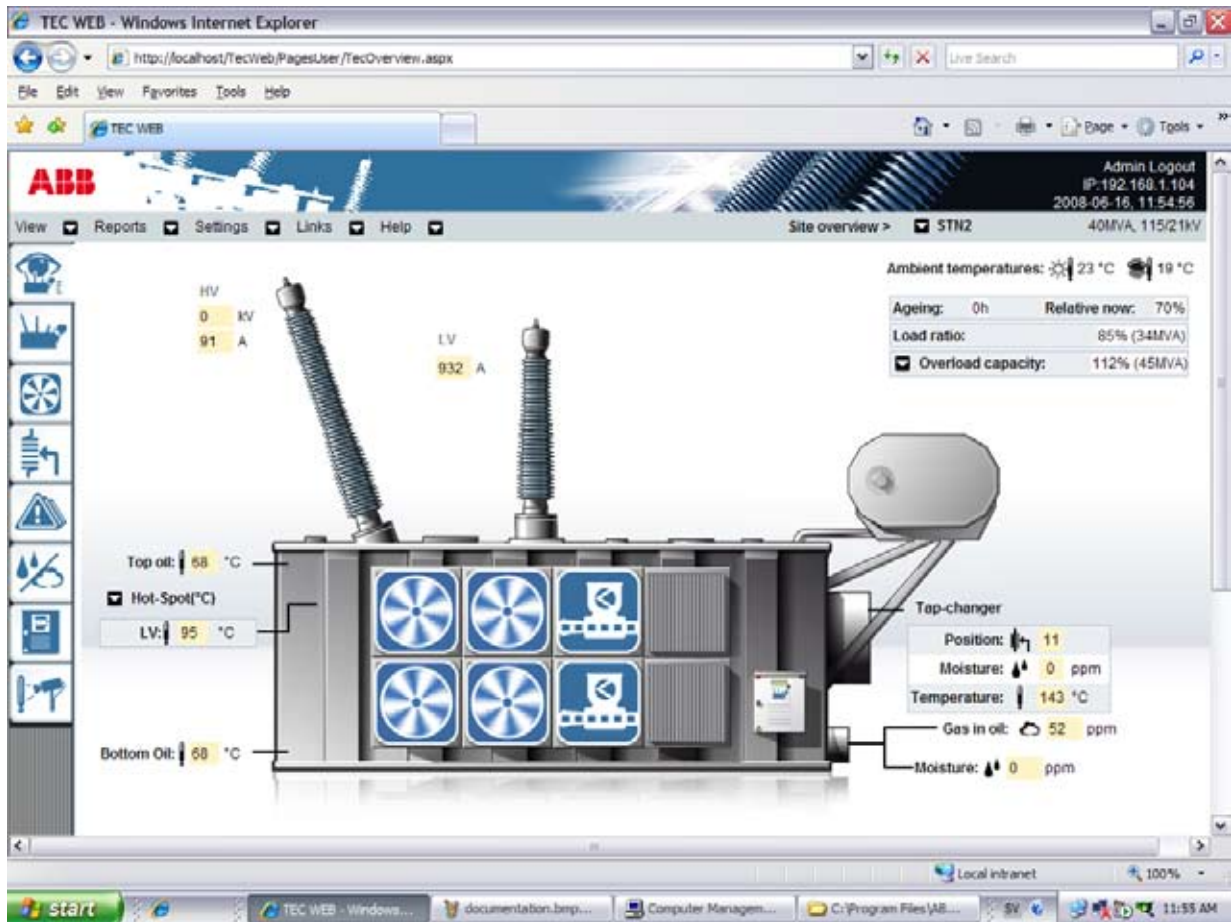


Intelligent Monitoring System, Type TEC

TEC Server – User's manual





Declaration of conformity

The manufacturer **ABB AB**
Components
SE-771 80 LUDVIKA
Sweden

Hereby declares that

The product Transformer Electronic Control

by design complies with the following requirements:

- EMC Directive 89/336/EEC (amended by Directive 91/263/EEC, Directive 92/31/EEC and Directive 93/68/EEC) regarding the characteristics intrinsic to emission and immunity levels *and*
- Low Voltage Directive 73/23/EEC (modified by Directive 93/68/EEC).

Date 2008-01-30

Signed by


Carl-Henrik Wigert

Title

General Manager TEC

This User's Manual has been produced to provide transformer manufacturers, and their designers and engineers, access to all the technical information required to assist them in their selection of a monitoring system. It is also intended as a TEC system information source for end-users.

The information provided in this document is intended to be general and does not cover all possible applications. Any specific application not covered should be referred directly to ABB.

ABB makes no warranty or representation and assumes no liability for the accuracy of the information in this document or for the use of such information. All information in this document is subject to change without notice.

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Recommended practices

ABB recommends careful consideration of the following factors when maintaining the Transformer Electronic Control:

- Before you begin maintenance work on a unit, make sure that the personnel conducting the work have read and fully understood the *Installation and Commissioning Guide* and the *Technical Guide* provided with the unit.
- To avoid damaging the unit, never exceed the operating limits stated in delivery documents and on rating plates.
- Do not alter or modify a unit without first consulting ABB.
- Follow local and international wiring regulations at all times.
- Use only factory-authorized replacement parts and procedures.

WARNING, CAUTION, and NOTE

WARNING

A **WARNING** provides information which, if disregarded, could result in injury or death.

CAUTION

A **CAUTION** provides information which, if disregarded, could result in damage to the equipment.

NOTE: A **NOTE** provides additional information to assist in carrying out the work described.

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1. About this manual

1.1 General

This manual describes the user interfaces in the Intelligent Monitoring System TEC Server. The TEC Server is used for connecting to TEC cabinets over a TCP/IP network using the web browser Internet Explorer®.

The information in this manual is intended for operators. The reader of this manual should understand the hardware and software functionality of the TEC system.

1.2 Terminology

The following is a list of terms associated with the TEC system with which you should be familiar. The list contains terms and abbreviations that are unique to ABB or that have a usage or definition that is different from standard industry usage.

Term	Description
TEC	Intelligent Monitoring System.
TEC Server	The PC hardware containing the TEC Server web.
TEC Server Web	The web system on the TEC Server.
HEX	File extension for program files on the TEC system. The abbreviation stands for hexadecimal file.
OPC	OLE for Process Control.

1.3 Related documentation

The table below lists all documentation related to the TEC system.

Title	Document ID	Description
Installation and Commissioning Guide	1ZSC000857-ABH	Describes installation and configuration of the TEC system.
Hard Facts	1ZSE 954003-003	Sales document that describes the basics and fundamentals of the TEC system.
User's Manual	1ZSC000857-ABK	This document describes the different functionalities of the TEC and how operators work via the cabinet display or the web interface.
Maintenance Guide	1ZSC000857-ABJ	This document contains descriptions about the TEC embedded web interface and how to load HEX files into the TEC. This document is intended for operators.
Technical Guide	1ZSC000857-ABG	This document contains detailed technical information about the TEC system. The guide is useful for the transformer designers.
Additional information		www.abb.com/electricalcomponents

2 System overview

2.1 TEC Server

The TEC Server system operates in a Windows Server® 2003 R2 environment. The system is pre-installed with the operating system already configured.

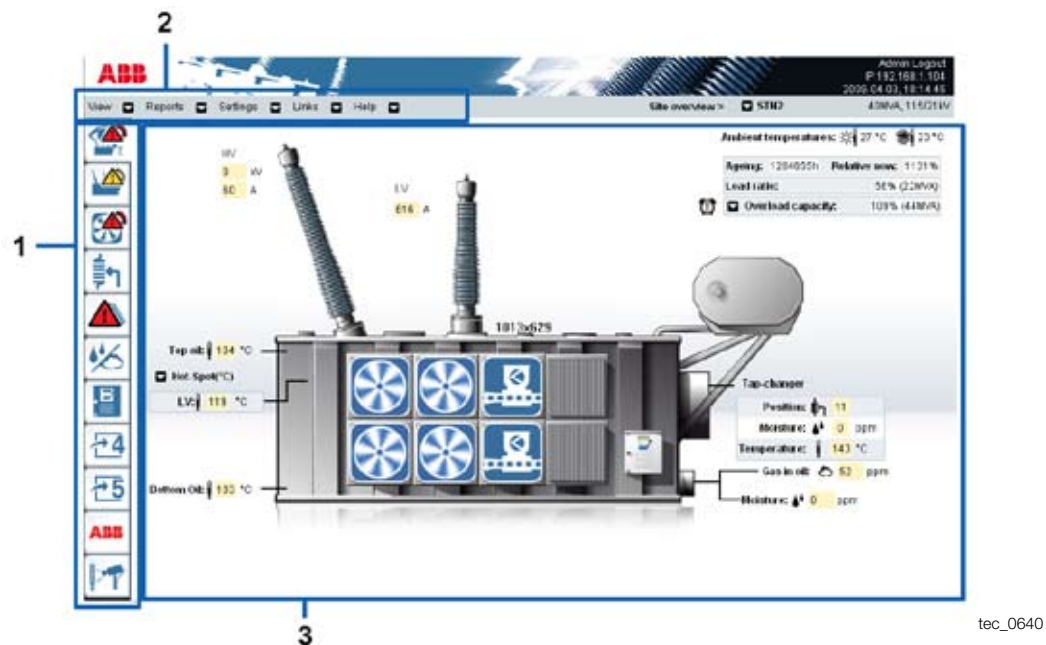
Before you connect the computer to the internet

- Connect behind a hardware-based firewall if available.
- Make sure your computer has anti-virus software installed and it has been updated on a regular basis.
- Make sure your operating system is up to date, with all critical updates it may need.

If these measures are not taken, ABB accepts no responsibility for the risk of virus infection. In addition, the PC warranty will not be valid. ABB accepts no responsibility for third party programs or software that may cause malfunction of the delivered system.

2.2 User interface

The TEC Server interface consists of the following graphical objects:



tec_0640

1. Navigation bar with quick tabs

This menu allows the user to quickly navigate the most important sections in the system. See section 4.2 for more information.

2. Top menu

This menu allows the user to navigate the different sections in the system. See section 4.3 for more information.

3. Content area

This is where the different system pages are shown.

2.3 User roles

The TEC Server web has three different access levels:

NOTE: *The TEC Server web could have other login accounts than the TEC Server.*

User	Password	Access rights
user	user	Can only view events in the event log.
maintenance	maintenance	Access to select events and clear them. This user account can also set new service dates for cooler groups.
admin	admin	Full system access.

2.4 User management

The user passwords can be changed using the user management function which is located on the login page.

How to change user passwords

1. If logged in as a normal user, click the “Logout” text string located in the upper right corner of the screen. (After the logout, Internet Explorer® reverts back to the TEC Login page which is the defined Home Page.)
2. Click “User management” in the TEC Login page.
3. Login as the admin user. Enter user name and password (admin is default for both), then click “Login”.
4. Select a user in the menu. Enter a new password in the box and click [Reset password].

How to reset user passwords

1. If logged in as a normal user, click the “Logout” text string located in the upper right corner of the screen. (After the logout, Internet Explorer® reverts back to the TEC Login page which is the defined Home Page.)
2. Click “User management” in the TEC Login page.
3. Login as the admin user. Enter user name and password (admin is default for both), then click “Login”.
4. Click [Reset all passwords].

How to disable the TEC Login page and make admin the default user

1. If logged in as a normal user, click the “Logout” text string located in the upper right corner of the screen. (After the logout, Internet Explorer® reverts back to the TEC Login page which is the defined Home Page.)
2. Click “User management” in the TEC Login page.
3. Login as the admin user. Enter user name and password (admin is default for both), then click “Login”.
4. Select the “Disable logon” check box. The admin user will now be the default user and no login is required.

How to enable the TEC Login page

1. Edit the text in the Internet Explorer® address bar and add the following string: “userManager.aspx”.
2. De-select the “Disable logon” check box. The login page is now enabled.

How to do a master reset of all passwords if the admin password is lost

1. If logged in as a normal user, click the “Logout” text string located in the upper right corner of the screen. (After the logout, Internet Explorer® reverts back to the TEC Login page which is the defined Home Page.)
2. Click “User management” in the TEC Login page.
3. Login as the admin user, but use “e4thgw” as password, then click [Reset all users]. All user passwords are now reset to their default passwords.

3. First time configuration

Before the TEC Server can be used, it has to be configured. Each TEC unit connected to the TEC Server needs unique IP addresses and TEC Server ports. This is configured in the network settings of the TEC Server and by using the TEC Server web interface.

3.1 Installation

By default, the TEC system IP address is set to 192.168.1.10 and the IP address of a TEC unit is set to 192.168.1.100. Depending on network configuration, this may need to be changed.

If, for example, more than one TEC unit is used in the same network, at least one TEC IP address needs to be changed. Alternatively, if the system requires another IP address, the system IP address and the IP addresses of each TEC unit need to be changed. You also have to define each TEC unit's connected IP address and port number on the TEC Server.

3.1.1 Change network settings in the PC (optional)

If the TEC Server is installed on a network with devices other than TEC units, the IP address of the TEC Server may need to be changed. If necessary, contact your local network manager.

To change the network address:

1. Click [Start] and then click [Control Panel].
2. In the Control Panel window, double-click "Network Connections".
3. In the "Network Connections" window, select "Local Area Connection".
(There might be other alternatives, but only one has 192.168.1.10 as the system IP address).
4. In the selected "Local Area Connection Status" window, click [Properties].
5. In the "Local Area Connection Properties" window, select "Internet Protocol (TCP/IP)" and then click [Properties].
6. In the "Internet Protocol (TCP/IP) Properties" window (under "Use the following IP address"), change the IP address and then click [OK].

3.1.2 Configure addresses/ports in the TEC Server

The "Site configuration" page is used to configure the contents of the "Site overview" page as well as to show detailed information about each TEC unit. No TEC units are visible until you have configured the addresses/ports.

Select and configure one TEC at a time. Up to nine TEC units can be connected to each TEC Server.

1. Start the TEC Server web (see section 3.2).
2. Click [Site configuration] to open the "Site configuration" page. The available TEC units should now be visible on the "Site configuration" page.

Site overview		Version information				
	TEC Name	OPC Address	OPC Port	TEC Address	TEC Port	Status
Ok	TEC1	192.168.1.10	2727	192.168.1.100	2727	
Cancel		192.168.1.10	2727	192.168.1.100	2727	
Apply	Activate					Connect
Edit	TEC2	192.168.1.10	2728	192.168.1.101	2728	
Edit	TEC3	192.168.1.10	2729	192.168.1.102	2729	
Edit	TEC4	192.168.1.10	2730	192.168.1.103	2730	
Edit	TEC5	192.168.1.10	2731	192.168.1.104	2731	
Edit	TEC6	192.168.1.10	2732	192.168.1.105	2732	
Edit	TEC7	192.168.1.10	2733	192.168.1.106	2733	
Edit	TEC8	10.140.56.48	2734	192.168.1.107	2734	
Edit	TEC9	192.168.1.10	2735	192.168.1.118	2735	

Refresh status

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3. Click [Edit] for the TEC unit to be configured. Begin with the TEC unit with the highest number (for instance TEC3) and finish with TEC1. Or start with TEC2, continue to the highest number, and finish with TEC1.
4. If necessary, change the OPC server's IP address (the same OPC address applies to all TEC units). This should be the IP address of the TEC Server.
5. If necessary, change the OPC server's port number (As default, TEC1 uses 2727, TEC2 uses 2728, and so on).
6. If necessary, change the IP addresses of TEC units.
7. If necessary, change the TEC unit's port number. This should be the same as the OPC server's port number.
8. Click [Activate] to display the TEC unit on the "Site overview" page.
9. Repeat steps 2-10 for the next TEC unit. Continue until all units are configured.
10. Click [Site overview] to open the "Site overview" page.
11. Panels with the activated TEC units should now be visible on the "Site overview" page.



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3.1.3 Configure addresses/ports in the TEC units

Verify that the TEC units have been configured with unique IP addresses. If this is not the case, see section 3.1.5.1 in the *Maintenance Guide*. Then proceed as follows:

1. On the “Site overview” page, click [Open] on the panel for the TEC unit to be configured.
2. On the TEC unit’s overview page, select Maintenance and then click “TEC unit”.
3. On the “Connect to TEC” page, click the “TEC Maintenance” link to open the TEC Maintenance page.

NOTE: *This can only be done from the same local network as the TEC.*

4. To log in on the TEC, choose the appropriate user level (admin), enter the correct user ID and password for the TEC, and then click [OK].
5. On the “TEC Maintenance” page, select TEC and then click “Set IP address”.
6. On the “Set IP address” page, verify that the IP address and port number of the “OPC server/TEC PC” is the IP address of the TEC Server and the port number configured in the TEC Server for this TEC unit. If not, correct the values and click [Execute].
7. Click [OK] in the confirmation question box.

NOTE: *If the TEC IP address is changed, you need to restart Internet Explorer® and enter the new IP address in the URL field.*

8. Repeat steps 1-7 for the next TEC unit. Continue until all units are configured.

3.2 Start the TEC Server web

1. To open the TEC Server web, double-click the Internet Explorer® icon on the desktop or click [Start] and then click [Control Panel]. The TEC Server web should start automatically.
2. If it does not, type “http://localhost” in the URL field and press [Enter]. The TEC Server web will now start.
3. To log in, choose the appropriate user level (admin), enter the correct user ID and password, and then click [Login]. The “Site overview” page should now be visible. See Fig. in section 4.1.

4. Operation

For more detailed description, see the *User's manual*, section 2.

Navigate in the TEC web by using the quick tabs to the left or by using the navigation bar at the upper part of the screen. The topmost quick tab is used to navigate back to the TEC web start page. The quick menu tabs are always available.

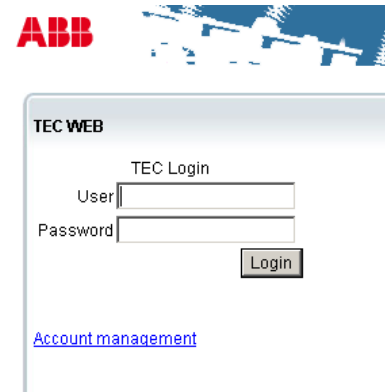
Tool tips are available when holding the cursor over an item and are only shown on the transformer overview page. They are also available when holding the cursor over a graph.

If a sensor has failed or is disabled, a “*” is displayed instead of the value.

All text forms support alphanumeric characters. The characters (and) are also supported. Other characters can cause system instability and should not be used.

4.1 Login procedure

Before using the TEC Server web interface, you have to log on with a valid user account. See section 2.3 for the different access levels. The image to the right is shown when starting Internet Explorer®.



tec_00292

4.2 Site overview

Use this menu item to display the Site overview page with an overview of all connected TEC units.

To view detailed information and configure each TEC, click [Site configuration].

To navigate to a specific TEC, click [Open].

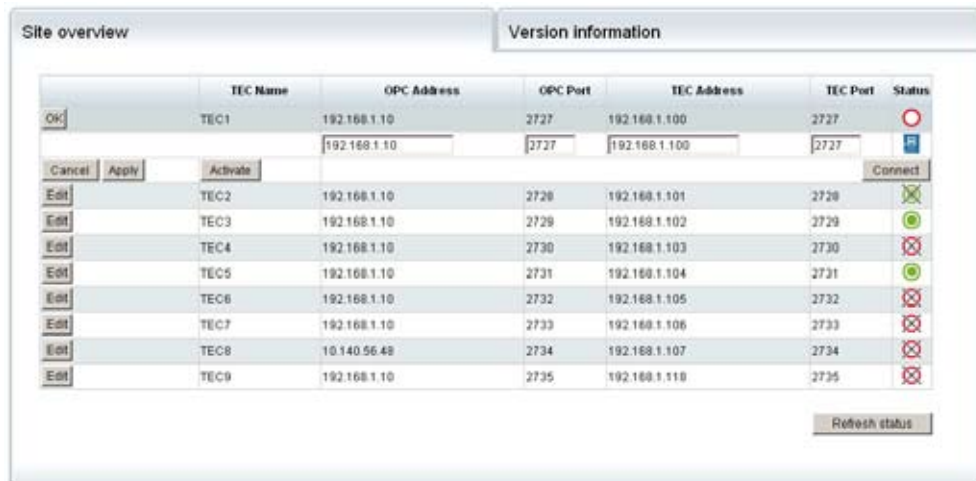


tec_0642

A page, TEC Overview - Specified Interfaces, showing more detailed information about each TEC, is displayed. You can also configure the TECs from this page.

4.3 Site configuration

1. Click [Edit] for the selected TEC.
2. Make your changes (for example, see section 3.1.2).
3. Click [Refresh status] to see the changes to the configuration.
4. To return to the Site overview, click [Site overview].
5. Click [Connect] to establish communication with the TEC unit.
6. Click [Refresh status] to see if the configuration has been successful.
7. Click [OK] to close the configuration panel for the selected TEC unit.



tec_0641

Icons used in the site configuration

- TEC is connected and activated.
- TEC is not connected but activated.
- TEC is connected but not activated.
- TEC is neither connected nor activated.
- Communication can be established with the TEC.
- Communication cannot be established with the TEC.

To view the version information of the system components in the TEC Server, select *Version information* in the menu.



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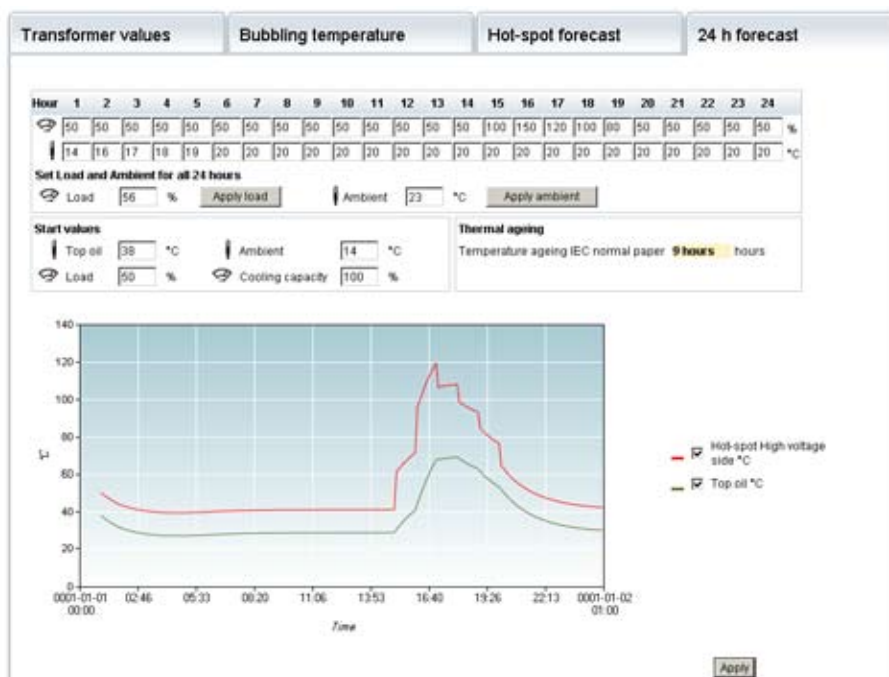
4.4 Additional features

4.4.1 24h hot-spot forecast

Use this menu item to display a 24h hot-spot forecast. The 24h hot-spot forecast is used when you want to simulate the transformer temperatures during certain user defined load intervals.

Choose the values to display by checking the values on the right, then enter load and ambient temperature values for every hour and click [Apply].

NOTE: Load and ambient temperatures are automatically set according to the actual temperatures in the TEC.



tec_00274

24 Hour forecast table

Hour	The hours (1-24) of the simulation.
Load	Load (for each hour) of the simulation.
Ambient	Ambient temperature (for each hour) of the simulation.

Set Load and Ambient for all 24 hours

This panel contains input fields and buttons for the configuration of the simulated 24h hot-spot forecast.

Load	Field for entry of load value.
Apply load	Changes the load value for all hours and redraws the graph.
Ambient	Field for entry of ambient temperature.
Apply ambient	Changes the ambient temperature for all hours and redraws the graph.

Start values

This panel contains input fields for the configuration of the start values of the 24h hot-spot forecast.

Top oil	Selected start temperature for the top oil.
Ambient	Ambient temperature.
Load	Actual load.
Cooling capacity	Actual cooling capacity.

Thermal ageing

The thermal ageing information box shows the total ageing that will occur if the transformer is loaded according to the forecast.

Buttons

Apply	Redraws the graph based on the new configuration data.
Print	Prints the graph based on the chosen configuration data.

Check boxes

The 24h hot-spot forecast will display the values according to the chosen check boxes.

Hot-spot High voltage side °C	Hot-spot temperatures in windings.
Top oil °C	Top oil temperature in transformer.

4.4.2 All history

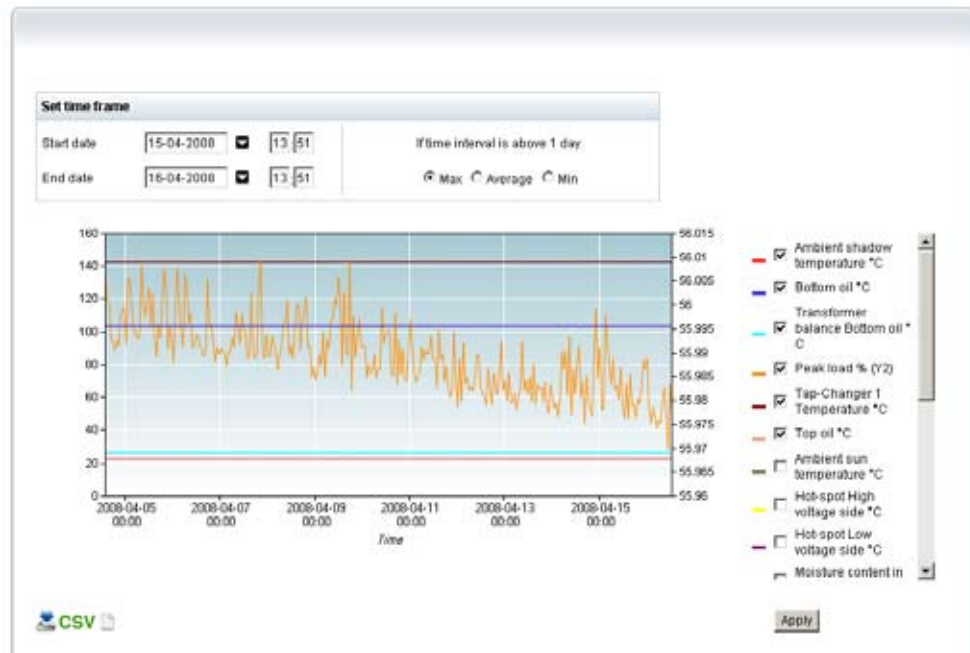
Use this menu item to display a graph with all available history data on the TEC Server.

Choose the values to display by checking the values on the right, then enter an appropriate time frame and click [Apply].

The values shown in the graph can be exported to a CSV file by clicking the CSV icon. The values in the CSV file contain all data retrieved from the database for the specified time interval.

NOTE: When saving the CSV file, a dialog window asks whether to save or open the file. The correct procedure is to save the file to the local hard drive and then open it in MS Excel. See Appendix A for more information about CSV files.

All history graph



Set time frame

This panel contains input fields for the configuration of the All history graph's time frame.

Start date	Date of first value to be displayed.
hh:mm	Time of first value to be displayed.
End date	Date of last value to be displayed.
hh:mm	Time of last value to be displayed.
Line resolution type	Max - Maximum value during the last measurement period. Average - Average value during the last measurement period. Min - Minimum value during the last measurement period.

Buttons

Apply	Redraws the graph based on the new configuration data.
Print	Prints the graph based on the chosen configuration data.
CSV	Exports the graph's values to a Comma Separated Values (CSV) file.

Check boxes

The All history graph will display the values according to the chosen check boxes.

Ambient °C	Ambient temperature in the shade.
Bottom oil reference temperature °C	Theoretical calculated transformer bottom oil temperature is shown here. Could be compared with measured temperature for transformer status.
Top oil reference temperature °C	Theoretical calculated transformer top oil temperature is shown here. Could be compared with measured temperature for transformer status.
Hot-spot HV °C	Hot-spot temperatures in windings.
Hot-spot LV °C	Hot-spot temperatures in windings.
Bottom oil °C	Bottom oil temperature in transformer.
Hydrogen gas ppm	Shows the actual value for the hydrogen gas ppm.
Load ratio (Y2)	Shows the actual load ratio.
Tap-Changer position pos (Y2)	Shows the tap-changer position.
Peak load (Y2)	Shows the actual peak ratio.
Tap-Changer Moisture mO (Y2)	Moisture in the tap-changer is displayed in the graph using the right axis (Y2).
Tap-Changer 1 Temperature °C	Temperature in tap-changer 1.
Top oil °C	Top oil temperature in transformer.
Transformer Moisture mT (Y2)	Moisture in transformer is displayed in the graph using the right axis (Y2).

4.5 Navigation

4.5.1 Settings menu

The top menu is described in section 2.3.3 in the *User's manual*.

The Settings menu consists of the following menu items:

- Language/Unit
- Maintenance

The following differs between TEC Web and TEC Server:

View

In TEC Server you will find the “24 hour forecast” under Transformer. In addition, there is a menu item for the “All history graph”.

Reports

In TEC Server you will also find Service Log.

Settings

In TEC Server you will find the TEC Web’s “Language, Temperature unit and Date format” under “Language/Unit”.

4.5.1.1 Language/Unit

Use this menu item to display the Language/Unit page. This page lets the user configure the following settings:

- Page language
- Temperature units
- Graph calendar culture
- CSV File delimiter.

NOTE: *The Windows regional settings affect how the date and time values are displayed.*

Settings

Select page language: English ▼

Select temperature unit: Degrees celsius ▼

Select graph calendar culture: Swedish (Sweden) ▼

CSV file delimiter: Semicolon (;) ▼

Apply

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Buttons

Apply	Updates the system with the new settings.
-------	---

4.5.2 Maintenance menu

The Maintenance menu consists of the following menu items:

- Database
- Documentation/Video
- TEC unit
- Download TEC configuration.

NOTE: The Maintenance menu is only available when logged in as the admin user.

4.5.2.1 Database

Use this menu item to display the Database Maintenance page. This page lets you perform certain database maintenance such as clearing log files and backing up/restoring the database.



How to clear database data (Alarm & Events and Collected Data)

Click [Alarm & Events] or [Collected Data] (the button which states the name of the database data that you want to clear) and the data is cleared from the database.

How to create a database backup

1. Click [Create Backup].
2. Click [Yes] in the dialog box asking whether you want to make a database backup. The database backup is stored as a zip file in a folder with the date and time (for example: 2007-12-24-18-00-00) of the backup occasion. The backup folder (with its zip file) is saved at D:\DBBACKUP on the TEC Server.
3. Wait a few minutes for the database backup to complete.

How to restore a database backup

1. Select an existing backup from the list box.
2. Click [Restore].
3. Wait a few minutes. The database is now restored.

How to delete a database backup

1. Select an existing backup from the list box.
2. Click [Delete].

How to download a database backup

1. Select an existing backup from the list box.
2. Click [Download]. A Save As window is displayed.
3. Choose where you want to save the backup and click [Save].

4.5.2.2 Documentation/Video

Use this menu item to display the Bind Document page. This page lets you bind existing documents stored on the TEC Server. The bound items will be shown in the Document/Video menu item in the Help menu (see section 4.3.5).

NOTE: The files in the Available files box can only be accessed from the TEC Server.

Bind Document

How to add new items:

Copy the files you want to include in the Documentation/Video pages into the folder `C:\inetpub\wwwroot\TecWeb\Documentation`. To display the new files, click [Update].

How to bind a new item

1. Select an area from the menu *Select area*.
The selected area becomes the heading in the new menu item.
2. Select a type from the menu *Select Type*.
The selected type becomes the sub heading in the new menu item.
3. Enter a file name or select a file in the Available files box.
4. Click [Bind] to bind the selected file.

How to unbind an existing item

1. In the menu *Select Area*, select the area of the menu item you want to unbind.
2. In the menu *Select Type*, select the type of the menu item you want to unbind.
3. Enter a file name or select the file in the Available files box.
4. Click [Unbind] to unbind the selected file.

How to create new types and areas

1. Click [Add] next to the menus *Select Area* / *Select Type*. A new window is displayed.
2. Enter a name for the new area/type.
3. Enter an NLS for the new area/type. The NLS is not translated in the TEC translation tool and is only available when using native language (see section 4.3.2 for changing languages).
4. Click [Save] to save the new area/type.

4.5.2.3 TEC Unit

Use this menu item to open the TEC units' maintenance pages. Click on the menu item TEC unit to open the maintenance pages.

Configuration of the TEC unit functionality can be performed in the TEC maintenance pages. For more information, see the *Maintenance Guide*.

NOTE: A connection to the TEC can only be established from the TEC Server.

4.5.2.4 Download TEC configuration

Use this menu item to download the TEC configuration report. Click [Save as] to save the configuration report as a text file on your local computer.

For more information about HEX files, see the *Maintenance Guide*.

4.5.3 Reports menu

The Reports menu consists of the following menu items.

- Status report
- Configuration report
- Service log.

4.5.3.1 Status report

Use this menu item to create a status report for the TEC in PDF format. The report shows present sensor values and active events.

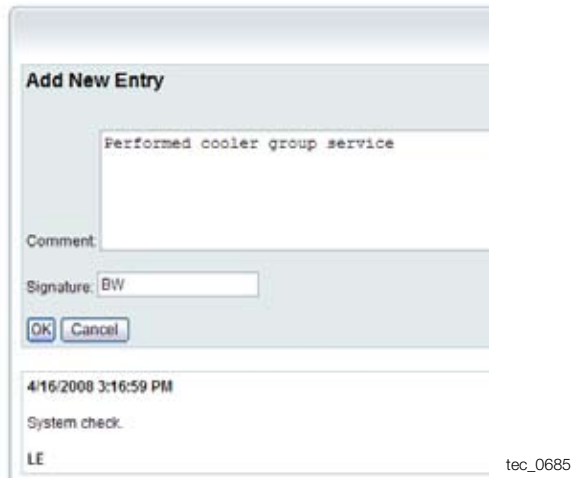
4.5.3.2 Configuration report

Use this menu item to create a configuration report for the TEC in PDF format. The report shows present settings for the TEC unit and the TEC Server.

4.5.3.3 Service log

Use this menu item to display entries on the Service Log page. The TEC operator may add various entries stating service operations etc.

Service Log



The screenshot shows a dialog box titled "Service Log" with a sub-header "Add New Entry". It contains a text area with the text "Performed cooler group service". Below the text area is a "Comment:" label. Underneath is a "Signature:" label followed by a text input field containing "BW". At the bottom of the dialog are "OK" and "Cancel" buttons. Below the dialog box, the text "4/16/2008 3:16:59 PM" is displayed, followed by "System check:" and "LE". The identifier "tec_0685" is located at the bottom right of the dialog area.

How to add an entry to the service log

1. Click [Add entry].
2. Write your comment.
3. Enter a signature in the signature field.
4. When ready, click [OK] and the comment is saved.

Service Log



The screenshot shows the "Service Log" page. At the top left is an "Add Entry" button. Below it, the text "4/16/2008 3:16:59 PM" is displayed, followed by "System check:" and "LE". The identifier "tec_0686" is located at the bottom right of the page.

4.5.4 Links menu

External links as defined in the TEC unit. For instance, they can lead to other TEC units, web servers or web cams.

4.5.5 Help menu

The Help menu consists of the following menu items:

- Contents and index
- Documentation/Video
- About.

4.5.5.1 Contents and index

Use this menu item to access the online help for the TEC Server.

4.5.5.2 Documentation/Video

Use this menu item to access the documents that are bound in the Maintenance menu (see section 4.3.4.2).

4.5.4.3 About

Use this menu item to display the About Page. This page shows system information about the TEC unit, TEC Server and its peripherals.

About

TEC Unit		AdvancedPC		Network	
Description	Article Number	Version	Release Date		
Bootloader data	1ZSC000015	3.01.000	10/6/2004		
Application software data	1ZSC000949-ADW	1.00.000	10/29/2007		
Parameter file	1ZSC000949A11569	2.01.000	1/6/2008		
Web software data	1ZSC000949-AAG	1.00.003	9/20/2007		

tec_0664

About

TEC Unit		AdvancedPC		Network	
Description	Article Number	Version	Release Date		
Sybase DB	1ZSC001984	1.00.000	12/21/2006		
TEC Client	1ZSC001986	1.00.000	2/21/2008		
OPC	1ZSC000956	1.0.1	11/16/2006		
PCU	1ZSC001727	4.4	4/5/2006		
TEC Server	1ZSC002008	1.00.000	11/16/2006		
Computer Image File	1ZSC001978AAB	1.00.001	10/24/2007		
Web Application	1ZSC001985	1.00.001	12/19/2006		

tec_0665

About

TEC Unit		AdvancedPC		Network	
Description	IP Address	Port			
TEC Cabinet	192.168.1.104				
TEC Cabinet Subnet mask	255.255.255.0				
TEC Cabinet Default gateway	192.168.1.1				
OPC Server/TEC PC	192.168.1.10	2731			
MTP Server	192.168.1.200				

tec_0666

Appendix A

Comma Separated Values (CSV) file

The CSV file includes data from the sensor values selected in the All history graph page (see section 4.3.1.8). The columns are by default delimited with a comma and rows are in descending order in the time column. The delimiter can be changed on the Settings page (see section 4.3.2).

The first column always shows local server time.

The following columns are the same as were chosen on the graph page.

How to import a CSV file into MS Excel

1. Open MS Excel.
2. From the File menu, choose Open.
3. Select the exported CSV file and click [OK].
The Text Import Wizard starts.
4. When Text Import Wizard Step 1 of 3 is displayed, click [Next].
5. When Text Import Wizard Step 2 of 3 is displayed, choose the correct delimiter. By default the semicolon is used. See the Settings page (see section 4.3.2) to make sure you are using the correct delimiter.
6. When Text Import Wizard Step 3 of 3 is displayed, select the leftmost column and change the Column data format to Date YMD.
7. Click [Finish] to complete the CSV file import.

Appendix B

Frequently Asked Questions (FAQ)

The TEC main screen is not displayed

The TEC main screen is not displayed when entering the TEC cabinet IP address into the Internet Explorer® address field. What could be causing the problem and what should I do?

1. Check that correct IP addresses are used, both for the TEC cabinet and PC.
2. Make sure the network cable and the fiber-optic cable are connected correctly.
3. Check that the TEC cabinet is up and running.

A value in the main screen is a "*" (star)

The sensor is disabled or the sensor is broken. For more information, see the *Technical Guide*.

When I plot graphs, the line goes below the graph or is missing

The sensor is disabled, the sensor is broken or the TEC was turned off during that time. For more information about enabling sensors, see the *Maintenance Guide*, and about sensor failures, see the *Technical Guide*.

There are no values in the graphs and it is not possible to generate a CSV file

Check that the TEC time is correct. The time can be checked and set in TEC web/Maintenance/Settings/TEC/Set time in TEC. For more information, see the *Maintenance Guide*.

Some pages cannot be printed

Make sure the popup blockers are disabled and try to print again.

Some pages are not working properly

Make sure you have enabled JavaScript in your browser.

I am having trouble seeing the entire interface on my screen

Make sure your display is using at least resolution 1024 x 768. You can also try to press F11 when using the TEC Server web to maximize the interface.

The graph does not fit when I try to print it

Make sure the printer orientation setting is set to "Landscape".

Appendix C

Guide for load and temperatures

Maximum current and hot-spot temperatures, according to IEC 60076 (2005-12).

Types of loading	Limits for medium power transformers (see NOTE)	Limits for large power transformers (see NOTE)
Normal cyclic loading		
Load K (Current (p.u.))	1.5	1.3
Winding hot-spot temperature and metallic parts in contact with cellulosic insulation material	120 °C	120 °C
Other metallic hot-spot temperature (in contact with oil, aramid paper, glass fiber material)	140 °C	140 °C
Top-oil temperature	105 °C	105 °C
Long-time emergency loading		
Load K (Current (p.u.))	1.5	1.3
Winding hot-spot temperature and metallic parts in contact with cellulosic insulation material	140 °C	140 °C
Other metallic hot-spot temperature (in contact with oil, aramid paper, glass fiber material)	160 °C	160 °C
Top-oil temperature	115 °C	115 °C
Short-time emergency loading		
Load K (Current (p.u.))	1.8	1.5
Winding hot-spot temperature and metallic parts in contact with cellulosic insulation material	160 °C	160 °C
Other metallic hot-spot temperature (in contact with oil, aramid paper, glass fiber material)	180 °C	180 °C
Top-oil temperature	115 °C	115 °C

NOTE: The temperature and current limits are not intended to be valid simultaneously. The current may be limited to a lower value than shown in order to meet the temperature limitation requirement. Conversely, the temperature may be limited to a lower value than shown in order to meet the current limitation requirement.

For power transformers with 65 °C rise, according to IEEE PC57.91-1995.

Types of loading	Suggested maximum limits of loading
Normal life expectancy loading	
Insulated conductor hot-spot temperature	120 °C (110 °C on a continuous 24 h basis)
Other metallic hot-spot temperature (in contact and not in contact with insulation)	140 °C
Top oil temperature	105 °C
Planned loading beyond nameplate rating	
Insulated conductor hot-spot temperature	130 °C
Other metallic hot-spot temperature (in contact and not in contact with insulation)	150 °C
Top oil temperature	110 °C
Long-term emergency loading	
Insulated conductor hot-spot temperature	140 °C
Other metallic hot-spot temperature (in contact and not in contact with insulation)	160 °C
Top oil temperature	110 °C
Short-term emergency loading	
Insulated conductor hot-spot temperature	180 °C
Other metallic hot-spot temperature (in contact and not in contact with insulation)	200 °C
Top oil temperature	110 °C

CAUTION

When hot-spot temperatures reach temperatures above 140-160 °C, it should be noted that gas bubbles might develop, which could jeopardize the dielectric strength of the transformer. (If there is moisture in the oil, the risk for bubble formation increases and the limits could even be lower.)

NOTE: *There could be restrictions for components in the transformers at high loads or temperatures.*

Appendix D

Hot-spot calculation method

The following formulas have been used in the calculation:

Increasing step:

$$\theta_h = \theta_a + \Delta\theta_{o,start} + \left\{ \frac{100}{X} \cdot \Delta\theta_{or} \cdot \left[\frac{1+R \cdot K^2}{1+R} \right]^{x_o} - \Delta\theta_{o,start} \right\} \cdot \left(1 - e^{-\frac{t}{\tau_o}} \right) + Hg_r K^{y_w}$$

tec_eq_001

Decreasing step:

$$\theta_h = \theta_a + \frac{100}{X} \cdot \Delta\theta_{or} \cdot \left[\frac{1+R \cdot K^2}{1+R} \right]^{x_o} + \left\{ \Delta\theta_{o,start} - \frac{100}{X} \Delta\theta_{or} \cdot \left[\frac{1+R \cdot K^2}{1+R} \right]^{x_o} \right\} \cdot e^{-\frac{t}{\tau_o}} + Hg_r K^{y_w}$$

tec_eq_002

In the formula, the following values for the winding with the highest hot-spot temperature are used:

θ_h	winding hot-spot temperature (°C)
$\Delta\theta_{o,start}$	temperature rise of top oil in tank at start (K)
θ_a	ambient temperature (°C)
$\Delta\theta_{or}$	temperature rise of top oil in tank at rated losses (K)
H	hot-spot factor
R	load losses/no-load losses
$K = I_{load} / I_{rated}$	load current/rated current
X	cooling capacity in percent (the complete cooling capacity available for the transformer that is used)
x_o	oil exponent
gr	winding-to-oil temperature difference at rated load current (K)
yw	winding exponent
$\Delta g_{h-s,start}$	hot-spot temperature rise above top-oil temperature in tank at start (K)
τ_o	average oil time constant (min.)



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