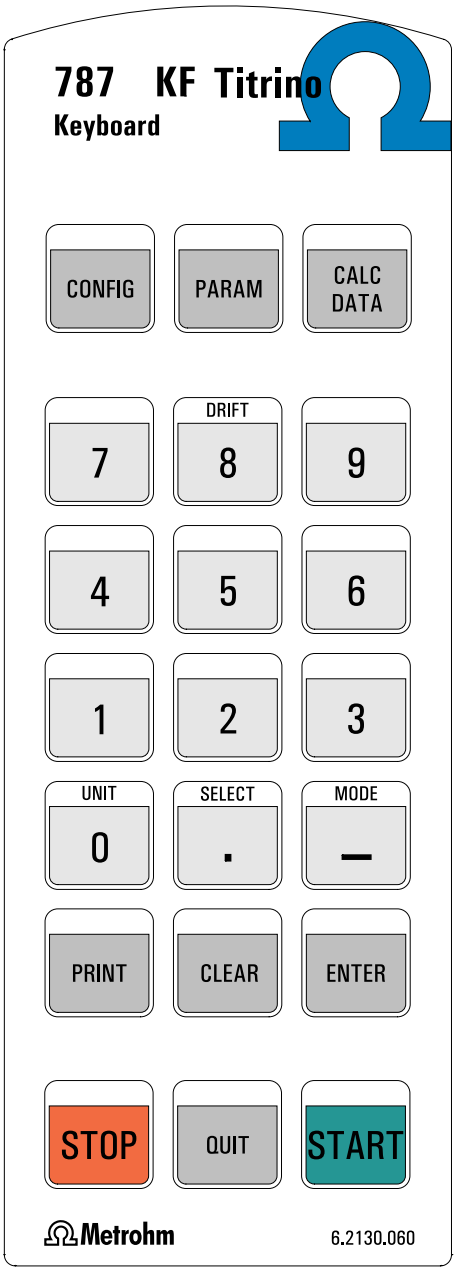
14 **Connection for Ti Stand or stirrer**
703 Ti Stand or 728 Magnetic Stirrer
Supply voltage: 9 VDC ($I \leq 200$ mA)

15 **Display of the set mains voltage**
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 voltage.

16 **Rating plate**
with fabrication, series and instrument number

2 Manual operation

2.1 Keypad



CONFIG	Configuration, see page 19.
PARAM	Parameters, see page 22.
CALC DATA	Result calculation, see page 31.

These keys are opening the corresponding menus. For the principle of data input see page 7.

DRIFT	ON/OFF switching of the drift display, see page 36.
UNIT	Unit of result and sample size, see page 34.
SELECT	Selection of special values (dialog marked with ":")
MODE	Mode selection, see page 18.
PRINT	Printing of reports, see page 37.
CLEAR	Clears values, set special values.
ENTER	Stores values.
STOP	Stops methods.
QUIT	Quits inquiries, waiting times, printing.
START	Starts methods.

2.2 Principle of data input

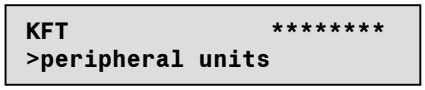
- The first line of the display always shows the active mode (in this case "KFT") and the state of the Titrino. "********" means the Titrinos is in its standby state.

- The keys <CONFIG>, <PARAM> and <CALC DATA> are opening the corresponding menus.

- Pressing one of this keys shows the first group of inquiries of the corresponding menu in the second line of the display.

Example key <CONFIG>:
You opened the configuration menu, the second line of the display shows the first group of inquiries of this menu ">KF device settings".

- By pressing <CONFIG> repeatedly you can move to the other titles of this menu. With pressing <CONFIG> 2 times you go to the group of inquiries "peripheral units".



- If a dialog text is marked with ">", it contains a group of inquiries. You branch into this group by pressing <ENTER>.

- Example first inquiry of the group "peripheral units": Now you opened the first inquiry of the group peripheral units in the configuration menu and you can change the setting.

  If a dialog text of an inquiry is marked with ":", you can select a value with the key <SELECT>.

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

- Repeated pressing of <ENTER> moves you through the inquiries of the group ">peripheral units“, after the last inquiry of this group you leave this group and return to the level above.
  The next group of the menu "configuration“ appears: ">auxiliaries“

- With key <QUIT> you leave an inquiry or a group of inquiries, it always moves you one level up.

- In this example you leave the menu "configuration" by pressing <QUIT> and return to the standby state with the display of the titration mode.

2.3 Tutorial

This short operating course teaches you to work quick and efficient with the 787 KF Titrino, by means of the most important applications.

Set up your Titrino and connect the peripheral devices needed, see chapter 4.

2.3.1 Entering data, setting the dialog language

We can thus make a start and first take a look at the fundamentals of the entry of data. We change the dialog language.

- Switch on the Titrino. It is now in the standby state, it shows you the active mode.

<CONFIG>

- Press the key <CONFIG>, the display shows:

This is the title of the group "KF device settings". This group contains various inquiries for the KF titraton.

3 × <CONFIG>

- Press <CONFIG> 3 times. You see the titles of the other groups of inquiries in the configuration menu. The display shows

This "auxiliaries" group contains the inquiry for the dialog language.

<ENTER>

- Pressing the <ENTER> key takes you to the inquiries of the group "auxiliaries". Note the ">" sign. All titles of inquiry groups are prefixed by this sign.

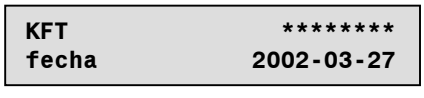
This is the first inquiry of the "auxiliaries" group: the selection of the dialog language.

<SELECT>

- You select the various dialog languages with the <SELECT> key. Press <SELECT> repeatedly until "español" appears in the display.
Note the sign ":". It appears if the values can be selected with the key <SELECT>.

<ENTER>

- Accept the new "value" with <ENTER>.
The next inquiry "fecha" (date) of the group "ajustes varios" (auxiliaries) is shown.



You can open this inquiry by pressing <ENTER> too and go through all the inquiries of this group this

way.
Because this inquiry follows no colon ":" the value can't be selected by <SELECT>, the date "fecha" has to be entered with the numeric keys.

<QUIT>

- Exit the inquiries with <QUIT>. You are one level higher in the "configuration" menu showing the title "ajustes varios" (auxiliaries).

```
KFT                 ********
>ajustes varios
```

<QUIT>

- Press <QUIT> once again to exit the "configuration" menu and return to the standby state.

```
KFT                 ********
```

All the dialog texts will now be displayed in Spanish. If you prefer English as the displayed dialog language, proceed as before and select "English".

2.3.2 Titer determination

Set up your titration vessel, see page 61f and plug your KF electrode into the measuring input ('KF electr.').
Put a Exchange Unit with KF reagent on the Titrino and rinse the tubing and the buret tip with <DOS>. Fill the buret again with <STOP/FILL>.
Fill your titration vessel with solvent, put a stirrer bar in the titration vessel and switch on the stirrer.

For the titer determination you need water and a syringe that allows the exact dispensing of 30 µL.

Selection of the mode

<MODE>

```
KFT                 ********
TITER with H2O or Std.
```

- Press <MODE> repeatedly until "TITER with H2O or std." appears in the display.

<ENTER>

```
TITER               ********
```

- Confirm "TITER with H2O or std." with <ENTER>.

  The mode "TITER" is active and instrument is in its standby state

Briefly check a few settings under the <PARAM> key:

2 × <PARAM>

```
TITER               ********
>preselections
```

- Press <PARAM> twice so that the title "preselections" appears in the display:

<ENTER>

View the individual inquiries of this group with <ENTER>. The following values should be set:

```
TITER               ********
conditioning:             ON
```

Automatic drying of the titration cell before and between titrations: "ON".

<ENTER>

```
TITER               ********
req.ident:               OFF
```

Request of the sample identification after the titration start: "OFF".

<ENTER>

```
TITER               ********
req.smpl size:            ON
```

Request of the sample size after the titration start: "ON".

<ENTER>

```
TITER               ********
report:                  OFF
```

If no printer is attached, the report printout after the titration must be switched off.

or

```
TITER                ********
report:                short
```

With a connected printer, the short report, for example, can be selected.

<ENTER>

If you have to alter one of these settings, you can do this with the <SELECT> key.

Your titration vessel already contains solvent. Start with <START>. First the titrations cell is dried. The display shows

```
TITER                   wait
```

as long as the vessel is still wet and the green "Cond." lamp flashes. As soon as the titration vessel is dry and hence ready for operation, this is shown by

```
TITER          conditioning
```

an the "Cond."-LED lights continuously.

To determine the titer we shall perform several titrations and store the mean value as "titer".

Calculating the mean value and standard deviation

Check that the mean value calculation is switched on:

2 × <CALC DATA>

- Press <CALC DATA> twice until the display shows

```
TITER                ********
>statistics
```

the title of the group is "statistics". Press <ENTER>.

<ENTER>

```
TITER                ********
mean:                  n=  20
```

Number of single determinations for the calculation of the mean value. Since the mean value is recalculated after every determination, the maximum value can remain set at 20. The mean calculation is terminated when the operating mode is changed.

2 × <QUIT>

- Exit the inquiry.

Determination

<START>

- Now prepare the sample, e.g. 30 µL water and start the titration with <START>. The display shows

```
KFR volume          0.000 ml
smpl size             1.0 g
```

0.03
<ENTER>

- Inject the sample and enter the weight in g:

If you have connected a balance, you can also back-weigh the syringe.

The titration now runs.

```
KFR volume  ↑       1.426 ml
#======
```

The first line of the display shows the current volume. In addition, a "↑" appears when dispensing is being performed.
A "control bar" appears on the second line and shows the control deviation of the current measured value from the set endpoint.

```
KFR volume          5.632 ml
titer           5.3267 mg/ml
```

On completion of the titration, the first line shows the dispensed volume and the second the calculated titer.

If you have connected a printer, a report is also printed:

```
date 2002-03-27      time  13:55:10    3
smpl size      0.03 g
titer        5.3267 mg/ml
          ============
```

Perform another determination.

On completion of the titration, the mean value of the two determinations is calculated. The report on the printer has the following appearance:

```
date 2002-03-27      time  13:55:10    3
smpl size      0.03 g
titer        5.3686 mg/ml
mean (2)     5.3477 mg/ml
+/-s        0.02973 mg/ml
s(rel)         0.56 %
          ============
```

Viewing the statistics data

If you have not connected a printer, you can view the statistics data on the display with <SELECT>.

```
KFR volume        5.676 ml
titer          5.3686 mg/ml
```

- From the result display "titer", switch to the display of the mean value with <SELECT>.

<SELECT>

```
KFR volume        5.676 ml
mean (2)       5.3477 mg/ml
```

Mean value of 2 determinations.

- Press <SELECT> again and the standard deviation is shown.

<SELECT>

```
KFR volume        5.676 ml
+/-s          0.02973 mg/ml
```

Absolute standard deviation.

- Pressing <SELECT> once more leads to the

<SELECT>

```
KFR volume        5.676 ml
s(rel)              0.56 %
```

relative standard deviation.

- <SELECT> returns you to the result display.

<SELECT>

Repeat the titer determination once more.

With a connected printer you may want a printout of the single results that are used for the statistics calculation: press the key sequence <PRINT><1><ENTER>.

Let us assume that you have discovered that one of the values is an "outlier" and you would like to delete it.

Deleting a result in the mean value calculation

In our example, the deviation of the second result is excessive. We thus wish to delete it:

2 × <CALC DATA>

- Press <CALC DATA> twice. The display shows:

```
KFR volume        5.676 ml
>statistics
```

2× <ENTER>

- Open with <ENTER> the inquiry of the result table "res.tab:"

```
KFR volume        5.676 ml
res.tab:          original
```

<SELECT>

- Press <SELECT> to display "delete n". This means that you wish to delete a single result with the index n in the result table.

```
KFR volume        5.676 ml
res.tab:          delete n
```

<ENTER>

```
KFR volume          5.676 ml
delete              n=     1
```

- Enter the index of the result you wish to delete, in our case the second:

<2>
<ENTER>

- Exit the inquiry with <QUIT>.

2 × <QUIT>

Mean value and standard deviation are recalculated and can be viewed in the display.

If you have connected a printer, a new report is printed out.

Following this titer determination, you now decide to perform Karl Fischer determinations. The titer just determined will be automatically used here.

2.3.3 Karl Fischer titration

<MODE>

```
KFR volume        5.676 ml
KFT
```

- Select the "KFT" mode: Press <MODE> repeatedly until the display shows

<ENTER>

- Accept this mode with <ENTER>

```
KFT           conditioning
```

The instrument is in the KFT mode and the titration cell is ready for operation.

<CALC DATA>
3 × <ENTER>

- Check briefly that the titer just determined has also been adopted: Press <CALC DATA>, branch to the group "calculation" with <ENTER> and then press <ENTER> two times more to display the following inquiry.

```
KFT           conditioning
titer         5.3326 mg/ml
```

2 × <QUIT>

- Exit the inquiry by pressing <QUIT> twice.

Now prepare your sample and titrate it.

Result calculation and unit of the result

The result is calculated by the following formula:

$$\text{water(content)} = \frac{(\text{volume(KFR)} - \text{blank}) \times \text{titer} \times \text{factor}}{|\text{smplsize}| \times \text{divisor}}$$

<UNIT>

```
KFT volume        3.459 ml
result unit:            %
```

- Change the unit of the result to mg/mL: Press <UNIT>. The display shows:

2 × <SELECT>

- You wish to have your result in mg/mL. Press <SELECT> repeatedly until "mg/ml" appears in the display.

<ENTER>

```
KFT volume        3.459 ml
result unit:     mg/ml;3
```

- Press <ENTER>. The number of decimal places is shown after the separator ";". The "3" flashes to show you that you can now enter a number. Enter here, e.g. 1 decimal place and exit the inquiry by pressing <QUIT> twice.

<1>
<ENTER>
<QUIT>

The result is outputted in the new unit.

It is now necessary to match the factor to the new result unit. A table with a selection of matched quantities for factor, divisor and unit of the sample size can be found in the quick reference.

<CALC DATA>
4 × <ENTER>

- Enter a new factor: Press <CALC DATA> and enter the inquiries of the "calculation" group with <ENTER>. Proceed with 3 times <ENTER> to the display:

```
KFT volume        3.459 ml
factor                0.1
```

<1>
<ENTER>

- Enter "1".

```
KFT volume        3.459 ml
divisor                 1
```

- As divisor enter the density of the sample.

<ENTER>

2 × <QUIT>

- Exit the inquiry by pressing <QUIT> twice. The result is recalculated and outputted.

2.3.4 Drift

The drift is measured in µL/min. It specifies how much KF reagent is consumed per unit time to keep the titration cell dry. The reagent is needed,

- to titrate moisture in the titration cell.
- to compensate the iodine consumption of slow side reactions.

The drift value is generally of the order of a few µL/min for "dry conditioned" titration cells.

Checking the condition of the solvent

The drift can be displayed during the conditioning of the titration cell with the <DRIFT> key:

<DRIFT>

- Press <DRIFT>. The first line of the display shows

```
Drift             4.3 µl/min
```

You can follow the progress of the drift. In fresh solvent the drift value should drop to less than 10 µL/min after a few minutes.

<DRIFT>

- Pressing <DRIFT> once again switches the drift display off.

Drift correction of the results

You can correct your results by the drift. This is primarily necessary if you wish to determine very small amounts of moisture or when you have very long titration times.
For the correction "drift value ∗ titration time" is subtracted form the dispensed volume:

corrected volume = dispensed volume – (drift value ∗ titration time)

The drift value can be determined automatically or entered manually. In the automatic determination the current drift value at the start of the titration is stored and used for the correction. In the manual entry you yourself enter a fixed value, e.g. the stable drift value that you have read off from the display during conditioning.

<CALC DATA>
7 × <ENTER>

- Activate the drift correction: Press <CALC DATA> and enter the inquiries of the "calculation" group with <ENTER>. Proceed with <ENTER> until the display shows:

```
KFT volume        3.459 ml
drift corr.:          OFF
```

2 × <SELECT>
<ENTER>

- Make your selection with <SELECT>, e.g. "man.".

```
KFT volume        3.459 ml
drift value     0.0 µl/min
```

- Enter a drift value, e.g. 2.2 µL/min and exit the inquiry.

2.2
<ENTER>
<QUIT>

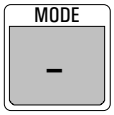
```
KFT-Vol  -d       2.365 ml
```

The result is recalculated and the first line of the display shows

-d means that a drift correction has been performed.
If you have connected a printer, the full report provides you with all data for recalculation of the result:

```
date 2002-03-27      time  13:55:10    3
smpl size      0.03 g
KFR volume    3.459 ml
drift man.      2.2 µl/min
(-d)time       1.03
water         922.2 mg/ml
          ============
```

2.4 Selection of the mode, key <MODE>



Press key <MODE> until the desired mode is displayed and confirm with <ENTER>.

The following modes can be selected:

- KFT:
  Karl Fischer titration
- TITER with H2O or std.:
  Titer determination with water or water-containing standard.
- TITER with Na2Tart*2H2O:
  titer determination with sodium tartrate.
- BLANK determination:
  determination of the blank value

The set values under the <CONFIG> and <PARAM> keys apply to all modes, whereas the calculations differ for each mode. Once values have been set they remain effective even if the instrument is switched off.

2.5 Configuration, key <CONFIG>

Key <CONFIG> serves to enter device specific data. The set values apply to all modes. The quantities marked with "cond." are also accessible during the conditioning

```
KFT                  ********
>KF device settings
```

KF device settings:
Settings for the monitoring of the reagent supply, the measuring input, the endpoint and the filling rate.
peripheral units:
Selection of printer, balance and the curve at the analog output.
auxiliaries:
e.g. setting of dialog language, date, time, etc.
RS232 settings:
RS parameters for the COM interface.

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

```
>KF device settings
```

KF device settings for all modes

```
   limit KF reag.    OFF ml
```

KF reagent volume counter (0...999 mL, OFF)
is used for monitoring of the
- reagent supply
- the buffer capacity of the solvent with 2-component reagents

<CLEAR> sets "OFF".
If the KF reagent volume counter is activated, the inquiry of the current counter status follows.

```
     actual KF reag.     0 ml
```

Current counter status (0...999 mL)

```
   polarizer:        I(pol)
```

Selection of the polarization mode (I(pol), U(pol))

```
     I(pol)            50 µA
     EP               250 mV
     cond.
```

Polarization current(-127...127 µA)
Endpoint voltage(-1500 mV...1500 mV)

```
     U(pol)           400 mV
     EP                25 µA
     cond.
```

Polarization voltage(-1270...1270 mV, in steps of 10 mV)
Endpoint current (-150...150 µA)

filling rate max. ml/min *cond.*	*Filling rate after the titration (0.01...150 mL/min, max.)* <CLEAR> sets "max.". The maximum rate depends on the Exchange unit: Exchange unit max. 5 mL 15 mL/min 10 mL 30 mL/min 20 mL 60 mL/min 50 mL 150 mL/min
>RS232 settings	**Settings of RS232 interface** see also page 68.
baud rate: 9600	*Baud rate (300, 600, 1200, 2400, 4800, 9600)*
data bit: 8	*Data bit (7, 8)*
stop bit: 1	*Stop bit (1, 2)*
parity: none	*Parity (even, odd, none)*
handshake: HWs	*Handshake (HWs, HWf, SWline, SWchar, none)* see page 68.
RS control: ON	*Control via RS232 interface (ON, OFF)* "OFF" means that the receipt of commands via the RS232 interface is blocked. Data output is possible.
>peripheral units	**Settings for peripheral units**
send to: IBM	*Selection of printer (Epson, Seiko, IBM) at the Titrino RS232 interface.* "Epson", for Epson Mode, e.g. Epson LX 300+, Citizen iDP 562 RS, Custom DP40-S4N "Seiko", e.g. for DPU-414 "IBM", e.g. for HP DeskJet types, for all printers with IBM character set Table 437 and IBM graphics, as well as for the data transmission to a computer with Metrodata software VESUV.
balance: Sartorius	*Selection of balance (Sartorius, Mettler, AND, Precisa)* Sartorius: Models MP8, MC1 Mettler: Models AT, AM, PM, AX, MX, UMX and balances with 011, 012, or 016 interface AND: Models ER-60, 120, 180, 182, FR-200, 300 and FX-200, 300, 320 Precisa: Models with RS232C interface
record: V vs. t	*Selection of the curve for the output at the analog output (V vs. t, dV/dt vs. t, U vs. t, -U vs. t)* V vs. t: Volume vs. time curve dV/dt vs. t: Drift vs. time curve U vs. t: Control deviation (current value – EP) vs. time curve

>auxiliaries	**General settings**
dialog: english	*Selection of dialog language (english, deutsch, francais, español)*
date 2001-03-27	*Current date (YYYY-MM-DD)* Format: Year-month-day, entry with leading zeros.
time 08:13	*Current time (HH-MM)* Format: Hours-minutes, entry with leading zeros.
run number 0	*Current run number for result output (0...999)* The sample number is set to 0 when the instrument is switched on and incremented on every determination.
electrode test: ON	*Electrode test (ON, OFF)* Test for polarized electrodes. Performed on changeover from the inactive state to a measurement. "OFF" means that the test is not performed.
display KFR vol.: ON	*Display the dispensed KFR volume in the result display (ON, OFF)* "ON" means the dispensed KFR volume will be displayed in the result output on the first line.
device label	*Individual identification of devices (up to 8 ASCII characters)*
program 787.0010	*Display of program version*

2.6 Parameters, key <PARAM>

The key <PARAM> is used for the entry of values that determine the titration sequence. Values marked with "cond." are accessible during the conditioning. "**titr." means that these values can be changed during the titration. They influence the ongoing determination. Other values can only be changed in the inactive state.

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

2.6.1 Parameters

KFT ****** **>titration parameters**	**titration parameters** are valid for the global titration sequence. **preselections:** ON/OFF of various auxiliary functions such as automatic requests after the start and report.
>titration parameters	**General titration parameters**
extr.time 0 s ***titr.**	*Extraction time (-9999.. 9999 s)* for - that evolve sample slowly - work with KF oven With positive extraction times, titration is performed continuously during this time; with negative values no titrant is added during the extraction time. The extraction time can be aborted with <QUIT>.
stop crit: drift ***titr.**	*Type of stop criteria (drift, time)*
stop drift 20 µl/min ***titr.**	*Titration stops if EP is and stop drift is reached. (1...999 µL/min)*
t(delay) 10 s ***titr.**	*Titration stops if there is no dosing during t(delay). (0...99 s)* Switch off when the end point is reached and the set time after the last dispensing has elapsed.
stop V 99.99 ml ***titr.**	*Stop volume (0...99.99 mL, OFF)* Safety stop, e.g. if no endpoint is found. <CLEAR> sets "OFF".
start V: 0.00 ml ***cond.**	*Start volume (0.00…99.99 mL.)* Performed and inquired only in KFT mode. Start volume is dispensed before titration start. In the

	case of a negative extraction time, it is dispensed after the extraction time has elapsed.
dos.rate max. ml/min ***titr.*	If a start volume has been entered, an inquiry appears regarding the dosing rate: *Dosing rate for start volume* *(0.01...150 mL/min, max.)* <CLEAR> sets "max.". The maximum rate depends on the Exchange Unit: Exchange Unit max. 5 mL 15 mL/min 10 mL 30 mL/min 20 mL 60 mL/min 50 mL 150 mL/min
max.rate 10.0 ml/min ***titr.*	*Maximum titration rate (0.01...150 mL/min, max.)* <CLEAR> sets "max.". This parameter determines primarily the addition rate outside the control range, see also page 26. The maximum rate depends on the Exchange Unit: Exchange Unit max. 5 mL 15 mL/min 10 mL 30 mL/min 20 mL 60 mL/min 50 mL 150 mL/min
min.volume incr. min. µl ***titr.*	*Minimum volume increment in the titration (0.01...999.9 µL/min, min.)* <CLEAR> sets "min.". This parameter determines the addition rate right at the start and the end of the titration, see also page 26. This parameter influences the titration speed and therefore its accuracy very strongly: A smaller min.rate results in a slower titration. The minimum increment depends on the Exchange Unit: Exchange Unit min. 5 mL 0.5 µL 10 mL 1.0 µL 20 mL 2.0 µL 50 mL 5.0 µL

>preselections	**Preselections for the sequence**
conditioning: OFF	*Automatic conditioning of titration vessel. (ON, OFF)* If conditioning is "on", between the titrations the titration solution is constantly maintained at the end point. When conditioning is performed, the volume drift can be displayed during the conditioning with <DRIFT>, see page 36.
req.ident: OFF	*Request of the sample identification after start of titration (ON, OFF)* After start, the sample identification can be requested automatically. Not performed or inquired in the "BLANK" mode.
req.smpl size: OFF	*Request of sample size after start of titration (ON, OFF)* Not performed or inquired in the "BLANK" mode.
report: OFF ***cond.***	*Selection of the result report on titration completion (short, full, OFF)* See also page 38.

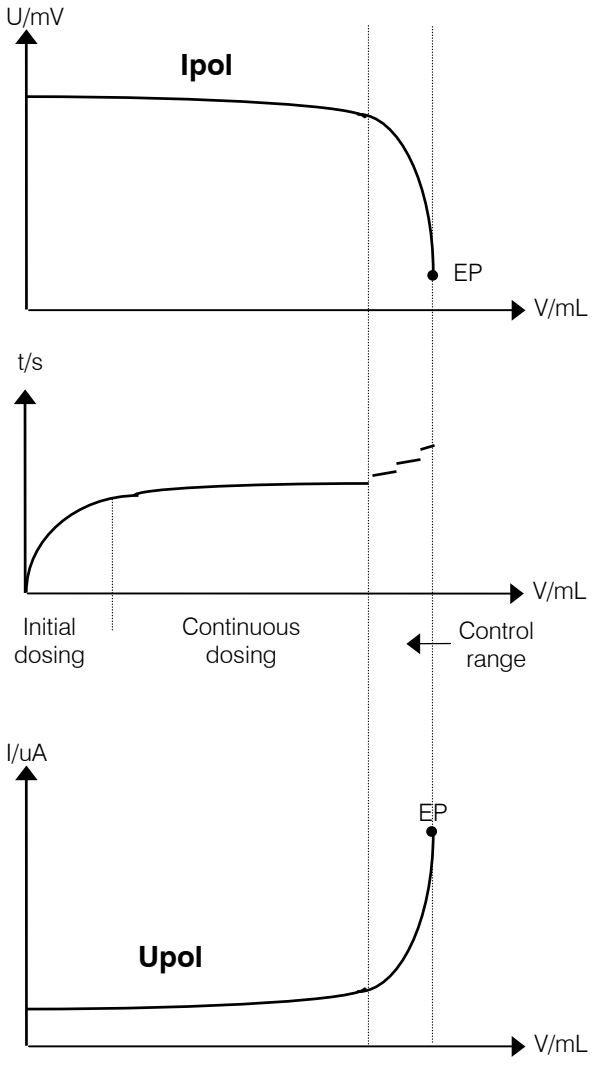
Titration sequence of KFT

<START>	
(Preconditioning) (<START>	If conditioning is on, the sample solution is titrated until the EP is reached. The display shows then **KFT conditioning** The vessel is now conditioned. The titration can be started with <START>.
(Request smpl size) (Request ident.)	The sample size ant the sample identification are requested.
(Start volume)	The start volume is dispensed.
(Extraction time) Titration with test of stop criterion	The titration is executed. If the extraction time is not yet over when the endpoint has been reached, the titration will only be terminated after the extraction time is over.
Calculations	Calculations are carried out.
Data output	Data are outputted.
(Reconditioning)	Conditioning is carried out.

Titration parameters for KFT

The titration parameters can be set according to your samples. The default parameters are already set to get satisfactory results. Optimize the control parameters for specific samples only.

During the titration, reagent dosing is carried out in 3 phases:



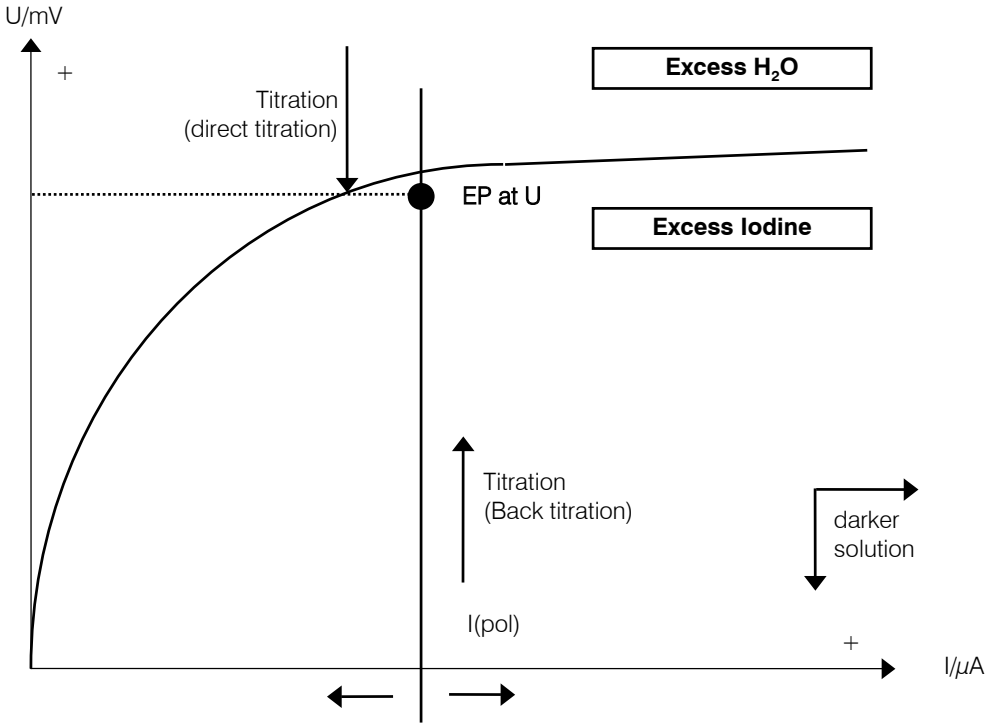
1. Initial dosing:
   Here the dosing rate increases constantly up to "max.rate".

2. Continuous dosing:
   Dosing is performed at the maximum rate "max.rate" until the control range (dynamics) is reached.

3. Control range (dynamics):
   In this range, dosing is performed in single steps. The last dosing steps are controlled by the parameter "min.volume incr.".

Remarks:
- Titer determination should have the same parameters as the sample titrations.
- In most cases the preset default parameters provide precise and reproducible results.
- Ipol gives relatively steep curves. They are flatter with Upol.

Mechanisms of the KFT parameters in Ipol mode



- The position and curve characteristics of the line between the ranges of excess water or excess iodine depends on the type of sample and the ingredients of the working media.

- The endpoint has to be set close to the range margin, but always within the iodine excess range. If the endpoint is set too close to the limit, an overdose of KF reagent may be dispensed. The steeper the curve at the preset polarization current I(pol), the more delicate it is to titrate to a steady and reproducible endpoint. For the titration of troublesome samples, the particular conditions must be optimized by trial and error. Always mind the color of the working medium at the end point as your guideline.
  Remark: In most cases the preset default parameters provide precise and reproducible results.

- If you select negative values for a polarization, you should choose negative values for all other parameters too in order to have compatible parameter sets.

- In measurements with the setting "Upol", all parameters work in a similar manner as in measurements with the setting " Ipol".

Relation between the stop criteria "time" and "drift"

The stop criterion "time", t(delay), means that the end point must be exceeded for a certain period of time. In other words, after the last dosed increment, time t is allowed to elapse before the titration is stopped. The size of this last increment depends on the volume of the Exchange Unit used. With a 20 mL Exchange Unit, the smallest possible increment is 2 µL. With a t(delay) = 5 s, the last 2 µL reagent must thus suffice for 5 s or longer. This results in a drift of ≤ 2 µL/5 s = 24 µL/min (the drift can be less than 24 µL/min as it is not known whether the last increment would also suffice for 10 s). If you have been working up to this point with a 20 mL Exchange Unit and a t(delay) = 5 s, you can set a value of ≤ 24 µL/min as stop drift. The following table shows several values for the maximum stop drift.

t(delay) / min.incr. (Exchange Unit)	5 s	10 s	20 s
0.5 µL (5 mL)	6 µL/min	3 µL/min	1.5 µL/min
1 µL (10 mL)	12 µL/min	6 µL/min	3 µL/min
2 µL (20 mL)	24 µL/min	12 µL/min	6 µL/min
5 µL (50 mL)	60 µL/min	30 µL/min	15 µL/min

Same t(delay) with a range of extremely small volume increments means different switch-off points. In case the stop criterion "drift" is used, the stopping point remains the same.

The determination of the free water is easily done, as far as the specifications of the reagent manufacturer regarding the "water capacity" of the reagents are considered. Problems may occur with specific sample matrices. The relevant literature contains many precise analysis instructions. Here, we give you some useful hints for the sample addition.

Sample addition

For sample addition various accessories are available, for example injection syringes, weighing spoons etc.

It is a good idea to apply the back-weighing technique, except when you are disposing small amounts of liquids with a micro-syringe. Fill the syringe or the weighing spoon with your sample just before the titration (e.g. during conditioning) and tare it on a balance with an appropriate precision, which ideally is connected to the Titrino. Sample size request should always be switched on (see page 24). Add the sample during the request for the sample size, and weigh the syringe or weighing spoon again to evaluate the weight difference. Use the transfer of balance data to enter the correct sample size if possible. The weight has to be transmitted in gram. If you transfer the sample size from the balance, the sample size request is confirmed automatically, and the titration is started at once. Otherwise use the keypad to enter the weight.

If the sample size request is switched off, and preconditioning is set, you are explicitly prompted to add your sample. For six seconds, the message "add sample" is displayed after which the titration is started by the Titrino itself.

Solid samples

Use the glass weighing spoon 6.2412.000 and dispose the sample through the opening for the septum stopper.

Liquid samples

Use a disposable syringe (2...20 mL) or a micro-syringe with a long needle attached. Puncture the septum and dispose the sample carefully. When using disposable syringes, add the liquid sample carefully without dipping into the solvent. Draw back the last drop of sample into the syringe before you redraw the needle. For disposing an exact, small volume of liquid sample, use a micro-syringe. Proceed as described above, but dip the needle into the preconditioned solvent and dispose the sample carefully. Here drawing back of solvent or sample adhering to the needle is not recommended.
Always keep in mind to exchange the septum as soon as it shows any large punctures impairing the tightness of the titration cell.

Pasty, viscous samples

For samples which cannot be disposed with a needle because of their high viscosity, you can handle your samples with disposable syringes with a large volume without using a needle. Dispose your sample through the opening of the septum stopper. Back-weigh the syringe after addition of the sample. Be sure to wipe off any adhering excess sample substance of the syringe before taring it.

In any case, pay attention to prevent the penetration of atmospheric moisture into the titration vessel when you are disposing the sample. If you still have to open the titration cell for any reason, determine a blank value and take it into account for the calculation of the titration result (see page 34).

In the following table we attempt to show you solutions related more to the instrument's side:

What to do if ...

Problem	Possible causes and remedial action
Dosing at end too long and increments too small. "Is never finished!"	• Increase "min.volume incr.". • Change stop criterion. Try to increase stop drift or use a short stopping time as stop criterion, e.g. • For problematic samples change solvents with ketones or aldehydes in 2-methoxyethanol or with amines mixture in methanol/glacial acetic, e.g., see literature.
The increments at the end of the titration are too large. "Overshoots".	• Lower "max.rate". The following experiment gives you a reference point for the optimum max.rate: Drift display during conditioning and add sample without starting the titration. Select a value below the maximum drift as "max.rate". • Optimize setup of electrode and buret tip and improve stirring.
Solution becomes too brown at the end of the titration.	• The methanol fraction in the solvent is too low. Change the solvent. • Electrode could be coated; wipe off with acetone.
Solution becomes darker with every titration.	• Renew solvent. • Electrode could be coated; wipe off with acetone.
The drift increases with every titration.	• Does your sample evolve water extremely sluggishly? Work with the KF oven. • Are acids esterified in your sample? Change solution more frequently. Increase buffer capacity of the solvent. • Does your sample contain ketones or aldehydes? Use special reagents suitable for ketones and aldehydes.
The endpoint is reached "too rapidly".	• Reduce "max.rate".
The titration times become longer and longer.	• With 2-component reagents the buffer capacity of the solvent can be exhausted. Change solution. • If the drift increases at the same time, see above.

2.8 Result calculations

Key <CALC DATA>

The key <CALC DATA> is used to enter the values for the calculations. The data of this key are method specific to a sample (sample size and identification) or to a mode (titer, factor, blank, mean value) and the drift correction applies to all modes. On exit the result is always recalculated. Values marked with "cond." are accessible during the conditioning. "**titr." means that these values can be changed during the titration. They influence the ongoing determination.

```
KFT                    ********
>calculation
```

calculation:
Values for result calculations.

statistics:
Calculation of mean values and standard deviation.

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

```
>calculation
```

Assignments for the result calculation

```
   smpl size          1.0 g
   **titr.
```

Sample size (6-digit number ±X.XXXXX)
Entry using keypad, via balance.
Sample sizes that are inquired automatically in the titration sequence can be viewed and modified with the <CALC DATA> key. For calculation the absolute sample size is used (negative signs that appear, e.g. in backweighing are ignored).
No inquiry of sample size in the "BLANK" mode.

```
   ident.
   **titr.
```

Sample identification (up to 8 ASCII characters)
Entry using keypad, via balance.
Sample sizes that are inquired automatically in the titration sequence can be viewed and modified with the <CALC DATA> key.
No inquiry of sample size in the "BLANK" mode.

```
   titer           5 mg/ml
   cond.
```

Titer(0.0...99.9991 mg/mL)
The titer is written in automatically from the titer determination modes.
Request only in the "KFT" mode.

```
   factor            0.1
   cond.
```

Factor (±1000000)
in the numerator of the formula. Entries for factors with different units for results and sample size, see page 33f.

divisor **0.1** *cond.*	*Divisor (±1000000)* in the denominator of the calculation formula. Used mainly for the density, see page 33. Request only in the "KFT" mode.
blank **0.0 ml** *cond.*	*Blank (0.0...99.9991 mL)* The blank value is written in automatically from the blank determination mode. Values that are corrected by a blank value are flagged with "-b". Request only in the "KFT" mode.
drift corr.: **auto** *cond.*	*Drift correction for the result (auto, man., OFF)* With the drift correction switched on, the value (drift*titration time) is subtracted from the KFR volume. Values that has been corrected by the drift are flagged with "-d". auto: The drift value at the start of the titration is subtracted. man: A fixed value of the drift is entered and subtracted. If the drift correction is set to "man.", the drift value is requested:
drift value **0.0 µl/min** *cond.*	*Drift value for the manual drift correction (0...99.9 µL/min)*
>statistics	**Statistics calculation**
mean **n= 20** *cond.*	*Mean value calculation from n single results (2...20)*
res.tab: **original** *cond.*	*Result table (original, delete n, delete all)* "original": The original table is used. Deleted individual results are again incorporated in the evaluation. "delete n": Deletion of single results with the index n. "delete all": The entire table is deleted.
delete **n= 1** *cond.*	*Delete data from sample number n (1...20)* The deleted result is removed from the statistics calculation.

Calculation formula and units

The calculation formulas are preset and depend on the selected mode.

Formula for the **KFT** mode

$$\text{water(content)} = \frac{(\text{volume(KFR)} - \text{blank}) \times \text{titer} \times \text{factor}}{|\text{smplsize}| \times \text{divisor}}$$

Factor and divisor are used for the conversion of the result to different units.

Unit of result	Sample size in...	Factor	Divisor
%	g	0.1	1
%	mg	100	1
%	ml	0.1	density of sample [g/mL]
ppm	g	1000	1
ppm	ml	1000	density of sample [g/mL]
ppm	µl	1	density of sample [g/mL]
mg/ml	g	1	density of sample [g/mL]
mg/ml	ml	1	1
mg	1	1	1
ml	1	1	1000 * density H_2O [g/mL] ≈ 1000
mg/pc	pc	1	1

The unit of the result can be selected with the <UNIT> key, see the following page.

Formula for the titer determination modes **TITER**

$$\text{titer} = \frac{|\text{smplsize}| \times \text{factor}}{\text{volume(KFR)}}$$

The factor is used to enter the water content of the standard.

Standard used	Sample size in...	Factor
Water	g	1000
Water	µl	density H_2O [g/mL] ≈ 1
Methanol	ml	content of methanol [g/mL]
Methanol	µl	0.001 * content of methanol [g/mL]
$Na_2Tart*2H_2O$	g	156.6
$Na_2Tart*2H_2O$	mg	0.1566

Formula for the blank determination **BLANK**

blank = volume(KFR) × factor

If the blank is determined with an excessive solvent volume, the result can be converted to the amount used subsequently with the aid of the factor.

If the drift correction is switched on, the "volume(KFR)" is corrected in all modes as follows:

volume(KFR) – d = volume(KFR) – (drift value * (-d)time)

"(-d)time" corresponds to the time during which control is exerted (i.e. during the positive extraction time and during the titration time, but not during the dispensing of the start volume and during negative extraction times).
With manual drift correction, the entered drift value is reconciled in the result calculation, whereas with automatic drift correction the drift value at the start of the titration is used.

The drift correction is used when the ingress of moisture during the titration needs to be compensated. A drift correction is appropriate when the ratio

$$\frac{\text{drift} * \text{titration time}}{\text{volume(KFR)}}$$

is large.

Key <UNIT>

The <UNIT> key can be used to select the unit of the result in the KFT mode and of the sample size. It is accessible during the conditioning and in the standby state.
In the modes "TITER" and "BLANK", the result unit can be viewed only but not changed.

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

result unit:	**%**	*Unit of the result in the KFT mode (%, ppm, mg/mL, g, mg, mL, mg/pc, no unit)*
result unit:	**%;2**	*Number of decimal places (0...9)* The number of decimal places in the result output follows the separator ";". The number flashes to draw attention to the fact that this value can now be entered.
smpl size unit:	**%**	*Unit for the sample size (g, mg, mL, µL, pc, no unit*)

Statistics calculations

If the mean value is active, the following quantities are calculated:

- mean
- standard deviation
- relative standard deviation

These values are printed out in the result report or they can be viewed with the <SELECT> key:

Press the <SELECT> key repeatedly until the desired value appears in the display. The following are displayed in succession, see also page 13.

- current result
- mean
- standard deviation
- relative standard deviation

A table of the single results can be printed out with the key sequence <PRINT><1><ENTER>.

Remarks:

- If the number of single results n has been reached, the statistics calculation begins anew at the next start.
- When the mode is changed, the statistics instructions of the previous mode come to an end (res.tab. deleted) and the instructions of the new mode are followed.
- Old results that are no longer needed for the statistics calculation can be deleted with "delete all".
- Recalculated single results are immediately incorporated in the statistics calculation.
- If a result can not be calculated, the run counter is incremented. The counter for the number of reconciled single results remains unchanged, however.

2.9 Drift display, key <DRIFT>

During the conditioning, the <DRIFT> key can be used to switch the display of the current drift on and off.

The value provides an idea for
- the condition of the titration cell.
- whether a drift correction should occur and the magnitude of the drift value.
- the sample matrix. Do side reactions take place? Does the sample contain ketones or aldehydes? etc.
- the magnitude of the stop drift as a stop criterion (value above basic drift).

2.10 Data output

Reports for the output at the end of a determination

 2 × <PARAM> 4 × <ENTER>	With <PARAM>, the report sequence at the end of the determination is defined. See also page 24. **report**: Definition of report blocks to be printed automatically at the end of the determination. The display texts of the Titrino are shown to the left. The values are the default values.
>preselections **report: OFF**	**Preselections** *Report sequence: full, short, OFF* Select a block with <SELECT>.

Meaning of the report blocks:

full	Full result report with raw results, calculations and statistics.
short	Short result report with calculations and statistics.

Original reports which are put out automatically at the end of the titration and after every recalculation of the result.

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

Report outputs can be stopped with <QUIT>.

Example of reports:

Full result report

```
date 2002-03-27      time  08:33:42    4
smpl size       1.0 g     ident.   08-4
KFR volume    2.278 ml
blank        0.0315 ml
titer           5.0 mg/ml
drift auto      1.9 µl/min
(-d)time       0:43
water           1.14 %
mean(4)         1.13 %
+/-s           0.005 %
s(rel)          0.44 %
          ============
```

- date, time, current run number.
- sample size, identification.
- The blank is printed out only if the value is ≠ 0 mL.
- The drift and the (-d)time are printed out only it the drift correction has been set to "OFF".
- result
- statistics

Short result report

```
date 2002-03-27      time  08:35:42    5
smpl size       1.0 g     ident.   08-5
(-d)time       0:45
water           1.14 %
mean(5)         1.13 %
+/-s           0.005 %
s(rel)          0.44 %
          ============
```

- date, time, current run number.
- result
- mean value with 5 single results
- standard deviation
- relative standard deviation

Additional possibilities for report outputs

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

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

List of reports:

Report	<Key X>
Configuration report	CONFIG
Parameter report	PARAM
Calculation data	CALC DATA
Table of the individual results for statistics calculation	1

Result display without a printer

Results can also be viewed in the display. After a determination the calculated result and the single results of the statistics calculations can be displayed with <SELECT>. <SELECT> switches to the next result, view also page 13.

3 Error messages, Troubleshooting

Data transfer inoperative See measures on page 41.

3.1 Error and special messages

change solvent
The limit volume of the reagent volume counter "limit KF reag." has been reached..
Exit: Change solvent and press <CLEAR>.

check electrode
There is a break or short circuit. Possible causes and rectification of the fault:
- the electrode is not plugged in ⇒ plug it in
- the electrode is not immersed in the solution ⇒ immerse it
- the electrode is defective ⇒ use new electrode.
- the electrode cable is defective ⇒ use new cable.
The electrode test can be switched off under the <PARAM> key.
Exit: Rectify fault or <STOP>.

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

cylinder empty!
During dispensing with <DOS> an entire cylinder ahs been dispensed.
Exit: Press <STOP/FILL>.

division by zero
The result could not be calculated as a divisor in the formula was equal to zero.
Exit: Enter appropriate value.

stop V reached
The determination has been stopped as the stop volume has been reached.

system error 3
The instrument adjustment data have been overwritten.
Exit: <CLEAR>. Default adjustment data are set. The error message appears each time the instrument is switched on until it has been readjusted (Metrohm service).

????
The result exceeds the valid data range or too many decimal places are needed to display.

Error messages in connection with the data transfer

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

Receive errors:

E36 Parity
Exit: <QUIT> and set corresponding quantity the same on both instruments

E37 Stop bit
Exit: <QUIT> and set corresponding quantity the same on both instruments

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

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

Send errors:

E40 DSR=OFF

E41 DCD=OFF

E42 CTS=OFF
Handshake unsatisfactory for more than 1 s.
Exit: <QUIT> Is the receiver switched on and ready to receive?

E43 The transmission of the Titrino has been interrupted with XOFF for at least 3 s.
Exit: <QUIT>.

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

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

Problem	Questions for remedial action
No characters can be received on a connected printer.	- Are the instruments switched on and cables plugged in correctly? - Is the printer set to ”on-line”? - Are baud rate, data bit and parity the same on both instruments? - Is the handshake set properly? If everything seems to be ok, try to print a report with the key sequence <PRINT><CALC DATA><ENTER>. If this report is printed out correctly, check if reports are defined in key <PARAM>.
No data transmission and the display of the Titrino shows an error message.	- **error 42:** Transmission error. Is the printer set to "on-line"? Is the connection cable properly wired? - **error 43:** Data output of the Titrino disabled for longer than 6 s by XOFF. - **error 36-39:** Receive error. Are the RS settings the same on both devices?
The received characters are garbled.	- Are the RS settings the same on both devices? - Has the correct printer been selected?
Wrong line spacing.	The printer does not emulate completely the preset mode. Usually these problems arise with the IBM mode. Set the printer to a different mode (e.g. Epson).

3.3 Diagnosis

3.3.1 General

The 787 KF Titrino 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 can not 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 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 he can provide the service engineer with much more accurate information.

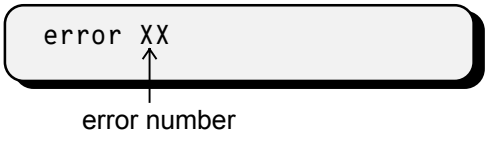
In inquiries always quote the manufacturing (page 4) and program number (see configuration, page 21) and specify possible error displays..

3.3.2 Procedure

- The diagnostic steps must be performed in sequence and compared with the reactions of the 787 KF Titrino (indented). In the "yes" case, continue with the next instruction.
- If the instrument does not show the expected reaction ("no" case), the appropriate diagnostic step must be repeated to exclude an operating error. With repeated wrong reactions, however, there is a strong possibility that a malfunction exists.
- The diagnostic steps allow re-entry into the test routine for repetition if the following display appears:

If the instrument is in a subprogram of the diagnostic routine: Press <Clear>.
If need be, switch the power off then on again after a few seconds. At the same time press key <9> until the above display appears.

- If <Clear> has been pressed during the display of 'diagnose press key 0...9', the instrument returns to the user program.
- Error display: An error is shown in the display as follows:



- If a fault causes the burette drive to stick at the top or bottom end of the cylinder, see page 52, point 3.5.

3.3.3 Equipment required:

- *voltage calibrator, e.g. 1.773.0010 Metrohm pH Simulator*
  or 1.767.0010 Calibrated Reference for mV, pH, Ω µS, °C
- *highly insulated interconnection cable 6.2108.060*
- *cable 3.496.5070*
- *exchange units, if possible with different cylinder volumes (or 3.496.0070 dummy exchange unit)*
- *stop watch or watch with second hand*
- *digital or analogue voltmeter (if need be, connect a calibrated recorder)*
- *2 connecting cables with 4 mm banana plugs*
- *test plug 3.496.8510 (necessary only if plug 'Remote' should be checked)*
- *test plug 3.496.8480 (necessary only if plug 'RS 232' should be checked)*

3.3.4 Diagnosis steps

1 Prepare instruments for diagnostic test

- Power off.
- Disconnect all external connections (cables at rear, except mains cable and keyboard).
- Remove exchange unit.
- Power on and immediately press and hold the <9> key until the power up test pattern disappears.

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

2 Perform display test

- Press <2>.

```
display test
```

- Press <Enter>.

Characters for a visual check of the display are generated on the eight lines.

Test sequence:

a) The display is cleared and overwritten from the left to the right with a dot pattern (■■■■■■■■).

b) The display is cleared and both lines are written into with the letters A, B, C,…Z.

c) The complete character set is shown as a moving display. At the same time with moving display the LED „Cond." are switches on and off.

- The test sequence can be held and then continued at any time by pressing <5>.
- Block 2 is quit by pressing <Clear>.

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

3 Keypad test

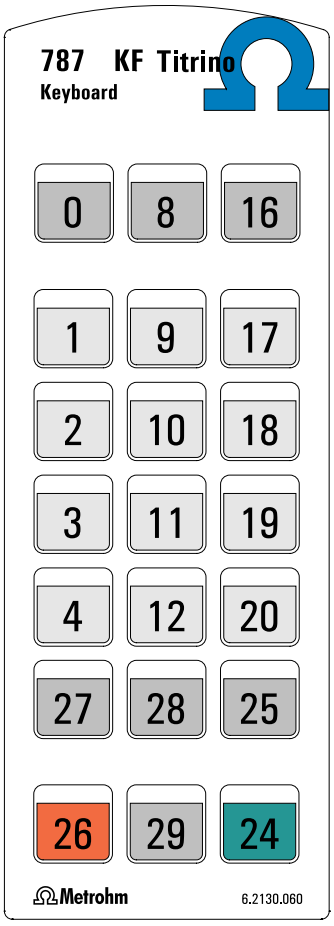
- Press <1>.

```
keys test
```

- Press <Enter>.

```
keys test
matrix code
```

- If any key is now pressed (on the 6.2130.060 keypad or on the front panel of the 787), the appropriate matrix code appears in the display.



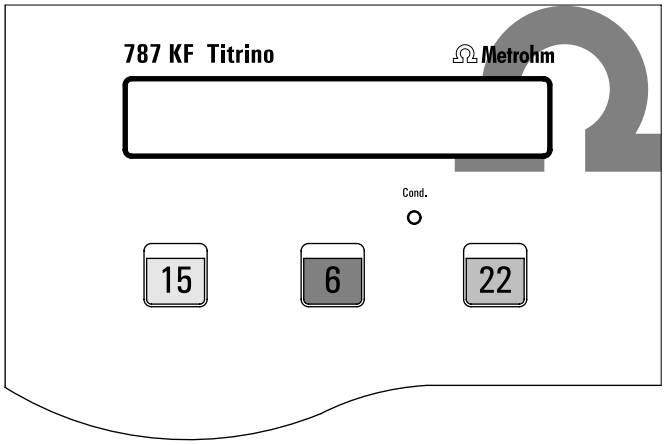


Fig. 1 Keypad 787

Fig. 2 Front panel 787

- Block 1 is quit by pressing the <Clear> key twice.

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

4 Cylinder code, date, time

- Put exchange unit or dummy on the Titrino and put the burette tip into a collecting receptacle.

- Press <0>.

```
date/time
cylinder code
```

- Press <Enter>.

```
date XX-XX-XX  XX:XX:XX
code:D0   XX ml
```

activated dosing unit — *mL-code*

- Check date and time.
- Check whether the ml-code does correspond with the exchange unit placed or not.
  For the sake of completeness, different exchange units can be inserted to check their ml code. If desired, the exchange unit can be removed again. If no exchange unit is inserted display does not show the ml-code but „check exchange unit !“.
- Press <Clear>.

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

5 Analogue output test

A voltage can be set at the analog output (sockets at D) using the keypad. But this should not exceed ± 2000 mV. This voltage can also be used for the calibration of a connected recorder.

- Connect a voltage measuring instrument (voltmeter, DVM, recorder) to the analogue output ***(10)***.
- Press <3>.

```
analog output-1 test
```

- Press <Enter>.

```
analog output-1 test
V-out =              XXmV
```

Enter a voltage value in the range ± 2000 mV using the keypad. After the <ENTER> key has been pressed, this value appears as a voltage at the analog output..

Read off value an the connected voltmeter and compare with the mV value on the display. (Tolerance ± 2 mV)

- Press <Quit>.
- Disconnect voltmeter.

6 Motor timer test

- Press <6>.

```
motor-timer test
```

- Press <Enter>.

```
pot.meter dV/dt ➜ 10?
```

- Turn knob 'dV/dt' to the right stop and press <Enter>.

Test sequence:

a) In a first step, the frequency of the RC oscillator (analogue rate) is tested over a period of 1 second.

b) In a second step, the frequency of the quartz oscillator (digital rate) is tested over a period of 1 second.

c) If no error is found, after about 3 s it appears

```
motor-timer test     o.k.
```

- Press <Clear>.

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

7 Polarizer test

- Press <7>.

```
polarizer test
```

- Press <Enter>.

```
dummy resistor 14.3kΩ ?
```

- Connect resistor switch-box (or suitable resistor 14.3 kΩ 0.1%) using 3.496.5070 cable to 'Pol' socket. Switch-box to 14.3 kΩ.
- Press <Enter>.

Test sequence:

1. *An asterisk flashes during the test.*
2. *In case of an error an error message appears. (If for example the switch-box is not connected, **error 100** appears).*
3. *If no error is found, after about 15 s display shows*

```
polarizer test    o.k.
```

- Press <Clear>.

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

- Remove cable and resistor switch-box.

8 External inputs and outputs

This test is meaningful only if the 787 KF Titrino is used interconnected with other instruments via the 'Remote' connection. In addition, a 3.496.8510 test plug normally used in the repair service is required for this test. However, this plug can also be purchased by customers under the above number.

For the sake of completeness, the procedure is described here. If a diagnostic test of the external inputs and outputs is not required, continue with point 9.

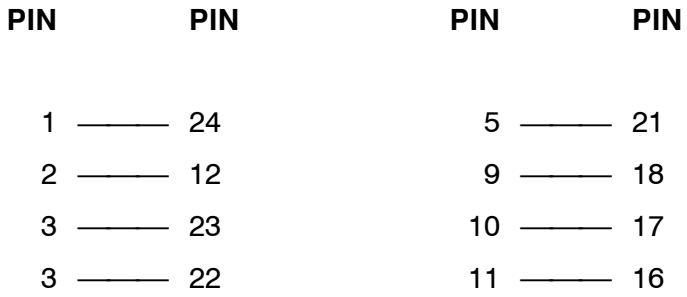


Fig. 3 Connections in the 3.496.8510 test plug

- Press <4>

```
extern input/output test
```

- Press <ENTER>.

```
I/O-test-connector?
```

- Insert the 3.496.8510 test plug in port B 'Remote'. (Do not switch off instrument!)
- Press <ENTER>.

Test sequence:

1. *In case of an error an error message is displayed. If for example no test plug is connected, error message* **error 50 01HEX** *appears).*
2. *If no error is found, after about 1 s display shows*

```
extern input/output o.k.
```

- Remove test plug.
- Press <CLEAR>.

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

9 RS 232 test

A 3.496.8480 test plug normally used in the repair service is required for this test. However, this plug can also be purchased by customers under the above number.

For the sake of completeness, the procedure is described here. If a diagnostic test of the RS 232 interface is not required, continue with point 10.

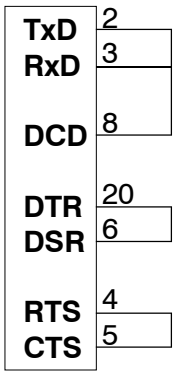


Fig. 4 Connections in the 3.496.8480 plug

- Press <5>.

```
RS232 test
```

- Press <ENTER>.

```
RS232 test-connector?
```

- Insert the 3.496.8480 test plug in 'RS 232' port.
- Press <Enter>.

Test sequence:

1. *In case of an error an error message is displayed. If for example no test plug is connected, error message **error 68** appears).*
2. *If no error is found, after about 5 s display shows*

```
RS232 test    o.k.
```

- Remove test plug.
- Press <Clear>.

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

10 Spindle drive and stopcock changeover

- Press <Clear>.

  The Titrino fills (only if an exchange unit is inserted)

  The Titrino gets out of the diagnosis menu and returns to the user program.

- Remove exchange unit.
- Check spindle zero position, see Fig. 5.

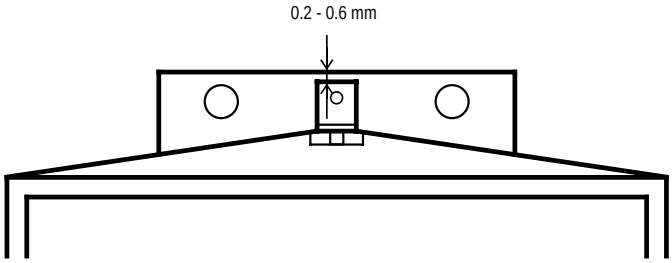


Fig. 5

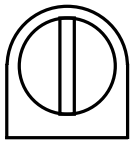


Fig. 6

The spindle must be 0.2 - 0.6 mm below the edge of the sliding plate.

The bar of the stopcock coupling must be exactly parallel to the lateral edges of the MPT Titrino, see Fig.6.

- Reinsert Exchange Unit.

  Titrino fills.

  The display of before reappears.

- Knob 'dV/dt' to right stop.
- Press the <DOS> key (on instrument) until the piston rod reaches the top and at the same time measure the time from start to end.

```
XXX X          ********
cylinder empty !
```

mind selected language!

Spindle remains at maximum position. The transit time of the spindle is 20 s.

- Measure spindle lifting (can be performed only if the 3.496.0070 Dummy Exchange Unit is inserted or the locking switch (in right hole) is carefully operated with a screwdriver after removal of the Exchange Unit).

  From the start point, the spindle travels 80 mm. Instead of the spindle height, the expelled volume can be measured (corresponds to max. vol. of Exchange Unit used).

- Press <FILL> (on instrument) and simultaneously measure the time until the Titrino is again in the 'ready' position.

  Times for filling: *per stop cock cycle* *1 s*
  for filling *20 s* *(Tolerance: 10 %)*

  The following generally holds: Spindle and stopcock must move at a constant speed (noise!). In the filling setting, the stopcock coupling must position the lever of the Exchange Unit correctly at the left stop (with virtually no play and without sticking).

- Set potentiometer 'dV/dt' to left stop.
- Press <DOS> (on instrument) at same time and use a stopwatch to measure the time for 1/10 of the cylinder volume to be expelled. The time should be ca. 90 ... 110 s.

- Set potentiometer 'dV/dt' to right stop.
- Press <FILL>.

11 Setting up original arrangement

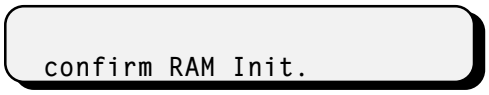
Reconnect all peripherals disconnected at the start of the diagnostic routine and perform a short function test with these.

3.4 Initialise and test RAM

On the odd occasion large disturbing signals (e.g. mains spikes, lightning, etc.) can have an adverse effect on the processor functions and hence lead to a system crash. After such a crash the RAM area must be initialised. Although the basic instrument data remain stored, the RAM initialisation should be performed only when necessary since the stored user data (configuration, parameters, calculation variables, etc.) are cleared as a result.

- Power OFF
- Power ON and simultaneously press keys <DOS> and <STOP/FILL>.

- Press <START>.



- Press <START>.

RAM is tested and initialised. Subsequently a warm start is executed.

The lost data of the user memory must now be reentered.

If 'system error 3' appears in the display, <Clear>can be used to return to the instrument program. The initialisation values are loaded automatically. The instrument thus remains capable of measurement. However, possibly a small loss in accuracy must be anticipated. A new optimum adjustment can be performed by Metrohm service. The error message 'system error 3' always appears after the instrument is switched on until this adjustment has been performed.

3.5 Releasing a locked spindle with inserted Exchange Unit

- The burette drive may very occasionally jam at the top or bottom end of the cylinder. If jamming occurs at the top or when the drive is out of function, the Exchange Unit can no longer removed. In this case, it is necessary to proceed as follows:

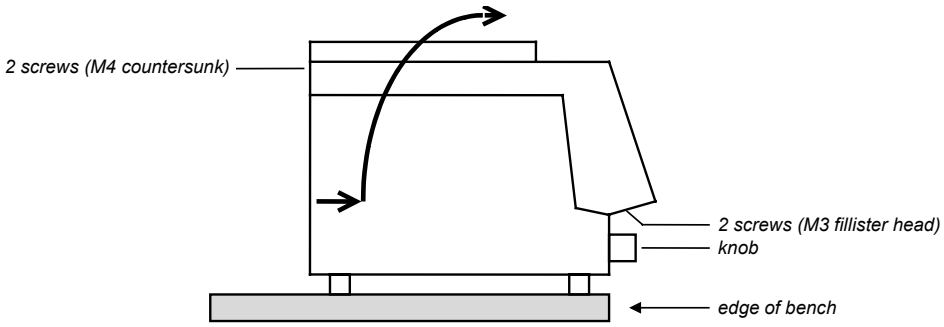


Fig. 7

- Disconnect instrument from power supply!
- Remove control knob
- Place instrument over edge of bench to allow the M3 screws to be removed (Fig. 7)
- Remove M4 screws
- Lift off top part of instrument together with Exchange Unit in the manner shown by the arrow

The electronic circuits are now accessible!
On no account touch these!

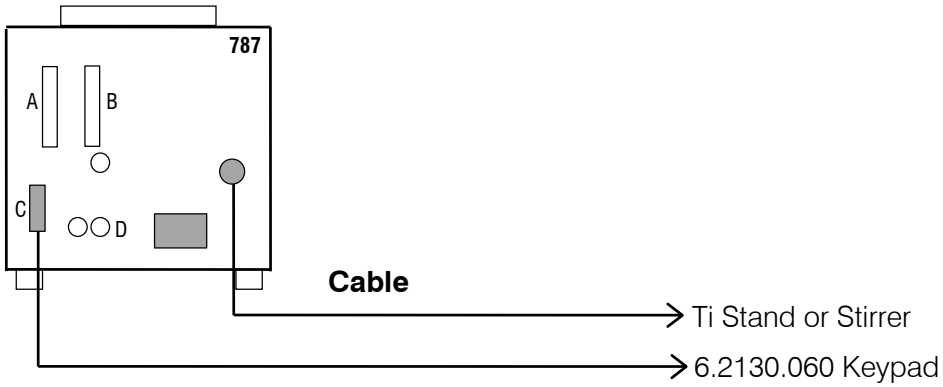
- Remove spindle from mechanical stop by turning the large gear wheel. (In case that the motor is inoperative, position spindle by hand to zero position.)

4 Preparations

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

4.1 Setting up and connecting the instruments

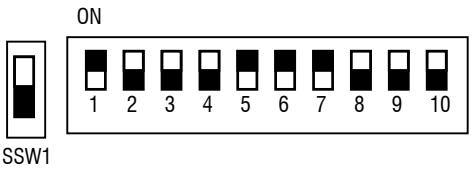
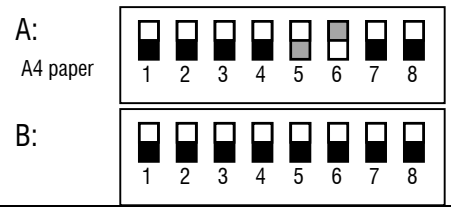
4.1.1 Titrino with Titration Stand or Stirrer



The 728 Magnetic Stirrer can also be connected instead of the 703 Ti Stand.

4.1.2 Connection of a printer

A variety of printers can be connected to the RS232 interface of the Titrino. If you connect a printer other than one of those mentioned below, ensure that the Epson mode is emulated or that it uses the international character set following the IBM Standard Table 437 and IBM-compatible graphics control characters.
If a **balance** is connected at the same COM of the Titrino as a printer, you need the 6.2125.030 Adapter. The printer must be plugged into the "data out" receptable of the adapter. It can be operated only with the simple hardware handshake (HWs) or without handshake.

Printer	Cable	Settings on Titrino		Settings on Printer
Seiko DPU-414	6.2125.130	baud rate: data bit: stop bit: parity: handshake: send to:	9600 8 1 none HWs Seiko	none
Custom DP40-S4N	6.2125.130	baud rate: data bit: stop bit: parity: handshake: send to:	9600 8 1 none HWs Epson	none, pre-set on Metrohm version IDP-560 EMULATION FONT MAP =GERMANY PRINT=REVERSE LITTLE CR CODE=VOID CR AFTER B :FULL=VOID CR ON b. EMPTY=VALID BUFFER 1K BYTE BAUD RATE=9600 PROTOCOL=8,N,1 FLOW CONTROL CTS-RTS
Citizen iDP562 RS	6.2125.050	baud rate: data bit: stop bit: parity handshake: send to:	9600 8 1 none HWs Epson	
Epson LX-300	6.2125.050	as above		see printer manual
HP Desk Jet with serial interface	6.2125.050	baud rate: data bit: stop bit: parity handshake: send to:	9600 8 1 none HWs IBM	
HP Desk Jet with parallel interface	2.145.0330 RS232/ Parallel Converter	baud rate: data bit: stop bit: parity handshake: send to:	9600 8 1 none HWs IBM	see printer manual

4.1.3 Connection of a balance

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

Balance	Cable
Sartorius MP8, MC1	6.2125.070
Shimadzu BX, BW	6.2125.080 Settings on Titrino: balance SARTORIUS Balance: delimiter CR+LF
Ohaus Voyager, Explorer, Analytical Plus	from Ohaus: AS017-09 (Ohaus parts number)+ 6.2125.170 Settings on Titrino: balance SARTORIUS Balance: SET BALANCE INTERFACE BAUD RATE 9600 DATA BITS 8 PARITY none STOP BITS 1
Mettler AB, AG (LC-RS25)	in the scope of delivery of the balance
Mettler AM, PM	6.2146.020 additionally from Mettler: ME 47473 Adapter and ME 42500 hand switch or ME 46278 foot switch
Mettler interface 016	Cable in scope of delivery of interface 016: red lead to pin 3, white lead to pin 7 of the 25-pin connector 25-pole/9-pole adapter
Mettler interface 011 or 012	6.2125.020
Mettler AT	6.2146.020
Mettler PG, AB-S	6.2134.120 + 6.2125.170
Mettler AX, MX ,UMX	6.2134.120 + 6.2125.170
AND Models ER-60, 120, 180, 182 Models FR-200, 300 Models FX-200, 300, 320 with RS232 interface (OP-03)	6.2125.020
Precisa, balances with RS232C-interface	6.2125.080

The balance type must be preselected at the Titrino with the <CONFIG> key.
Balance **and** printer can be connected at the same time with the aid of the 6.2125.030 adapter. The balance must then be plugged into the "data in" receptable of the adapter.

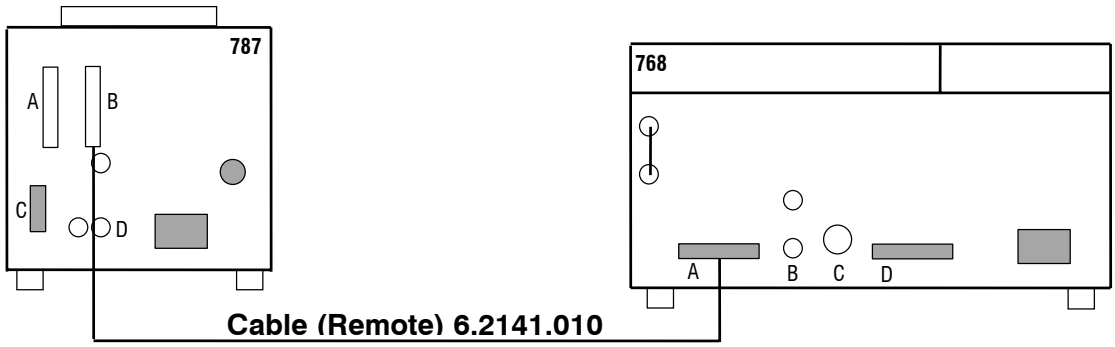
The weight is transferred as a number with up to 6 digits, sign and decimal point. Units and control characters sent by the balance are not transmitted.
With the aid of a special input unit supplied by the balance manufacturer, in addition to the weight an identification can be inputted from the balance. For this, the address of the identification must be preselected on the input unit.

Balance	Id
Sartorius	ID.1 or 26
Mettler (AT)	C (ID#1)

If the balance works only with 7 bit and the printer with 8 bit and if they are at the same Titrino, the balance has to bet to "space parity" and Titrino/printer to 8 bit, "no parity".

4.1.4 Connection of a KF Oven

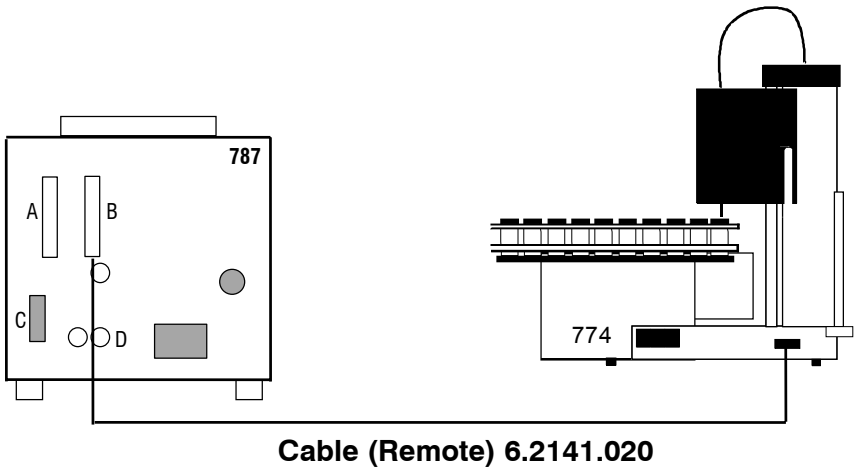
It is expedient to place the oven on 6.2041.180 instrument bridge. Take care that the gas outlet of the oven enters the titration vessel as directly as is possible to prevent the formation of condensed water in the outlet tubing.



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

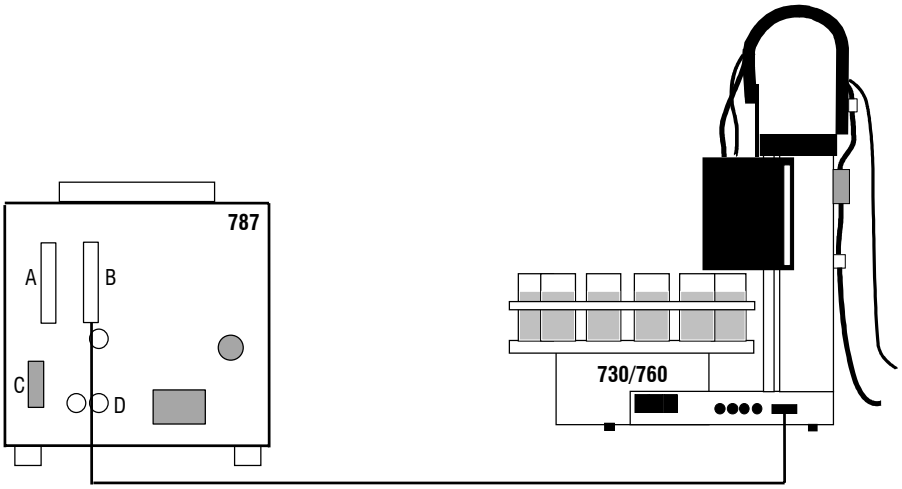
4.1.5 Connection of the 774 Oven Sample Processor

The Oven Sample Processor heats the sample and transfers the moisture from the sample to the titration vessel of the Titino. Titrino and Oven Sample Processor are connected via the remote sockets (cable 6.2141.020).



- The "Remote" socket allows not only connection of a sample changer but also additional control functions. Pin assignment of the "Remote" socket and control possibilities, see page 65f.

4.1.6 Connection of a Sample Changer



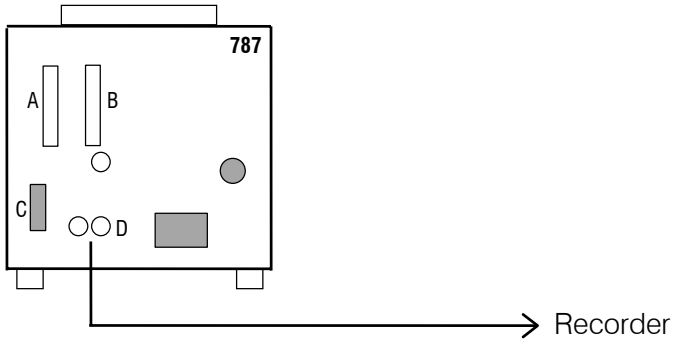
Cable (Remote)6.2141.020

With 6.2141.030 cable (instead of 6.2141.020), two Titrinos can be connected to the 730 or 760 Sample Changer at the same time.

- The "Remote" socket allows not only connection of a sample changer but also additional control functions. Pin assignment of the "Remote" socket and control possibilities, see page 65f.

4.1.7 Connection of a recorder

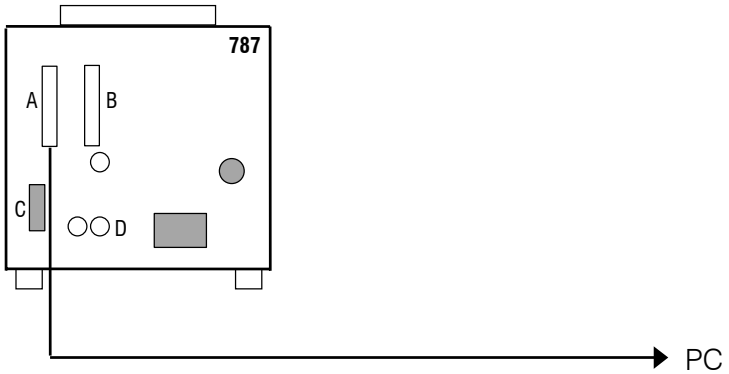
The recorder is connected to the analog output of the Titrino.



The signal at the analogue output can be preselected on the Titrino (key <CONFIG>, ">peripheral units", "curve:"):

Preselection at Titrino	Meaning	Resolution, Signal at analogue output	
V vs. t	Volume vs. time Dispensing curve, e.g. in work with the KF oven	1 cylinder volume:	2000 mV
dV/dt vs. t	Drift vs. time Drift curve, e.g. to observe the basic drift	100 µL/min:	1000 mV
U vs. t	Control deviation vs. timet	1 mV	+1 mV
-U vs. t	Control deviation vs. time	1 mV	-1 mV

4.1.8 Connection of a computer



Cable 6.2125.060 (+6.2125.010)

Preselections on the Titrino:

RS232 settings: ..... depend on the control program of the computer
Send to: ..... IBM
Vesuv 3.0, PC program for data acquisition and method backup
for up to 64 devices 6.6008.200

4.2 Connection of electrodes, preparing titration vessel

The 787 KF Titrino has one measuring input.

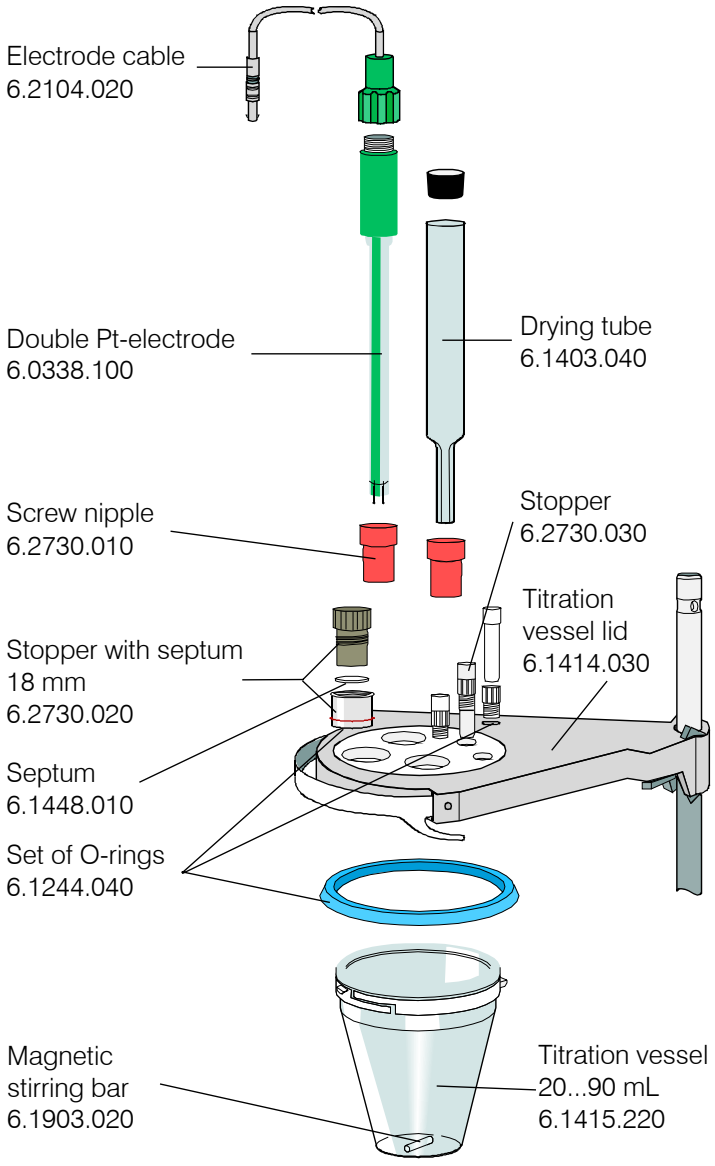
Rear panel:

Pol

Pol — Connection of polarized electrodes.
If measured quantities Ipol or Upol are selected, this measuring input is automatically active.

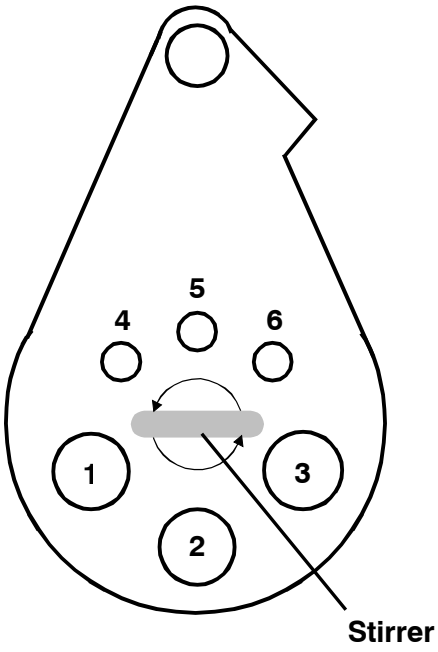
Setting up the KF titration vessel

For volumetric KF titrations install the titration vessel according to the following figure:



Arrangement of the parts on the titration vessel lid

View from above:



1 Electrode

2 Sample addition

3 Drying tube

4 Stopper or aspirating tube

5 Buret tip with titrant

6 Stopper or dispensing tip

This arrangement applies to the shown stirring direction.

5 Appendix

5.1 Technical specifications

Modes	KFT:	Karl Fischer titration
	TITER:	Titer determination with water or water-containing standard, resp. with sodium tartrate
	BLANK:	Blank determination
Measuring input	1 measuring input for polarized electrodes.	
Measuring range		
Voltage	0...±1500 mV, resolution 1 mV, error limit 0.1 % fullscale	
Current	0...±150 µA, resolution 1 µA	
Polarizer		
Ipol	0...±127 µA, resolution 1 µA	
Upol	0...±1270 mV, in steps of 10 mV	
Measuring amplifier (at 25 °C and Titrino warmed-up)		
Input resistance	$>10^{13}\,\Omega$	
Offset current	$<3*10^{-13}$ A	
Deviation of offset voltage	15 µV/K	
Dosification		
Volume of buret cylinder	1, 5, 10, 20 or 50 mL	
Resolution	10 000 steps per buret cylinder	
Titrating buret	1 internal buret	
Auxiliary buret	additional: 776 or 765 Dosimat	
Materials		
Housing	Polybutyleneterephthalate (PBTP)	
Keypad cover	Polycarbonate (PC)	
Display	LCD, 2 lines of 24 characters each Height of characters 5 mm LED back-lit	

RS232 interface for printer, balance or computer connection: completely controllable from external control unit

Remote input/output lines for Sample Changer, robot connection, etc.

Analog output

Output signal	-2000 ... 2000 mV
Signal at analog-output	depending on preselection: V vs. t dV/dt vs. t U vs. t -U vs. t

Ambient temperature

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

Safety specifications Designed and tested in accordance to IEC publication 61010-1, safety class I. This manual contains information and warnings which have to be followed by the user to ensure safe operation and to retain the apparatus in safe condition.

Mains connection

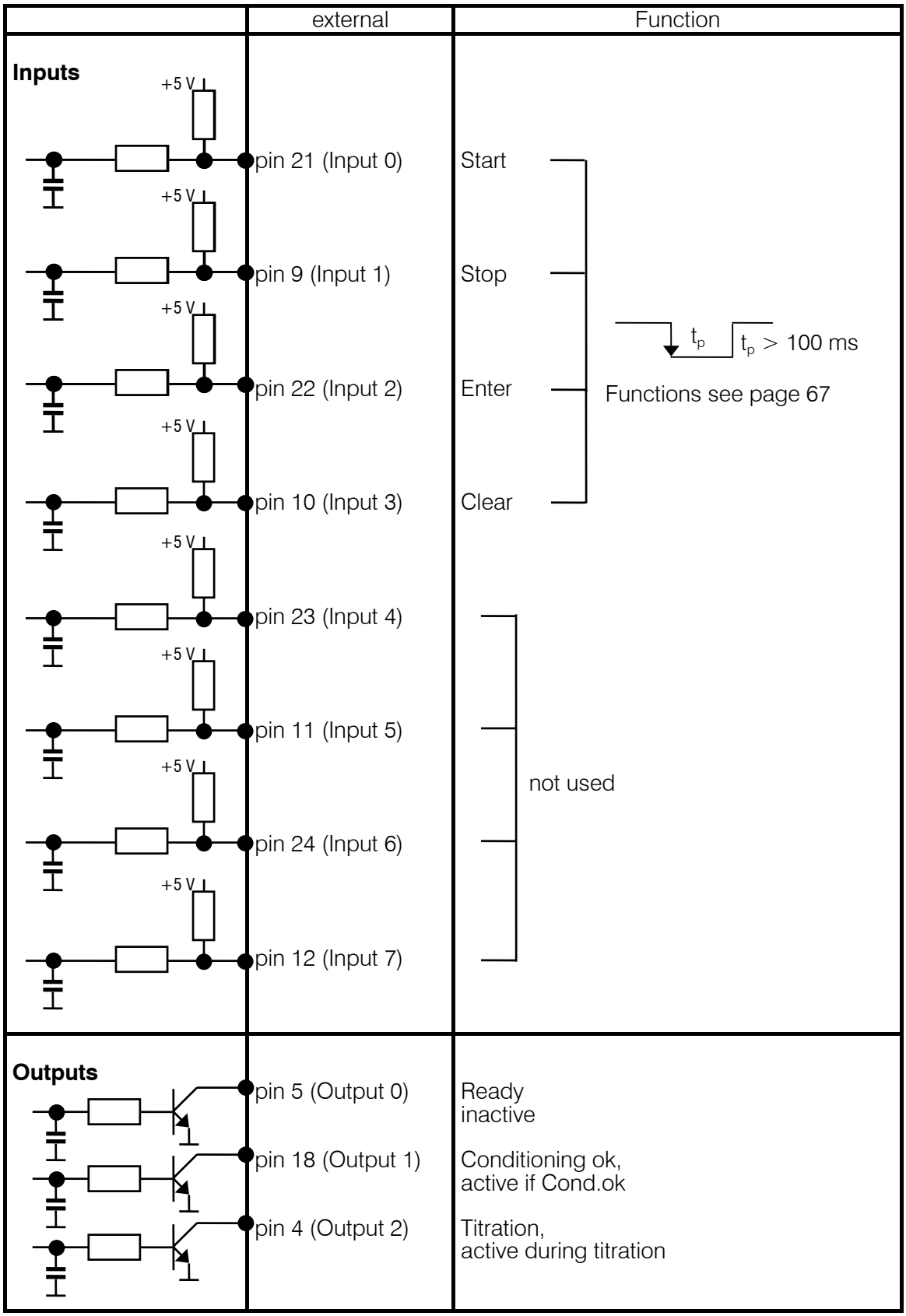
Voltage	100, 117, 220/230, 240 V (switchable)
Frequency	50 ... 60 Hz
Power consumption	15 W
Fuse	Thermal fuse

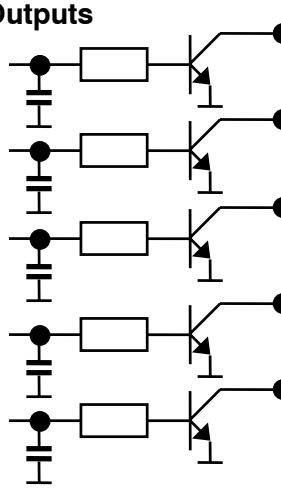
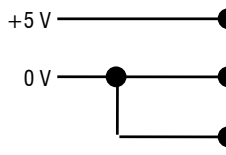
Dimensions with Exchange Unit

Width	150 mm
Height	450 mm
Depth	275 mm

Weight, incl. keypad app. 3.6 kg

5.2 Pin assignment of the "Remote" socket

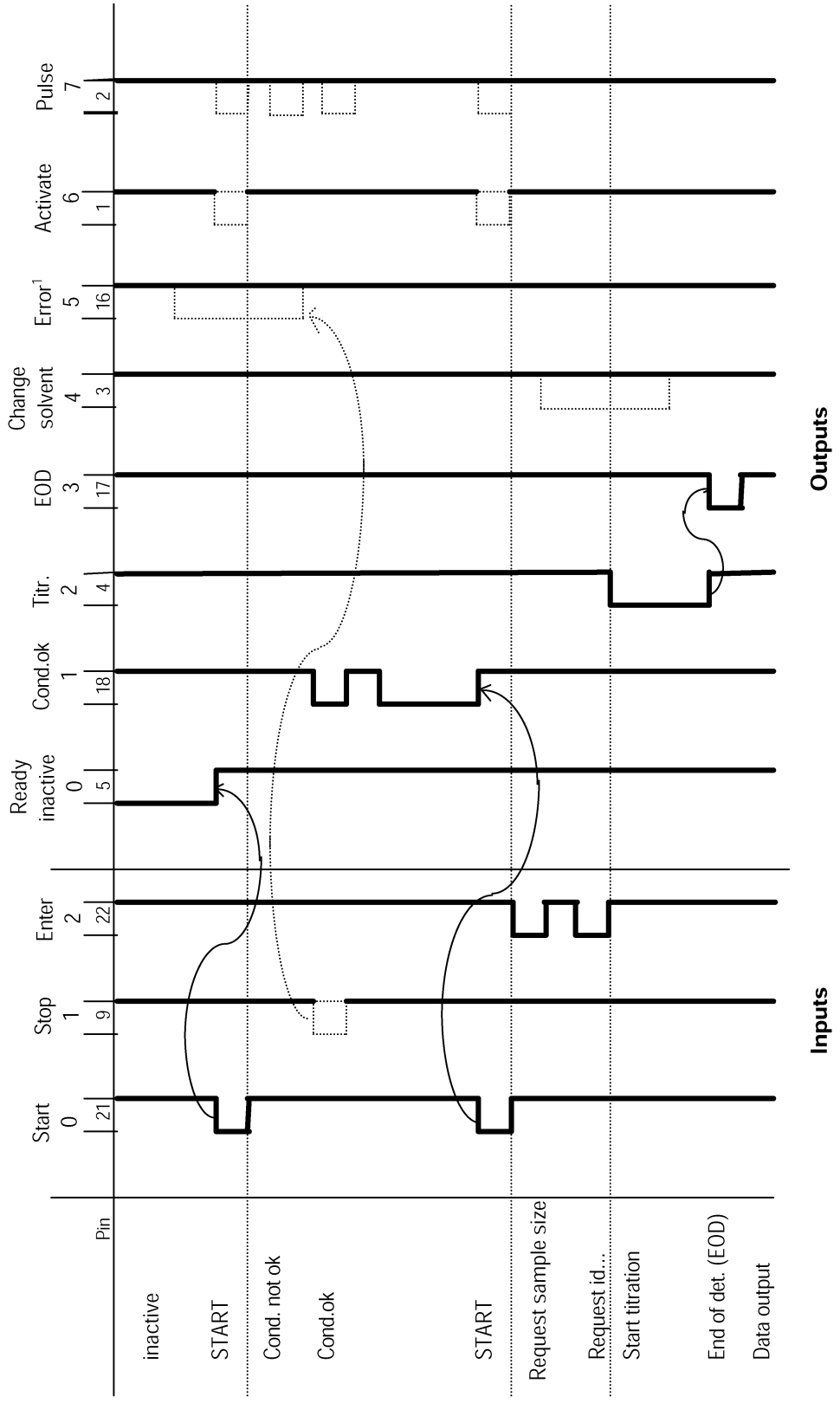


Outputs 	pin 17 (Output 3)	End of determination EOD
	pin 3 (Output 4)	Change solvent
	pin 16 (Output 5)	Error, active with errors
	pin 1 (Output 6)	Activate pulse, see page 67.
	pin 2 (Output 7)	Pulses for recorder (t_p=150 µs) 10 000 per buret cylinder
		For all outputs: V_{CE0} = 40 V I_C = 20 mA t_{Pulse} > 100 ms Functions see page 67.
Voltage 	pin 15	I ≤ 75 mA
	pin 14	0 V: active 5 V: inactive
	pin 25	

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

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

5.2.1 Lines of the "Remote" socket during the titration



1: The error line is reset when the error is rectified.

5.3 RS232 interface

The 787 KF Titrino is configured as DTE (Data Terminal Equipment).

The interface complies to the standard RS 232C.

The RS232 interface allows full remote control of the Titrino with an external controller.

Refer to your Metrohm agency if you need a detailed description of the RS232 interface and the remote control commands.

5.4 Validation / GLP

GLP (Good Laboratory Practice) requires the periodic validation of the analytical instruments. The reproducibility and accuracy of the instruments are checked according to standard operating procedures.

Guidelines for the testing regulations (SOP, Standard Operating Procedure) are given in the following Metrohm Application Bulletin:
No. 255: Validation of Metrohm KF titrators and KF ovens according to GLP/ISO 9001.

Contact your Metrohm agency for support with the validation of your Titrino. There you get a validation documentation, which helps you to perform the installation qualification (IQ) and the operational qualification (OQ).

5.5 Warranty and conformity

5.5.1 Warranty

The warranty regarding our products is limited to rectification free of charge in our workshops of defects that can be proved to be due to material, design or manufacturing faults which appear within 12 months from the day of delivery. Transport costs are chargeable to the purchaser.

For day and night operation, the warranty is valid for 6 months.

Glass breakage in the case of electrodes or other glass parts is not covered by the warranty. Checks which are not a result of material or manufacturing faults are also charged during the warranty period.

For parts of outside manufacture insofar as these constitute an appreciable part of our instrument, the warranty stipulations of the manufacturer in question apply.

With regard to the guarantee of accuracy, the technical specifications in the Instructions for Use are authoritative.

Concerning defects in material, construction or design as well as the absence of guaranteed features, the purchaser has no rights or claims except those mentioned above.

If damage of the packaging is evident on receipt of a consignment or if the goods show signs of transport damage after unpacking, the carrier must be informed immediately and a written damage report demanded. Lack of an official damage report releases METROHM from any liability to pay compensation.

If any instruments and parts have to be returned, the original packaging should be used if at all possible. This applies above all to instruments, electrodes, buret cylinders and PTFE pistons. Before 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.

5.5.2 EU Declaration of conformity

CE

EU Declaration of Conformity

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

787 KF Titrino

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

Source of the specifications:

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

Description of apparatus:

Titrator for fast and precise water determination.

Herisau, October 30, 2001

Dr. J. Frank	Ch. Buchmann
Leiter Entwicklung	Leiter Produktion und Beauftragter Qualitätssicherung

5.5.3 Certificate of Conformity and System Validation

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:	787 KF Titrino
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, EN50081-2, EN55022 (class B)

Electromagnetic compatibility: Immunity
EN50082-1, IEC61000-6-2, Namur, IEC61000-4-2, IEC61000-4-3, IEC61000-4-5, IEC61000-4-6, IEC61000-4-11

Safety specifications
IEC61010-1, EN61010-1

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

The technical specifications are documented in the instruction manual.

The system software, stored in Read Only Memories (ROMs) has been validated in connection with standard operating procedures in respect to functionality and performance. 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, October 30, 2001

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

5.6 Scope of delivery and ordering designations

787 KF Titrino 2.787.0010
inclusive the following accessories:

1 Titrino 1.787.0010
1 Keypad for 787 KF Titrino 6.2130.060
1 Key for Exchange Units 6.2739.010
1 Double Pt-electrode with plug-in head, without cable 6.0338.100
1 Electrode cable with plug F 1M 6.2104.020
1 Titration vessel lid 6.1414.030
1 Titration vessel 20 mL 6.1415.220
1 Titration vessel 50 mL 6.1415.250
1 Set of O-rings for the Titration vessel lid 6.1244.040
1 Drying tube 6.1403.040
1 Molecular sieve 250 g 6.2811.000
2 Screw nipple for KF 6.2730.010
1 Stopper with septum, diameter 18 mm 6.2730.020
3 Stopper with nipple and O-ring 6.2730.030
2 Septum (5 p.) 6.1448.010
1 Glass weighing spoon 6.2412.000
2 Teflon stirring bar, length 16 mm 6.1903.020
2 Teflon stirring bar, length 25 mm 6.1903.030
1 Cover 6.2723.130
1 Mains cable with cable socket, type CEE(22), V
Cable plug to customer's specifications
type SEV 12 (Switzerland...) 6.2122.020
type CEE(7), VII (Germany...) 6.2122.040
type NEMA/ASA (USA...) 6.2122.070
1 Vesuv 3.0 light, PC program for data acquisition and method backup
for 2 devices 6.6008.500
1 Instructions for Use for 787 KF Titrino 8.787.1003
1 Quick Reference for 787 KF Titrino 8.787.1013

Options

Accessories to separate order and on payment of extra charge:

Burets

Auxiliary burets

765 Dosimat 2.765.0010
776 Dosimat 2.776.0010
Cable Titrino (activate pulse, line L6) — 765 or 776 Dosimat 6.2139.000

Exchange Units

V = 1 mL, ... 6.3026.110
V = 5 mL, ... 6.3026.150
V = 10 mL, ... 6.3026.210
V = 20 mL, ... 6.3026.220
V = 50 mL, ... 6.3026.250

Titrating Stand and Stirrer

703 Ti Stand for rinsing and addition of fresh solvent,
with built-in magnetic stirrer 2.703.0010
Cable Titrino — 703 Ti Stand 6.2108.100
728 Magnetic stirrer 2.728.0040

Titration equipment

Equipment for KF titrations 6.5609.000
Titration vessel, volumes
1... 50 mL 6.1415.110
5... 70 mL 6.1415.150
10... 90 mL 6.1415.210
20... 90 mL 6.1415.220
50... 150 mL 6.1415.250
70... 200 mL 6.1415.310
Titration vessel with thermostatic jacket, volumes
1... 50 mL 6.1418.110
5... 70 mL 6.1418.150
10... 90 mL, order 6.2036.000 holding ring separately 6.9914.023
20... 90 mL 6.1418.220
50... 150 mL 6.1418.250
Titration vessel lid (5 openings) 6.1414.010
Magnetic stirring bars, length
12 mm 6.1903.010
16 mm 6.1903.020
25 mm 6.1903.030

Electrodes and accessories

Double Pt-electrode with plug-in head, without cable 6.0338.100
Electrode cable, 1m 6.2104.020

Printers

Custom-Drucker DP40-S4N 2.140.0200
Cable Titrino – Custom DP40-S4N (25/9 pins) 6.2125.130
Cable Titrino – Seiko DPU-414 ..... 6.2125.130
Cable Titrino – EPSON LX300+ (25/25 pins) 6.2125.050
Cable Titrino – HP Desk Jet (serial interface) (25/25 pins) 6.2125.050
Cable Titrino – HP Desk/Laser Jet (parallel IF) 2.145.0330
Adapter for connection of printer/balance at the same COM 6.2125.030

Balances

Cable Sartorius – balances MP8, MC1 (9/25 pins) 6.2125.070
Cable Shimadzu – balances BX, BW 6.2125.080
Ohaus Voyager, Explorer, Analytical Plus ..... cable from Ohaus
Mettler AB, AG balances (interface LC-RS25) ..... cable with balance
Mettler AT balance 6.2146.020
Mettler AM, PM balance ..... 6.2146.020+accessories from Mettler
Mettler balances with interface 016 ..... cable from Mettler
Mettler balances with interface 011 or 012 ..... 6.2125.020
Mettler PG, AB-S, AX, MX, UMX balances ..... 6.2134.120+6.2125.170
AND balances (with RS232 interface OP-03) 6.2125.020
Precisa balances 6.2125.080
Adapter for connection of printer/balance at the same COM 6.2125.030

Connection of 768 KF Oven

KF Oven 2.768.0010
Cable 795 KFT Titrino — 768 KF Oven, control 6.2141.010

PC connection

Cable Titrino – PC (25/25 pins) 6.2125.060
Cable Titrino – PC (25/9 pins) ..... 6.2125.060+6.2125.010
RS232 C extension cable (25/25 pins) 6.2125.020
Vesuv 3.0, PC program for data acquisition and method backup
for up to 64 devices 6.6008.200

Sample Changer

730 Sample Changer, 1 working station, 1 pump and 1 valve 2.730.0010
730 Sample Changer, 1 working station, 2 pumps and 2 valves 2.730.0020
730 Sample Changer, 2 working stations, 2 pumps and 2 valves..... 2.730.0110
730 Sample Changer, 2 working stations, 4 pumps and 4 valves..... 2.730.0120
760 Sample Changer, 1 working station..... 2.760.0010
760 Sample Changer, 1 working station, no pumps and 2 stirrer connections... 2.760.0020
for KFT applications
774 Oven Sample Processor 2.774.0010
Cable Titrino — 730, 760, 774 Sample Changer 6.2141.020
Cable 2x Titrino — 730, 760 Sample Changer..... 6.2141.030
Cable Titrino — 730, 760 Sample Changer+665, 725, 765, 776 Dosimat 6.2141.040
Cable Titrino — 730, 760 Sample Changer+ 2x 665, 725, 765, 776 Dosimat ... 6.2141.050
Cable Titrino — Control Unit 664 for Sample Changer 673/674..... 3.980.3560

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