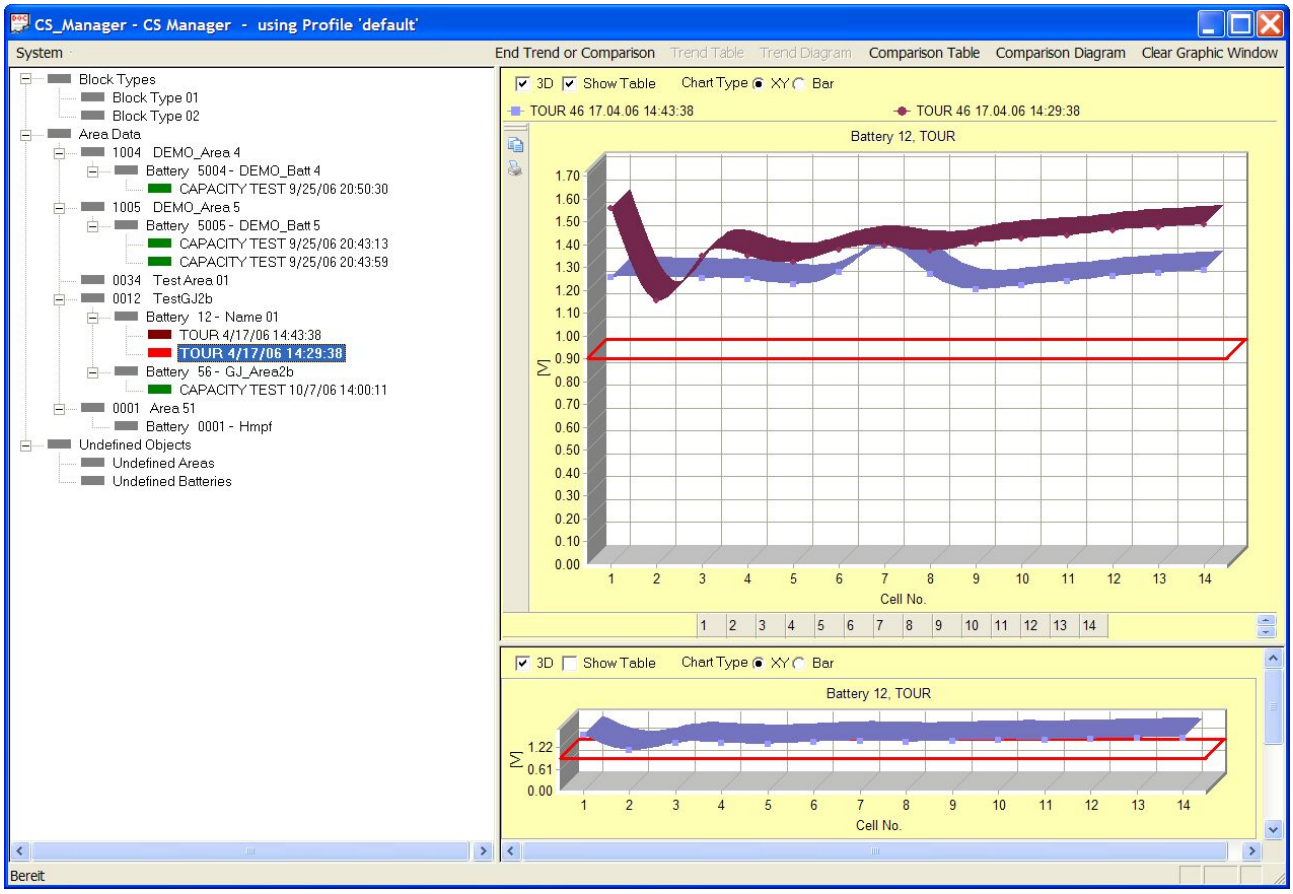
CS-Manager

User's Manual

G. Jost - Electronic, 12.05.07

Version 1.3



CRM-2010

Table of Contents

List of Figures

1 Introduction

1.1 Overview

CS-Manager is a software which allows to maintain measurement data of batteries. The measurement data are obtained from our new Cellizer Measurement Systems, CRM-2010, CS-4001 and CM-9010. The software allows:

- Maintenance of area data
- Maintenance of block type data
- upload of battery definition data to the measurement systems
- Download of the measurement data from the CRM-2010
- Analysis of Measurement Data

This document describes the installation of the software, the maintenance and analysis of data.

1.2 Typographical Conventions

Objects belonging to the system environment (a path within the computer's file system, a program name) are printed in `courier font face`. A definition is printed in *italic*.

2 Architecture of CS-Manager

2.1 Overview

The following sections describe aspects of the architecture of CS-Manager, e.g.

- Software Architecture
- The CRM-2010 as a USB drive
- Format of Measurement Data Files
- Format of Battery Definition Files
- Restrictions

Not described are the architecture or concepts of the CRM-2010 device or CS-4001(see [1] and [2]).

2.2 Software Architecture

The internal architecture of CS-Manager follows a classical two-tier-System (Fat Client). The backend where data are stored is a database. Currently only a built-in database is supported. Future releases will support arbitrary relational database systems (RDBMS) which will allow the user to do individual data processing on the measurement data collected be the CRM-2010 or data warehouse business.

Measurement data downloaded from the CRM-2010 is not only stored in the database. In additions the data file is stored in a history directory. In case the database is damaged by external processes or “accidents“ this allows a disaster recovery.

The Software does not register itself in the Windows registry. This might seam a bit unusual. The reason which CS-Manager has been implemented that way is to make it as robust as possible. It is possible to move the directory which contains the CS-Manager Software and its configuration files without changing special configuration parameters manually or even affect the integrity of data.

When CS-Manager is installed the software and its configuration and database will be installed in a directory by default. The location of the database or the history directory can be changed arbitrarily. A form in CS-Manager allows to change the affected system parameters at any point in time. So it is impossible to “move“ the application or only its database when the file system is full.

2.3 The CRM-2010 as a USB drive

From the perspective of CS-Manager the CRM-2010 device is “just“ a removable device. In the system data of CS-Manager the name of the volume associated with the CRM-2010 is configured. This allows to implement easy and straight-forward data exchange mechanisms. When the user tries either to download measurement data or to upload CS-Manager first locates the volume associated with the CRM-2010 device. If this fails the user cannot initiate a data transfer operation. If the volume is found the exchange file is copied to or from the device depending on the operation.

If measurement data are downloaded from the CRM-2010 the data is checked whether or not it has been already downloaded. If not, the data file is copied into CS-Manager's history directory and is imported in the database. Duplicate imports cannot take place.

2.4 File Formats of Data Exchange Files

2.4.1 Overview

If the Software CS-Manager and the CRM-2010 device exchange data they use special files for that. If battery definitions should be uploaded to the CRM-2010 a file is copied into the CRM-2010's file system.

If measurement data should be transferred from the device into the database a file generated on the CRM-2010 is copied to the CS-Manager history directory. The content of this file is imported into the database.

The files types are comma separated values (CSV) and can be viewed with Microsoft Excel or any other spreadsheet program. Both file types contain header information and a data section. Its values are separated with semicolons.

The formats of these files are described in the next sections by giving an example.

2.4.2 Format of Measurement Data Files

The following table shows an example Battery definition file:

Battery Data for CS-4001

	Batt_Name	Area_Name	Battery_ID	Area_ID	No. Of Cells	UCELL min [V]	UCELL max [V]	UBATT min [V]	UBATTmax [V]	Shunt [A]	Shunt [mV]	Capacity [Ah]	MEMO Discharge Current	MEMO Discharge Time		
{																
<	TestGJ1	GJ_Area1	1	5	32	2	1	2	7	60	80	100	60	10	100	1>
<	TestGJ2	GJ_Area2	12	56	64	2	2	2	8	70	90	200	60	100	200	2>
<	TestGJ2b	GJ_Area2b	12	56	64	2	2	2	8	70	90	200	60	100	200	5>
<	TestGJ3	GJ_Area3	123	567	96	12	1	13	1	200	280	1000	1000	1000	300	3>
<	TestGJ4	GJ_Area4	1234	5678	127	12	2	13	2	230	290	2000	1000	9999	9	400>

Figure 1: Battery Definition File

2.4.3 Format of Battery Definition Files

The following table shows an example of a measurement file. The last line contains the measurement data. In the example the battery consists of 14 cells. The display of the voltage values is truncated a cell number 2.

SYSTEM:	CS-4001/127		V01.0	
SN:		4001001		
CALIBRATED:		26/01/06		
SOFTWARE:	CS-4001/127		V01.0	
PRODUCER:	G. JOST - ELECTRONIC		GERMANY	SUPPORT@CELLIZER.COM

BATT-ID:	12	
BATT-NAME:		
AREA-ID:	34	
AREA-NAME:		
CELLS:	14	
CAPACITY [Ah]:	100	0
CELL LIMIT MIN [V]:	1	400
CELL LIMIT MAX [V]:	2	345
BATT LIMIT MIN [V]:	15	67
BATT LIMIT MAX [V]:	24	56
SHUNT DEF. A:	100	
SHUNT DEF. MV:	10	

FUNCTION:	TOUR	
TEST DATE:	17/04/06	
TEST TIME:	14:43:38	

Time	UBatt [V]	I [A]	CBatt [Ah]	TBatt [°C]	CELL-1 [V]	CELL-2 [V]
00:00:00	19	57	673	4	0	0

Figure 2: Battery Definition File (truncated at Cell No 2)

2.5 Restrictions

2.5.1 Supported Platforms

CS-Manager has successfully been tested on the following Systems:

- Windows 2000
- Windows XP
- Windows Server 2000
- Windows Server 2003

2.5.2 Capacity Limits

CS-Manager uses a built-in database system which allows “only“ to store an amount of data of 4 Gigabyte. If another RDMBS is used CS-Manager theoretically has got no capacity limits. Other RDMBS will be supported in future.

3 Installation of CS-Manager

3.1 Overview

The installation of CS-Manager will be conducted by a setup program. After the installation CS-Manager is ready to use. At the first start it creates an empty database which is used for operation from that point in time.

After the installation a default configuration is used. If this should be changed – for example the database or history directory should renamed – this can be achieved with a CS-Manager's form.

3.2 Installation

To install CS-Manager the program `Setup.exe` should be invoked. The installation process will be conducted by the setup tool. The installation process can be aborted by pressing the button "Cancel" at any stage of the installation process. When the installation tool has been started the following form is displayed:

Figure 3: Start of Installation Tool

Pressing the button “Next“ leads to the following form, where the target directory can be defined. The default directory is `c:\Program Files\Cellizer\CS-Manager:`

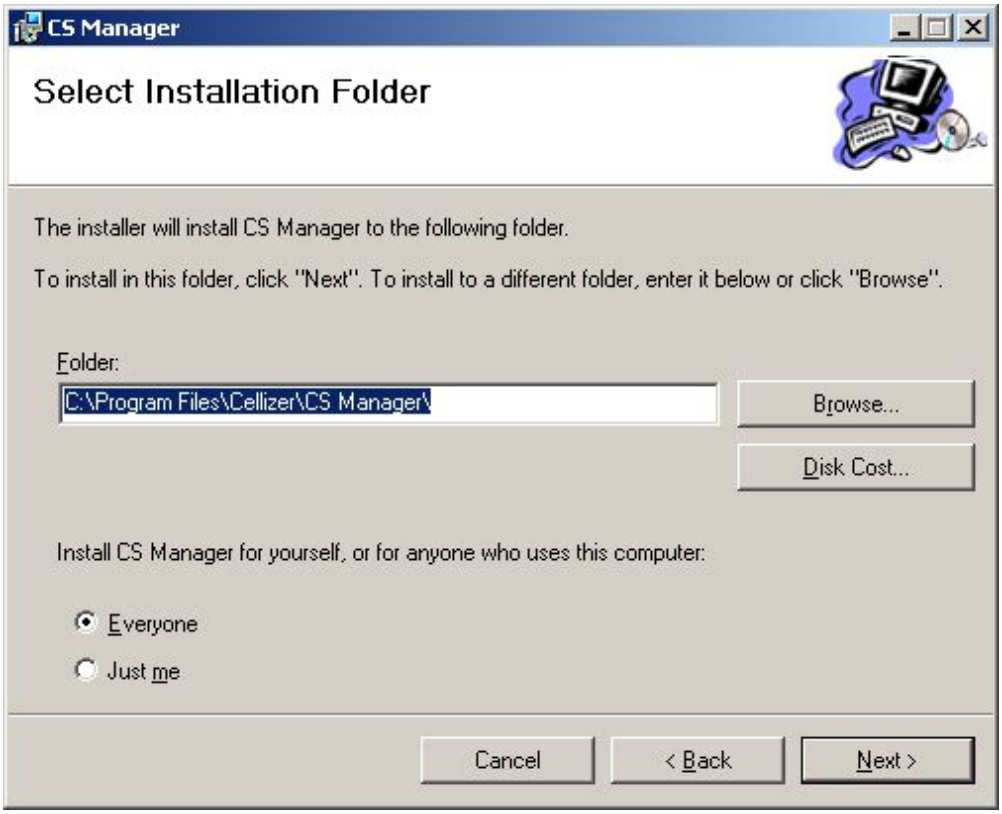


Figure 4: Defining the Target Directory

The administrator can decide whether or not CS-Manager should be available for every user on the workstation. This can be achieved by selecting the appropriate radio buttons “Everyone“ or “Just me“. The amount of disk space required for the installation can be checked by pressing the button “Disk Cost ...“.

If the button “Browse“ is pressed the target directory can be changed.

Pressing the button “Next“ allows to start the installation process:

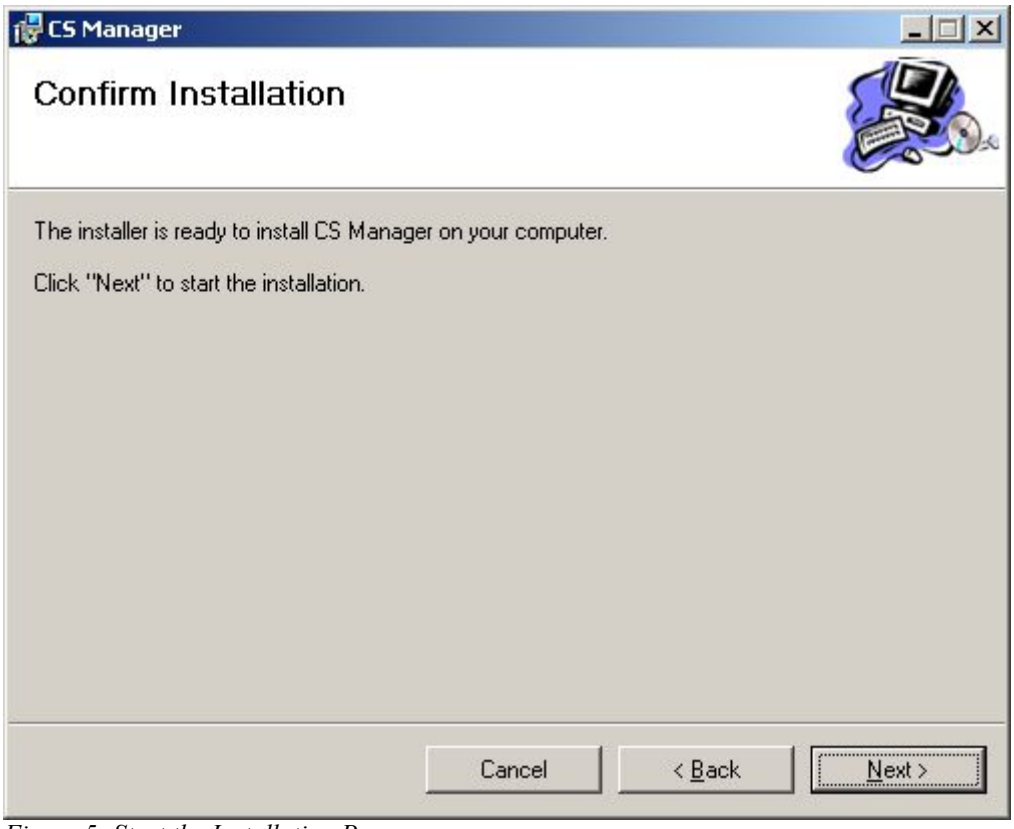


Figure 5: Start the Installation Process

If you are not sure you can either go back by pressing “Back“ or quit the installation completely by pressing the button “Cancel“.

If the installation process succeeds the following form is displayed:

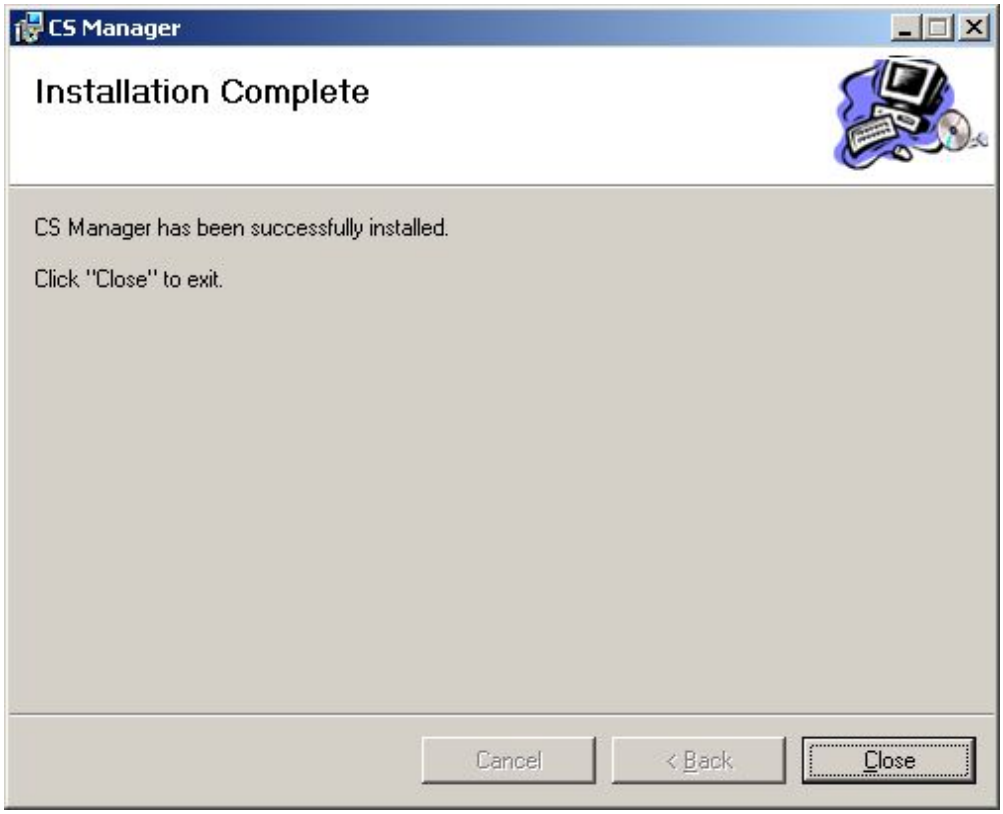


Figure 6: Installation succeeded

Now the Software has been installed in the directory
C:\Program Files\Cellizer\CS-Manager.

The Software, its configuration data and the database has been installed in this directory. The next figure shows the subdirectories created by the installation tool:

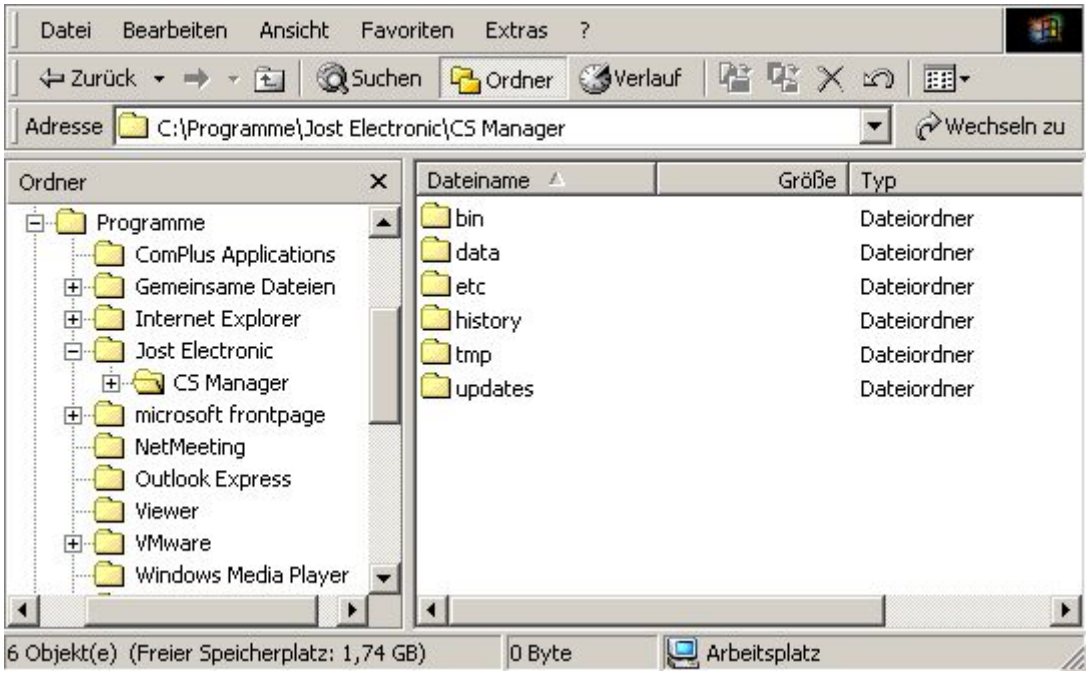


Figure 7: Directory Structure used by CS-Manager

Usage of subdirectories:

Directory	***Used for***
`bin`	Contains the program `CS-Manager.exe`
`data`	Contains the database
`etc`	Contains the configuration and profile files
`history`	Measurement data imported from the CRM-2010 are stored here
`tmp`	Used for temporary data
`updates`	Program Updates will be stored here (future releases will support that)

3.3 Configuration

If CS-Manager started for the first time the database is empty and profiles are not configured. CS-Manager asks the user whether or not a default profile should be created. If the users presses the button “Yes“ a default profile is created and CS-Manager starts. To change the system parameters of CS-Manager the menu “System“ has to be invoked:

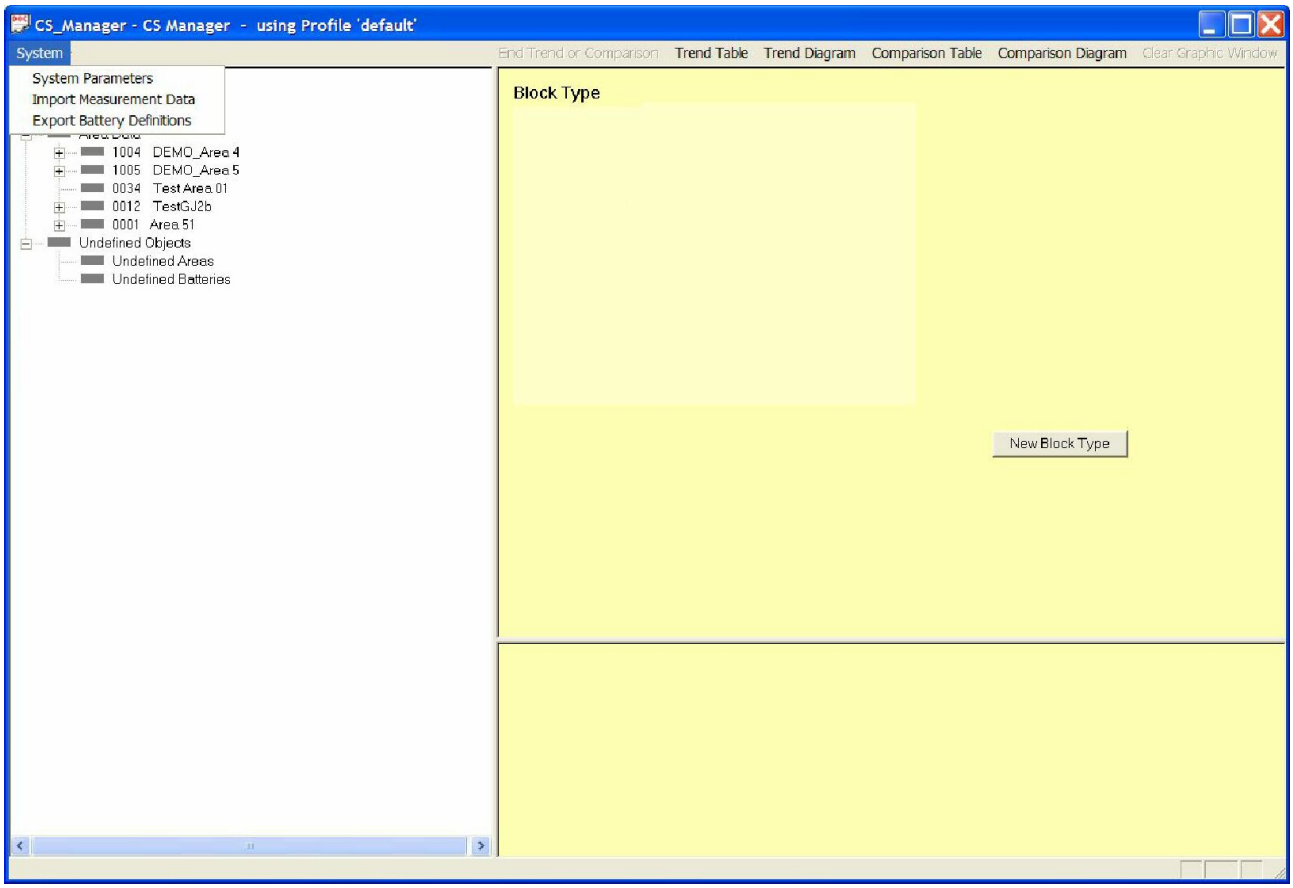


Figure 8: System Menu

Next the user should select the menu item “System Parameters“. If this menu item is selected the following form displays global parameters of CS-Managers which can be changed:

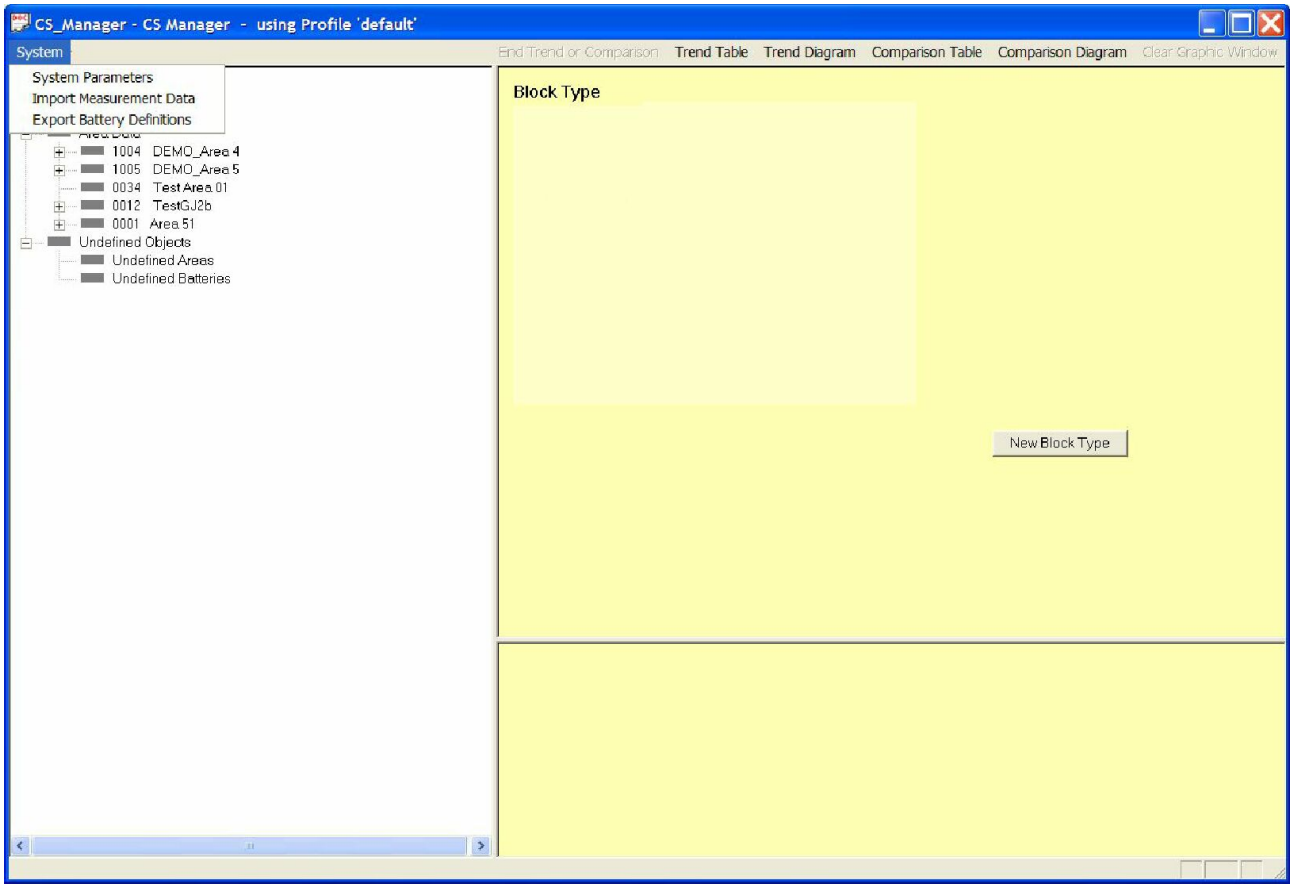


Figure 9: System Menu

Currently only the parameters “Temperature“, ”Database Name“ and “Volume Name“ can be changed. Future releases will support different profiles with different languages. If the button “Save is pressed the changes are stored. These changes will affect CS-Manager only if the program is re-started.

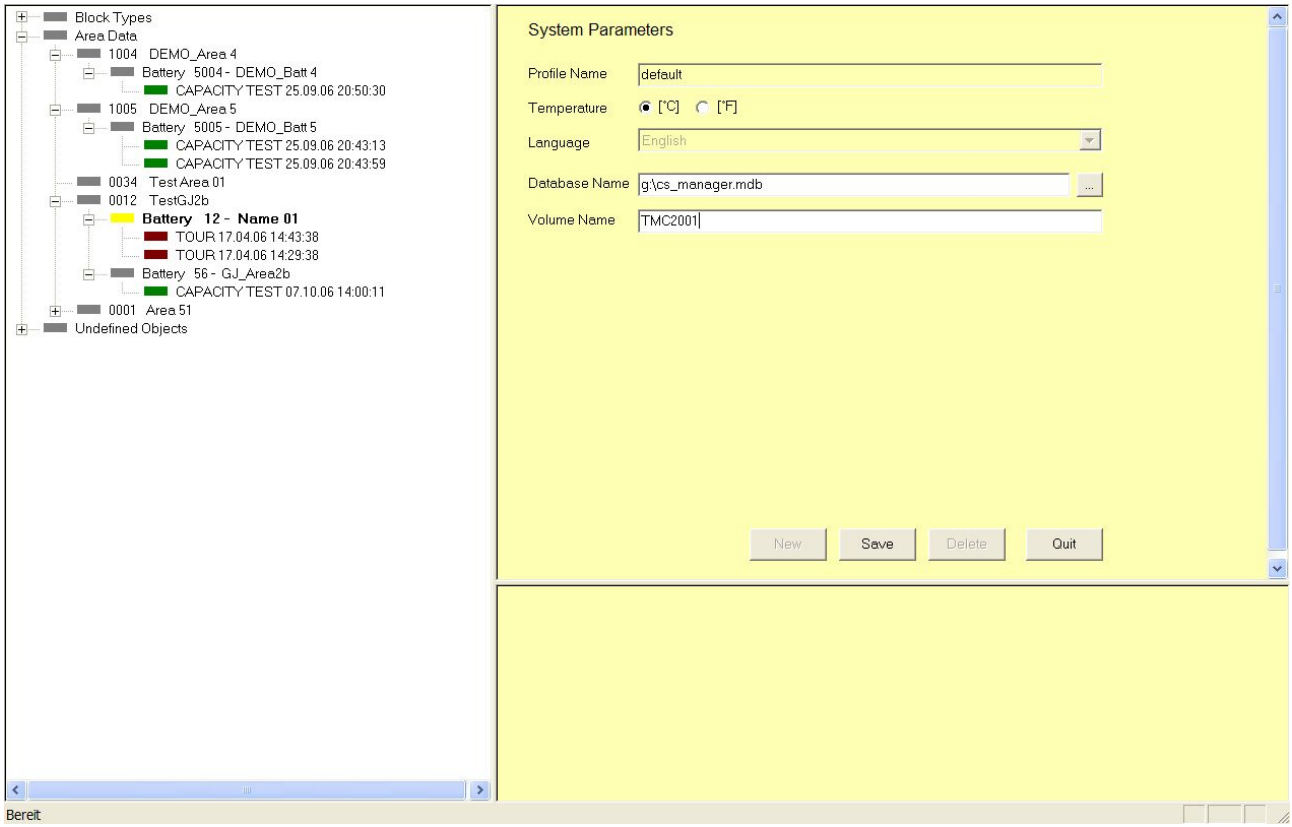


Figure 10: System Data

Currently only the parameters „Temperature“, „Database Name“ and „Volume Name“ can be changed. Future releases will support different profiles with different languages. If the button „Save is pressed the changes are stored. These changes will affect CS-Manager only if the program is re-started.

4 The First Steps

4.1 Overview

Before the CS-Manager software can be used some preparations have to be done. Notions and objects used in CS-Manager are introduced in section 4.2. How to use CS-Manager is described in section 4.4. To download the measurement data the steps described in section 4.3 have to be done.

4.2 Notions and Objects

4.2.1 Overview

The following sections describe notions and objects used in CS-Manager.

4.2.2 Profile

A *profile* is a set of parameter settings, for example language, database, etc. Profiles can be used to set up CS-Manager for different clients. If a user works for different customers he can associate different profiles with the customers. As a result, each customer gets his own database.

4.2.3 Navigation Tree

The *navigation tree* is a user interface component and defines the hierarchy between areas, batteries and measurement data. By clicking its entries the user can navigate within this hierarchy. The associated data is displayed in a different form.

4.2.4 Tree Node

A *tree node* is an entry in the tree used for navigation.

4.2.5 Root

The *root* is the topmost node of a (sub-)tree.

4.2.6 Child node

A child node is a tree node connected to another tree node.

4.2.7 Area

An *area* is a location where the batteries are situated. An area can be a building, a room, etc.

4.2.8 Area ID

An *area ID* is a unique identifier (numbers from 1 ... 1000000) for an area used in a profile.

4.2.9 Block Type

A *block type* defines the characteristics of a battery. Every battery has to be associated with a block type.

4.2.10 Battery

A *battery* consisting of cells is the object from which the measurement data are obtained. Every battery has to be located in an area.

4.2.11 Battery ID

A *battery ID* is a unqiue identifier (numbers from 1 ... 1000000) for batteries in an area. Batteries in different areas may have the same battery ID.

4.2.12 Measurement Parameters

Measurement parameters supported by the CRM-2010 are

- block voltage
- block resistance
- battery capacity (CS-4001)
- battery temperature

4.2.13 Measurement Type “Tour“

In a *tour* the voltage values for all cells of a battery at a certain point in time are retrieved. A collection of tours of a certain battery is called “history“.

4.2.14 Measurement Type “Test“

A *capacity test* retrieves cell voltage values of a battery periodically. The length of the test interval defines the amount of data.

4.2.15 Analysis Type “Trend“

A *trend* visualises the history (collection of tour data) of a battery or a cell. A trend can be displayed either as a table or as a diagram.

4.2.16 Analysis Type “Comparison“

A *comparison* allows to compare measurements of the same type (tour or capacity test) of different batteries.

4.2.17 Preview of Measurement Data

A *preview* consists of a small diagram and a form containing important parameters of a measurement.

4.3 The Basic Workflow

4.3.1 Overview

When CS-Manager is used for the first time it does not contain any data. Measurement data can be downloaded from the CRM-2010, but how do battery and area information get into the device? And where do the data come from?

Areas, batteries, block types, etc. have got a certain relationship. This relationship defines in what sequence data should be processed.

Because batteries are situated in areas everything begins with defining the required areas. Before a battery is created and associated with one of the areas the user should make sure that the block types which should be used are defined. After that the batteries are created and associated with the areas.

Before the user does the actual measurement the information about areas and batteries have to be transferred to the measurement device (upload battery definitions). Now everything is ready to do the actual measurement. When this has been finished, die measurement data can be downloaded from the device and are imported into CS-Manager's database. The basic workflow

1. Define Areas
2. Define Block Types
3. Define Batteries
4. Upload Battery definitions
5. Do the measurement tasks
6. Download measurement data

is described in the sections to 4.3.7.

But what happens if the user forgets one of the steps or he takes a different CRM device which does contain area and battery definitions not stored in his CS-Manager version? Will the measurement data captured with this device be useless?

Of course, the answer is no. CS-Manager imports measurement data even if the ”come from the wrong areas“. The data are imported and kept as ”Unknown Objects“. The user can define areas, battery definitions, etc. after the import and re-associate the batteries manually (see section).

4.3.2 Define Areas

To define a new area the node ”Area Data“ has to be selected. After pressing the button “New Area“ a form is displayed allowing to enter the area parameters (see figure 10).

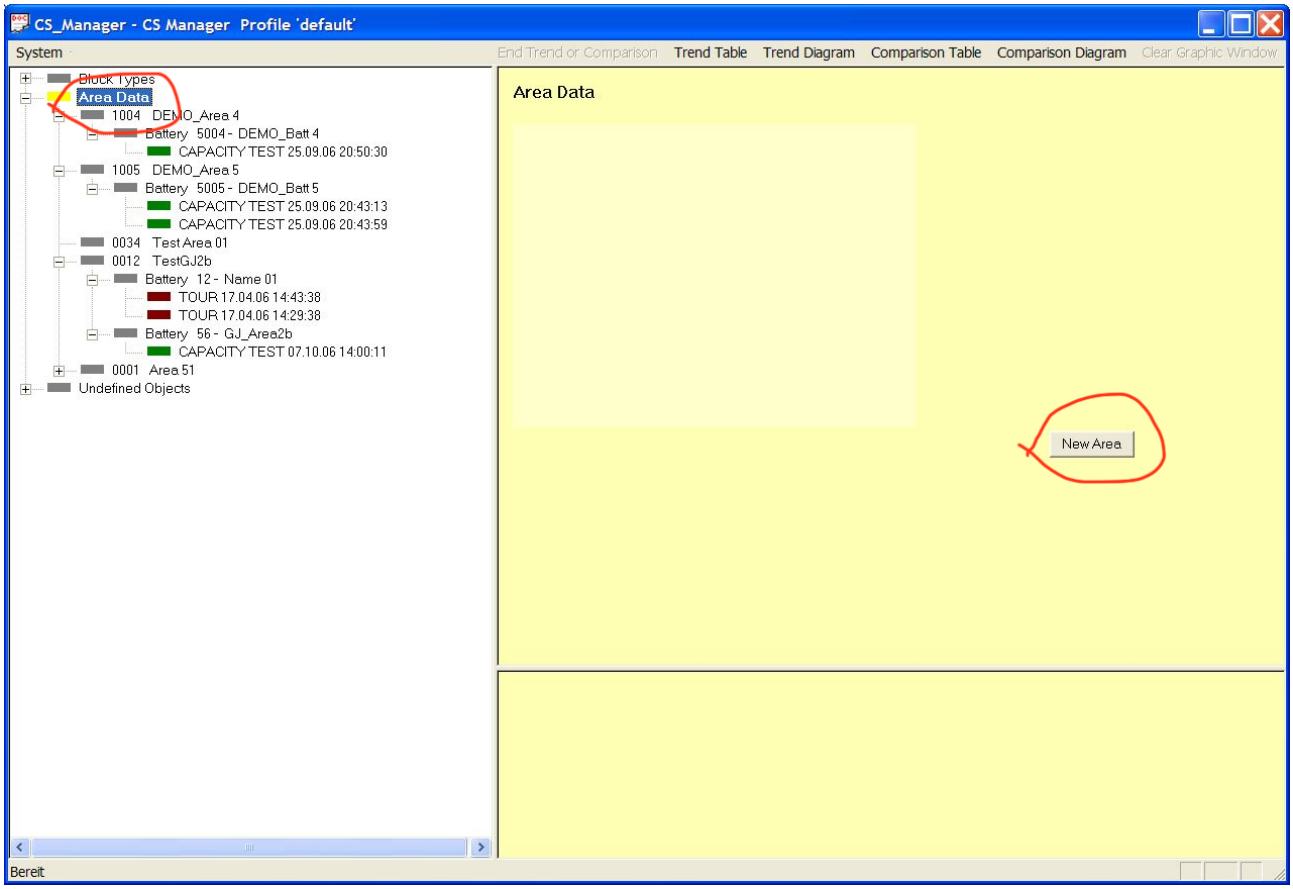


Figure 11: Add new area

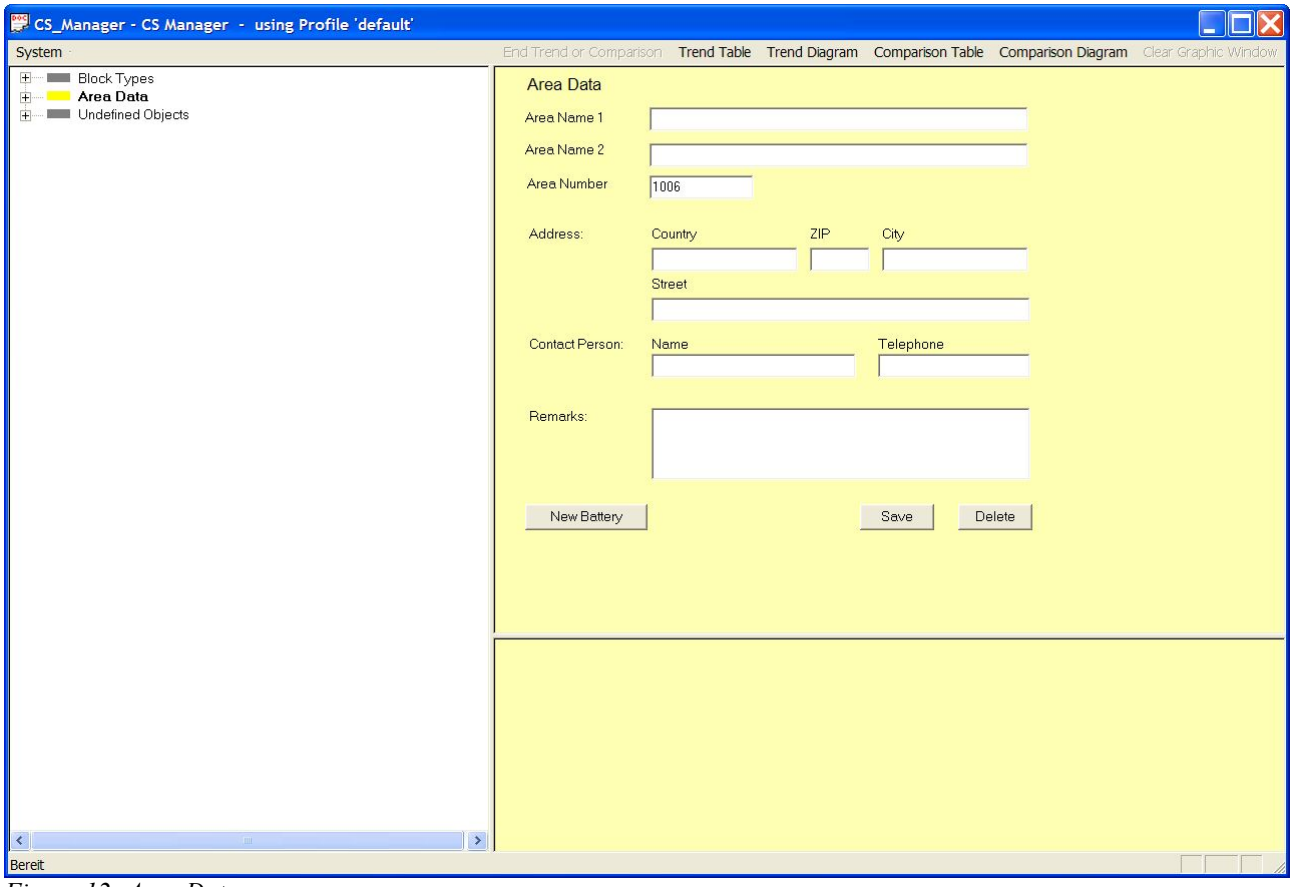


Figure 12: Area Data

The area ID has to be unique within the database. Therefore, the system suggests an area ID which can be changed manually. After the data have been entered they can be written into the database by pressing the button “Save“.

4.3.3 Define Block Types

Before a battery can be associated with an area it has to be ensured that the required block type is defined. To create a new block type record the node “Block Types“ in the tree should be selected. If the button “New Block Type“ is pressed a form is displayed allowing to enter the block type's parameters (see figure 11).

First manufacturer, block type and battery design (Pb, NiCd, etc.) should be entered. In the next section on the form minimum and maximum values can be entered, either as absolute or relative values. These values are considered in the analysis processes. For example, the minimum voltage is displayed as a red line in the diagram, values less than the minimum voltage are marked red in a table, etc.

The last section contains parameters only relevant in the context of capacity tests. If the current record should be written into the database, the user should press the button “Save“.

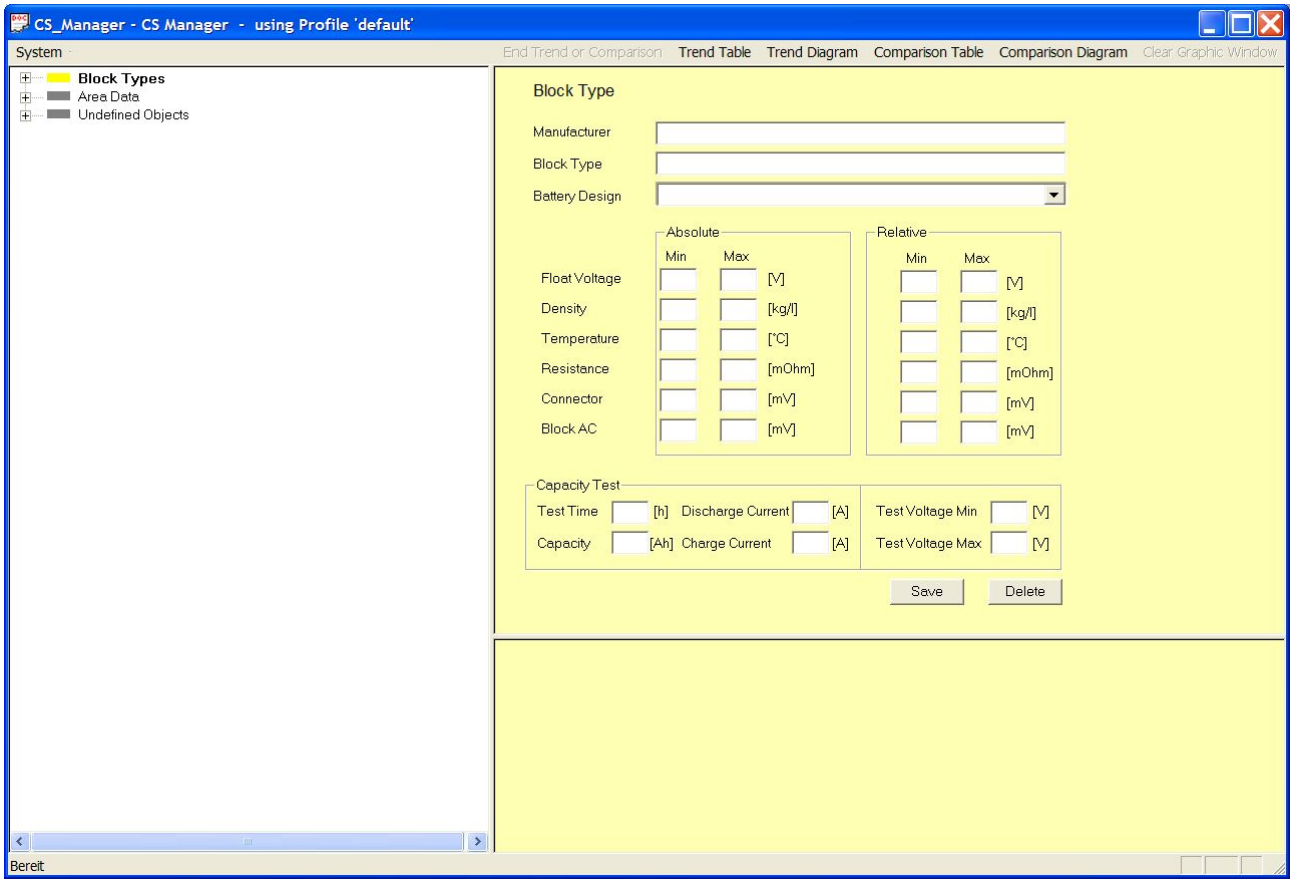


Figure 13: New Block Type

4.3.4 Define Batteries

When areas and block types are defined battery records can be created. This can be achieved by selecting the area in which the battery is located.

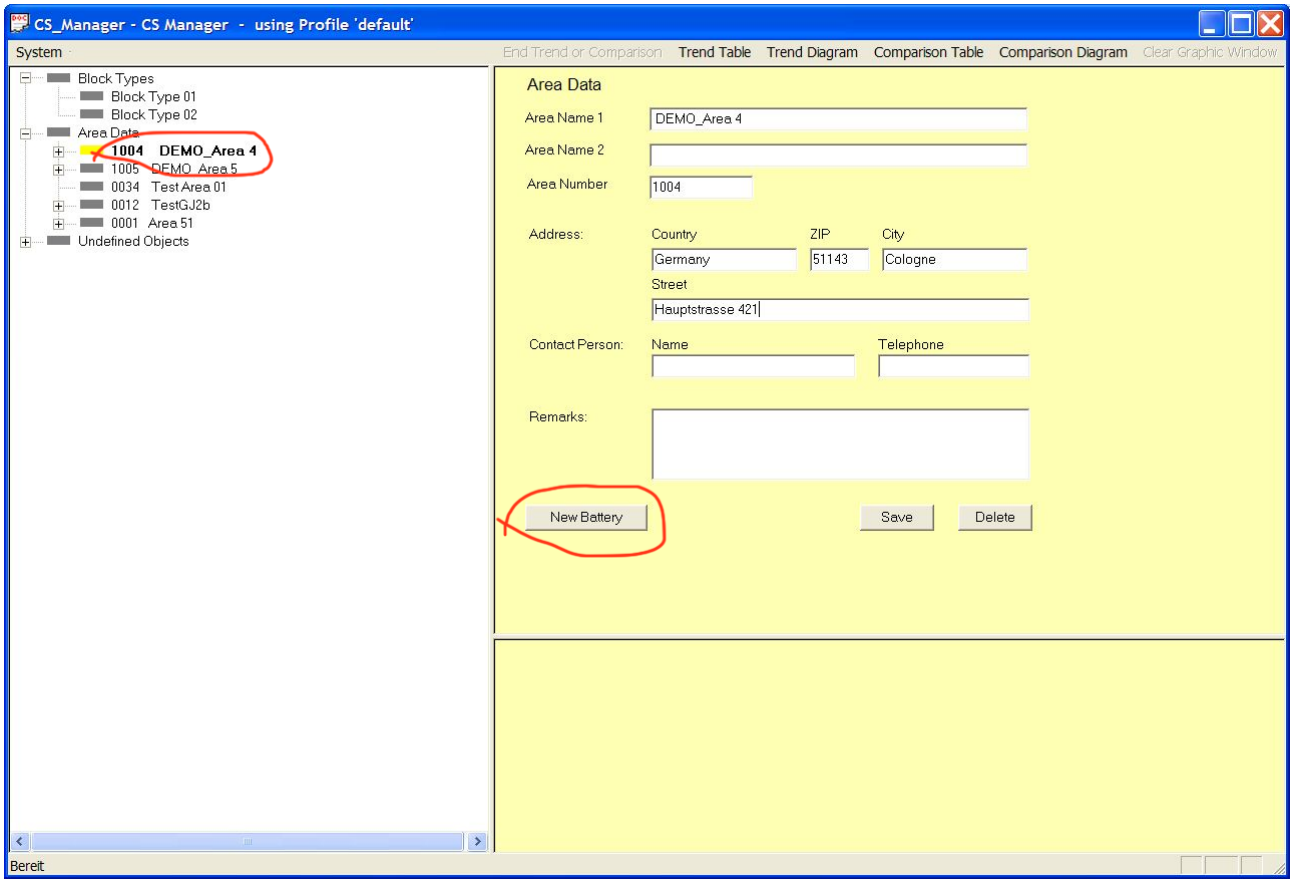


Figure 14: Create new battery

By pressing the button “New Battery“ a form is opened see figure 13).

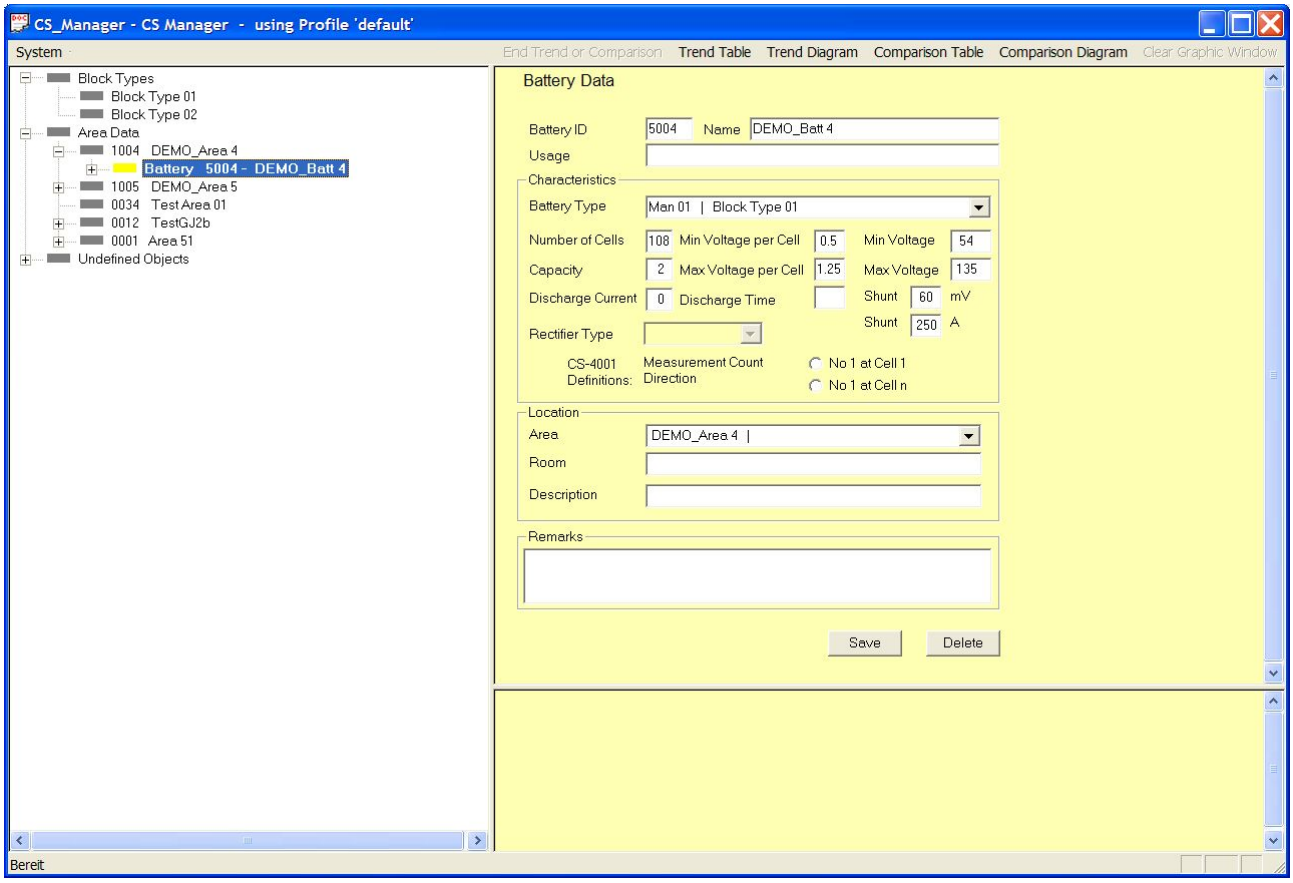


Figure 15: Battery Data

CS-Manager suggests a battery ID because this ID has to be unique within this area. The battery ID can be changed manually. In this case the user has to ensure that the battery ID is unique.

When the parameters have been entered the battery record can be saved by pressing the button "Save".

4.3.5 Connect the Device

The measurement device (CRM-2010) now can be connected to the computer using an USB cable. If the device is powered on it will be recognised as a mass storage system and appear as a "normal" volume in the explorer. The measurement files on the CRM-2010 are CSV files.

If the device is not displayed in the explorer of the Windows system please check whether or not the cable is properly connected and the device is switched on.

4.3.6 Upload Battery Definitions

If new areas or batteries are defined since the last measurement download the new battery definitions should be uploaded to the CRM-2010. The appropriate menu entry is part of the pulldown menu “System“:

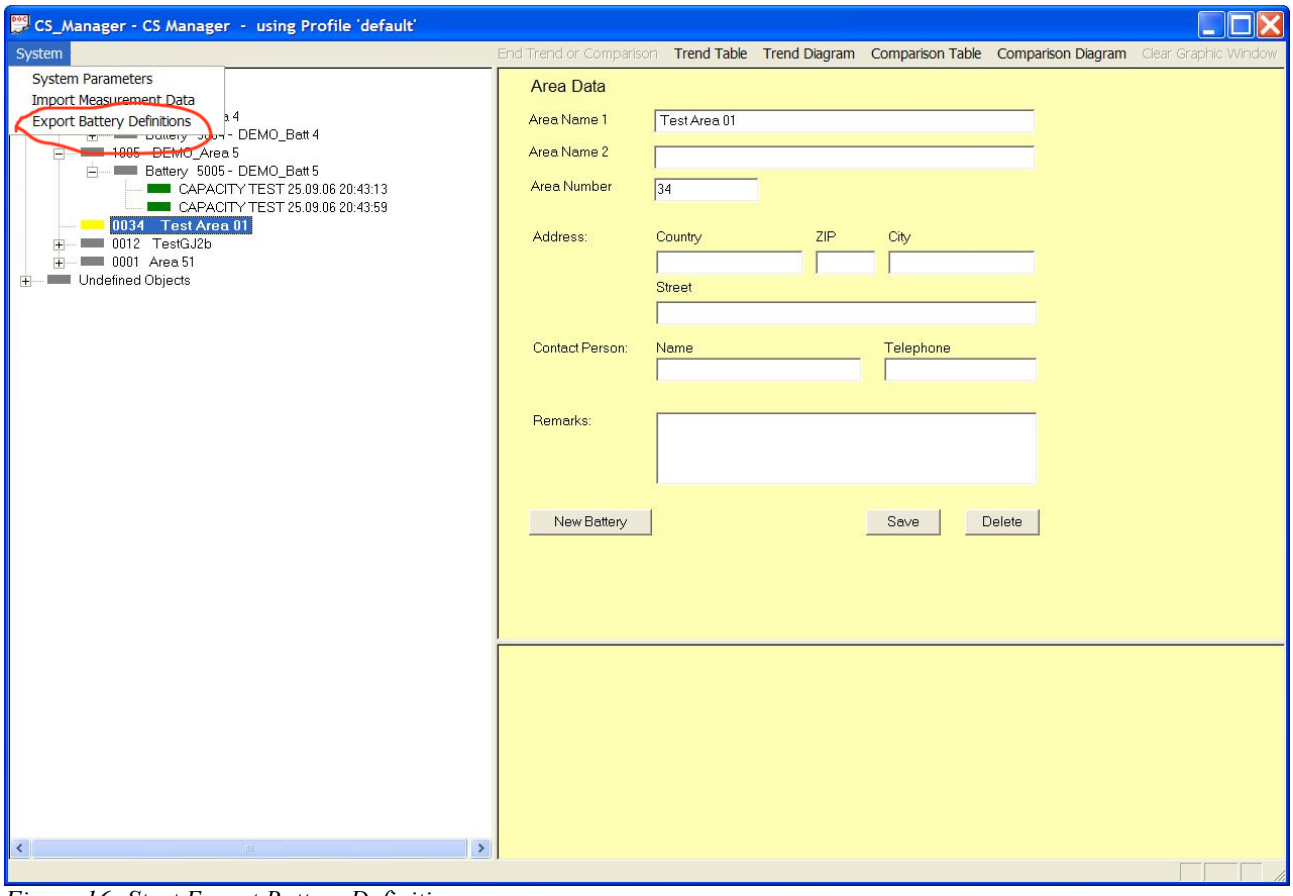


Figure 16: Start Export Battery Definitions

When the entry is selected a form is displayed which allows to define which areas and which batteries should be uploaded (see figure 17). The leftmost list contains the available areas. If an entry is selected the associated batteries will appear in the list in the middle. The rightmost list indicates the list of batteries to be uploaded to the device. This list acts as a container which can be filled by selecting batteries from the list in the middle and „moving“ the selected entries with the buttons “>“ or “>>“. The button „>“ picks only the selected batteries. With “>>“ all batteries displayed are selected even if they are not highlight.

Items can be remove from the list using the buttons “<“ (remove selected items) and “<<“ (remove all items).

To make life a bit easier “Select All“ buttons are available for every column. Before the collection of batteries is transferred to the device the choice should be saved first with the button “Save Settings“. When this has been done the actual data transfer can be initiated by pressing the button “Export Battery Definitions“.

Note: The CRM-2010 has to be set into the correct mode before starting the data transfer (please refer to the manual of the measurement device).

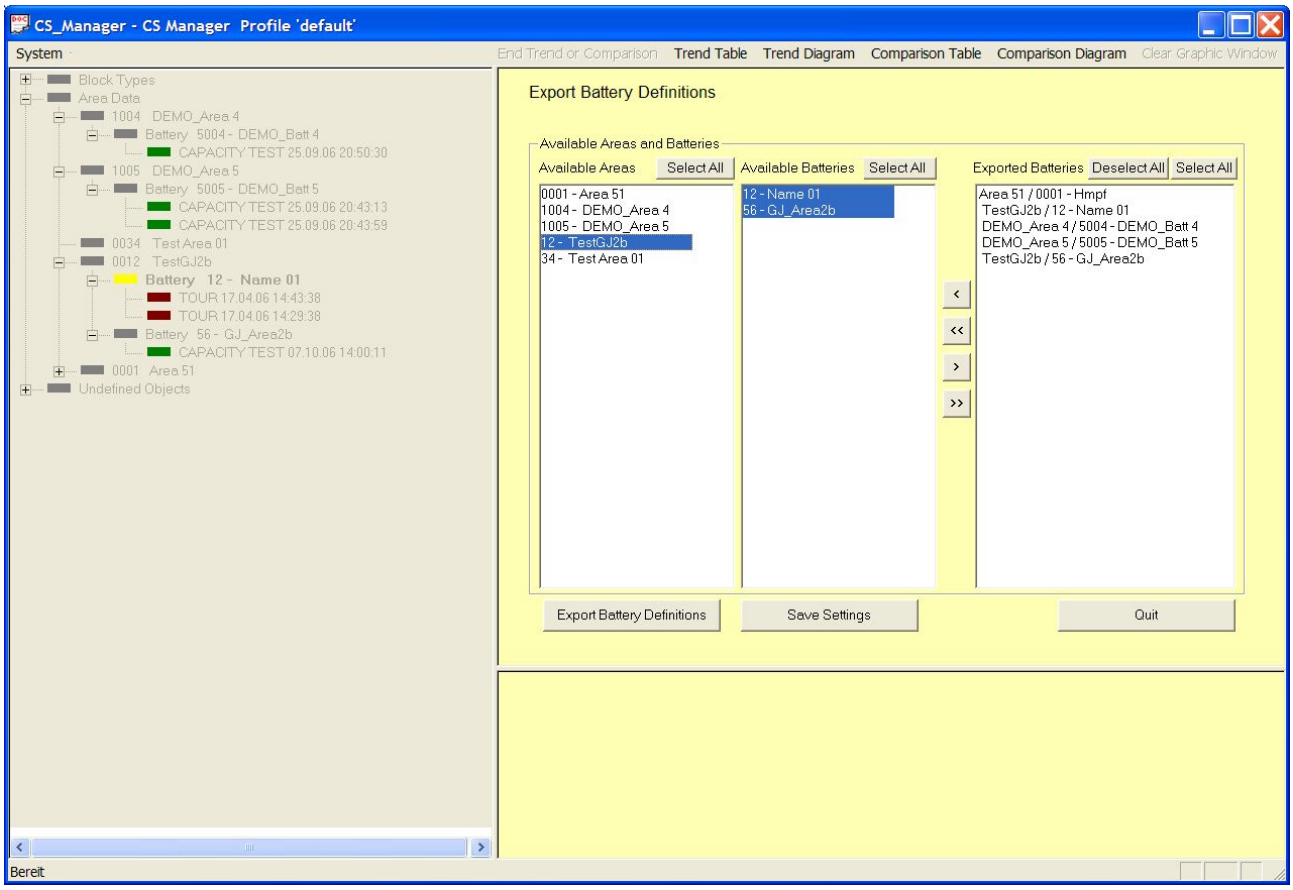


Figure 17: Export Battery Definitions

4.3.7 Download Measurement Data

When the measurements are done the data should be imported into CS-Manager. To to this the pulldown menu “Import Measurement Data“ has to be used:

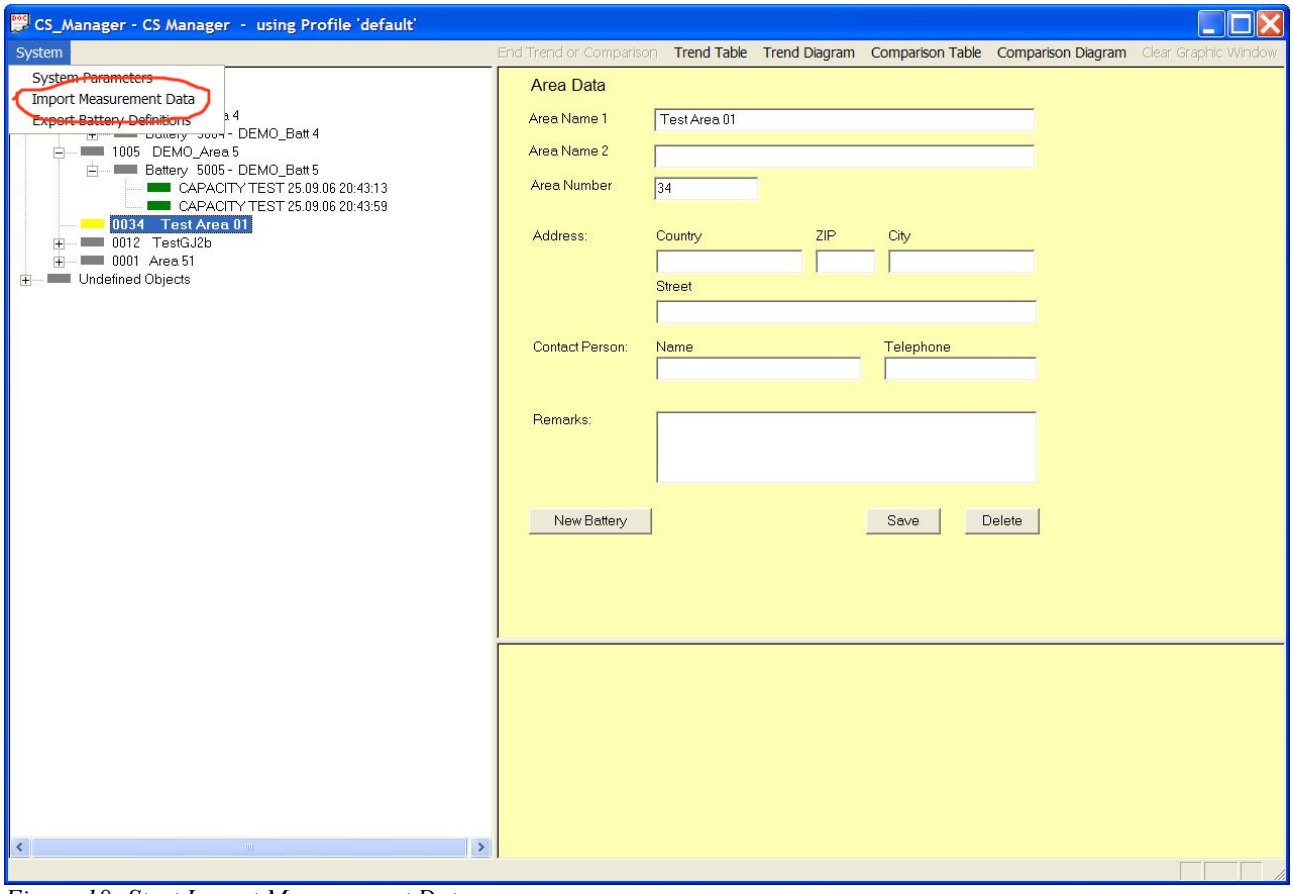


Figure 18: Start Import Measurement Data

When the menu entry is selected the following form is displayed (see figure 19). If the button ”Import Measurement Data“ is pressed the measurement data is imported into the database.

Note: The CRM-2010 has to be set into the correct mode before starting the data transfer (please refer to the manual of the measurement device).

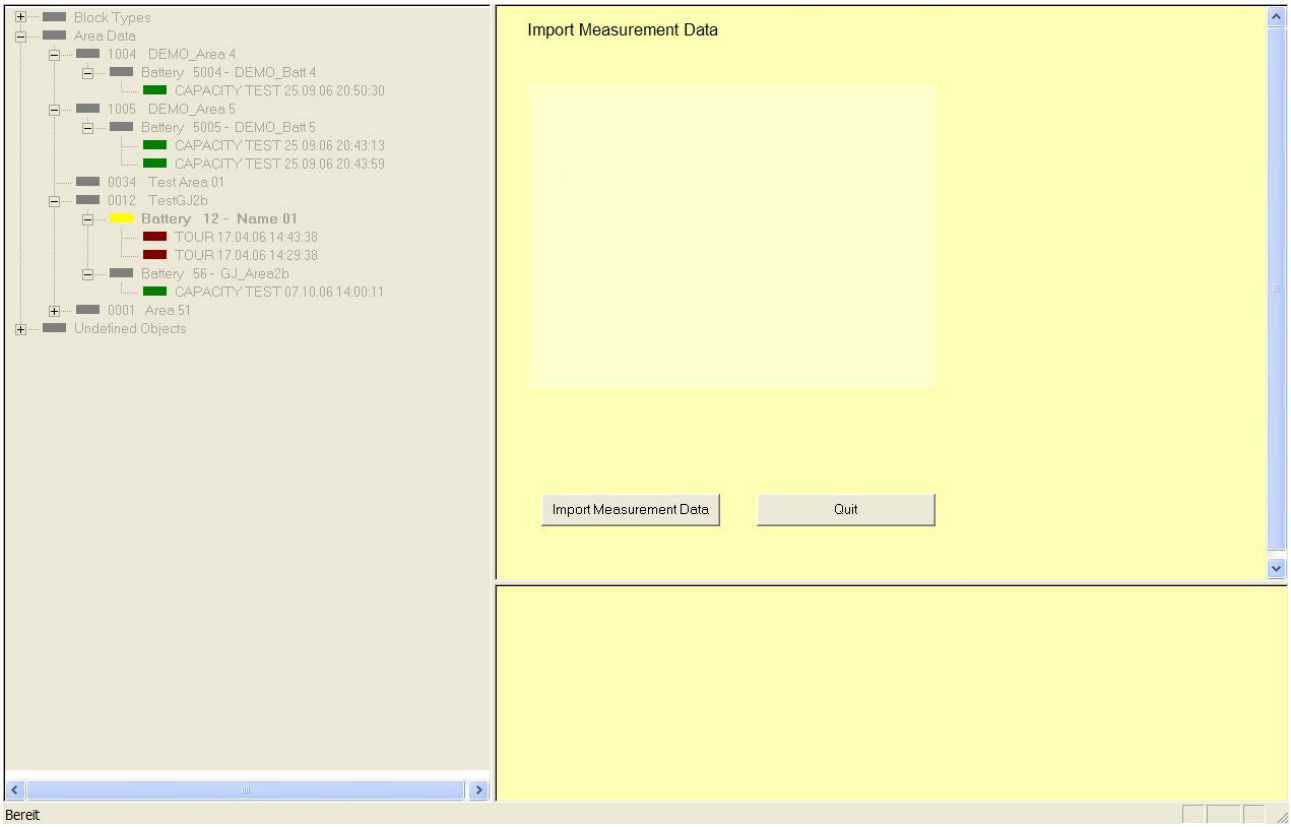


Figure 19: Import Measurement Data

During the import process CS-Manager checks whether or not a measurement has already been imported and denies multiple imports. If the import has finished the data can be used immediately for analysis purposes.

4.3.8 Associate Unassociated Areas and Batteries

What happens if measurement data are imported of batteries and areas which are not stored in the database? This might happen for example if the user picks a "wrong" measurement device which has been configured for different client. Actually, this is not a problem. The records will be imported and indicated as "Unknown Objects". If an area ID occurs which is not stored in the database an appropriate record will be generated and displayed in the subtree "Unknown Areas". Analogously, unknown batteries appear at "Unknown batteries". The user may change these records manually so that these areas and batteries are "correctly" put into the database.

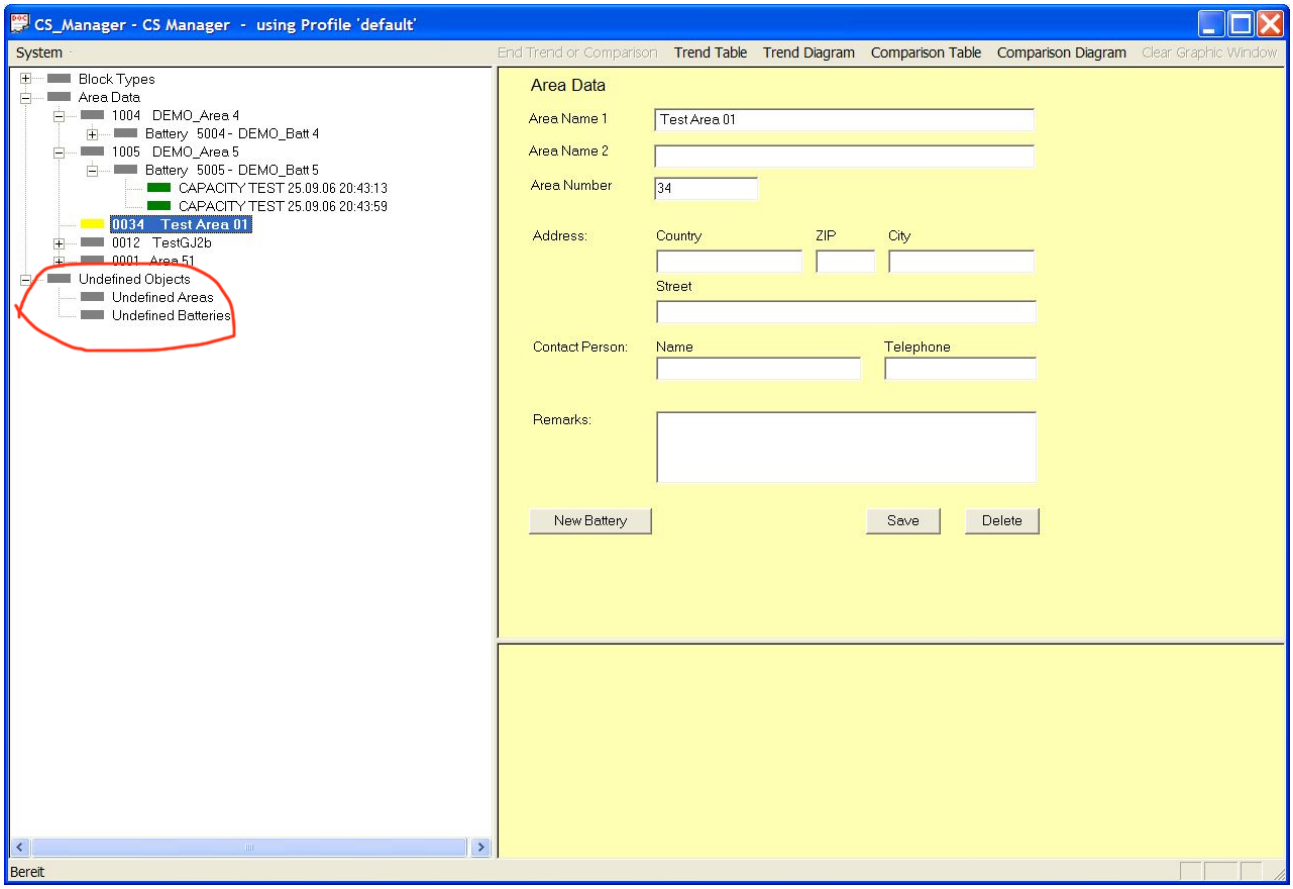


Figure 20: Unknown Areas

4.4 The CS Manager Browser

4.4.1 Overview

The following sections describe the handling and concepts of CS-Manager briefly. CS-Manager is a tree navigator which visualises the associations between areas, batteries and measurement data. Figure 21 shows the different areas of CS-Manager:

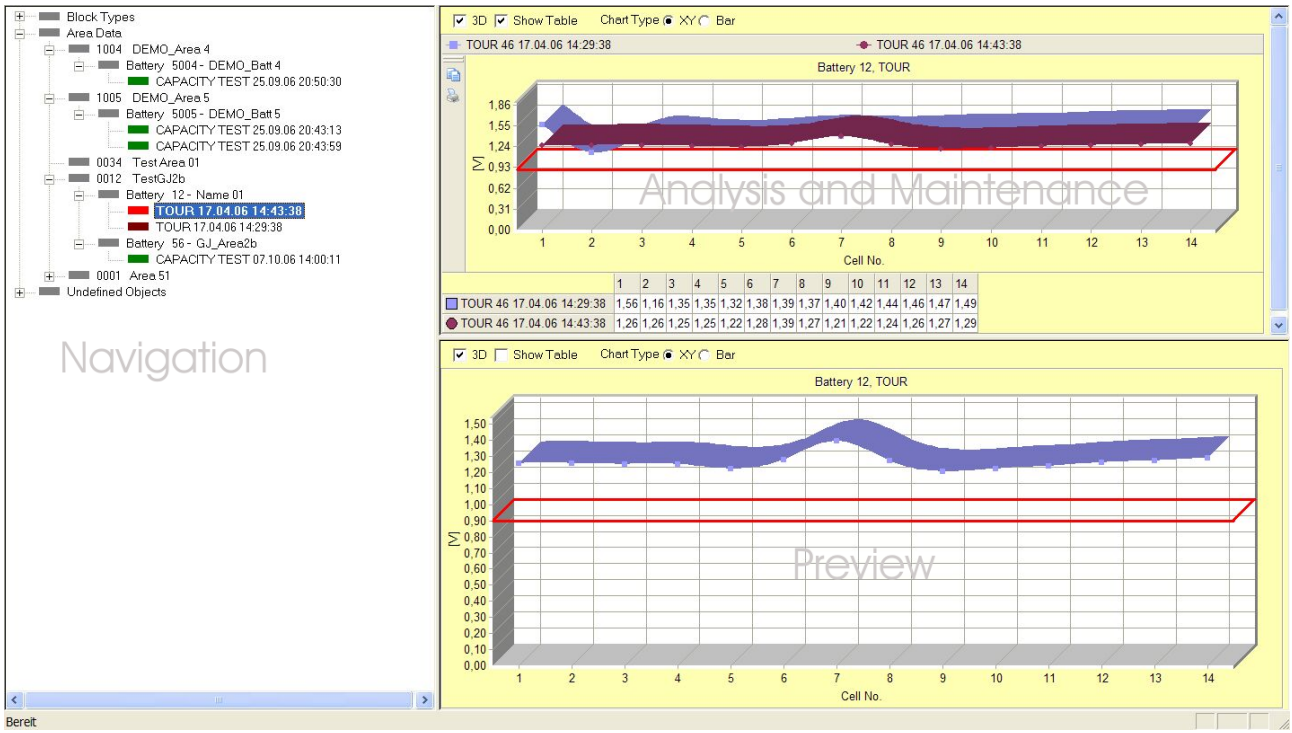


Figure 21: Different Areas in CS-Manager

The left side is the navigation area. The first entry in the tree is associated with the block types defined for the current profiles. Areas used in the current profile area added below the tree node "Area Data". If a battery is situated in an area its representing tree node is put below the area node. As expected, associated measurement data are put below the appropriate battery node.

The node "Undefined Objects" has got two child nodes:

- Undefined Areas
- Undefined Batteries

If measurement data are downloaded from the CRM-2010 and an area ID is used which is not stored in the database an appropriate entry is made in "Undefined Areas". Similarly unknown battery IDs are treated and appended to the node "Unassociated Batteries".

4.4.2 Navigation

The tree in the left window area is used to navigate through the database. When CS-Manager is started only the nodes

- Block Types
- Area Data
- Unknown Objects

are displayed:

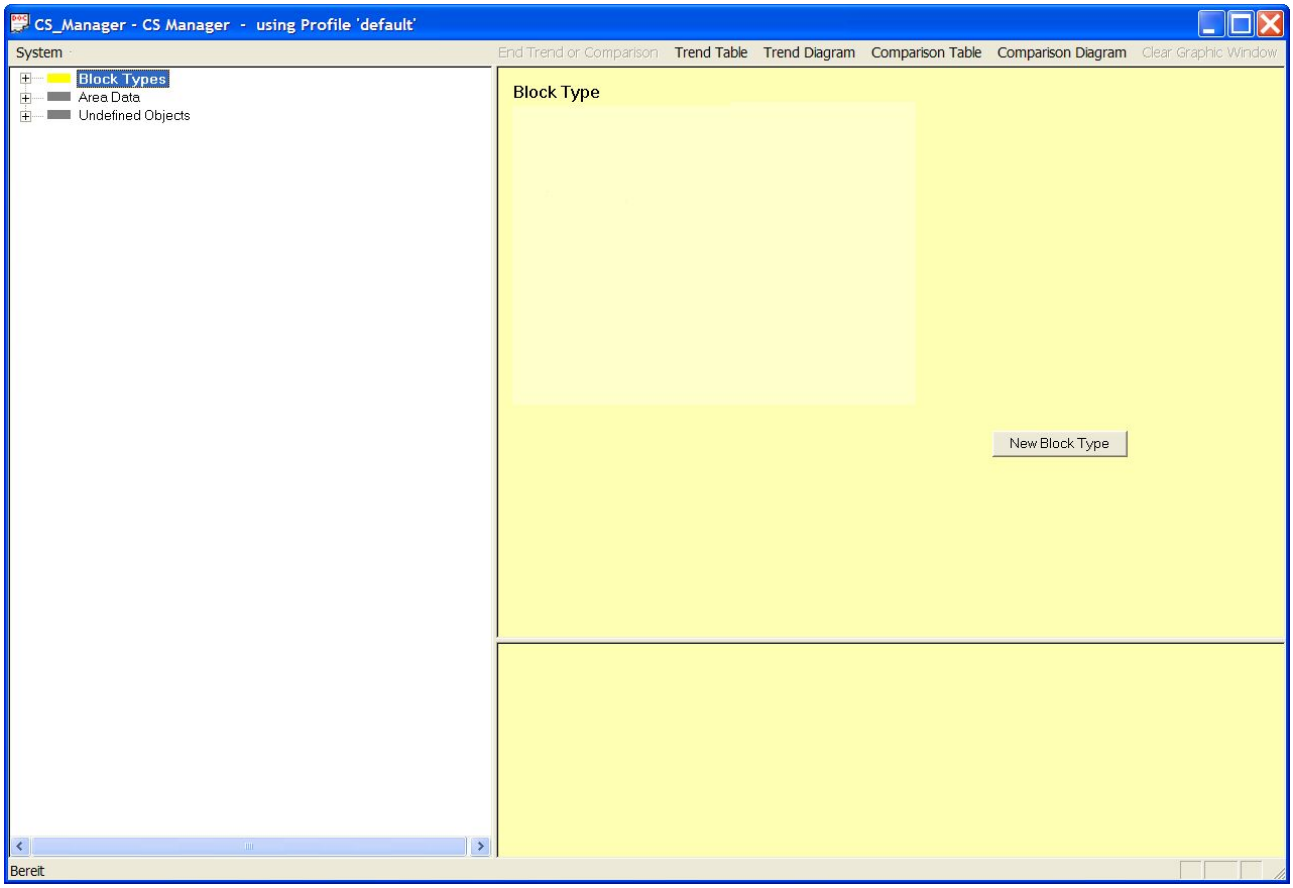


Figure 22: Initial Tree State

The node currently selected in the tree is high-lighted (here Block Types). A node can be selected by clicking with the mouse on it or using the cursor keys “up“ and “down“. A “+“ sign in front of a tree node indicates that this node has got child nodes. For example, if an area node is shown with a “+“ batteries are associated with this area.

When a node with a leading “+“ is high-lighted the subtree can be unfolded either by clicking with the mouse on the „+“ or by pressing the cursor key “right“. When a subtree is unfolded a leading “-“ is displayed.

To collapse the subtree the user either can click on “-“ or use the cursor key “left“.

Figure 23 shows a partially expanded tree:

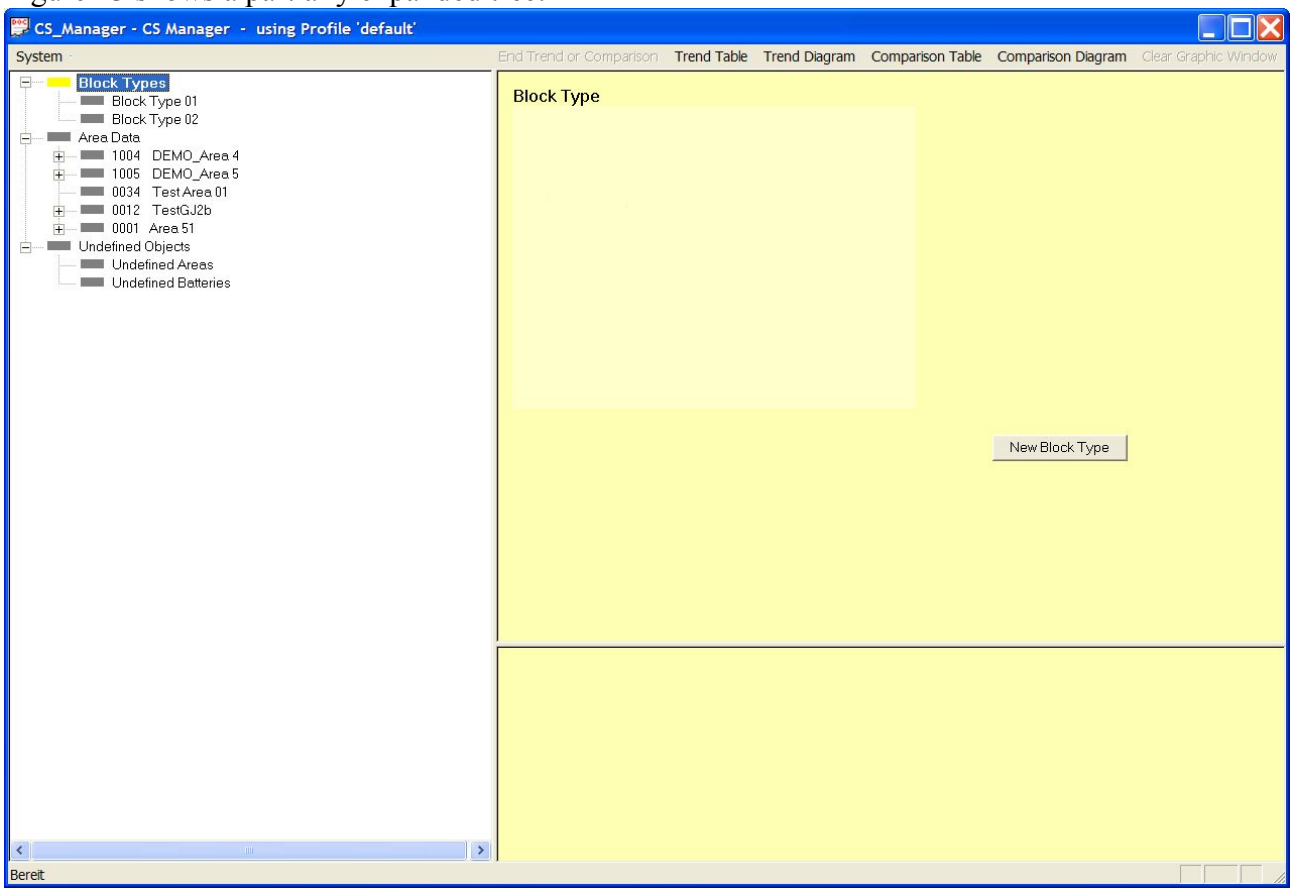


Figure 23: Partially expanded tree

Whenever the user selects a node within the tree on the right side an appropriate form is displayed. Because the root of the subtree “Block Types“ is selected a form allowing to create a new block type is shown. If one of the area entries is selected a form displaying the data of that area will be displayed.

The grey bars separating the three screen regions can be moved. If one of these bars is picked with the mouse an the left mouse button remains pressed the sizes of the areas can be changed by moving the mouse.

4.4.3 Maintain Data

CS-Manager allows to maintain the objects

- Block Type
- Area
- Battery
- Measurement

The maintenance operations are

- Create new object
- Change object
- Delete Object

To use one of the maintenance operations first an entry in the tree has to be selected. After that a form is displayed which allows the user to trigger one of the operations. Figure shows a tree with a selected are node, a form displaying the data of that area and buttons “Save“ and “Delete“ is shown:

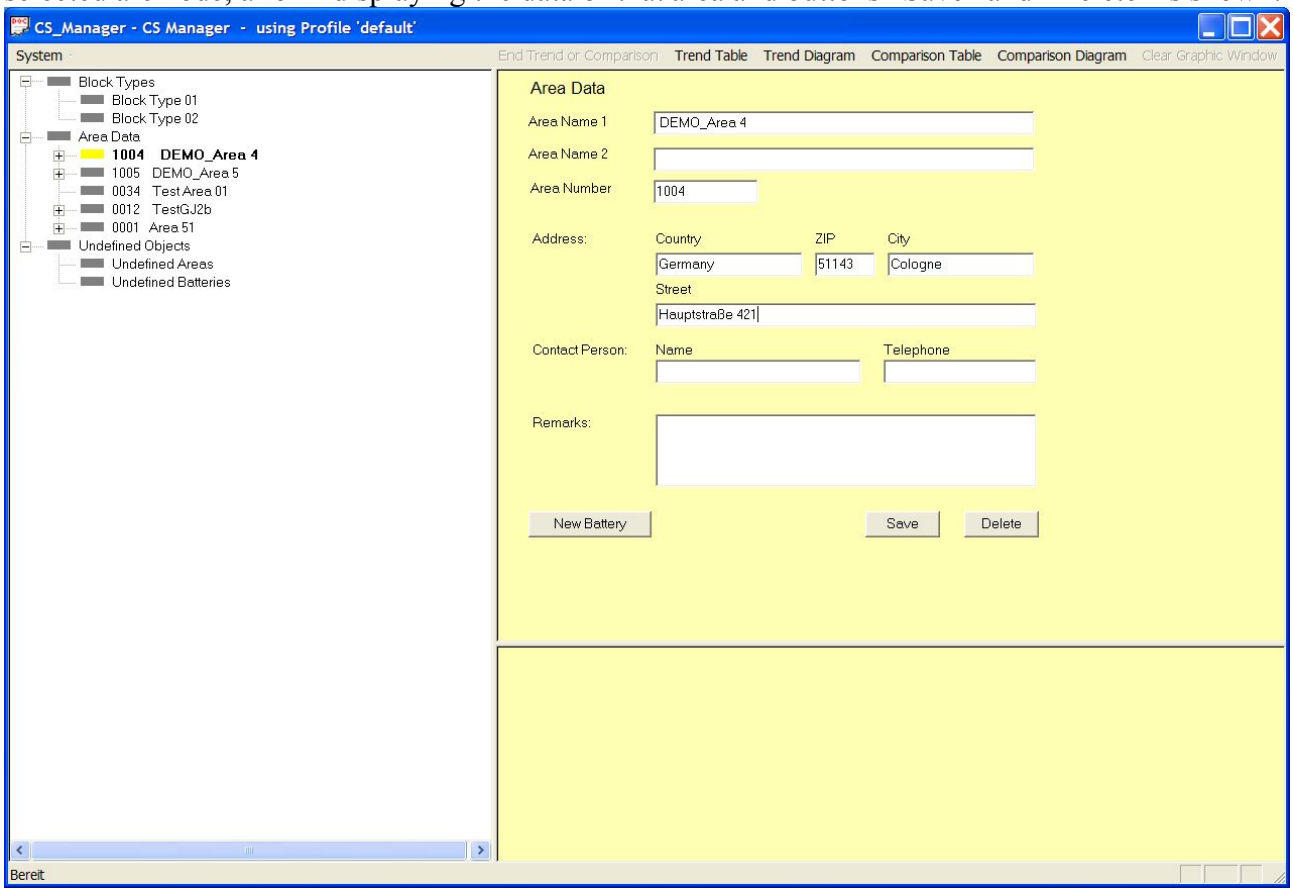


Figure 24: Area Data

Because batteries always have to be assigned to an area – in CS-Manager dangling batteries do not exist – there is a button "New Battery" allowing the user to create battery which will be associated with that area.

4.4.4 Preview Measurement

Whenever a measurement entry is selected a graphical preview is displayed in the right screen area:

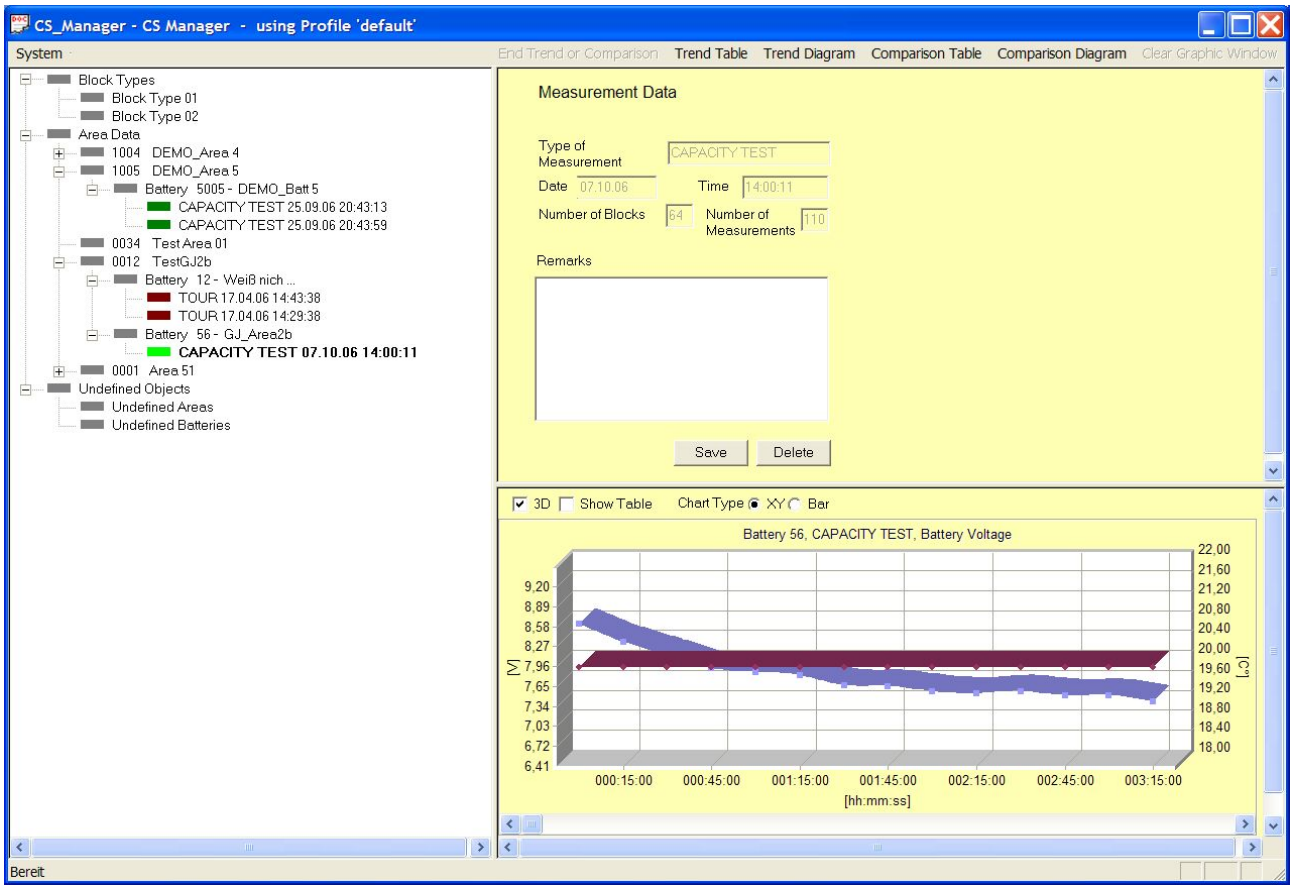


Figure 25: Preview of Measurement Data

When the selected tree node changes the preview window is updated immediately. The preview can be customised with the radio buttons and check boxes at the top of the preview window. For example, the chart type can be changed from xy chart to a bar diagram by clicking on the appropriate radio button.

4.4.5 Analysis of Measurement Data

4.4.5.1 Overview

Two different analysis types are currently supported:

- Comparison: Compare different measurements of a battery using the same measurement type (tour or capacity test).
- Trend: Show the history of a single cell of a battery

The result of an analysis can either be displayed as a diagram or a table which will be shown at the top of the right screen region.

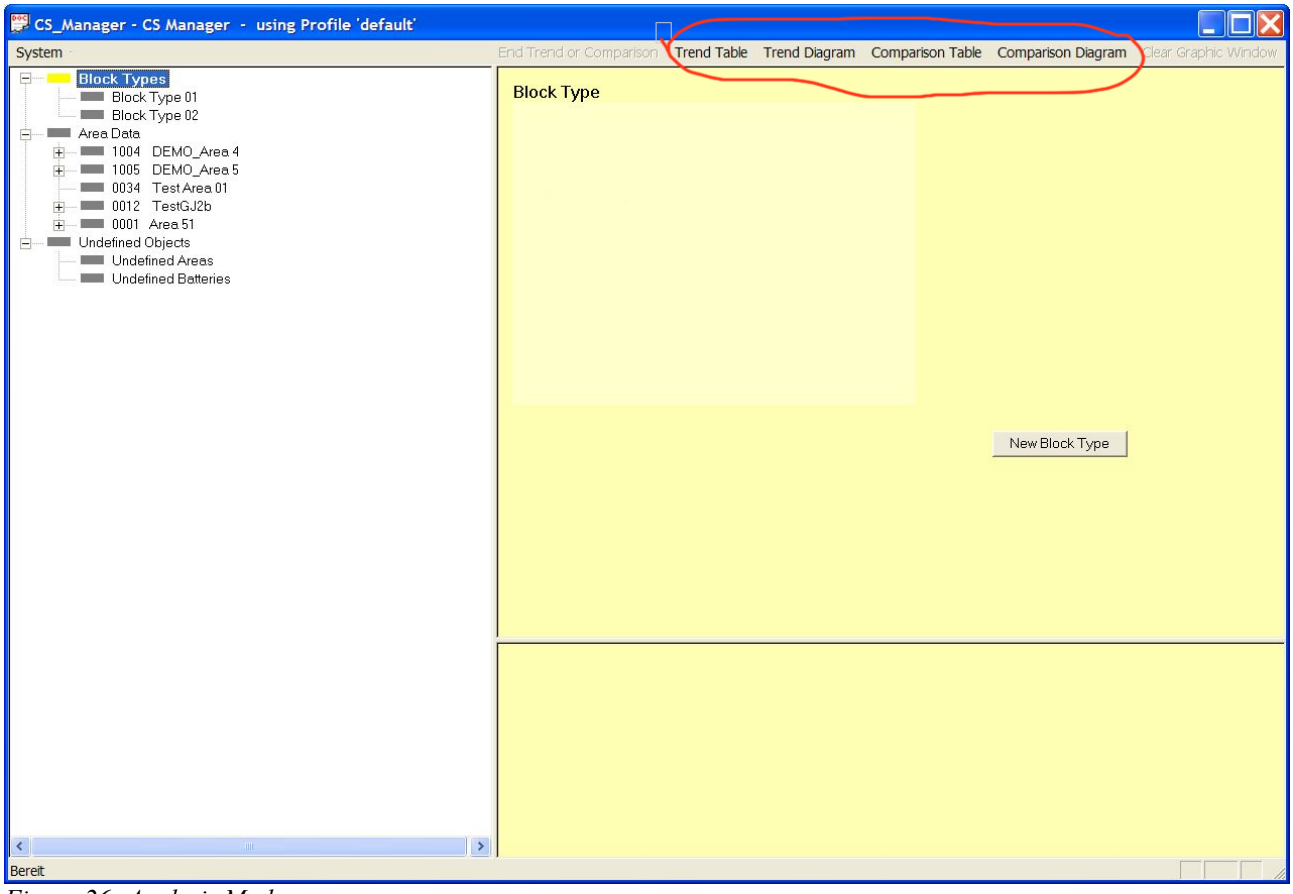


Figure 26: Analysis Modes

The different analysis types are enabled by pressing the menu buttons at the top. The tree item which is selected when one of the analysis buttons is pressed provides the data for the analysis. The window in which the data – diagram or table – is displayed is locked. If the user picks another item in tree the analysis region will not change, only the preview area will change accordingly. This

allows the user to browse through the measurement data without loosing the content of the analysis area.

If another analysis task should be performed the window has to be cleared first. This is done by pressing the button “Clear Graphic Window“. The status of CS-Manager – Trend analysis or Comparison – will remain.

To go back to “normal“ navigation mode the button “End Trend or Comparison“ has to be pressed.

4.4.5.2 Trend

To do a trend analysis the following steps have to be performed:

1. Start in Navigation mode (The button “End Trend or Comparison is grey and cannot be pressed)
2. Select a *battery* from tree (it does not work if a measurement is selected in the tree)
3. Press button “Trend Table“ or “Trend Diagram“

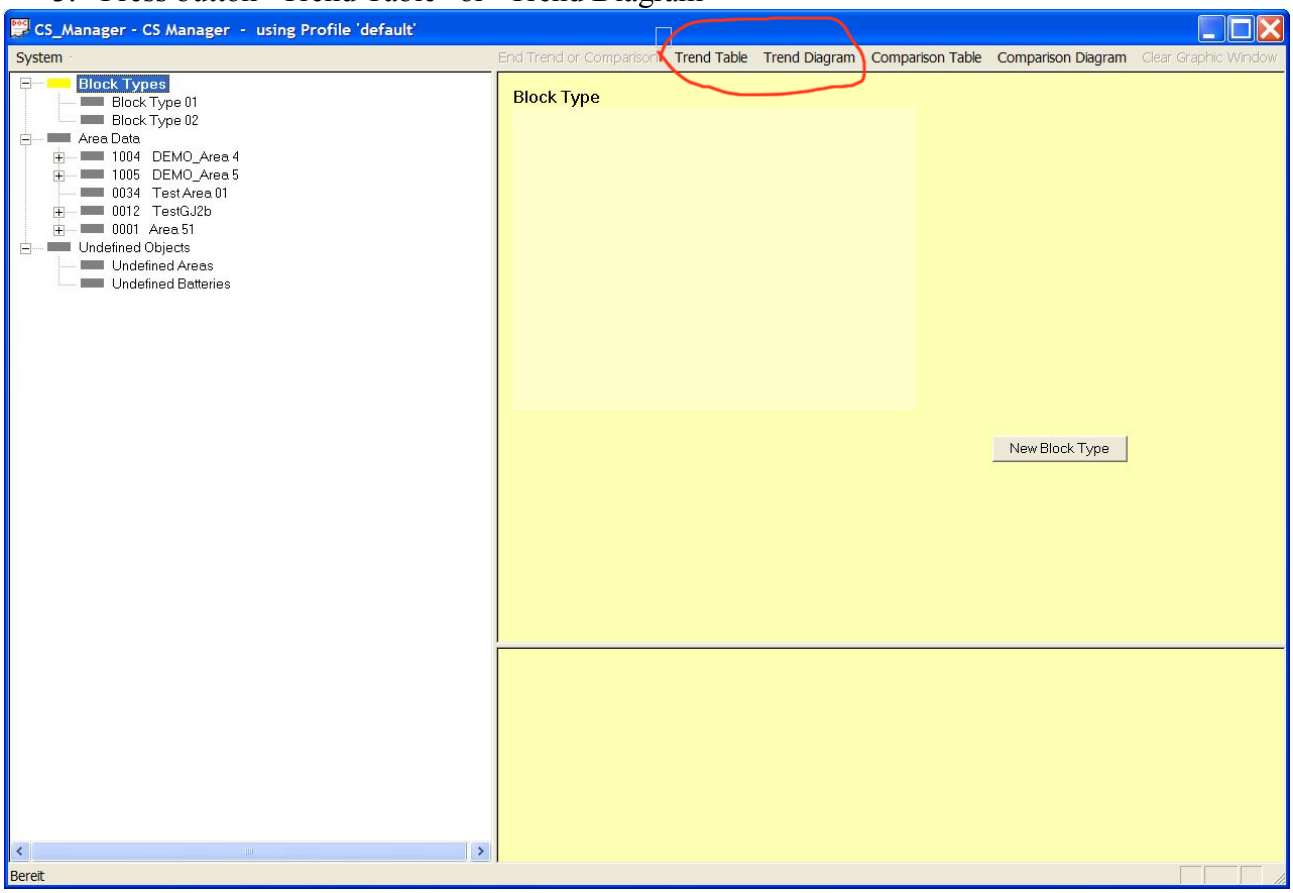


Figure 27: Start Analysis "Trend"

When these steps are done either a table or a diagram is displayed showing the available voltage values for the first cell of the battery.

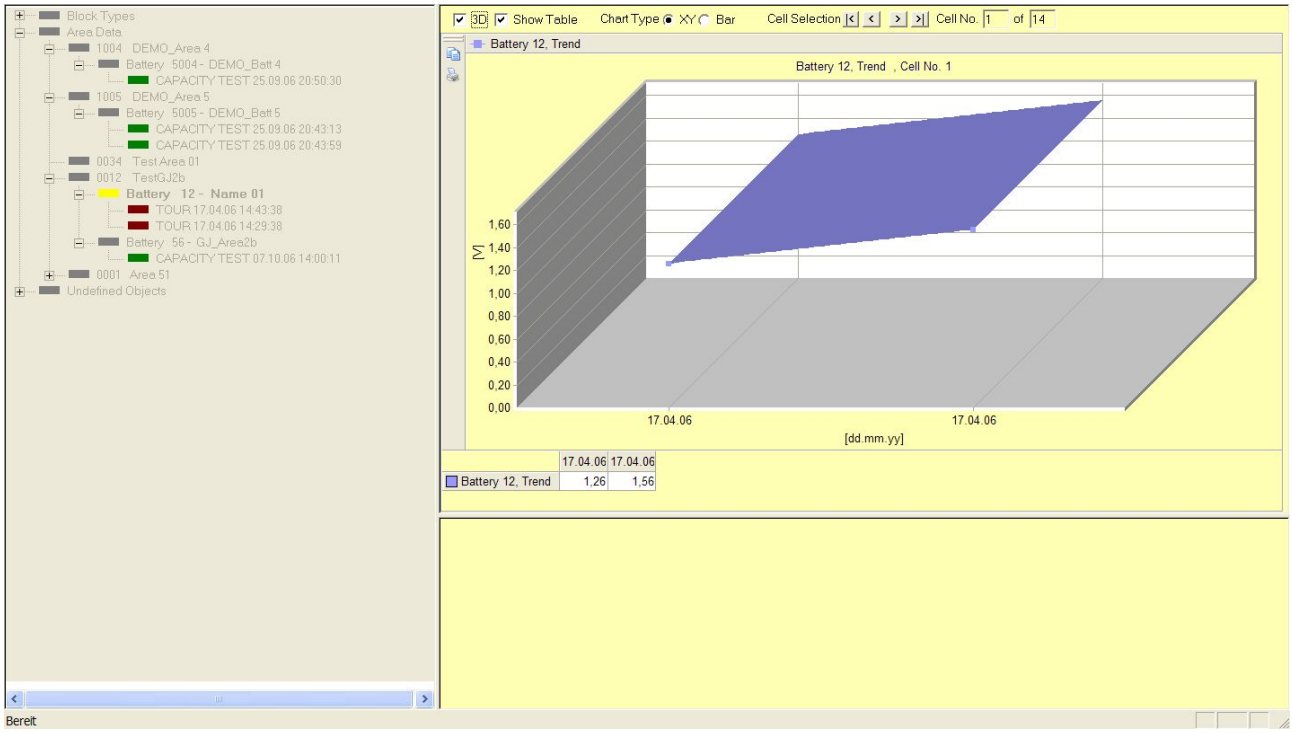


Figure 28: Trend Diagram

With the buttons “<“ or “>“ (“previous“ or “next“, respectively) the user can navigate through the cells of a battery.

4.4.5.3 Comparison

To perform a comparison proceed as follows:

1. Start in Navigation mode (The button “End Trend or Comparison is grey and cannot be pressed)
2. Select a *measurement* from tree
3. Press button “Comparison Table“ or “Comparison Diagram“

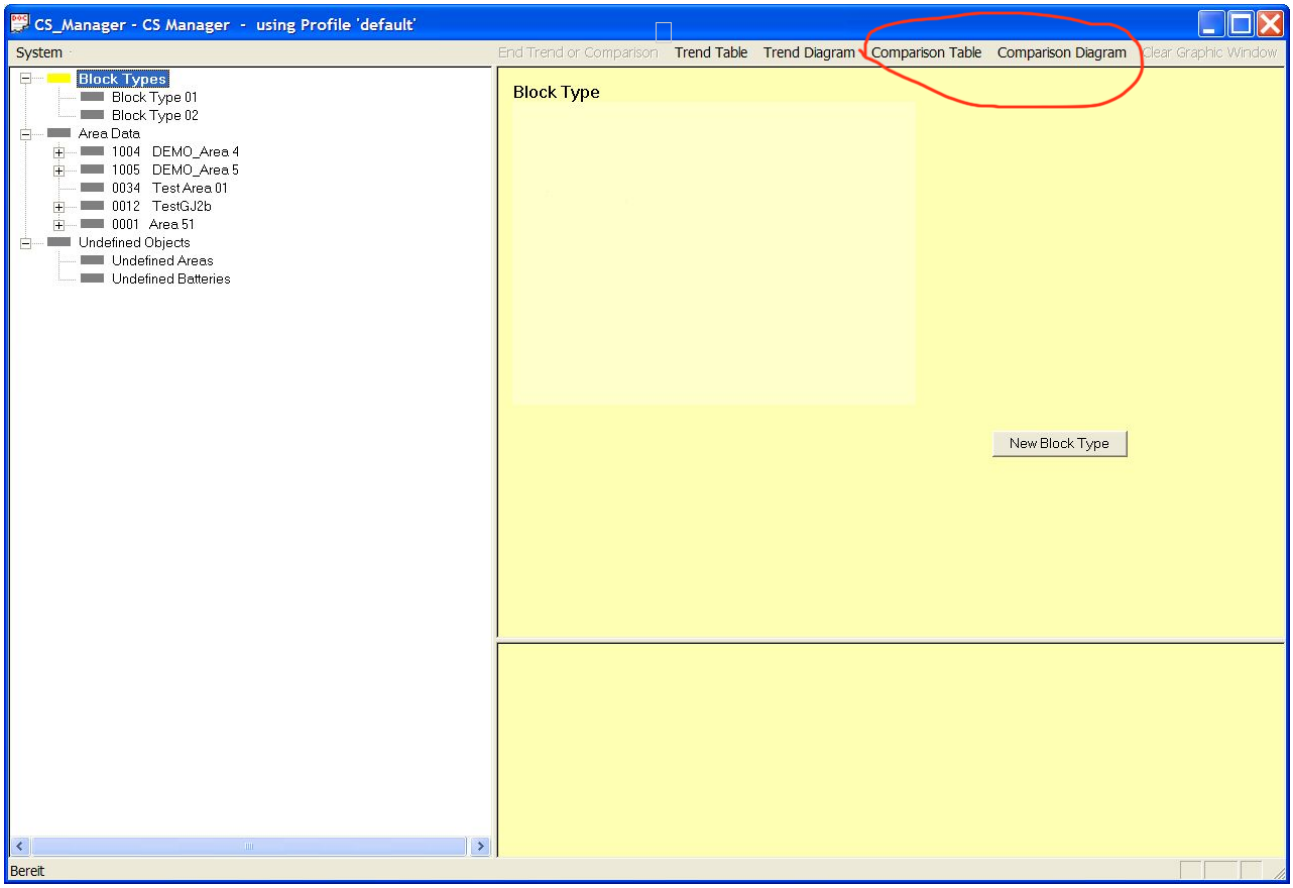


Figure 29: Start Analysis "Comparison"

If a double-click is performed on the tree node this measurement is selected immediately. If CS-Manager was in navigation mode the graphic window opens automatically and the data is displayed.

If for example a tour is selected and analysis mode “Comparison Diagram“ is chosen a diagram appears in the right screen region displaying the associated data. At the bottom of the diagram the voltage values are also displayed as a table. This table can be switched off by de-selecting the checkbox “Show Table“. The chart type can be changed accordingly when the radio buttons are clicked.

The minimum voltage value is displayed as a red line.

Figure 30 shows a scenario where tour data are displayed:

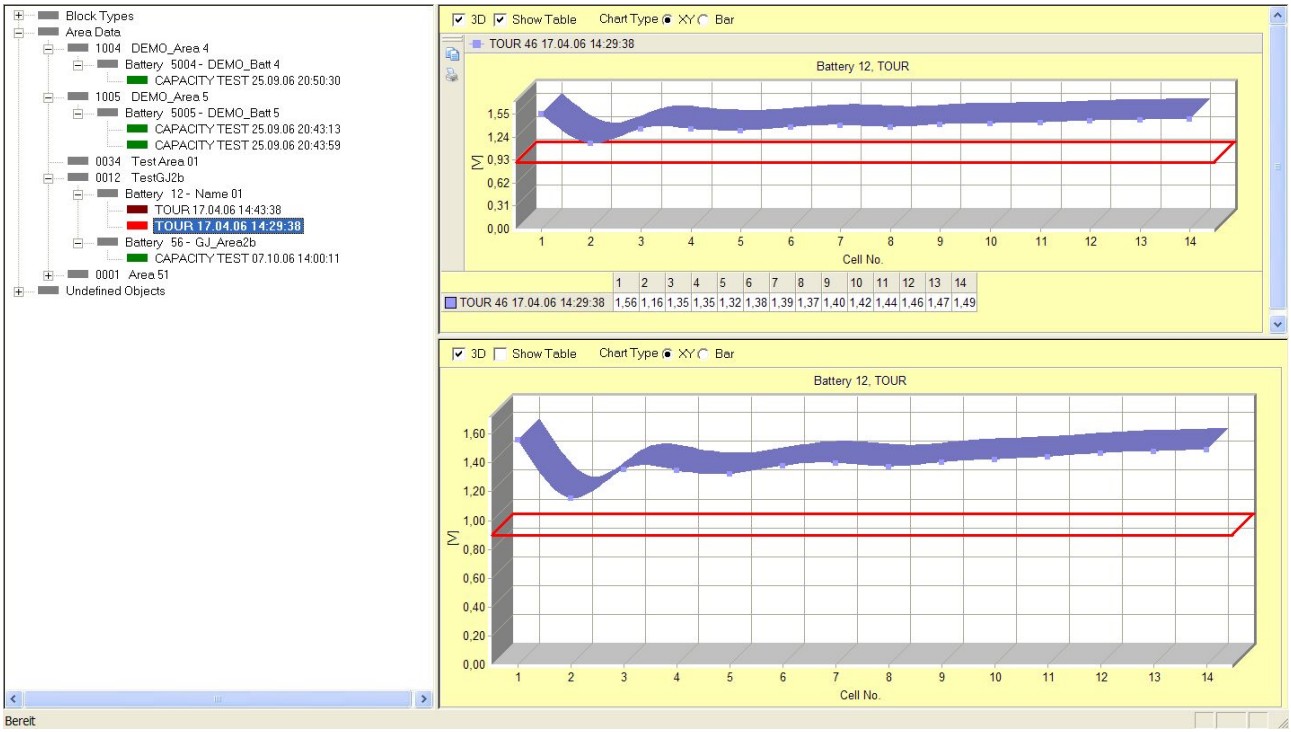


Figure 30: Comparison (one measurement selected)

Because the tour data in the tree is still selected the preview window contains the same information. If the user selects another entry in the tree the preview changes accordingly. The analysis screen region remains constant.

Do do a comparison between two tours the user should add a second tour to the analysis window. This can be achieved by selecting the appropriate tree node with a double-click. Figure 31 on page 38 shows a comparison of the two tours of battery “12“ in area „TestGJ2b“.

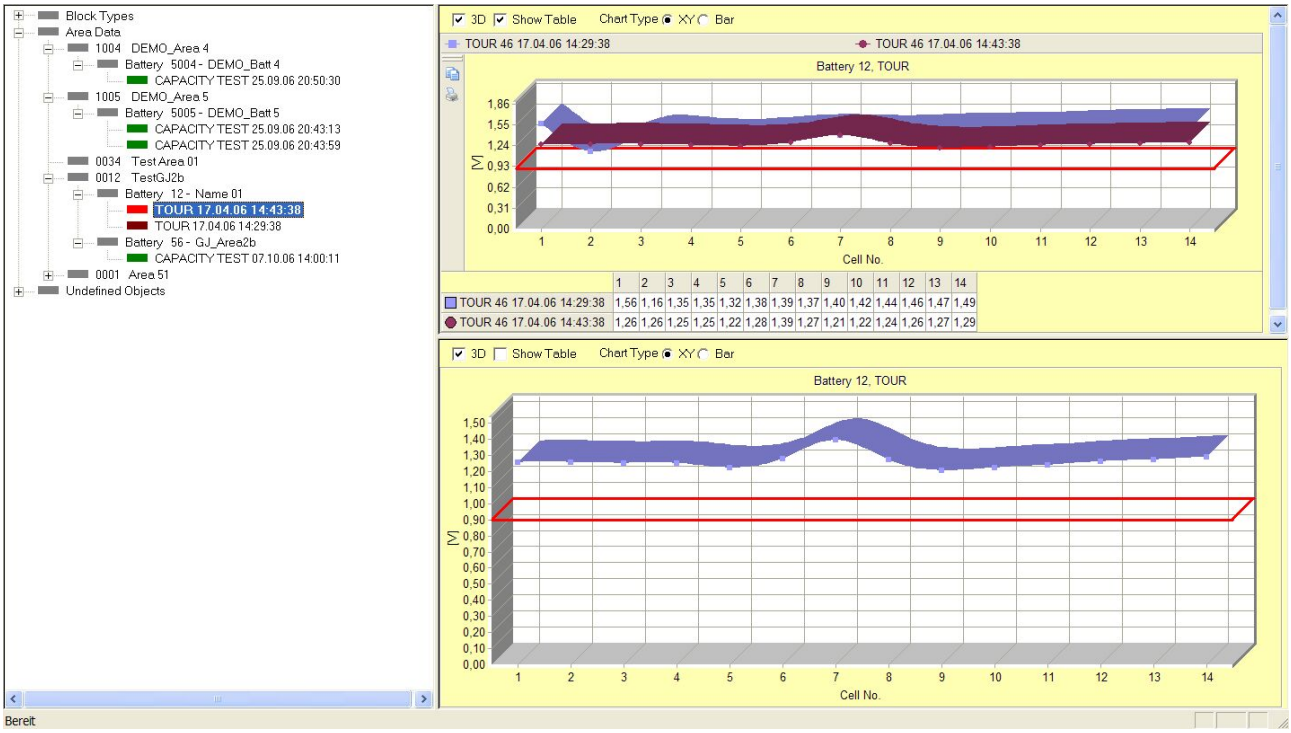


Figure 31: Comparison (two measurements selected)

The tour data of the battery are displayed simultanously, its charts are stacked. To put a third chart into the diagram an appropriate tree node has to be selected with a double-click.

Restrictions:

- It is not possible to mix tour data and capacity tests, even if they are from the same battery
- If the measurement type should be switched the graphic windows has to be cleared first.

5 Data Maintainance

5.1 Overview

CS-Manager distinguishes four objects in its database:

- Area
- Block Type
- Battery
- Measurement

Measurement data is imported from a device and cannot be manipulated by the user. Only remarks can be attached to a measurement.

The maintenance operations

- Create
- Change
- Delete

for the other objects are described in the sections 5.2 to 5.4.

5.2 Maintain Area Data

5.2.1 Overview

In the following sections the maintenance operations for areas are described. The attributes of an area are explained only in the section “Create New Area“.

5.2.2 Create New Area

To create a new area the node „Area Data“ should be selected in the tree. When the button “New Area“ is pressed the form according to figure 33 is displayed. The following attributes are displayed:

Name	*Used For*	*Remarks*
Area Name 1	Name for the area	mandatory
Area Name 2	Additional name (may be empty)	
Area Number	Unique Area ID	Unique

Name	*Used For*	*Remarks*
Country	Country	
ZIP	ZIP Code	
City	City	
Street	Street	
Name Contact Person	Name of a contact person	
Phone Number Contact Person	Phone number of a contact person	
Remarks	Remarks about the area	

Figure 32: Attributes of AREA

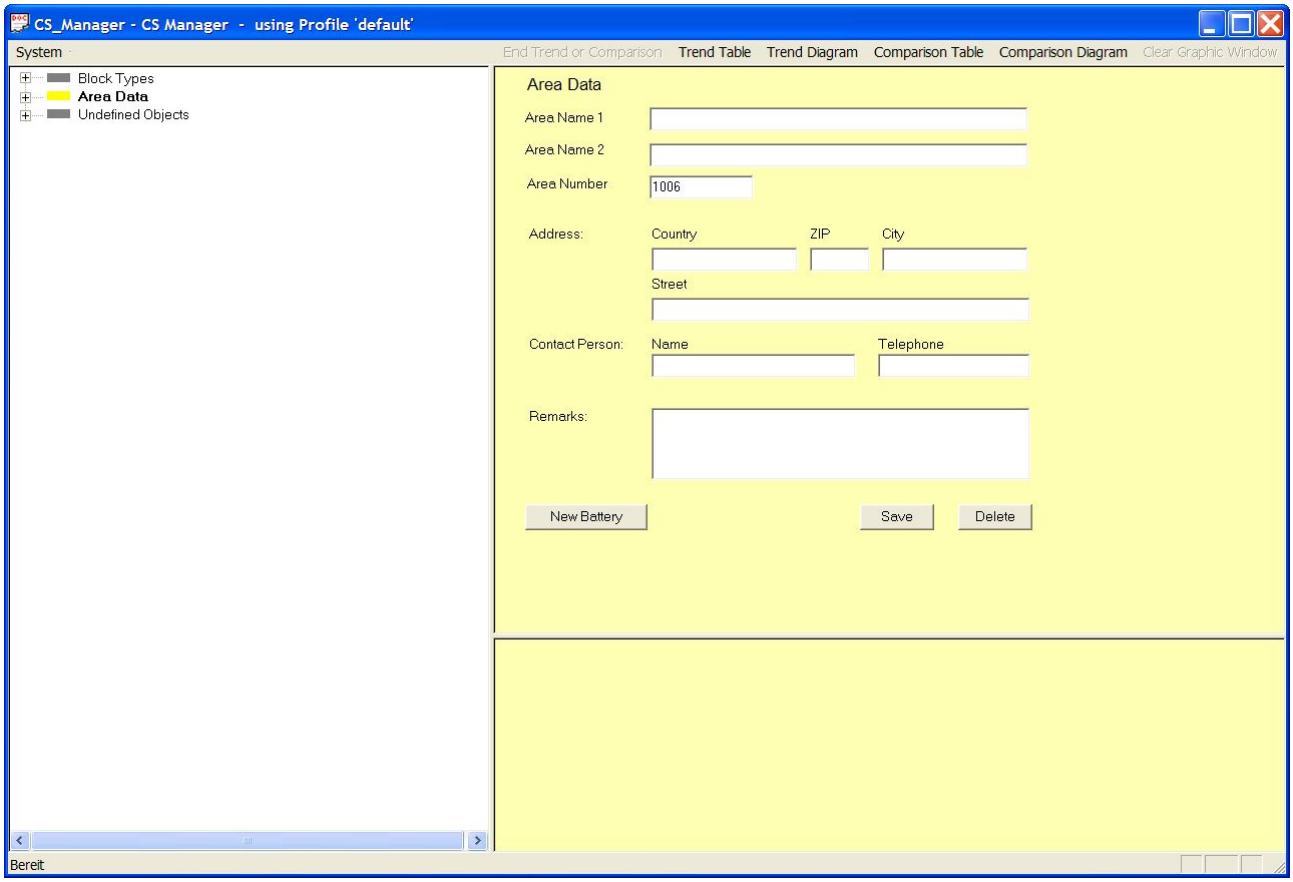


Figure 33: Create Area

If the button “Save“ is pressed CS-Manager checks the plausibility of the data. If the plausibility checks fail appropriate error messages are issued. If the checks succeed a message box appears

asking whether or not the data should be saved. If the user answers with “Yes“ the data is written into the database.

When the user tries to select another item in the tree and the data has been changed, CS-Manager asks whether or not the record should be saved before displaying the data of the new tree node.

5.2.3 Change an Existing Area

To change the data of an area the representing node in the tree has to be selected. If the button “Save“ is pressed CS-Manager checks the plausibility of the data. If the plausibility checks fail appropriate error messages are issued. If the checks succeed a message box appears asking whether or not the data should be saved. If the user answers with “Yes“ the data is written into the database.

When the user tries to select another item in the tree and the data has been changed, CS-Manager asks whether or not the record should be saved before displaying the data of the new tree node.

5.2.4 Delete an Area

To delete an area an area node in the tree has to be selected first. If the button “Delete“ is pressed CS-Manager asks whether or not this record should be deleted. If the user answers with “Yes“ the record will be removed from the database. The tree representation will be updated.

5.3 Maintain Block Type Data

5.3.1 Overview

In the following sections the maintenance operations for block types are described. The attributes of a block type are explained only in the section “Create New Block Type“.

5.3.2 Create New Block Type

To create a new block type the node “Block Types“ has to be be selected in the tree. When the button “New Block Type“ is pressed the form according to figure 34 is displayed.

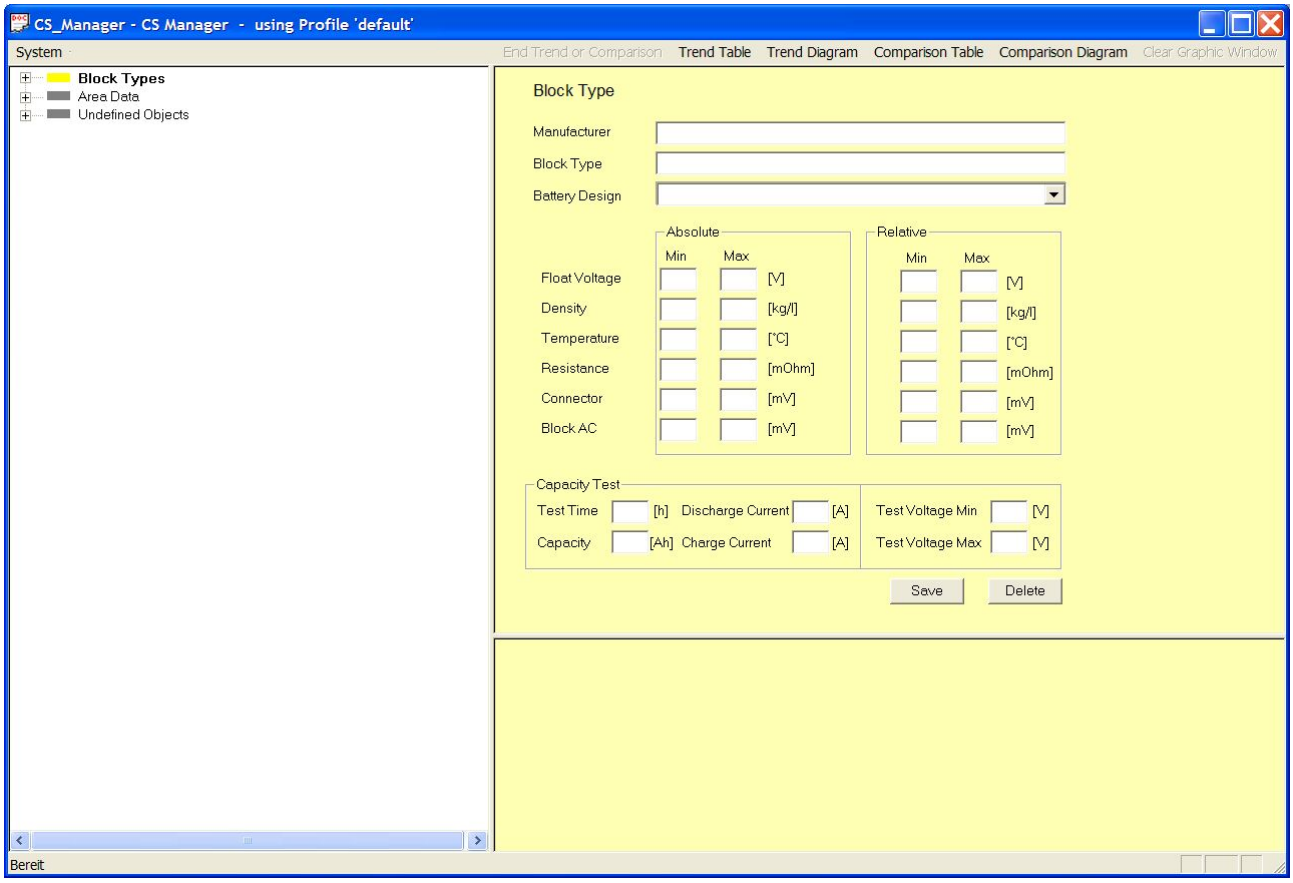


Figure 34: New Block Type

The following attributes are displayed:

Name	***Used For***	***Remarks***
Manufacturer	Name of the battery manufacturer	mandatory
Block Type	Description (e. g. What it is used for)	
Block Design	Pb, NiCd, etc.	
Float Voltage		
Density		
Temperature		
Resistance		
Connector		
Block AC		

Name	*Used For*	*Remarks*
Test Time		
Discharge Current		
Capacity		
Charge Current		
Check voltage min		
Check voltage max		

Figure 35: Attributes of BLOCK TYPE

If the button “Save“ is pressed CS-Manager checks the plausibility of the data. If the plausibility checks fail appropriate error messages are issued. If the checks succeed a message box appears asking whether or not the data should be saved. If the user answers with “Yes“ the data is written into the database.

When the user tries to select another item in the tree and the data has been changed, CS-Manager asks whether or not the record should be saved before displaying the data of the new tree node.

5.3.3 Change an Existing Block Type

To change the data of an existing block type the representing node in the tree has to be selected. If

the button “Save“ is pressed CS-Manager checks the plausibility of the data. If the plausibility checks fail appropriate error messages are issued. If the checks succeed a message box appears asking whether or not the data should be saved. If the user answers with “Yes“ the data is written into the database.

When the user tries to select another item in the tree and the data has been changed, CS-Manager asks whether or not the record should be saved before displaying the data of the new tree node.

5.3.4 Delete an Block Type

To delete a block type an appropriate node in the tree has to be selected first. If the button “Delete“ is pressed CS-Manager asks whether or not this record should be deleted. If the user answers with “Yes“ the record will be removed from the database. The tree representation will be updated.

5.4 Maintain Battery Data

5.4.1 Overview

In the following sections the maintenance operations for batteries are described. The attributes of a battery are explained only in the section “Create New Battery“.

5.4.2 Create New Battery

To create a new battery an area node should be selected in the tree. The area node represents the area in which the battery is located. When the button “New Battery“ is pressed the following form is displayed:

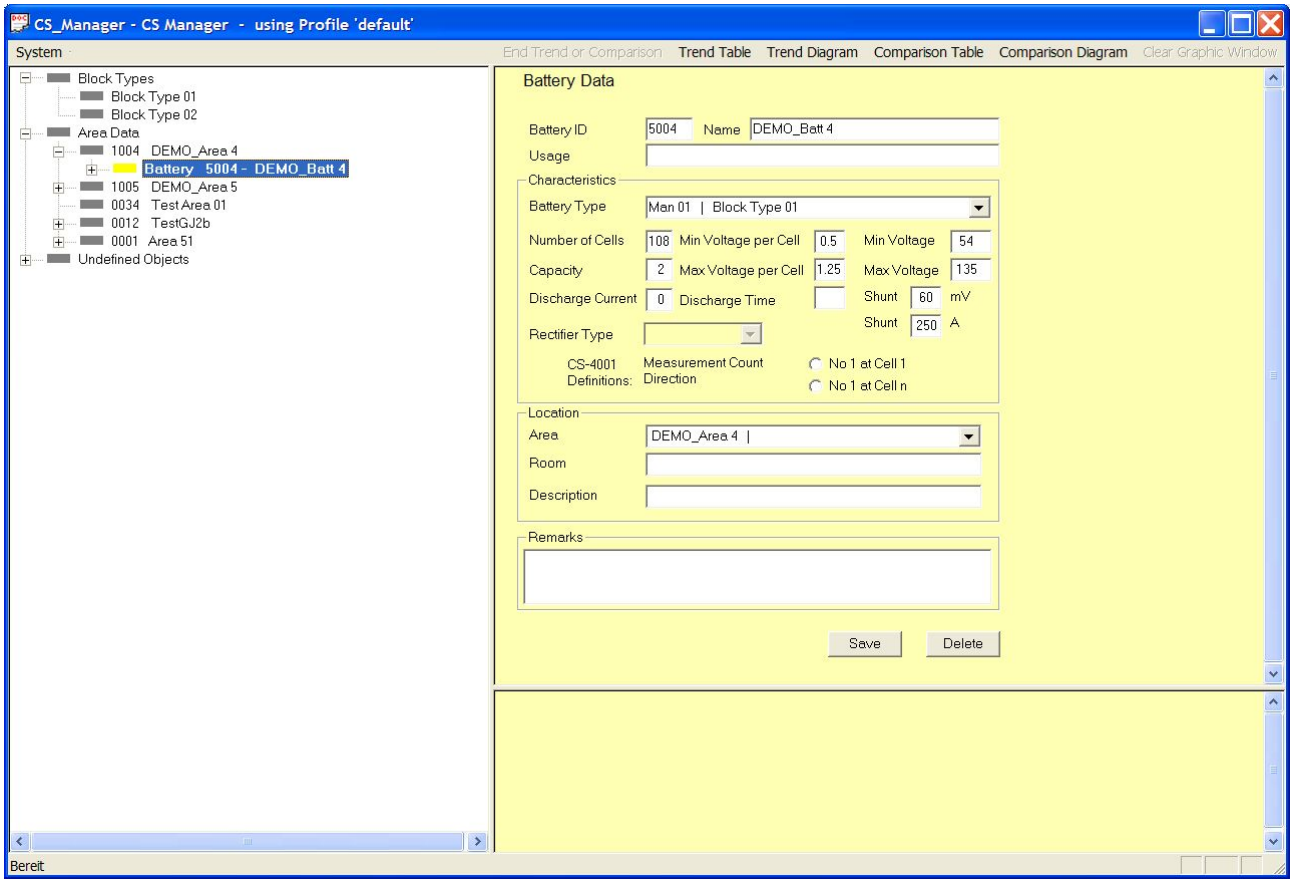


Figure 36: New Battery Data

Its attributes are explained in a table (see figure 37).

Name	*Used For*	*Remarks*
Battery ID	Identifier, unique within the associated area	Mandantory, unique
Name	Name of the battery	mandantory
Block Type	Link to an existing block type	mandantory
Usage	What is the battery used for	
Number of Cells	Number of cells building the battery	
Min voltage	Minimum voltage (calculated from the number of cells and the minimum cell voltage)	
Min voltage per cell	Minimum cell voltage (default obtained from the appropriate block type record)	
Max voltage	Maximum voltage (calculated from the number of cells and the maximum cell voltage)	
Max voltage per cell	Maximum cell voltage (default obtained from the appropriate block type record)	
Capacity	Capacity (default obtained from the appropriate block type record)	
Discharge current	Discharge Current (default obtained from the appropriate block type record)	
Discharge time	Discharge time (default obtained from the appropriate block type record)	
Shunt mV		
Shunt A		
No 1 at cell 1, No 1 at cell n	Count direction: is number one at the first or last cell?	
Area	Area in which the battery is located	
Room		
Description		
Remarks		

Figure 37: Attributes of BATTERY

If the button “Save“ is pressed CS-Manager checks the plausibility of the data. If the plausibility checks fail appropriate error messages are issued. If the checks succeed a message box appears

asking whether or not the data should be save. If the user answers with “Yes“ the data is written into the database.

When the user tries to select another item in the tree and the data has been changed, CS-Manager asks whether or not the record should be saved before displaying the data of the new tree node.

5.4.3 Change an Existing Battery

To change a battery record the representing node in the tree has to be selected. If the button “Save“ is pressed CS-Manager checks the plausibility of the data. If the plausibility checks fail appropriate error messages are issued. If the checks succeed a message box appears asking whether or not the data should be saved. If the user answers with “Yes“ the data is written into the database.

When the user tries to select another item in the tree and the data has been changed, CS-Manager asks whether or not the record should be saved before displaying the data of the new tree node.

5.4.4 Delete an Battery

To delete a battery a battery node in the tree has to be selected first. If the button “Delete“ is pressed CS-Manager asks whether or not this record should be deleted. If the user answers with “Yes“ the record will be removed from the database. The tree representation will be updated.

6 Data Analysis

6.1 Overview

The following sections describe the handling of (measurement) data. To work with measurement data first they have to be downloaded from the measurement device (section 4.3.7). Usually area and battery definitions are uploaded to the device before the measurement tasks are performed. If the device is used in an area the software CS-Manager is not configured for it might be that area and battery IDs are downloaded which are inconsistent with the database. In that case the user may re-associate area, battery and measurement data (see section). When the database is consistent analysis tasks may be performed. In the following sections the supported analysis types are explained.

6.2 Print or Export Main Data

The objects

- Block Type
- Area
- Battery

in CS-Manager can be printed by right-clicking a node in the tree. This opens a context menu with the entries “Print“ and “Export“. If the user selects “Print“ the information associated with the selected tree node is sent to a printer. If “Export“ is used, an appropriate CSV file is created.

The following table explains the results when using the context menu on the different tree items:

Node Type	***Result***
„Block Types“	List of block types stored in the current profile
Single Block Type	Attributes of the selected block type
Area Data	List of areas stored in the current profile
Single Area	Attributes of the selected area
Battery	Attributes of the selected battery
„Unknown Objects“	List of unknown batteries with its areas stored in the current profile
„Unknown Areas“	List of unknown areas stored in the current profile
„Unknown Batteries“	List of unknown batteries stored in the current profile
Single Measurement	Message: Measurement data can be printed in the analysis window

Figure 38: Export or Print Data

6.3 Analysis of Measurement Data

6.3.1 Overview

Currently two analysis modes are supported in CS-Manager:

- Trend Analysis
- Comparison

With a trend analysis the focus is on the battery's cells and visualise their history (e.g. cell voltage over time). In a comparison batteries are compared (e.g. voltage over cells). The following sections describe how a trend analysis or a comparison can be performed with CS-Manager.

6.3.2 Trend Analysis

6.3.2.1 Overview

In an trend analysis the history of the battery's cells are visualised. Voltage values collected in several tours are displayed over the time axis. This allows to judge the development of a battery. A trend can be displayed either as a table or a diagram. Both variants allow to navigate through the battery's cells in the form.

6.3.2.2 Trend Table

To display a trend of a battery as a table the following steps have to be performed:

1. Select an a battery node in the tree
2. Press menu button “Trend Table“
3. To finish press menu button “End Trend or Comparison“

Figure 39 shows how to start a trend analysis. In Figure 40 the cell voltages of the battery are displayed as a table. With the buttons “Previous Cell“ and “Next Cell“ the user can navigate through the battery's cells. The menu entry “End Trend or Comparison“ becomes black when a trend or comparison table/digram is display. The menu entry can be used to finish the analysis task and to return to the navigation mode of CS-Manager.

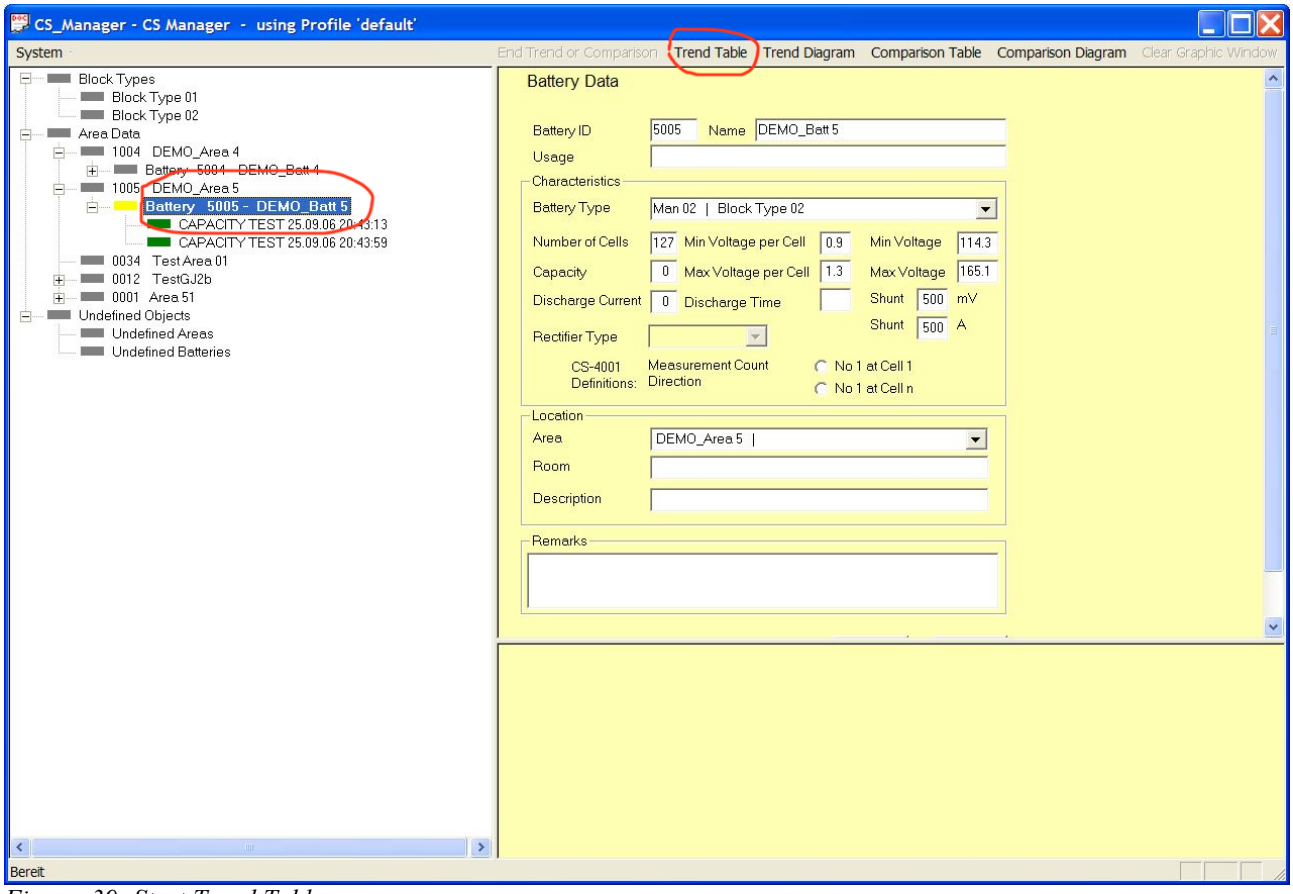


Figure 39: Start Trend Table

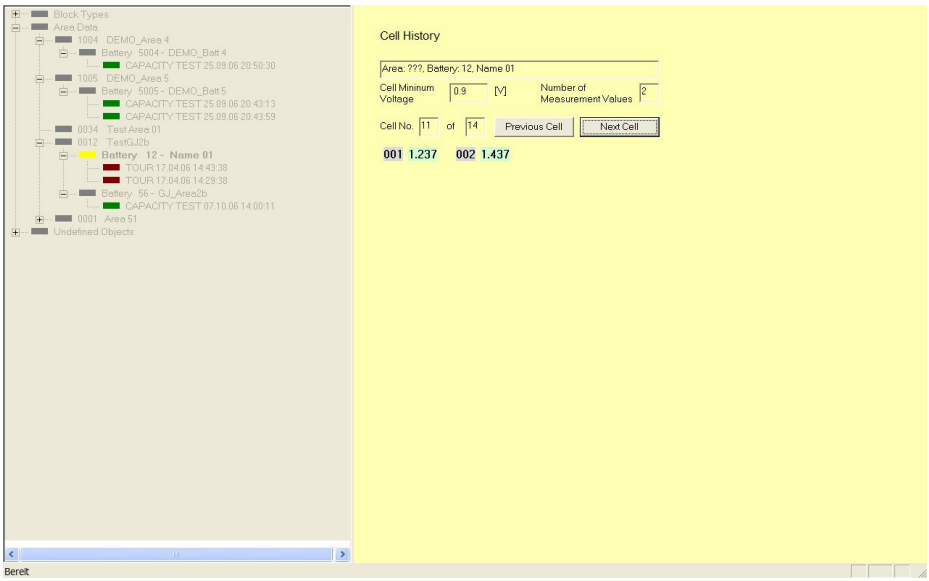


Figure 40: Trend Table

6.3.2.3 Start Trend Diagram

To display a trend of a battery as a table the following steps have to be performed:

4. Select an a battery node in the tree
5. Press menu button “Trend Table“
6. To finish press menu button “End Trend or Comparison“

Figure 41 shows how to start a trend diagram. Figure 42 shows the available he cell voltage values of the battery. With the buttons “<“ (previous cell) and “>“ (next cell) the user can navigate through the battery's cells. The buttons “<<“ and “>>“ allow to jump to first or to the last cell. The menu entry “End Trend or Comparison“ becomes black when a trend or comparison table/digram is display. The menu entry can be used to finish the analysis task and to return to the navigation mode of CS-Manager.

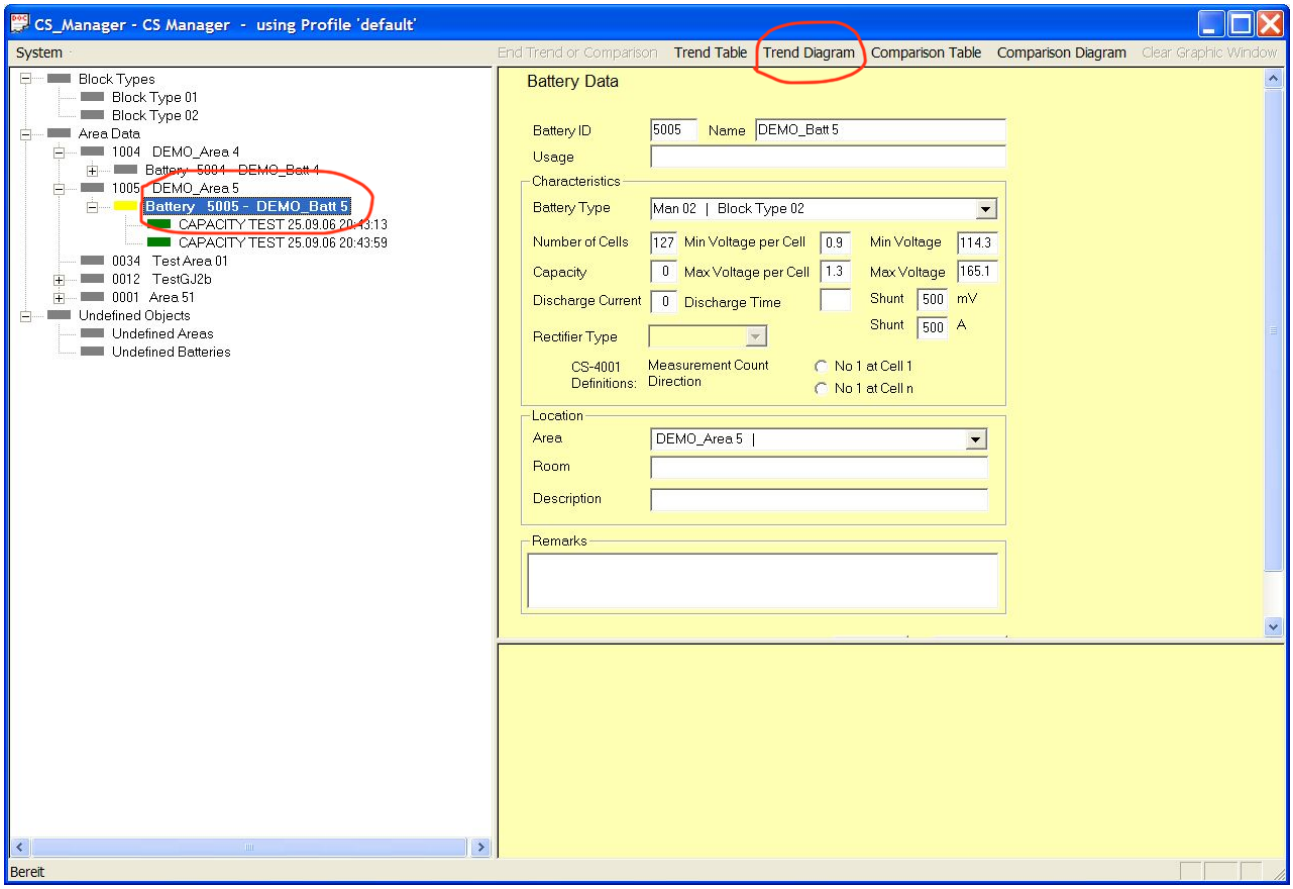


Figure 41: Start Trend Diagram

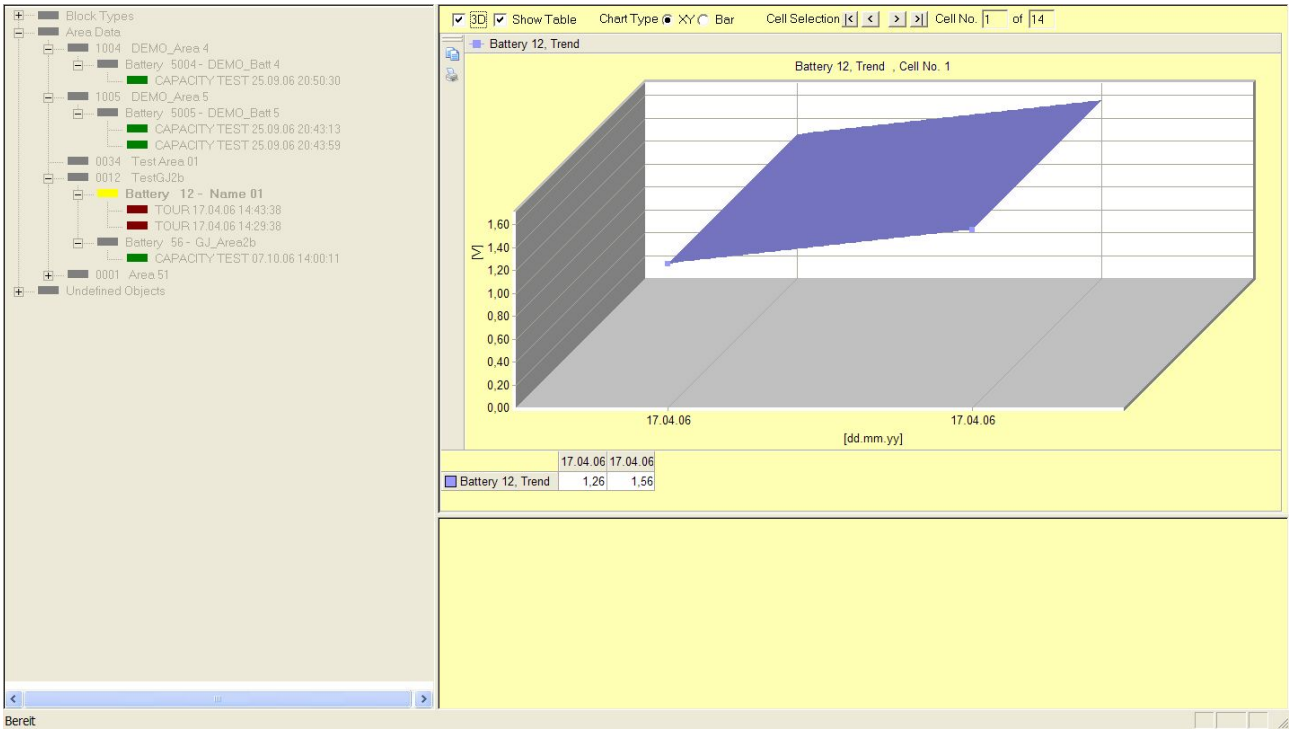


Figure 42: Trend Diagram

The design of the diagram can be influenced with the buttons and check boxes at the top of the window. For example, the chart type can be changed from xy chart to a bar diagram, the 3D view can be switched off, etc.

6.3.2.4 Print or Export Trend Diagram

If the diagram and the table (if visible) should be printed or exported as a CSV file, the buttons at the left side of the diagram can be used.

6.3.3 Comparison

6.3.3.1 Overview

A comparison allows to display parameters of a battery (e.g. voltage) over cells and compare them with other measurements. If a comparison diagram is used the associated graphs can be stacked.

6.3.3.2 Comparison Table

To display a comparison of a battery as a table the following steps have to be performed:

7. Select an a battery node in the tree
8. Press menu button “Comparison Table“
9. To finish press menu button “End Trend or Comparison“

Figure 43 shows how to start a comparison analysis:

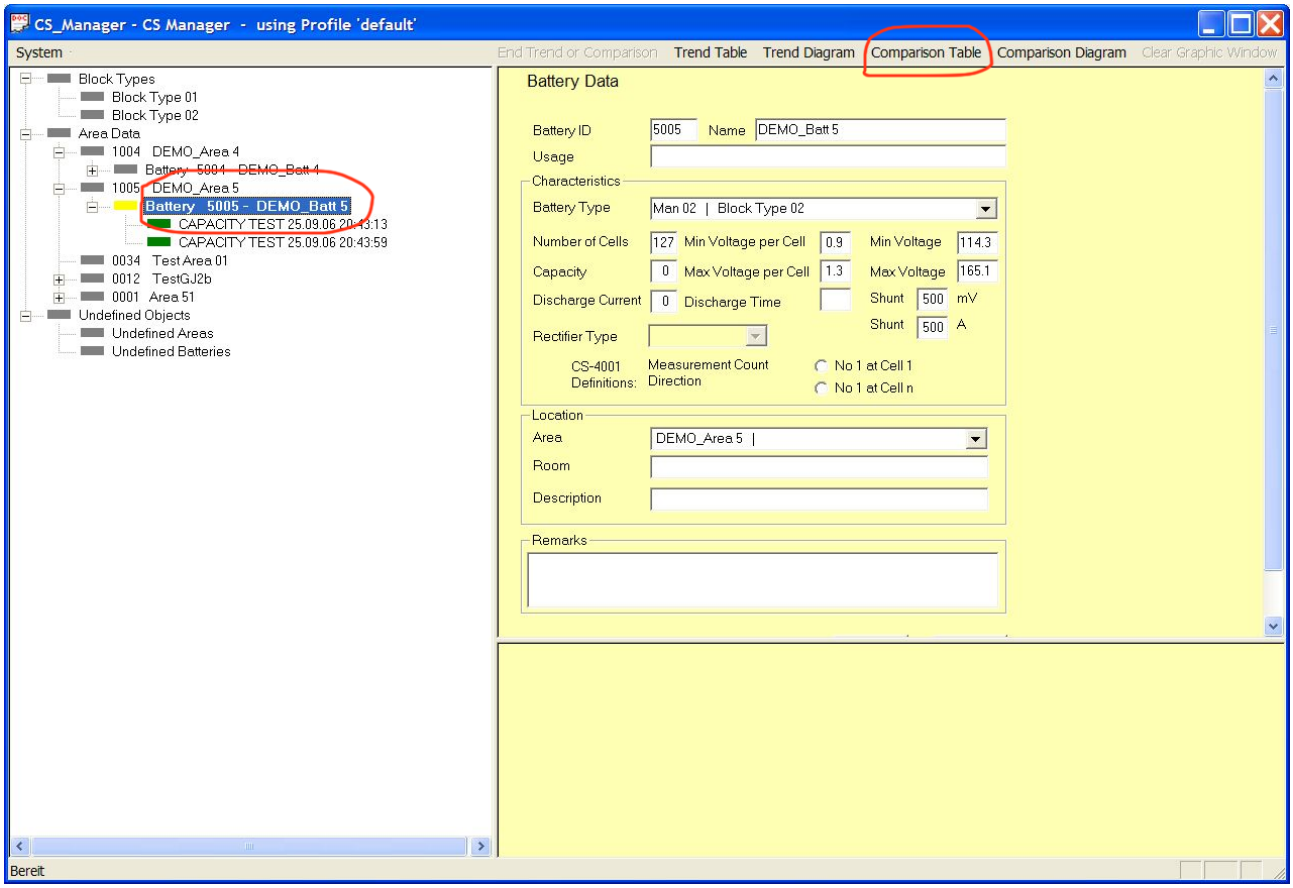


Figure 43: Start Comparison Table

Figure 44 shows a comparison table of a defective battery. The voltage values which are less than the minimum voltage value defined for this battery are indicated with a red instead of a green background. The navigation through the cells can be done with the buttons „Previous Cell“ and „42 shows a comparison table of a defective battery. The voltage values which are less than the minimum voltage value defined for this battery are indicated with a red instead of a green background. The navigation through the cells can be done with the buttons “Previous Cell“ and

"Next Cell".

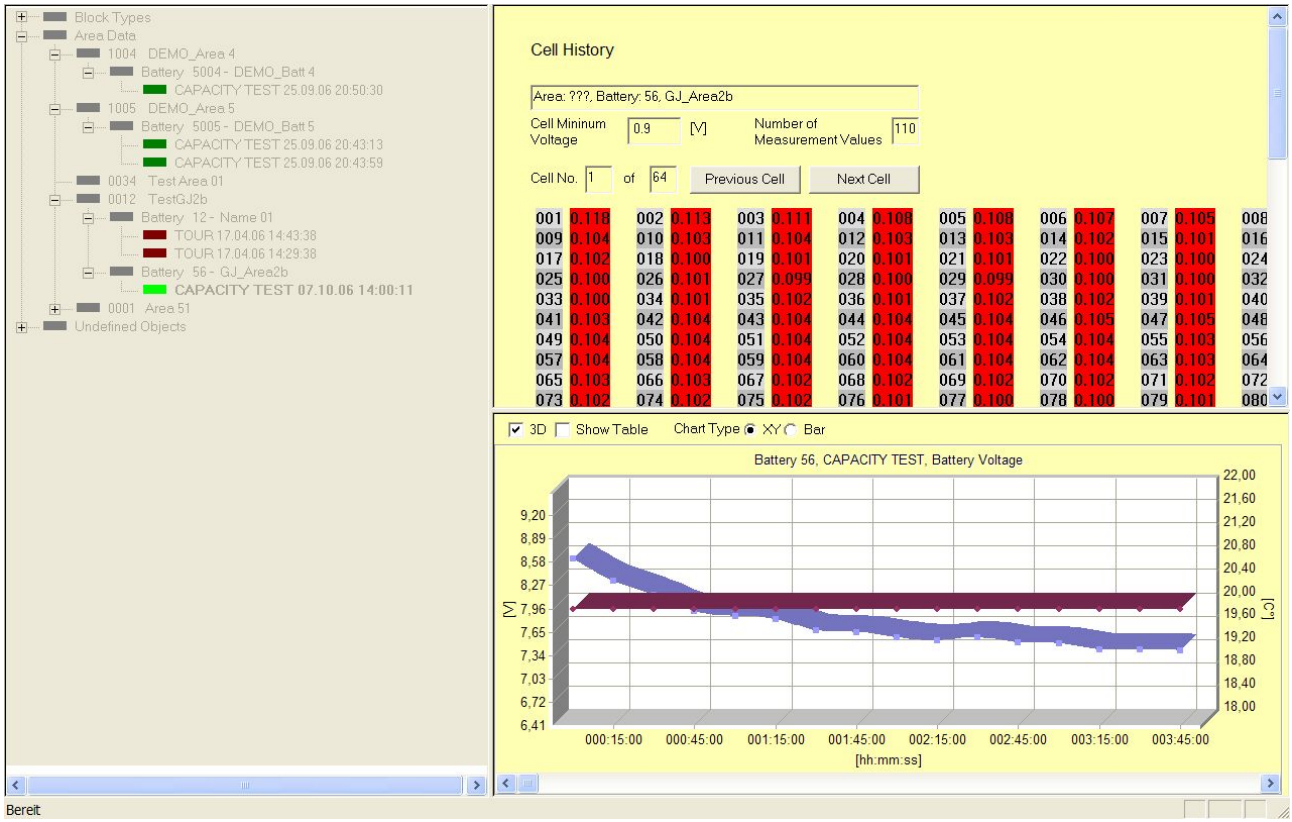


Figure 44: Comparison Table (defective battery)

To finish the analysis task the menu button „End Trend or Comparison" should be used.

6.3.3.3 Comparison Diagram

A comparison diagram allows to display more than one diagram simultanously. The only restriction is that the types (tour or capacity test) of measurement have to be homogenously. It is not possible to mix tour and capacity test data. To put a candidate to the analysis window just double-click the node representing the measurement. Figure 45 shows the comparison with one tour selected. The tree still can be browsed, the preview window changes accordingly. If a second tour should be selected, again a double-click on the tree node is required (see figure 46).

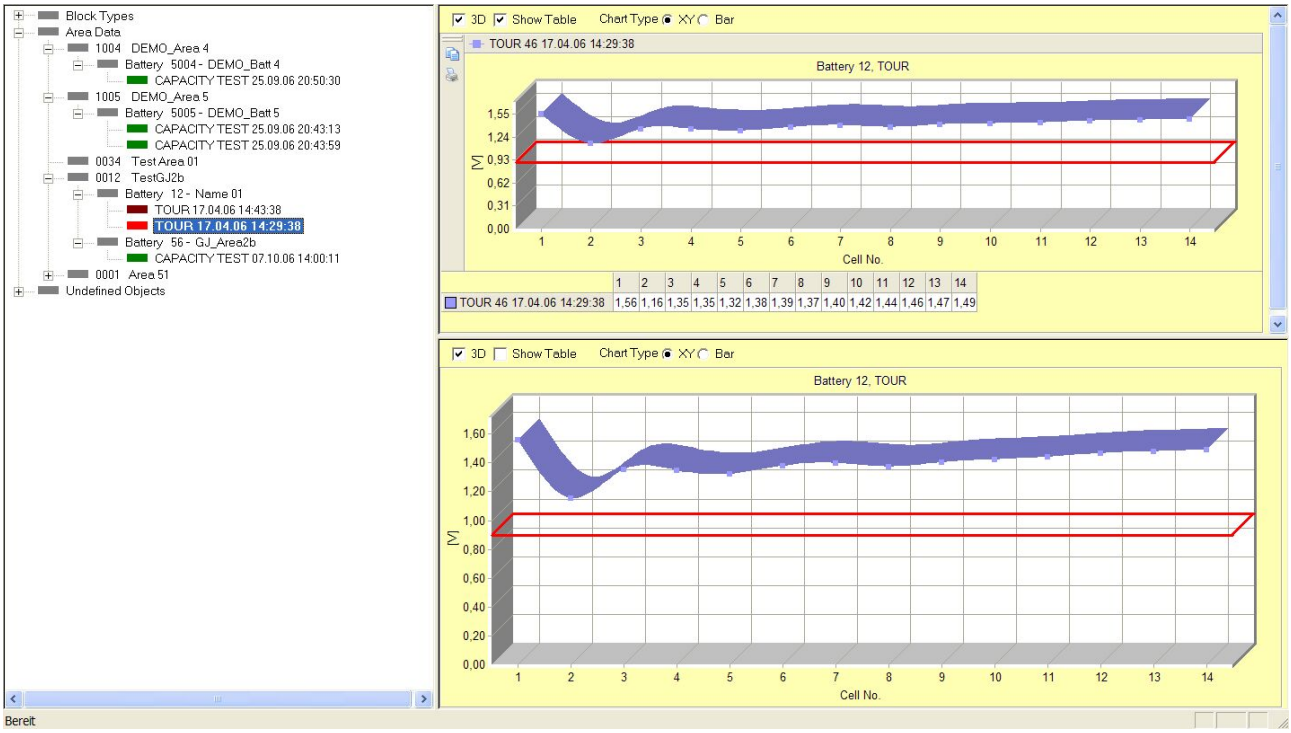


Figure 45: Comparison Diagram: One Tour

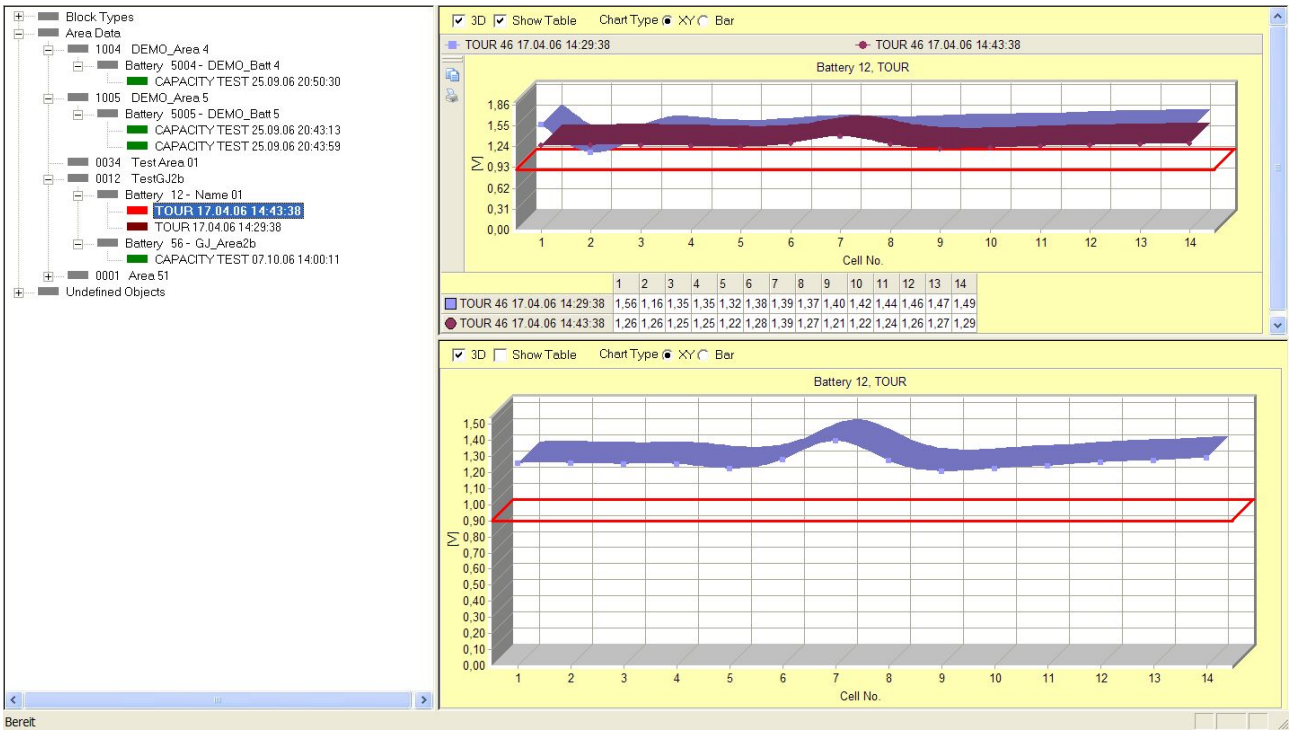


Figure 46: Comparison Diagram: Two Tours

If a new comparison should be started it is not necessary to close the graphic window with “End Trend or Comparison“. Instead, the graphic can be cleared with the menu entry “Clear Graphics Window“ and the selection process can be started again.

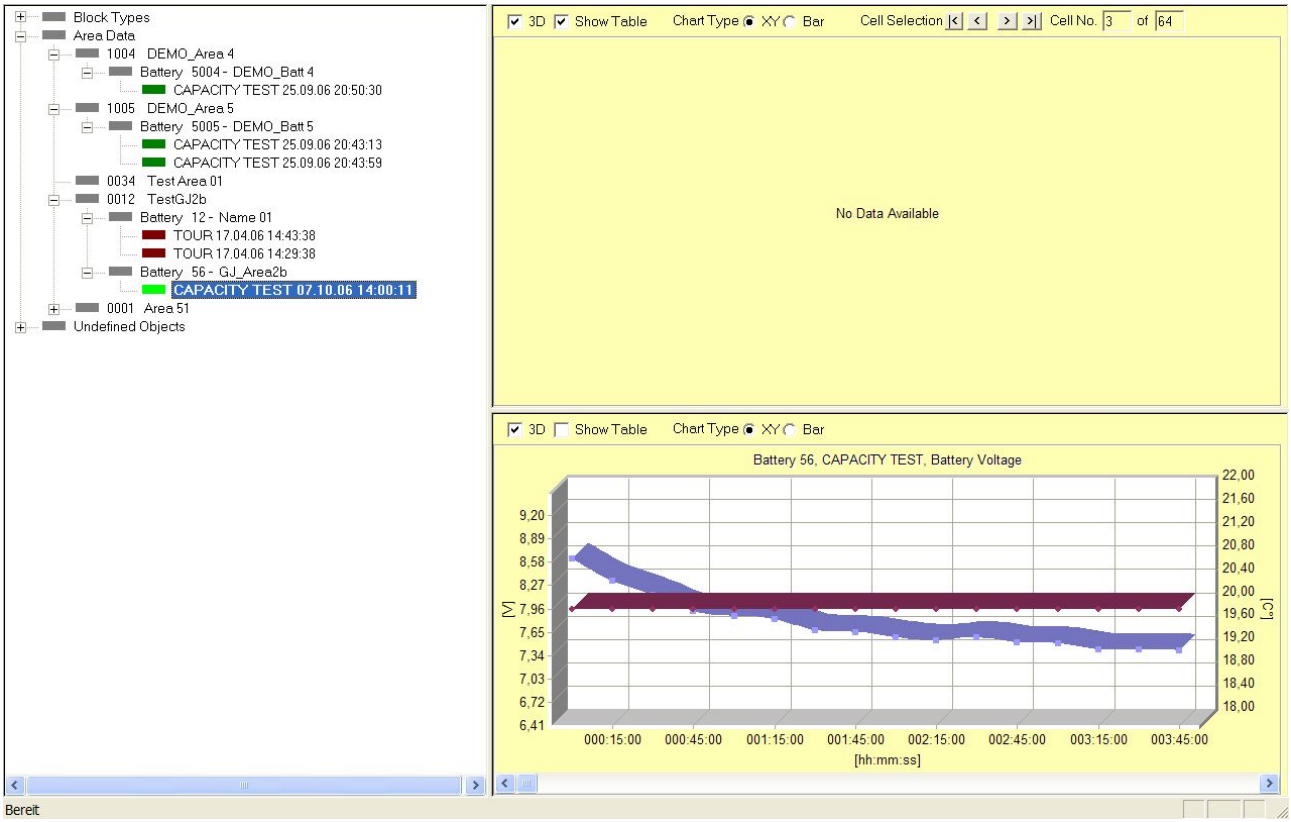


Figure 47: Clear Graphics Window

6.3.3.4 Print or Export Comparison

If the diagram and the table (if visible) should be printed or exported as a CSV file, the buttons at the left side of the diagram can be used (see figure 46).

7 Appendix

7.1 Release Notes

7.1.1 Version 1.2

7.1.2 Version 1.1

7.1.3 Version 1.0

N/A

7.2 Future Development

The following features will be supported in future releases:

- Support of multiple Profiles
- Support of multiple Languages
- Standard Reports for Measurements

8 References

[1] Datasheet CRM.2001, Jost Electronics, http://www.cellizer.com

[2] Datasheet CS-4001/127, Jost Electronics, http://www.cellizer.com

1