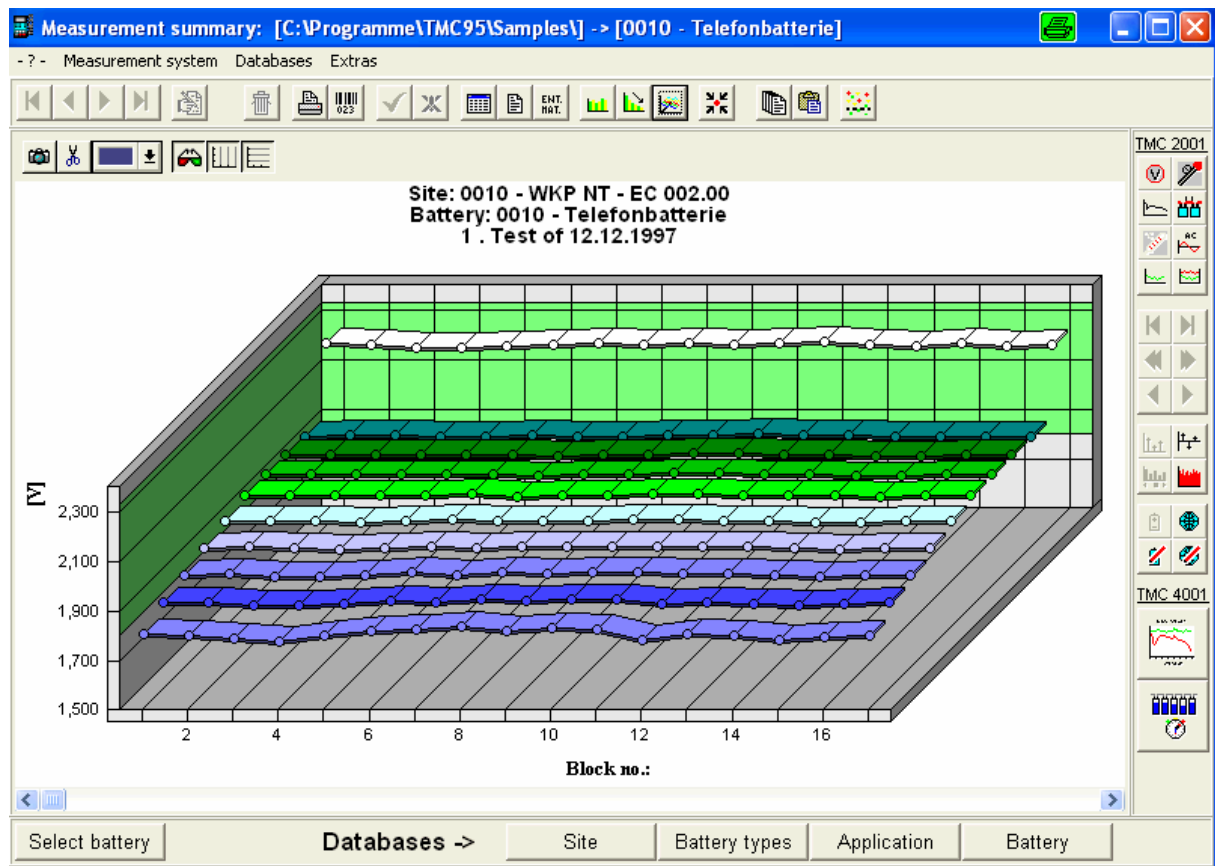


TMC 95 V2.00

Battery – Management – System



Manual Software-Description

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1. Introduction

1.1. About this Software

The Software TMC 95 V 2.00 was written for Windows 9x / ME / Windows NT 4.0 / 2000 and Windows XP operating systems. It incorporates data handling and evaluation routines for the TMC2001, TMC4001/127/63/31/19“ and the former MMC measuring systems within a shared interface so that all parts of the program can process a shared set of data.

1.2. What hardware is required?

- PC with Pentium processor
- 32 MB of RAM memory
- 100 MB of free space on hard disk
- Color monitor with resolution of 800 x 600 dots per inch
- CD-ROM drive for installation
- One Com- port (RS232) available

1.3. What advance knowledge is required?

Basic knowledge of the Windows 95 user interface is needed. Since the program's user interface incorporates many Windows 95 procedures, new users can learn the system very rapidly.

1.4. Validity of this manual

This manual is valid for the TMC95 V2.00 software. It exclusively describes and explains the software functions. The, to the PC connected and with this software operated measuring systems (see 1.1) are **NOT** covered by this manual. Separate manuals are dedicated to these measuring systems and must be taken into consideration especially in regards to the safety requirements.

We reserve the right to impose the following limitations:

- We reserve the right to make alterations and changes in the said system and to make changes in the information included in this manual without notice.
- We do not accept responsibility for damages of any type occurring in the use of the test system and/or occurring due to the fact that employment purposes could not be performed. The manufacturer can, in no case, be held responsible for direct damages, indirect damages or subsequent damages which occur to the customer by employment or non-employment possibilities of the product.
- The programs may neither be copied nor duplicated. Even though we have taken the utmost care in the preparation of the program and this manual, malfunctions can still occur in the program sequence which we cannot take responsibility for.
- Should a part of the guarantee specification be invalid the laws and ordinances of the Federal Republic of Germany are valid.

2. Installation

To install the TMC 95 software, use the included CD-ROM having the following directory structure:

Folder/Directory	Content	Description
\BDE	BDE.exe	Installation file for BDE- Administrator
\TMC_deutsch	Setup.exe	Installation file for the German software version
\TMC_english	Setup.exe	Installation file for the English software version
\TMC_svenska	Setup.exe	Installation file for the Swedish software version

Start the installation by executing the setup.exe file from the folder corresponding to your desired language e.g. by:

Start, Run, *drive*:\TMC_english\setup.exe

where *drive* represents the character that designates your CD-ROM drive.

Follow the instructions of the installation wizard as it steps you through the installation procedure.

After you have rebooted your system as instructed by the wizard, the TMC 95 icon will appear.

The installation routine places the TMC 95 files in the following folder:

C:\Program Files\TMC95

In networks running Windows XP, 2000 or NT, it may be necessary for you to ask your system administrator for assistance.

3. Common software components

3.1. Software structure

This program package is database-oriented. A main database includes the following sub-databases:

Database	Usage
• Site	Defines the battery location e.g. substation XY, turbine hall...
• Battery Types	Defines the different battery types such as 2 OPzS 100 including its technical data as capacity, discharge time...
• Batteries	Defines a at a previously defined site existing battery e.g. 12-cell 2OPzS 100. This means, batteries can't be defined without having sites and Battery Types defined
• Usage	Describes the battery's applications such as UPS, communication, protection and control. It is not mandatory to use Usage.

Prior to receive data from the measuring systems these databases must be defined or filled with data respectively. Hereby the usage/definition of at least one main database is required by the system. There might be circumstances where the usage of more than one main database is an advantage.

Example: You are responsible for several service areas and a TMC 2001d is used in each of them. In that case you could define one main database per service area. That would mean that in the main database "service area A" only the, to that one dedicated sites, batteries, measurements etc. appear there. In regards to this please take into consideration that only one main database can be stored in the TMC 2001d data logger.

This fundamental considerations and definitions should be made in the very beginning of the establishing process of the TMC 95 software and the TMC- measuring systems. A later change of a once defined and with measurements filled structure is probably difficult or maybe even impossible.

3.2. Main databases

During the Installation of the software the following main databases are created:

- Databases

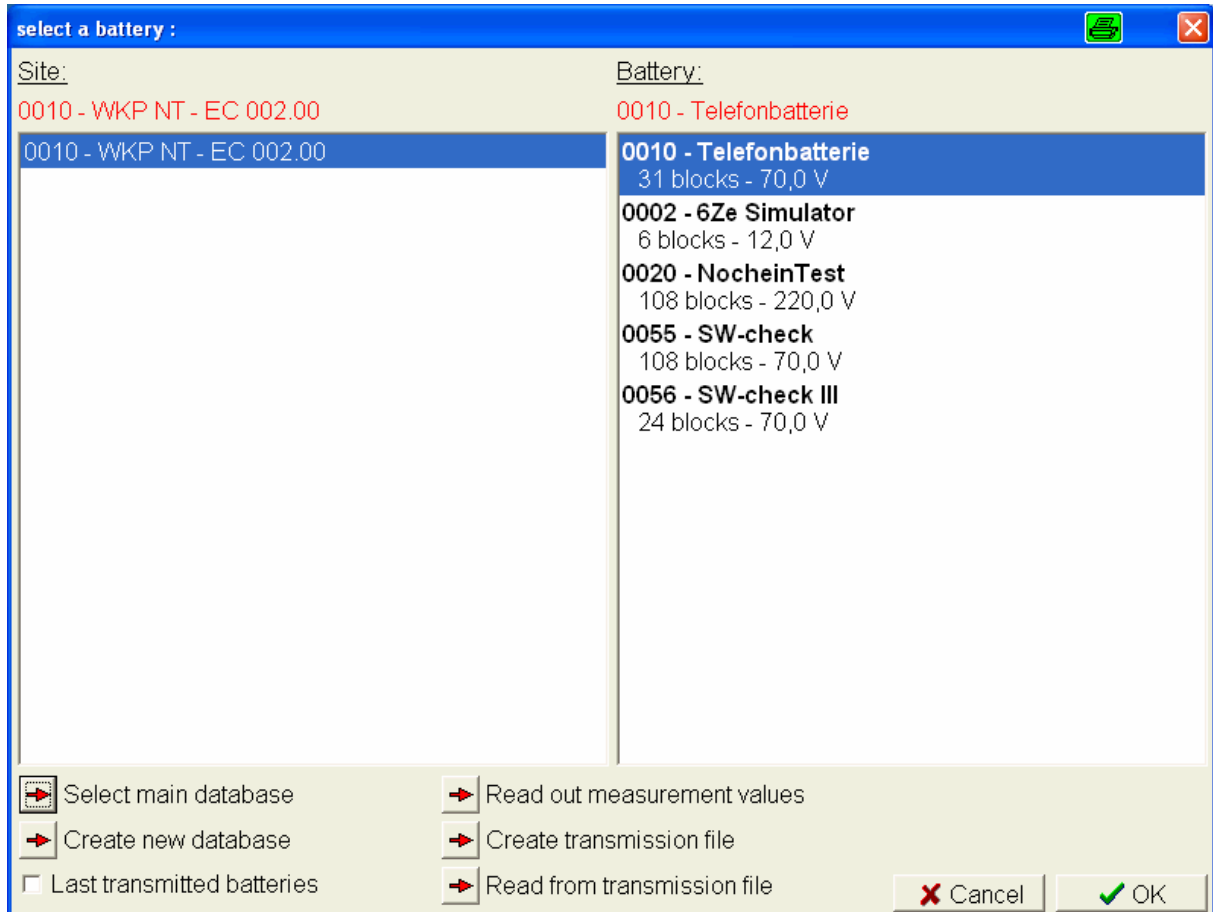
This is an empty database, for real usage. But it is recommended to define a new one with a for you significant name.

- Samples

It contains samples for demonstration and training purposes. Your own databases should NEVER be defined into this one due to the fact that „Samples“ will be overwritten during a re-installation or when installing an update.

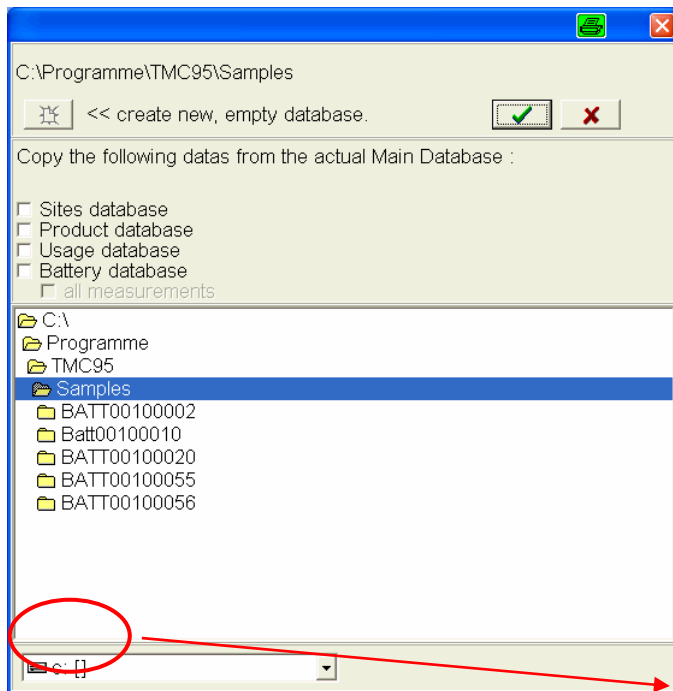
Any time the software is started the battery selection window appears showing the batteries of the last selected main database.

On the left hand side of the window all sites of this main database are displayed. On the right hand side all batteries of the highlighted site are shown. The image below shows the content of the "Samples" database. By clicking on [OK] the selection will be confirmed and you proceed to the "Measurement summary" window. All data and measurements of the so selected battery and the analysing and reporting tools are available there.



Define a new main database:

As stated before this should be your first step when starting the TMC 95 software the very first time. Click on the arrow button next to „Create new database“ in the lower part of the window and the following window appears.



By double-clicking you can move through the folder structure. A white window background indicates, that the selected folder contains a database already. In such a folder it is not possible to define a new database.

Select a drive and a folder where the new database shall be created in.

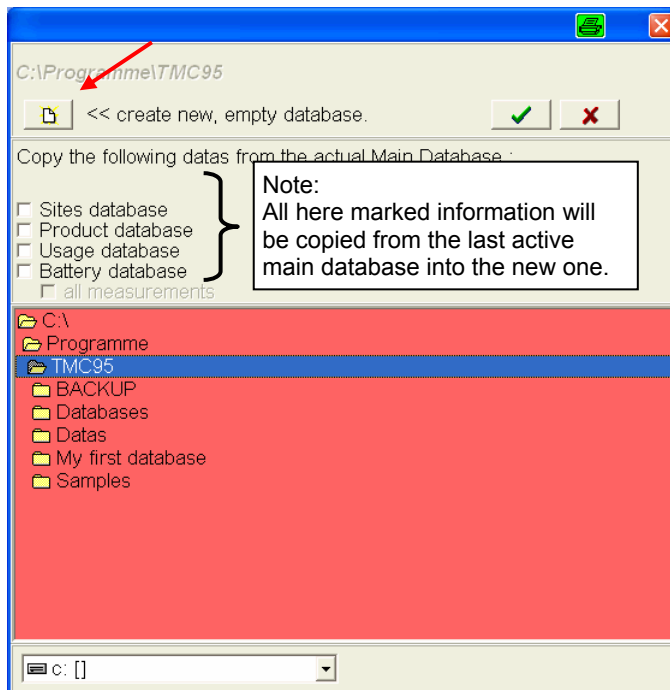
The drive selection is done via the pull-down- menu at the lower part of the window.

Note: You must double-click!



Mapped network drives can also be selected but you don't have access to the network neighbourhood here.

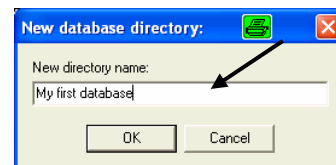
Note: Only one user at a time can access the database. TMC95 is not a multi-user .



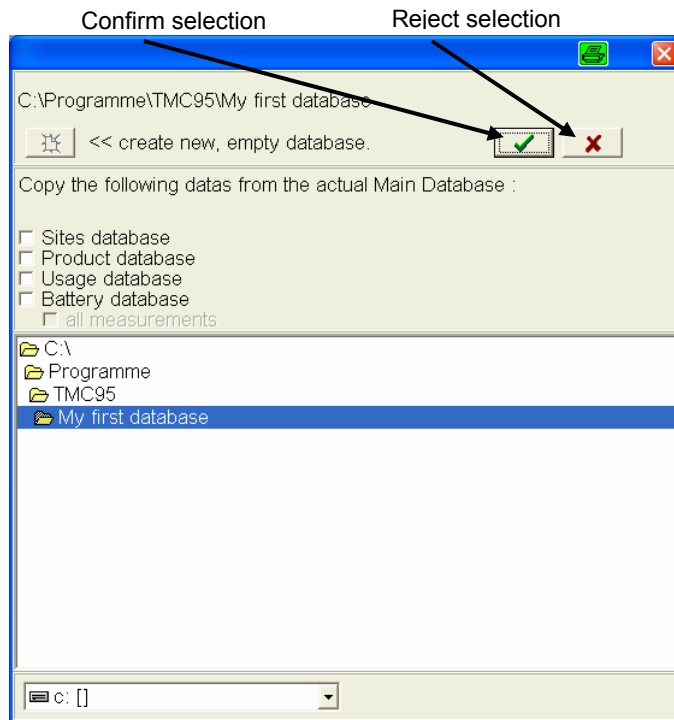
A red window background indicates permitted areas for databases.

Click on the button „<< create new, empty database“

The following window appears.

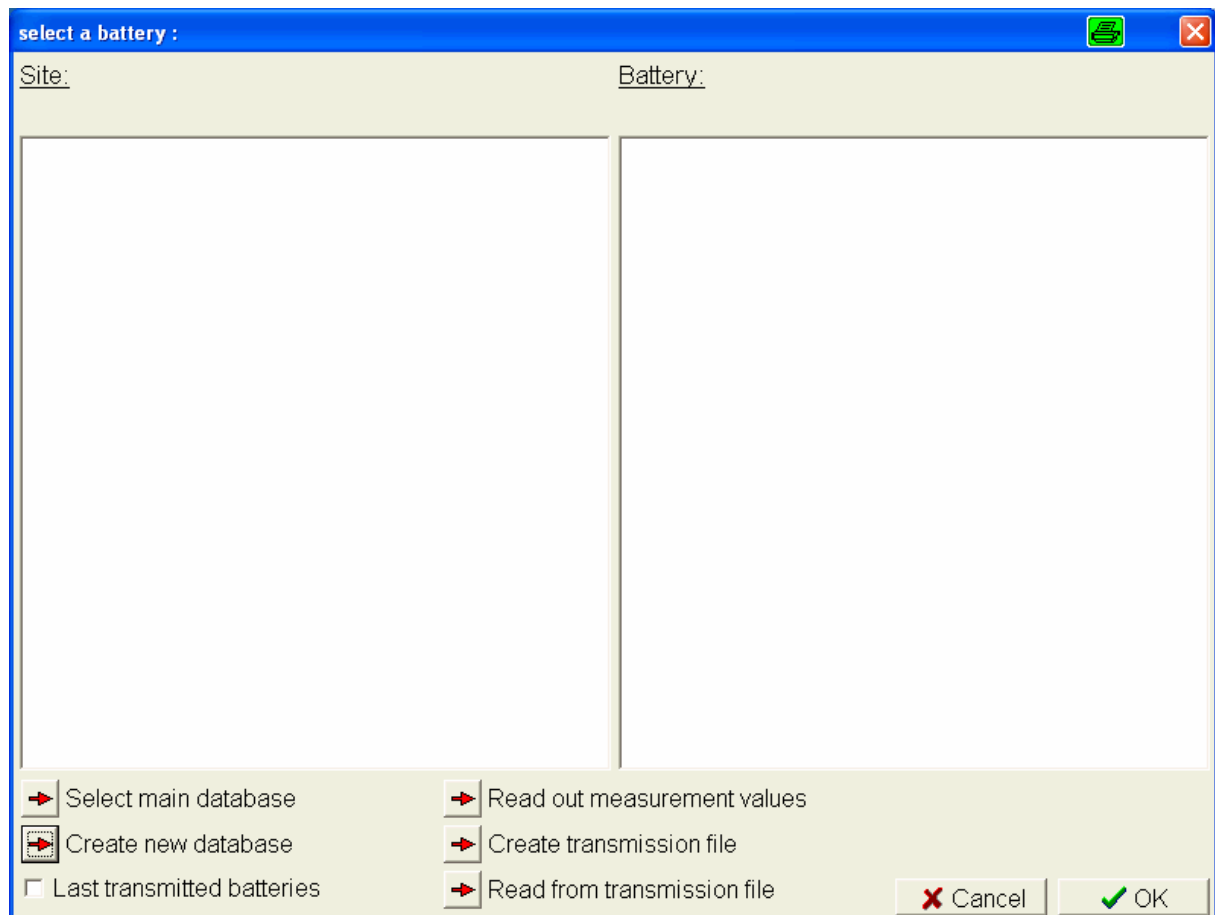


Name your database and click on [OK]



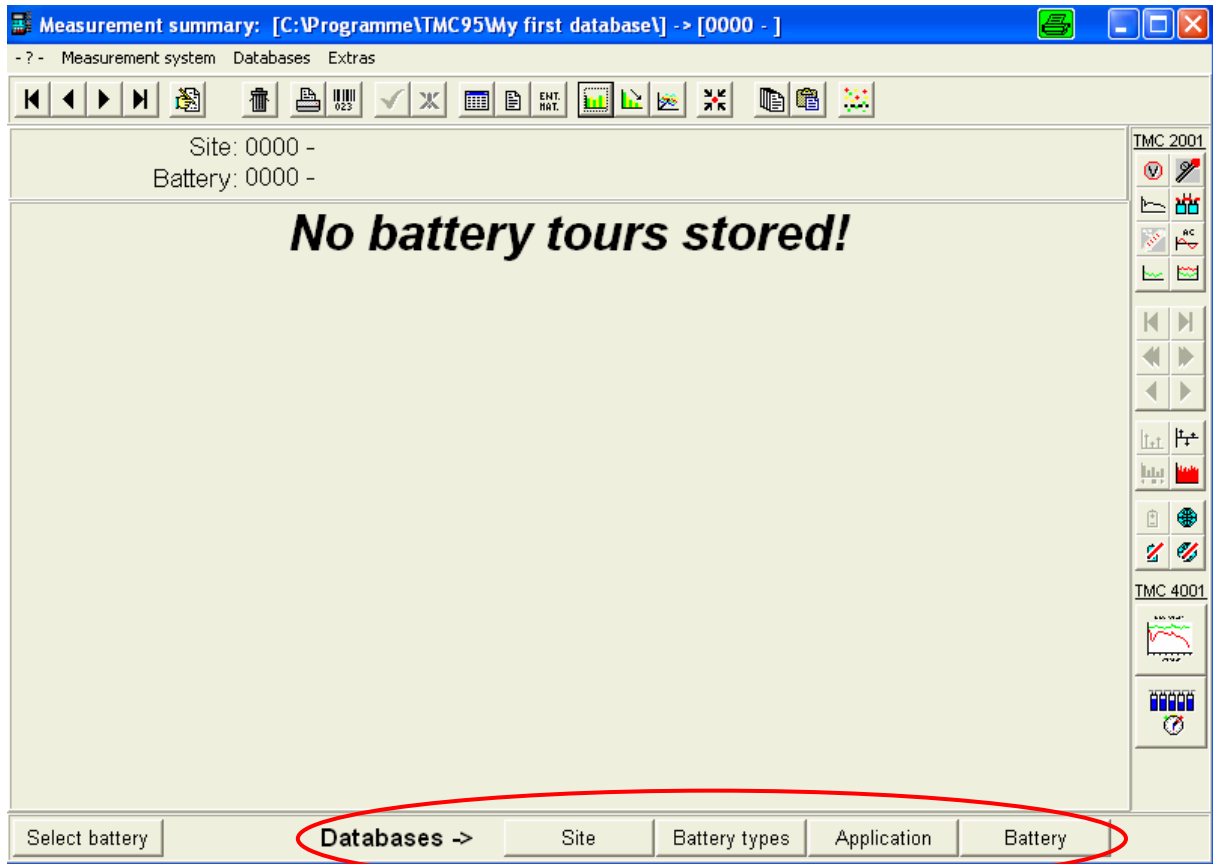
The new database is created now. By clicking on the button „Confirm selection“ it will be selected.

The battery selection window for this new Still empty database appears.

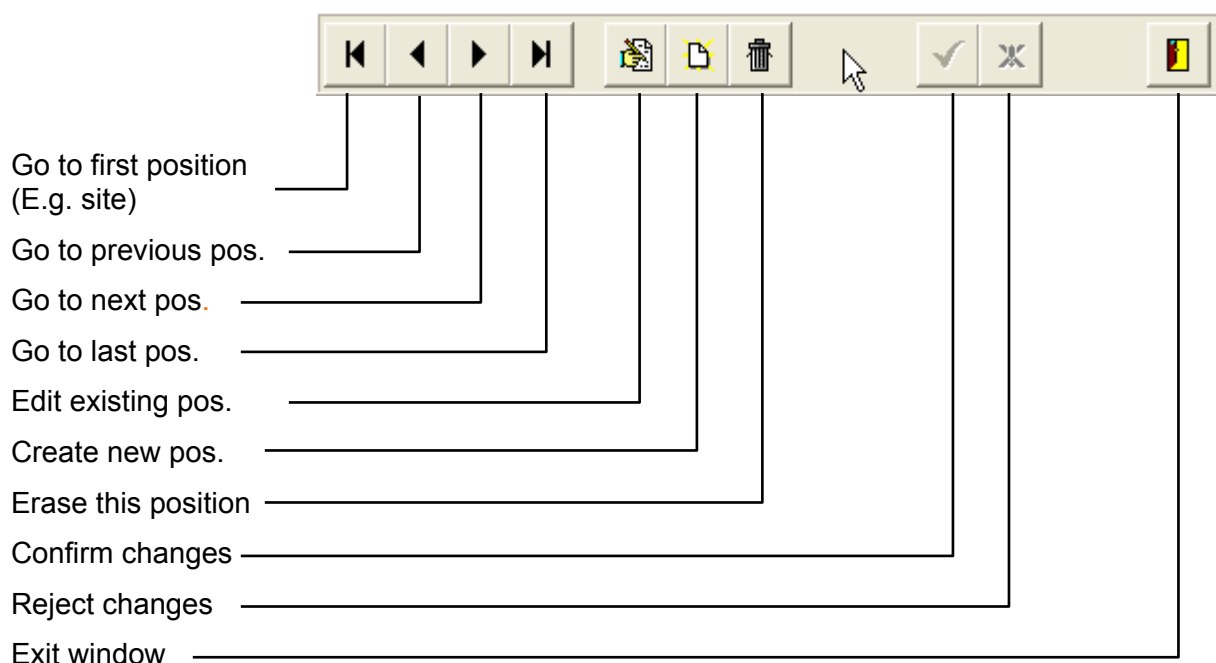


Click [OK] to continue and to fill the database with all relevant information.

Now you are in the analyse and measurement window called „Measurement summary“. In a next step the databases for your sites, battery types, applications and batteries will be defined here.

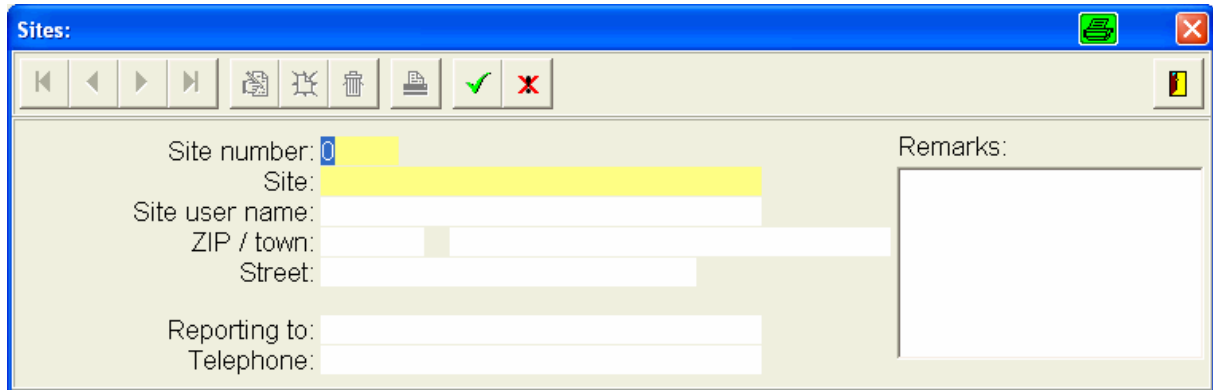


All database menu windows have the following icons in its toolbar.



Site

Now select the "Sites" option in the "Database" menu, whereupon the following window will appear:



The screenshot shows the 'Sites' window with the following data entered:

Site number:	0	Remarks:	
Site:	[Yellow highlight]		
Site user name:			
ZIP / town:			
Street:			
Reporting to:			
Telephone:			

When you have clicked on the "Create new site" icon, you can type information about the site into the entry fields.

All data about the site will be stored under a "Site number" (which can contain a maximum of four digits, with leading zeros omitted if so desired). This site number must also be entered when measurements are taken using (for example) the TMC2001d. Here, the site number must be specified before measurement starts, thereby enabling the collected measurement values to be arranged correctly.

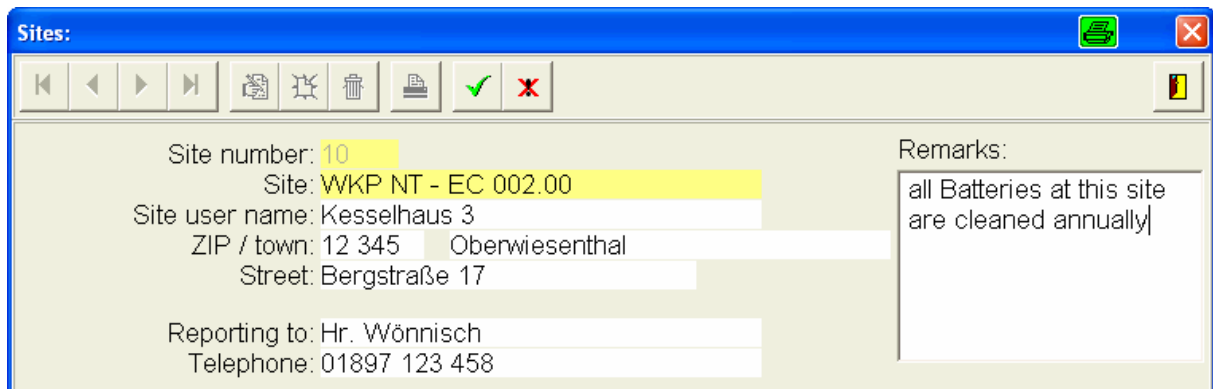
For this reason a site number can only be used once within a main database. If by mistake it is tried to use a site number twice the software will not accept it. A message showing the hint to select another number will pop up in that case.

You can enter a maximum of 9999 different sites. Moreover, you can change them at any time and then click on the "Edit entry"- button.

Site numbers are in numerical format. The entry field „Site“ can be used to maintain your already existing site names. Both site number and site name will be shown on the TMC 2001d display when selecting the battery to test.

The yellow entry fields require mandatory information.

Example:



The screenshot shows the 'Sites' window with the following data entered:

Site number:	10	Remarks:	
Site:	WKP NT - EC 002.00		
Site user name:	Kesselhaus 3		
ZIP / town:	12 345		Oberwiesenthal
Street:	Bergstraße 17		
Reporting to:	Hr. Wönnisch		
Telephone:	01897 123 458		

After all data is entered and confirmed (green check-mark) it will be saved automatically and the window can be closed.

3.3. Battery types

Next, you must enter all of the battery types encountered at the site.

To accomplish this select the "Battery type" option in the "Database" menu in the main window, whereupon the following window will appear:

Battery types:

Battery type: 6 GroE 600
Design: PB
Producer: Hagen

Limits :	Absolute :			Relative :		
	Min.:	Max.:		Min.:	Max.:	
Float voltage :	2,18	2,33	V	-20	50	mV
Gravity :	1,21	1,24	kg/l	0	0	kg/l
Temperature :	15	25	°C	0	0	°C
Connector :	0	0	mV	0	0	mV

Discharge Test parameters :

Test time : 10 h
Capacity : 600 Ah
Current : 60 A
End voltage : 1,8 V

<< Additional datas :

Block topology :

Volt. meas. points : 1
Gravity meas. points : 1
Temp. meas. points : 1
Connector meas. points : 1

Only used for test with TMC 4001

Fill in this field if you are going to perform tests with TMC2001 or TMC 4001

Advice: Have this field set to 1

If there are batteries of the same types but of different brands, we recommend that you assign one or more letters to the battery types, thereby identifying the manufacturers and enabling the system to recognize them.

These entries can be confirmed/accepted in the usual way—or rejected (canceled) by clicking on the appropriate icons.

Limit values for the different types of battery can only be changed in this window. All TMC measuring systems will make use of these limits.

As decimal separator please use the same symbol as set in your Windows operating system.

Data concerning „Block Topology“ can only be entered after clicking on the „Additional Data“ button.

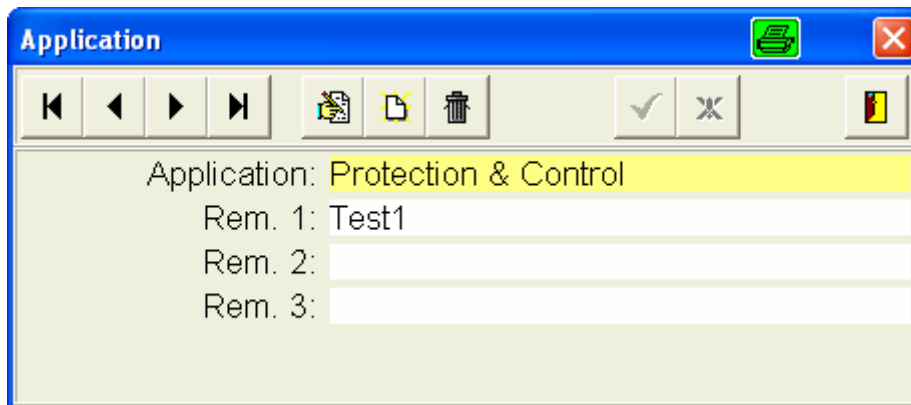
Note: We recommend that you always have Volt. Meas. Points set to 1 even if a block has more than 1 measurement points. Then in Battery's window (see below) specify the total number of measurement points of the battery instead of number of blocks. This allows

batteries consisting of blocks with different numbers of cells to be handled and the software presents the results as a series of measurement points anyhow.

Via the appropriate icons, you can (as in all entry windows) scroll through the already-entered battery types.

3.4. Application

The program allows you to assign usage for a battery from a list. To define the different usages you must select the "Application" option in the "Database" menu, whereupon you can confirm/accept the window entries:



The following are examples of usages:

- Control-system battery
- Telephone battery
- UPS battery

3.5. Battery

When the site, battery types and usages are properly filled in the corresponding databases, you can specify individual batteries.

When you select the "batteries" option in the "Measurement summary" window in the "Database" menu, the following window appears:

Battery id: 1	Blocks per batt.: 31
Battery name: Prot & Ctrl #1	<input checked="" type="radio"/> Meas. point count direction minus to plus <input type="radio"/> Meas. point count direction plus to minus
User name:	
Site: 0010 - WKP NT - EC 002.00	Last: Tour: 23.05.1996 Test: 01.02.1997
Batt. type: 6 GroE 600	
Application:	
Location data Additional data Remarks	total voltage [V]: 70
Building: 10kV Substation	Min.: Max.:
Room: Y01.03	for test [V]: 55,8 72,23
Floor: 01	for tour [V]: 67,58 72,23
Tour no.:	

Most of the buttons are now known from previous windows.

After clicking on the "New" icon, you can confirm/accept the following entries:

Battery ID:

For all of the batteries that are involved, you must first establish a systematic numbering scheme to which you adhere throughout. This will facilitate accurate, well-organized collection of measurement values for the individual batteries. A battery ID can contain a maximum of 4 digits. Leading zeros can be omitted.

Battery name

Any alphanumeric designation can be typed in here. You might enter a designation such as AKZ, KKS or simply 220 V Battery 1 (for example).

User name

If the battery has a second name, it can be entered here.

Blocks / mp per batt

The number of blocks or number of measure-points at the battery has to be entered here.

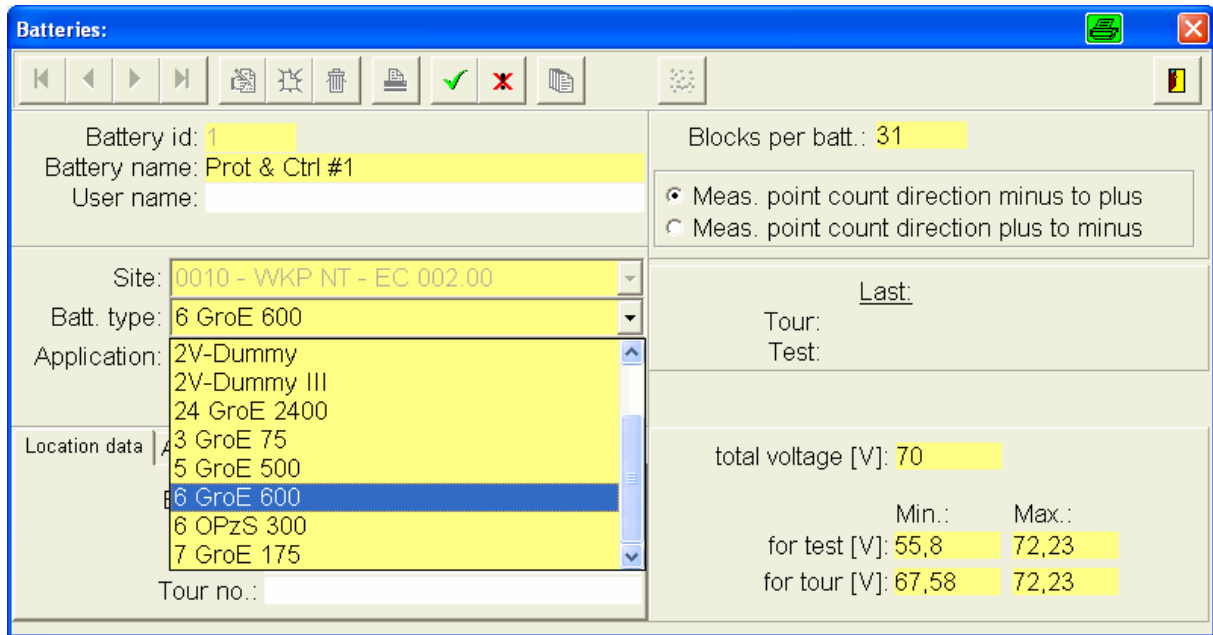
Note: If Volt. Meas points in "Battery Types" window is set to 1, you can treat this field as total number of measure points at the battery instead of number of physical blocks. We recommend this since

- TMC 95 presents the results as a series of measurement points
- it enables batteries having blocks with different numbers of cells to be handled.

Counting direction

You can set "Counting direction from plus to minus" or "Counting direction from minus to plus" in order to get cell/block numbering according to company standard. This is only important for testing with TMC4001 where you always must connect the first channel to the negative terminal of the battery.

Since you have previously specified sites, battery types and usages, you can now easily select the desired entries by opening the appropriate pull-down menu as shown in the following example:



The numeric items of information in the column headed "last" opposite the words "tour" and "test" are updated automatically.

The target total (float) voltage and the lowest and highest total voltage limits can also be entered.

Example of values for a Lead –Acid battery with 12 cells:

Target total value: $2.23 \text{ V} \times 12 = 26.76$

Min. total voltage for tour: $2.21 \text{ V} \times 12 = 26.52 \text{ V}$

Max. total voltage for tour: $2.25 \text{ V} \times 12 = 27 \text{ V}$

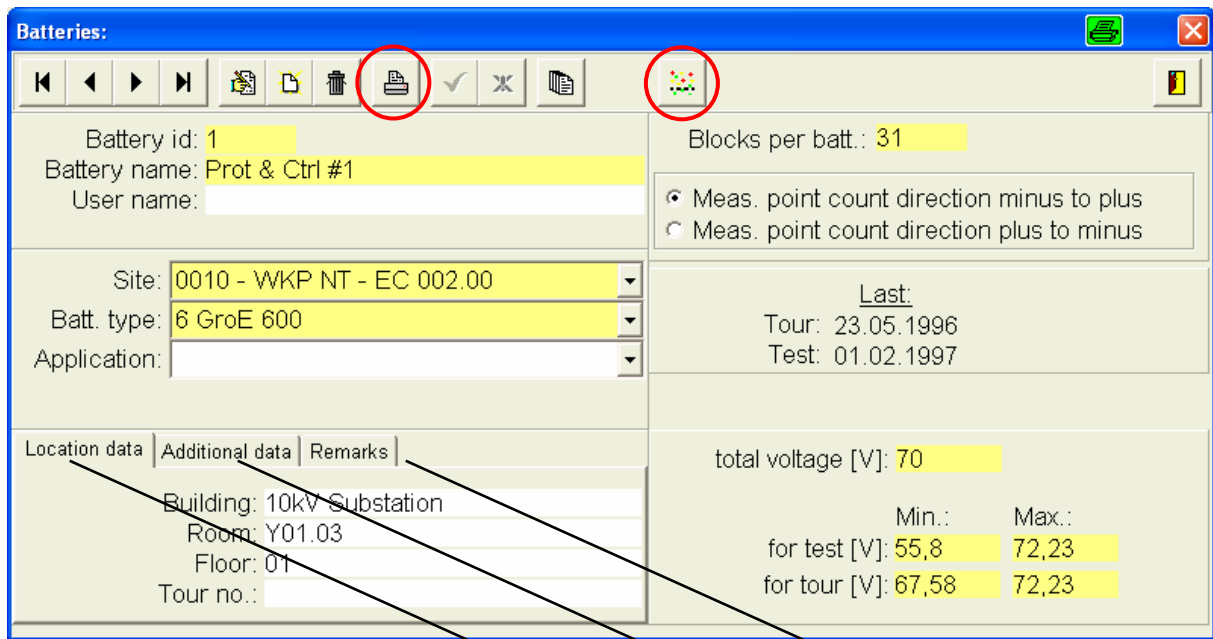
Min. total voltage for test: $1.8 \text{ V} \times 12 = 21.16 \text{ V}$

Max. total voltage for test $2.25 \text{ V} \times 12 = 27 \text{ V}$.

The total voltage limits are automatically filled in when you specify the number of blocks/measurement points during creation of the battery. The values are calculated from the float voltage and end voltage values specified for the battery type. You can change the total limit values whenever you want later on.

Appropriate text fields are provided for entering location data, additional data and remarks.


Note: Regarding Date Format, the TMC95 program expects date to be entered according to the "Short Date Format" set in your Windows operating system. You can check this at by clicking Start, Settings, Control Panel, Regional Options, Date (Windows 2000).

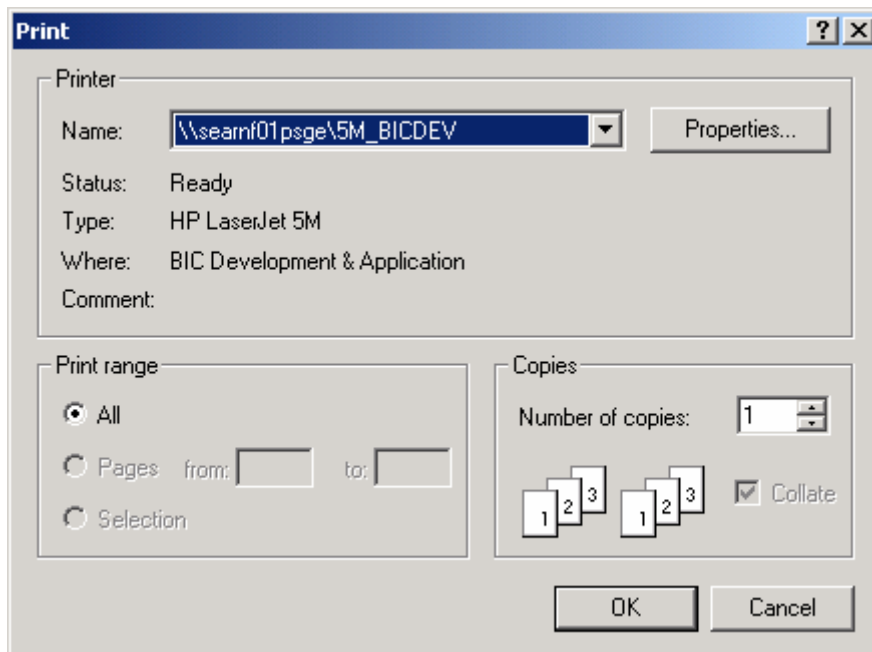



Click here for further information about location data, additional data and remarks.

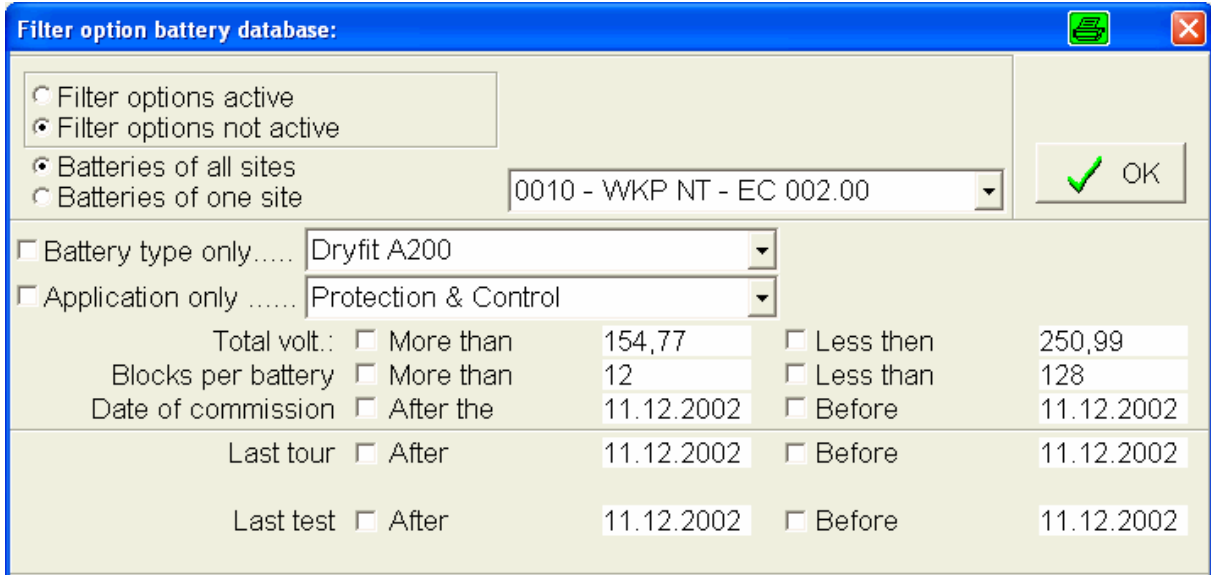
3.6. Additional functions

Some database windows display as shown above additional buttons:

Clicking on the printer button  the Windows-printout window appears.



In the "Battery" window there is an icon  on which you can click to open a window containing an assortment of filters from which you can make a selection. These filters place limits on the number of batteries displayed.

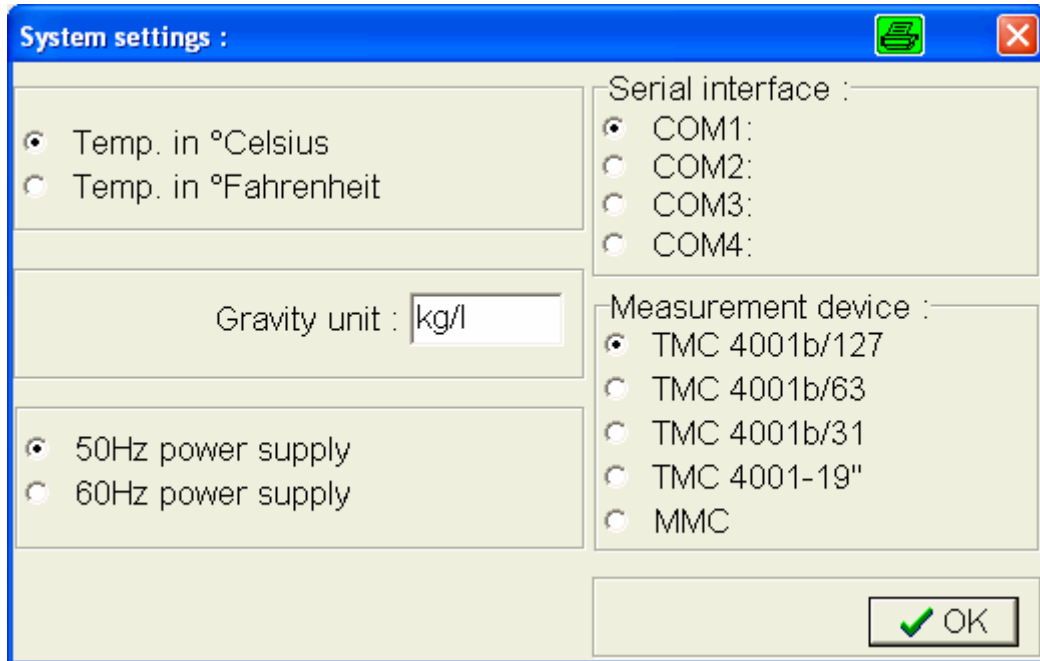


<input type="radio"/> Filter options active				
<input checked="" type="radio"/> Filter options not active				
<input checked="" type="radio"/> Batteries of all sites	0010 - WKP NT - EC 002.00			<input checked="" type="checkbox"/> OK
<input type="radio"/> Batteries of one site				
<input type="checkbox"/> Battery type only.....	Dryfit A200			
<input type="checkbox"/> Application only	Protection & Control			
Total volt.:	<input type="checkbox"/> More than	154,77	<input type="checkbox"/> Less than	250,99
Blocks per battery	<input type="checkbox"/> More than	12	<input type="checkbox"/> Less than	128
Date of commission	<input type="checkbox"/> After the	11.12.2002	<input type="checkbox"/> Before	11.12.2002
Last tour	<input type="checkbox"/> After	11.12.2002	<input type="checkbox"/> Before	11.12.2002
Last test	<input type="checkbox"/> After	11.12.2002	<input type="checkbox"/> Before	11.12.2002

You can determine the selection criteria by clicking on the appropriate check-mark fields and entering the desired values.

3.7. System settings

In the Window „Measurement summary“ from the menu „Extras“ select „System settings“
Following window appears.



Temperature: Select unit

Gravity: Select unit

Mains-frequency: This selection is relevant for measurements performed using a device of the MMC and TMC 4001- series.

ATTENTION:

When TMC95 is used together with TMC 4001 it must be adjusted to the appropriate mains frequency. Otherwise correct measurements are not possible!!!

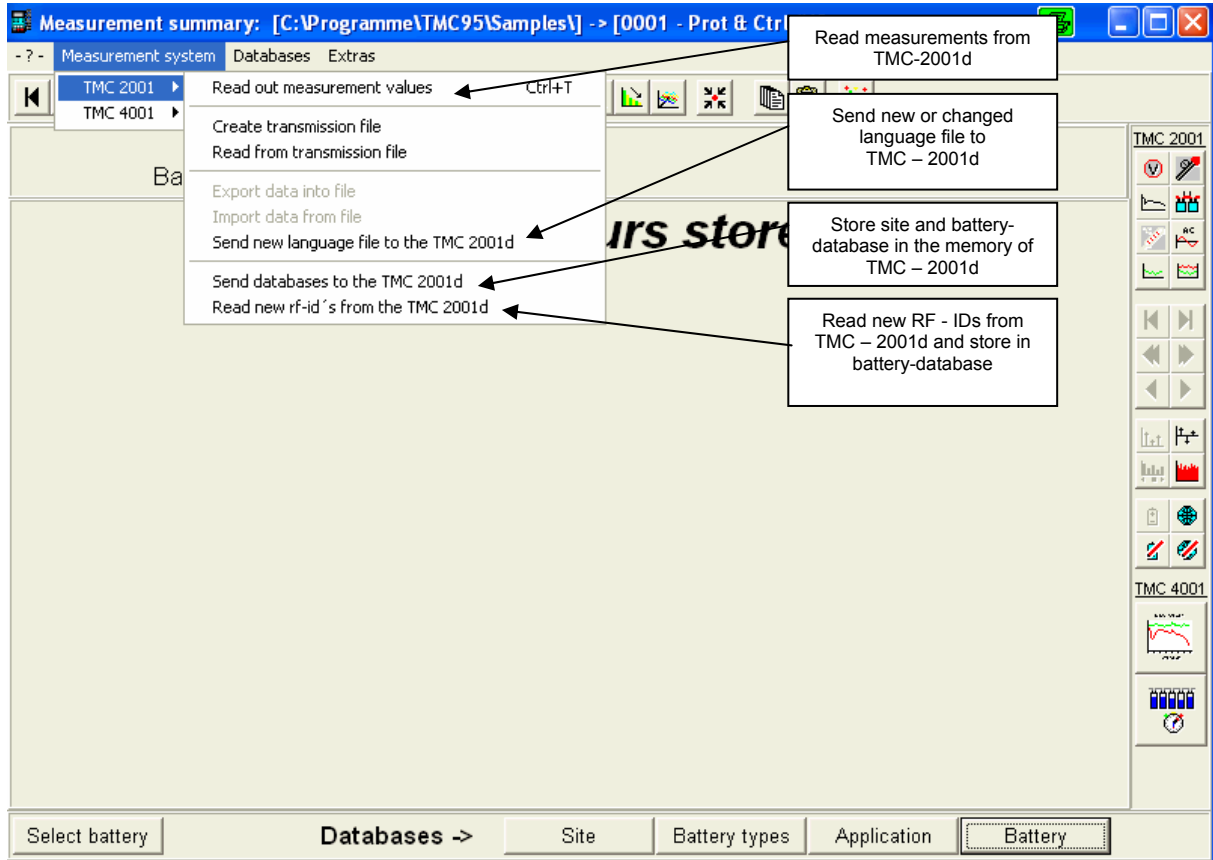
Measurement device: Select the device you will use. This selection is not relevant for TMC 2001

In this same window, you specify the serial port for transmission of measurement values.

4. TMC2001d measuring system

4.1. Data transmission

As soon as the measuring system is selected, the data transmission can be started.



Connect the TMC2001 to the in system settings selected port and turn it on. For all data transmissions (upload & download) you must not invoke any submenu in the TMC-2001.

After any change or new entries in the databases a “Send databases to the TMC 2001d” should be performed. Doing so ensures that for testing latest data is stored in the data logger. Hereby the databases sites and batteries in the data logger will be overwritten with the information from the momentary selected main database. Make sure that measurements have been read out in advance.

Data is transmitted fully automatically. After transmission is completed, you can turn off the TMC2001 and disconnect it from the computer.

During transmission of measurements from TMC2001, you are asked via an entry window to specify any other items of information that may be useful in connection with measurement.

Note: A voltage measurement (tour or test) will not be accepted if the number of voltage measurement values from TMC2001 not conforms to number of measurement points defined for the battery in the PC. For temperature and gravity measurements there is no restriction on number of measurement values.

Transmission files

A transmission is a PC-file containing the measurements in your TMC2001. It is useful

- as a backup if for some reason reading of the measurements into the battery database fails
- if you want to input the measurements also into another database in another PC. This can be the case if several persons are traveling around with their laptops but have a central master database at the head office. The laptops have copies of the master database and are mainly used for on-site evaluating and reporting. Transfer of the measurements must be done also to the master database in order to keep it updated. Changes of the sites, battery types and battery databases may only be done in the master database

The function "Create transmission file" creates a file on your PC. You can then mail or copy this file to another PC and use "Read from transmission file" option to get the measurements into the database in that PC.

This feature also permits you to store temporarily data from an unsuccessful transmission (designated "Failed") and then read it in again.

Note: The functions "Send new language file..." and "Send databases to.." are not possible with TMC 2001, TMC2001d is required. The function "Read new RF-Id.." requires a TMC2001d equipped with the RF-Id option.

4.2. Select battery

Select a battery, for analysis or reporting from the battery selection window. That can be reached by clicking on the „Select battery“ button in the „ Measurement summary“ window or at any time the software is started.

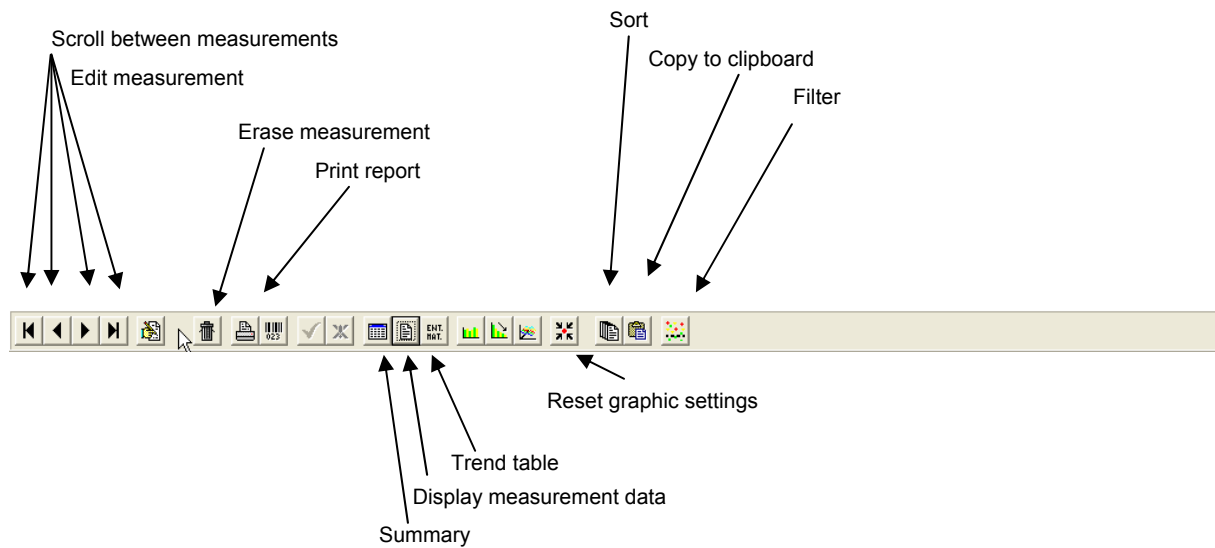
4.3. Evaluating measurements

The collected measurement values can be evaluated in table form and also through graphic processing.

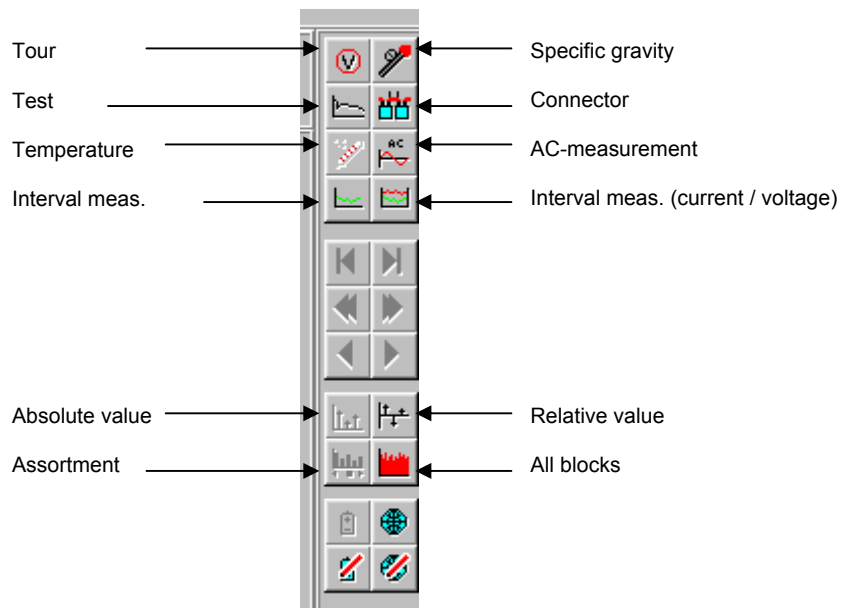
4.3.1. Evaluation in table form

When you exit from the "Battery" window, you proceed to the "Measurement summary" window, which is explained below.

The icons used for graphic presentation are explained further on.



The icons in the right-hand column in the display are of the radio-button type:



You can print out a sample test report for the selected tour (inspection tour). Select using the directional (arrow) buttons.

Example:

Test Report:

Battery Tour

Site:	WKP NT - EC002.00	Battery main volt. /total volt.:	70,0 V/67,8 V
Site number:	10	Umin at cell/block :	2,000 V/at cell/block no. 9
Street:	Bergstraße 17	Umax at cell/block :	2,500 V/at cell/block no. 7
Town:	12 345 Oberriesenthal	Uaverage :	2,187 V
Battery name:	Telefonbatterie	Min. gravity at cell/block :	1,230 kg/l at cell/block no. 1
Battery id:	10	Max. gravity at cell/block :	1,240 kg/l at cell/block no. 8
Blocks:	31	Electrolytic fluid temp.:	_____ °C
Date of commission:	01.03.1992	Electrolytic fluid :	<input type="checkbox"/> OK <input type="checkbox"/> not OK
Product :	6 Gro E 600	Test results :	
Battery kind :	PB	Battery status :	<input type="checkbox"/> OK <input type="checkbox"/> not OK
Date of testing:	04.05.1994		<input type="checkbox"/> needs maintenance
Testing no.:	TestNo 123 - 456		<input type="checkbox"/> needs repair
Examiner:	Lütke		<input type="checkbox"/> _____

No.:	V	°C	kg/l
1:	2,100	20,0	1,230
2:	2,200	20,0	1,230
3:	2,100	20,0	1,230
4:	2,300	20,0	1,230
5:	2,100	20,0	1,230
6:	2,300	20,0	1,230
7:	2,500	20,0	1,230
8:	2,100	20,0	1,240
9:	2,000	20,0	1,230
10:	2,300	20,0	1,230
11:	2,100	20,0	1,230
12:	2,200	20,0	1,230
13:	2,300	20,0	1,230
14:	2,100	20,0	1,230
15:	2,200	20,0	1,230
16:	2,300	20,0	1,230
17:	2,400	20,0	1,240
18:	2,200	20,0	1,230
19:	2,300	20,0	1,230
20:	2,100	20,0	1,240
21:	2,200	20,0	1,240
22:	2,300	20,0	1,240
23:	2,100	20,0	1,240
24:	2,000	20,0	1,230
25:	2,300	20,0	1,240
26:	2,100	20,0	1,240
27:	2,200	20,0	1,230
28:	2,100	20,0	1,230
29:	2,000	20,0	1,230
30:	2,100	20,0	1,240
31:	2,200	20,0	1,230

Signature examiner	Signature customer	Date

4.3.1.1. Displaying measurement values

Measurement values for the tour (inspection tour) are selected by scrolling with the directional buttons, and they can be studied by clicking on the “View measurement data” icon. You can display selected parts of the measurement values as follows:

Measurement summary: [C:\Programme\TMC95\Samples] -> [0010 - Telefonbatterie]

- ? - Measurement system Databases Extras

Site: 0010 - WKP NT - EC 002.00
Battery: 0010 - Telefonbatterie

2. Tour of 07.09.1994 By Meier

Meas. time: 00:00:00 Rel. meas. time: 00:00:00

Lowest value: 2,21 V At block no. 28
Highest value: 2,273 V At block no. 1
Average: 2,241 V

1:	2,273	17:	2,232
2:	2,238	18:	2,252
3:	2,246	19:	2,251
4:	2,249	20:	2,231
5:	2,259	21:	2,232
6:	2,249	22:	2,227
7:	2,268	23:	2,26
8:	2,215	24:	2,259
9:	2,258	25:	2,237
10:	2,243	26:	2,244
11:	2,255	27:	2,22
12:	2,231	28:	2,21

Select battery Databases -> Site Battery types Application Battery

Change to view of all blocks

You can also display them as follows as an overview that covers all blocks:

Measurement summary: [C:\Programme\TMC95\Samples] -> [0010 - Telefonbatterie]

- ? - Measurement system Databases Extras

Site: 0010 - WKP NT - EC 002.00
Battery: 0010 - Telefonbatterie

2. Tour of 07.09.1994 By Meier

Meas. time: 00:00:00 Rel. meas. time: 00:00:00

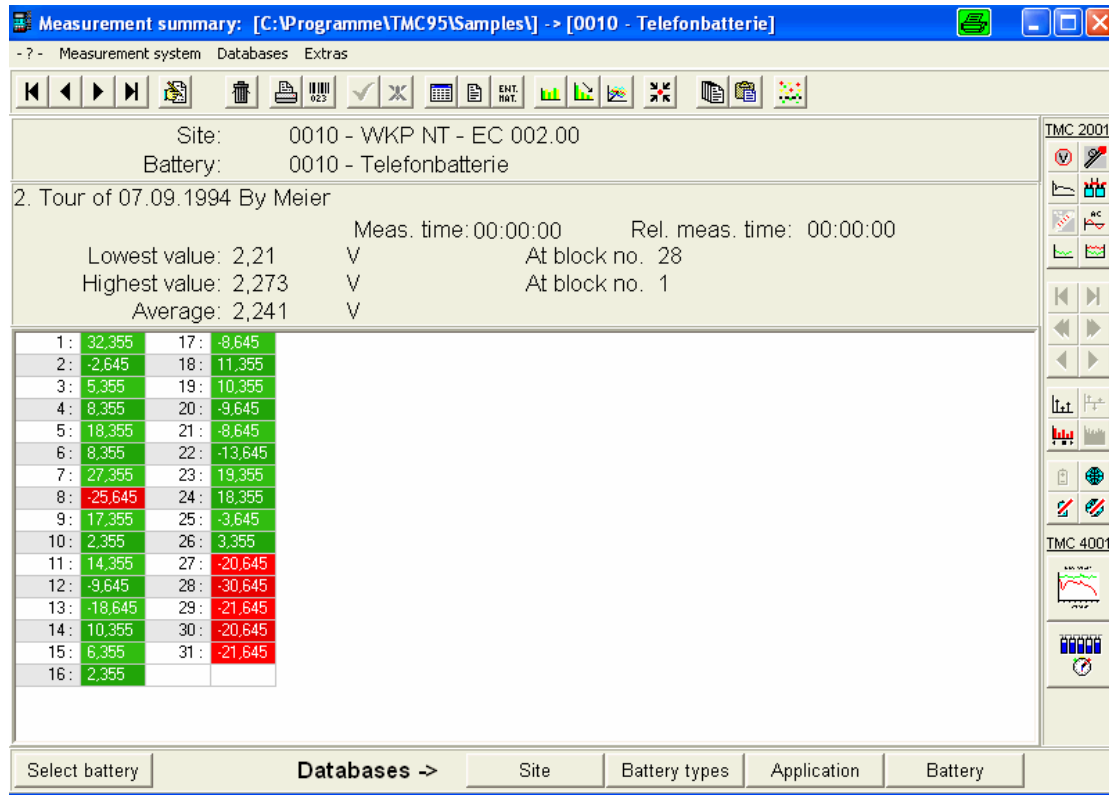
Lowest value: 2,21 V At block no. 28
Highest value: 2,273 V At block no. 1
Average: 2,241 V

1:	2,273	17:	2,232
2:	2,238	18:	2,252
3:	2,246	19:	2,251
4:	2,249	20:	2,231
5:	2,259	21:	2,232
6:	2,249	22:	2,227
7:	2,268	23:	2,26
8:	2,215	24:	2,259
9:	2,258	25:	2,237
10:	2,243	26:	2,244
11:	2,255	27:	2,22
12:	2,231	28:	2,21
13:	2,222	29:	2,219
14:	2,251	30:	2,22
15:	2,247	31:	2,219
16:	2,243		

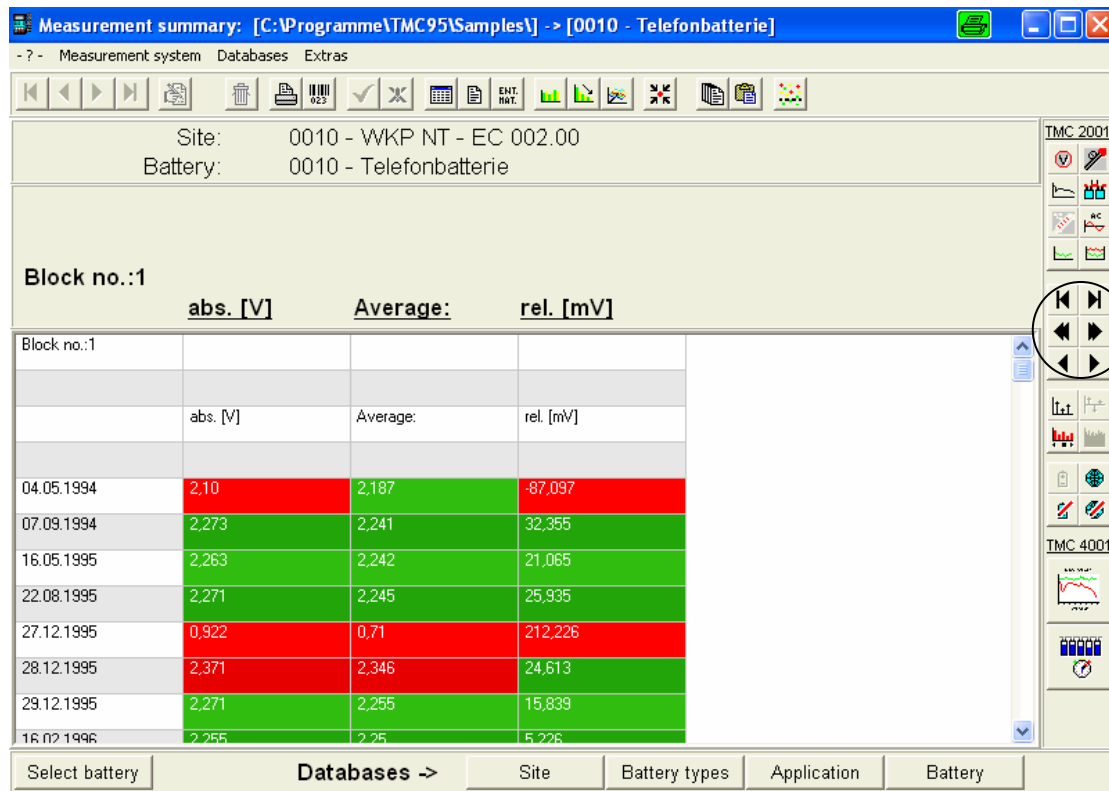
Select battery Databases -> Site Battery types Application Battery

Change to: absolute values
Change to relative values
Change to assortment

From the above presentation of absolute values you can change over to a presentation of relative values:









4.3.1.2. Trend table



When a number of tours are available for a battery, you can click on the "Trend table" icon to view the trend for each cell.

You can scroll among the cells using the directional buttons. Their functions are described below:

	Test, trend diagram and trend table	Test, comparison diagram	Interval measurement
	To first block	To first round	Compress interval graphics
	To last block	To last round	Extend interval graphics
	10 blocks backward	10 rounds backward	Scroll interval graphics 10 units backward
	10 blocks forward	10 rounds forward	Scroll interval graphics 10 units forward
	To previous block	To previous round	Scroll interval graphics 1 unit backward
	To next block	To next round	Scroll interval graphics 1 unit forward

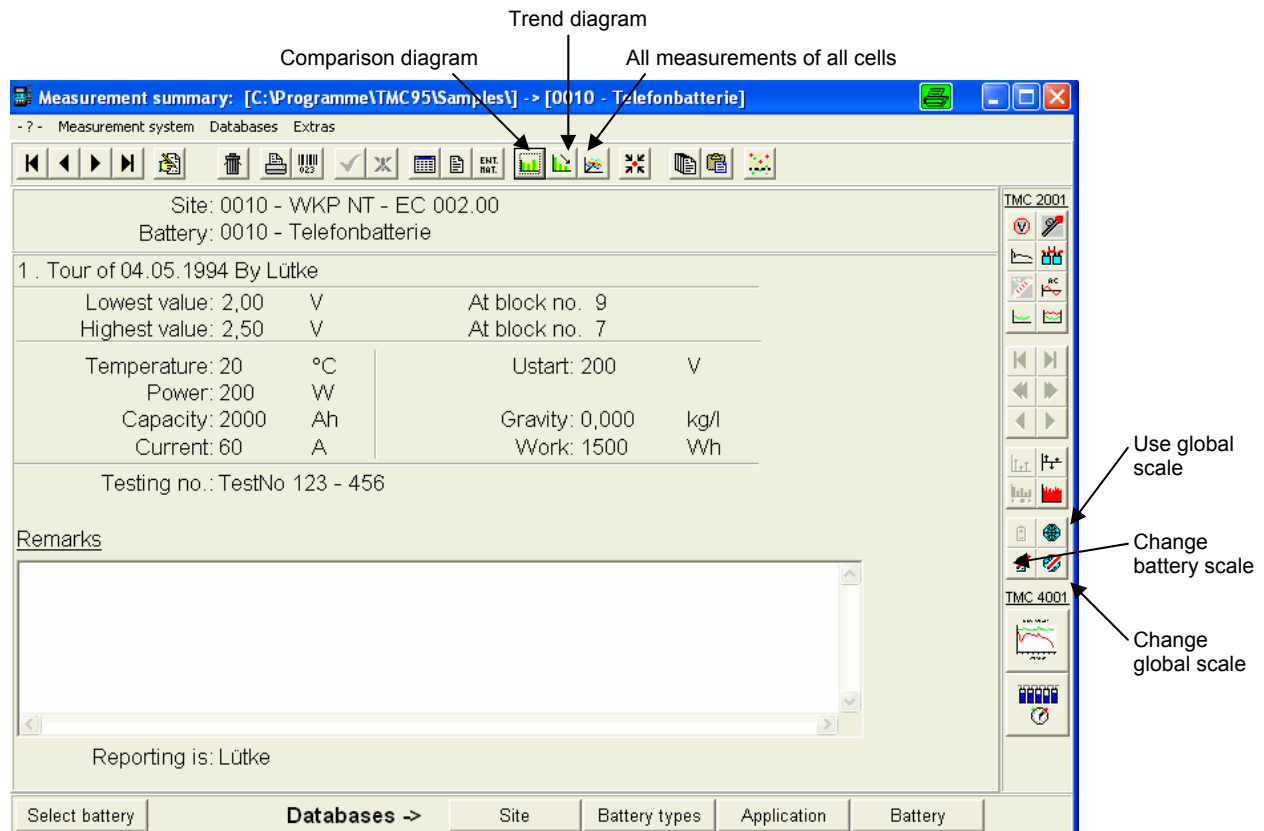
For the most recently displayed windows you can, by using the aforesaid icons, change, correct or print out measurement values.

From the voltage measurement values you can change over to displays of specific gravity, temperature and connector measurements.

4.3.2. Graphical evaluation

A good way to obtain a general idea of the condition of a battery is to present the measurement values graphically.

This can be accomplished using additional icons in the "Measurement summary" window



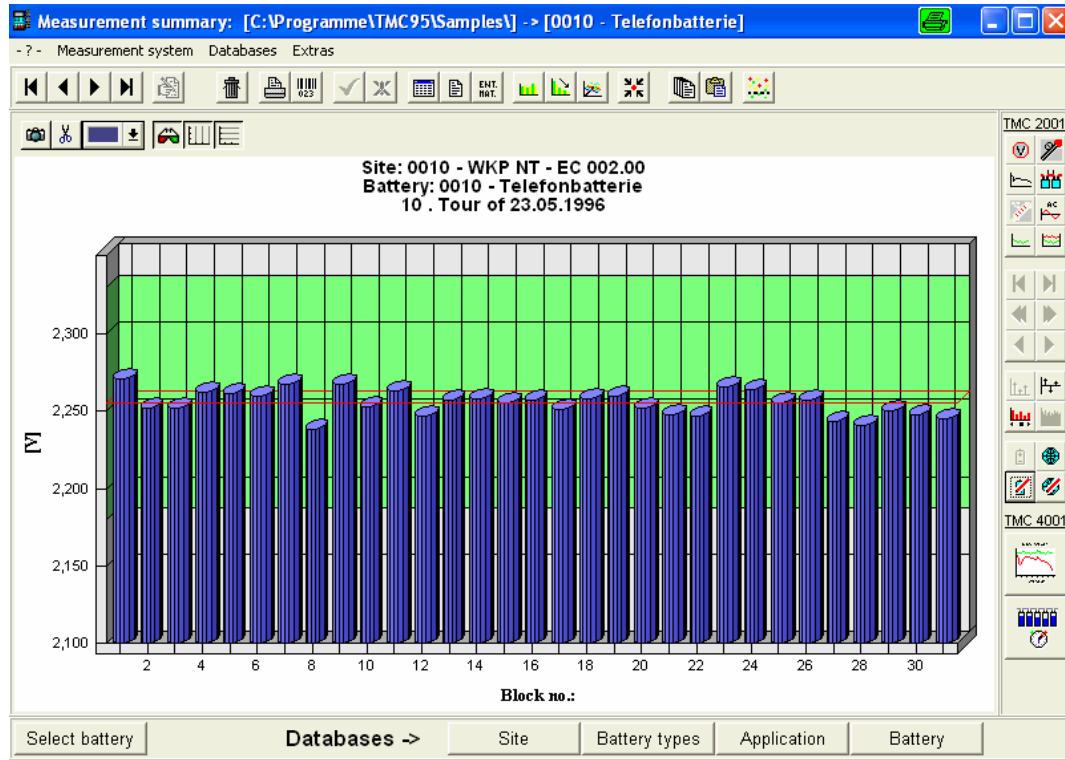
The screenshot shows the 'Measurement summary' window for site '0010 - Telefonbatterie'. The window title is 'Measurement summary: [C:\Programme\TMC95\Samples] -> [0010 - Telefonbatterie]'. The main content area displays site information, a tour log, and various measurement parameters such as voltage, temperature, power, capacity, current, gravity, and work. A 'Remarks' field is at the bottom. The right-hand side of the window contains a vertical toolbar with several icons. Annotations with arrows point to these icons: 'Comparison diagram' points to a bar chart icon; 'Trend diagram' points to a line graph icon; 'All measurements of all cells' points to a grid icon; 'Use global scale' points to a scale icon; 'Change battery scale' points to a battery icon; and 'Change global scale' points to a globe icon. The bottom of the window has a navigation bar with buttons for 'Select battery', 'Databases ->', 'Site', 'Battery types', 'Application', and 'Battery'.

4.3.2.1. Comparison diagram

The best way to make comparisons is to use a comparison diagram. Here, a single glance provides you with information about uniformity of cell voltage, specific gravity and connector voltage.

The permissible tolerance range is clearly indicated so that any faulty cells can be detected easily.

An example is shown below:



A three-dimensional comparison diagram of cell voltage is illustrated above.

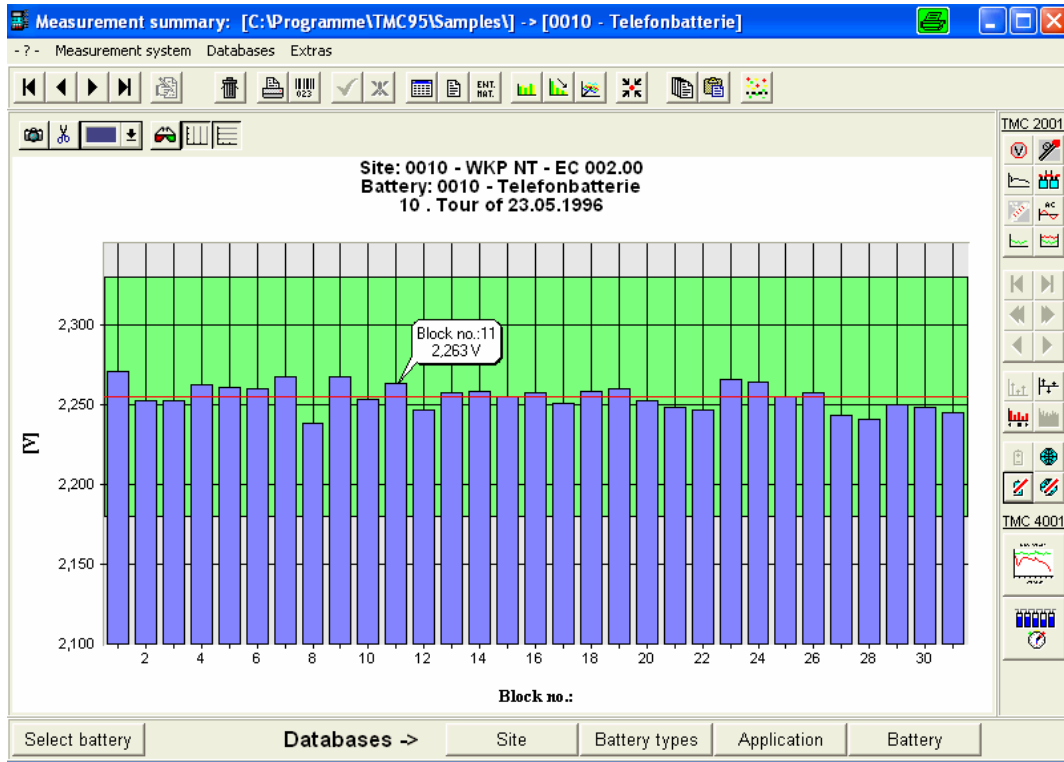
In addition to the familiar menu options, there is a graphics toolbar that can be used to adapt the graphics to your personal preferences.

By clicking on the "Switch between 3D and 2D views" icon for example you can toggle between three- and two-dimensional presentations.

A two-dimensional presentation appears below. Here, "Overview of all blocks" was also selected.

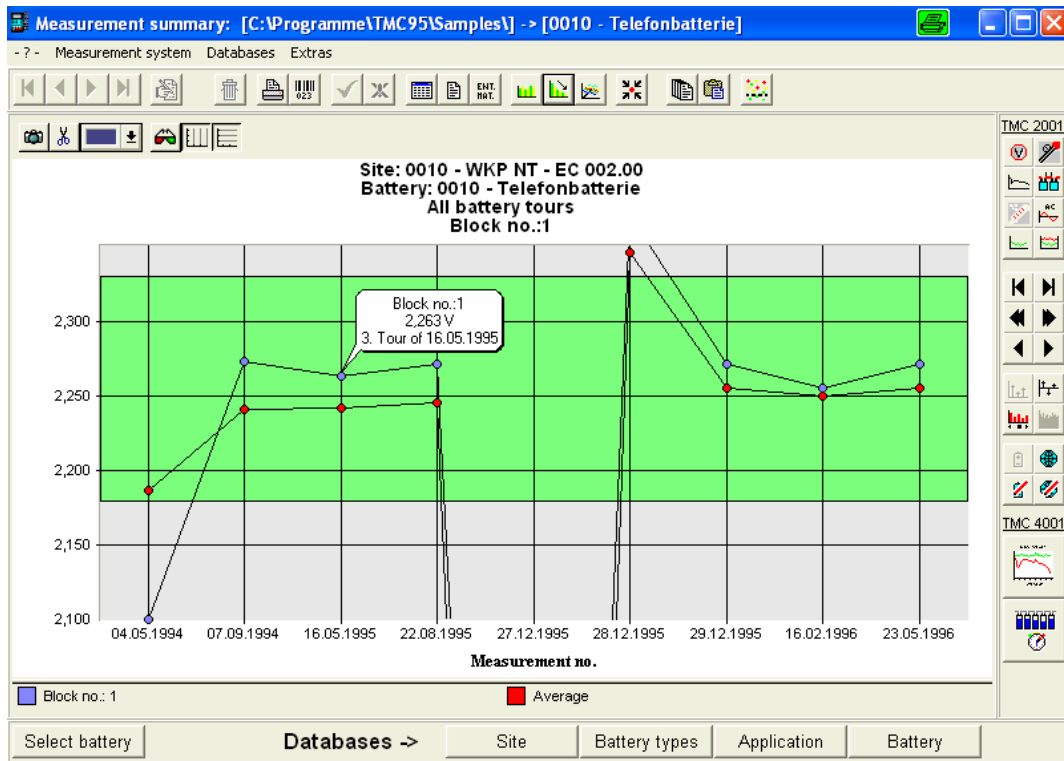
All icons on the right-hand side of the display are available for both table-form and graphic presentations.

When you double-click on any desired column, the absolute value of the measurement value is shown.

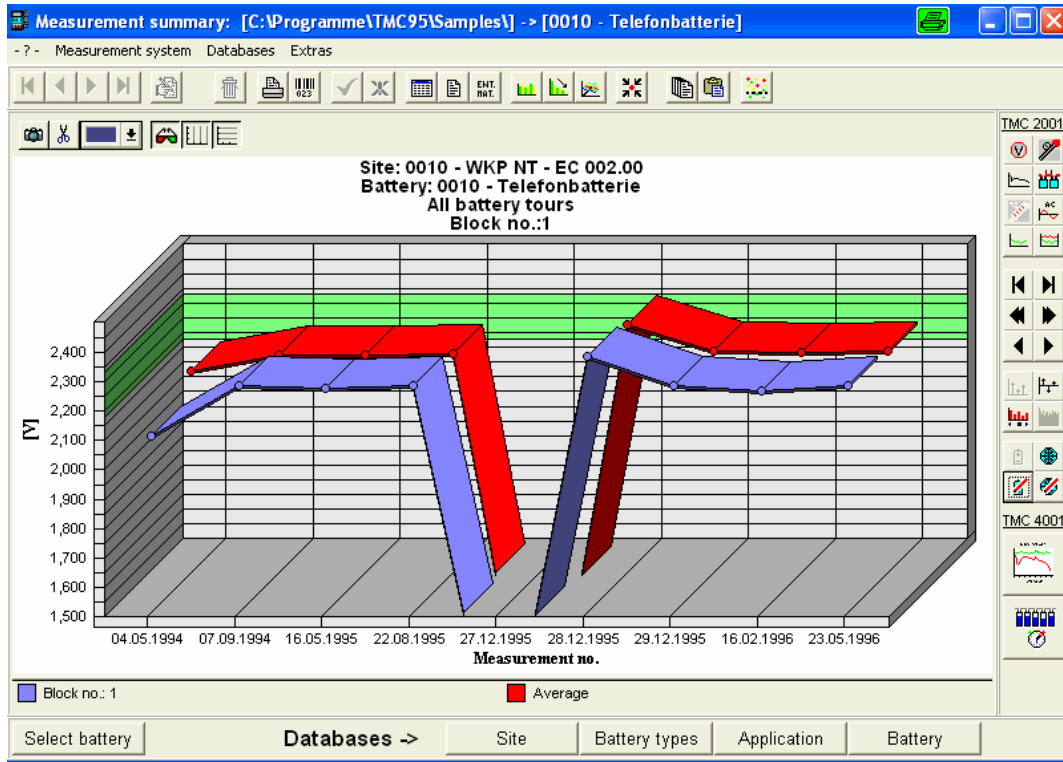


4.3.2.2. Trend diagram

A trend diagram is the graphic equivalent of the previously described trend table. This diagram is used to show existing trends. This is especially useful for problematic cells.

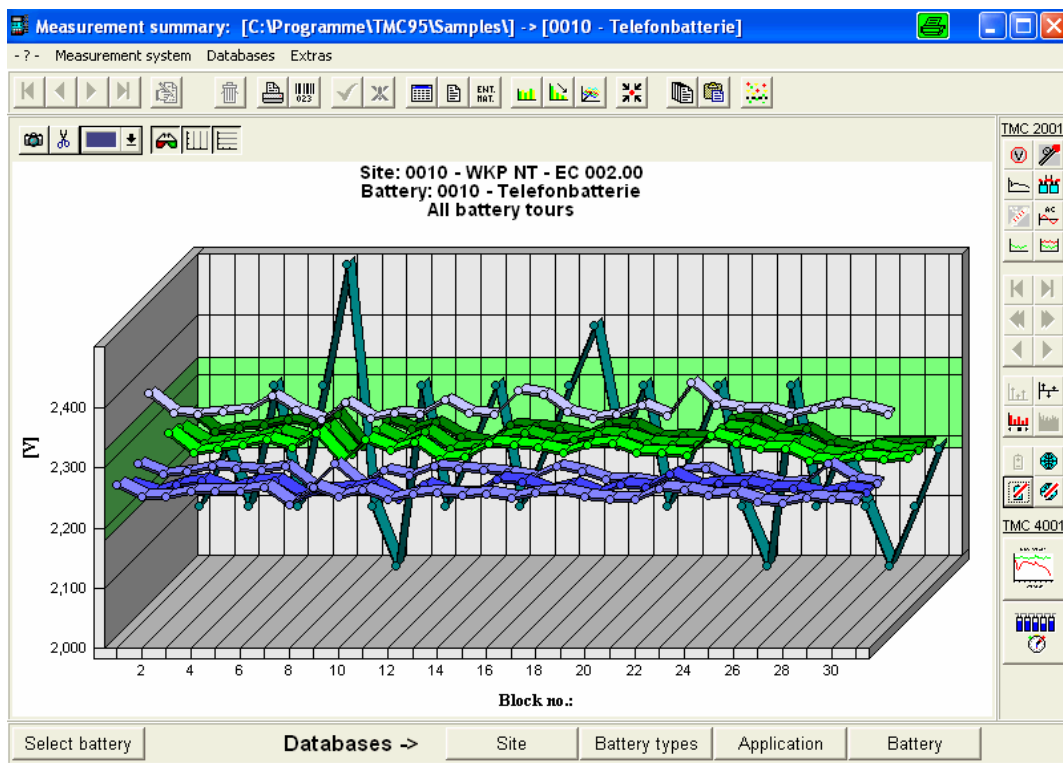


Here too, just as in the trend table, you can use the directional buttons in the right-hand display column to scroll among the cells and change over to displays of voltage, specific gravity, temperature and connector measurements. Three-dimensional presentation is also available here, of course



4.3.2.3. Comparison of all cells

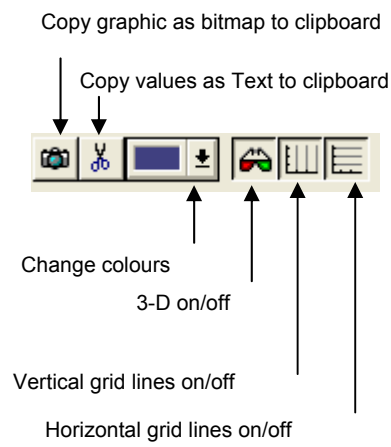
Battery measurement values can be presented three-dimensionally in such a way that you can compare all measurements in all cells—a very useful feature:



4.3.2.4. Graphics toolbar

An extra graphics toolbar enables you to adapt the graphics to your personal preferences. Relevant icons are explained below.

Graphics and values can be copied to the clipboard if so desired and used in other windows program like for instance EXCEL.



4.3.2.5. Copying TMC2001 measurement values into EXCEL

TOUR

1. Make sure that the desired tour is present in the "Measurement Summary" Window
2. Click button with tip text "View Measurement data"
3. Click button with tip text "Copy measurement into Clipboard"
4. Start EXCEL
5. Paste into the EXCEL worksheet.

Note 1:

All tours can be copied if the button "All measurements of all blocks" is clicked at point 2.

Note 2:

Values for a single cell at all tours can be copied if the button "Trend diagram" is clicked at point 2.

TEST

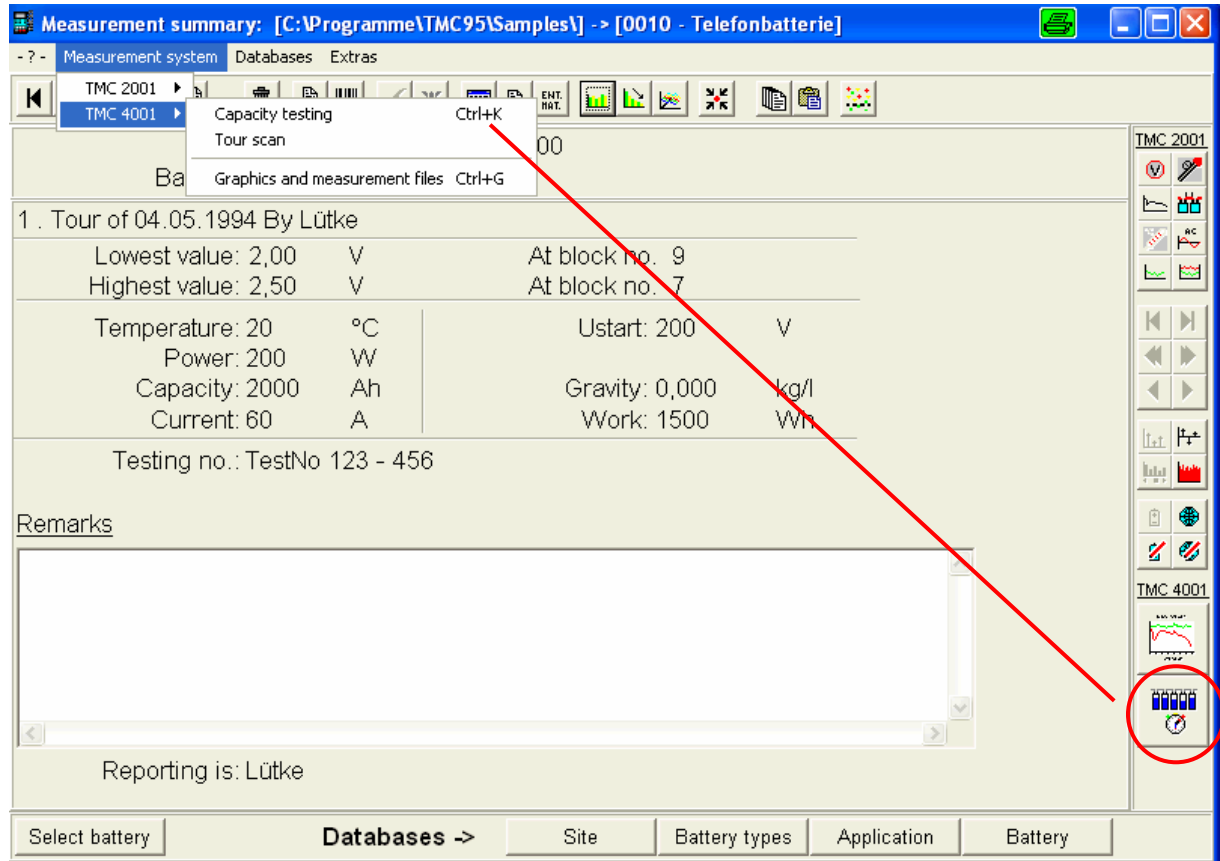
1. Make sure that the desired test is present in the "Measurement Summary" Window
2. Click button with tip text "Trend table" or "Trend Diagram"
3. Click button with tip text "Copy measurement into Clipboard"
4. Start EXCEL
5. Paste into the EXCEL worksheet.

Note: The kind of information copied is dependent on the of presentation selected in the window "Measurement Summary". If "Trend diagram" is active as presentation when the "Copy measurement into Clipboard"-button is clicked, results from all tours on a specific cell are transferred to EXCEL and if the button "All measurements of all blocks" is clicked, all measurements on all cells on all tours are transferred.

5. TMC4001 measuring system

5.1. Performing capacity test:

A capacity test with TMC 4001 is started by selecting “TMC 4001 – Capacity testing” from the “Measurement system” menu.



Alternatively the capacity test can be started by clicking on the marked button in the picture above or by using the key combination [Ctrl] + [k]. Depending on the keyboard layout (e.g. German) the [Ctrl] key can be replaced by a [Strg] key. The functionality is the same. The starting alternatives are equivalent.

A multi-page form in which you can enter all data relevant to the test will now appear:



On this page of the form the appropriate site of the battery to test is selected via the “site” pull- down menu. Doing so, the entry fields are automatically filled with data from the database.

Still it is possible to edit the entries or to use data/sites, that don't exist in the database. When doing so please note that only a well maintained database makes a life- time-supervision possible which is a fundamental corner stone of a Battery- Management-System. The only reason for having the possibility to enter data manually is unique measurements (e.g. unique service order). At this point we want to refer to the new TMC4001 – light software that enables you to work with equivalent testing functionality but without database. This software can be downloaded from the www.gjost.de website.

Click on the “Battery” tag to continue.



Capacity test:

battery 1 | battery 2 | clear setup battery 2

Site | Battery | Test

Battery id: 10 0010 - Telefonbatterie

Battery name: Telefonbatterie

Battery user name:

Date of commission: 01.03.1992

Blocks per battery: 31

meas. points per block: 1

Plus to minus

Minus to plus

Rated capacity [Ah]: 600

Test time [h]: 10

Meas. point min/max [V]: 1,8 2,33

Total main voltage min/max [V]: 67,58 72,23

Start Load Test Setup 1 Save Test Setup 1 Cancel

Load Test Setup 2 Save Test Setup 2

On this page of the form the appropriate battery to test is selected via the “battery” pull-down menu. The entry fields are automatically filled with data from the database.

Regarding manual entries refer to the comments on the previous page.

Click on the “Test” tag to continue.



Capacity test:

battery 1 | battery 2 | clear setup battery 2

Site | Battery | Test

Test no.:
Examiner:

Current
 Manual
 Automatic

Shunt voltage [mV]: 60
Shunt current [A]: 600

Temperature
 Manual
 Automatic

stop Torkel on alarm :
 stop Torkel on single meas. point 1,8 V
 stop Torkel on total voltage 67,58 V

Remarks:

Start Load Test Setup 1 Load Test Setup 2 Save Test Setup 1 Save Test Setup 2 Cancel

Temperature:

This option is not displayed for measurements with TMC4001/63 and TMC4001/31 (see system settings) because those units don't have temperature sensor inputs. In that case please refer to description under "Manual".

By selecting "Manual", you can enter temperatures that you measure as the test proceeds.

If "Automatic" is selected please note that TMC4001/127 can handle up to two sensors (or one per battery if two batteries are tested). TMC 4001/19 supports up to four sensors for a single battery or up to two sensors per battery if two batteries are tested.

All temperatures that are received and displayed are saved, but only an average value for all sensors is shown on the display. Unconnected sensors are recognized, but they are not included in the calculated average.

If no temperature sensor is connected, the temperature is set to 20°C. Automatic temperature entry differs from manual in that even though you can change the temperature value, the program tries to read the sensor again for each measurement and sets the value to 20°C if no sensor is connected.

Current:

By selecting "Manual", you can enter current values that you measure as the test proceeds. In case the discharge current is controlled via an electronic load unit such as TORDEL this option can be used as well. The value of the constant current is entered manually, which reduces the test hook up.

Note! Do not forget to enter the current value directly when you start the discharge!

The option "automatic" enables a real current measurement via current shunt or current clamp. This requires a correctly entered ratio.

Stop TORDEL on Alarm:

In case TORDEL is used for testing and connected to the **TMC4001 (SER2 - or. AUX - connector)** the software can interrupt the test when the limit values are reached. The limit can be a single measurement point (cell or block) or the total voltage or a combination of both. If the combination is selected the first criteria reached will give the alarm.

Is one of these alarm options activated without having TORDEL connected the alarm (Message on the screen and buzzer in TMC 4001) will be stated anyhow. It is the operator's duty then to take care of further necessary actions.

Save Test Setup:

We recommend that you store the test data the first time a battery is tested, thereby making it available for additional tests without having to enter it again. Normally, these test data are saved in the folder used for this battery in the management system. If this battery did not originate in the TMC 95 management system or if you want to save finished test data separately, you can do so under any desired name in any desired folder. (If you conduct tests for different customers you might, for example, create a folder for each customer on your hard disk. In such case you would only have to load test data from this folder the next time you test batteries for this customer.)

Battery 2:

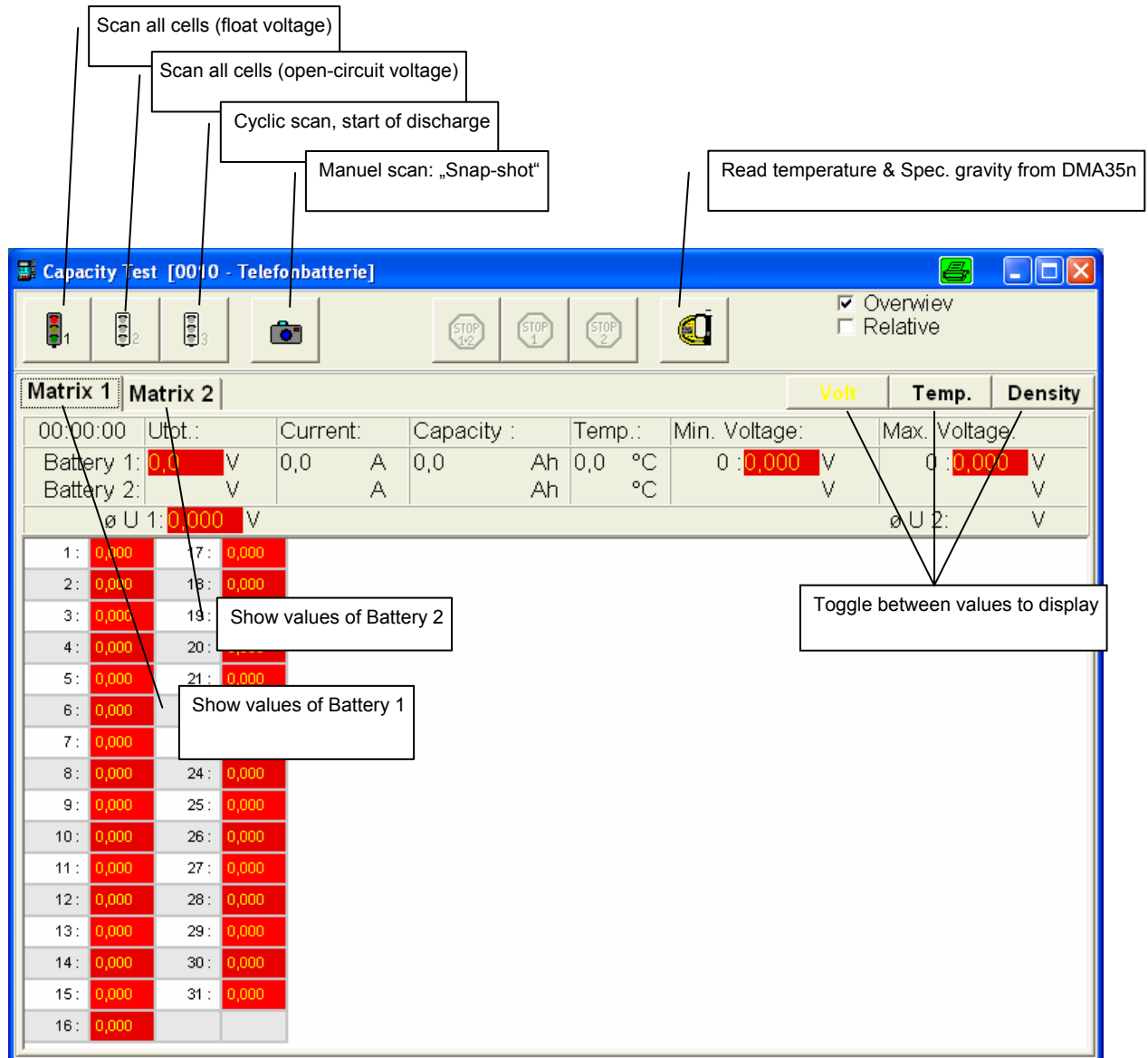
TMC 4001/127 and TMC 4001/19 allow two batteries to be tested simultaneously.

Note: Always click the "Clear set-up battery 2" button if only a single battery is tested. This prevents undesired alarms caused by settings for battery 2.

Select "Battery 2" for entering test data for the second battery. The procedure is similar to that used for the first battery. Here, however, the following must be kept in mind:

- a) The parallel test of two batteries is only possible with TMC 4001/19 and TMC 4001/127 (max. 2*63 cells/blocks).
- b) Both batteries must be in the same site.
- c) The test of both batteries starts at the same time.

Now you can continue by clicking on the "Start" button. The following window appears:



The discharge test will be controlled from this window. Further buttons are:

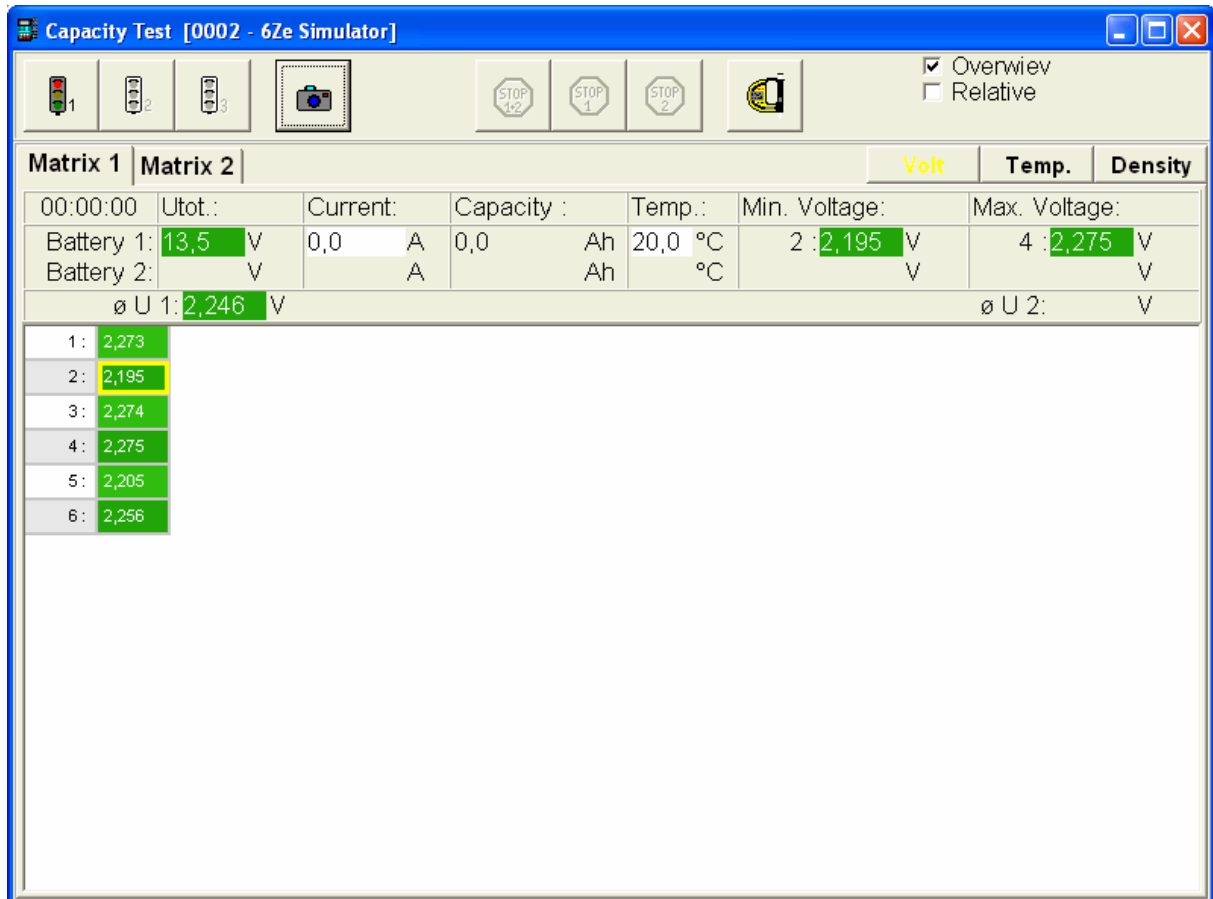
- „Stop 1+2“ Finish the test for both batteries
- „Stop 1“ Finish the test for battery 1
- „Stop 1“ Finish the test for battery 1

Up to this window you can work without having a TMC-4001 connected to the PC. But most of the actions from this window require a connected TMC-4001.

Do the necessary connections now. Follow the instruction in the TMC4001 manual.

After having the TMC-4001 connected to the battery and the PC, a manual scan (camera-button) should be performed in order to check the measuring lead connections.

After that scan the measured values will be displayed.

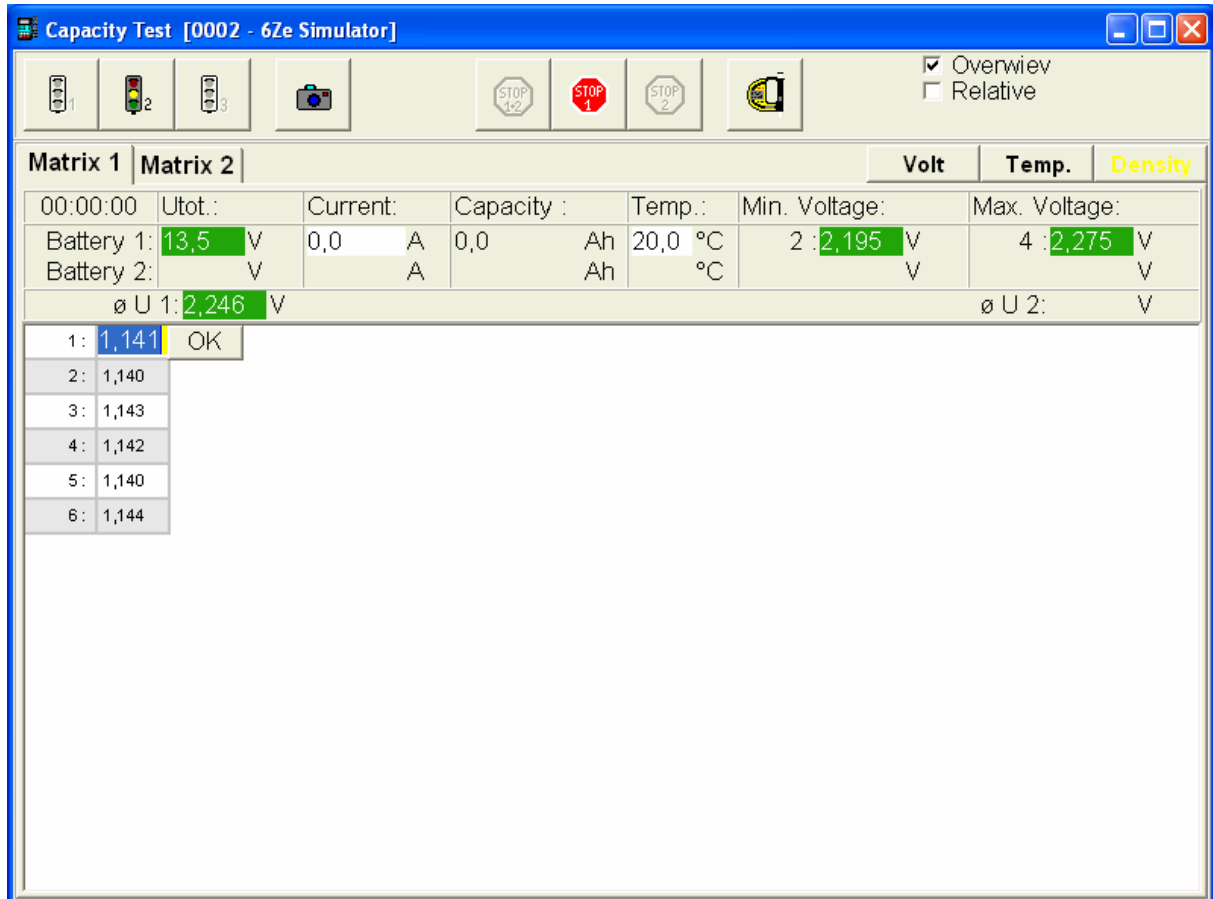


In the row battery 1 total voltage, discharge current, discharged Ah, temperature, lowest cell voltage with number and highest cell voltage with number are displayed. Row battery 2 has the same structure. This row is empty in this example because only one battery is tested and the button "clear setup battery 2" was clicked on in the previous window.

The white background colour of the current and temperature values in the example above indicate that those values are entered manually instead of being measured.

If the manual scan looks OK, the test can be started. Click on the button with the first traffic light (red) in order to measure the floating voltage of all cells. After the scan is completed the previously operated button becomes inactive and the button with the second traffic light is active.

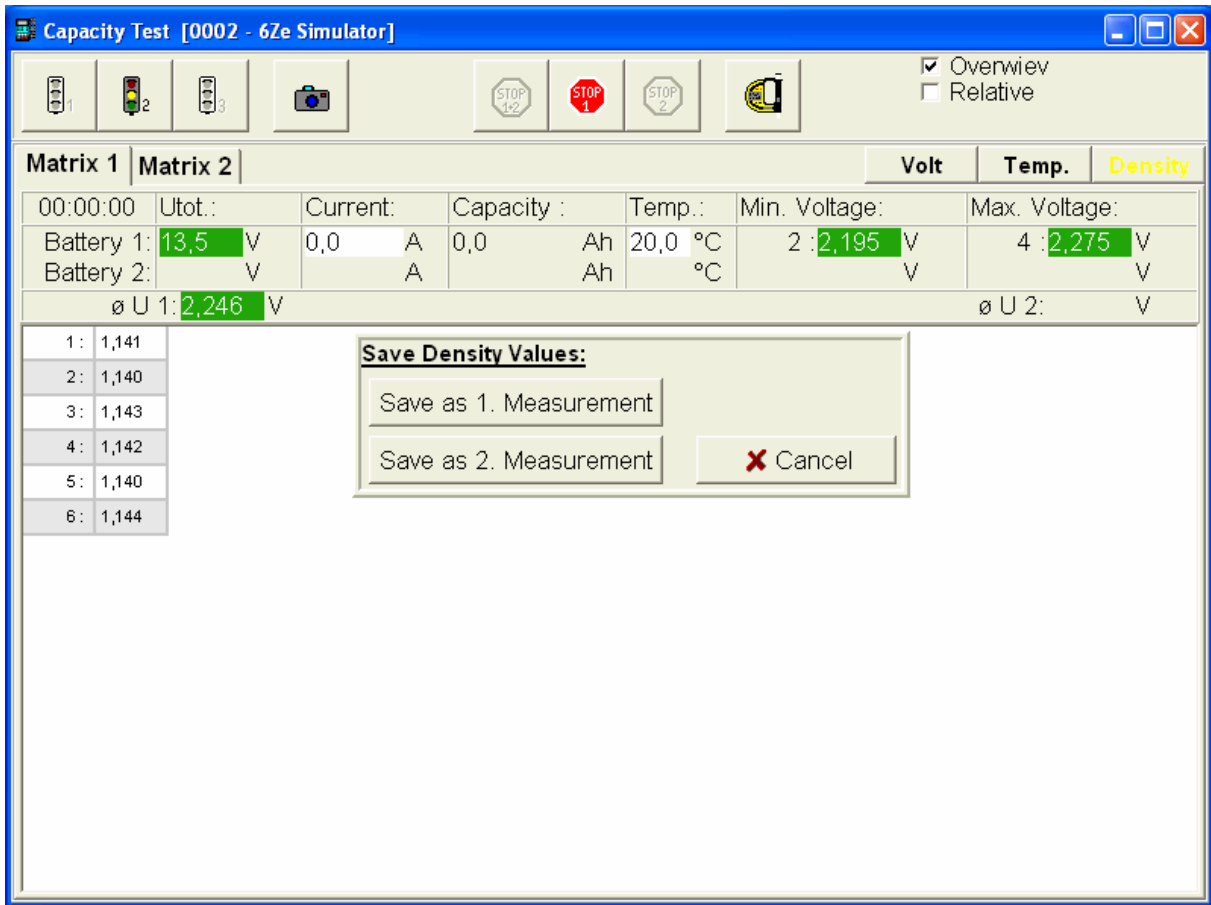
In case values for specific gravity shall be recorded it is recommended to do this now. After gravity and float voltage measurements are completed the charger (rectifier) should be switched off. Now it has to be waited long enough for the open circuit voltage to be reached (remember to comply with the test instructions or information supplied by the manufacturer). The waiting time can be used to enter or to transmit the gravity values. For this toggle from voltage table to gravity table by clicking on the button named density.



Double-clicking on the first value in the matrix enables you to enter the first value, but do not yet click on OK. Press the Return/Enter key or the Down-arrow key and proceed to the next value. In that way all values or pilot cell values are entered.

If you are using a DMA 35n made by Anton Paar, connect it instead of the TMC 4001 to the serial port on the computer. Now click on the "Specific gravity logger" button (upper right). The specific gravity logger will be read, and the specific gravity and temperature table will be stored together with the measured values. Also the so automatically read values can be manually edited as described above.

Do not click the OK button until all values have been entered and you are sure they are correct. When you click the OK button, a field containing three buttons will appear:



To save the entered value as a measurement value BEFORE conducting the test, choose the button designated "Save as 1. measurement".

A similar procedure is used to enter the temperature values and all values for the second battery.

You can make these entries just before measuring the open-circuit voltage. Thereafter, the table is permanently set for the measured voltage and cannot be changed until after the test is concluded. To measure the open-circuit voltage click on the second (yellow) traffic light.

You can now click on the third traffic light (green), thereby starting the automatic sampling tests. Next, you cut in the load. In case you are using the electronic load unit TORKEL it will start automatically. All received measurement values will now be shown on the status line or in the table.

If you specified manual entry of current or temperature in the test data you can, at any time, enter new values by double-clicking on “Current” or “Temperature”. These values remain valid until the next entry is made. If you specified automatic temperature recording, but have not connected a temperature sensor, a neutral temperature of 20°C will be used. You can, of course, change such temperatures manually, but when the next measurement value is recorded, the temperature will again revert to 20°C if no sensor is connected.

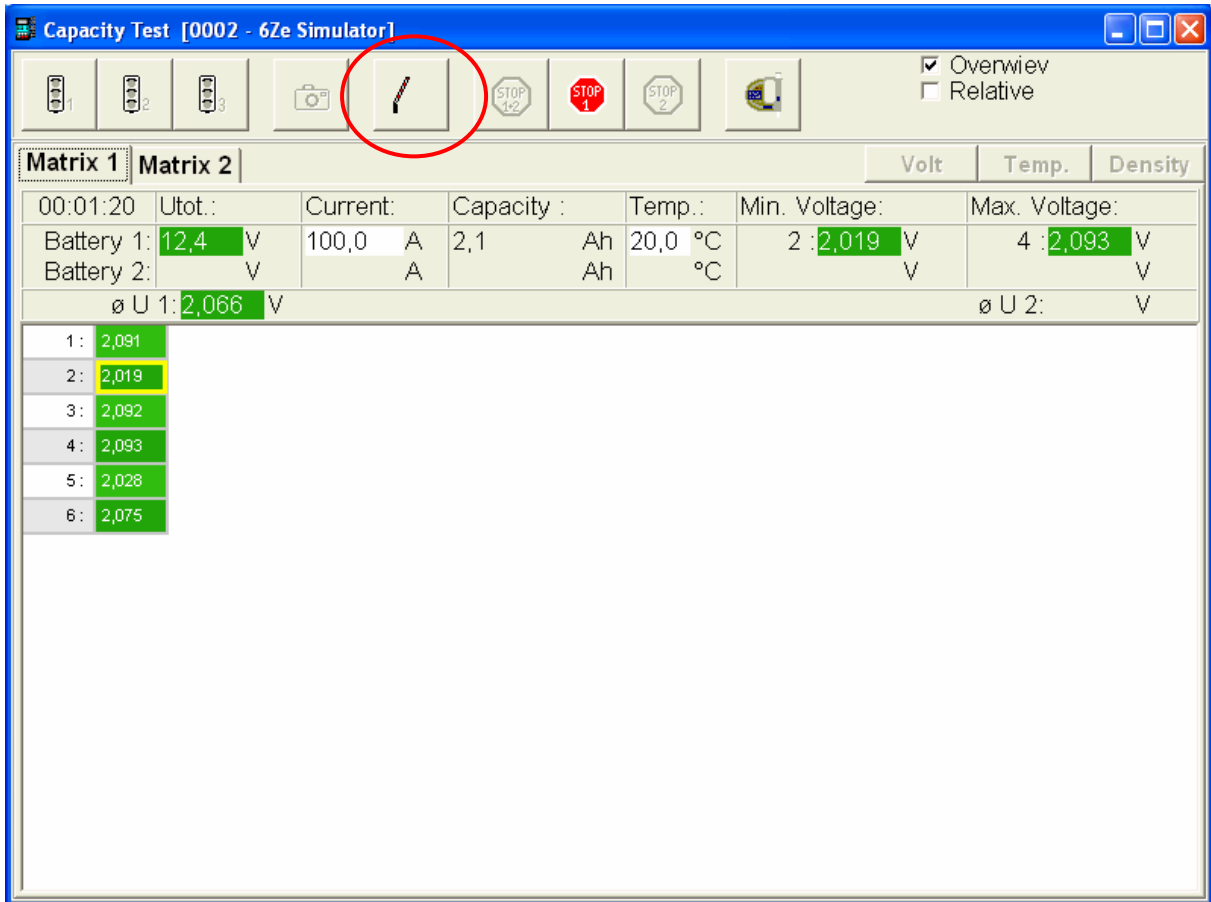
Note: Do not forget to enter the current value when the discharge is started.

The screenshot shows the 'Capacity Test [0002 - 6Ze Simulator]' window. It features a toolbar with traffic light icons (1, 2, 3) and stop signs (STOP 1, STOP 2). A table displays test parameters and results. The 'Current' field is highlighted in yellow and contains '100'. The 'Temp.' field is '20,0 °C'. The 'Min. Voltage' is '2 : 2,194 V' and the 'Max. Voltage' is '4 : 2,275 V'. Below the main table, a list of voltage measurements is shown, with the second value '2,194' highlighted in yellow.

Matrix 1	Matrix 2	Volt	Temp.	Density
00:00:00	Utot.:	Current:	Capacity :	Temp.:
Battery 1:	13,5 V	100 OK	Ah	20,0 °C
Battery 2:	V	A	Ah	°C
ø U 1:		2,246 V	ø U 2:	
1:	2,272			
2:	2,194			
3:	2,273			
4:	2,275			
5:	2,205			
6:	2,255			

In the example above you see that the current value is entered shortly before operating the third traffic light. In this case TORKEL was used and by that the current was assumed to be constant.

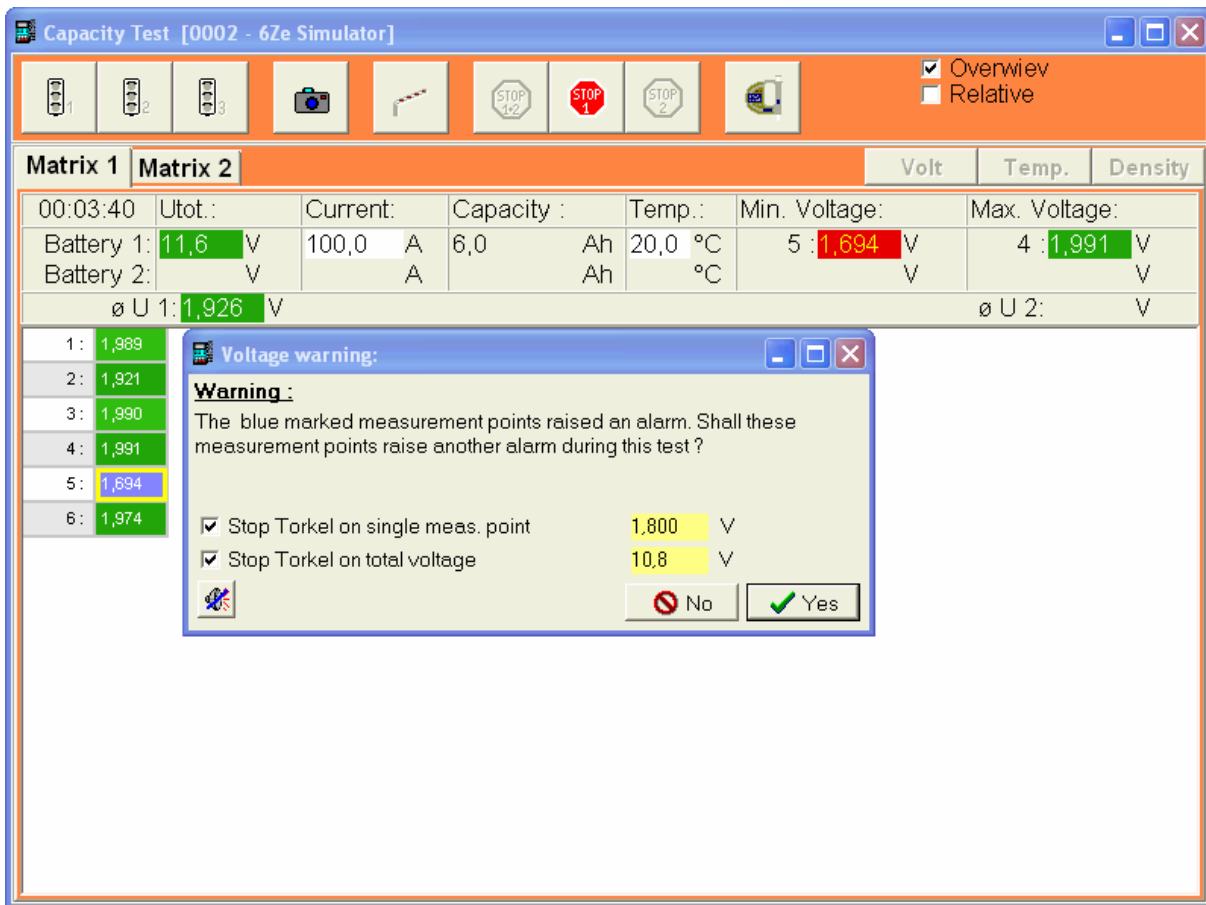
The following picture shows a running measurement.



A new button (barrier) has appeared. It can be operated at any time to interrupt the test. In this case the symbol will change from an open barrier into a closed one. A new click on this button continues the test and the symbol will change again to an open barrier.

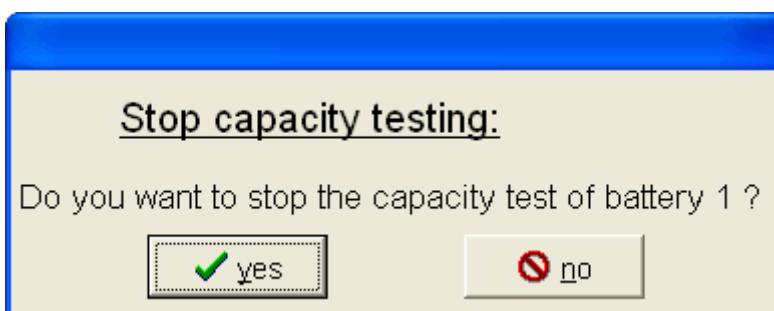
By this you have the possibility to undertake appropriate actions during a running test if for example the end voltage of a single cell/block is reached.

Is TORKEL used and the Stop-TORKEL-on-Alarm function activated the test would be interrupted automatically and the buzzer in TMC4001 will sound. This is visualised in the following picture.



You can acknowledge the buzzer (small button with loudspeaker symbol) and change or disable the alarm function. Next, the test can be continued by clicking on the barrier button.

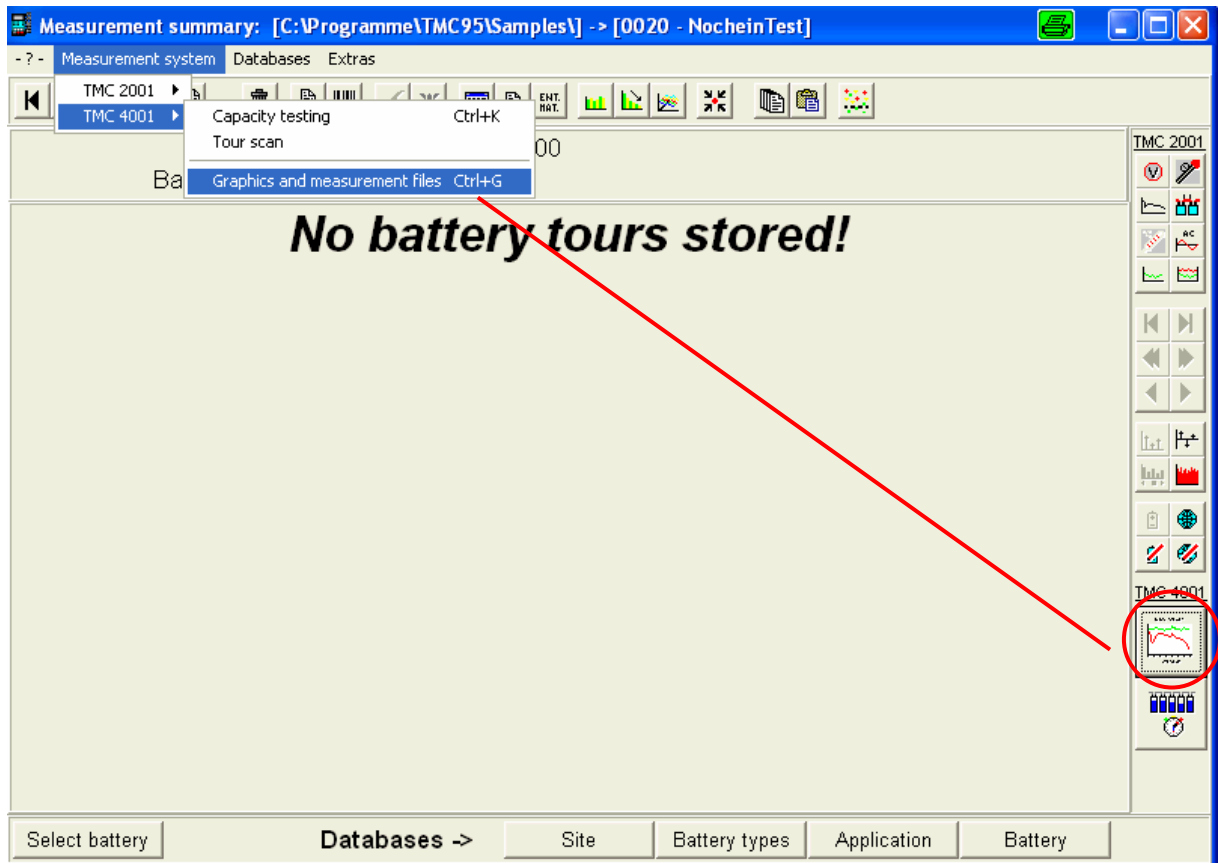
You end a test by clicking on one of the previously described Stop buttons and Yes/No confirmation. When clicking on the stop button the battery is scanned a last time.



After that you can enter once again density and temperatures and save it as measurement after the test (button "save as 2. measurement"). You also have the option after a certain recovery time to measure cell voltages once more by clicking on the camera button. For that you **MUST** remain in the battery test window!

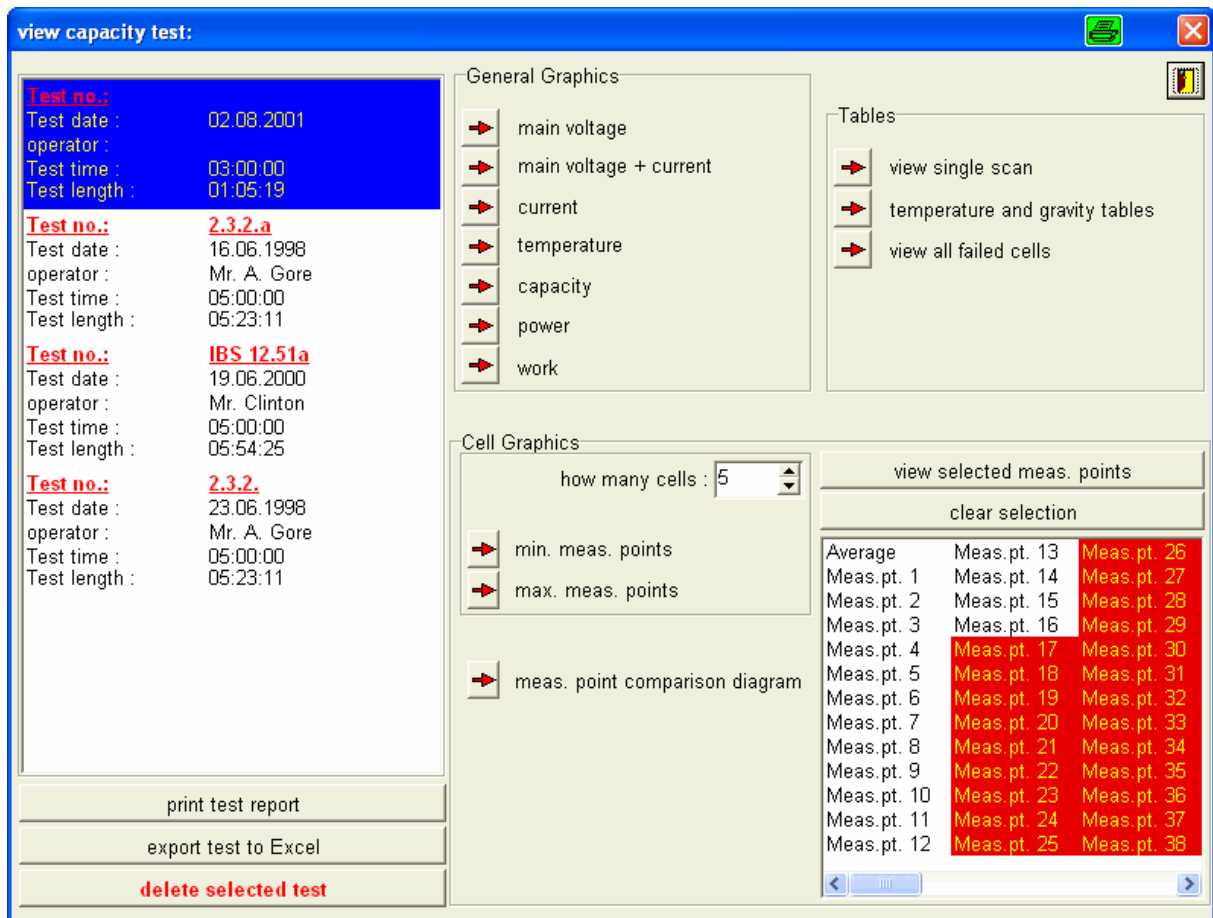
5.2. Graphics and reports from capacity tests

To create graphics and reports select the battery to analyse and invoke the following options: "Measurement system—TMC4001—Graphics and files". Alternatively, you can press [G] while holding down [Ctrl]. or click on the marked button.



The window "View capacity tests" appears.



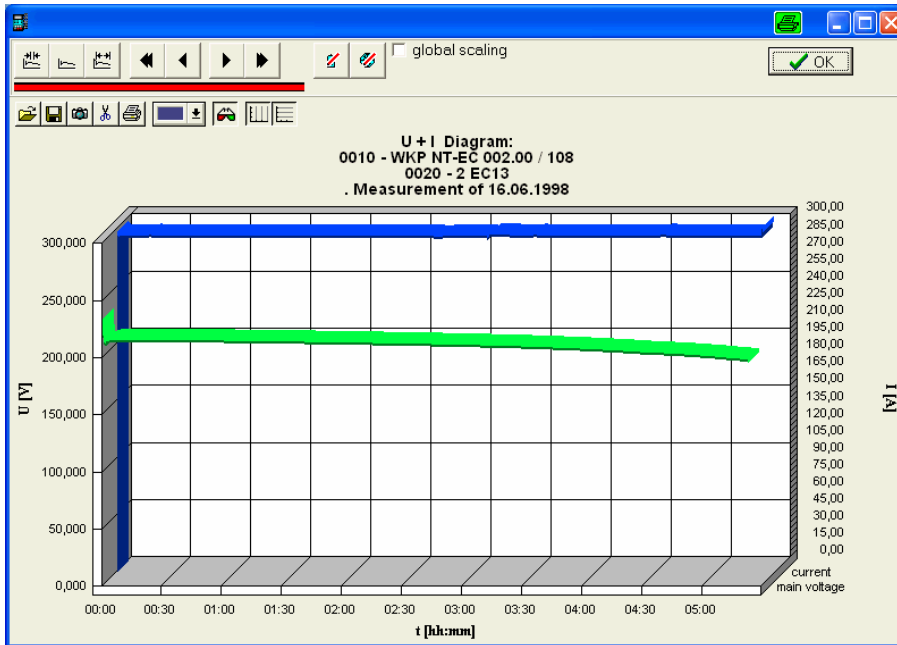


In the left part of the window you select a test, start a report printout, export a selected test to EXCEL or delete a test.

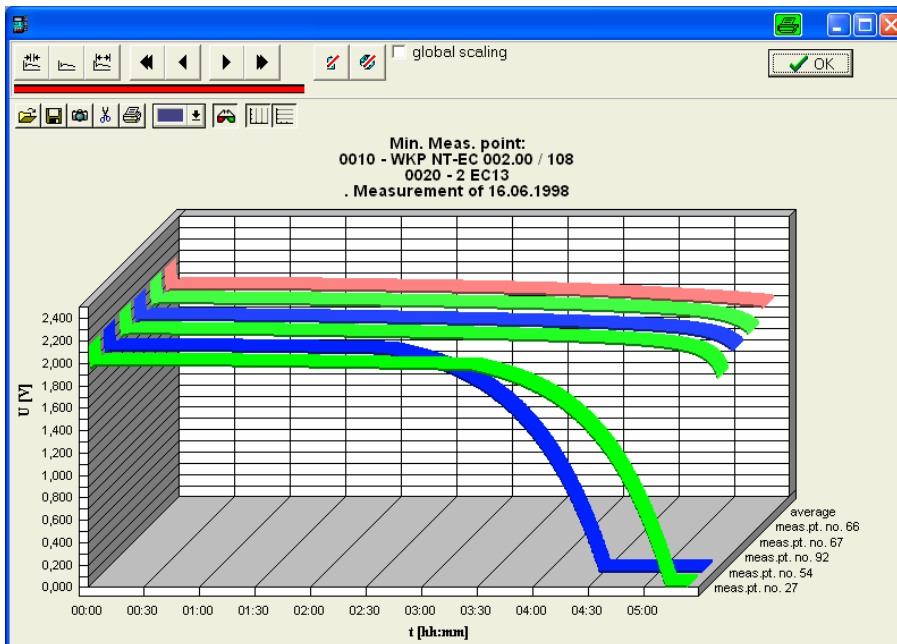
For Analyse you have three basic ways of visualisation at disposal: "General Graphics", "Tables", "Cell graphics" and the comparison diagram. In the lower part on the right hand side of the window up to max. 10 cells can be selected to be displayed in a cell graphic. Selecting cells with the mouse works as usual under Windows using [SHIFT]- or [CTRL]-key.

On the following pages you find examples of the different ways of visualisation.

General Graphic; total voltage and current:



Cell Graphic; min. meas. points:



Meaning of the buttons on the toolbar:



Compress graphic in the time domain



Show entire test



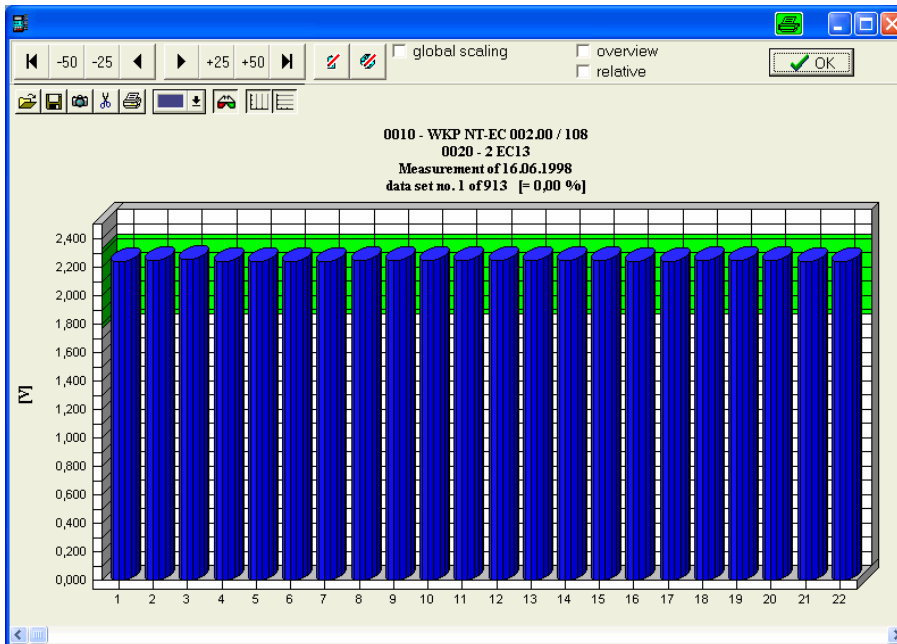
Expand graphic in the time domain

Arrows Move graphic on time axis left/right, rough/fine

Table; view single scan:

PlotForm													
measurement time : 07:33:17						rel meas. time : 00:00:00 [= 0,00 %]							
Utot :		242,89		V		temperature :		20,0		°C			
current :		-0,1		A		work :		0,0		Wh			
capacity :		0,0		Ah		power :		-15,0		W			
average :		2,249		V		min. meas. point voltage :		2,234		V at No. 28			
						max. meas. point voltage :		2,264		V at No. 56			
1 :	2,241	17 :	2,243	33 :	2,246	49 :	2,260	65 :	2,251	81 :	2,251	97 :	2,237
2 :	2,248	18 :	2,248	34 :	2,247	50 :	2,259	66 :	2,254	82 :	2,245	98 :	2,248
3 :	2,254	19 :	2,245	35 :	2,247	51 :	2,258	67 :	2,254	83 :	2,249	99 :	2,246
4 :	2,244	20 :	2,245	36 :	2,242	52 :	2,260	68 :	2,259	84 :	2,247	100 :	2,252
5 :	2,243	21 :	2,239	37 :	2,248	53 :	2,247	69 :	2,251	85 :	2,252	101 :	2,253
6 :	2,239	22 :	2,242	38 :	2,250	54 :	2,248	70 :	2,257	86 :	2,248	102 :	2,249
7 :	2,243	23 :	2,241	39 :	2,253	55 :	2,261	71 :	2,248	87 :	2,254	103 :	2,248
8 :	2,245	24 :	2,242	40 :	2,248	56 :	2,264	72 :	2,250	88 :	2,252	104 :	2,252
9 :	2,246	25 :	2,242	41 :	2,242	57 :	2,251	73 :	2,252	89 :	2,262	105 :	2,248
10 :	2,247	26 :	2,251	42 :	2,244	58 :	2,252	74 :	2,244	90 :	2,253	106 :	2,255
11 :	2,247	27 :	2,239	43 :	2,242	59 :	2,253	75 :	2,253	91 :	2,250	107 :	2,253
12 :	2,246	28 :	2,234	44 :	2,254	60 :	2,253	76 :	2,253	92 :	2,251	108 :	2,243
13 :	2,246	29 :	2,246	45 :	2,260	61 :	2,250	77 :	2,254	93 :	2,253		
14 :	2,246	30 :	2,250	46 :	2,248	62 :	2,249	78 :	2,252	94 :	2,241		
15 :	2,246	31 :	2,244	47 :	2,247	63 :	2,247	79 :	2,250	95 :	2,261		
16 :	2,238	32 :	2,253	48 :	2,249	64 :	2,252	80 :	2,252	96 :	2,251		

Comparison diagram:



Meaning of the buttons on the toolbar:

- |< / >| Go to first / last Scan
- 50 / +50 50 Scans back / ahead
- 25 / +25 25 Scans back / ahead
- < / > one Scan back / ahead

6. Appendix: TMC-2001 reports; change header

The test report's header line can be adapted to individual needs (e.g. company logotype). As a header a graphic (WMF- Format) is pasted into the report-files. Following header files are used by the TMC95 software for it:

Logo1.wmf	for four protocols,
Logo2.wmf	for test protocols and
Logo3.wmf	for temperature, density and connector protocols.

Those files are located in the installation folder of the TMC95 software. The same file, but in CorelDRAW- format (*.cdr) are located there as well. Those can be used as a template for individual modifications. Hereby it is important that the size of 180mm x 55mm is kept for the graphic. This can be also achieved by drawing a rectangle of this size without filling and without outline, in which the required objects shall be placed.

The so created or changed header must be exported into WMF-format using the, for the purpose (see above), dedicated names. To do so mark all objects in question and use the option "Marked objects only" when exporting. Finally the Logo-file in the installation folder must be replaced by the new/changed one.

It is recommended to backup the original Logo-files first.

Of course any other software than CorelDRAW which can create WMF-files can be used as well. The only important thing is that the created WMF-file describes an area of 180mm x 55mm.

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