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796 Titroprocessor

Tutorial

Preface

This short tutorial to the 796 Titroprocessor is meant to facilitate your getting familiar with this complex but powerful instrument.

Each chapter stands for a separate lesson. Read the lessons step by step. It is strongly recommended to work through the chapters 'Overview' and 'Configuration' first.

Store this manual near the instrument, to keep it always in reach for any user of the 796 Titroprocessor.

Important note



Pressing the <HELP> key on the keyboard will always display a help page that will show information on the current dialog page.

When editing any parameters, pressing the [Help on entry] softkey or the <HELP> key will give you information on the parameter you are editing, including the entry range and an example.

Markings used in this manual

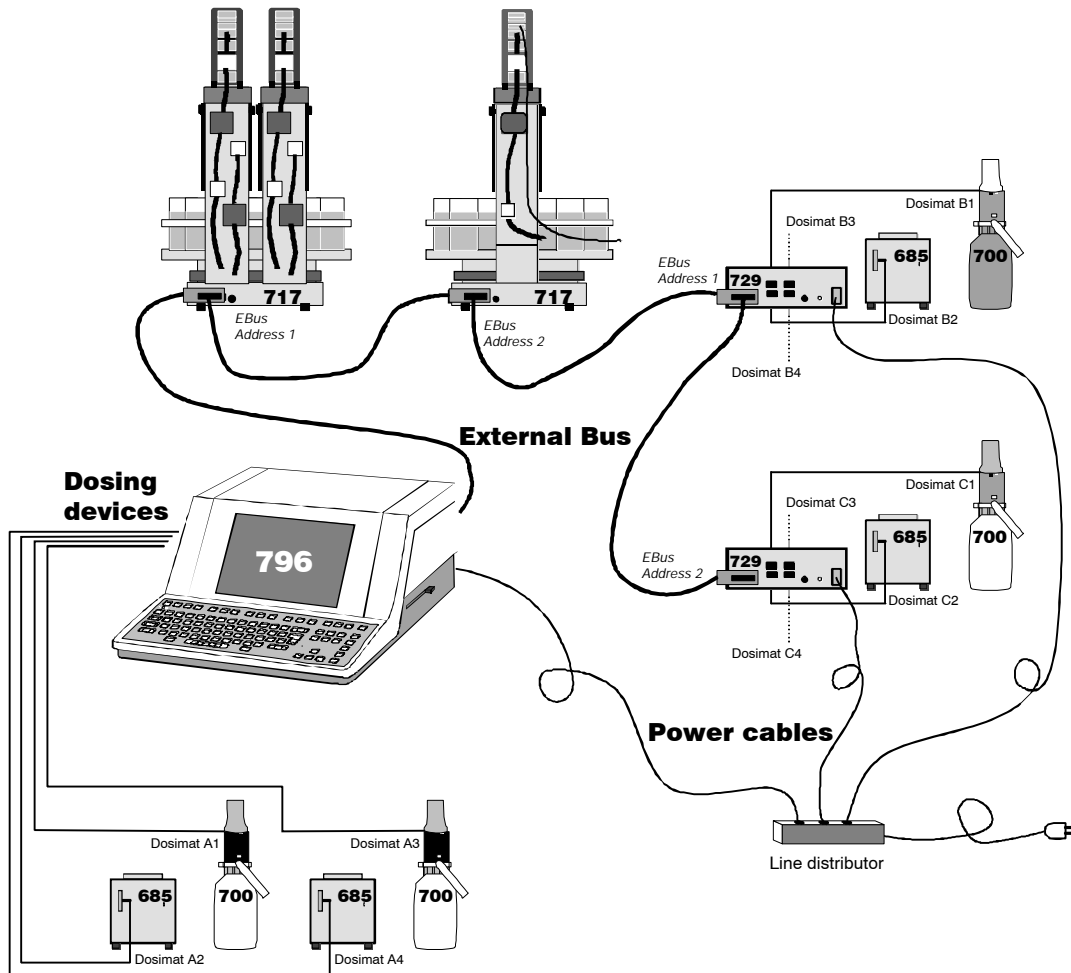
<QUIT>	Physical hardkey on the keyboard
[File]	Softkey as shown on the screen, referring to the hardkeys <F1>..<F9>
Display Text	Display text as shown on the screen
[one / another]	Selection of optional entries

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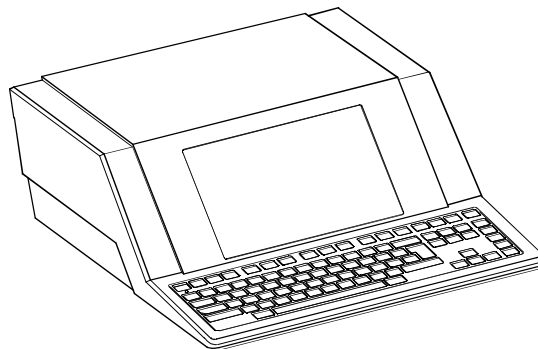
1 Overview

1.1 The 796 Titroprocessor System

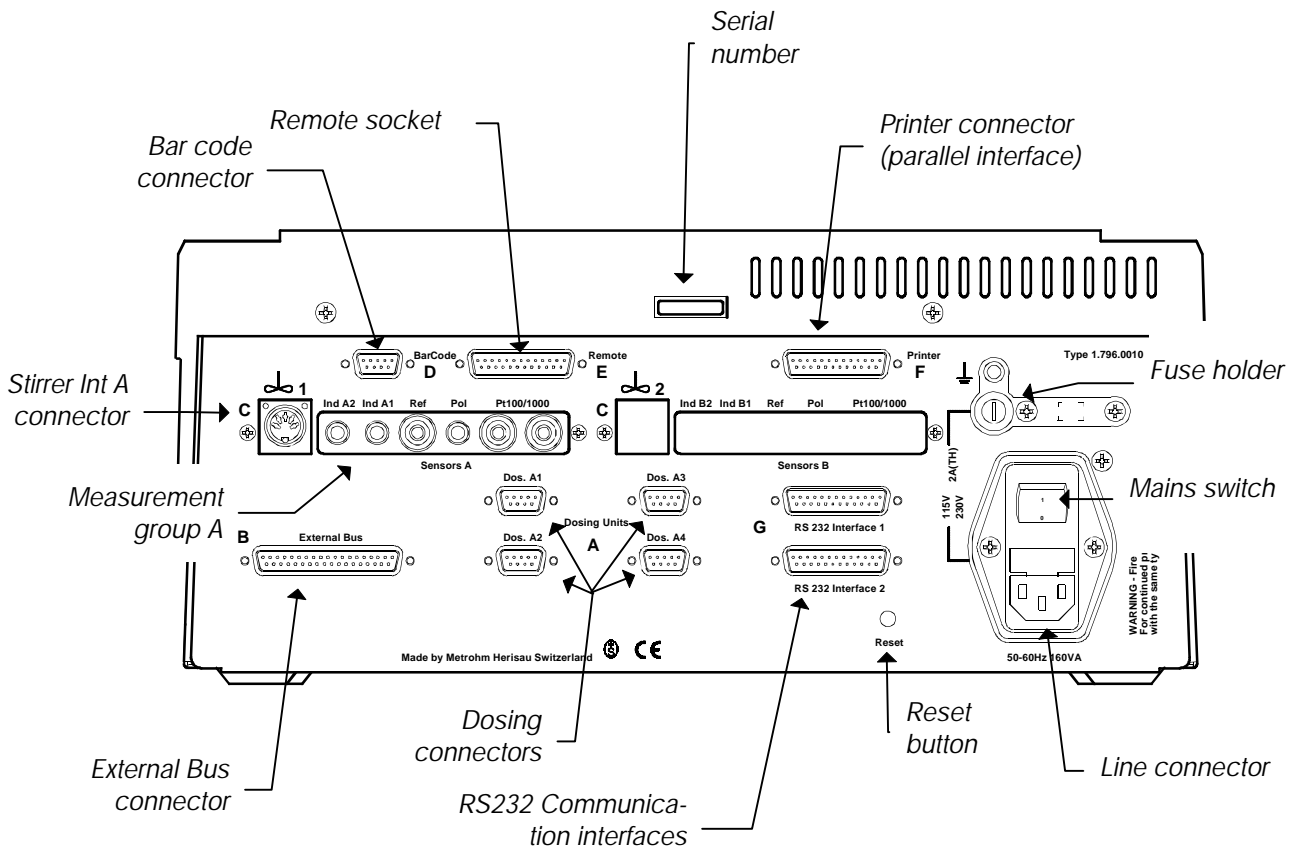


1.2 Front View

The 2.796.0010 Model of the 796 Titroprocessor without built-in printer.



1.3 Rear View

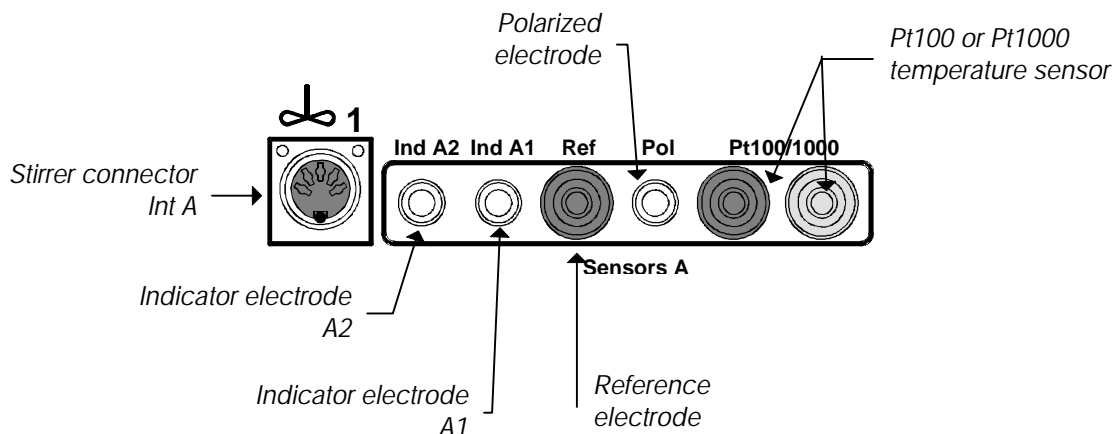


1.4 Where to Connect the Peripherals

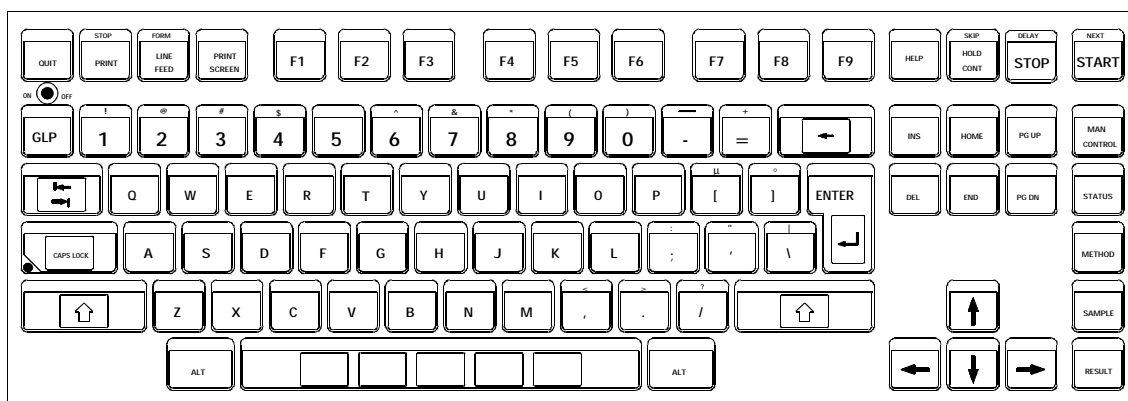
Device	Interface designation	Label
Balances	RS232 interface 1 or 2	G
Indicator electrodes	Sensors A or B (Ind A1, Ind A2, ...)	C
Indicator electrodes	Sensors A or B (Ref)	C
Temperature sensors	Sensors A or B (Pt100/1000)	C
Stirrers	Sensors A or B	C
Dosing devices	Dosing Units	A
Sample changers	External Bus	B
Dosing interface 729	External Bus	B
Printers (Centronics)	Printer	F
Printers (serial)	RS232 interface 1 or 2	G
Bar code readers	Barcode	D
Personal computers/LIMS	RS232 interface 1 or 2	G
Auxiliary instruments	Remote	E

1.5 Measuring Interfaces

The 796 Titroprocessor models 2.796.0110 and 2.796.0120 are equipped with 2 measurement groups (Sensors A and Sensors B). The drawing below shows where to connect the sensors at the measuring interface A, which is common to all 796 Titroprocessor models.



1.6 The Keyboard



The PC-like keyboard allows comfortable editing and data entry in method development and routine use.

1.6.1 Function keys (Softkeys)



The blue function keys are used for the navigation within the windows oriented user dialog. The action that will be executed on pressing these function keys depends on the dialog page or window. The softkey list at the bottom of the screen always displays the available functions.

1.6.2 Hotkeys



The yellow Hotkeys enable direct access to the most important functions or dialog pages of the 726. Hotkeys may be pressed at any time.

MAN CONTROL - opens the dialog page for manual operation

STATUS - displays the basic status info

METHOD - opens the method selection window

SAMPLE - opens the sample input window or the sample silo

RESULT - opens a window that shows the short result reports and statistics

1.6.3 Action Keys



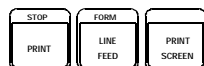
The action keys have an immediate effect on the course of a method. The <START> key starts a method; the <STOP> key will terminate it. With <HOLD / CONT> the course of a method may be interrupted or continued. By simultaneously pressing the <Shift> key and an action key the processing of a sample series (with autostart 'on') can be controlled directly.

<Shift><START> (=NEXT) ends the treatment of the current sample and starts the same method with the next sample in the series.

<Shift><STOP> (=DELAY) stops the sample series after the current sample has been processed.

<Shift><HOLD> (=SKIP) ends the execution of the current command and continues with the next command line of the loaded method.

1.6.4 Manual Printing



The built-in A4 thermal printer or any connected printer can be manually controlled via the yellow printing keys.

The <PRINT> key opens the printer menu, where any report type can be selected. Global reports and determination reports (if any determination is present in the working memory) may be selected.

<Shift><PRINT> (= STOP PRINT) will stop a printout immediately.

<LINE FEED> will execute a line feed of the connected printer.

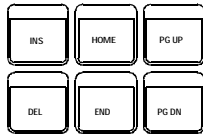
<Shift><LINE FEED> (= FORM FEED) will execute a form feed on the connected printer.

<PRINT SCREEN> will print the actual screen contents.

1.6.5 Navigation and edit keys



The **<QUIT>** key closes an edit field, a window or a dialog page and accepts any parameter changes beforehand. The dialog switches to the next higher level.



<INS> (=Insert) switches on or off the insert mode for editing an entry field.

**** (=Delete) deletes the next character to the right of the cursor position.

<Shift> clears an entire edit field.

<HOME> places the cursor into the first edit field of a dialog window (in navigation mode).

<END> places the cursor into the last sample silo line or command line (in method editor).

<PG UP> moves the field cursor up in the sample silo or the method editor by one page.

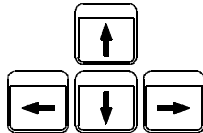
<PG DN> moves the field cursor down in the sample silo or the method editor by one page.

<Cursor up> moves the cursor up by one line.

<Cursor down> moves the cursor down by one line.

<Cursor left> moves the cursor to the left by one field (in navigation mode) or by one character (in edit mode).

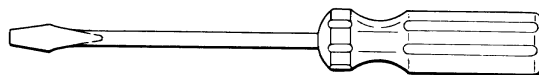
<Cursor right> moves the cursor to the right by one field (in navigation mode) or by one character (in edit mode).



1.6.6 HELP key



The **<HELP>** key opens a page with help text referring to the opened dialog page or window. In edit mode it opens the help window for the parameter entry.



2 Configuration

Before performing the first titrations with the Titroprocessor 796, it should be configured to your requirements.

Switch on the device and confirm the first black message window by pressing the <ENTER> button. The method selection window should now appear on the screen:

```

2000-04-22 09:39:57      MAIN PAGE 796 Titroprocessor      * ready *
Method
  Method
Internal saved methods
File      Comment
User
  No entries found
Sample
  Press <Enter> to load method
Remark
  QUIT

```

--	--	--	--	--	--	--	--	--

Close the window with the <QUIT> button.

If the display is difficult to read, you can alter the brightness of the screen.

- Keep the <ALT> button pressed and simultaneously press the arrow key <↑> or <↓> several times until the display is easy to read.

- Press the key <F1> on the keyboard of the Titroprocessor.

```

Configuration (Program version 5.796.0010)
Dialog in english      Date 2000-04-22
                        Time 10:07:19
LCD contrast 95
Screen save 30 min    Standard data file name DATA
                        File name type YYMMDDhh.mms
Error beep on        File comment type Ident1,2+Meth+Remark
Edit beep off
Edit mode overwrite  Power on PREP warning on
User level Standard  Remote terminal mode off
Key card no          File transfer protocol Metrohm(Bkup)
Monitoring off
                        QUIT

```

Device header	File	Access control	Sample changer	Inter-faces	Config. idents.	Tubings	>>	>>
---------------	------	----------------	----------------	-------------	-----------------	---------	----	----

On this configuration page and its subpages, you can make the basic device settings.

If you prefer to use a dialog language other than English (German, French or Spanish), you can alter it accordingly.

- If the black cursor bar is not at the input field 'Dialog in ...', use the <HOME> keys to place the cursor at the mentioned field.
- Press the spacebar. Move the arrow key (↓) in the selection list which now appears to the desired language. Press the <ENTER> key to confirm.

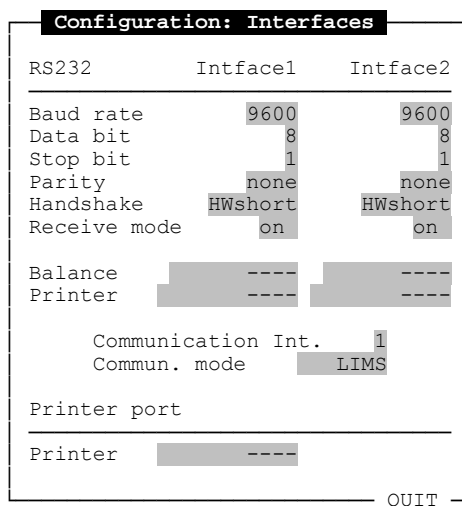
The following example assumes that you wish to keep to the English dialog.

- Enter today's date. You can enter the date directly in the order Year-Month-Day (with a dash as separator) or you can open the input field first by pressing the spacebar. Should you press the spacebar first, you can alter the defined date as you wish, otherwise you must re-enter the entire date. This is because the edit mode 'overwrite' is a standard setting of the Titroprocessor 796. This setting can be altered to 'insert', if desired. The input field 'Edit mode' can also be found on this configuration page.
(Should you make an error during entry and wish to recall the previous date, press the softkey [Cancel], and/or the function key <F9>.)

- After confirming the date entry with <ENTER>, enter the current time. For this purpose, use the colon as separator for the hours, minutes and seconds.
- Place the black bar cursor with the aid of the arrow keys at the input field 'Power on PREP warning'. This setting activates the automatic display of the warning window which you saw when the Titroprocessor 796 was started. It is intended to remind you before using Dosinos or Dosimats as dosage devices, to prepare the hose system of the burettes, i.e. to rinse and fill them without air bubbles. For this tutorial switch off the warning. Press the spacebar, select 'Off' and confirm with <ENTER>.
- The following settings contribute largely to facilitating the operation of the Titroprocessor 796. The user level 'Standard' should already be switched on. It is thus possible to define individual settings for different users of the Titroprocessor 796. These settings can be filed on a storage card which can then be used as an individual key card. With a key card all users of the Titroprocessor 796 can load their defined device settings and thus set an operating environment suitable to their requirements.
- Select the input field 'key card' with the arrow keys and alter the setting to 'yes'. To continue this tutorial, you can now use the application storage card which is enclosed with the Titroprocessor 796 as a key card.
- Only a few configuration settings now remain.

2.2 Interfaces, Balance, Printer

- On the configuration page, press the softkey 'Interfaces', and/or the function key <F5>.



- The correct setting of the interface parameters ensures the problem-free data exchange between balance and printer.

- Should you wish to adopt the sample weights directly from the balance, you must connect same with an appropriate cable to one of the two RS232 interfaces of the Titroprocessor 796. The interface connections (RS 232 Interface 1 and 2) are on the rear panel of the device.
- Depending on which socket the balance is connected to, you must now set the required parameters in the column 'Interface1' or 'Interface2' (baud rate, data bit, stop bit, parity and handshake). Each input field has a selection list with permissible values. Press the spacebar to open the relevant selection list.
The required parameter values can be found in the balance manual.
- In the same column in which you set the interface parameters, you must also set the receive mode to 'on'.
- Select under 'Balance' the manufacturer of your balance. (Mettler AT-balances have their own setting. For other types of balance of the same manufacturer, select 'Mettler'.)
If your balance is not included in the selection list, select 'Precisa'.
- The settings for the printer depend on which Titroprocessor model you have selected. If your device has a thermoprinter, no further settings are required.
- If you have chosen a 796 Titroprocessor without built-in printer, we recommend connecting a printer with parallel interface (Centronics interface) to the 25 pin 'Printer' connection on the rear panel of the device. The commercially available ink-jet, needle or laser printers are suitable for this purpose.
- When connecting a printer with parallel Centronics interface, select a suitable printer emulation in the bottom line of the dialog box. For the ink-jet printers of the manufacturer Hewlett-Packard, select under 'printer' the entry 'HP Deskjet'. Use the same setting for a laser printer. For all other printers, in particular for ink-jet printers, select 'Epson 80*60' or 'Epson 60*72'. If you do not receive a satisfactory print out with these settings, use 'IBM Proprietary' as printer emulation.
- After making the described settings, press the <QUIT> key to return to the configuration page of the Titroprocessor 796.

2.3 Report Header

- Press the softkey [Device header] (the function key <F1>). A dialog box with four lines of text appears.

```

Configuration (Program version 5.796.0010)
Dialog in english Date 2000-04-22
LCD contrast 100 Time 10:32:51
Screen save 30 min Standard data file name DATA
Error beep on File name type YYMMDDhh.mms
Edit beep off File comment type Ident1,2+Meth+Remark
Device header
Industry company Quality Control Lab1
Chemical Division Titrator Me796/5
-----
Configure your own device header
QUIT
QUIT
Help on Delete Blank Copy Paste Cancel
entry line line line line line

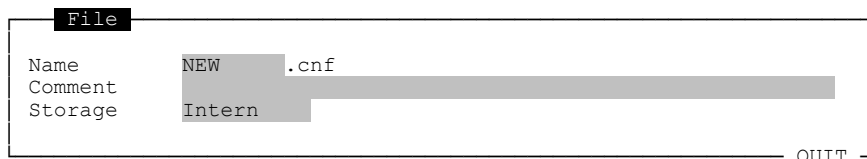
```

- This is the definition of the header which is printed together with every device report. The report headers should clearly state on which device a report has been issued. Enter your own text.
- Close the input window again with the <QUIT> key.
- You can issue a report for your configuration settings and simultaneously check the display of the self-made header of the report. Press the yellow <PRINT>key, at the top left of the keyboard. Select the entry 'Configuration' in the displayed report selection window and press <ENTER>.
- Check the quality of the header. Should certain characters be illegible, alter the settings of the printer in the interface configuration window. This extensive report informs you which additional configuration settings can be made. The settings already made suffice however, to proceed with the following chapters of this tutorial.

2.4 To save the configuration

It is recommended to save the configuration after you have finished editing the configuration settings. You can create a configuration file which can be reloaded later on. Using a configuration file it is also possible to copy the configuration settings to different 796 Titroprocessors.

- Press the softkey [File] on the configuration page.



- Enter any file name.
- Enter any descriptive comment in the comment field.
- Select 'Internal' for storage location, if you wish to save the configuration permanently in the instrument itself.
Select 'Data card', if you wish to transfer the configuration settings to another instrument. For this case insert a formatted SRAM memory card in the card slot on the right hand side of the housing of the 796 Titroprocessor. See below also.
- Press [Save] to create the configuration file.

2.5 Formatting a memory card

Along with the 796 Titroprocessor a Data card (SRAM Memory Card, 2 MB capacity) is delivered. On the one hand it can be used to store titration methods or determination data, on the other hand you can use it as a key card which carries your personal dialog and status settings for the 796 Titroprocessor.

Any user of the Titroprocessor may sign-on to the instrument using his own individual key card. Each user has his own working environment, which may be very restricted, e. g. to prevent careless alterations to a method. One can use individual predefined status settings, such as user name, storage location of methods or statistics settings.

A memory card has to be formatted before the first use, i. e. a file system has to be established which enables file access for the 796 Titroprocessor.

Initial formatting

- Insert the memory card (SRAM card) into the card slot on the right hand side of the Titroprocessor. Push the card all in. The edge of the card has to fit the release button next to the card slot.
- Open the file manager page of the Titroprocessor by pressing the softkey [File manager] on the main dialog page of the instrument.
- Press [Change storage] and select 'Data card'.
- If the memory card is unformatted yet, or contains a unknown file system, the Titroprocessor will ask you to format the card.
- After the confirmation request (press 'Y'), enter a label text for the data card. Confirm with <ENTER>.

- After formatting press <QUIT> to return to the main dialog page.
- Remove the data card from the card slot. Push the release button next to the card slot.



Please note that SRAM memory cards cannot store data forever.

SRAM cards have a supporting battery which guarantees power supply for 2 to 5 years. That is necessary for storing data during longer time periods. The lifetime of the battery depends primarily on ambient temperature.

Store your data cards in a dry and cool place (< 25 °C). Do not permanently carry SRAM cards with you (body temperature!).

Carefully read the leaflet that comes with the memory card and follow its advices.

3 How to titrate

To perform the titrations described in this tutorial you need the application card distributed with the 796 Titroprocessor. You also need the formatted data card (2 Mbyte, SRAM card) to save the titration data.

For the titration itself you deserve:

- one 700 Dosino or 685 Dosimat connected to the Titroprocessor.
- $c(\text{HCl})=0,1 \text{ mol/L}$ as titrant
- Tris(hydroxymethyl)aminomethane as sample
- a combined pH glass electrode connected to the measuring input A1
- a balance, preferably connected to the RS232 interface 1
- titration stand or magnetic stirrer

It is assumed you have configured the 796 Titroprocessor before. The user level mode 'Standard' must be selected. Key card must be set to 'yes'.

```

Configuration (Program version 5.796.0010)
Dialog in  english          Date      2000-01-21
                               Time      08:07:19
LCD contrast  95
Screen save   30 min      Standard data file name  DATA
                               File name type  YYMMDDhh.mms
Error beep    on          File comment type  Ident1,2+Meth+Remark
Edit beep     off
Edit mode     overwrite   Power on PREP warning  off
User level    Standard   Remote terminal mode  off
Key card      yes        File transfer protocol Metrohm(Bkup)
Monitoring    off
                               QUIT
  
```

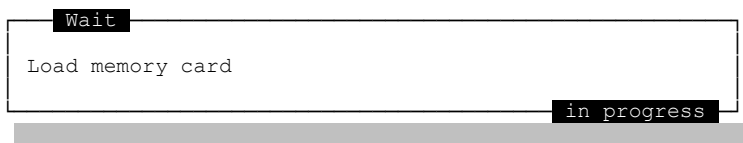
Device header	File	Access control	Sample changer	Inter-faces	Config. idents.	Tubings	>>	>>
---------------	------	----------------	----------------	-------------	-----------------	---------	----	----

To start with this titration lesson, switch off the Titroprocessor. Follow the instructions step by step.

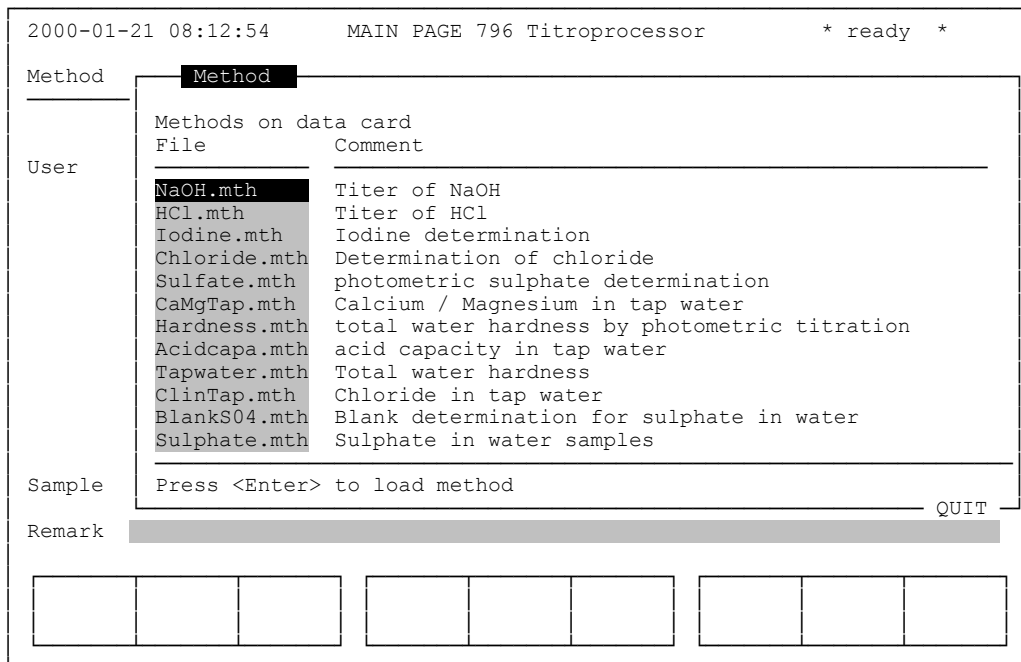
3.1 Preparations

- Insert the Application Card (Flash card) in the memory card slot on the right side of the Titroprocessor. Gently push the card all in to ensure a tight fit.
- Switch on the Titroprocessor.

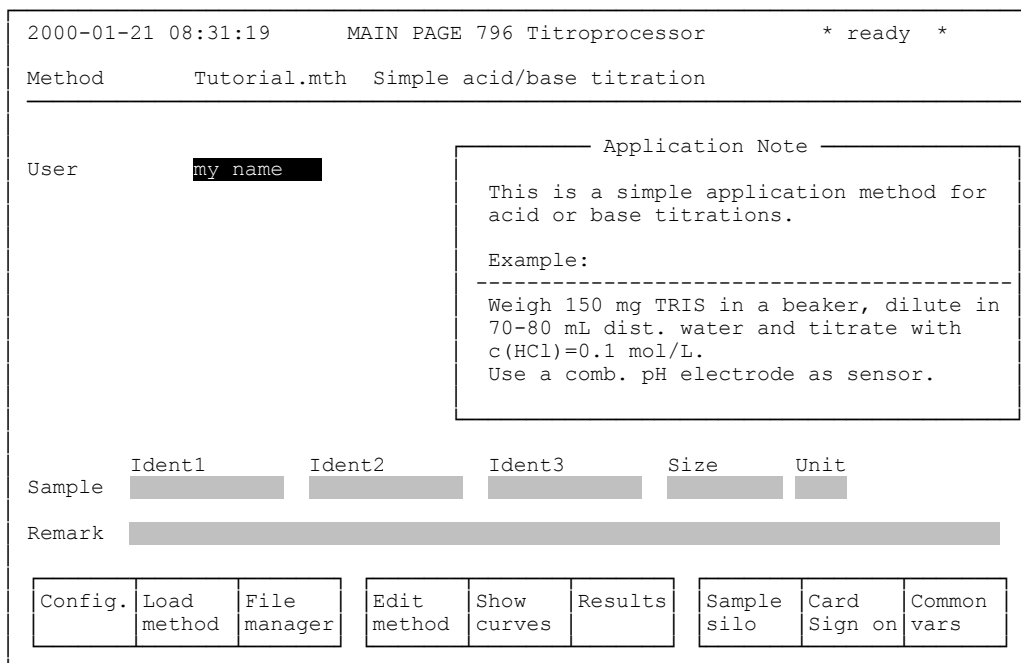
The card will be loaded during the boot-up process.



The 796 Titroprocessor then will show the methods stored on the Application Card.



- Press the <PG DN>key several times to select the method 'Tutorial.mth Simple acid/base titration'. Use the Cursor keys <↓> or <↑> to select this method name. Load the method by pressing the <ENTER>key.



You now see the application note. It tells you, how to prepare your samples for this titration method. The example chosen for this tutorial is a simple acid titration. A content determination of Tris(hydroxymethyl)aminomethane, the substance you usually need for the titer determination of hydrochloric acid.

We start with an easy case of application. The next steps will be more elaborate versions of this titration method and other status settings to show you the possibilities of the 796 Titroprocessor.

- Prepare two samples for titration. Exactly weigh 150 mg (approx.) of Tris(hydroxymethyl)aminomethane in a suitable beaker (100-200 mL size) and dissolve it in 70-80 mL of distilled water. Note the sample sizes on a piece of paper.
- Connect a combined pH glass electrode to the measuring input 'Ind A1' on the rear panel of the Titroprocessor. Connect a 700 Dosino or a 685 Dosimat with the titrant $c(\text{HCl})=0.1 \text{ mol/L}$ to the 'Dos.A1' socket. Attach the electrode and the titration tip to the titration head of a titration stand.
- It is most important to prepare the buret correctly to prevent the presence of any air bubbles in the dosing cylinder or the tubings. The 796 Titroprocessor offers a comfortable PREP function, which automatically rinses the tubing system of a buret. It applies an optimized rinsing volume and may be adapted to different tubing sets for non-standard buret use.
- Place a waste beaker on your titration stand and put the titration tip in it.
- To execute any manual operation with your Titroprocessor press the yellow action key <MAN CONTROL> on the keyboard.

```

Devices & Manual Control
-----
Dosing devices at interface A                                press <TAB> for more
Dos. drive          A1          700          A2          A3          A4
Reagent             [redacted]             [redacted]             [redacted]             [redacted]
Concentr.           [redacted]             [redacted]             [redacted]             [redacted]
Tubing              Default             Default             Default             Default
Buret type          10.0mL             ---             ---             ---
Piston position     exchange             -----             -----             -----
Dosing status       ready              -----             -----             -----
-----
Sensors at interface A                                    press <TAB> for more
Meas. input        A1          A2          Adiff          AT
Sensor             [redacted]             [redacted]             [redacted]             [redacted]
Cal. sensor        [redacted]             [redacted]             [redacted]             [redacted]
Cal.method         [redacted]             [redacted]             [redacted]             Apol
Cal.date           [redacted]             [redacted]             [redacted]             [redacted]
Next Calibr.       [redacted]             [redacted]             [redacted]             [redacted]
pH(as)             7.000             7.000             7.000             Stirrer on
Slope              1.000             1.000             1.000             [redacted]
-----
QUIT
-----
Sample changer | Fill all | Fill | Prepare buret | Dosing drive | Empty | STOP | STOP all | Remote lines

```

The 'Devices & Manual Control' window shows the connected peripherals. The upper part displays the current status of the connected dosing drives. If your dosing drive is connected properly the display looks something like the screen shot above. It indicates a 700 Dosino at the measuring input A1 with a 10mL-dosing unit ready to titrate.

- The block cursor must be set in the 'A1' column. If this is not the case move the cursor using the <←> or <→>key.
- Now press the softkey [Prepare buret]. The prepare cycle starts now with emptying the dosing cylinder of the buret. Then all of the tubings will be flushed and filled. After that, the tubings should be filled bubble-free.
- Press <QUIT> to close the MANUAL CONTROL-Page.

Rinse electrode and titration tip with distilled water. Place the first sample on the titration stand or stirrer and dip the electrode and the titration head into the sample solution. Switch on the stirrer and adjust its stirring rate.

3.2 The first titration

- Remove the application card from the card slot by pressing the push button next to the card slot. Insert the formatted memory card (SRAM card). It will be used to store the titration data.
- Now enter your name as user name.
- Press the red <START>key.

A dialog window pops up. Now you can enter the sample data.

- Enter the sample unit and any remark first. Then enter the sample size of the first sample. Select mg as sample size unit.

Ask for sample data

Ident1	Ident2	Ident3	Size	Unit
			150.24	mg
Remark				
my first titrations				

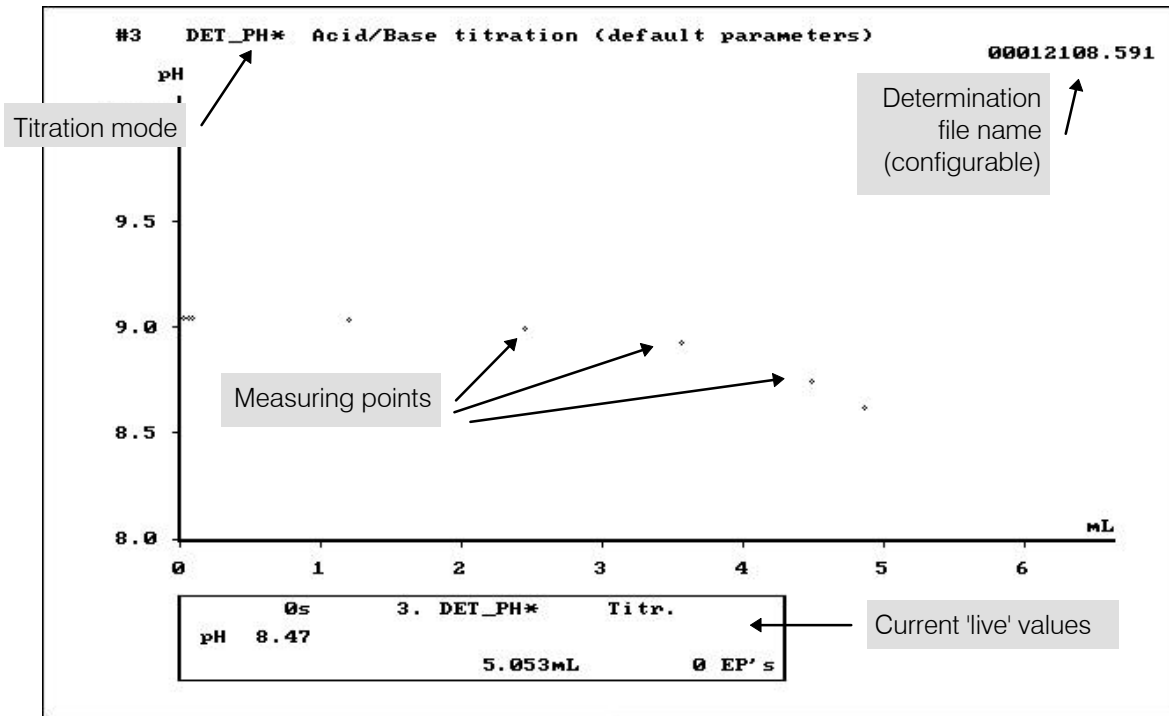
QUIT

As soon as you enter the sample size and confirm the entry with <ENTER>, the sample data window closes and the titration starts.

The titration curve is now being displayed. As the titration evolves, you can observe the live titration curve. Every measuring point is displayed. The curve is being resized automatically.

The titration will last until the first equivalence point is recognized.

See next page.



At the end of the titration the titration result is being displayed on a separate page and a report is printed out. The titration data (measuring point list, curve, results etc.) are saved on the memory card.

The result page is automatically displayed. It shows a statistical view of the calculated results of the titration.

```

2000-01-21 09:01:19      MAIN PAGE 796 Titroprocessor      * busy *
  Result
-----
Original data                      View : Statistics
Comment      Formula      Mean      S.dev +/- Unit      s in %      n
-----
Content      R1           99.92           %           1
  
```

At the bottom of the screen, there are several input fields for 'Determ. view'.

As soon as the results page is shown, the Titroprocessor is ready to start the next titration.

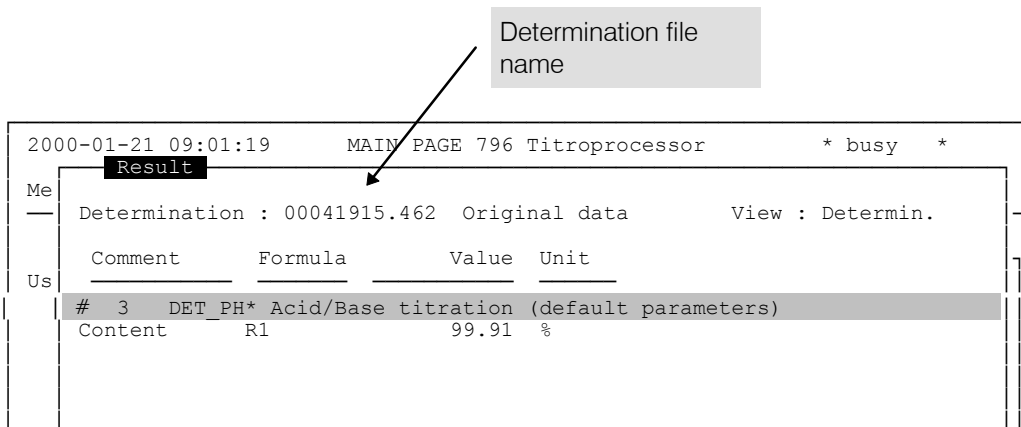
- Prepare the the second titration. Remove the first sample beaker and replace it by the second one. Do not forget to rinse the electrode and titration tip.
- Press the <START>key again to start the second titration.
- As soon as the sample data windows appears, you may enter the sample data of the second sample. You might notice, that the previous sample data is displayed again. You only have to enter the new sample size and press the <ENTER>key.

After the end of the second titration the result page might look like this:

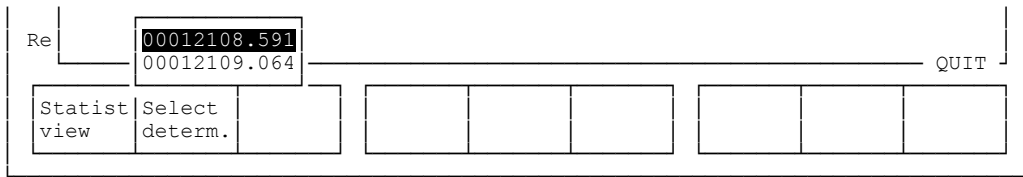


You now see the mean value of the two titration results. In addition the absolute and relative standard deviation are displayed, too.

- If you want to see the results of each titration press the softkey [Determ. view].



The determination view shows the result(s) of the last titration. Press the softkey [Select determ.] to get a list of the available results.



Re | 00012108.591 | QUIT
 00012109.064
 Statist view | Select determ. | | | | |

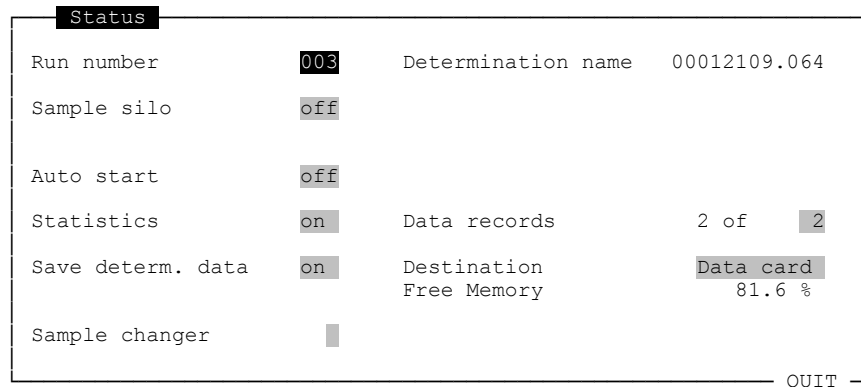
The determination file names are built of the date and time of the titration start in the format 'YYMMDDhh.mms' by default.

- If you select the upper file name (press <ENTER>) the results of the first titration are displayed.
- If you select the lower file name (press <ENTER>) the results of the second titration are displayed.
- Press the softkey [Statist view]. Now you see the statistics results again.
- Close the result window by pressing the <QUIT>key.

Some explanations

You did a repeat determination of the same sample. The necessary settings were defined in the access control file on the application card. At start-up of the Titroprocessor this file was loaded and the settings were applied.

- Press the <STATUS>key to check the current status settings of the instrument.



Status

Run number	003	Determination name	00012109.064
Sample silo	off		
Auto start	off		
Statistics	on	Data records	2 of 2
Save determ. data	on	Destination	Data card
		Free Memory	81.6 %
Sample changer	█		

QUIT

You can see that the statistics is turned on and two data records are predefined to be taken in account for the statistics calculations. In addition this settings defines the size of the working memory. This means two determinations can be held in the working memory concurrently, not only for statistics calculations but also for re-evaluation.

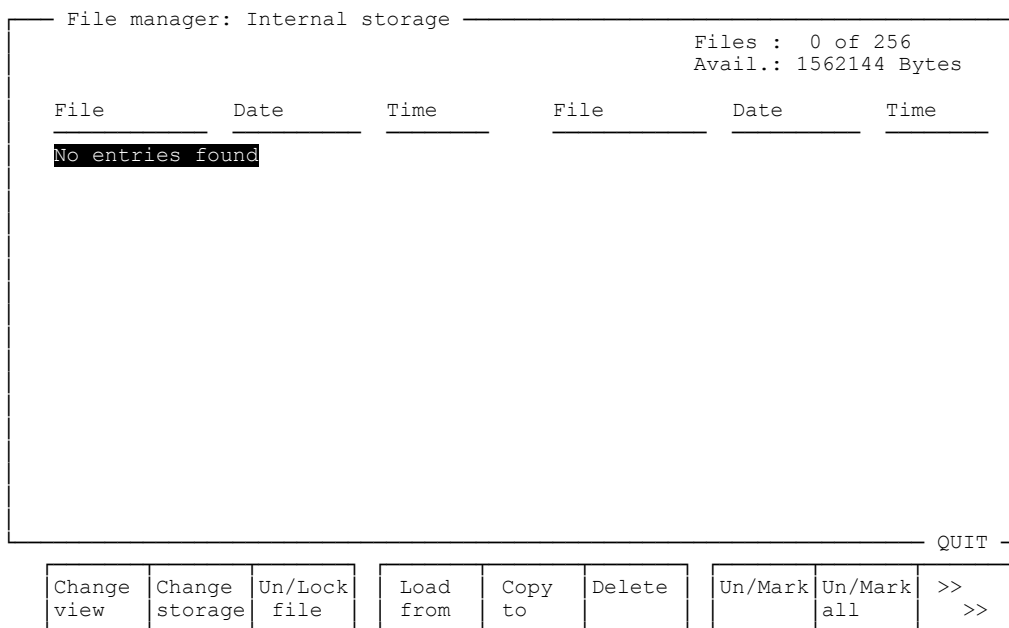
The automatic saving of determination data is also switched on. The measuring list and evaluation parameters of a titration will be saved permanently on a data card after its completion. Saved titration data may be loaded and

evaluated again later. Alternatively the internal storage may be used to save determination data.

The Titroprocessor's memory organisation:

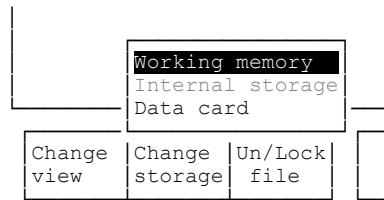
Working memory	
Temporary memory for: <ul style="list-style-type: none"> • current method • current determination(s) 	The size of the working memory is determined by the statistics settings ('Data records'). 1...20 Determinations can be held in the working memory. All of the determinations in the working memory may be re-evaluated and re-calculated.
Internal storage	Data card
Permanent storage for: <ul style="list-style-type: none"> • Methods • Determination data • Silo files • Configuration files • Access control files Limited storage capacity. Use preferably for methods.	Permanent storage for: <ul style="list-style-type: none"> • Methods • Determination data • Silo files • Configuration files • Access control files Use for key cards, methods and determination data.

- Press the softkey [File manager] to view the content of these storages.



First you see the content of the Internal storage. It should be empty until now.

- To view the content of the other storages press [Change storage]. A selector list is displayed.



- Select 'Working memory' and press <ENTER>.

Now the content of the working memory is shown.

```
File manager: Working memory
```

File	Date	Time	File	Date	Time
00012109.064	2000-01-21	09:07:42	00012108.591	2000-01-21	09:00:51

Files : 2 of 20
Avail.: 992072 Bytes

Two determination files should now be listed, which are identified by their file names. These are the two titrations that you just performed.

- Press the softkey [Change view] and you will see another listing of the same entries.

```
File manager: Working memory
```

File	Comment	Size
00012109.064	Tutorial my first titration	5094
00012108.591	Tutorial my first titration	5076

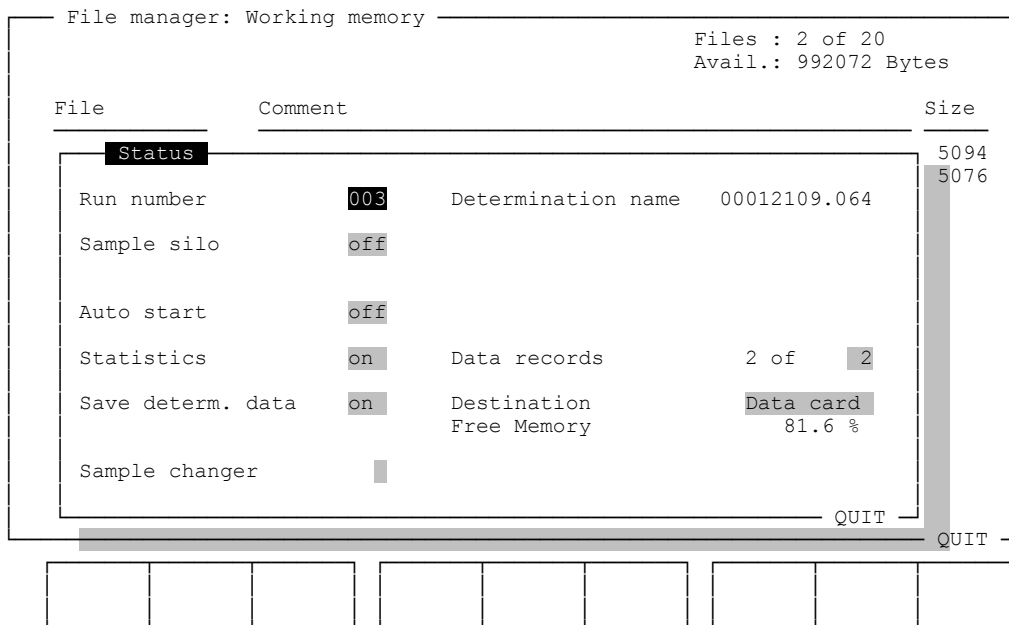
Files : 2 of 20
Avail.: 992072 Bytes

This listing shows a file comment and the file size of the determinations. Like the file name, the file comment is built automatically, depending on the configuration settings. The ones above consist of the method name and the sample remark.

These two temporary files, containing determination data (measuring list etc.) will be deleted, as soon as the next titration will start. Remember, the statistics setting 'Data records' limits the working memory to two determinations.

- Press the <STATUS>key, to display these settings again.

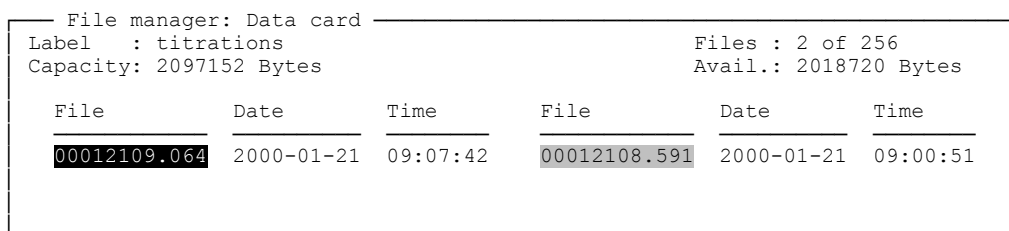
See next page.



The setting 'data records 2 of 2' limits the working memory. For further titrations you could modify the entry to 10 or even 20 data records.

The 'Auto save' function stores the temporary determination files created in the working memory to a permanent file storage on a data card or in the internal storage. The 'Destination' setting determines the location of the file storage. The previously performed titrations should therefore now be stored on the data card, that you inserted before.

- Press <QUIT> to close the 'Status' window and display the content of the data card by pressing [Change storage] and selecting 'Data card'.



The same determination files are shown in the listing of the data card. But these files are permanently stored.

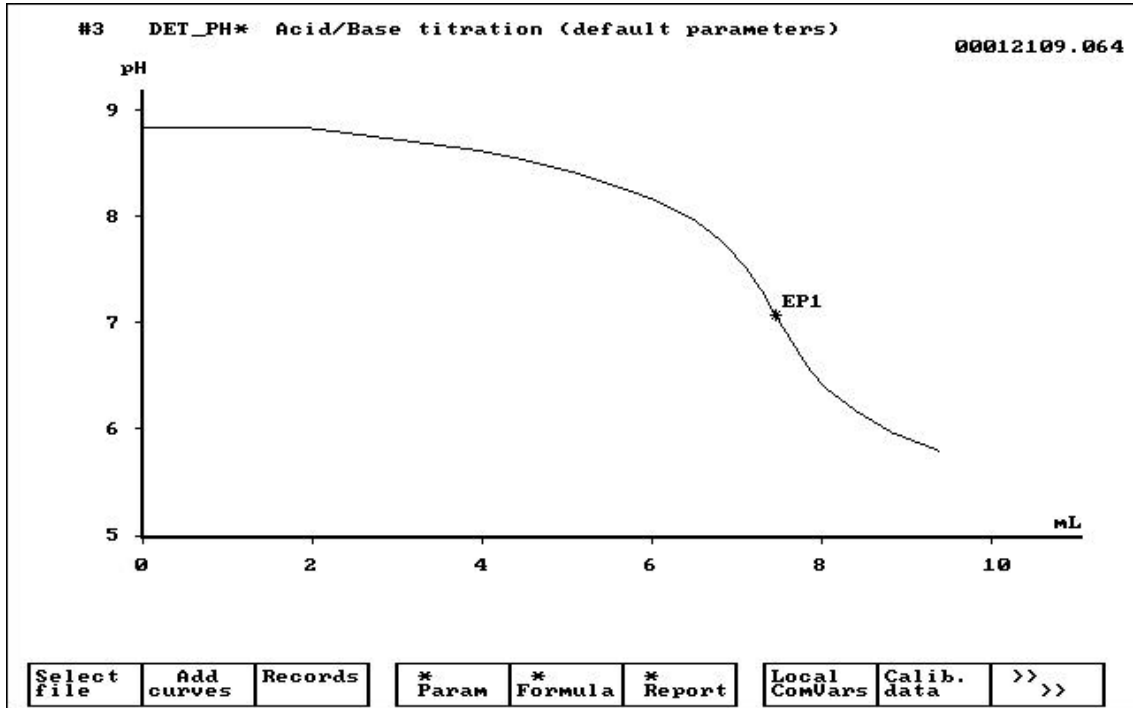
The data card has a capacity of 2 Megabytes. The maximum number of files that can be stored on a card is 256.

It is possible to re-evaluate or re-calculate any determinations stored on a data card. For this you have to copy the files to the working memory. See the 'Instructions for use' for further explanations.

- Press <QUIT> to close the file manager page.

The titration curves are accessible via the softkey [Show curves] on the main page.

- Press [Show curves].



The graphical display shows the latest titration curve. You can also view the first titration curve, as long as it is stored in the working memory.

- Press the softkey [Select file] and select the file name of the previous titration.



The titration title is displayed.

- Press <ENTER> to load the previous titration.

It is also possible to display all titration curves concurrently, that are available in the working memory.

- Press the softkey [Add curves].

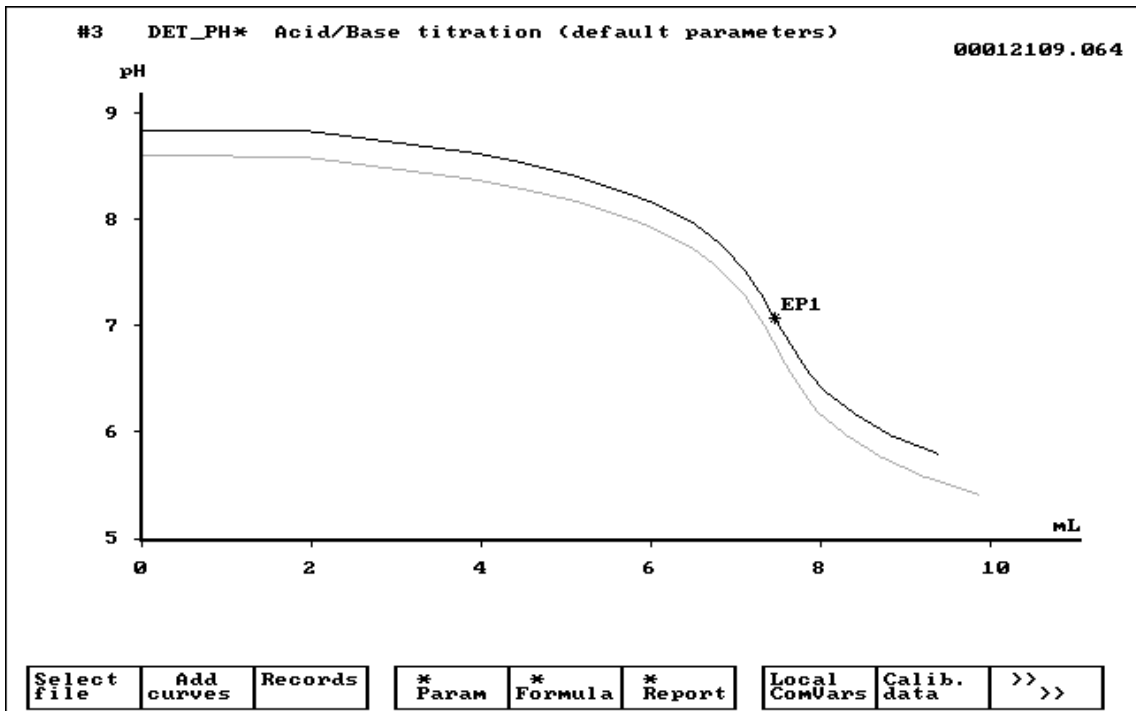


A checkmark indicates the currently displayed titration curve.

- To check the the titration curve you wish to add, hold down the shift-key (<↑>) and and select the curve with the cursor key <↑> or <↓>. This way you could select multiple curves to add.

```
J 00012109.064 #3 DET PH*
J 00012108.591 #3 DET PH*
```

- When all the curves are checked, press <ENTER>



Both of the titration curves are visible now. The endpoint and the file name of the activated curve is shown in black. The inactivated curve is shown in gray.

- To change the active curve press <↑> or <↓>.
- You may print out the currently visible screen by pressing the <PRINT SCREEN> key.
- To return to the main page, press <QUIT>.

4 Methods

After the first titrations you might want to modify the titration method.

- Press the softkey [Edit method] on the main page of the Titroprocessor.

Method : Tutorial.mth			
t/s	Command	Parameters	Parameters
1	ASK	Ident. item none	Size yes
2	SHOW	Page curve	
3	DET_PH*	Acid/Base titration (default parameters)	
		Reagent HCl or NaOH	Sensor comb.pH
		Concentr. 0.1 mol/L	Meas. input A1
		Dos. drive A1	
4	SHOW	Page stat.	
5	END		

QUIT

Note	File	Determ. report	* Param	* Formula	* Report	Insert line	Delete line	>>	>>
------	------	----------------	---------	-----------	----------	-------------	-------------	----	----

The current titration method consists of five command lines, which are to be executed one by one. Each one of them has its own parameters. Titration or measuring modes, such as DET_PH (dynamic pH titration mode) or MEAS_U (mV measuring mode) have additional parameter sets to optimize the course of the titration or measuring process and additional settings.

To get familiar with the the basics of how to edit a method, modify the current method.

4.1 Editing a method

- Set the cursor to the column 'Command' in the first line, see above.

The 'ASK' command requests the input of sample date. However, the sample data may be entered in other ways.

- Delete the first command line (ASK command) by pressing the softkey [Delete line].

The next command 'SHOW' with its parameter 'Page: curve' causes the Titroprocessor to display the 'live' titration curve.

- Delete both of the SHOW commands

Do not delete the 'END' command. It stands for the end of the command sequence and must not be deleted.

```

Method : Tutorial.mth
-----
t/s  Command      Parameters
-----
1    DET PH*      Acid/Base titration (default parameters)
                          Reagent   HCl or NaOH   Sensor   comb.pH
                          Concentr. 0.1 mol/L  Meas. input Al
                          Dos. drive Al
2    END
    
```

Now you have a minimal titration method, consisting of nothing more than a dynamic pH titration mode.

4.2 Titration parameters

The titration parameters may be adapted to suit your application's needs.

- Be sure to have placed the cursor in the first command line (DET_PH*).
- Press the softkey [* Param].

```

Method : Tutorial.mth
-----
t/s  Command      Parameters
-----
1    DE          DET PH* Parameters
                          |
                          | Start conditions
                          | Volume      off
                          | Meas.val. pH off
                          | Slope        off pH/mL
2    EN          Dos. rate  max mL/min  Pause      0 s
                          |
                          | Titration conditions
                          | Adjustment  medium
                          | Temperature  25.0 °C
                          | Time recording on
                          |
                          | Stop conditions
                          | Volume      absolute
                          | Size        20 mL
                          | Fill. rate  max mL/min
                          | Meas.val. pH off
                          | EP#        1
                          | Stop time   off s
                          | Mpt. overflow on
                          |
                          |-----| QUIT
    
```

	EP Recogn.	Curve display	Custom adjust
--	---------------	------------------	------------------

The titration parameters are separated into start conditions, titration conditions and stop conditions.

Start conditions:

Settings for the initial dosing of a start volume of titrant.

Titration conditions:

Titration control settings.

Stop conditions:

Conditions to be met to end a running titration.

Modify the following settings:

- | | | | | | |
|----------------------|----------|--------|--|--|--|
| Start conditions | | | | | |
| Volume | relative | | | | |
| Factor | 0.04 | | | | |
| Dos. rate | max | mL/min | | | |
| | | | | | |
| Titration conditions | | | | | |
| Adjustment | slow | | | | |
| Temperature | 25.0 | °C | | | |
| | | | | | |
| Stop conditions | | | | | |
| Volume | absolute | | | | |
| Size | 10 | mL | | | |
| Fill. rate | max | mL/min | | | |
| | | | | | |
| Meas.val. pH | 2.5 | | | | |
| EP# | 9 | | | | |
| Stop time | off | s | | | |
| Mpt. overflow | on | | | | |
- A start volume of titrant can be added, depending on the sample size.
 - The titration conditions can be adjusted to a 'slower' set of control parameters, in case of sensitive samples or troublesome sample solvents.
 - You can define various criteria, which may determine when to quit a titration, e. g. an absolute volume or a measuring value reached.

It is possible to adjust the titration conditions in detail (softkey [Custom adjust]). However, this is not required for routine analysis.

4.3 Curve display

You may want to modify the curve display and print-out.

- Press the softkey [Curve display].

```

DET PH* Parameters
Start conditions
Volume      relative      Meas.val. pH  off
Factor      0.04          Slope         off pH/mL
D           * Display
Tit Curve   Y_Axis      X_Axis
A
T Quantity  M. value     Volume
Scale      auto         auto
Sto begin   pH          mL
V end      pH          mL
S Division  1           mL/cm
F Grid      off         s
QUIT
QUIT
  
```

Both curve axis are set to auto scaling by default.

- Change the scaling of the Y-axis to 'fixed'. Enter the values 2 and 10 for axis limits (begin pH and end pH resp.).
- The division of the X-axis (volume) may be set to 0.5 mL/cm for a convenient print-out. Switching on the grid may also be helpful.
- Press <QUIT> to close the 'Display' subwindow.

4.4 Calculations

- To edit the calculations press the softkey [* Formula].

Method : Tutorial.mth

t/s	Command	Parameters	Parameters
1	DET_PH*	Acid/Base titration (default parameters)	
		Reagent HCl or NaOH	Sensor comb.pH

* Formula

#	Comment	Formula (R\$\$, C##, X\$\$, EP# ..)	Unit	Dec	Type
1	Content	R1=EP1*C*204.23*100/SS	%	2	stat.
2					
3					
4					
5					
6					
7					
8					
9					
10					

QUIT

QUIT

Copy line	Cut line	Paste line				Insert line	Delete line	
-----------	----------	------------	--	--	--	-------------	-------------	--

Up to ten different formulas may be defined for one titration. The current formula is called 'Content' and defines the following calculation:

$$\text{Content in \%} = \frac{\text{titrant consumption in mL} * \text{titrant conc.} * \text{molar mass of TRIS} * 100}{\text{sample size in mg}}$$

The titer of the titrant is not taken in account in this formula. It is intended to store a titer in a so called 'Common variable'. Common variables are permanently stored variables which can be used for the calculation of any results. The application card for the 796 Titroprocessor provides a titration method for titer determinations of Hydrochloric acid. The results of the titer determinations are automatically stored as Common Variable C18 in the Titroprocessors storage.

Modify the calculation formula of the current method. The titrant consumption (EP1 = equivalence point 1) has to be multiplied by the titer (C18). Introduce the Common variable C18 in the formula.

$$R1=EP1*C18*C*204.23*100/SS$$

- Close the formula window with <QUIT>.

4.5 Reports

Titration curves and results can be printed out or be transferred to a LIMS system. The data output can be formatted by use of individual reports.

- Press the softkey [* Report]

Method : Tutorial.mth

t/s	Com	Type	Specification	print	send	FF
1	DET	V_Curve	M. value	yes	no	no
2	END	*Stand		yes	no	no
				no	no	no
				no	no	no
				no	no	no
				no	no	no

Reports for titration / measuring mode

Reports to be printed on full statistics counter

QUIT

The report listing shows two reports for the current method. 'V_Curve' stands for the titration curve. It will be printed as standard curve (measured values vs. volume). The results will be outputted in a standard result report. If you want more informations to appear in the result report, do the following:

```
C_Curve
V_Curve
T_Curve
*Stand
*FullRes
*ShrtRes
SmplData
CalData
*Param
MP_List
Calc
RawData
FormFeed
FullStat
ShrtStat
```

- Move the cursor to the '*Stand' entry and press the space bar.
- Select 'SmplData' and press <ENTER>. This report includes the sample size and the sample identifications.
- Add '*FullRes' to the report list. The 'Full results' report comprises detailed information on the titration.
- Press <QUIT> to close the report definition window.

4.6 Application note

A method may be commented by the use of the application note. You may want to display a prescription for sample preparation or other comments after loading a method.

- Press [Note] on the method editor page.

Method : Tutorial.mth

Note	Parameters
<p style="text-align: center;">Application note</p> <p>This is a simple application method for acid or base titrations.</p> <p>Example:</p> <p>-----</p> <p>Weigh 150 mg TRIS in a beaker, dilute in 70-80 mL dist. water and titrate with c(HCl)=0.1 mol/L. Use a comb. pH electrode as sensor.</p>	<p>on (default parameters)</p> <p>NaOH Sensor comb.pH</p> <p>1 mol/L Meas. input A1</p> <p> A1</p>
QUIT	

QUIT

Help on entry

Delete line

Blank line

Copy line

Paste line

Cancel

- Edit the 11 lines of text as you wish. If you want to change the text entry mode (insert <> overwrite) press <INS>.
- Close the application note window with <QUIT>.
- To complete the current method, edit the titration title and reagent description.

Method : Tutorial.mth

t/s	Command	Parameters	Parameters
1	DET PH*	Acid Titration (dynamic equivalence point titr.)	Reagent HCl Sensor 6.0232.100
		Concentr. 0.1 mol/L	Meas. input A1
		Dos. drive A1	
2	END		

4.7 Saving the method

A method can be saved permanently in the internal storage or on a data card. If you use key cards for daily use, it is recommended that you store the methods on the same card.

- Press the softkey [File] on the method editor page.

Files	
Name	Tutorial.mth
Comment	Simple acid/base titration
Storage	Internal

QUIT

- Change the method name. It may consist of up to 8 characters. The file extension will be automatically applied (*.mth).
- Enter a descriptive file comment of up to 51 characters.
- Select 'Data card' for file storage.
- Insert the SRAM-Data card (2 MB) in the memory card slot.

Files	
Name	TRIS.mth
Comment	Acid titration of TRIS
Storage	Data card

QUIT

Rename				New	Load	Save		
--------	--	--	--	-----	------	------	--	--

- Press [Save].
- To close the method editor page press <QUIT>.

5 Common Variables

It is recommended to store the titers of reagents in Common Variables. Up to 19 Common Variables can be used for calculations of any results. The values of Common Variables may be entered manually or can be stored automatically by the calculation of formula in a titer determination.

In the method you modified before you introduced the Common Variable C18 as the titer of $c(\text{HCl})=0.1 \text{ mol/L}$. You have to create the Common Variable before the next titration.

5.1 Manual Editing

- Press the softkey [Common vars] on the main page of the 796 Titroprocessor.

Common Variables : actual

C#	Value	Unit	Comment	Date	Time	Method	Flag
1			-..:..		
2			-..:..		
3			-..:..		
4			-..:..		
5			-..:..		
6			-..:..		
7			-..:..		
8			-..:..		
9			-..:..		
10			-..:..		
11			-..:..		
12			-..:..		
13			-..:..		
14			-..:..		
15			-..:..		
16			-..:..		
17			-..:..		
18			-..:..		
19			-..:..		

QUIT

						Delete ComnVar	Delete all
--	--	--	--	--	--	-------------------	---------------

- Move the cursor to the line 18. Enter a value (1.000) for the Common Variable C18.
- Enter a comment for C18, such as 'Titer HCl'.

17			-..:..		
18	1.0000		Titer HCl	2000-01-31	09:56:25	by edit	nn
19			-..:..		

QUIT

- Press <QUIT> to return to the main page.

6 Status Settings

Before you start a titration, you usually have to check and change some status settings.

- Press the <STATUS>key on the keyboard.

6.1 The Status window

```

2000-01-31 11:29:52      MAIN PAGE 796 Titroprocessor      * ready *
Method      TRIS.mth      Acid titration of TRIS
-----
Use  Status  Application Note
-----
Run number  000      Determination name
Sample silo  off
Auto start  off
Statistics  on      Data records      0 of 2
Save determ. data  on      Destination      Data card
Sam  Sample changer  Free Memory      95.1 %
Rem  QUIT
-----

```

The status window contains all the basic settings you need for your daily work.

Run number

This is an incremental determination counter. It is initialized at start-up of the instruments. You can set the run number at will. It may be used for the automatic creation of determination file names, see configuration.

Sample Silo

The sample silo allows to enter more than 100 sample data, including sample size, three different identifications and an additional sample remark (51 characters). Each sample may be linked to a method in the Internal storage that will be applied for the treatment of this specific sample. The content of a sample silo can be saved in a file and be loaded for later use.

- For the next titration, the sample silo should be switched 'on'. After each sample series the silo can be reset (selection: 'rst'), i. e. the output pointer will be set to the first silo line.

Auto start

When working with a 717 Sample Changer the auto start function must be activated. After finishing a determination the Titroprocessor will start the next titration immediately. The next silo line will be activated.

- If you do not use a Sample Changer do not switch on the auto start function.

Statistics

You have to switch on the statistics for the calculation of mean values and standard deviations of a sample series. Statistics calculations require all titration data to be temporary held in the working memory. For this you have to define the size of the working memory in terms of data records, i. e. for a sample series of five determinations switch on the statistics and set 'Data records x of 5'.

Calculation formulas which are to be included in statistics calculations have to be declared as 'stat.', see page 34, Calculations.

- Switch on the statistics and set 'data records' to 2.

Save determ. data

Titration data may be saved automatically. You have to define the storage location, i. e. where to save the data file. The file name will be created according to the settings on the configuration page (`File name type`).

- For the next titrations turn off the auto save function.

Sample changer

If a 717 Sample Changer is connected, you have to define the address of the changer (1 or 2). But for the next titrations you do not need any sample changer.

7 Sample Silo

It is very comfortable to use the sample silo as a sample table, even if you do not have a sample changer.

- Open the sample silo with the softkey [Sample silo] on the main page of the 796 Titroprocessor. If the sample silo is 'on', you may as well use the <SAMPL>key.

Sample Silo: NEW.slo

#	Method	Ident1	Ident2	Ident3	Size	Unit
<> 1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						

QUIT

Remark	File	Un/Mark	Insert line	Copy line(s)	Delete line(s)	Un/Mark all	Edit mode	>>>
--------	------	---------	-------------	--------------	----------------	-------------	-----------	-----

Up to 160 silo lines can be filled with sample data. The sample identifications (Ident1...3) may be customized.

- Press the softkey [>>>] to switch over the softkey bar.

<-- Out pointer	--> In pointer		Copy line	Cut line	Paste line	Sample idents	>>>
-----------------	----------------	--	-----------	----------	------------	---------------	-----

- Press the softkey [Sample idents].

Sample Silo: Sample idents

	Name	Field type
Ident1	Ident1	auto
Ident2	Ident2	auto
Ident3	Ident3	auto

QUIT

You may rename the sample identifications and change the field type to 'text' or 'numeric'. Numeric identifications can be included in any calculations.

```

Sample Silo: Sample idents
  Name      Field type
  -----
Ident1 Lot. no  text
Ident2 Net weight numeric
Ident3 Analysis text
  
```

QUIT

- Press <QUIT>.
- Enter some sample identifications of four samples. You may use the <TAB>key to move the cursor in horizontal direction.

Silo lines can be copied via an internal clipboard. You just have to move the cursor to the line that you want to copy. Press the softkey [Copy line], move the cursor to the target line and press [Paste line].

7.1 Pointers

You can enter the sample sizes directly via data transmission from a balance. To do this, you have to set the input pointer to indicate where to insert the sample size. You see the **Input pointer** in the upper left corner of the sample silo screen.

Output pointer

```

Sample Silo: NEW
  #      Method
  <>    -----
      1
      2
      3
  
```

The input pointer can be set by selecting a silo line with the cursor and pressing the softkey [--> In Pointer]. If you can not see this softkey press [>> >>] to switch the softkey bar.

After you have set the input pointer to the first silo line that contains sample date, weigh in four samples (approx. 150 mg of TRIS) in a beaker. Read the balance's user manual for how to send the sample weight to the Titroprocessor.

After each sample weight transfer the input pointer will be moved to the next silo line. If your balance is not able to send the unit, you have to enter the unit manually.

```

Sample Silo: NEW.slo
  #      Method      Lot no.      Net weight      Analysis      Size      Unit
  <-----
  1      [redacted]    256/8        254.6           000205-7      0.15034   g
  2      [redacted]    256/8        254.6           000205-7      0.15100   g
  3      [redacted]    256/9        253.4           000205-8      0.14985   g
  4      [redacted]    256/9        253.4           000205-8      0.14838   g
  >-----
  5
  6
  
```

The output pointer in the upper left corner of the sample silo screen indicates the first silo line to be used for the next determination. Be sure to have set the output pointer in the first silo line.

The output pointer can be set by selecting a silo line with the cursor and pressing the softkey [`<-- Out Pointer`]. If you can not see this softkey press [`>> >>`] to switch the softkey bar.

- Press `<QUIT>` to close the sample silo page.

If you open the STATUS window (`<STATUS>`key) on the main page of the 796 Titroprocessor you find information about the silo status.

Status	
Run number	000
Sample silo	on
Auto start	on off rst
Statistics	Data records 0 of 2
Save determ. data	off
Sample changer	
QUIT	

'Next sample' indicates the location of the output pointer. If necessary you can reset the output pointer to silo line 1 by selecting 'Sample silo rst' (=reset), see above.

'Sample entry' indicates the location of the input pointer. Even while a method is running you can transfer sample weights from a balance. The input pointer defines the silo line where the data will be stored.

When you return to the main page, you can see the sample data input lines with changed identification texts.

8 'Live' Titrations

- When you have prepared the four samples and the first of them is ready to titrate, press the <START>key.

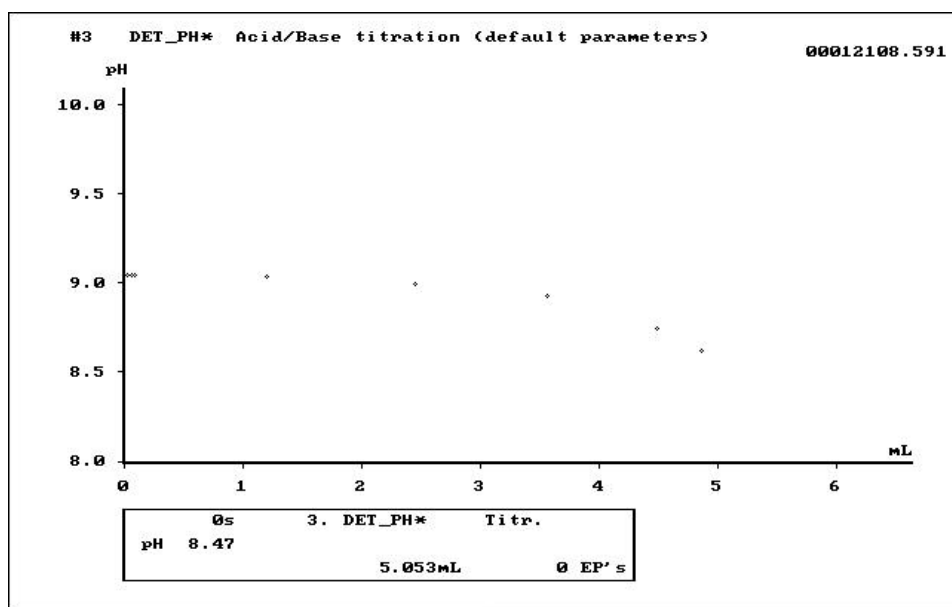
```

2000-02-01 14:23:03      MAIN PAGE 796 Titroprocessor      * busy      *
Method      TRIS.mth      Acid titration of TRIS
-----
User        D. Miller
-----
0s          1. DET_PH*      Titr.
pH          9.96
-----
0.026mL      0 EP's
-----
Sample      Lot no.      Net weight      Analysis      Size      Unit
256/8      254.6      000205-7      0.15034      g
Remark
-----
Config.  Load  File  Edit  Show  Results  Sample  Common
method  manager  method  curves
-----

```

While a determination is running the application note window changes to trace mode. The measured value (pH) is displayed in big letters. The added reagent volume and the number of equivalence points found are indicated as well.

- Press the softkey [Show curves] to watch the live titration curve.



8.1 While Running a Method

- You can interrupt a running titration by pressing the <HOLD>key. In the 'hold' status of the instrument, you can modify any settings even titration parameters. Press <HOLD> again to continue the titration.
- After finishing the titration and print out of the reports, simply press <START> again. The sample data will change and the sample size and the identification data of the next silo line will be shown on the main page.
- If you press the <RESULT>key, you can view the results of the latest titration.
- After finishing the second titration a full statistics report will be printed out. When you start the third titration the statistics will be reset and the working memory be cleared.

9 Key cards and access control levels

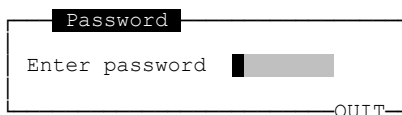
Key cards enable every user of the 796 Titroprocessor to have his own working environment, which includes individual status settings, his own specific methods on the card and a customized user dialog, which means, only the dialog pages are accessible that he needs.

9.1 Key files

The application card contains eight predefined key files (or access control files). The settings of these files may be used to be adapted to your needs.

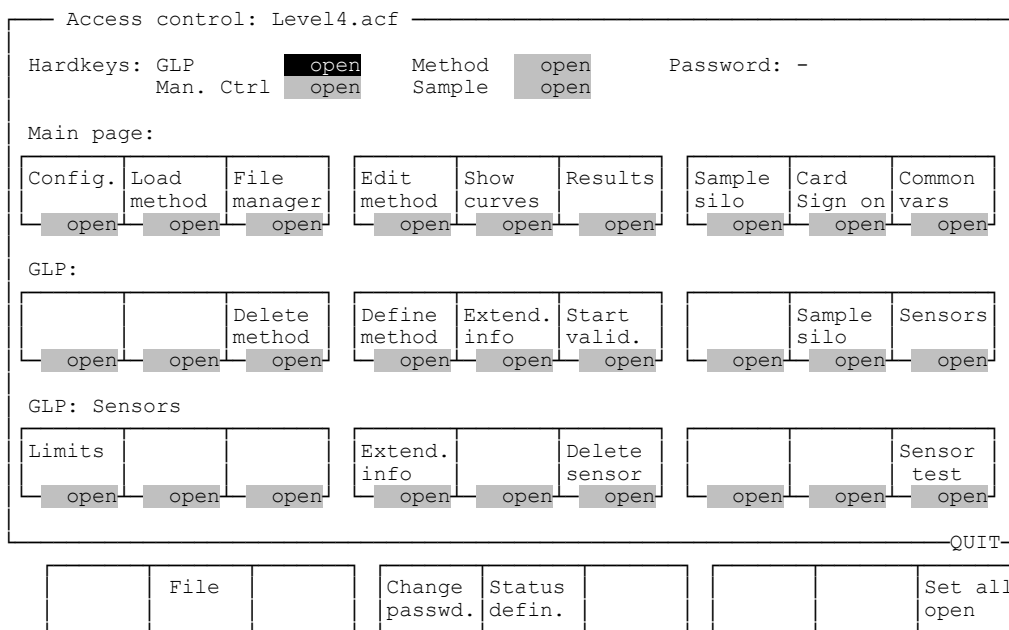
- Press the softkey [Config] on the main page of the Titroprocessor.
- Press [Access control] to open the dialog pages for the user level definitions.

These dialog pages are meant to be password protected. By default there is no password defined yet. It is recommended to set a password later on.



- Just press <QUIT> or <ENTER> to quit the password request.

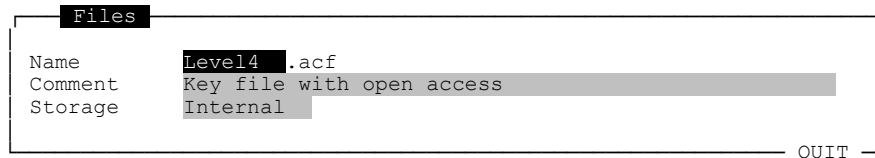
The head line of the 'access control' page indicates the currently loaded key file 'Level4.acf'. It was automatically loaded as you started up the Titroprocessor with the application card.



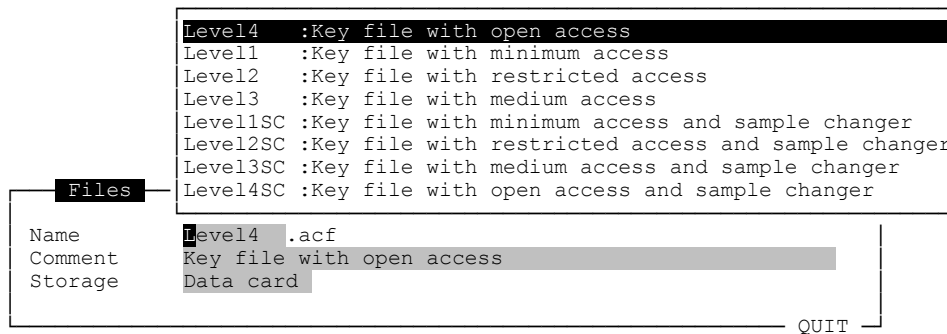
This scrollable page lists the top level softkey bars, which appear in the user dialog of the 796 Titroprocessor. The first lines show the access declarations of the yellow action keys of the keyboard.

All of the keys (softkeys and hardkeys) are by default declared as 'open'. This means that the key functions are activated, the softkeys are visible. Each softkey (or the hardkeys) can be set to 'hide' and would therefore be invisible and deactivated. All of these settings, included the status definitions (you will see later on), can be saved in a key file.

- To load another key file press the softkey [File].

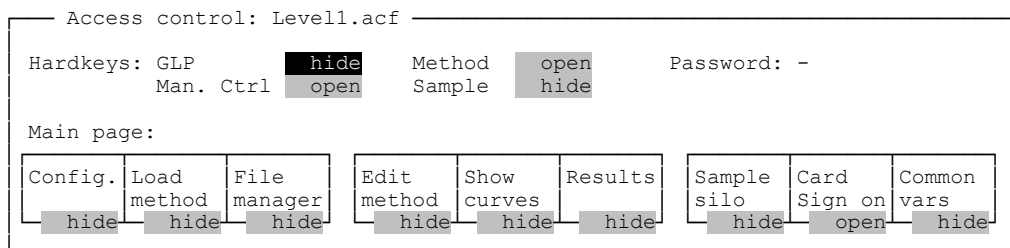


- Insert the application card in the card slot on the right side of the Titroprocessor.
- Change the storage setting to 'Data card'. Set the cursor to the 'Storage' field, press the space bar and select 'Data card'.
- Set the cursor to the 'Name' field and press 'Space' again to display the listing of the key files on the application card.



- Select 'Level1', press <ENTER> and the softkey [Load].

The settings have changed now.



This is the most restricted key file on the application card. Most of the softkeys of the main page are set to 'hide'.

- To see the effect of these restrictions close the current dialog page. Press <QUIT> twice.

```

2000-01-24 10:48:27      MAIN PAGE 796 Titroprocessor      * ready *
Method      Tutorial.mth  Simple acid/base titration
-----
User        my name
Application Note
-----
This is a simple application method for
acid or base titrations.

Example:
-----
Weigh 150 mg TRIS in a beaker, dilute in
70-80 mL dist. water and titrate with
c(HCl)=0.1 mol/L.
Use a comb. pH electrode as sensor.
-----
Sample      Ident1      Ident2      Ident3      Size      Unit
           [redacted]  [redacted]  [redacted]  [redacted]  [redacted]
Remark      [redacted]
-----
[ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]
Card
Sign on
    
```

All but one softkeys are deactivated. The one which is left enables the user sign-on using a key card. It is still possible to load methods (<METHOD> key) and to enter sample date. But you cannot edit the titration method or modify the configuration settings. Even the user name cannot be changed. It is predefined in the key file.

9.2 How to edit a key file

To edit the key file, you have to enter the access control page. But the [Config] softkey is disabled. Therefore you have to use a shortcut.

- Hold down the <ALT>key and press <A> (which stands for 'Administrator').

The password request is now displayed. You may close it, without any input.

- Press <ENTER> or <QUIT>.

The current settings are very restrictive and may be applied, if only well elaborated methods are used and any changes of the titration parameters or configuration settings are not allowed.

It is always possible to load another key file with different settings. You may try them later.

Edit the current settings. You may open more dialog pages and allow more functions to be used.

Hide or open any softkey

- Move the cursor to the first softkey bar. Select [File manager] and set it 'open'.
- Set the softkey [Edit method] 'open'. This enables the access to the method parameters.
- Set the softkey [Show curves] 'open'. This enables to view the 'live' titration curve and to rescale the titration curve after completion.
- Set the softkey [Results] 'open'. This enables the recalculation of the titration results.
- Set the softkey [Sample silo] 'open'. This enables to edit the sample silo, if you have sample series. To enable the access to the sample silo, you may also set the <SAMPLE>key 'open'. You find this setting on the second line of the dialog page.

```

Access control: Levell.acf
Hardkeys: GLP          hide      Method  open      Password: -
           Man. Ctrl   open      Sample  open
Main page:
Config.  Load  File  Edit  Show  Results  Sample  Card  Common
method  method manager  method  curves  Results  silo  Sign on  vars
hide    hide    open  open  open  open  open  open  hide

```

You just opened the most important softkeys of the main page. The sub-pages may be customized, too.

- Move the cursor down (<↓>key) to the softkey line 'Edit method:'.
- Set all softkeys of this softkey line 'hide', except the [* Param] softkey. This setting allows changes to the titration parameters, but it restricts changes to the course of the method.

```

Edit method:
Note    File    Determ.  *    *    *    Insert  Delete  >>
hide    hide    report  Param Formula Report  line   line   >>
hide    hide    hide   open  hide  hide  hide  hide  hide

```

- Move the cursor down (<↓>key) to the softkey line 'Man. control:'.
- 'Open' all of the softkeys of this line, except [Sample changer] and [Remote lines]. This enables the user to use all dosing drive functions.

```

Man. control:
Sample  Fill  Fill  Prepare  Dosing  Empty  STOP  STOP  Remote
changer all  all  buret   drive  Empty  STOP  all  lines
hide    open open  open  open  open  open  open  hide

```


After you have done your modifications, your status definitions may look like this:

```

Status definitions
-----
Status settings for Standard User Level:

Settings          edit.          Settings          edit.

Sample silo       on   no         Load methods from Data card
Auto start        off  no         Auto save data      on   yes
No. of samples    9999 no         Save data to        Internal yes
Statistics        off  yes        Clear working area  yes
No. data records  2    yes        Show method window auto
Sample changer    |    no

User              D. Miller      yes
Request user name yes

QUIT
    
```

You can see the effects of these setting by pressing the <STATUS>. The status window will show these settings:

```

Status
-----
Run number        000      Determination name 00012115.403
Sample silo       on         Next sample       in silo line 1
Sample entry      in silo line 1
Auto start        off
Statistics        off
Save determ. data on         Destination        Internal
Free Memory       93.9 %
Sample changer    |

QUIT
    
```

- Press <QUIT> to close to the status window.

You have now finished the status definitions.

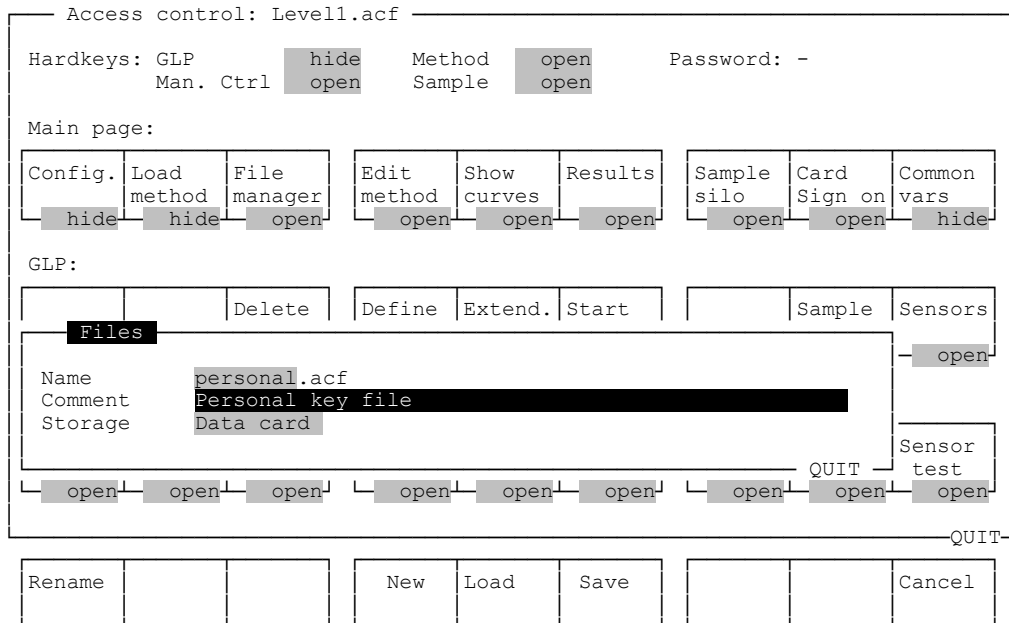
- Press <QUIT> to return to the Access control page.

9.3 Creating a key card

A data card can be used as a key card if it contains a key file (*.acf) containing access control definitions. To create a key card all you have to do is to save the previously defined access control and status definitions on a data card.

- Insert the formatted SRAM card (2 MB) in the card slot of the 796 Titroprocessor.
- Press the softkey [File] on the Access control page.
- Select 'Data card' as storage location.

- Enter a file comment.
- Enter a file name.



- Press the softkey [Save].

It is not recommended to store more than one key files on a data card, except for backup purposes. During a sign-on process the first found (which usually is the first saved) key file will be loaded. This is the case with the application card.

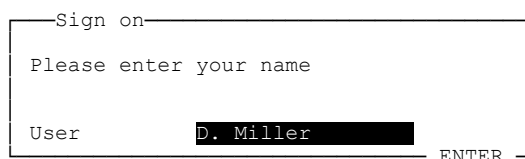
- Press <QUIT> to return to the main page.

9.4 How to use key cards.

After you have done the settings described above and saved the key file on the data card, you now have two different key cards. To test the abilities of key files you may use both for a short explanation.

- Insert the previously created key card (SRAM card).
- Turn the Titroprocessor off and on again. The power switch is located on the rear side near the left edge of the instrument.

The instrument with the boot-up process followed by the user name request window.



- You may enter a different user name or confirm the predefined name with <ENTER>.

The table of content of the key card will be loaded and the list of methods be displayed.

- This time do not load any method. Close the method selection window by pressing the <QUIT>key.

As you can see now, there is no sample data left, no method loaded. The working memory is cleared.

2000-01-25 13:57:21		MAIN PAGE 796 Titroprocessor			* ready *	
Method		NEW.mth				
User	D. Miller		Application Note			
Sample	Ident1	Ident2	Ident3	Size	Unit	
Remark						
		File manager	Edit method	Show curves	Results	Sample silo Card Sign on

The softkey bar is reduced. The status settings (<STATUS>key) are preset according to the definitions in the key file on the data card.

- Press the <METHOD>key to load any method from the key card.

Now the 796 Titroprocessor is ready to perform any titration.

You do not have to switch off and on the Titroprocessor to sign on with a key card.

- Remove the data card from the card slot and replace it with the application card (Flash card).
- Press the softkey [Card Sign on].

The key file 'Level4.acf' will be loaded and the method selection window be displayed. Select any method to be loaded and press <ENTER>.

The user name was entered without any request. You can enter your name at any time.

```

2000-01-25 14:40:47      MAIN PAGE 796 Titroprocessor      * ready *
Method      HCl.mth      Titer of HCl
-----
User      my name
Application Note
-----
Titer of HCl
-----
Weigh in a 100 mL beaker app. 100 mg
Tris(hydroxymethyl)aminomethane, dried
2 h at 105°C.
Dissolve in 50 mL dist. water and
titrate with c(HCl) = 0.1 mol/L.

Set Statistics "on" with X of 5.
Perform 5 determinations.
-----
Sample      Ident1      Ident2      Ident3      Size      Unit
-----
Remark
-----
[Config.] [Load method] [File manager] [Edit method] [Show curves] [Results] [Sample silo] [Card Sign on] [Common vars]
    
```

All of the softkeys are now visible. There is no restriction of the user dialog. The status settings are set to default values.

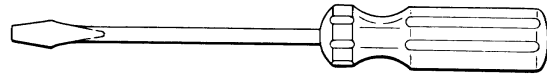
It is easily possible to lock the access to the 796 Titroprocessor for foreign users without a key card.

- Remove the application card from the card slot.
- Press the softkey [Card Sign on].

```

-----Sign on-----
Please insert a valid key card and
press ENTER!
-----
ENTER
    
```

The sign-on request window blocks the user dialog until a key card is inserted. Even switching off and on the instrument will not allow to use the Titroprocessor without a valid key card.



10 Sample Changer Configuration

Should your Titroprocessor system contain a 717 Sample Changer, it must also be correctly configured. The relevant settings can be found in a sub-window of the configuration page of the 796 Titroprocessor .

From the main page of the 796 Titroprocessor you can reach the configuration page by pressing the softkey [Config.] (= Function key <F1>). Press the softkey [Sample changer.] (= Function key <F4>) and make the necessary settings for the 717 Sample Changer.

Configuration (Program version 5.796.0010)

Configuration: Sample changer

Dial	Rack definitions									
	LCD #	Name	Beakers	Special positions				Type	Code	
LCD				Work	Shift	Rinse	Spec.			
Fehl	1	12*250mL	12	0 mm	0 mm	0 mm	0 mm	M12-0	000001	
Edit	2	16*150mL	16	0 mm	0 mm	0 mm	0 mm	M16-0	000010	
Edit	3	24*75mL	24	0 mm	0 mm	0 mm	0 mm	M24-0	001000	
	6	12*150mL	12	0 mm	0 mm	0 mm	0 mm	M12-0	100000	
	5	14*8oz	14	0 mm	0 mm	0 mm	0 mm	M14-0	000101	
	4	14*200mL	14	0 mm	0 mm	0 mm	0 mm	M14-0	000011	
	7	19*100mL	19	0 mm	0 mm	0 mm	0 mm	M19-0	001001	
	8			0 mm	0 mm	0 mm	0 mm			
	9			0 mm	0 mm	0 mm	0 mm			
	10			0 mm	0 mm	0 mm	0 mm			
	11			0 mm	0 mm	0 mm	0 mm			
	12			0 mm	0 mm	0 mm	0 mm			
	13			0 mm	0 mm	0 mm	0 mm			
	14			0 mm	0 mm	0 mm	0 mm			
	15			0 mm	0 mm	0 mm	0 mm			
	16			0 mm	0 mm	0 mm	0 mm			

QUIT IT

Delete type	Rack File	Special beakers	Changer 1	Changer 2	Delete line	Delete all	Check code
-------------	-----------	-----------------	-----------	-----------	-------------	------------	------------

In order to ensure the safe and reliable operation of the 717 Sample Changer, it is important to correctly configure the used sample racks. Not only Metrohm standard sample racks can be used with the 717 Sample Changer and the 796 Titroprocessor but also special racks. The required rack data (position tables) can be loaded from a PC into the device from a data card or via an RS232 connection.

Every Metrohm standard sample rack has a defined magnetic rack code to ensure the correct identification of the type of sample rack.

10.1 Sample Rack Definitions

Depending on the type of sample beakers and the lift head of the sample changer, the working, rotating and rinsing position of the lift must be defined accordingly. As a matching sample rack has to be selected for the sample beaker, these settings must be made according to the specific racks.

A selection of the most used rack types is entered in the rack definition table. Set the cursor at the line in the table which corresponds with your sample rack. The characterization of the rack can be seen in the column 'Name', '12*250mL' for example, refers to the standard rack with 12 spaces for 250 mL Metrohm titration beakers. The name of a rack can be freely selected and used in the CHANGER command for identifying the rack.

A sample rack which rests on the 717 Sample Changer, is identified via a magnetic code. This magnetic code can be seen in the last column. Do not alter the code of the Metrohm standard rack.

Set the varying lift positions for your rack. Place the black cursor bar in the column 'Work' on the line of the rack type. For measuring e.g. a titration, the lift head together with electrode and dosing nozzle requires moving to the so-called working position. You can now set the lift position exactly by manually controlling the sample changer.

- Press the key <MAN CONTROL> on the keyboard of the Titroprocessor.

```

Devices & Manual Control
-----
Dosing devices at interface A                                press <TAB> for more
Dos. drive          A1          700      A2          685      A3          ---      A4          ---
Reagent             AgNO3
Concentr.           0.01 mol/L
Tubing              Default
Buret type          10.0mL
Piston position     exchange
Dosing status       ready

Sensors at interface A                                    press <TAB> for more
Meas. input         A1          A2          Adiff         AT
Sensor              6.0232.100
Cal. sensor         6.0232.100
Cal.method          manual
Cal.date            97-12-10  14:37
Next Calibr.       97-12-14  08:00
pH(as)              7.000
Slope               1.000

Stirrers:
Stirrer            on

QUIT
-----

```

Sample changer	Calibr.	Meas	Stirrers on/off	Remote lines
----------------	---------	------	-----------------	--------------

This dialog page contains functions for connected devices and sensors which can be controlled manually. The manual control page can be invoked at all times (even when measurement is currently taking place) from every dialog page.

- Press the softkey [Sample changer].

Devices & Manual Control

Sample changer

```

Do  Changer          1: ready [000001]          2: not available
Do  Rack type/name   M12-0 - 12*250mL
Re  Max. beakers    12
B^n Tower           1                2
Ko  Lift pos.[mm]   0                0
Do  Beaker pos.     1                12
Do  Beaker found    yes               no
Se  Pumps           rinse aspir  rinse aspir
Me  off off         off off
Se  Stirrer         1 2 3 4
Ka  off off off off
Ka  Stirring rate  3 3 3 3
NΣ
pH  <PG UP> lift to shift position
St  <PG DN> lift to work position;  <HOME> lift to rest position
                                          QUIT
  
```

Reset changer	Remote lines	Stirrer on/off	Pump on/off	Lift up	Lift down	Shift left	Shift right	Shift to pos.
---------------	--------------	----------------	-------------	---------	-----------	------------	-------------	---------------

- Set a sample rack on the turntable of the changer. Both of the openings at the bottom of the rack match the cam followers of the turntable.
- Press the softkey [Reset changer]. The sample changer now moves the lift (or both lifts with the two tower model) into the rest position at the top end of the tower and the turntable with the rack is rotated to the initial position. The rack code is now read out and the sample rack identified. Its data, rack type, name and code are displayed.
- Equip the lift head (or both lift heads) with the accessories required for measuring which you wish to perform on this rack. Insert an electrode in an opening in the lift head and insert a buret tip in one of the smaller openings. If you wish to use a rod stirrer and/or want to aspirate the processed sample solutions after measurement with one of the built-in pumps, install the required accessories.
- Set a sample beaker at any position on the rack. Should you wish to stir the samples with a Metrohm 741 Magnetic stirrer, place a stirrer bar in the beaker.
- By pressing the softkey [Shift left] or [Shift right] rotate the rack until the beaker is underneath the lift head. If you have a two tower model of the 717 Sample Changer and wish to position the sample beaker in front of the second tower, press the tabulator key to select the second tower as target. Now move the rack as described above.
- Lower the lift with the fully equipped lift head using the softkey [Lift down]. Select the corresponding tower first with the tabulator key should you wish to use the lift at the second tower. On the display screen you will now recognize a black frame which springs from one column to the other when the tabulator key is pressed, thus displaying the selected tower.
If you keep the key [Lift down] pressed for a longer period of time, the lift is lowered quickly. Briefly tapping the key, moves the lift millimeter by millimeter.

- Position the lift using the keys [Lift down] and [Lift up], so that the electrode and the dosage nozzle can be inserted as far as possible into the beaker without touching the bottom of the beaker or the stirrer and/or the magnetic stirrer. Rearrange the accessories, if necessary. A suction hose should reach to the bottom of the beaker without, however, being touched by the stirrer.
- Switch on the stirrer (stirrer or magnetic stirrer) briefly. Select the corresponding stirrer with the arrow keys <➔> or <➠> and press the softkey [Stirrer on/off]. Check whether the stirrer and/or the magnetic stirrer touch the electrode or other accessories. Switch off the stirrer in the same manner as switching on.

You have now set the working position. The respective lift position can be found in the display under 'Lift pos. [mm]'. The lift position is always measured from the top (rest position = 0) of the tower. The current lift position in millimeters must now be entered in the rack definition.

- Quit manual control by pressing the <QUIT> key twice.

You can now see the configuration page again for the sample changer.

- Enter the read lift position in the column 'work' and confirm the entry with <ENTER>.
- The rotation position of the lift can be set in the same manner. Press the <MAN CONTROL> key again and then [Sample changer].
- Raise the lift (Softkey [Lift up]) so that the electrode, stirrer and hoses no longer reach into the sample beaker. It must be possible to rotate the rack freely (softkeys [Shift left] and [Shift right]). If necessary, correct the lift position.
- Read the current lift position and quit manual control again by pressing <QUIT> twice.
- Enter the read lift position in the column 'shift'.
- A lift position for rinsing the electrode can be entered in the same manner in the column 'rinse'. The column 'spec.' allows you to define an additional special position for the lift.
- Check the set positions. Press <MAN CONTROL> again and [Sample changer].
- In manual control move the selected lift head using the <HOME> key on the keyboard into its rest position (0 mm). On pressing the key <PG DN> the lift moves to the working position. <PG UP> positions the lift at the defined rotation position. Press the softkey [Reset changer] to initialize the changer.
- Return to the configuration page. Press <QUIT> twice.

10.2 Special Beaker

It is useful to define reserved special beakers on a sample rack, e.g. for rinsing the electrode or for inserting it briefly before a series of samples in a conditioning solution.

The spaces on a sample rack allocated to a special beaker are not processed as normal sample beakers during the processing sequence. Reserved special beakers can be approached during a sequence with a special command.

- On the configuration page of the sample changer, press the softkey [Special beakers] to process the table of the special positions of your rack.

Rack 1		
#	Spec.beaker	Position
1	Rinse	12
2	spec.2	0
3	spec.3	0
4	spec.4	0
5	spec.5	0
6	spec.6	0
7	spec.7	0
8	spec.8	0

QUIT

Eight special beaker positions are possible for every sample rack.

- Enter a name for a special beaker according to the above example, and allocate this beaker a rack position in the right column.

Select high rack positions for special beakers. This simplifies the processing sequences.

- Press <QUIT>, to close the special beaker table.

10.3 Standard Configuration of the Sample Changer

The standard configuration of the sample changer can be found in the sub-window 'Changer 1' of the configuration page of the sample changer.

- Press the softkey [Changer 1].

```

Changer 1
Tower 1/2 max. height 235 mm
Tower 1 : 1 Pump[s]
           Swing head no
Tower 2 : 1 Pump[s]
Power-up sequence
MOVE      Beaker 1 to Tower 1
           Shift direction +
LIFT      on tower 1 to position 0 mm
LIFT      on tower 2 to position 0 mm
Remote    Pattern *****
QUIT
    
```

- Enter under 'max. height' the lowest possible permissible lift position. This entry is intended to prevent the lift from being lowered too far in manual control and possibly damaging the electrode in the lift head. This setting applies to the two tower version of the sample changer for both lifts.
- For determining this lift position, proceed as for setting the working or rotating position of the lift. Press <MAN CONTROL> and [Sample changer], lower the lift as far as possible and read the lift position (in mm).
- After pressing <QUIT> twice, enter the read value for the lowest possible lift position under 'max. height'.
- Under 'Tower 1 :' and 'Tower 2 :' respectively (with the two tower version) enter the number of installed pumps at each tower.
- Should your sample changer be equipped with a swivel arm for processing several rows of racks, you must enter same under 'Swing head'.

The lower half of the dialog page contains the entries for the switch-on sequence of the sample changer. The listed commands are automatically executed immediately after switching on the device. Do not make alterations to entries until you have become familiar with the sample changer commands.

To complete the sample changer configuration, press the <QUIT> key three times to return to the main page of the 796 Titroprocessor .

11 The 717 Sample Changer

To process larger sample series with the 796 Titroprocessor it is recommended to use a Sample Changer. It offers the possibility to automate time consuming manual handling and preparation of large quantities of samples.

The 717 Sample changer has to be connected to the External Bus-Interface on the rear side of the instrument. After connecting a dosing device the 717 Sample changer has to be turned off and on again.

Place a sample rack onto the Sample changer. For the automatic recognition of the rack, you have to reset the Sample changer. Press <MAN CONTROL> and the softkeys [Sample changer] and [Reset].

To work with a sample changer you have to configure the sample rack correctly in order to get satisfactory functioning of all sample changer commands. Be sure to have set all necessary lift positions, such as work and shift position at least. For the next following examples of sample changers you need a special beaker named 'Waste' defined in the rack definition table.

See the previous chapter for the sample changer configuration.

11.1 Common sample changer commands

Besides the standard commands for titration and dosing of reagents there are several Sample changer commands available to automate the treatment and exchange of large quantities of samples.

A Sample changer methods consists mainly of the following commands:

MOVE turns the rack to place a beaker at the lift station. MOVE_S moves the (next) sample beaker, see SAMPLE command also. MOVE_B moves a special beaker to the specified target lift station.

LIFT runs the lift head to a specified height. Four preset positions can be assigned any height (in mm, measured from the top of the lift station):

- work position
- shift position
- rinse position
- special position

any lift position (in mm) may be chosen as well.

STIR controls the stirrers. It is possible to set the stirring rate in 15 steps. STIR_C controls the stirrers of the Sample changer (two stirrers per lift station). STIR_I controls the Titroprocessor's stirrer, connected to the measuring interface on the rear side of the instrument.

PUMP controls the Sample changer's pumps, which may be used to rinse electrodes or to suck off the sample solutions after finishing a determination. Sample changers can be equipped with none, one or two pumps per lift station.

With a two-tower model of the 717 Sample changer the pumps are addressed as follows:

- 1.rinse
- 1.aspir
- 2.rinse
- 2.aspir

CHANGER sets the basic parameters of the Sample changer, such as the shift direction or rate of the rack, the lift rate or the operation mode of the beaker sensor.

SAMPLE modifies the sample variable, which determines the sample beaker (i.e. its rack position) that is to be processed. The initial value of the sample variable is set by the parameter 'First rack position' on the status page. Without use of the SAMPLE command the sample variable is incremented by one with every run of a sample series.

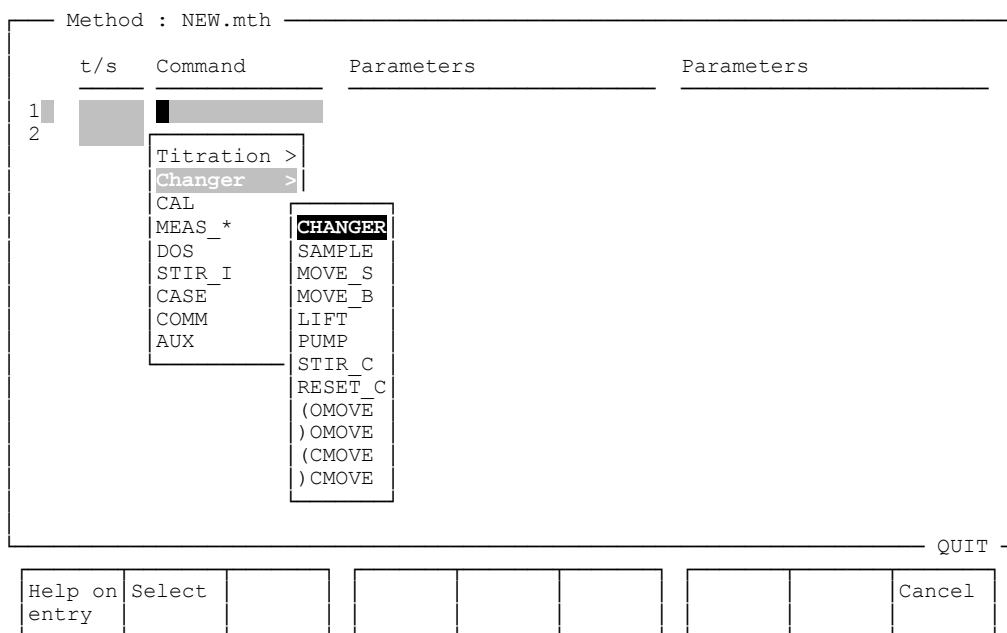
11.2 A simple sample changer method

To demonstrate the purpose of these commands create a new Titroprocessor method and elaborate a simple command sequence for the 717 Sample changer.

- Press the softkey [Edit method] on the main page of the 796 Titroprocessor.
- On the method editor page press [File] and [New].

Now, you get a blank method. Ignore the END command in the second command line.

- Set the black field cursor to the first command line and press the space bar to open the command selection list.
- Select 'Changer' and press <ENTER>.



Now you see the list of sample changer commands.

- Select 'MOVE_S' and press <ENTER>.

t/s	Command	Parameters	Parameters
1	MOVE_S	Sample to tower	1

The MOVE_SAMPLE command will rotate the rack to place the current sample beaker to the desired lift station, which is determined by the parameter 'Sample to tower'.

- If you have a single-tower model of the 717 Sample Changer the parameter 'Sample to tower' has to be set to '1'. With a two-tower model you may either chose tower 1 or 2. Press <ENTER>.
- A new command line will be inserted.

Titration >	
Changer >	
CAL	CHANGER
MEAS_*	SAMPLE
DOS	MOVE_S
STIR_I	MOVE_B
CASE	LIFT
COMM	PUMP
AUX	STIR_C
	RESET_C
	(OMOVE
) OMOVE
	(CMOVE
) CMOVE

- Press the space bar once again and select the changer command LIFT. Confirm with <ENTER>.

The LIFT command runs the lift to the specified height, i.e. the working position.

This command offers two parameters: the lift station (on tower) and the lift position.

- Chose the same tower as above for the MOVE_S command.
- Set a target position by selecting 'work' from the selector list of the second parameter. Press the space bar to open the selector list.

It is also possible to enter an absolute lift position in millimeters. But if you have configured the rack definitions properly, it is much easier to use the predefined lift positions (work, shift, etc.).

t/s	Command	Parameters	Parameters
1	MOVE_S	Sample to tower	1
2	LIFT	on tower	1 to position work mm
3			
4	END		

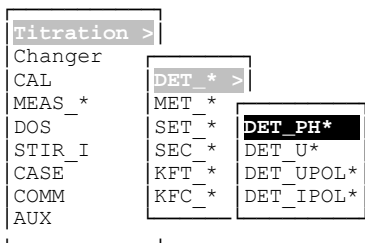
Next command could be a stirrer command. Append the following command line.

t/s	Command	Parameters	Parameters
3	STIR_C	Address	1 Stirring rate 6

The STIR_C command controls the stirrers (741 Magnetic Stirrer or 722 Rod Stirrer) which are **connected to the 717 Sample Changer**. If you did not install a stirrer on the sample changer yet, it is time to do this now, see the 717 Sample Changer user manual.

- Enter the address of the stirrer that you want to use. The address is related to the socket the stirrer is connected to.
- Set the stirring rate to a medium value of 6.

Next could be a titration mode. In line 4 insert a DET command.



- Pressing the <Space>key opens a selection list. Chose 'DET_*' for a dynamic equivalence point titration and 'DET_PH*' for pH as quantity to be measured .
- Alternatively you may type 'DET' or 'DET_PH' instead of opening the selection list.

You do not have to optimize the titration parameters for this sample changer method. The default settings suffice for this example method. Just enter a description for the DET command.

```

4 | DET_PH* Titration mode
  | Reagent
  | Concentr. Sensor Meas. input A1
  | Dos. drive A1
  
```

- Now add the following two command lines:

```

5 | STIR C Address 1 Stirring rate off
6 | LIFT on tower 1 to position rinse mm
  
```

These two commands are ment to stop the stirrer and to raise the lift to the predefined rinsing position.

The rinsing procedure is programmed by PUMP commands, like these:

```

7 | 5 PUMP Address 1.rinse State on
8 | 5 PUMP Address 1.rinse State off
  
```

- Add these two command lines above.

This is a simple rinsing procedure, using the rinsing pump of the sample changer's tower 1. The duration of the rinsing (5 seconds) is controlled by the line time of the first PUMP command. The line time of a command always defines the time interval that this command will last. The second PUMP command will turn off the pump immediately and cause the Titroprocessor to wait 5 seconds until the next command will be processed. This delay will allow the electrode to drip off.

Finish the sample changer method with a LIFT comand, which raises the lift to a predefined shifting position.

```

9 | LIFT on tower 1 to position shift mm
10| END
  
```

The END command declares the end of the command sequence and must not be deleted. If you did already so, place the block cursor to the last entry field of the command sequence ('shift') and press <ENTER>. A blank command line will be appended. Now you can enter the END command.

The complete method should now like as shown on the next page.

```

Method : NEW.mth
-----
t/s  Command      Parameters                                     Parameters
-----
1  MOVE_S        Sample to tower                               1
2  LIFT          on tower                                     1 to position work mm
3  STIR_C        Address                                       1 Stirring rate 6
4  DET_PH*      Titration mode                               Sensor
Reagent                                           Meas. input A1
Concentr.                                           Dos. drive A1
5  STIR_C        Address                                       1 Stirring rate off
6  LIFT          on tower                                     1 to position rinse mm
7  PUMP          Address                                       1.rinse State on
8  PUMP          Address                                       1.rinse State off
9  LIFT          on tower                                     1 to position shift mm
10 END
-----
QUIT

```

Note	File	Determ. report	* Param	* Formula	* Report	Insert line	Delete line	>> >>
------	------	-------------------	------------	--------------	-------------	----------------	----------------	----------

Save the method in the internal storage of the 796 Titroprocessor.

- Press [File]. Enter a file name and a descriptive comment for the method file.

```

Files
-----
Name      Changer .mth
Comment   A sample changer method
Storage   Internal
-----
QUIT

```

- Press [Save].

11.3 Testing a sample changer method

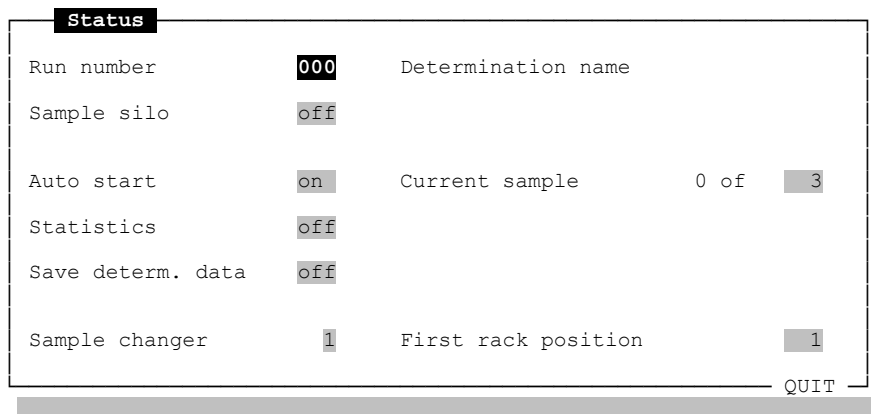
The sample changer method can now be tested.

- Place three beakers on the sample rack. Use the rack positions 1 to 3. If you want to use a magnetic stirrer, put a stirring bar in each beaker.

A Metrohm 685 Dosimat or 700 Dosino has to be connected to the **Dos.1** connector of the 796 Titroprocessor.

The status settings are to be modified to ensure the smooth run of the method.

- Press the <STATUS> key to open the status window. Edit the settings as shown on the next page.



The most important settings for processing a sample series using a sample changer is the 'Auto start' function.

- Set 'Auto start' on and enter the number of samples as second parameter (Current sample 0 of xx).
- Do not forget to set the sample changer address (1) and the rack position of the first sample to be processed (1).

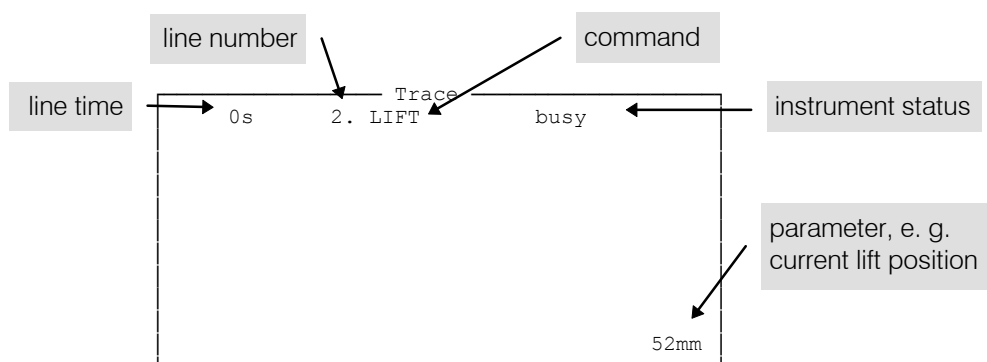
Close the status window with <QUIT> before starting the method.

- Press the <START>key.

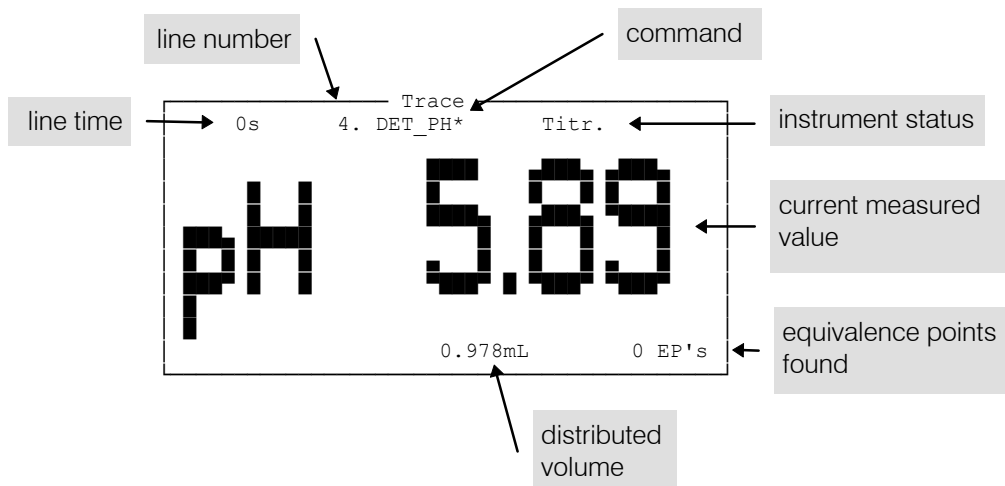
Now you can observe the progress of the method.

First the sample changer will be reset. The lift will run to zero position and the rack will be rotated to the initial position.

During the method run the screen of the 796 Titroprocessor will show the trace window to display the currently active command, e. g. the LIFT command in line 2:



The display of the trace window may be different with other commands, e.g. a titration mode, see next page.



You do not have to wait for the end of the titration. Abort the titration with the SKIP function, which will always skip the currently running command.

- Hold down the <Shift>key (<⇧>) and press <HOLD CONT>.

After finishing the first method run, the 796 Titroprocessor will start the next run automatically.

11.4 Complex sample changer methods

If you want to create highly automated sample changer methods for the processing of larger sample series, you can modify existing methods, which are delivered with the application card.

Insert the application card into the card slot of the 796 Titroprocessor and press <METHOD> or [Card sign on] on the main page.

When the method selection window appears, select the method 'SCsimple.mth' and press <ENTER>.

```

2000-02-29 10:43:37      MAIN PAGE 796 Titroprocessor      * ready *
Method      SCsimple.mth  Rinse and aspirate in the titration beaker
-----
User        my name
Application Note
-----
Sample Changer, Rinsing in Titr. Beaker
-----
This is a method structure for the Sample
Changer.
The sample is aspirated after the titra-
tion and the electrodes and buret tips
are rinsed in the titration beaker.

Insert your titration mode instead of
Command REM (line 15).
-----
Sample      Ident1      Ident2      Ident3      Size      Unit
-----
Remark
-----
Config.  Load  File  Edit  Show  Results  Sample  Card  Common
method  method manager  method  curves  Sample  Sign on  vars

```

This is a simple template method for processing a sample series by use of a 717 Sample Changer.

This method basically consists of a start sequence (or opening moves) and the actual sample sequence. An end sequence (or closing moves) is not provided with this method, see below.

Always ensure to have placed an empty waste beaker on the rack position that you have configured in the rack configuration table, see chapter 3.2. It is also important to have set the required lift positions: work, shift and rinse position, see chapter 3.1.

Start sequence

The command sequence inside the (OMOVE ...)OMOVE brackets will be executed once before the sample sequence is started. A start sequence can be used to prepare the equipment for the sample series. This may include rinsing of the electrode (see example method on the next page) or flushing (PREP command) of the tubings of a buret.

It is a good idea to include a CHANGER command in a start sequence, see command line 2. It can be used to define the sample changer's basic settings, such as the shift direction of the sample rack, the lift rate or the operating mode of the beaker test, which checks the presence of beaker with every MOVE command.

Sample sequence

The actual sample sequence will be executed with every sample beaker. The start sequence will be skipped after the first run of method in a series.

End Sequence

It may be useful to define an end sequence, which includes commands that will be executed after the processing of the last sample. This could be a short command sequence to immerse the electrode in a conditioning solution (in a special beaker) or just a simple BEEP or SHOW command to state the finishing of the sample series acoustically or to display a statistical overview of the results.

- Press [Edit method] to view the method sequence.
- Use the <PD DN> or <PG UP> key to scroll through the method. You may also use <END> or <HOME>.

```
Method : SCsimple.mth
```

t/s	Command	Parameters	Parameters
1	(OMOVE		
2	CHANGER	Selection 1	Rack name
		Lift rate 1 25	Lift rate 2 25
		Shift rate 20	Beaker test mode single
		Shift direction auto	On beaker error MOVE_S
3	MOVE_B	Special beaker Waste	to tower 1
4	LIFT	on tower 1	to position rinse mm
5	PUMP	Address 1.rinse	State on
6	PUMP	Address 1.aspir	State on
7	PUMP	Address 1.rinse	State off
8	PUMP	Address 1.aspir	State off
9	LIFT	on tower 1	to position shift mm
10)OMOVE		
11	MOVE_S	Sample to tower 1	
12	LIFT	on tower 1	to position work mm
13	STIR C	Address 1	Stirring rate 6
14			
15	REM	Select a titration mode	
16			
17	STIR_C	Address 1	Stirring rate off
18	PUMP	Address 1.aspir	State on
19	PUMP	Address 1.rinse	State on
20	PUMP	Address 1.aspir	State off
21	PUMP	Address 1.rinse	State off
22	LIFT	on tower 1	to position shift mm
23	SAMPLE	Function +	Value 1
24	END		

QUIT

The method consists of 24 command lines, which are to be executed one by one. It serves as a template for sample changer methods and can easily be adapted.

Line 15 of this method is just a dummy command, which stands for any titration or measuring mode, that you wish to apply.

- Replace the REM (Remark) command in line 15 by a titration mode, e.g. DET (dynamic endpoint titration). Move the field cursor to line 15 and type 'DET'.
- Modify the settings and parameters of this titration mode, see also chapter '5 Methods'.

```

15 | DET_PH* | Dynamic endpoint titration
    |         | Reagent      HCl      Sensor      comb.pH
    |         | Concentr.    0.1 mol/L Meas. input Al
    |         | Dos. drive   Al
  
```

Depending on the sample changer model you own, you can program your methods in different ways. Especially the way of rinsing electrodes and aspirating sample solutions may vary depending on the number of pumps integrated in the sample changer.

These are the variations:

1. If you have a two-pumps model (one or two lift stations) of the 717 Sample Changer, you got a rinsing and an aspiration pump. You can aspirate the sample solution and rinse the electrode simultaneously.
 ⇒ **Do not aspirate solutions containing solids (e.g. silver chloride) or sticky substances, which could clog the sample changer's aspiration pump.**
Do not aspirate organic solvents, such as acetone, acetanhydride or dimethylformamide (DMF), which are corrosive to PVDF.

2. If you have a one-pump model (one or two lift stations) of the 717 Sample Changer, you got a rinsing pump only. You can rinse the electrode automatically.

3. If you prefer to aspirate sample solutions by use of an auxiliary pump (e.g. with a non-pump model of the 717 Sample Changer), you cannot use the PUMP command. External pumps (e.g. the Metrohm 772 Peristaltic Pump Unit) are controlled via the 'Remote' interface in combination with the Metrohm 731 Relay Box.

Modify the currently loaded method, according to your equipment.

11.4.1 Rinsing and aspirating in the titration beaker (with two pumps)

This is a very effective way to simultaneously aspirate the titrated sample solution and rinse the electrode.

The aspirating pump starts to aspirate the solution 5 seconds before the rinsing pump starts to operate. While the electrode is rinsed, the excess liquid is aspirated. The sample beaker is emptied.

```

17 | STIR_C | Address | 1 | Stirring rate | off
18 | 5 PUMP | Address | 1.aspir | State | on
19 | 5 PUMP | Address | 1.rinse | State | on
20 | 2 PUMP | Address | 1.rinse | State | off
21 | PUMP | Address | 1.aspir | State | off
22 | LIFT | on tower | 1 | to position | shift mm
  
```

11.4.2 Rinsing and aspirating in a special beaker (with two pumps)

This sequence requires a dedicated rinsing beaker, which is to be moved to the lift station after each titration. With this mode of operation, the shift direction of the rack becomes important. To avoid dripping of excess titrant in yet unprocessed sample beakers, the shift direction has to be changed in the course of the sequence.

Insert a CHANGER command in line 11. Set the cursor in line 11 and press the softkey [Insert line]. Type 'changer' and press <ENTER>.

```

11 | CHANGER Selection 1 Rack name
    | Lift rate 1 25 Lift rate 2 25
    | Shift rate 20 Beaker test mode single
    | Shift direction + On beaker error MOVE_S

```

Set 'shift direction +'. Then remove the blank line 15 with [Delete line]. Modify the method as follows:

```

17 | STIR_C Address 1 Stirring rate off
18 | LIFT on tower 1 to position shift mm
19 | 2 CHANGER Selection 1 Rack name
    | Lift rate 1 25 Lift rate 2 25
    | Shift rate 20 Beaker test mode single
    | Shift direction - On beaker error MOVE_S
20 | MOVE_B Special beaker Waste to tower 1
21 | LIFT on tower 1 to position rinse mm
22 | PUMP Address 1.aspir State on
23 | 5 PUMP Address 1.rinse State on
24 | 2 PUMP Address 1.rinse State off
25 | PUMP Address 1.aspir State off
26 | LIFT on tower 1 to position shift mm

```

11.4.3 Rinsing the electrode in the titration beaker (with one pump)

With one pump per lift station, it is possible to rinse the electrode, but not to aspirate the sample solution in a beaker.

```

17 | STIR_C Address 1 Stirring rate off
18 | LIFT on tower 1 to position rinse mm
19 | 5 PUMP Address 1.rinse State on
20 | 2 PUMP Address 1.rinse State off
21 | LIFT on tower 1 to position shift mm

```

11.4.4 Rinsing the electrode in a special beaker (with one pump)

This sequence requires a dedicated rinsing beaker, which is to be moved to the lift station after each titration. With this mode of operation, the shift direction of the rack becomes important. To avoid dripping of excess titrant in yet unprocessed sample beakers, the shift direction has to be changed in the course of the sequence.

Insert a CHANGER command in line 11. Set the cursor in line 11 and press the softkey [Insert line]. Type 'changer' and press <ENTER>.

```

11 | CHANGER Selection 1 Rack name
    | Lift rate 1 25 Lift rate 2 25
    | Shift rate 20 Beaker test mode single
    | Shift direction + On beaker error MOVE_S

```

Set 'shift direction +'. Then remove the blank line 15 with [Delete line].
 Modify the method as follows:

17		STIR_C	Address	1	Stirring rate	off
18		LIFT	on tower	1	to position	shift mm
19		CHANGER	Selection	1	Rack name	
			Lift rate 1	25	Lift rate 2	25
			Shift rate	20	Beaker test mode	single
			Shift direction	-	On beaker error	MOVE_S
20		MOVE_B	Special beaker	Waste	to tower	1
21		LIFT	on tower	1	to position	rinse mm
22	5	PUMP	Address	1.rinse	State	on
23	2	PUMP	Address	1.rinse	State	off
24		LIFT	on tower	1	to position	shift mm

11.4.5 Aspiration with an external pump

If you wish to aspirate sample solutions containing solids (e.g. silver chloride) or sticky substances, use a peristaltic pump, such as the Metrohm 772 Pump Unit. The pump can be controlled via the 'Remote' interface and a Metrohm 731 Relay Box. See the corresponding user manuals for further information.

In the following command sequence the communication command 'CTRL_Rm' is used to activate (and deactivate) a remote line which controls the external pump, while the integrated rinsing pump of the sample changer rinses the electrode.

17		STIR_C	Address	1	Stirring rate	off
18	10	CTRL_RM	Remote	1	Pattern	*****1
19	5	PUMP	Address	1.rinse	State	on
20	5	PUMP	Address	1.rinse	State	off
21		CTRL_RM	Remote	1	Pattern	*****0
22		LIFT	on tower	1	to position	shift mm

Do not forget to save a modified method in the internal storage or on a data card.

11.5 Sample series

11.5.1 Entering sample data

Before you start the processing of a sample series, weigh in the samples and enter the sample data in the sample silo.
The sample size and unit can be entered directly via data transfer from a balance.

- Press the [Sample silo] softkey on the main page.
- If the sample silo is empty, you can the sample data immediately via data transmission from a balance or manually via keyboard.
- You do not have to begin with line 1. If the sample silo is not empty and you wish to keep the existing sample data, you can place the Input pointer (softkey [--> In pointer]) on the silo line that you want the new data to be entered first. The input pointer will be moved automatically with every new sample size entered.
- Enter identification text via the keyboard.

Sample Silo: NEW.slo

#	Method	Ident1	Ident2	Ident3	Size	Unit
1		000425-001	Lot no. 34/7		0.1235	g
2		000425-001	Lot no. 34/7		0.1242	g
3		000425-001	Lot no. 34/7		0.1413	g
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						

Output pointer < (points to line 1)

Input pointer > (points to line 4)

Switches the softkey list (points to the menu)

QUIT

Remark	File	Un/Mark	Insert line	Copy line(s)	Delete line(s)	Un/Mark all	Edit mode	>>
<-- Out pointer	--> In pointer		Copy line	Cut line	Paste line	Sample idents		>>

Sets the Output pointer (points to <-- Out pointer)

Sets the Input pointer (from balance) (points to --> In pointer)

- Before you close the Sample silo page set the Output pointer [<-- Out pointer] on the silo line, which you want to be processed first.

11.5.2 Preparing the 717 Sample Changer

Set up the lift head of the Sample changer with the tubings needed and the appropriate sensor for you application.

- Prepare the sample according to your application description and place the sample beaker on the rack. It is recommended to use the first rack positions for samples.
- Also place an empty waste beaker on the highest rack position.
- Put the rack on the sample changer.

If the method to be applied does not contain all necessary commands for a complete preparation of the sample changer and the peripherals you can prepare them manually.

- Press the <MAN CONTROL>key on the Titroprocessors keyboard.
- Press the softkey [Sample changer].

```

Devices & Manual Control
Sample Changer
Do Changer      1: ready  [000001]      2: not avail.
Do
Re Rack type/name  M12-0 - 12*250mL
Co max.Beakers    12
Tu
Bu Tower          1                12
Pi Lift pos.[mm]  130             0
Do Beaker pos.     1                12
Se Beaker found    yes             yes
Se
Me Pump           rinse aspir  rinse aspir
Se off off        off off
Ca
Ca Stirrer        1                2
Ca off off        off off
Ca Stirring rate  3                3
Ne
pH <PG UP> lift to shift position
Sl <PG DN> lift to work position;  <HOME> lift to rest position
QUIT
QUIT
Reset Remote Stirrer Pump Lift Lift Shift Shift Shift
lines on/off on/off up down left right to pos.
  
```

This is the presentation of the 'Manual control' page of the two-tower model (two pumps each) of the 717 Sample Changer. Reset the sample rack with the softkey [Reset] first.

To use any manual function of the sample changer with the two-tower model you have to select a lift station. You can do this by using the cursor keys or <TAB>. The selected tower is marked with a rectangle.

- First run the lift to the shift position. Press the <PG UP>key.
- Now you can transport the waste beaker to the selected lift station. Use the softkey [Shift left] or [Shift right] to rotate the rack by one position.

Alternatively you may press [Shift to pos.] and enter the absolute beaker position to rotate the rack.

```

Move beaker absolute
-----
Changer          1
Move beaker      12
to tower         1
-----
QUIT
  
```

	Shift left	Shift right	Shift auto
--	---------------	----------------	---------------

You may chose the shift direction by selecting one of the softkeys [Shift left], [Shift right] or [Shift auto]. Close this window with <QUIT> after the execution of the rotation of the rack.

- Lower the lift to work position by pressing the <PD DN> key.

Now you can prepare the buret (or burets) which you want to use for the sample series. Close the sample changer window with <QUIT>.

```

Devices & Manual Control
-----
Dosing devices at interface A
                                press <TAB> for more
Dos. drive      A1      700    A2      700    A3      ---    A4      ---
Reagent         [redacted]
Concentr.       [redacted]
Tubing          Default
Buret type      20.0mL
Piston position exchange
Dosing status   ready

-----
Sensors at interface A
                                press <TAB> for more
Meas. input     A1      A2      Adiff   AT
Sensor          [redacted]
Cal. sensor     [redacted]
Cal. method     [redacted]
Cal. date       [redacted]
Next Calibr.    [redacted]
pH(as)          7.000
Slope           1.000

-----
QUIT
  
```

Sample changer	Fill all	Fill	Prepare buret	Dosing drive	Empty	STOP	STOP all	Remote lines
-------------------	-------------	------	------------------	-----------------	-------	------	-------------	-----------------

- Select a dosing drive (e.g. A1) with the cursor keys <→> or <←>.
- Press [Prepare buret] to start a preparing cycle for the selected dosing drive. The dosing cylinder and all of the tubings of the buret will then be flushed with reagent.
- Prepare other burets which you need e.g. for adding auxiliary reagents.

If you want to rinse the electrode or empty the waste beaker, open the 'Sample changer' window again with [Sample changer]. Otherwise (if rinsing the electrode is part of the determination method) close the 'Manual control' window with <QUIT>.

```

Devices & Manual Control
Sample Changer
Do Changer      1: ready  [-----]      2: not avail.
Do
Re Rack type/name      M12-0 - 12*250mL
Co max.Beakers        12
Tu
Bu Tower              1                2
Pi Lift pos.[mm]      180            0
Do Beaker pos.        12             11
Se Beaker found       yes             yes
Se Pump              rinse aspir  rinse aspir
Me off               off             off off
Se
Ca Stirrer            1                2
Ca off              off             off off
Ca Stirring rate     3                3
Ne
pH <PG UP> lift to shift position
Sl <PG DN> lift to work position; <HOME> lift to rest position
QUIT
QUIT
Reset Remote Stirrer Pump Lift Lift Shift Shift Shift
lines on/off on/off up down left right to pos.
  
```

To select a stirrer (1 or 2 for each tower) or pump (rinse or aspir for each pump) use the cursor keys.

```

Tower              1
Lift pos.[mm]     180
Beaker pos.       12
Beaker found      yes
Pump              rinse aspir
                  off         on
Stirrer            1                2
                  off         off
Stirring rate     3                3
  
```

Empty the waste beaker:

- Select 'aspir' (2).
- Press the softkey [Pump on/off] to switch on the aspiration pump. The waste beaker will be emptied.
- To switch off the pump press the same softkey again.

```

Tower              1
Lift pos.[mm]     180
Beaker pos.       12
Beaker found      yes
Pump              rinse aspir
                  on         off
Stirrer            1                2
                  off         off
Stirring rate     3                3
  
```

Rinse the electrode:

- Select 'rinse' (1).
- Press the softkey [Pump on/off] to switch on the rinsing pump. The electrode and buret tip(s) will be rinsed.
- To switch off the pump press the same softkey again.

- Empty the waste beaker again, see above.
- Close the 'Manual control' pages by pressing <QUIT> twice.

11.5.3 Setting up the processing of a sample series

- Define the following settings in the status window (press the <STATUS>key):

Status			
Run number	000	Determination name	
Sample silo	on	Next sample	in silo line 4
		Sample entry	in silo line 1
Auto start	on	Current sample	0 of 3
Statistics	on	Data records	0 of 3
Save determ. data	on	Destination	Internal
		Free Memory	95.5 %
Sample changer	1	First rack position	1
QUIT			

- Switch on the sample silo. Then you can see the settings for 'Next sample' and 'Sample entry' which display the location of the Output and Input pointers. The Output pointer could be set to silo line 1 by selecting Sample silo 'rst' (=reset).
- 'Auto start' has to be switched on for a sample series. Define the number of samples to be processed. You can also select '*' for an infinite number of samples, 'Silo' to process all samples in the Sample silo or simply 'Rack' to process all samples placed on the sample rack. With '*' the the Titroprocessor will not stop automatically. It will process every sample beaker found on the rack (even the already processed ones). You will have to stop the sample series manually (<STOP>). With 'Rack' the 796 Titroprocessor will stop the sample series after one complete turn of the sample rack.
- It is recommended to switch 'Statistics' on for a sample series. The determination data will then be stored temporarily in the working memory and may be re-evaluated and re-calculated if needed. The number of data record may be set up to 20. With every new complete sample series the statistics counter is reset. It may also be reset manually by 'Statistics rst' (= reset).
- You may want to save the determination data and results permanently for backup purposes. Select the destination 'Internal storage' or 'Data card'. The file name of the determination records will be set automatically according to the configuration settings. See the user manual (p. 35) for details.
- Select the sample changer address '1' and define the rack position of the first sample beaker of your sample series.
- Close the status window with <QUIT>.

It is a good idea to check whether the appropriate method is loaded. If not press the <METHOD>key and select the appropriate method.

11.5.4 Executing a sample changer method

If you have all setup as described above, you may start the sample series. Three action keys can be used to control the processing of a sample series. You can find them in the upper right corner of the Titroprocessor's keyboard:



- To start the sample series press the <START>key.

On the main page of the 796 Titroprocessor you can see the 'Trace window' where the course of the method can be visually monitored. Each command that is currently executed will be displayed.

The 717 Sample Changer will be reset first, e.i. the lift(s) will be run to the rest position and the sample rack will then be rotated to take the initial position (position 1). The magnetic rack code will be read to identify the type of rack.

With every MOVE command a so-called 'beaker test' is executed. Infrared sensors will detect the presence of a beaker at the target lift station. If no sample beaker can be detected, the next beaker will be moved or a error message will be displayed, according to the settings of the CHANGER command ('On beaker error'). See CHANGER command in the user manual. If a **special beaker** or the **first sample beaker** is missing, an error message will be displayed anyway and the course of the method will be stopped.

A sample series can be cancelled with the <STOP>key. Use the <STOP>key for emergency stops.

A sample series or a single determination can be temporarily interrupted and continued.

- Press <HOLD CONT> to interrupt the course of a method. While a method run is interrupted you can edit the parameters of a method. Modifications made are applied with the next run of the method.
 - Press <HOLD CONT> again to continue the course of the method.
-

It is possible to cancel the execution of a single command in a method sequence. This may be appropriate not to cancel a titration whose stop conditions can not be reached for any reason.

To cancel a single command press <SKIP> (= <Shift> and <HOLD CONT>). The course of the method will be continued with the next following command in the method sequence.

If you wish to cancel a sample series, but want the current running method run to be finished properly, press <DELAY STOP> (= <Shift> and <STOP>).

If you wish to cancel the current method run and want the next sample to be processed immediately, press <NEXT START> (= <Shift> and <START>).

11.5.5 When the sample series is over

When the sample series is finished, the determination data and results (up to 20 determinations) are stored in the working memory, if you switched on the statistics function. Along with the measuring point list, the sample data, common variables and parameters for the re-evaluation of the titrations are stored in the determinations files. See the user manual for re-evaluation and re-calculation of determination data or statistics functions.

If you did chose to not save data automatically, you can use the Titroprocessor's file manager to store any currently existing determination data record on a data card or in the internal storage of the 796 Titroprocessor, see the user manual for this task.

It is recommended to reset the sample silo for later use.

- If you wish to document the content of the sample silo first, just press the <PRINT>key and [Global reports]. Select 'Sample Silo' from the displayed selection list and press <ENTER>. Close the print menu with <QUIT>.
- Press [Sample silo] on the main page or the <SAMPLE>key to open the silo.
- Press [File] to open the file dialog window. You may now save the silo content on a data card or the internal storage for future use or load a previously saved silo file. If you press [New], the sample silo will be cleared and the pointers be reset.