POWERSOFT

INSTRUCTION MANUAL

INDEX

INTRODUCTION

1.1 WHY POWERSOFT?

To correctly and efficiently manage any electrical distribution system, mainly considering the cost reduction point of view, it is important to monitor the energy consumptions, to control the demanded power peaks and to exploit accurate data processing and analysis tools.

PowerSoft is a sophisticated data acquisition and processing system developed to satisfy these requirements and to supply a very flexible but easy-to-use Energy management tool.

1.2 FEATURES

PowerSoft is modular software consisting of a main core (which includes the data acquisition and database functions) and of a series of optional modules that allows adding different features to satisfy different requirements or to solve specific applications.

The software can automatically adapt itself according to the electrical system configuration. In this way the user can easily configure the instruments and the software (parameters and synoptic pages) without the need of particular programming or computer knowledge.

1.3 GENERAL SPECIFICATIONS

PowerSoft is an analysis platform suitable for Win98, 98SE, 2000 and XP, which has been specifically developed to interface, by means of the Modbus protocol (RTU and TCP/IP), the Carlo Gavazzi products for Energy Management.

The system is composed by a main module (called "core") and by a series of modules, some of which are included in the base package (ordering code "POWERSOFT"). The core module communicates with the instruments, shows the real-time variables, and stores the acquired data in the system, while the other modules tasks are to process the stored data, to analyse the acquired information, to create reports.

In detail, the core:

provides the interactive and animated synoptic pages that allow:

- to display the plant configuration
- to display the real-time data
- to monitor the digital input status acquired by the instruments on the field

commands the instruments digital outputs, manually or following an alarm situation

displays an alarm window that informs the user in case of set point exceeding or communication errors

has 3 access level, protected through a password.

Every further operation is carried out through the optional modules. No additional module is necessary for the core operations. The available optional modules are the following.

- **Trends (analytical and graphical, included in the base package "PowerSoft"):** A selectable set of variables (different from instrument to instrument) can be stored in the PowerSoft database with a selectable time interval. All the data can be analysed later on in both graphical and analytical format and exported in various formats

(wmf, csv, xls). Up to 4 variables (from the same or from different instruments) can be contemporarily displayed. With simple and intuitive procedures it is also possible to zoom the graph or analyse it in detail with a cursor, freely choosing the time period to be displayed. If the tariffs and the different contractual powers are set (if the "PWS-Tariff" module is available), this information can be graphically related to the stored variables.

- **Active alarm/Alarm and Events (included in the base package "PowerSoft"):** an active alarms window (that automatically pops up in any case of alarm) advises the user if a set point has been exceeded or if a communication error is present; it allows the qualified users to acknowledge the selected alarm. An alarms and Events log allows to access the archive of the events (login, logout, start-up, alarm acknowledgment, etc.) and of the alarms (set point alarm, communication errors, missing data storage, etc.) and to carry out filter-based searches.

- **Set point configuration (optional module "PWS-Alarm"):** the set point alarms can be associated to both an up and a down threshold on all the variables measured by all the instruments of the network. The alarm can be software, being displayed in the Active alarms windows and stored in the Alarms and events log, or hardware-based, being stored as above and switching the digital output of the instrument that are pointing out the anomaly. If the PWS-Tariff module is available, the set point on the active power can be in function of the current tariff.

- **Tariffs configuration (optional module "PWS-Tariff"):** the different tariffs during the day and the distribution of the typical-days among the year can be set according to the supplier tariff regulations in a very easy and extremely flexible way. It can manage: up to 12 tariffs; up to 24 tariff change per day; up to 365 different typical-days per year. For each tariff the relevant contractual power can be edited

to be displayed on the graphics or to be used as a set point to avoid overpower demands (if the "PWS-Alarm" module is available).

- **Analysis support (optional module "PWS-Analysis"):** it carries out statistical analysis on the power trends and energy consumption by extrapolating the average demand of each day of the week, the week-based consumption trends, and the estimation of the ideal installed power for each tariff, calculated with a selectable confidence level. The data can be filtered removing from the computation, if needed, the week-ends, the holidays and the days with anomalous consumption due to external events.

- **Costs estimation (optional module "PWS-Bill"):** according to the utility contract parameters, the module allows to estimate the costs, relevant to a selected month, due to the energy, water and gas consumption. This is useful to perform the cost allocation among the monitored lines, to display the daily trend of the consumption or to identify the reasons of any penalty.

- **E-mail (optional module "PWS-Mail"):** it manage the automatic e-mailing, able to notify the electrical system status to one or more e-mail addresses. The e-mailing can be carried out on regular basis and/or as a consequence of a defined alarm or event.

- **Web-server (optional module "PWS-Web"):** the web-server module allows to remotely accessing PowerSoft, using a standard browser without additional licenses, in order to access all the real-time information and historical data.

2 INSTALLING POWERSOFT

2.1 SYSTEM REQUIREMENTS

PowerSoft needs of the following minimum requirements:

Processor: Pentium II 400

RAM: 256 Mb

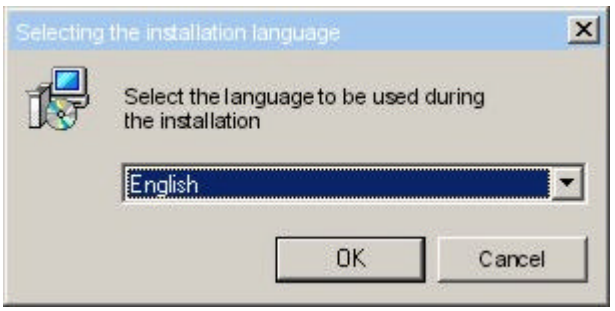
Hard disk: 100 Mb free

Monitor: 1024x768

Windows 98 / NT 4 / 2000 / XP (preferable XP)

2.2 INSTALLATION

The installation program guides the user installing PowerSoft, allowing to choose the default language and the installation folder, and to create an icon on the desktop.



The navigation through the installation program is carried out by means of the "Next", "Back", or "Cancel" keys respectively to proceed, recede, or exit the program and therefore not installing PowerSoft... After a successful installation, a new entry on the "Start"/"Program" menu is available; it includes the link to PowerSoft, the Configurator and to the relevant uninstalling program.

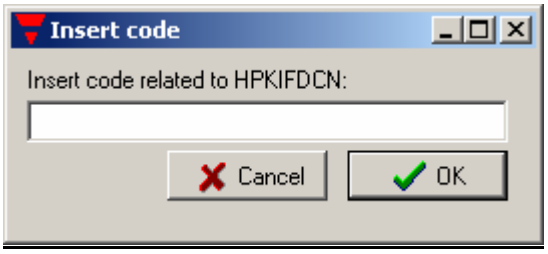
After the installation, PowerSoft is available with a minimum configuration (no synoptic page, no connected instrument, etc.), therefore the configuration program "Configurator.exe".

If Powersoft is entered before the configuration process, a login as Administrator is mandatory to exit the program itself (see paragraph 2.4). Only the Administrator can exit PowerSoft.

On the system, two predefined user are set by default (see paragraph 2.4).

2.3 THE FIRST POWERSOFT START-UP

The first time Powersoft is launched, an access code is required. The code depends on the optional modules bought by the user.



This window asks for the code after the first start-up

To get the proper access code, the software supplier or distributor is to be contacted, communicating him the access key provided by the software itself (in the above example, see the picture, it is "HPKIFDCN"). Editing the returned access code, paying attention to the capital letters, the software and the desired modules are available.

Without the access code, PowerSoft cannot be used. The access code will not expire and therefore it is not to be edited again.

IMPORTANT NOTE: the code is depending on the PC and on the hard-disk. If the software is to be moved in another PC or in a new hard-disk, a new access code is to be asked to the supplier.

2.4 USERS AND PASSWORDS

The installing program sets two default users on the system:

User 1:

Name: admin
Password: admin
Level: Administrator

User 2:

Name: user
Password: user
Level: User

These default users can access all the PowerSoft functions (according to the relevant level, see below) but, for safety reasons, it is suggested to create at least a new "Administrator" user (or more of them and the required simple "Users"= and then delete both the default users.

The "User" can access all the data, acknowledge the alarms, and ask for any report, also via web-server.

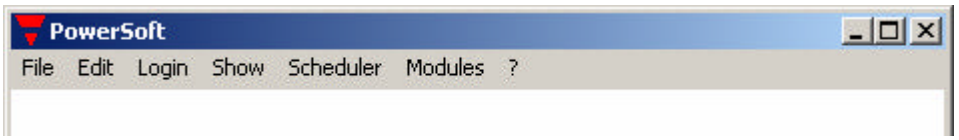
The "Administrator" can access all the "User's functions and, in addition, can configure Powersoft and all the relevant modules

A user without the password can only access the real-time values and display the active alarms list.

3 OPERATING POWERSOFT

3.1 MENU BAR

The menu bar allows carrying out any operation on the software.

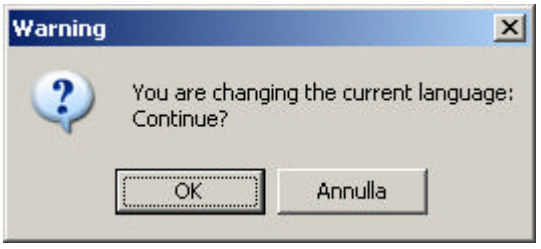


3.1.1 THE *FILE* MENU

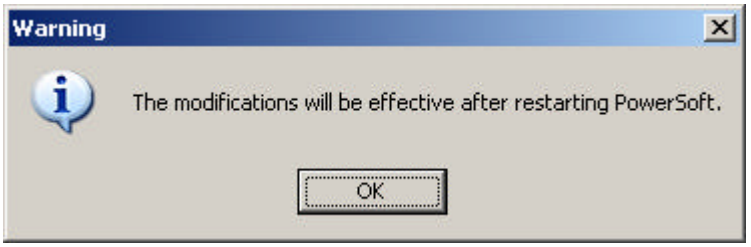
It includes only an entry: *Exit*. Selecting it, only if the logged-in user is an "Administrator", PowerSoft is closed otherwise a warning message informs on the missing qualification. Exiting PowerSoft, the variable recording on the database is interrupted.

3.1.2 THE *EDIT* MENU

It includes the "Language" submenu that allows changing the language of the menus, windows and messages of PowerSoft. Only a logged-in user (User or administrator level) can change the language.



Once the language is selected, a message informs the user that the modifications are available only after the next launch of the software.



3.1.3 THE *LOGIN* MENU

It allows managing the user list (access levels, passwords). See the Software safety chapter (4) for the details.

3.1.4 THE *SCHEDULER* MENU

It includes only the "E-mail" entry which manages the tasks for the automatic e-mailing. It is available only if the "PWS-mail" module is installed.

3.1.5 THE *SHOW* MENU

It includes four entries.

- The *Pages* entry includes, in its submenu, a link to all the synoptic pages generated in the configuration process. Clicking on a synoptic page, it is automatically displayed.

- The *Single Meter* entry includes, in its submenus, the list of all the instruments connected to the system. Clicking on an instrument, the real-time window of that instrument is displayed. The instrument is grouped according to the relevant communication line. For the details on the real-time window, see paragraph 1.11.

- The *All the meters* entry allows to show all the measurements (in three groups) of all the meters at the same time; in this way a global vision of the system and a comparison among the same variables from different instruments are possible.

- The *Active alarms* entry opens the window showing all the active alarms.

3.1.5.1 "*ALL THE METERS*" MENU

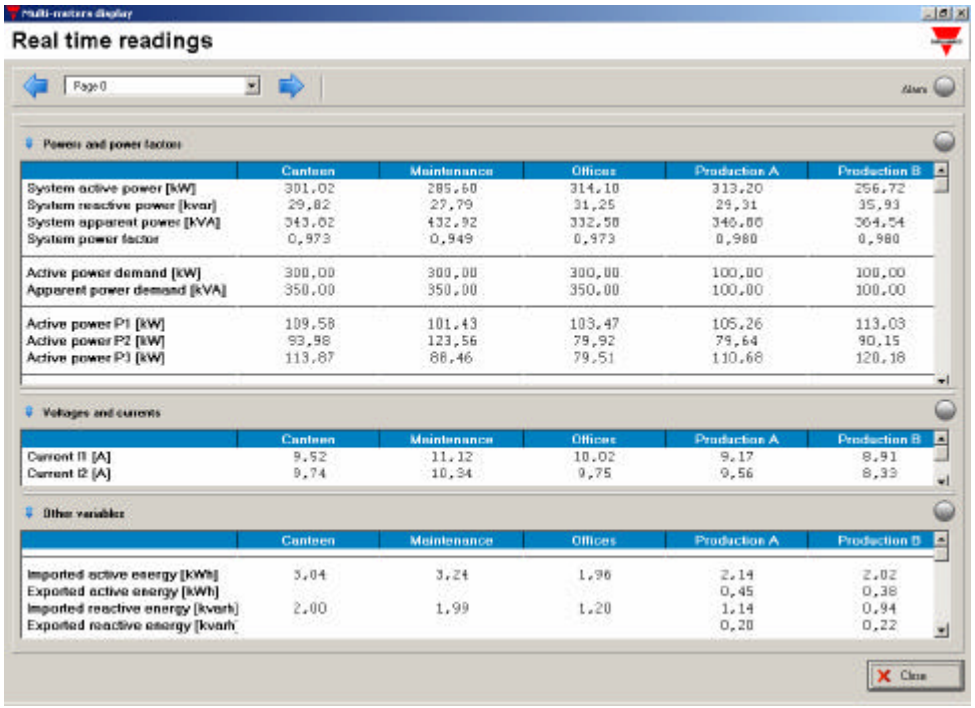
To have a global vision of the system and to perform a comparison among the same variables from different instruments, this function shows a table where all the measurements of all the meters are available.

The available variables are grouped in three categories:

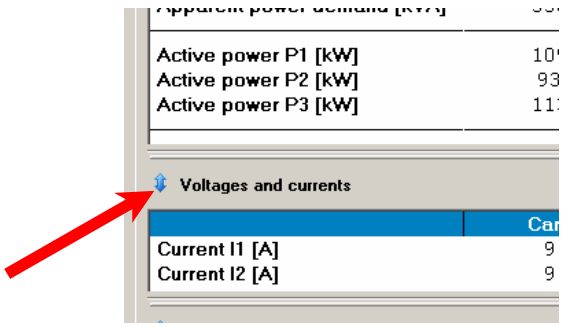
- **Powers and power factors**
- **Voltages and Currents**
- **Other variables**

In each group, the first column describes the variables and the relevant engineering unit. Each other column is dedicated to a specific instrument and indicates the value of the variable described in the first column.

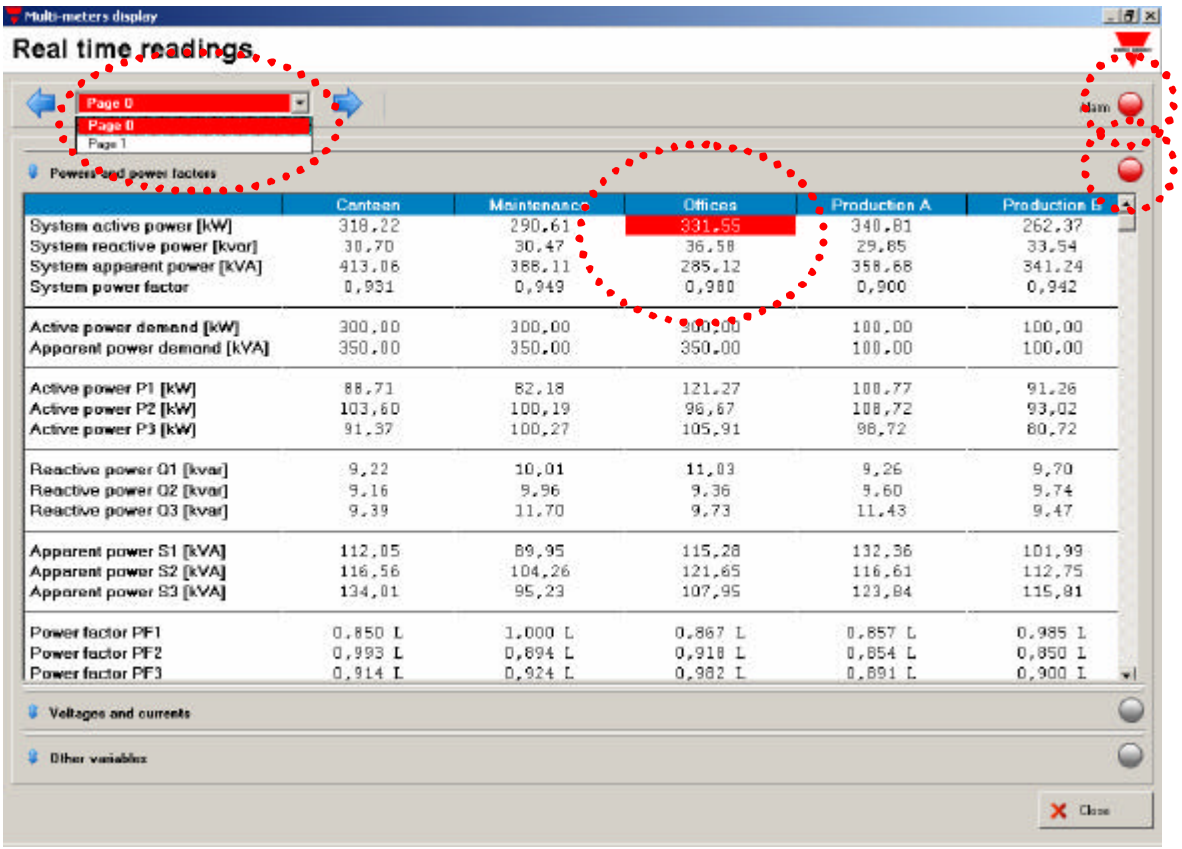
The table is split into more pages: each one of them includes five instruments; using the arrows in the top left box (or the relevant drop-down menu), it is possible to scroll the different pages. In the same box, there is the indication of the current page.



To analyse a different group of variables, double click in the area between the boxes or click once on the double arrow near the group name. The variable of more than one group can be shown at the same time, just dragging the relevant group boxes until the desired size is obtained.



The window shows a red indication in case of setpoint alarm; in the top right of the window, a red LED indicates the alarm situation. Another red LED is in the variable group where the alarm situation is present, and the variable value is highlighted.



If the alarm condition occurs in an instrument not included in the current page, it is possible to locate the right page looking at the page drop-down menu, where the relevant page is highlighted in red too.

3.1.5.2 THE "*ACTIVE ALARMS*" SECTION

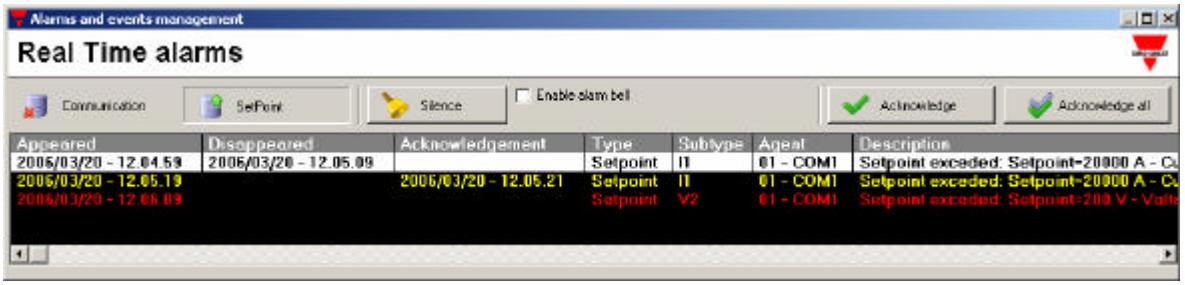
Clicking in this section opens the Active alarm window.

Each alarm is grouped according to its *Type* and *Subtype*; the *Agent* who/which caused the alarm and the event *Description* are indicated too. The first three columns include the starting, ending and acknowledgment date and time of the event.

The event has a different colour according to its status: red if the alarm is active but not acknowledged, yellow if the alarm is active and acknowledged, and white if the alarm is not active but acknowledged. The alarms which are neither

active nor acknowledged are automatically deleted from this window and they are stored in the event log.

To promptly inform the user of any new alarm or of the end of an alarm situation, the Active alarm window automatically pops up when such a situation occurs.



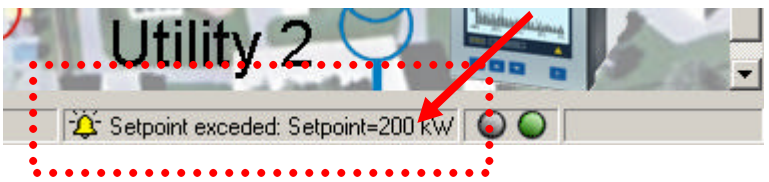
The following operations are possible:

Acknowledgement: using the two top right buttons it is possible to acknowledge the selected alarm or all the alarms at the same time. Only a logged-in user can acknowledge an alarm.

Filtering: using the two top left buttons it is possible to filter the alarms choosing to show/hide the setpoint alarm or the communication errors.

Enabling the alarm bell and silencing it: it is possible to enable the PC alarm bell in case of alarm. This signalling is active until the user silences it with the relevant button.

The Active alarm window can be accessed double clicking on the status bar, as shown in the picture:



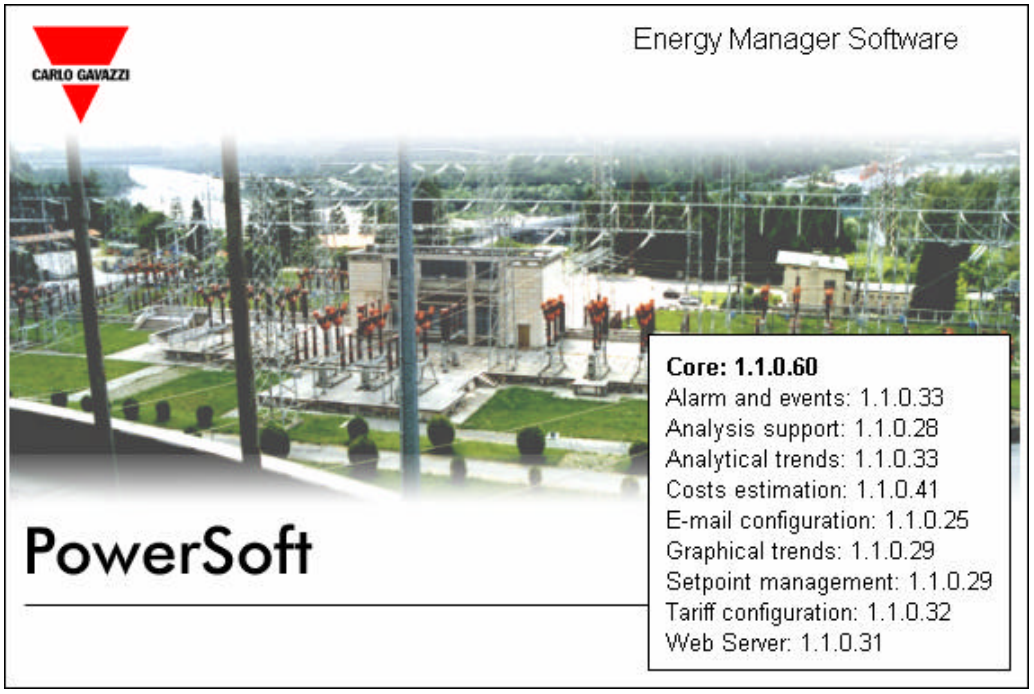
3.1.6 THE *MODULES* MENU

This menu allows using the different modules of PowerSoft: each entry corresponds to a module. The enabled modules depend on the modules which have been purchased and on the access level of the user. A detailed description of each module is available in the relevant chapter of this manual.

3.1.7 THE "?" MENU

This menu includes the *Add-ons* and *New key* entries.

- *Add-ons*: it supplies the information about the version of the software and of all the modules. The shown page is the one which appears during the start-up of the software.



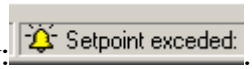
- *New key:* it allows entering a new access code to enable new modules. To get the proper access code including the new feature to be added, the software supplier or distributor is to be contacted, communicating him the access key provided by the software itself (see paragraph 2.3). Editing the returned access code, paying attention to the capital letters, the new modules are available.

3.2 THE STATUS BAR

The status bar is in the bottom part of the window and includes different data:

1) Date and time of the PC. Double clicking on it, the software presentation page (see paragraph 3.1.7), with the software and modules versions, is shown.

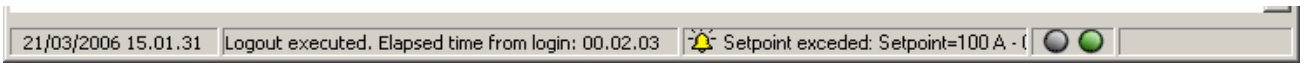
2) The last event stored in the system.

3) The presence of active or non-acknowledged alarms, if the following icon is yellow: 

. If any alarm is active or non-acknowledged, the icon is grey. Double clicking on the icon, the active alarm window appears.

4) Two LED's indicating any communication error; the green LED means that no communication error is present, the red LED that at least one instrument in not correctly communicating. Double clicking on the icon, the active alarm window appears.

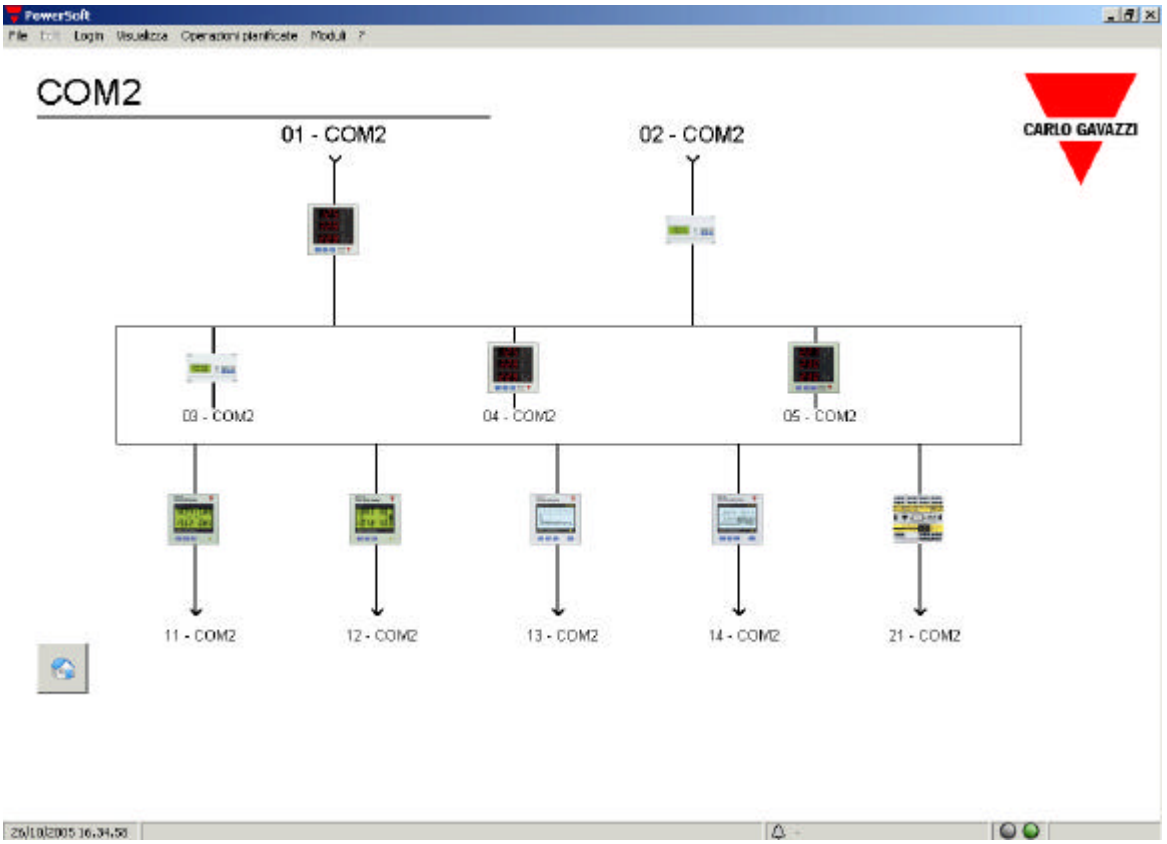
5) A bar indicating the progress of any process.



1 2 3 4 5

3.3 THE SYNOPTIC PAGES

The central part of the window shows the synoptic pages which can represent the system diagram or the factory plan. From every page it is possible to access the real-time pages of each instrument, just clicking on the instrument picture, or to browse among the other pages, using the proper link buttons.



Any alarm status of each instrument is directly available on the synoptic pages: if the instrument is not communicating, a fuchsia square appears around it; if there is a setpoint alarm, the square indication is red.

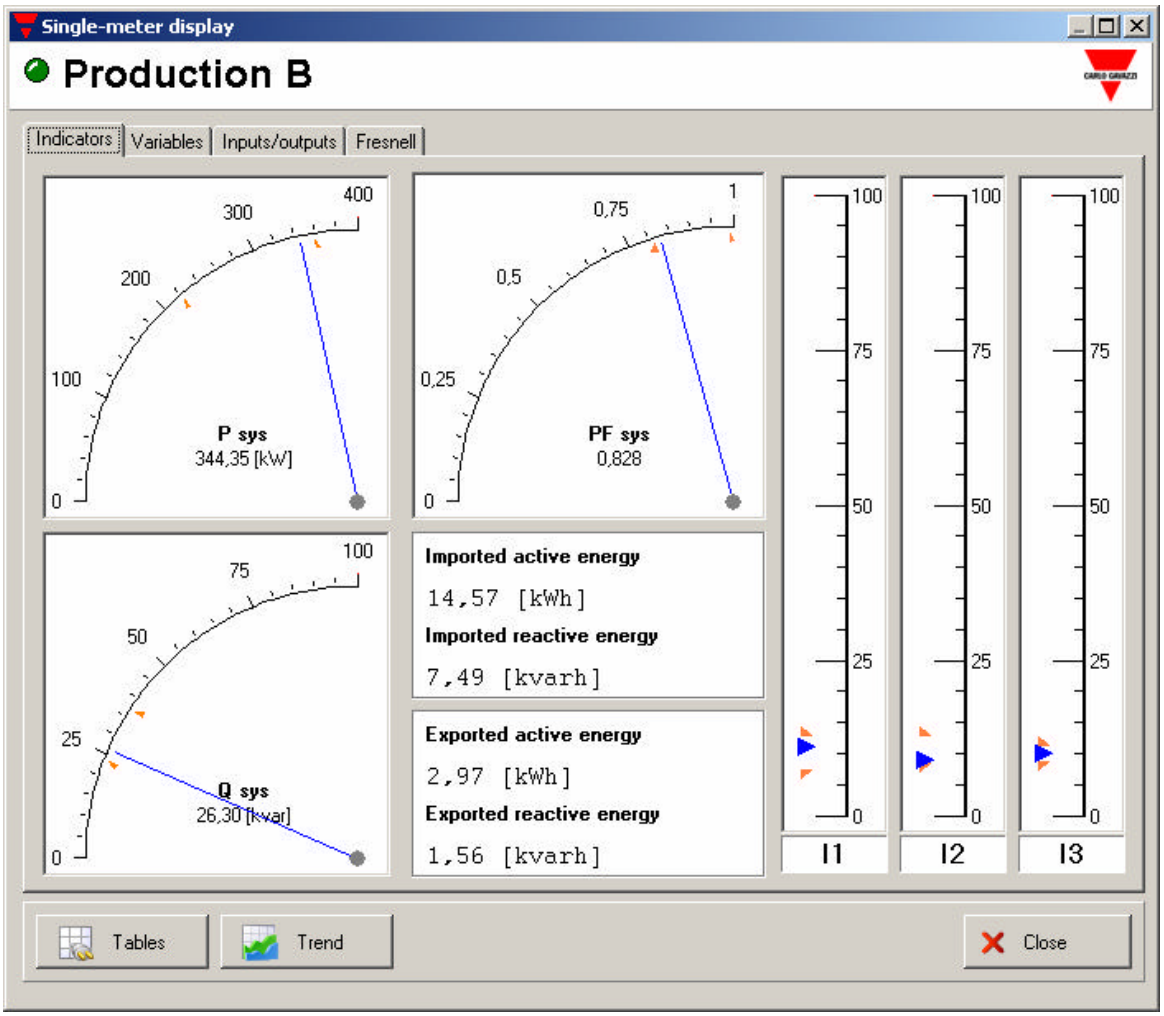
Setpoint alarm

Communication error

In addition, the synoptic pages can include the status of maximum two digital inputs per instrument: a square LED is green or red according to the input status.

3.4 THE INSTRUMENT REAL-TIME PAGE

Clicking on the picture of any instrument opens the relevant real-time page, in which all the variables are shown in real-time.



On the top of the page, the name of the instrument and the communication status are shown. The flashing of the green LED indicates that a new reading has been preformed from this meter and that the displayed values have been updated.

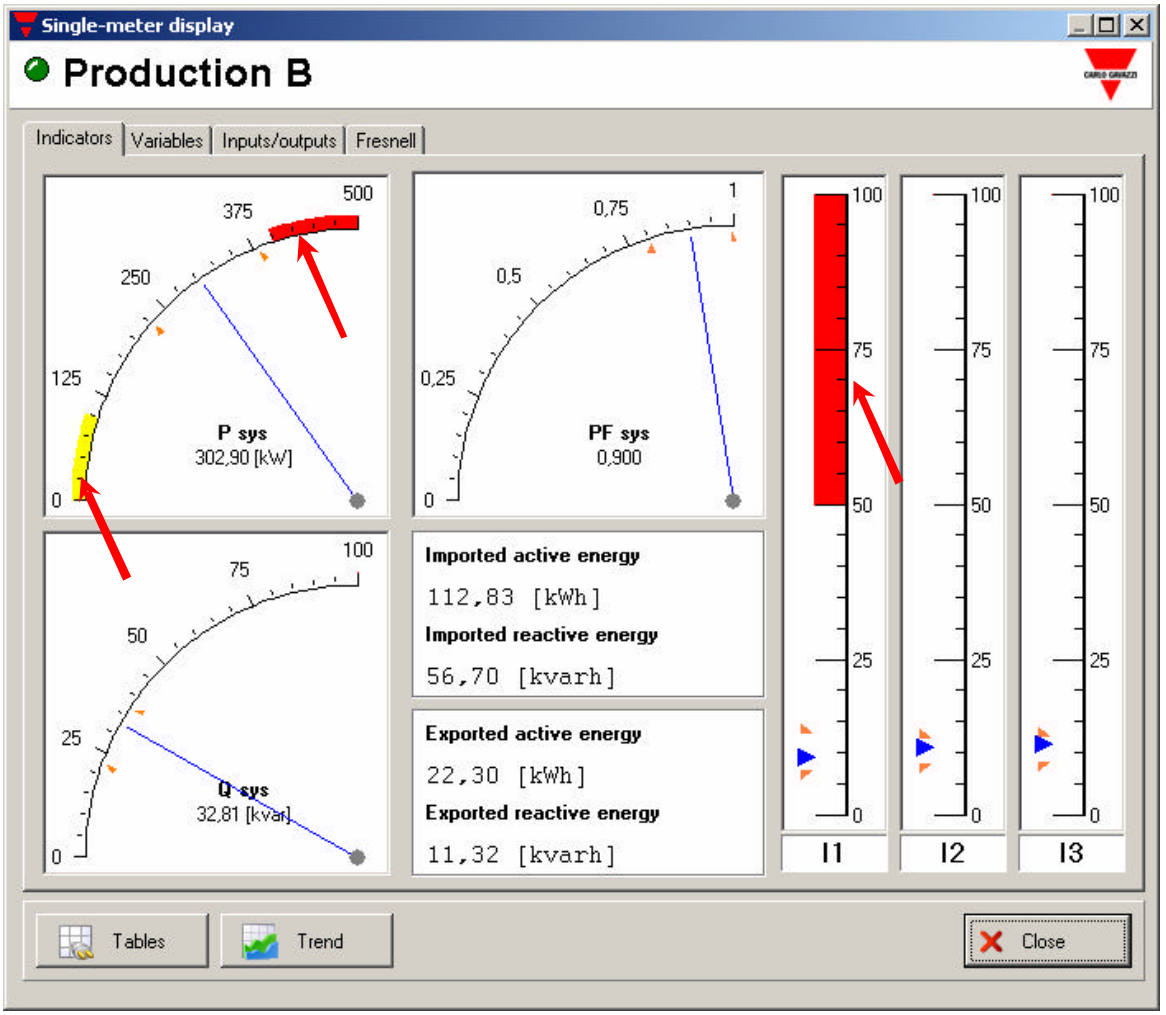
The buttons functions on the bottom are respectively: to enter the analytical trends window, to enter the graphical trends window, to exit the real-time page.

The centre of the page shows the real-time data in different formats. Up to four sections (according to the instrument model and to its programming) are available: *Indicators, Variables, Inputs/Outputs, Fresnell.*

The following paragraphs explain each single section.

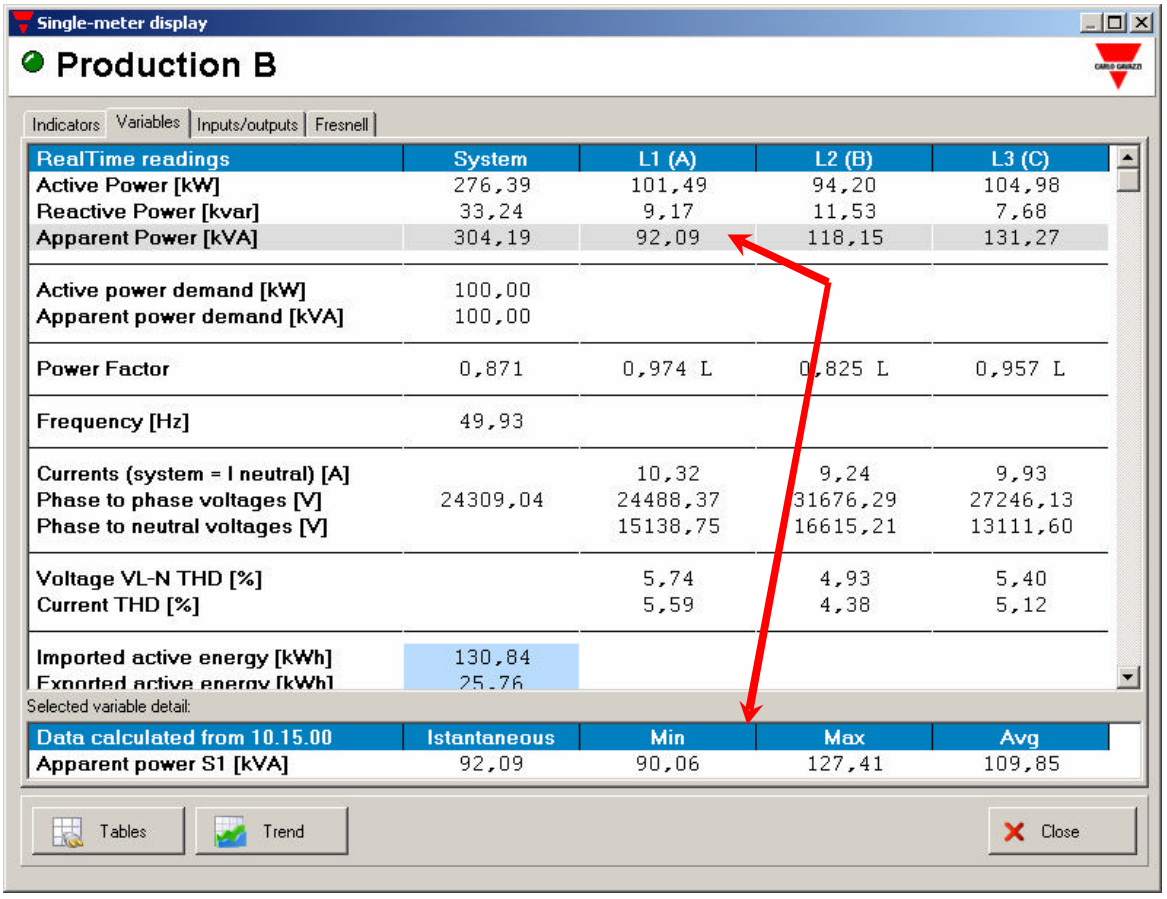
3.4.1 ANALOGUE INDICATORS

The *Indicators* section is the default one when the real-time page is opened. It shows the active and reactive system powers, the system power factor, the phase currents, and the active and reactive energy meters (imported and exported). It is not possible to change the displayed variables.



In the above picture, the red arrows show the setpoint values assigned to the variables (system active power and current phase 1 in the example). Two setpoints are available for each variable: an upper setpoint (red band, "up" type alarm) and lower setpoint (yellow band, "down" type alarm). The minimum and maximum values reached by the variable from the previous recording (variable data log on the hard disk) are shown by means of two amber indicators, close to the scale.

3.4.2 VARIABLES



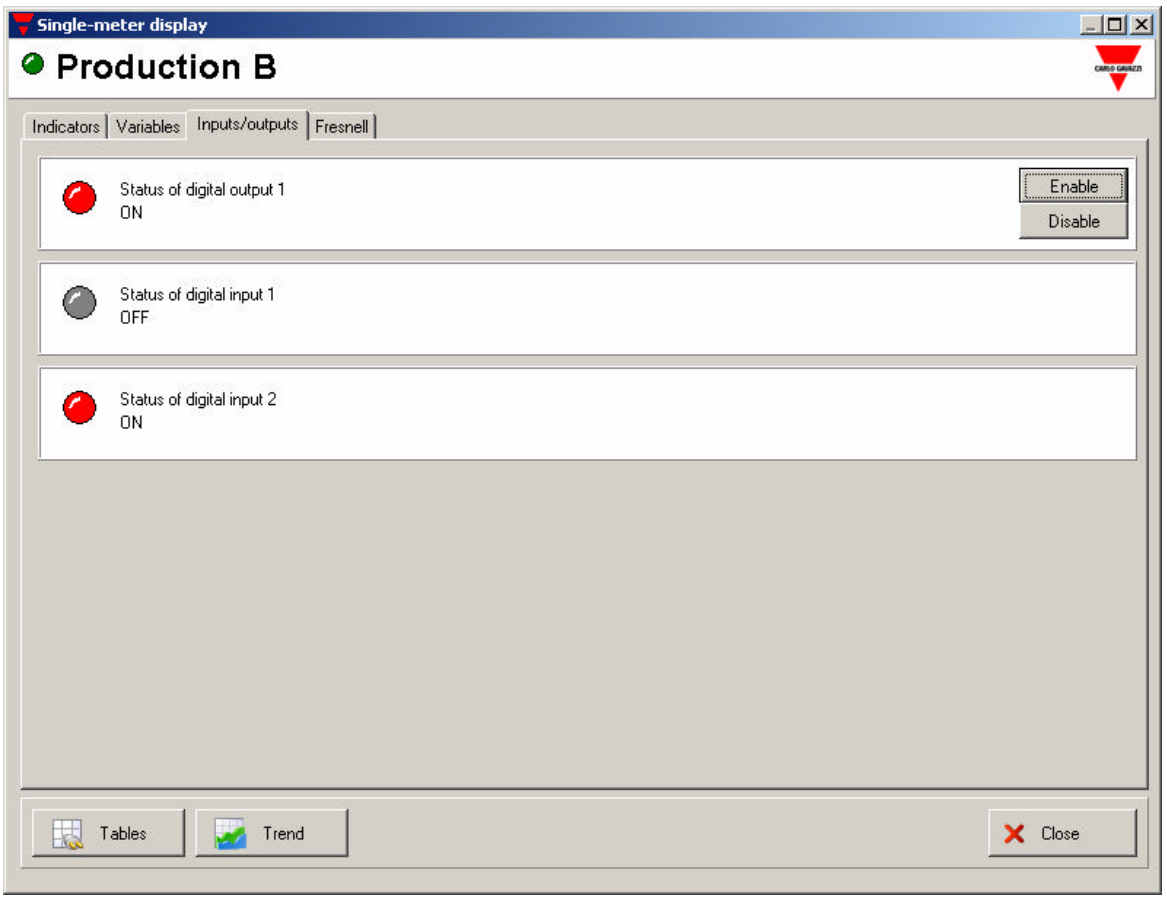
This section shows the real-time values of all the variables of the selected instrument. Clicking on one of the variables, the details of the selected variable are displayed on the bottom of the table; the details are: the last real-time value, the minimum, maximum and average values calculated from the last recording (variable data log on the hard disk), and the time of the last recording.

If one of the variables exceeds the relevant setpoint, the background of the same variable is red.

The background of the meters (energy, gas, or water) is always sky-blue.

3.4.3 INPUTS/OUTPUTS

This section shows the status of the digital inputs and the digital output of the selected instrument. This section is available if the instrument is equipped with the proper hardware and if the inputs/output are properly set in the configuration process.



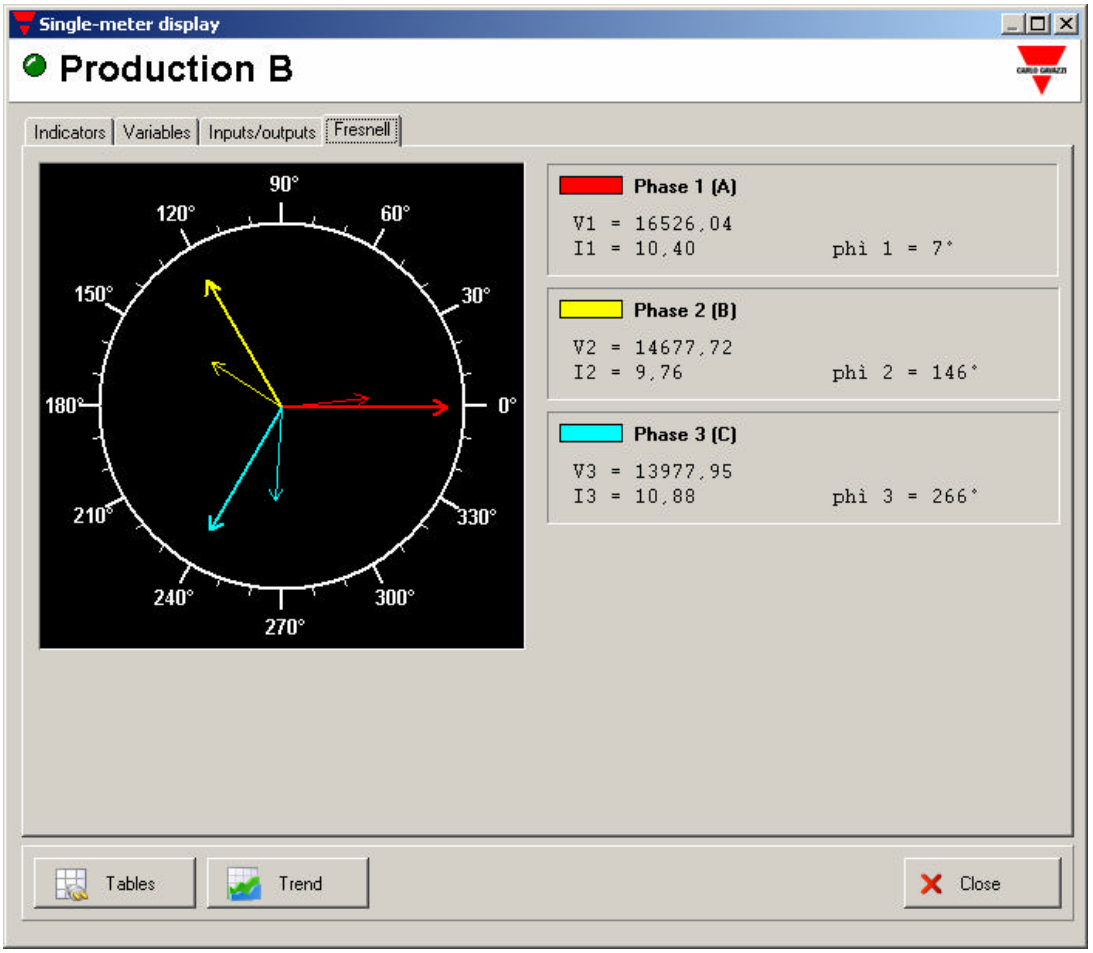
The status is indicated by means of both an ON/OFF text and a status LED (respectively red/grey). If the inputs/output are not configured, they are shown in this section as not available.

The digital output status can be manually modified by means of the *"Enable"* and *"Disable"* buttons; the command is sent to the instrument after the positive answer to a confirmation request. The digital output status can be changed only by a user logged-in as "Administrator". Once the command has been sent, the new status can be displayed only when the system polls the relevant instrument again.

NOTE: PowerSoft can manage only one digital output per instrument (the first one, or the first of slot D, in case of a modular instrument). **This output is to be set as "REM" directly on the instrument**.

3.4.4 FRESNELL

This section shows the Fresnell diagram of the branch monitored by the selected instrument. On the right, the details of each phase (voltage, current, phase angle between them) are shown.



4 SOFTWARE SAFETY

4.1 SAFETY LEVELS

Considering the different operations that can be performed both on the software and on the installation by means of PowerSoft, it is necessary to assign to each possible user a different access level. Each user is to be provided with a different password according to the allowed access level. The three access levels are listed below.

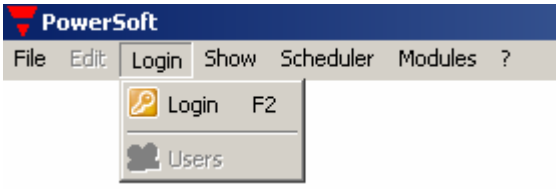
Administrator level: it allows a full control of the software/system. New users (administrator or user levels) can be created and the system and relevant modules can be configured.

User level: it allows to acknowledge the alarms and to consult both real-time and historical data. New users (User level only) can be created.

Guest level: a guest user is any non-logged in user. This level only allows to access the real-time data of the system No operation is allowed.

4.2 LOGIN

To access the PowerSoft functions, it is necessary to be logged in by entering the user name and relevant password. To access the login window, choose the *Login* menu and the *Login* entry, or press the F2 key. The *Users* entry is disabled until the login is carried out.

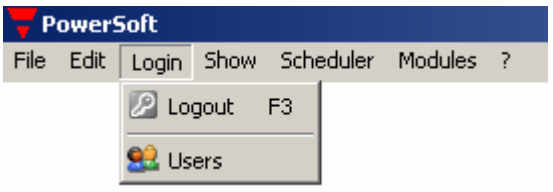


By means of the window below, the user name and the password are to be entered. Both user name and password can be indiscriminately written in capital or small letters.

To confirm the edited data, the *"Login"* button is to be pressed. Now the "*Login"* entry of the *"Login"* menu is replaced by "*Logout"* According to the access level of the new user, the disabled buttons and menus (grey text) are now available.

4.3 LOGOUT

The end of the session is to be communicated by the user to the system carrying out a log out operation. In this way any unwanted access to the system by unentitled people is avoided. To be logged out, choose the *Logout* entry from the *Login* menu, or press the F3 key.



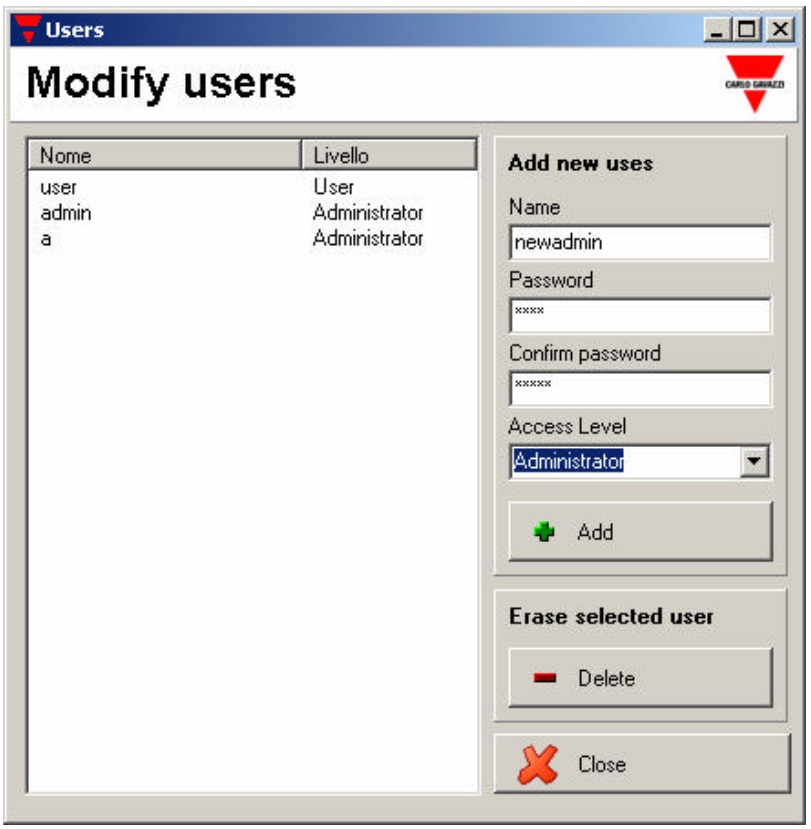
In every case, even if the operator forgets to log himself out, the system performs an automatic log out 15 minutes after the log in. Thirty seconds before the automatic log out, the system asks, by means of an appropriate message, if the session is to be extended or not.

4.4 EXIT

PowerSoft, even after a log out, continues to: poll the meters, store the desired values on the database, control the variable set points, send the automatic e-mails, etc... To shut down PowerSoft, the current user is to be logged in as Administrator.

4.5 USER CONFIGURATION

In the window below, new users can be added with the relevant access level, or existing users can be deleted.



To exit the window, press *Close*.

4.5.1 CREATING A NEW USER

To create a new user:

Choose *Login*, then *Users,* to get the above window.

Edit Name, Password and confirm the password.

Choose the access level for the new user.

Click on the "*Add*" button.

The new user and its access level are added in the list on the left.

4.5.2 DELETING A USER

To delete an existing user:

Choose *Login*, then *Users,* to get the above window.

Select the user to be deleted on the list on the left.

Click on the "*Delete*" button and choose "*Yes*" when the system asks for the confirmation. Pay attention, because this operation cannot be undone.

5 ADDITIONAL MODULES

5.1 INTRODUCTION

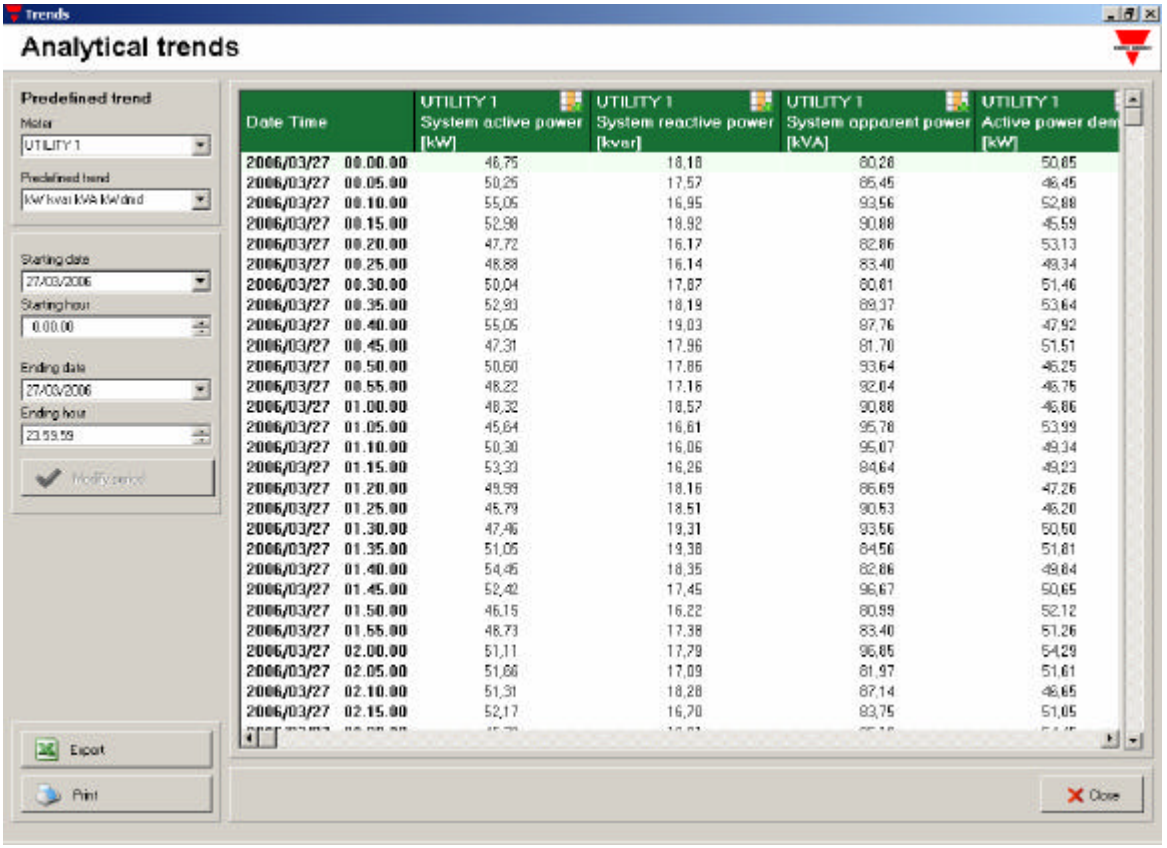
Some functions of PowerSoft are implemented in additional modules which are integrated in the main core of the software. No module is needed to PowerSoft, but each module simply adds some features.

Some modules are included in the base package, some others are optional. See paragraph 1.3 "General specification" for any detail.

In this chapter the available modules are listed and described.

5.2 ANALYTICAL TRENDS

This module allows displaying the logged data as a table.



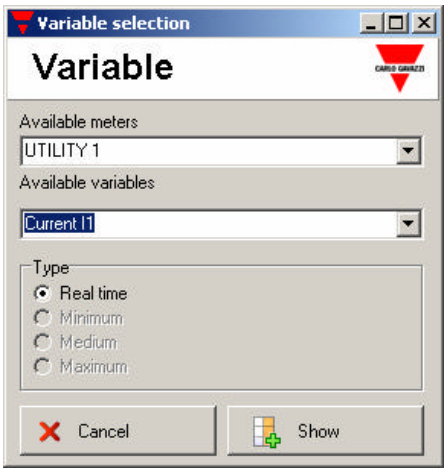
The first column of the table indicates the date and hour of the variables in the same row. The other columns list the logged values of the variables indicated in the head of the same columns, together with the relevant instrument.

All the reports can be printed and exported in xls format (Excel version 4 and following) and in csv (comma separated values) format.

5.2.1 CREATING A REPORT (TABLE)

The first step to create a report is to select the (up to 4) variables to be shown in the table. For this purpose, each column has on the top right of the first row, a proper button clicking on which the variable dialogue box appears. In the dialogue box it is possible to select: the variable and the

relevant instrument. The values to be shown can be the real-time ones, or the minimum, the maximum or the average from the last recording on the hard disk. The availability of these different values is set in the configuration of the instrument properties (Configurator), when the values to be stored are decided.

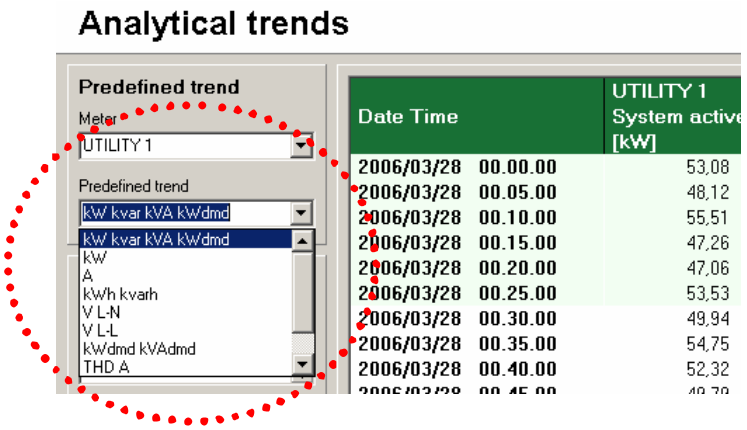


The *Show* button changes the variable on the selected column, while Cancel leaves the previously displayed values.

Once the variables are configured, the period of time to be analysed is to be set. On the left the starting and ending time and dates can be set. Clicking on the *Modify period* button changes the period displayed in the report.

5.2.2 PREDEFINED TRENDS

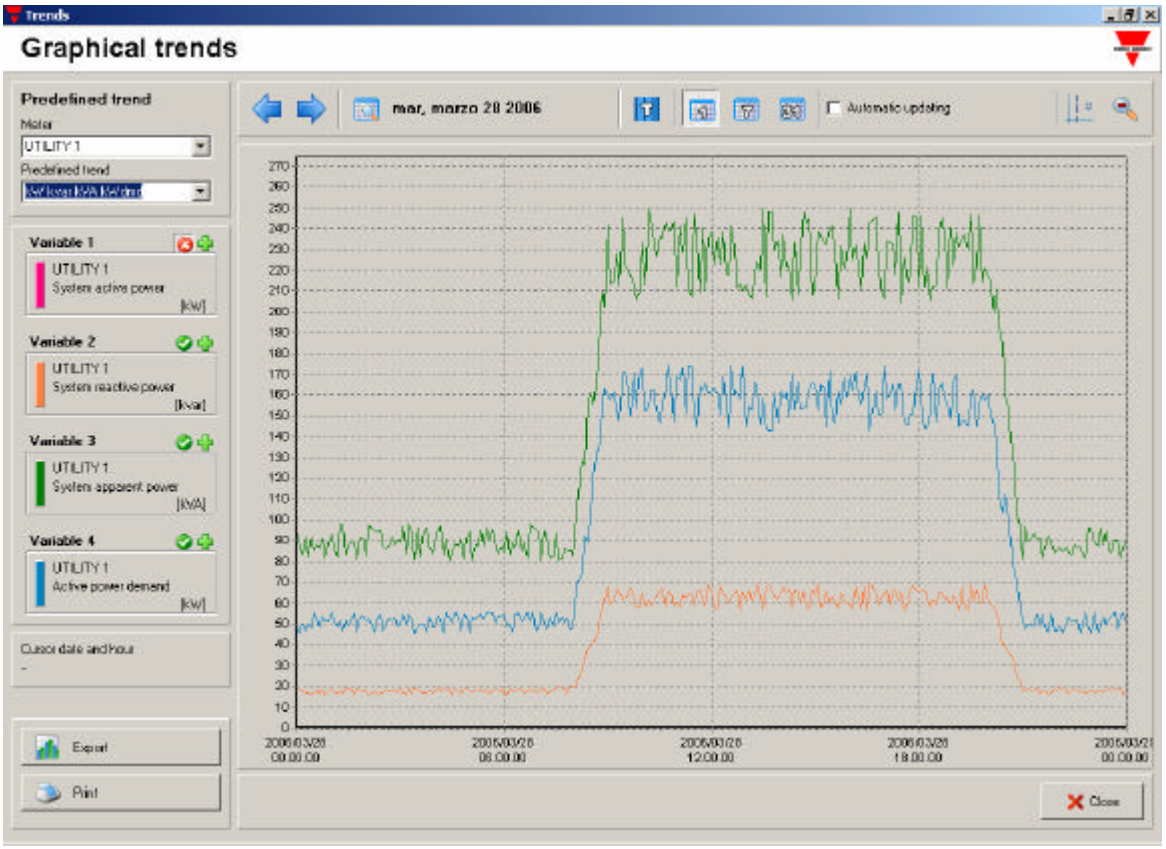
To simplify the use of this module, a series of predefined reports are available using the boxes in the top left square. For each instrument, selectable in the upper box, a number of predefined combinations of variables can be selected. The chosen variables of the instrument are displayed with reference to the time period set in the relevant square.



NOTE: other predefined trends can be added to the system. Please contact the supplier for the relevant instructions.

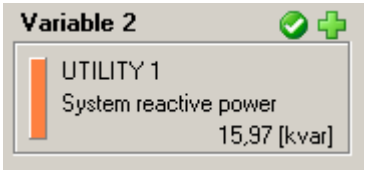
5.3 GRAPHICAL TRENDS

This module allows displaying the logged data as a graph. In the same graph up to 4 variables (of the same or of different instruments) can be shown at the same time.



5.3.1 ANALYSING A GRAPH

The information relevant to the programmed trends is displayed on the legend on the left side: each part of the legend is relevant to the trend. The following picture is an example of one of the legend blocks.

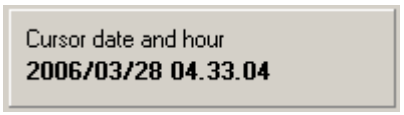


In the legend the name of the variable, the relevant instrument, and the value (with the engineering unit) which is pointed by the mouse cursor in

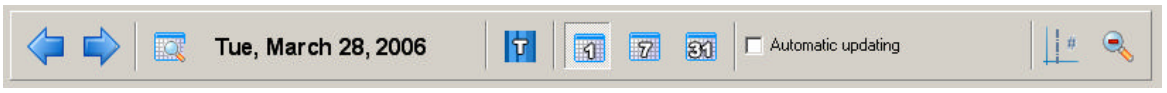
the graph are described. The coloured rectangle is the reference to the colour of the trace.

In the same row of the legend title, there are two buttons. The left one disables the displaying of the relevant trend (it is green if the trace is enabled, red if disabled). Clicking on the right one, the variable selection dialogue box appears.

Below the legend, a square indicates the date and time pointed by the mouse cursor.



In the top of the window there is the graph tool bar.



The tool bar includes:

The date of the displayed data.

The displayed time interval. If *1* is selected, the time interval is 1 day. *7* means one week and 31 one month. The displayed week or month are the ones including the date on the tool bar.

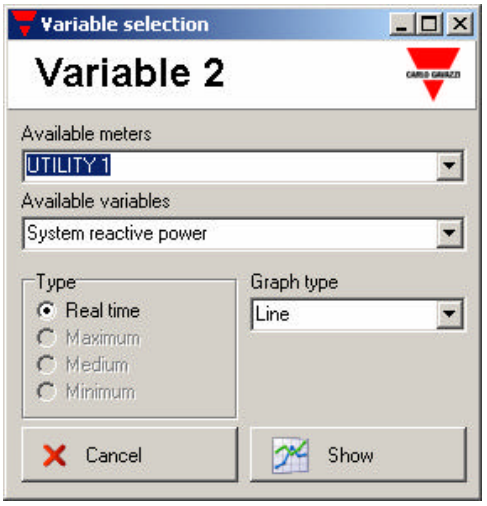
If the *PWS Tariff* module is available, selecting *T* it is possible to display in the graph background the different tariffs, represented by different colours.

It is possible to enable the *automatic updating* of the graph, which is updated every time a new value is acquired from the system.

5.3.2 CREATING A REPORT (TREND)

The first step to create a report is to select the (up to 4) variables to be shown in the table. For this purpose, the cross-shaped buttons on the

legend are to be clicked after which the variable dialogue box appears. In the dialogue box it is possible to select: the variable and the relevant instrument. The values to be shown can be the real-time ones, or the minimum, the maximum or the average from the last recording on the hard disk. The availability of these different values is set in the configuration of the instrument properties (Configurator), when the values to be stored are decided. The trend can be displayed as a line or as a histogram, according to the selection in the graph type box.



The *Show* button changes the variable on the graph, while Cancel leaves the previously displayed trend.

Once the variables are configured, the period of time to be analysed is to be set in the graph tool bar. By means of the  button, it is possible to select the desired date. The extension of the displayed time period is to be selected among 1 day, 1 week, or 1 month (respectively using the *1,* 7, or 31 buttons). To change the base date, the two arrows can be used. They increase or decrease the actual date respectively by 1, 7, or 31 days according to the selected time period.

The trends of the selected variables are now displayed in the graph area.

5.3.3 PREDEFINED TRENDS

To simplify the use of this module, a series of predefined trends are available using the box in the top left square. For each instrument, selectable in the upper box, a number of predefined combinations of variables can be selected. The chosen variables of the instrument are displayed with reference to the current day. It is then possible to modify one or more variables or instruments, or modify the displayed date or period.

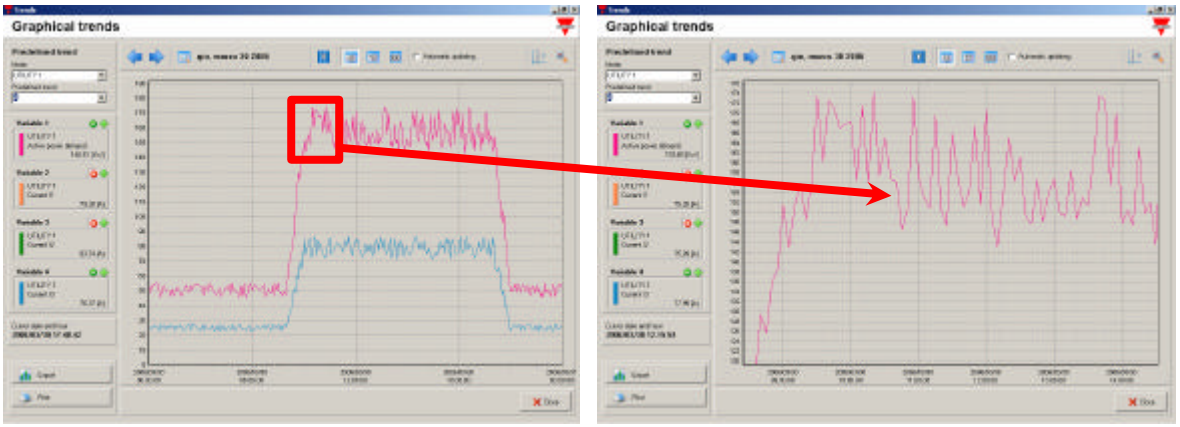
NOTE: other predefined trends can be added to the system. Please contact the supplier for the relevant instructions.

5.3.4 OTHER TOOLS

Other tools, such as the zoom, the cursor, the colour customisation, and the comparison with the tariffs are available.

5.3.4.1 THE ZOOM

The trends can be analysed in detail using the zoom function. To zoom a graph, click on a point of the graph area and drag the mouse to the bottom right direction. The rectangle identified in this way represents the part of the graph that will be enlarged.



To return back to the original graph, press the unzoom button on the very right of the tool bar. 

To unzoom the graph, it is also possible to drag the mouse to the top left direction.

5.3.4.2 THE CURSOR

To better display the mouse position in order to analyse and compare the graph values in the variables boxes, it is possible to use a cursor. Pressing the relevant button, in the right of the tool bar, a vertical line is associated to the mouse standard cursor. To disable the cursor, press the button again.

5.3.4.3 DISPLAYING OF THE TARIFFS

This function is available only if the optional module PWS-Tariff is available. Clicking the *T* button on the tool bar it is possible to display, in the background of the graph area, the different colours associated to the tariffs. In this way it is possible to correlate in an easy and immediate way, the trend of the consumptions and their costs.

The contractual powers, in function of the tariffs, can be displayed in the graph together with the demanded power, in order to evaluate any exceeding or any critical situation.

5.3.4.4 COLOUR CUSTOMISATION

The colours of the four different trends are customisable by the user using the relevant buttons (the vertical rectangles which indicate the trend colour in the legend boxes). Clicking on them, the Colours dialogue box appears. Once a new colour is chosen, the system automatically changes the trend colour.

5.3.5 EXPORTING THE TRENDS

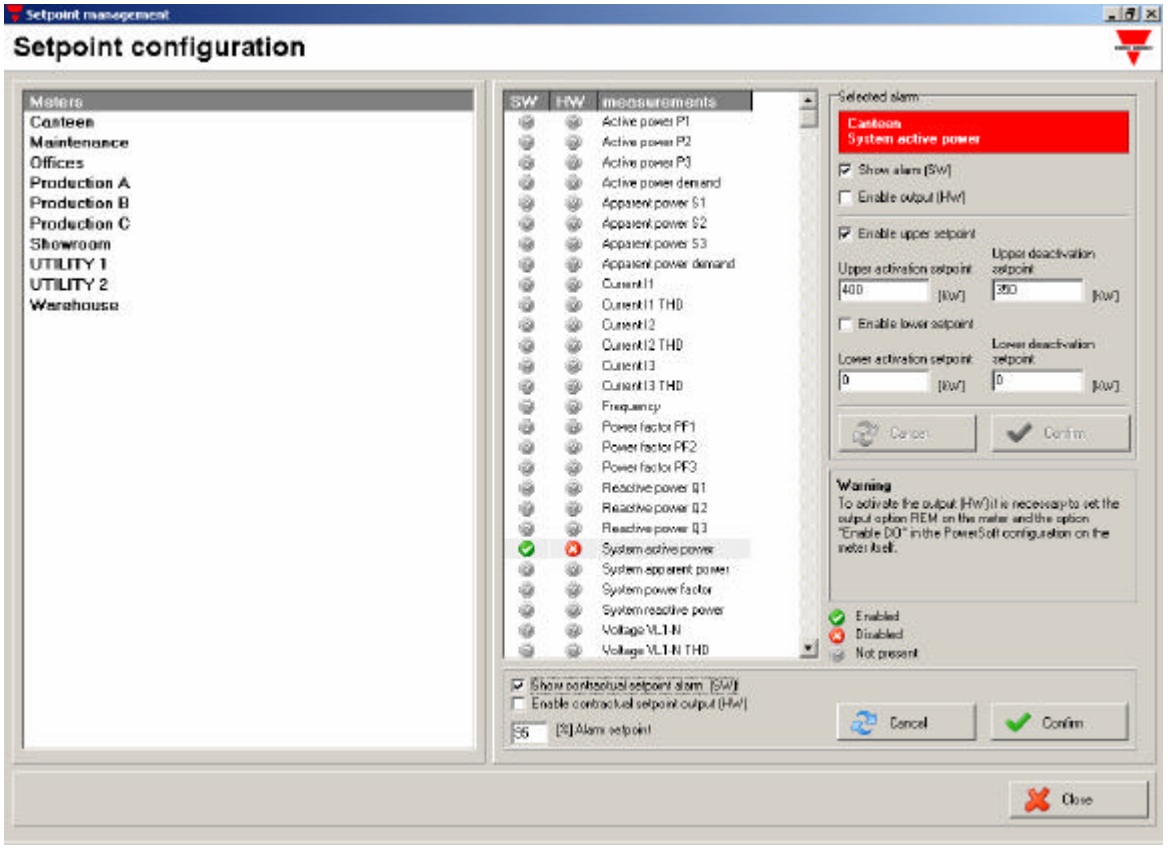
Every graph can be exported as a file or printed. The relevant buttons are available in the bottom left area.

The graphs can be exported:

- in wmf format (windows media format), that is a vectorial format
- in 24-bit bmp format

5.4 SETPOINT CONFIGURATION (PWS-ALARM MODULE)

This module allows the configuration, for each instrument connected and for each one of the relevant variables, of an upper and/or lower setpoint/s.

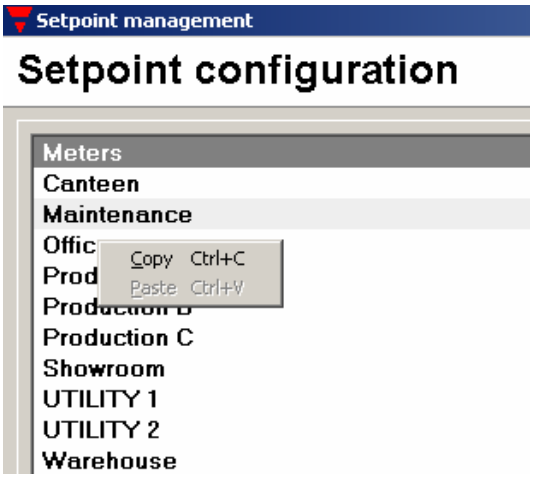


To configure a setpoint, an instrument is to be selected first. The list of all the connected instruments is available on the left. All the variables of the selected instrument are listed in the central box. Two indicators are shown close to each variable. The SW indicator shows if any software alarm connected to that variable is enabled (green), disabled but configured (red), or disabled and not configured (grey). The HW indicator shows if any hardware alarm connected to that variable is enabled (green), or disabled (red). If HW is enabled and in case of alarm, the digital output of the relevant instrument (the first one, or the first one of slot D, in case of modular instrument) is activated. **This output is to be set as "REM" directly on the instrument**.

When the variable to be controlled is selected, in the box on the right, the details are shown. In this box it is possible to: choose the setpoint to be activated (upper and/or lower); edit the activation and deactivation setpoint; enable or not the hardware alarming.

The activation setpoint cannot be equal to the deactivation one, but they are to differ at least by 2% of the activation one. In case of wrong selection, the system automatically helps the user to set the right values.

If the same setpoint on the same variables are to be set in different instruments, a copy/paste function is available. When the setting is done in one instrument, its name is to be right clicked choosing copy. After selecting the other instruments, right click on them to perform the paste function.



5.4.1 SETPOINT ON THE CONTRACTUAL POWER

This function is available only if the optional module PWS-Tariff is available.

On the bottom of the window, it is possible to configure an alarm based on the contractual powers (depending on the current tariff). The contractual powers are to be set in the Tariff Management module (PWS-Tariff).

The box, different according to the instrument, allows configuring a setpoint on the instantaneous system active power measured by the instrument

The alarm can be software only or software and hardware as per the other alarms.

The setpoint is to be set as a percentage of the actual contractual power (the percentage is fixed for all the tariffs). The setpoint is therefore dependent on the actual tariff.

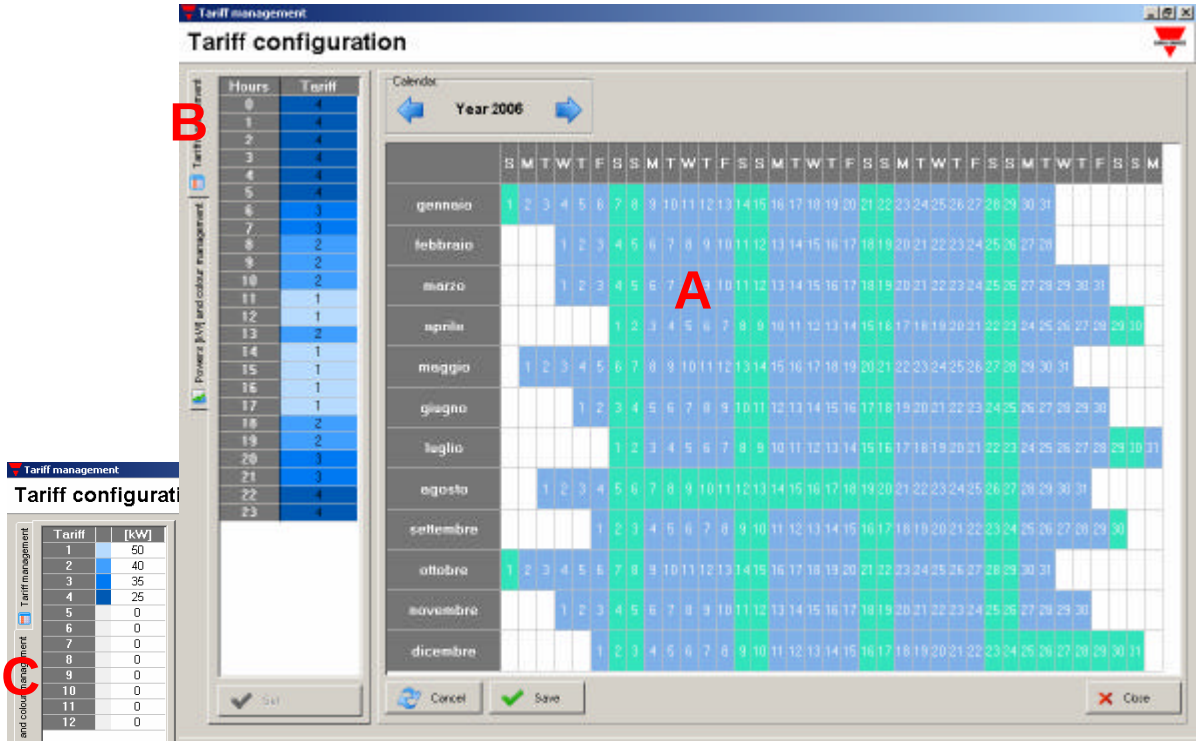
After configuring and confirming the parameters, the system controls the instantaneous system active power comparing its value with the described setpoint.

Example: the system active power value acquired at 11.00 from the instrument named 01_TCP1 is 185kW. The system checks if the *Enable contractual setpoint alarm (SW)* box is enabled: in this case the contractual power of the tariff relevant to hour 11.00 is acquired (for example it is 200 kW). The setpoint is 90% of 200kW that is 180kW. The instantaneous value is compared with the setpoint: since 185kW is higher than 180kW, there is an alarm condition. The alarm is highlighted in the synoptic, in the real-time pages and in the active alarm window that automatically pops up. Only if the *Enable contractual setpoint output (HW)* box is enabled, a command is sent to the relevant instrument in order to switch on its digital output.

When the actual tariff varies, the setpoint changes proportionally. If for example the new contractual power is 220kW, the new setpoint is 198 kW.

5.5 TARIFF CONFIGURATION (PWS-TARIFF MODULE)

This module allows configuring the tariffs and the relevant contractual powers in a dual- or multi-tariff system. It is possible to easily implement the multi-tariff schedule that is emitted by each Country Energy Authority.



The window of this module is composed of 3 parts:

- a calendar of the whole year (table A);
- a table including the tariff associated to each hour of the day (table B);
- a table where a different contractual power and identification colour can be associated to each tariff (table C).

5.5.1 THE TARIFF INFORMATION

The calendar shows all the days of the year, to each of which a certain colour is associated. Each colour represents a different subdivision of the day in time bands characterised by a defined tariff according to the Country's energy regulations. If the day number is in bold characters, it means that it is a festive day (this indication does not have any effect: it is

only a memo). To add or modify any festive day, the Holiday section of the bandscolor.cfg file (on the PowerSoft/Configurations folder) is to be manually modified. The displayed year is shown on the top of table A. The arrows allow browsing the previous or following years.

Clicking a day of the year in the calendar (table A), the relevant subdivision in time bands is displayed in table B. In table B, the tariff number and colour are associated to each hour of the day. Note that the colours of the tariffs are independent of the colours of the days.

In table C it is possible, by associating a colour, to enable the tariffs (up to 12) and to assign a maximum contractual power to each tariff (to be used in the graphical trends module and in the contractual alarm management).

5.5.2 MODIFICATION OF THE TARIFFS

5.5.2.1 TARIFF COLOURS AND RELEVANT CONTRACTUAL POWER

To modify the colour associated to a tariff, double click on the colour box, on table C. The colour dialogue box appears. In the next box, the contractual power of that tariff can be edited.

5.5.2.2 SETTING OF THE DAY COLOURS

Each day of the calendar (table A) has a particular colour, that is the same of each day with the same time bands subdivision. Double dicking on a day, the colour dialogue box appears. Changing the colour of a particular day, all the days with the same time bands subdivision assume the same colour.

5.5.2.3 SETTING THE TIME BANDS

To set the time bands in a day, the number of the actual tariff is to be edited in the proper cells relevant to the hours composing that time band. All the cells with the same tariff assume the same colour; the new configuration of the day is valid, only after confirmation, by pressing the Set button. To assign the same configuration to other days, it is not requested to repeat the same procedure more times: a copy/paste function is available. The day is to be selected in the calendar (table A) and the Ctrl-

C keys are to be pressed (or right click choosing *Copy*). To paste the configuration to another day, select the latter and press Ctrl-V (or right click choosing *Paste*). To paste the configuration on more days, the paste command is valid even in case of multiple-day selection.

5.5.2.4 SAVING THE TARIFF CONFIGURATION

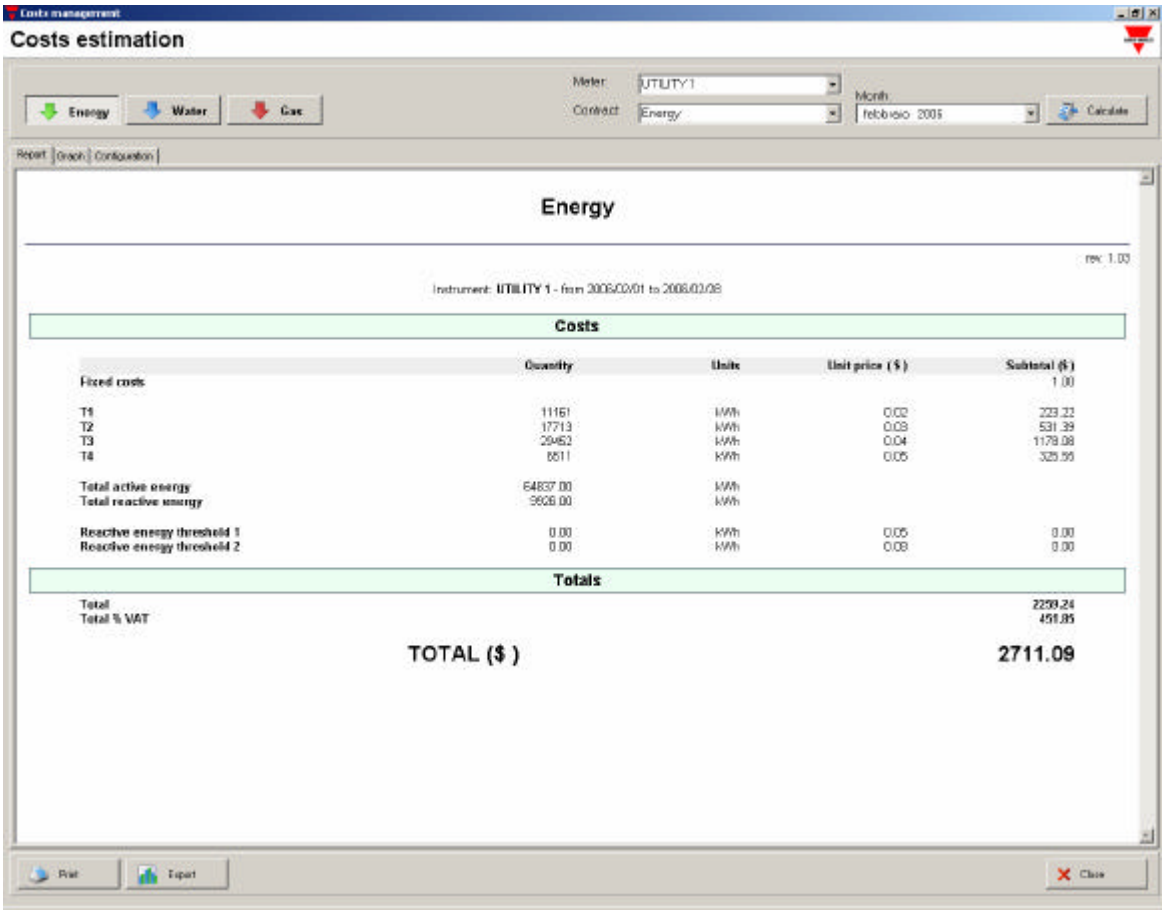
To save a new configuration or the modifications, press the Save button on the bottom. Pressing *Cancel* all the modifications are cancelled and the old configuration is displayed. For this reason it is advisable to save frequently when introducing any modification.

When modifying the setting, if trying to change the displayed year, the system warns the user that the last modification has not been saved and asks if it is to be saved (*Yes* button) or not (*No* button). The *Cancel* button allows cancelling the attempt to change the displayed year.

5.6 COSTS ESTIMATION (PWS-BILL MODULE)

This module allows estimating the costs due to the energy, water and gas consumptions measured by a defined instrument in a selected month.

It allows analysing the daily trend of the costs in the selected month too.



5.6.1 COST CALCULATION

The procedure to calculate the costs is the following.

1. Choose *Energy*, *Gas* or *Water* by means of the 3 top left buttons.

2. Choose the contract to be applied in the *Contract* box. If one of the predefined contracts does not meet the actual contract (the existing parameters are different), please contact the supplier for the relevant instructions.

3. Select the instrument and the month whose costs are to be calculated.

4. Press the *Calculate* button.

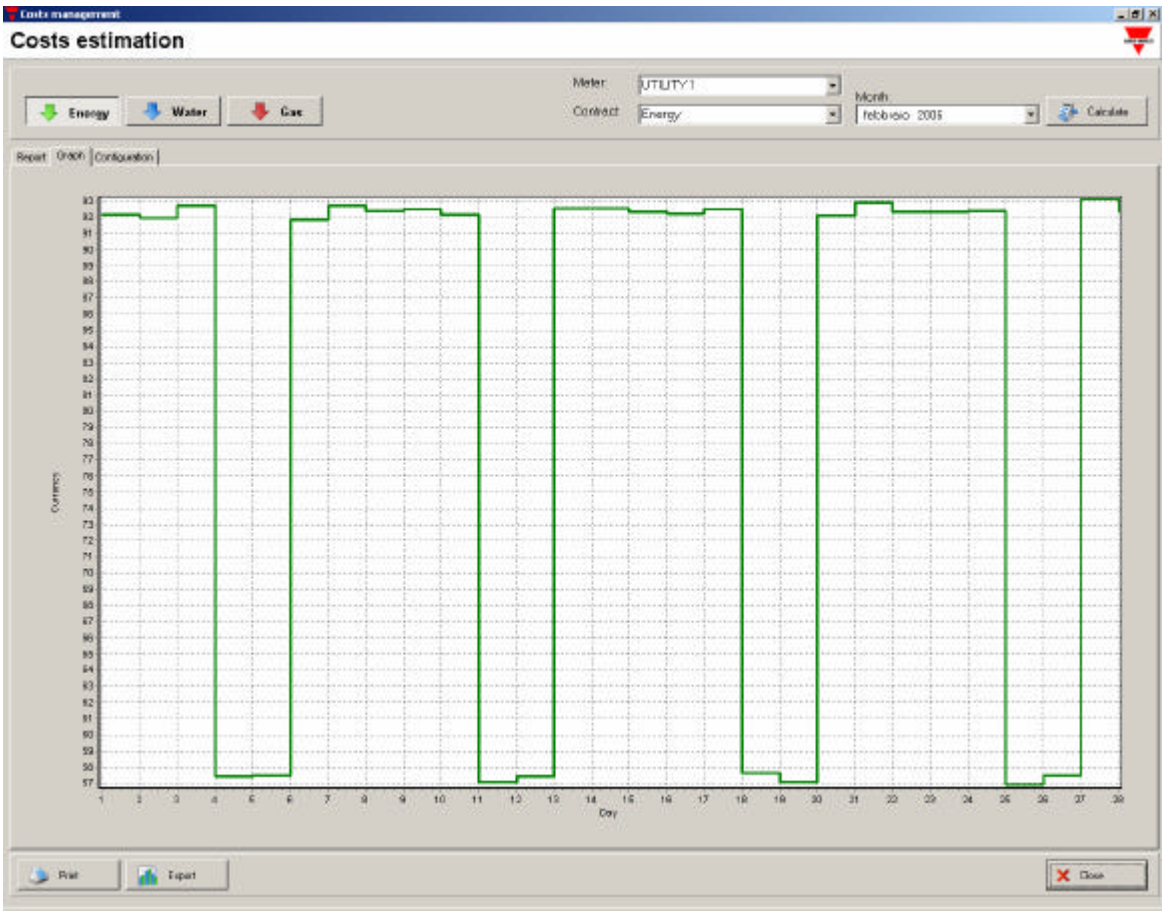
In the central area, if the *Report* section is selected, the summary of the consumption costs appears.

The report can be printed or exported in html format, using the buttons on the bottom left.

5.6.2 GRAPH OF THE DAILY COSTS

This section allows graphically displaying the daily costs of energy (or gas or water).

The cost calculation is to be performed as explained in the previous paragraph. Choosing the *Graph* section, the following diagram appears.

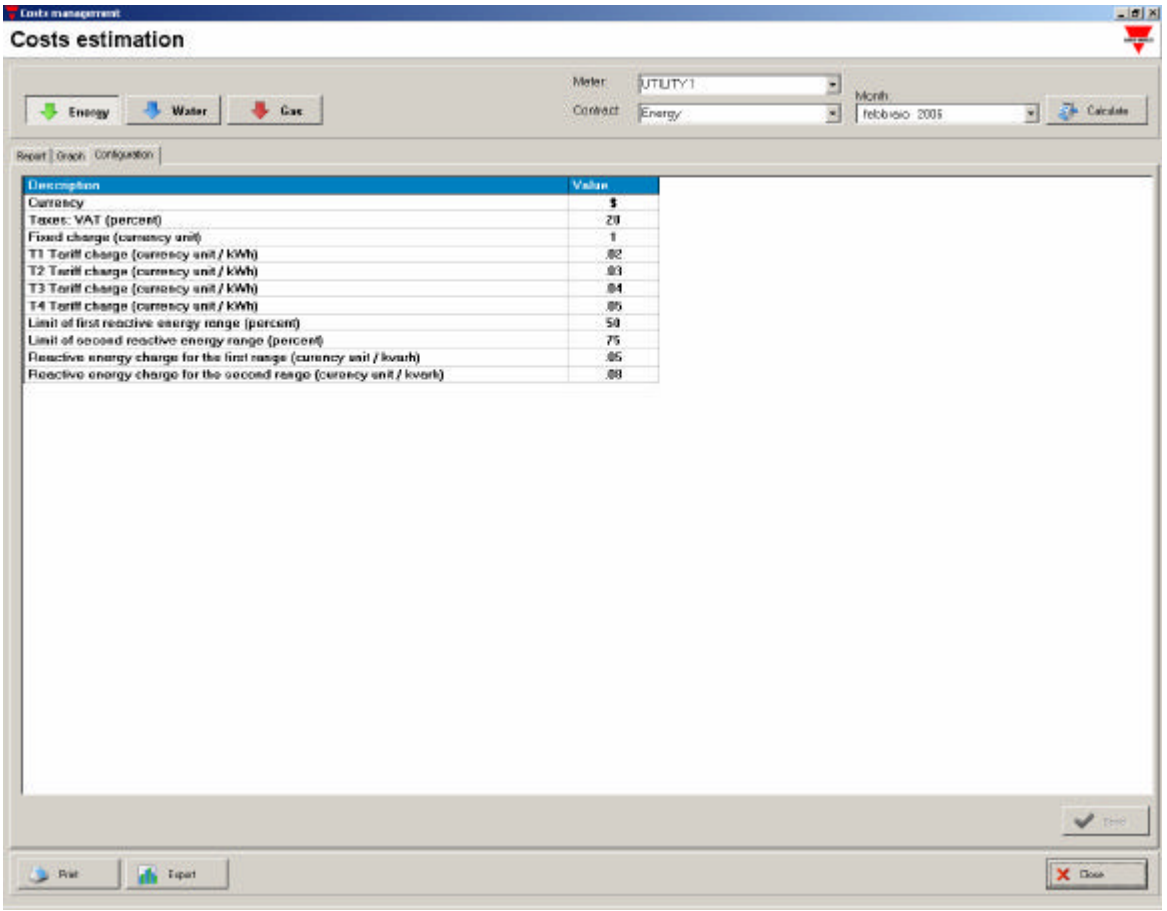


The graph can be printed of exported in wmf or bmp format by means of the proper button on the left bottom.

5.6.3 CONFIGURATION

The *Configuration* section is to be used to set the parameters which characterise the contract with the supplier. In this section any modification can be stored by means of the *Save* button. The *Cancel* button restores the last parameters.

The parameters can be different according to the supplier. The default parameters of PowerSoft meet the most of the contracts: the taxes, the fixed cost of the installed kW, the energy costs (depending on the tariff) are listed.

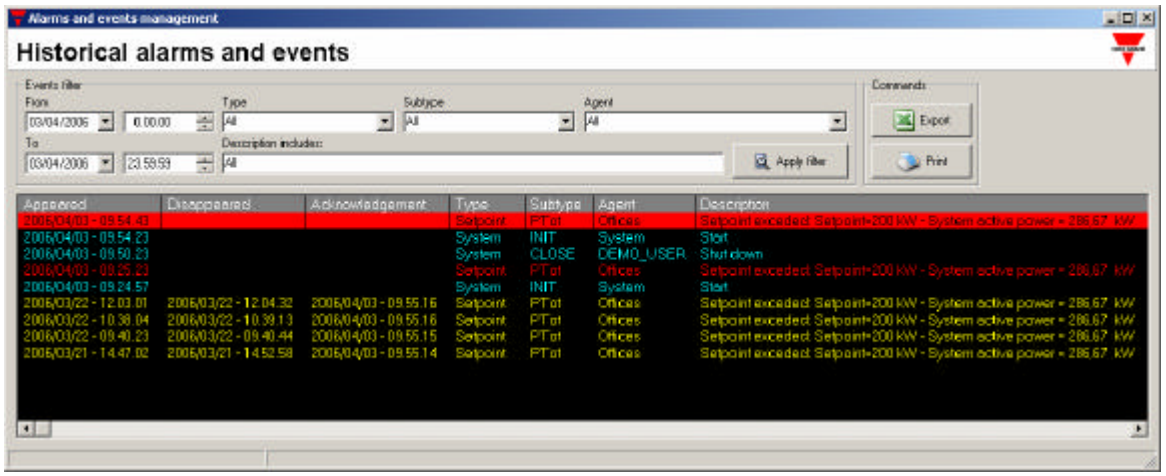


If some parameters are different or missing, a customised contract can be implemented. Please contact the supplier for the relevant instructions.

5.7 ALARMS AND EVENTS

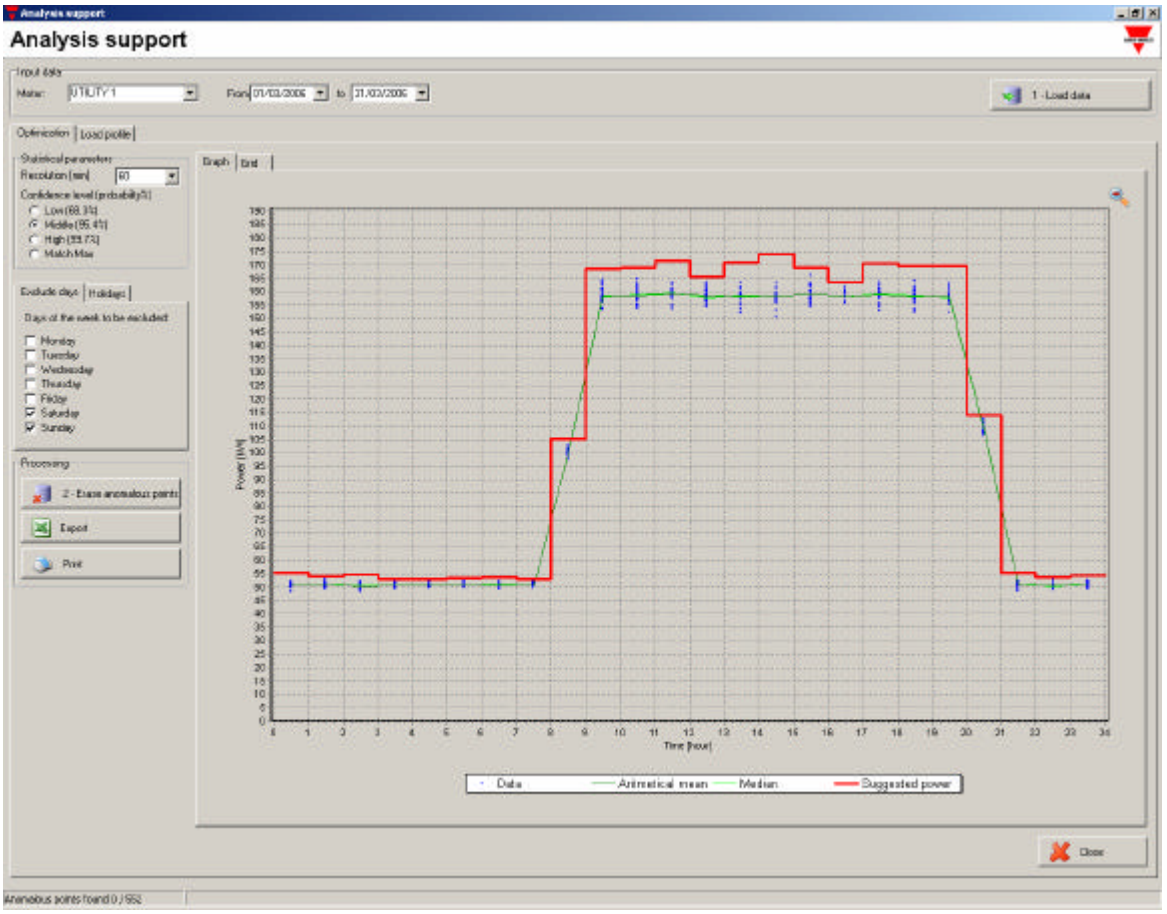
This module allows accessing the historical archive of the alarms (stored when disappeared and acknowledged) and of all the events relevant to the system. The displaying concept is similar to the one described for the active alarms: in addition there are the system events (such as software start/shut down, login, output status commands, etc.), written in light blue. It is not possible to acknowledge any event in this module.

The list can be filtered, acting on the *type*, *subtype*, *agent*, and/or *description* field. By the proper buttons in the right top, the filtered queue can be printed or exported (in xls or csv format).



5.8 ANALYSIS SUPPORT (PWS-ANALYSIS MODULE)

This module allows carrying out the analysis of the consumptions data stored in the database, in order to get important information for the energy management of the company. The module is intuitive and user-friendly like the other ones but, because of the complexity and of the delicacy of this kind of analysis, it is recommended that the module is used by expert users only, to grant the precision and the reliability of the results returned by the module.



5.8.1 TARGET

The module extracts information from the consumption trends, elaborates the load profile of each instrument, and suggests the optimal contractual power. To do it, a series of options and statistical tools can be exploited. They help the user in performing the right analysis.

5.8.2 GRAPHICAL STRUCTURE

In the top of the window the instrument and the period to be analysed can be chosen. The button *Load data* allows uploading the relevant data from the database to the software memory.

On the central area, the graph takes up the right side, while on the left there are the commands and the options necessary for a reliable analysis. Two sections are available: the *Load profile* section and the *Optimisation* one, where the ideal contractual powers are suggested.

In the bottom, the buttons allow printing or exporting the analysis result either in wmf (or bmp) format (if the *Graph* section is selected in the central area) or in xls spreadsheet (if the *Graph* section is selected in the central area).

5.8.3 OPERATIONS

The operations to be performed are suggested in the following paragraphs. The first step is to generate the load profile graph of the selected instrument.

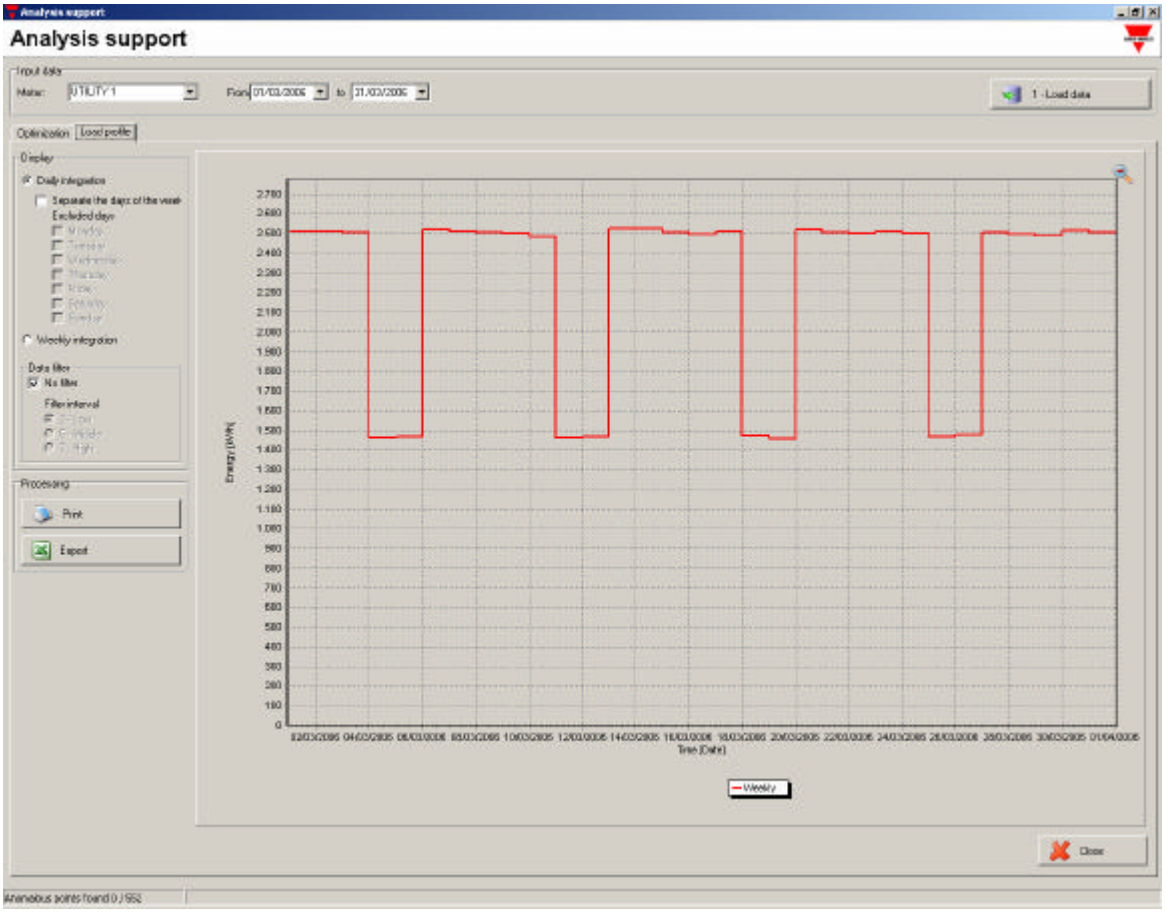
5.8.3.1 LOAD PROFILE EXTRAPOLATION

The instrument and the period to be analysed are to be chosen in the top area, pressing *Load data*. The *Load profile* section is to be selected. The load profiles of that instrument in that period are shown day by day or week by week according to the *daily integration/weekly integration* of the *Display box*.

The weekly integration is suggested to show the long-term consumptions trend. The daily integration is suitable to analyse shorter periods (a few weeks).

To analyse the trend of each day of the week separately (every Monday for example), the daily integration view can be spitted with *separate the days of the week*. Each day, or group of days, can be displayed selecting the proper boxes in the *excluded days* list. In this way it is possible, for example, to understand the differences in terms of consumptions within the week or if

an increase of the consumptions is a general trend or if it happens only in particular days of the week.

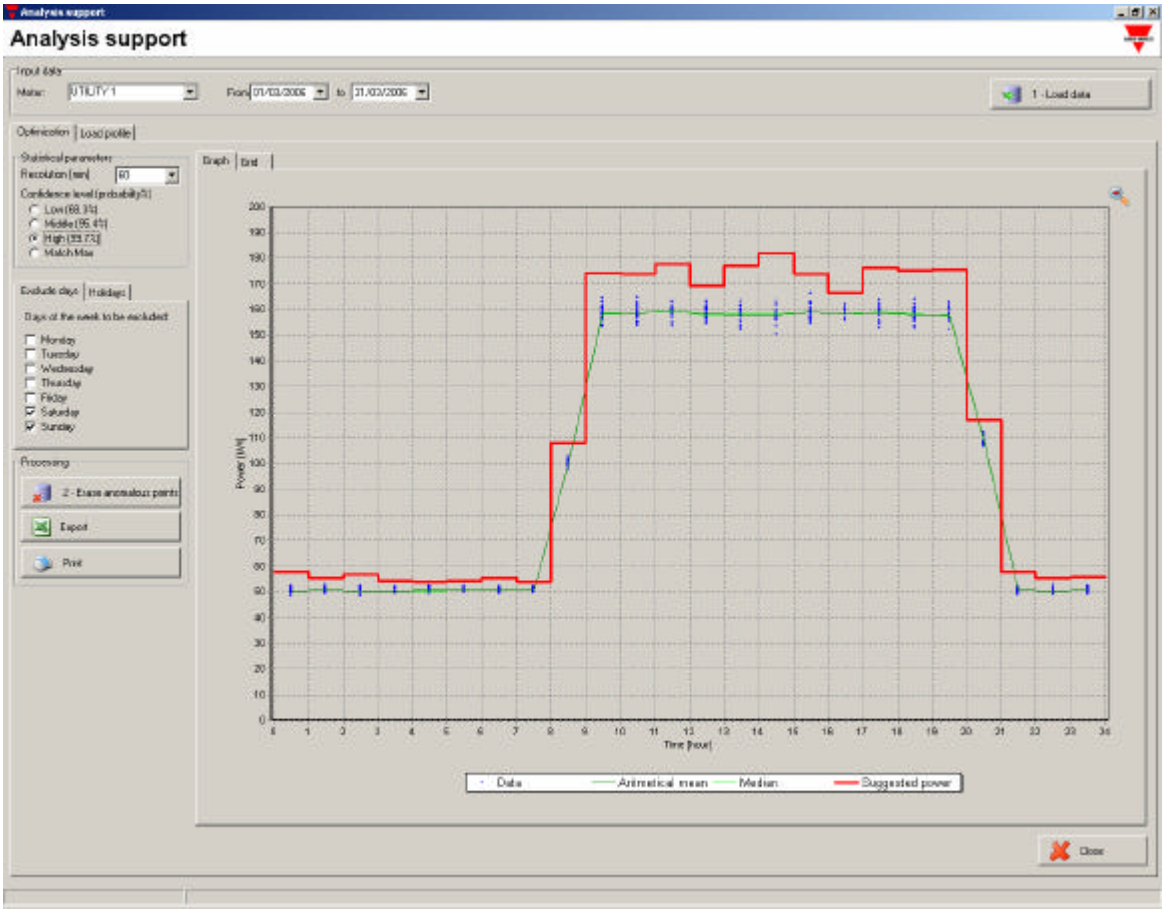


In the database some anomalous data could be present. They can be due to temporary problems of the instrumentation, of the network, of the monitored system or plant: those measurements are real but they can affect the statistical analysis. It is possible to filter these anomalies to get a more homogeneous set of data.

The available filter is a "median filter" with selectable steps of 3, 5, or 7 data. It means that every 3-, 5-, or 7-data sequence of the original trend, the value of the central datum will be replaced by the median of the same sequence. This filter cuts the isolated peaks but preserves the trends (increasing, stable, or decreasing): the higher the step, the more homogeneous the final trend. The aim of this filter is only to clarify and highlight the trend of the consumptions. It is to be used only for this purpose and not to carry-out further analysis or calculations.

5.8.3.2 CONTRACTUAL POWER OPTIMISATION

The graph displayed in the section *Optimisation* shows the consumptions of the selected instrument in the selected period in function of the time of the day. Studying the consumptions hour by hour, it is possible to identify the average consumptions and the maximum values that can be expected by that instrument. The procedure to get this information is automatic, but it requires important user's interventions in order to carry out a correct analysis.



After uploading the data, the statistical parameters are to be properly set. The *Resolution* indicates the duration of the time intervals in which the day is split (from 5 to 60 minutes). The *Confidence level* indicates the probability that the consumptions of the instrument are below the proposed contractual power.

Determining the optimal power profile, it is important to understand that this analysis is meaningless if the consumptions are not constant in the selected period. In fact, it is useless to find a "typical" trend if it is known that the consumptions are changing. The procedure described in the previous paragraph can help in understanding if this analysis can be done, avoiding any incorrect estimation.

One (or more) day(s) of the week can substantially differ from the other days; in this case the analysis is to be repeated for each group of "homogeneous" days. It is possible to tick/untick the days in the *Excluded day* section and carry out the analysis; then the operation is to be repeated for the other days. Consider that a trend which is regularly higher or lower than the "standard" trend allows to an over-estimated proposed contractual power.

Even if the previous factors are considered, other anomalous data can still be present. They can be due to different reasons: holidays during the working days of the selected period; production stops; strikes; damages or anomalies in the energy supply.

The holidays can be excluded from the calculation selecting the relevant days in the *Holiday* section. In the *Excluded days* box the desired days can be added to the holiday list. To remove a wrong day, select it and press the *Delete* button.

To delete the other anomalous points (due to occasional and short damages, production stops, etc.), an automatic filter is available. Press the *2 - erase anomalous points* button to execute the filtering. A report (erased points/total points) is available in the bottom status bar.

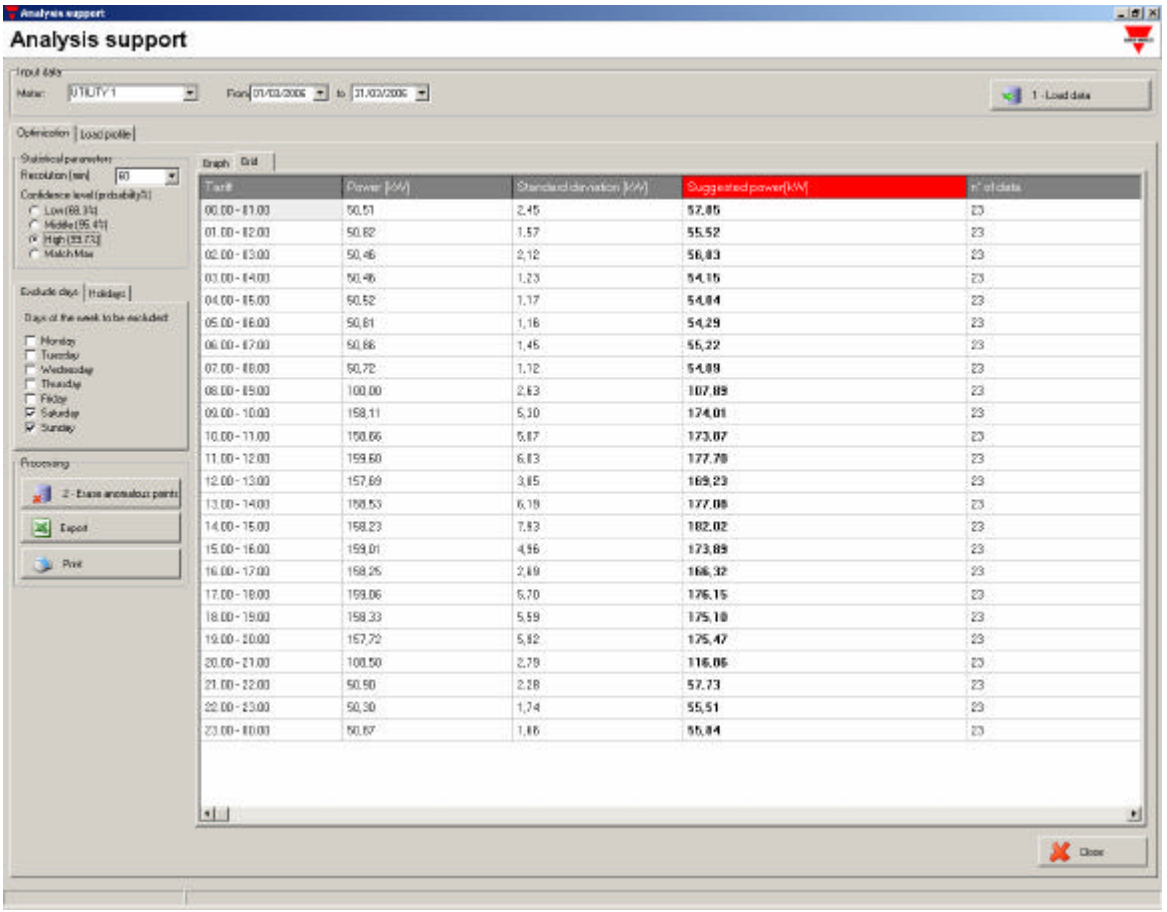
Now the system is able to provide the optimised contractual powers. The graph displays the arithmetical mean, the median and the variance (that is the square of the standard deviation) of the demanded power.

The arithmetical mean of the power is not a reliable value to estimate the typical consumptions, because any anomalous point can lead to an inaccurate estimation.

The median estimates the typical consumptions with a higher accuracy; this parameter allows achieving accurate estimation even if anomalous points are still present, but the number of the analysed samples is to be high enough.

Variance and standard deviation estimate how the values are distributed around their mean or median. The higher the variance, the wider the distribution of the values around the mean/median.

These parameters are very important in determining the optimal contractual power: the suggested powers are in fact defined as the median plus the standard deviation (or 2 or 3 times the standard deviation). If the analysis has been correctly performed (as suggested before) and without any unpredictable events, setting the *Confidence level* as *Low,* the probability that the actual requested power is lower than the suggested one is 68.3%; if it is set as *Middle* the probability is 95.4%, while if it is *High* the probability is 99.7%.



The suggested contractual power can be defined, choosing *Match max* on the *Confidence level* selection, as the sequence of the maximum of the values relevant to each one.

The definition for the optimal contractual power is to be chosen by the user considering the fixed cost of the power (cost per kW), the number of expected overpower demands, and the cost of the penalties due for them.

On the graph of the optimised power, the following data are displayed: the blue dots are the power values stored in the database (and relevant to the selected instrument in the selected period); the light green line is the median of the power (blue dot) values; the dark green one is relevant to the arithmetical mean of the same data. The red line is the suggested contractual power.

The first visual analysis is to detect any anomalous points: their presence can be deduced in case of scattered blue points and if the median is far from the arithmetical mean. The result is that the proposed red line is meaningless with respect to the actual consumptions (the ideal situation is when the red line is close to the higher of the blue dots). The anomalous points are to be deleted (as explained above) excluding the holidays/failure/strike days and with the automatic filter (*2- Erase anomalous points* button). When the analysis is consistent with the expected results, the graph or the correspondent table (*Grid* tab) can be used, printed, or exported.

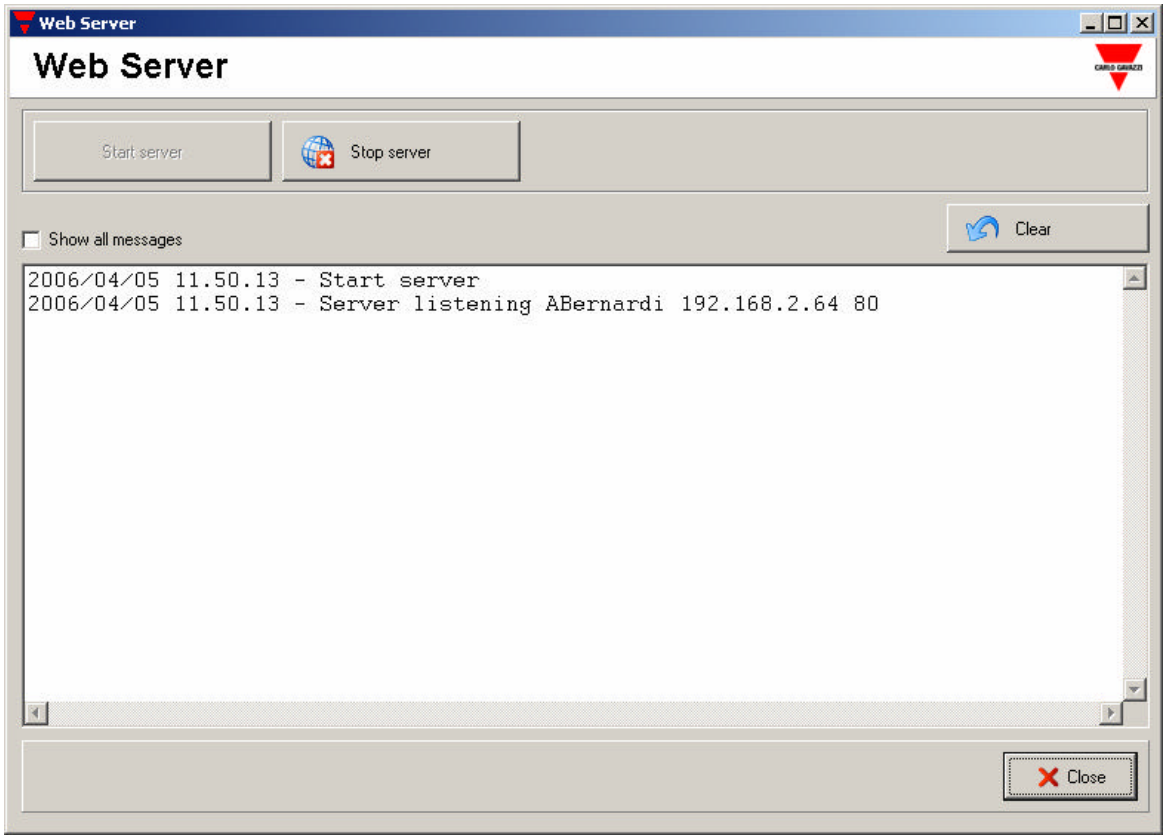
5.8.3.3 IMPORTANT NOTE

This analysis process has been developed to be automatic, stable, and accurate, even in case of anomalies stored in the database. As all the automatic processes, in case of unexpected or heavy anomalies, it can fail. The critical ability and supervision of the operator is thus indispensable to avoid any incorrect analysis. For this reason this module has been called *Analysis support*, being actually a useful tool for the final analysis which is to be carried out by the user.

5.9 THE WEB-SERVER (PWS-WEB MODUILE)

This module allows remotely accessing the real-time data, the database, and the reports using a standard browser.

Launching the module from PowerSoft allows accessing the following window.



From this window it is possible to activate or deactivate the web server function by means of the relevant buttons. The log of the events relevant to the web server allows the user to be updated on the module status. Only the most important messages are shown, unless the *Show all messages* box is ticked. To clear the log, the relevant button is to be used.

The web server module has been optimised to be used with web clients as Internet Explorer version 6 or higher.

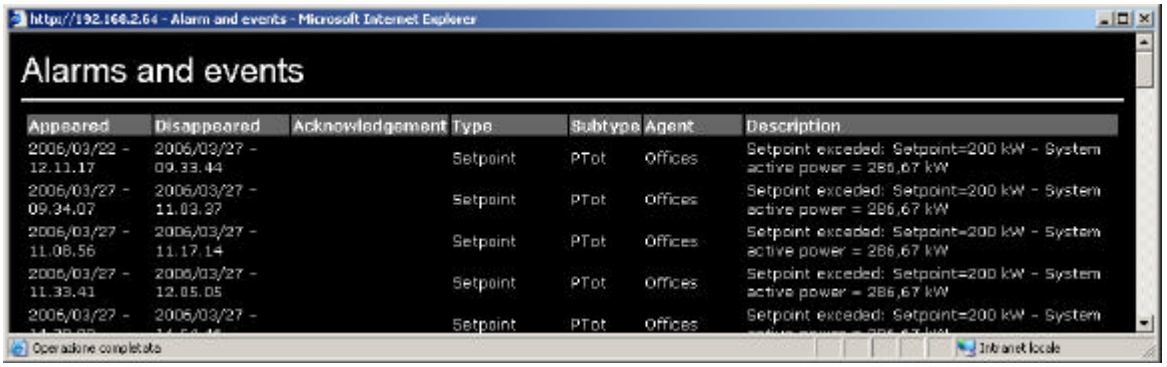
The functions available via web are similar to the ones available for a guest user of PowerSoft (plus the simplified Analysis support): for their description, please see the relevant paragraphs.

To remotely access the PowerSoft web server, the IP address of the PC where PowerSoft is running is to be edited in the address bar of Explorer.

It is requested to log in before accessing the information: only one access level is available and it is common both to the Users and to the Administrators.

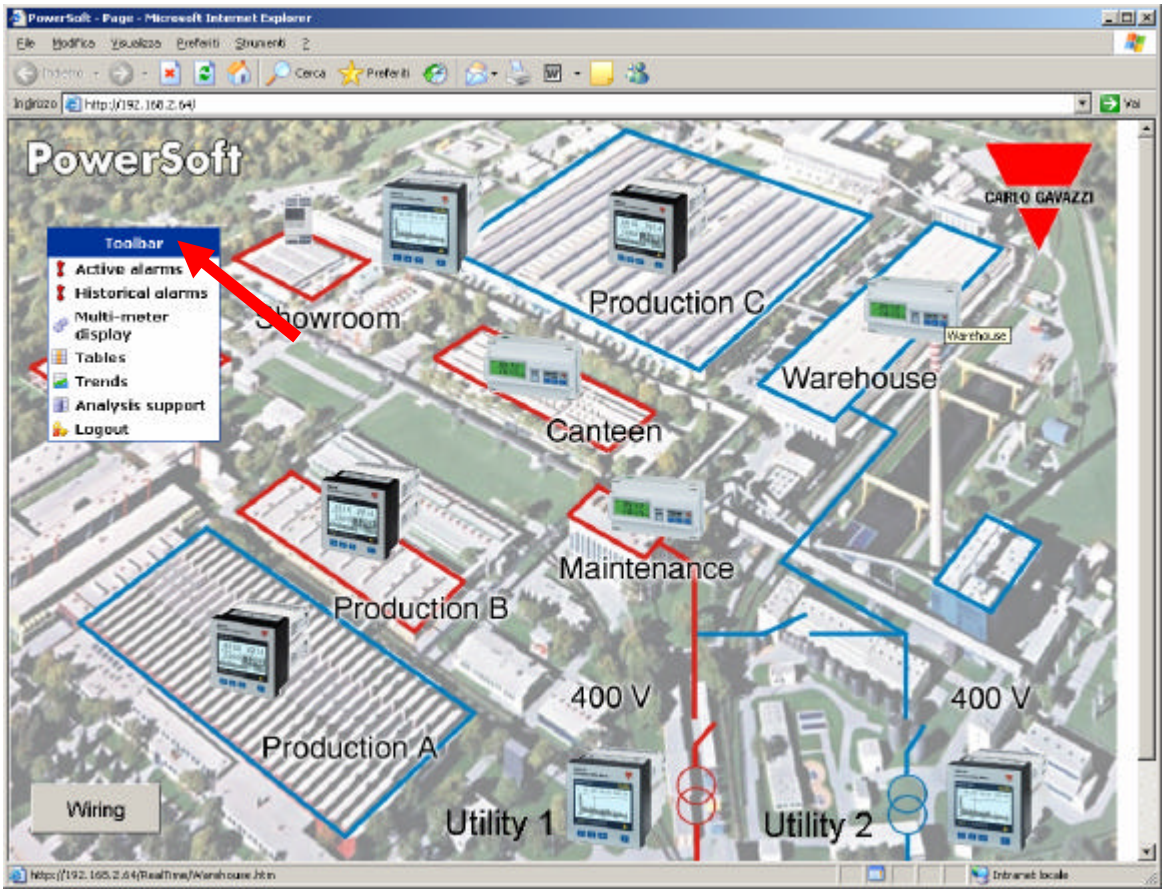
The web server opens a pop-up window to warn about a new alarm situation, as PowerSoft does. Note that this function could be considered an undesired function and then excluded. The web client is to be set not to filter the pop up windows to exploit this function.

If the pop up windows are not desired, it is still possible to manually open the active alarm list.



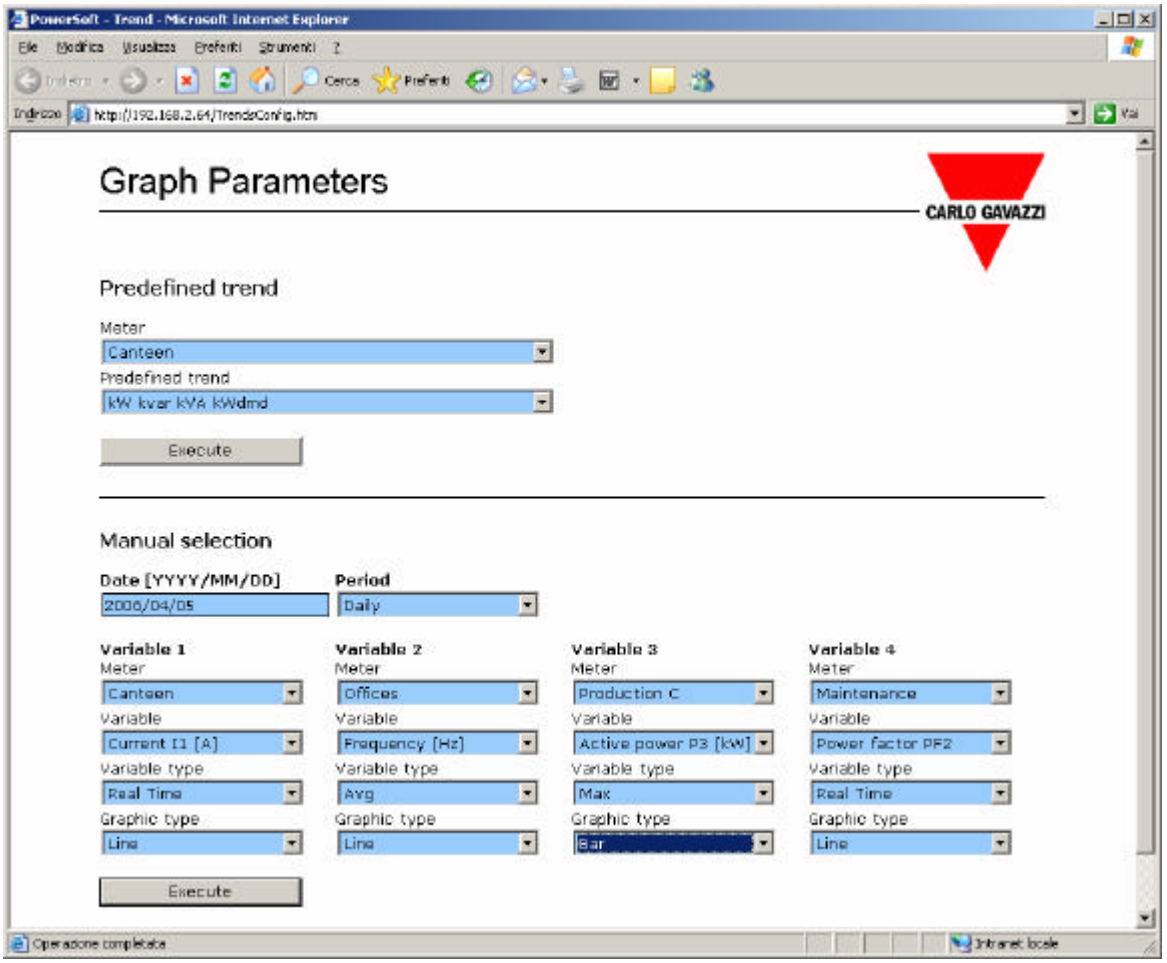
5.9.1 THE TOOLBAR AND THE MODULES

One of the main differences between consulting PowerSoft directly or remotely is the toolbar.

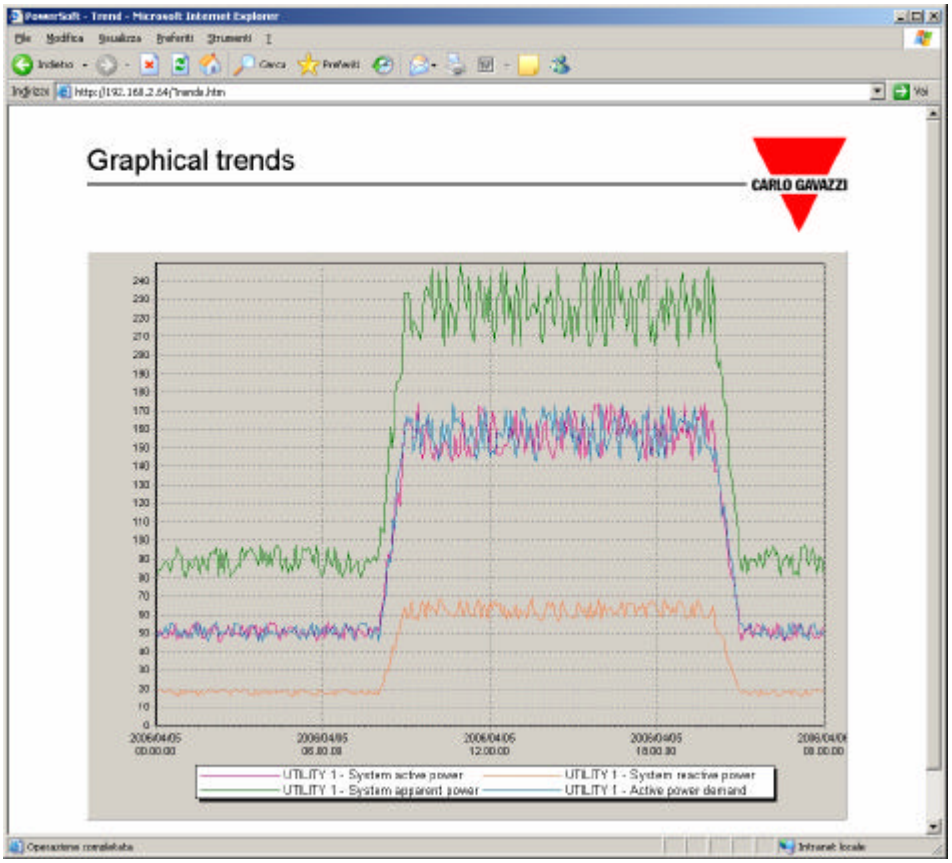


The toolbar allows activating all the functions of the installed modules. Clicking any available entry on the toolbar, a new Explorer window, where the parameters necessary to the execution of the required report are to be entered, is opened.

To get a graphical trend, for example, click on *Trends* on the toolbar and fill the parameter boxes in the following form.



The required parameters are the same as the local version of PowerSoft, but are listed with a different layout. After setting the parameters, pressing on the *Execute* button the desired report appears.

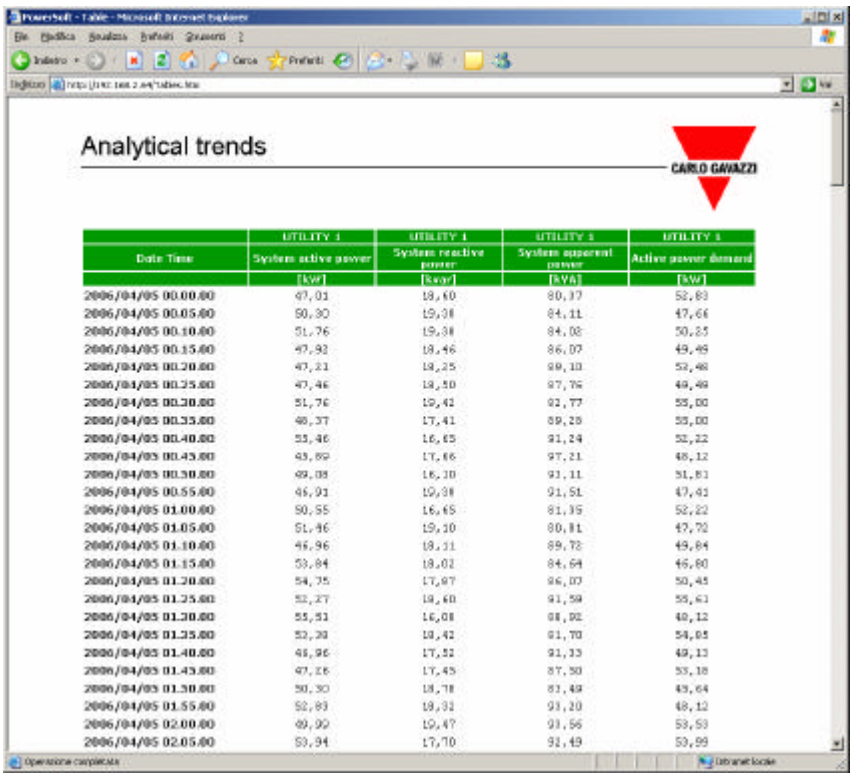


The picture can be exported right clicking on it and choosing *Save image as...*

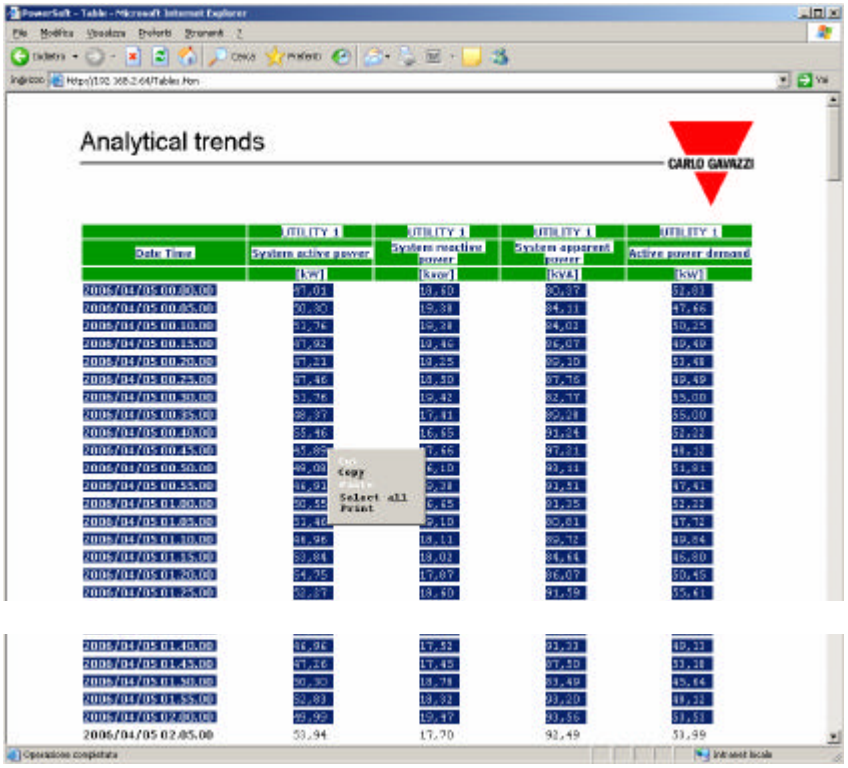
5.9.2 EXPORTING A TABLE ON EXCEL

To export on Excel the data included in a table, provided by the analytical trend module, the below procedure is to be followed.

- Choose *Tables* on the toolbar and fill the required parameters in the form. After pressing *Execute* the following table appears.



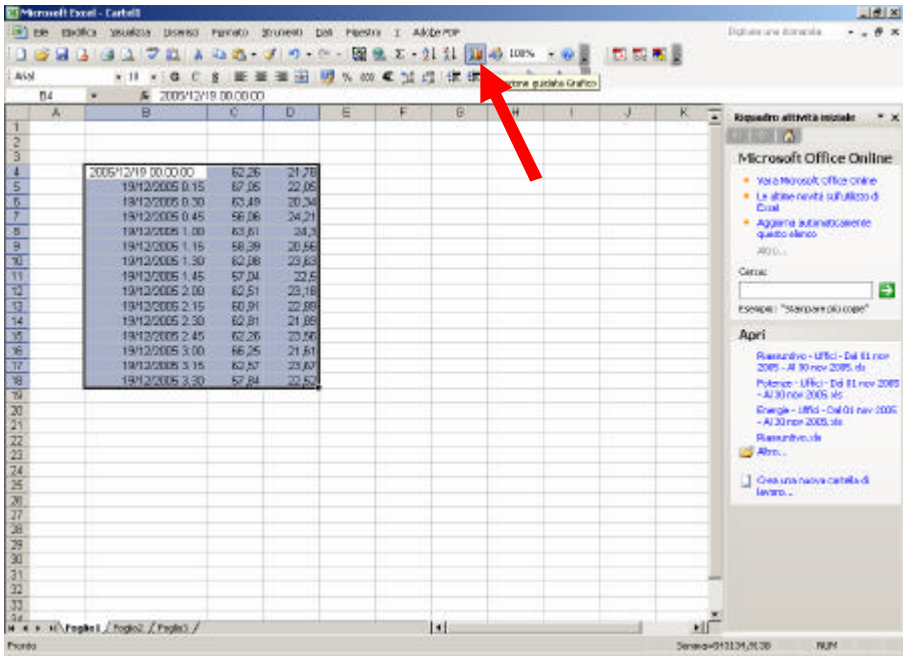
- Select the values to be exported dragging the relevant area with the left button of the mouse; then right click and *Copy*



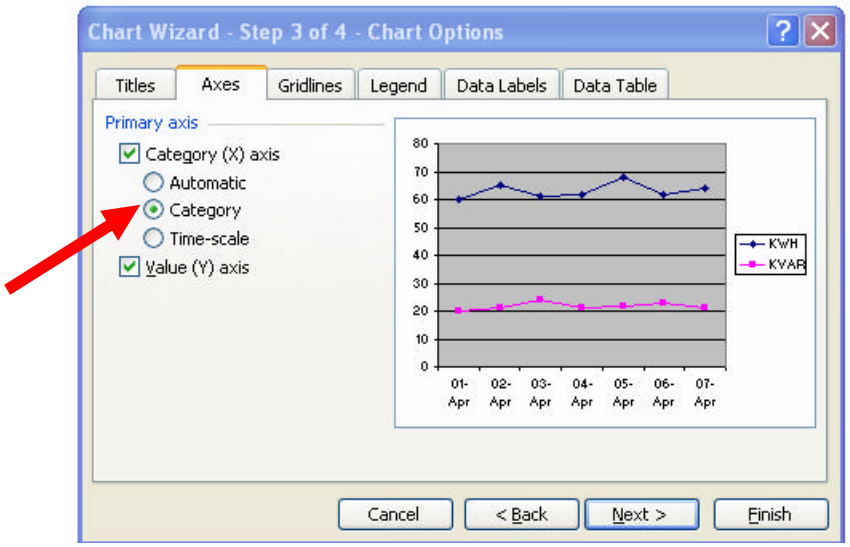
- Launch Excel and choose, from the *Modify* menu, *Special paste* then *Text*

Because of the format of the data when copied from Explorer, to create a graph on Excel from the PowerSoft Web server table, the below procedure is to be followed.

- Select the pasted data.
- Click on the *Graph wizard*



Follow the wizard instructions, paying attention that the following options are to be selected.



5.10 AUTOMATIC E-MAILING (PWS-MAIL MODULE)

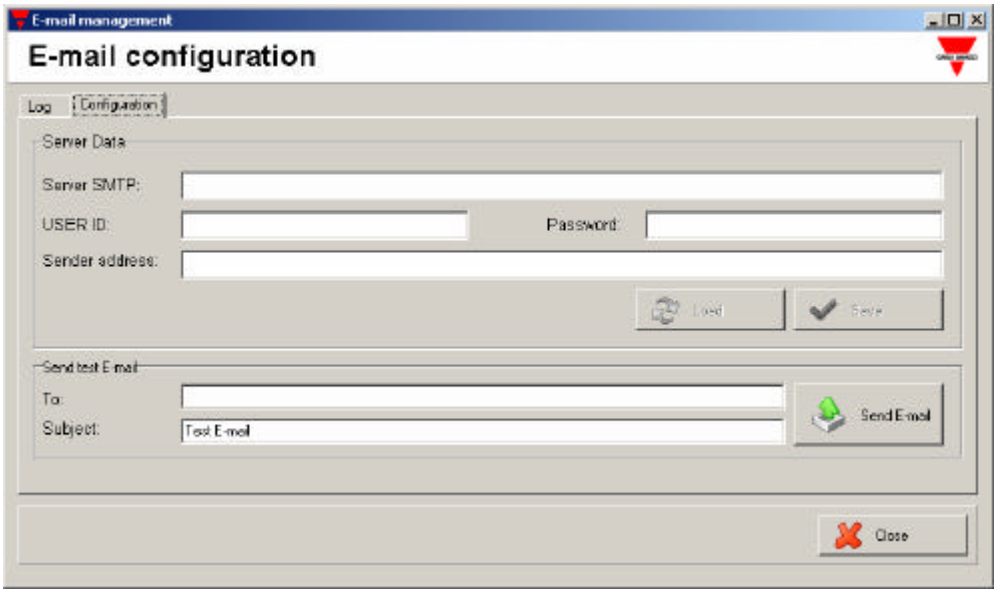
This module allows the automatic sending of E-mails on regular basis or as a consequence of selectable events. Its configuration is composed of two parts, available only to the Administrators:

The configuration of the E-mail parameters

The configuration of the events and of the data to be sent

5.10.1 E-MAIL PARAMETERS

The module windows are composed of two sections: the first one displays the log of the events connected to the e-mailing; the second one includes the form to configure the automatic e-mailing.



To send an E-mail the following parameters are required:

The SMTP server (the server for the outgoing mail)

The server "user ID" (if required)

The server "password" (if required)

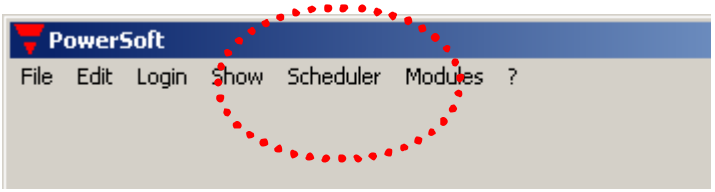
An existing e-mail address

These parameters are the same used in the e-mail clients (Outlook, Eudora, Thunderbird, etc.) and can be copied from their configuration parameters.

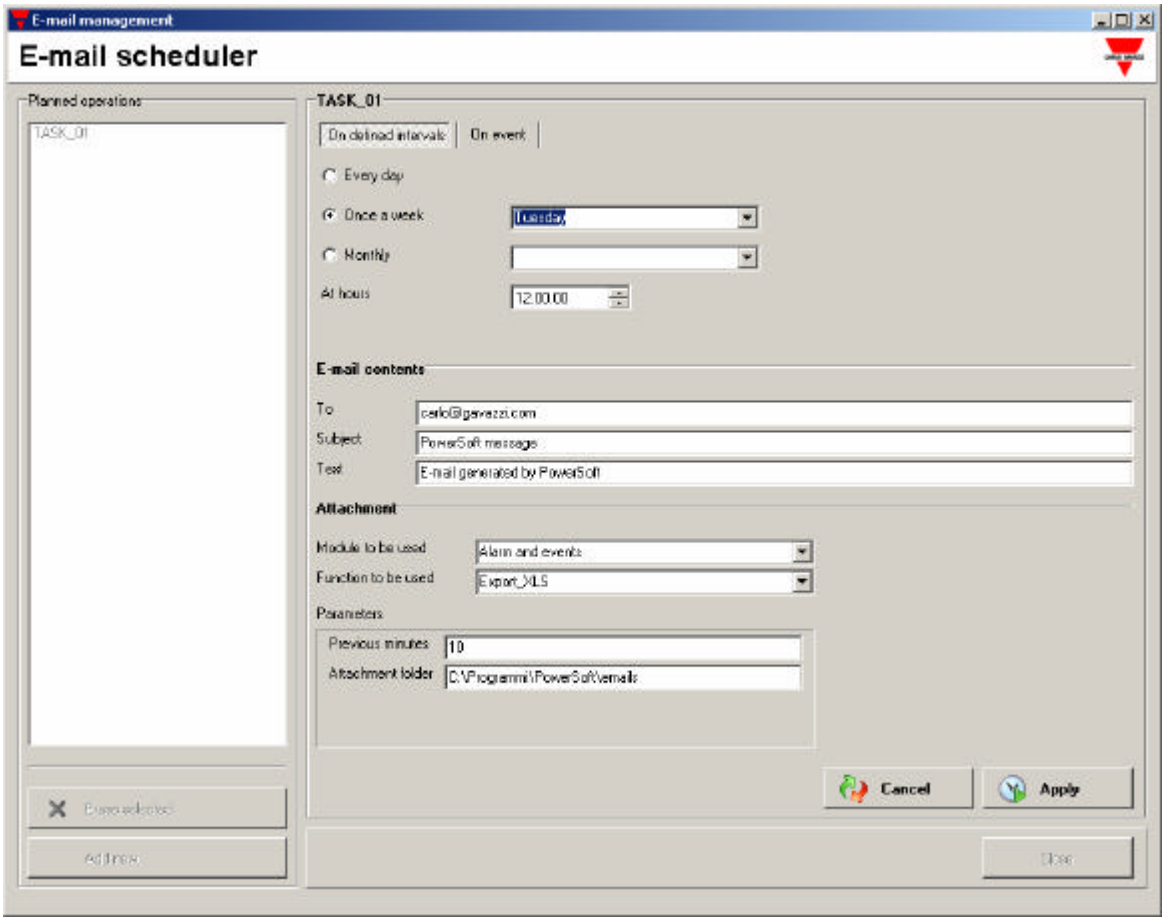
To check if the parameters are correctly set, a test e-mail can be sent.

5.10.2 E-MAIL SCHEDULER

The E-mail module enables the *Scheduler* menu:



The configuration relevant to the e-mailing is possible selecting this menu.

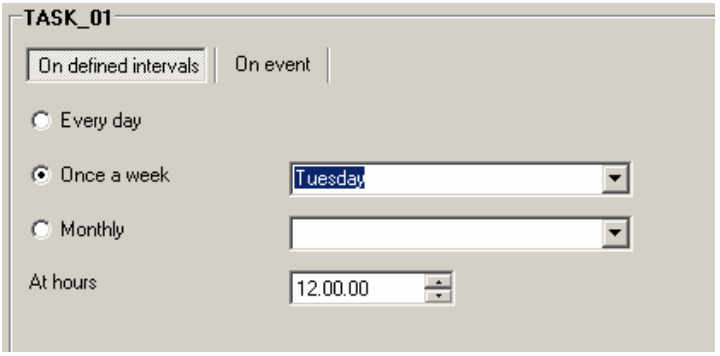


It allows programming to whom the mails are to be addressed, when and with which attachments.

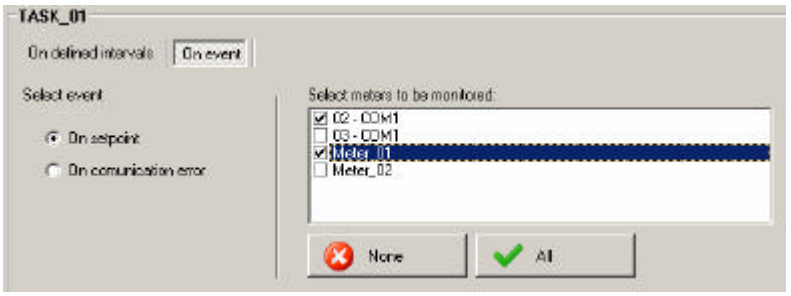
A new scheduled e-mail task can be added pressing the *Add new* button, while a task can be deleted, after confirmation, with the *Erase selected* button.

Adding a new task, the first choice is when the mail is to be sent:

- On regular basis. The mail can be sent once a day (selecting the desired hour), once a week, or once a month (selecting the day and hour).



- On event: it is possible to send a mail when a communication error or a setpoint alarm appears. These events can be filtered applying the rule to all, some or only one instrument.



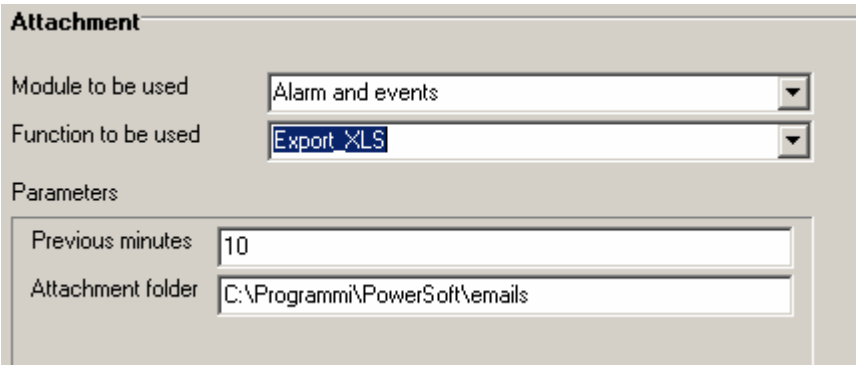
In this case, the E-mail is not immediately sent, but only after a delay of 1 minute, so to avoid a great number of E-mails if the event is frequent (for example a setpoint with a low hysteresis).

The following parameters are:

- A valid e-mail address, or a series of addresses separated by the ";" character
- A subject for the mail
- The text of the mail

Then it is requested to specify the attachment to be sent. An attachment is a report from the *Alarm and event log*, the *graphical trends,* or the *analytical trends* (see the relevant paragraphs for the details of these modules).

If, for example, all the events happened in the last 10 minutes are to be sent, the procedure is the following.



Select the *Alarm and events* module.

Select *Export_XLS* or *Export_CSV*, according to the selected format to be exported. A list of parameters appears, depending on the selected module.

In the case of the *Alarm and events* module:

- Set the previous minutes whose events are to be enclosed;
- Set the desired attachment folder where a copy of the attachment is to be saved. If the folder does not exist, it is automatically created.

In the case of a trend module:

- Choose the predefined set of variables;
- Select the instrument whose data are to be exported;
- Set the desired attachment folder where a copy of the attachment is to be saved. If the folder does not exist, it is automatically created.

Clicking the *Apply* button, the task is saved and the system is ready to send an E-mail as soon as the condition (time or event) is verified. When the mail is to be sent, the system checks the availability of an Internet

connection. If it is not available it tries to create a connection using the predefined connection. Then the attachment reports are created and sent using the programmed SMTP server and E-mail address.