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DCRJ8 DCRJ12

Automatic power factor regulator

REMOTE CONTROL SOFTWARE MANUAL



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Introduction

With DCRJSW Remote control software, you can connect one or several DCRJ or DCRJ-F regulators to a PC via a RS232 serial port or a RS485 serial bus.

It can be used for commissioning of the controller, for troubleshooting in case of problems and also for continuous supervision.

The software provides the following functions:

- Graphic display of all the measurements returned by the device with numeric and bar-graph type readout.
- For each step:
 - Status display (ON/OFF)
 - Function display (step/alarm/fan)
 - Display of the power set or measured
 - Display of the number of switching operations
 - Display of total step functioning time
 - Manual close/open commands
- Access to the Basic, Advanced, Function Setup menus
- Access to alarm properties programming
- Access to the DCRJ Real time clock
- Possibility of set-up parameter save/load/printout
- Display of virtual front panel of the controller with the possibility of activating the keys
- Switching between manual and automatic mode
- Keypad lock function
- Procedure for automatic testing of the PFC panel, with printout of the test report
- Data log function, allowing to periodically sample a set of measurements defined by the user and save them on disk in different formats (MS-Access, ASCII text, MS-Excel).
- Display of trend graphs based on Data log
- Display of the Event log, showing the most recent 40 events with date and time
- Display of actual FFT (Fast Fourier Transform) for current and voltage signals
- Display of actual voltage and current waveforms
- Display of 7 harmonic events of the last week plus the highest harmonic event, each of them with:
 - Date and time
 - Peak value
 - FFT
 - Waveform capture
 - Total duration

Minimum resources of the PC

- Windows® 95/98/2000/XP operating system
- Graphic card with 1024x768 or higher resolution
- A free standard RS232 serial interface (COM:)
- 64Mb of RAM
- Pentium® class or higher processor
- CD-ROM drive for installation

Installation

To install the software, you need a PC with the operating system already installed and running and the program setup CD. You should also have at least a basic knowledge of the PC and be familiar with Windows®. operating system commands.

1. Close all applications running
2. Insert the CD in the drive
3. From the root directory, start the *Setup.exe* program
4. If a previous installation is already present on the hard drive, then the installation program will automatically start a procedure to remove the older revision. After this , the installation process will start.
5. A window is displayed asking you to specify the directory in which you want to install the program. To change directory, enter the new name in the specific box.
6. Follow the instructions that will be shown until the end of installation.
7. Reboot the PC.

Activation of the PC-DCRJ connection

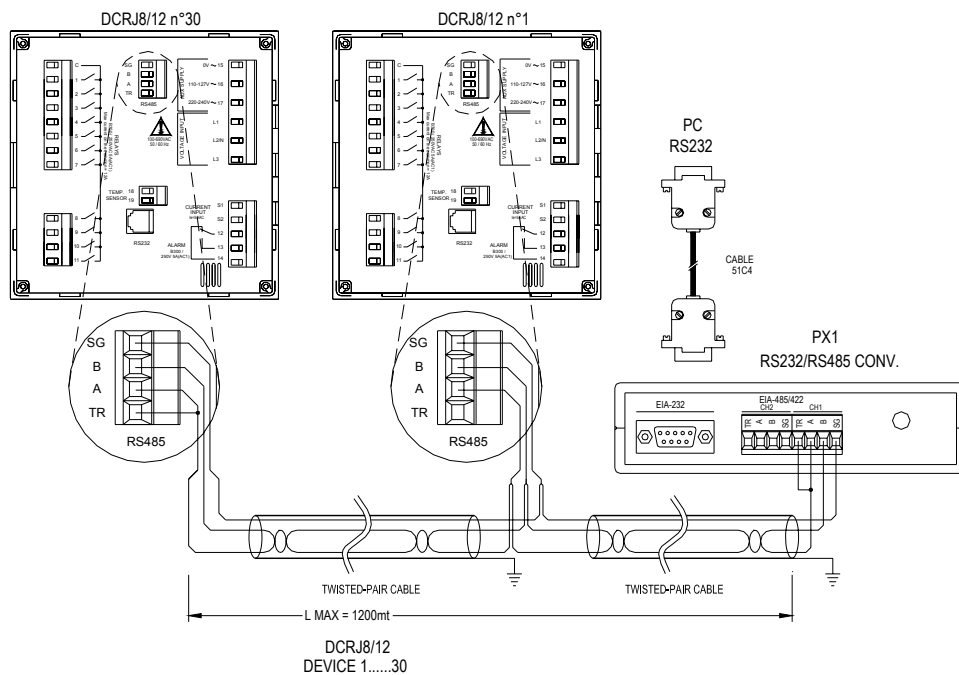
To operate the remote control program, it is essential the PC and DCRJ can communicate by serial interface. The connection can be realized in different ways, since the DCRJ is provided with two independent serial interfaces:

RS-232 direct connection

- Connect the DCRJ and the PC using the Lovato cable code 51C2
- Can be used to quickly connect the device during commissioning / maintenance
- It is possible to connect only one device at a time

RS-485 connection

- Connect the Rs-232/Rs-485 converter to the PC using cable 51C4.
- Connect all DCRJ RS-485 interface terminals in parallel with the twisted-pair cable and then to the interface converter, as shown in the following wiring diagram. Make sure the polarity is correct (A and B terminals).
- We strongly recommend to use an interface converter supplied by Lovato. If the user wants to use an interface converter of another brand, we will not be able to help with wiring, nor to assure that the communication will work properly. However, the interface converter must be insulated and have an automatic enable line control circuit.
- In case you have connected more than one device, from the front keyboard of each device, enter the Function setup and set one different RS-485 serial address for each DCRJ, starting from address 01. Make sure that the PC speed and parity settings match the DCRJ RS-485 setting.



Modem connection

Using the remote control it is also possible to achieve connection from a remote location, using a couple of modems. Modems can be of standard type or GSM, and can be connected on the RS-232 or RS-485 port. See the I106IGB1002 document on the original CD for more details about modem connection.

When working with modems, both the PC software and the DCRJ must be set to work with modbus® ASCII protocol. See the Configuration-options chapter and the Function setup parameters on the operating manual of the DCRJ.

Main window

The main window displays all the various measurements returned by the device, providing a complete overview of PFC panel status.

All the functions are accessible from the drop-down menus and those used most frequently are also shown on the toolbar. Some of these functions are blocked and can be accessed only after entering the user-modifiable password (at the first setting, the default password is *LOVATO*).

The following are displayed in the main window:

- Three 7-segment displays indicating respectively current power factor, the setpoint power factor and the average weekly power factor.
- A graphic representation of the phase displacement angle in the four quadrants.
- Panels with voltage, current, Delta-kvar, capacitor overload and temperature, each with numeric and bar graph readout and, where available, an indicator of the MAX value detected. If the DCRJ has been programmed with the Auto-Setup procedure, some of these measurements are not available.

A set of panels, one for each step, with the following information:

- An icon representing relay status (ON/OFF) and function (capacitor bank, fan command or global alarm).
- A box indicating the power of the step in Kvar. This box usually indicates the power set (programmed in the setup). If the step trimming function has been activated on the DCRJ, this box shows the measured power of the bank of capacitors. If the DCRJ has been programmed with Auto-Setup, the power of the step will not be available.
- A graphic bar indicating the percentage ratio between the power set and that measured. This is available only when the step trimming function has been activated.
- A box indicating the total number of switching operations of the step. The count is maintained even if the device is switched off. This counter can be reset from the Instruments-Reset-Switching operations counter menu. *Note:* the DCRJ distributes the number of switching operations equally between steps with the same power. It is normal therefore that steps of different power have a different number of switching operations.
- A box indicating the total switch-in time of the steps in hours-minutes. The switch-in time can be reset using the Instruments-Reset-step functioning time menu.

Lastly, the following are indicated, from left to right, on the *status bar* close to the lower edge of the main window:

- Model and release of the internal firmware of the DCRJ connected
- Serial communication status (ONLINE = connection active, OFFLINE = connection not active)
- DCRJ operating mode (MANUAL / AUTOMATIC)
- Any alarm conditions
- Page refresh rate
- Setup mode (None/Standard/ Autosetup)
- Modem connection status (if used)

Main window

The screenshot shows the 'DCRJ Remote control' software interface. At the top, there are several callouts for navigation and control buttons: 'Switches to OFFLINE mode (communication OFF)', 'Switches to ONLINE mode (communication ON)', 'Switches to AUT mode on the DCRJ', 'Selects MANUAL mode on the DCRJ', 'Accesses the Basic, Advanced, Function, Static setup and alarm properties menus', 'Displays the virtual front panel', 'Opens Data log and data log graphs window', 'Displays the event log window', 'Open FFT and Harmonic event window', 'Switches locking of the DCRJ keypad ON/OFF', 'Drop-down box to select the controller in RS-485 multi-drop networks', 'Opens the TEST capacitors window', and 'Real-time measurements with numeric value and bar-graph'.

The main display area includes:

- Top Panel:** 'Lovato electric DCRJ Remote control' title, 'DCRJ 01' dropdown, and status indicators for VOLTAGE (399 V), CAP OVRL (101 %), CURRENT (479.1 A), DELTA-kVar (012), and TEMP (022°C).
- Phase Angle Displacement:** A circular gauge showing 'ACTUAL COS-PHI' (0.94 IND), 'SETPOINT COS-PHI' (0.95 IND), and 'WEEK AVG P.F.' (0.94). The gauge also shows 'PHASE ANGLE DISPLACEMENT' with a blue marker at 20° and a white marker for the setpoint.
- Bar Graphs:** Four vertical bar graphs for VOLTAGE (462), CAP OVRL (115), CURRENT (100%), and TEMP (22.2).
- Step Control Table:** A table with 10 steps and columns for Kvar, Pwr%, OpCnt, and Time. Each step has 'IN' and 'OUT' buttons.
- Bottom Panel:** 'DCRJ Rev.00', 'ONLINE', 'MAN M', '0.15', and 'STANB' indicators.

Additional callouts at the bottom explain specific data points and controls:

- 'Current P.F. measurement' points to the 0.94 IND value.
- 'Setting of P.F. setpoint' points to the 0.95 IND value.
- 'Average weekly P.F.' points to the 0.94 value.
- 'Step status and function icon' points to the step control buttons.
- 'Device model and software revision' points to 'DCRJ Rev.00'.
- 'Power of the steps' points to the Pwr% column.
- 'Step manual control buttons' points to the IN/OUT buttons.
- 'Number of operations counter' points to the OpCnt column.
- 'Total time of use of the step' points to the Time column.
- 'Graphic bar of percentage power measured in relation to that set' points to the bar graphs.
- 'Marker and numeric value of the max. peak detected' points to the 22.2 value in the TEMP bar graph.
- 'Serial connection status' points to the ONLINE indicator.
- 'DCRJ operating mode MAN / AUT' points to the MAN M indicator.
- 'Graphic representation of the phase displacement angle (in the 4 quadrants). Blue marker = current angle White marker = Setpoint' points to the phase angle gauge.

System configuration

To access the configuration window it is necessary to enter the password. After the first installation, by default, the password is *LOVATO* (the user can change it later). Click on *Password* menu, key-in *LOVATO* and then confirm with *OK*.

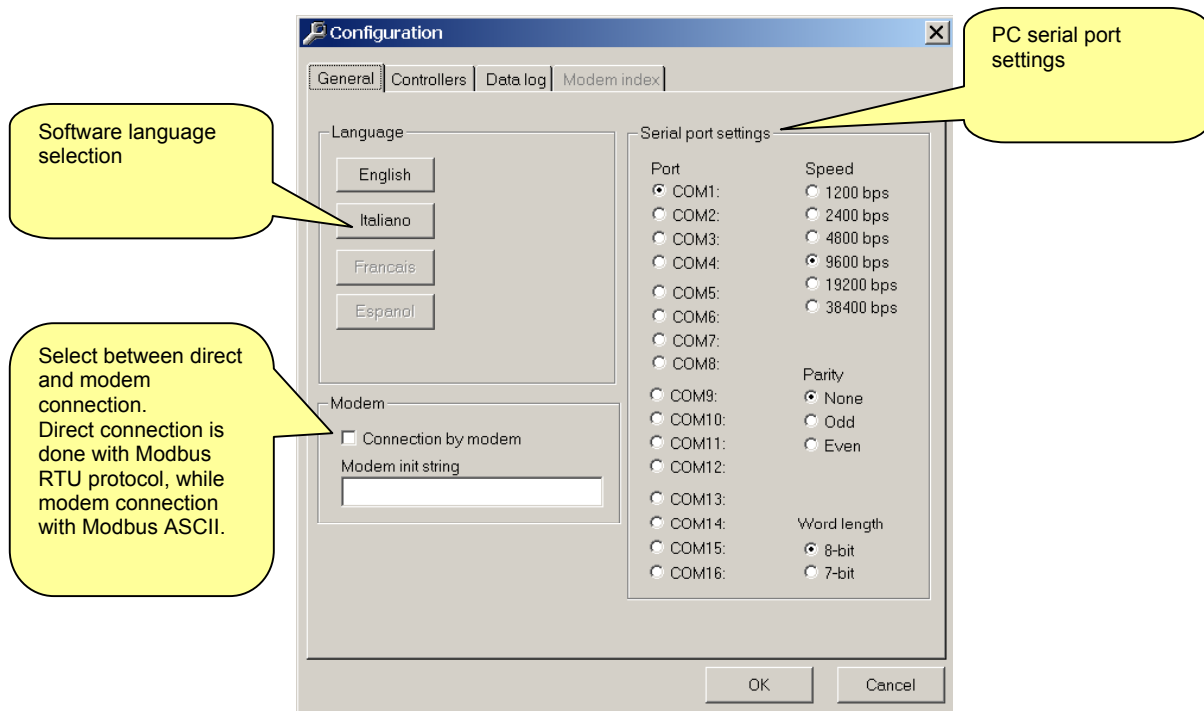
Now, to open the configuration window click on *Configuration-Options* menu.

The configuration phase is a very important step to correctly define the program operation. In particular, in the case in which are connected more than one device, the user will have to pay attention to the setting of each DCRJ connected to the network.

Before proceeding with the explanation of the various functions of the software, we will examine the configuration window, looking at the meaning of all settings.

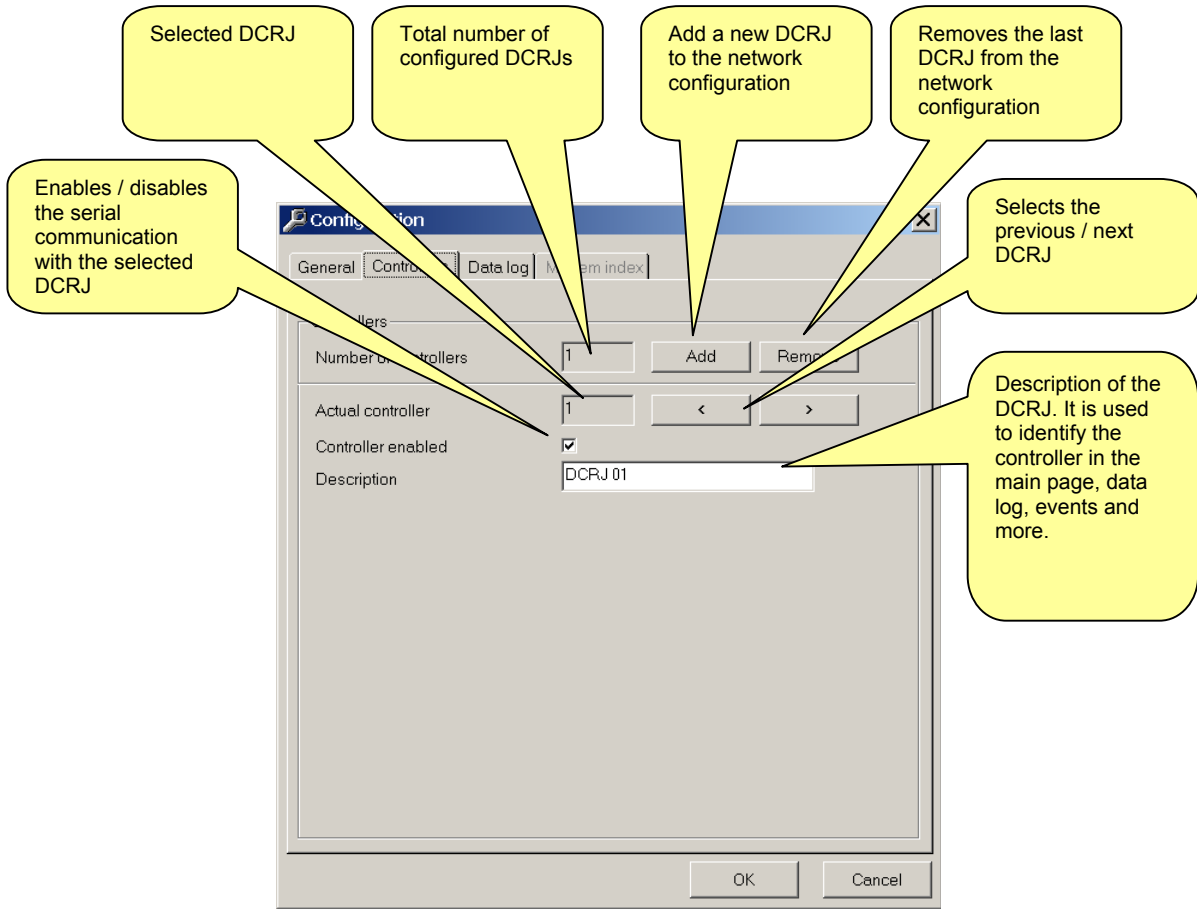
Configuration-Options-General

In the general window there are some generic setting of the software. Particular attention must be paid to the serial port setting, that must be used to select the PC serial port, and to the serial interface settings that must be the same as the ones programmed into the controllers Function setup.



Configuration-Options-Controllers

When using a RS-485 multidrop network, it is necessary to specify how many controllers are connected to the PC. Using this window it is possible the total number of DCRJ, and to give a name to each of them. In case one controller is not to be accessed, it is possible to disable it using the dedicated checkbox.



Configuration-Options-Data log

This window is used to define which measures must be sampled by the PC and stored in the Data Log database. These data can be shown in the form of a trend graph (see following chapters).

The screenshot shows the 'Configuration' window with the 'Data log' tab selected. The window contains the following fields and controls:

- Sampling period:** A text box containing '10' followed by a 'sec' label. Callout: 'Time interval between data log sample recording in the database'.
- Keep data of the last:** A text box containing '30' followed by a 'days' label. Callout: 'Defines how many days the data log database will keep sample records.'
- Select controller:** A dropdown menu with 'DCRJ 01' selected. Callout: 'Selects the source controller for the measure to be sampled'.
- Select measure:** A dropdown menu with 'CAPACITORS CURRENT OVERL' selected. Callout: 'Selects the measure to sample'.
- Add / Remove buttons:** Two buttons located below the dropdown menus. Callouts: 'Adds a row to the data log list, copying the controller and the measure selected in the drop-down boxes' (pointing to 'Add') and 'Deletes the selected row from the list. **Note:** Deleting fields in the data log database structure will mean losing of all currently present records.' (pointing to 'Remove').
- Table:** A table with two columns: 'Controller' and 'Measure'. It contains six rows of data. Callout: 'List of the measures to be sampled. They will be sampled at the same time and will be used for graph plots, data export etc. Max 64 measures.' (pointing to the table).
- OK / Cancel buttons:** Two buttons at the bottom right of the window.

	Controller	Measure
1	DCRJ 01	ACTUAL COS-PHI
2	DCRJ 01	VOLTAGE
3	DCRJ 01	CURRENT
4	DCRJ 01	WEEKLY POWER FACTOR
5	DCRJ 01	PANEL TEMPERATURE
6	DCRJ 01	CAPACITORS CURRENT OVERLOAD

Configuration-Options-Modem Index

If the software is configured for connecting via modem, it is possible to store a list of the various installations, that is a list of places where a DCRJ network with modem is installed. For each installation, the user can define a code, a name and the corresponding phone number of the modem on the field. This way, when wanting to connect with a particular installation, it will be possible to dial it directly from this list. For each installation it is possible to define if one or more units are installed and associate an initial page to be loaded once connection has been established.

The screenshot shows a software window titled 'Configurat...' with a 'Modem Index' tab. The window contains a form with the following fields: 'Code' (001), 'Description' (Remote plant), 'Phone number' (123456789), and a field for 'Number of DCRJ units connected to the modem'. Below the form is a table with columns 'Code', 'Desc', and 'Tel'. The table contains one row: '001', 'Remote plant', '123456789'. Below the table are buttons for 'New', 'Add', 'Remove', and 'Update', along with navigation arrows. At the bottom are 'OK' and 'Cancel' buttons. Callouts provide instructions for each element:

- Installation code. They must all be different.** (points to the Code field)
- Description of installation** (points to the Description field)
- Phone number of modem to be called** (points to the Phone number field)
- Number of DCRJ units connected to the modem.** (points to the units field)
- Name of page to be loaded after connection has been established.** (points to the page field)
- To enter a new record, first click on *New*, fill the fields and then click on *Add*.** (points to the New and Add buttons)
- To eliminate a record, first select it in the table, then click *Remove* button.** (points to the Remove button)
- To modify an existing record, first select it from the table, then do your modification in the field above, finally click on *Update*.** (points to the Update button)

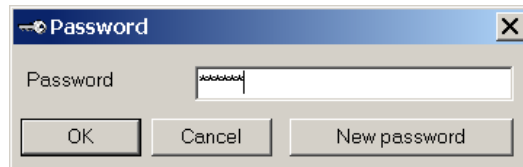
Code	Desc	Tel
001	Remote plant	123456789

Password

When the software is started some of the functions are disabled. By means of the *Password* menu it is possible to key in the password that will allow access to all functions, including:

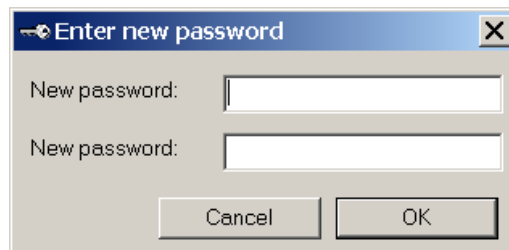
- Modifying remote control software settings
- Entering a new password
- Delete records from *Data log* databases
- Modify the DCRJ settings from the remote control
- Operate the virtual front panel keys
- Reset MAX values, event log, operation counters etc.

Password



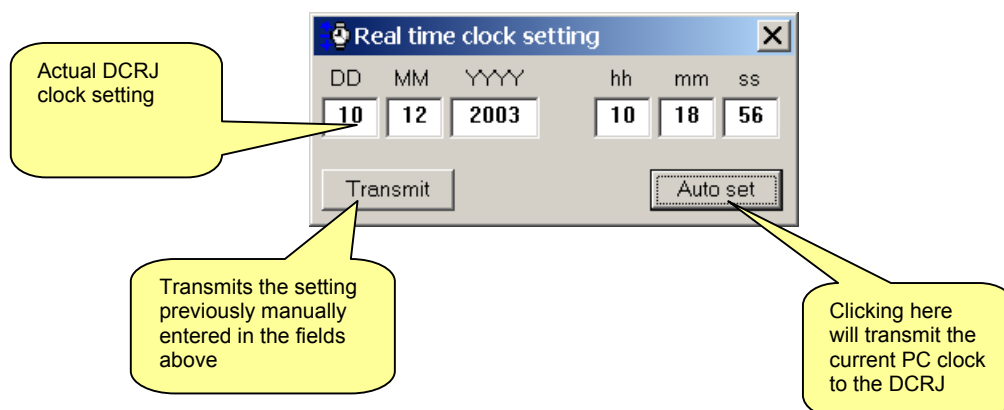
After the first installation the password is LOVATO. Later, the user will be able to customize its password, using the New Password button and then entering the new desired password two times.

New password



Real Time Clock setting

To view and set the RTC (real time clock) of the DCRJ, click on the dedicated icon on the toolbar. The following window will be shown, allowing to check and eventually modify the clock setting.



Access to Setup menus

Device settings are entered via the setup parameters which you can display and modify from the specific *Parameters* menu or directly from the toolbar by clicking on the matching icon. If you have not entered the password previously, only the current settings are displayed without transmission of modifications to the device.

This method of accessing DCRJ settings is handier and more immediate compared with direct access from the front keypad as, using the PC; the following are displayed:

- Code of the parameter
- Description in the language set
- Value set
- Graphic box or drop-down box with possible options

The parameters have been grouped in three menus that reflect the organization described in the operations manual.

- Basic setup (basic settings such as primary CT, number and power of the steps, etc.)
- Advanced setup (particular operating modes and other advanced functions)
- Function setup (particular operating modes and other advanced functions)

If the connected controller is a DCRJ-F (controller with static outputs) then a fourth menu will be shown:

- Static setup (settings concerning the application with static outputs)

The Basic and Advanced menu have the same parameters as the controllers of DCRK series, while new functions dedicated to DCRJ controllers are grouped in the Function menu.

In addition to these three menus, the properties of the alarms have been grouped in a fourth window from which you can modify the behavior of the device following occurrence of an alarm.

You can save the complete series of settings of an device in a file so as to re-use these to set another device with the same settings.

You can save the complete series of settings of a DCRJ on the disk of the PC in an ASCII text file for fast, easy reloading of these in another device. This function is useful when programming a number of control units with the same settings or in order to maintain a master file of the original settings of a system. To save the parameters on disk, select the *Parameters-Save to file* menu and enter the name required.

The following are saved in each file:

- Type (number of steps) and internal release of the device
- P.F. setpoint
- Basic setup parameters
- Advanced setup parameters
- Function setup parameters
- Properties of the alarms

This type of file has a .PAR extension. To carry out the reverse operation, i.e. to transfer a file from the PC to the DCRJ, access the *Parameters-Load from file* menu. Obviously, this operation can be carried out only between devices of the same type, i.e. with the same number of steps and with the same internal release. From the *Parameters-Print* menu, you can obtain a printout of the settings to be filed with system documentation.

Base setup

The screenshot shows the 'Base setup - DCRJ 01' window with the following parameters and values:

Code	Description	Value
P.01	CT primary winding	500 A
P.02	Smallest step kvar	10.00
P.03	Capacitor rated voltage	400 V
P.04	Reconnection time	5s
P.05	Sensitivity	60
P.06	Step 01 coefficient	1
P.06	Step 02 coefficient	2
P.06	Step 03 coefficient	4
P.06	Step 04 coefficient	4
P.06	Step 05 coefficient	4

Callouts provide the following information:

- Code of the parameter:** Points to the parameter code (e.g., P.01).
- Parameter description:** Points to the parameter name (e.g., CT primary winding).
- Graphic bar:** Points to the slider for P.02, stating: "Drag this with the mouse to modify the setting".
- Setting of the parameter:** Points to the value field for P.04, stating: "Highlighted in yellow if different from the factory-set default value. Double clicking on this box, the parameter can be set using the numeric keypad".
- Scroll bar:** Points to the vertical scroll bar on the right, stating: "Scroll bar to access the parameters below".
- Transmit:** "Transmits the values displayed in the window to the DCRJ and saves them. Enabled only with password."
- Receive:** "Receives the values of the parameters from the DCRJ and displays these in the window".
- Default:** "Resets the values to the factory-set default".
- Exit:** "Closes the setup window".
- Dropdown arrow:** "Scroll down box with possible options".

Advanced and Function setup

The screenshot shows the 'Advanced setup - DCRJ 01' window with the following parameters and values:

Code	Description	Value
P.11	Wiring configuration	(A) 3-Ph VL1-L2 IL3
P.12	CT connection	Auto
P.13	Cap. rated frequency selection	Auto
P.14	Step trimming	OFF
P.15	Regulation mode	Standard
P.16	Step selection mode	Standard
P.17	Cogeneration Setpoint	OFF
P.18	Disconnection sensitivity	OFF
P.19	Step disconnection passing in MAN	OFF
P.20	Overload alarm threshold	125%

The screenshot shows the 'Function setup - DCRJ 01' window with the following parameters and values:

Code	Description	Value
P.41	VT ratio L1-L2	1.0
P.42	VT ratio L1-L3	1.0
P.43	Programmable input mode	NTC ext temperature sensc
P.44	Second cosfi setpoint	OFF
P.45	Low voltage threshold	380
P.46	High voltage threshold	420
P.47	Step failure threshold	75
P.48	Harmonic event source	Capacitor current overload
P.49	Harmonic event threshold	120
P.50	Harmonic event delay	5

Alarm properties

Using this window, you can personalize the behavior of the device following occurrence of a specific alarm, setting the following properties for each alarm:

- **Enabled** – Establishes whether or not the alarm is to be enabled. If an alarm is disabled, it is no longer generated (the device behaves as if the alarm does not exist).
- **Relay** – Establishes whether or not the contact of the global alarm is to be activated following occurrence of the alarm concerned.
- **Disconnection** – Establishes whether or not the control unit must disconnect the step when the alarm occurs. The step is disconnected gradually with a time of two seconds between one step and the next.
- **Delay** – Sets the delay between occurrence of the conditions that generate the alarm and activation of this. The delay is expressed in minutes or seconds according to which of the two min and sec options is selected. The maximum programmable delay is 240 minutes.

Some of the properties of the alarms are not accessible (modifiable) as, due to their nature, they must behave in a certain way (for example, there is no point in setting a delay on a micro-interruption).

Note:

Unlike the parameters, the properties of the alarms cannot be set from the front panel of the device. The programming software therefore represents the only possible means of displaying / setting these properties.

The screenshot shows the 'Alarm properties' window with a table of alarm settings. Callouts provide detailed explanations for various elements:

- Code of the alarm:** Points to the 'Alarm' column header.
- Description of the alarm:** Points to the text description of each alarm (e.g., 'Under compensation').
- Properties enabled:** Points to the 'Enabled' checkbox column, stating that if not selected, the alarm is never generated.
- Relay properties:** Points to the 'Relay' checkbox column, explaining it establishes whether the global alarm contact is activated.
- Disconnection properties:** Points to the 'Disconnect' checkbox column, explaining it establishes whether steps are disconnected.
- Activation delay:** Points to the delay input field and radio buttons, explaining it sets the delay after conditions occur.
- Buttons:**
 - Transmit:** Transmits alarm properties to the DCRJ (password-enabled).
 - Receive:** Receives alarm properties from the DCRJ.
 - Default:** Sets alarm properties to factory defaults.
 - Exit:** Closes the window.
- Selection of time base:** Points to the 'sec' and 'min' radio buttons for selecting the delay unit.
- Scroll bar:** Points to the vertical scroll bar on the right, used to view all alarms from A01 to A11.

Alarm	Enabled	Relay	Disconnect	Delay
A01 Under compensation	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	015 sec min
A02 Over compensation	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	120 sec min
A03 Low current	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	005 sec min
A04 High current	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	120 sec min
A05 No-voltage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	005 sec min
A06 High voltage	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	015 sec min
A07 Capacitor overload	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	180 sec min
A08 Overtemperature	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	030 sec min
A09 No-voltage release	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	000 sec min

View menu

Front panel

Using the programming software, you can also display a 'virtual' representation of the front panel of the DCRJ on the monitor of the PC; this is useful, for example, if you want to demonstrate functioning by projecting the image of the monitor of the PC.

Accessing this window from the *Display-Front Panel* menu, the front panel of the device connected is shown, with real-time display of the readouts and leds in their current status.

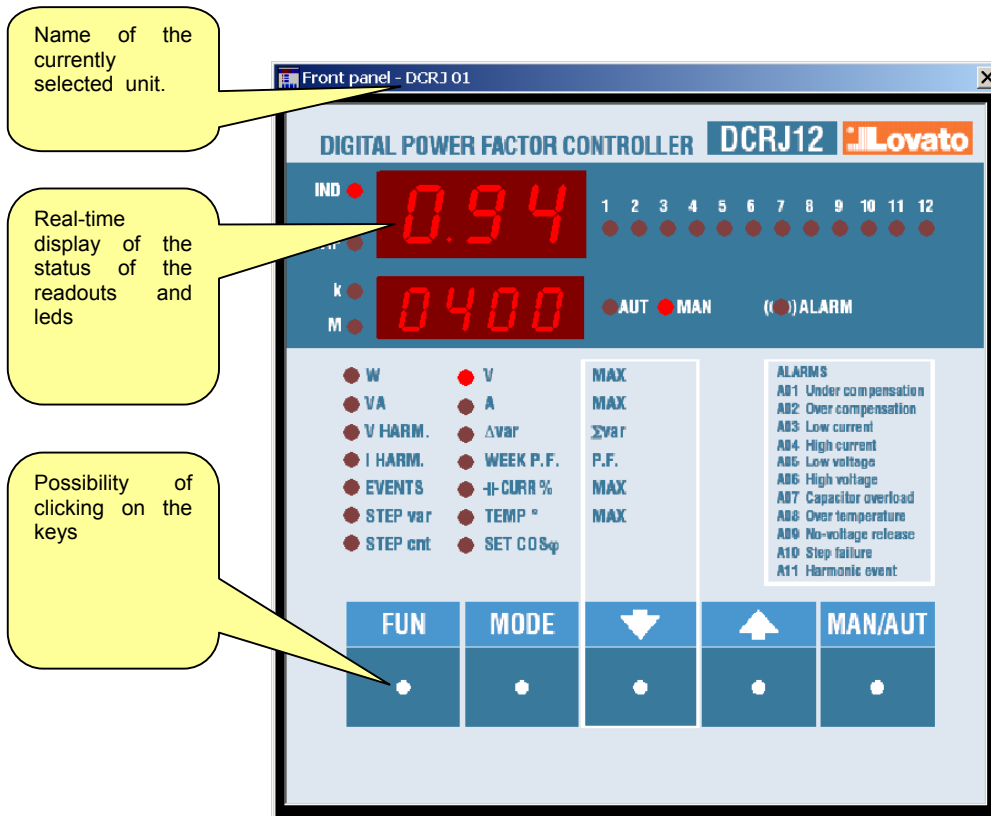
When working in a multi-drop network, in the title bar of the window it is reported the name of the unit currently selected.

Clicking with the mouse on the keys, you can select the measurements and functions in the same way as on the physical device. However, you cannot access those functions (such as parameter programming, reset max. peaks, etc.) that require simultaneous pressing and/or holding down of the keys.

There are two types of front panels which represent DCRJ8 and DCRJ12 respectively. Display will be adapted automatically to the model currently connected.

Note:

The quality of the graphic representation of the front panel may vary according to the graphic resolution of your PC and/or the monitor settings used.



Data log

Variables defined in the *Data log* configuration are sampled and stored by the software cyclically, with an acquisition rate defined by the user with the *Sampling period* setting.

For instance, if the sampling period has been set to 30 sec, once every 30 sec the a set of data will be read by the PC from the DCRJ and stored in a new record of the database.

When the user defines the *Sampling period*, he must pay attention to the disk space available on its PC. For instance, setting a sampling period of 5 sec, a total of 17280 records/day will be added to the database, each one with date, time and value of each variable defined in the data log list.

To limit the hard disk space occupation, it is possible to eliminate automatically from the database the samples older than a defined number of days. Setting *Keep samples of the last...days* to 7, only records of the last week will be kept in the database.

Data recorded in the database can be displayed in a table with View-Data log menu, or clicking on the corresponding icon on the toolbar.

View-Data log

The screenshot shows a window titled "Data log - (7 records)" containing a table of data. The table has the following columns: Date, Time, 01 - COS-PHI, 01 - VOLT [V], 01 - CURR [A], and 01 - TEMP [°C]. The data rows are as follows:

Date	Time	01 - COS-PHI	01 - VOLT [V]	01 - CURR [A]	01 - TEMP [°C]
09/12/2003	19.03.23	0.94 IND	399	477.60	21
09/12/2003	19.03.35	0.94 IND	399	477.50	21
09/12/2003	19.10.29	0.94 IND	399	477.80	21
09/12/2003	19.16.07	0.94 IND	400	478.10	21
09/12/2003	19.24.11	0.94 IND	400	478.30	21
09/12/2003	19.24.21	0.94 IND	399	478.30	21
09/12/2003	19.24.31	0.94 IND	400	478.50	21

Below the table is a control panel with the following elements:

- From:** 09/12/2003 00:00:00
- To:** 10/12/2003 00:00:00
- Auto refresh** (checkbox)
- Select period** (button)
- View all** (button)
- Export** (button)
- Delete** (button)

Callouts provide the following descriptions:

- Sample date and time:** Points to the Date and Time columns in the table.
- Number of selected records:** Points to the "(7 records)" in the window title.
- Values of the sampled variables:** Points to the columns 01 - COS-PHI, 01 - VOLT [V], 01 - CURR [A], and 01 - TEMP [°C].
- Start / end date and time for extracting records from the database:** Points to the From and To date/time fields.
- Refresh the window after each sample On / Off:** Points to the Auto refresh checkbox.
- Opens the window for defining start and end date:** Points to the Select period button.
- Displays all records of the database:** Points to the View all button.
- Allows to export data in ASCII text format or MS-Excel format:** Points to the Export button.
- Delete selected records from the database:** Points to the Delete button.

Graphs

The content of the *Data log* database can be shown in the form of a graph (strip-chart). In this way it is possible to have immediately a global idea of the trend of the most important measures, or to compare on the same graph two measures taken from two different part of the plant.

To open the graph window click on *View-Graph* menu or use the correspondent icon on the toolbar.

The operation criteria of this graph is very similar to on oscilloscope. The X-axis (horizontal) represents the time. The horizontal scale is common to all shown traces and is indicated with sample date-time labels .

It is possible to plot up to 8 traces simultaneously, selecting them among the measures defined in *Data log*. The selection is done by the eight drop-down boxes, one for each trace color.

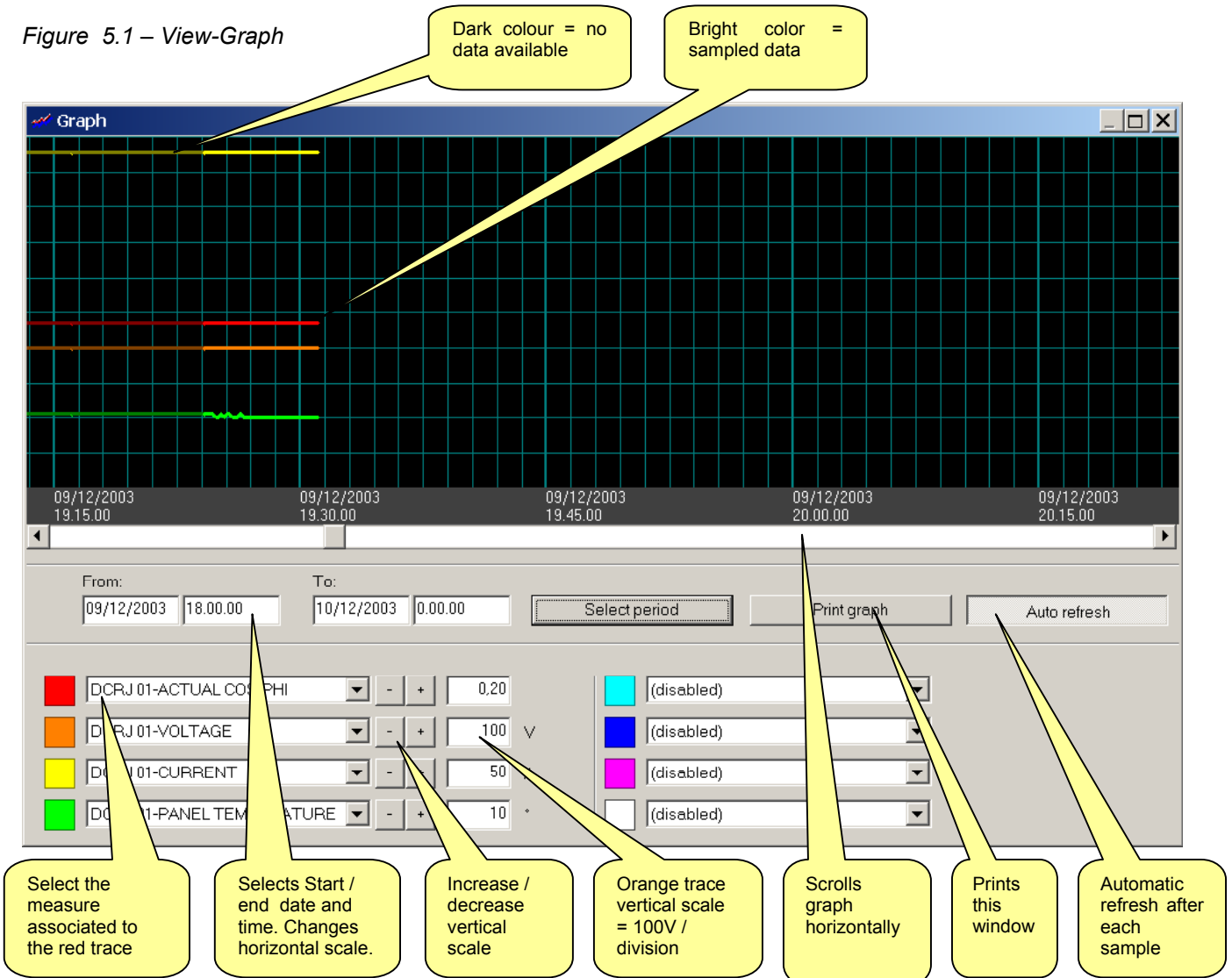
For each measure it is possible to modify the vertical scale using the + and – pushbuttons. The value of one measure in a certain moment can be calculated looking at the vertical scale division value (one square).

If , for instance, the vertical scale is 50V/division and the plot is about at 8 division, then the absolute value of the measure is about 400V. When looking at a graph of this type, it is more important to look at the trend of the measure rather than its absolute value.

The graph is 240 divisions wide per 10 division in height. When opened, the window is set to show data of the current date, that is from 00:00:00 of current day up to 00:00:00 of the next day (tomorrow). Using the *Select period* pushbutton it is possible to select a different period and also to change the horizontal scale resolution.

If in the database there is no data for a certain period of time (for instance because the software has been inactive) one straight line is drawn using a dark colour, connecting the two edges of the 'hole'.

Figure 5.1 – View-Graph



Event log

The event log window shows what happened to the system in the past, keeping trace of the last 40 events each of them with date and time reference. Events history is stored in non-volatile memory, so it is kept even without power supply.

Events include:

- Alarms begin and end
- Change of operation mode
- Change of setup parameters
- Remote communication on/off
- Power supply on/off
- MAX values update
- Reset of Max values

The screenshot shows a window titled "Event log - D001 01" containing a table of event logs. The table has four columns: "Event number", "Date", "Time", and "Event". The "Event" column contains codes and descriptions. Below the table are four buttons: "Delete", "Export", "Print", and "Exit". Callouts provide detailed information about each element.

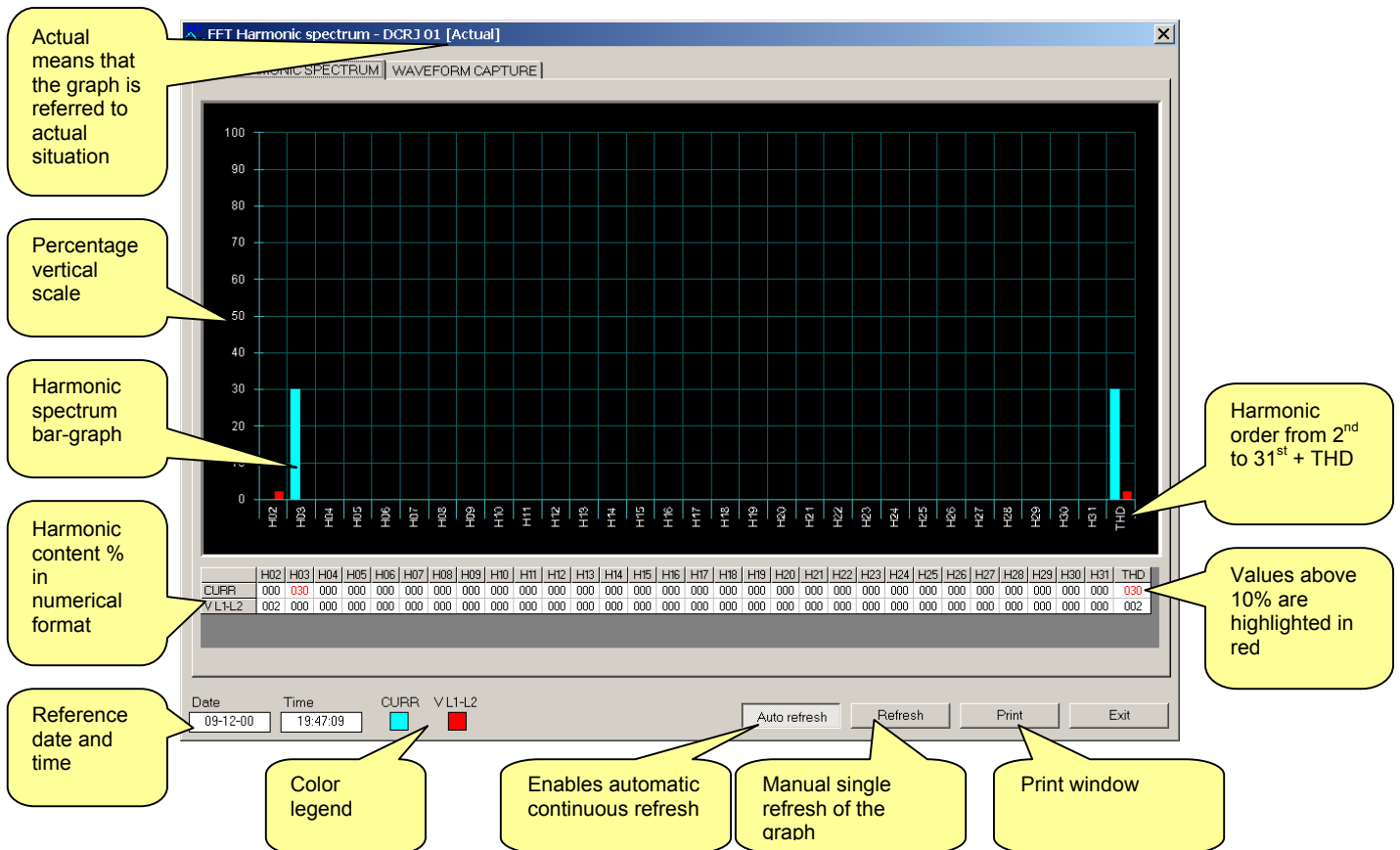
Event number	Date	Time	Event
22	12-09-03	16:25:02	[001] - Auxiliary power on
23	12-09-03	16:25:04	[016] - Remote communication active
24	12-09-03	17:55:40	[018] - Access to setup menu from remote control
25	12-09-03	17:55:40	[015] - System reset (warm boot)
26	12-09-03	17:55:42	[016] - Remote communication active
27	12-09-03	18:00:23	[015] - System reset (warm boot)
28	12-09-03	18:00:24	[016] - Remote communication active
29	12-09-03	18:34:44	[017] - Remote communication broken
30	12-09-03	19:03:17	[016] - Remote communication active
31	12-09-03	19:05:05	[017] - Remote communication broken
32	12-09-03	19:10:53	[016] - Remote communication active
33	12-09-03	19:12:01	[017] - Remote communication broken
34	12-09-03	19:16:31	[016] - Remote communication active
35	12-09-03	19:17:37	[017] - Remote communication broken
36	12-09-03	19:24:35	[016] - Remote communication active
37	12-09-03	19:40:15	[018] - Access to setup menu from remote control
38	12-09-03	19:40:15	[015] - System reset (warm boot)
39	12-09-03	19:40:16	[016] - Remote communication active
40	12-09-03	19:40:24	[004] - Switched to AUT mode

Buttons and their functions:

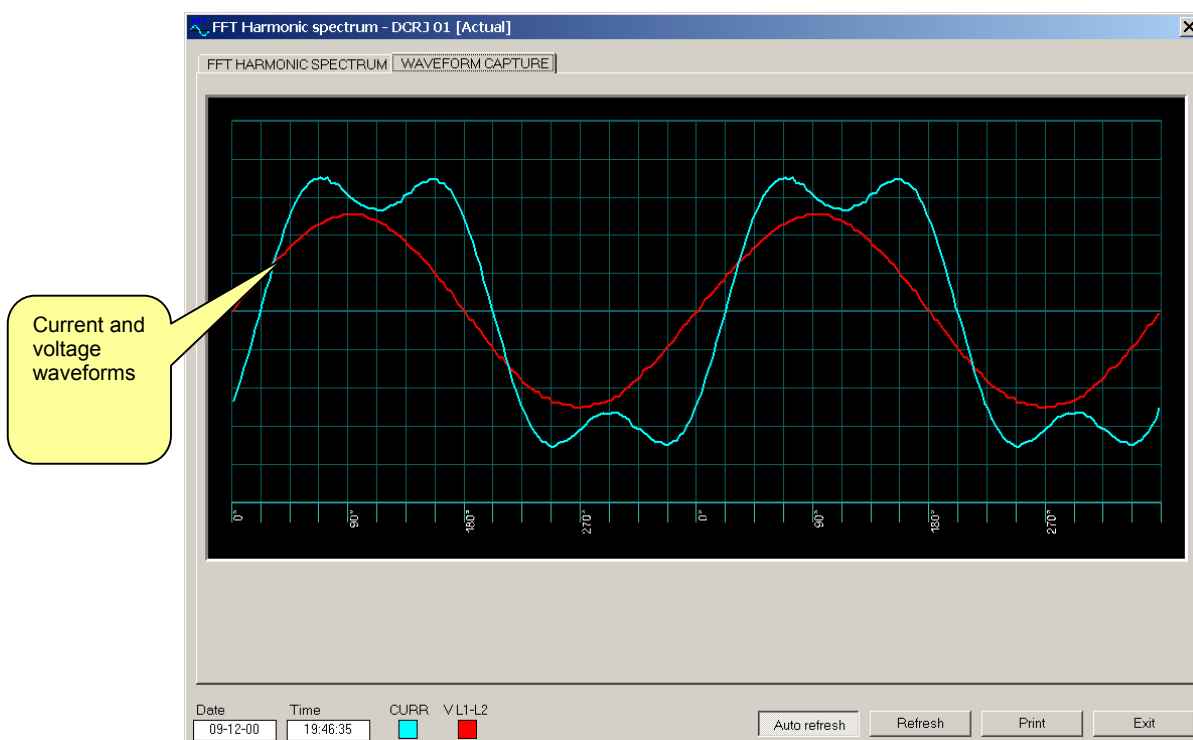
- Delete:** Clear events history. Available only after entering the password.
- Export:** Export to ASCII file.
- Print:** Print event history.
- Exit:** Close Event log window.

FFT Harmonic spectrum

This function allows to view in real time the FFT analysis of the voltage and the current. Harmonic content from the 2nd to the 31st harmonic are shown plus the THD, in numerical and graphical format.



On the second tab of the window it is possible to display the actual voltage and current waveforms, shown like on an oscilloscope. Graphs and waveforms are refreshed about once a second.



Harmonic events

This window displays the harmonic events captured in the last week ,one harmonic event each day from Event-0 (today) , Event -1 (yesterday) up to Event -6 (six days ago). In the last position, a panel titled EVENT-HI shows the highest value event ever recorded.

Using the appropriate Function setup parameters it is possible to define which measure triggers the harmonic event, the threshold and the delay time (see DCRJ manual for more details).

For each harmonic event it is possible to see:

- Date and time of the event
- Maximum value
- Total duration along the day
- FFT harmonic analysis
- Waveforms capture

The screenshot shows a software window titled "Harmonic events - DCRJ 1". It contains a table of harmonic events and two columns of graphs. Callouts provide the following information:

- Today harmonic event:** Points to the "EVENT-0" row.
- Date, time, max value and total duration:** Points to the input fields for "EVENT-0".
- Double-clicking will zoom the graph:** Points to the "FFT HARMONIC SPECTRUM" graph for "EVENT-0".
- Scroll bar to view the harmonic events below:** Points to the vertical scroll bar on the right side of the window.
- Harmonic event of three days ago:** Points to the "EVENT-3" row.
- Color legend:** Points to the "CURR" (cyan) and "VL1-L2" (red) indicators at the bottom.
- Clears whole harmonic event memory. Available only after entering the password:** Points to the "Delete" button.
- Refresh whole window:** Points to the "Update" button.

Tools menu

Capacitor test

The *Capacitor test* function has been provided to facilitate testing of the PFC panel by manufacturers of this type of panels. The test consists in a cycle during which all the steps available are activated one by one and their effective measured power is checked comparing this with that set in the setup parameters.

This test comprises:

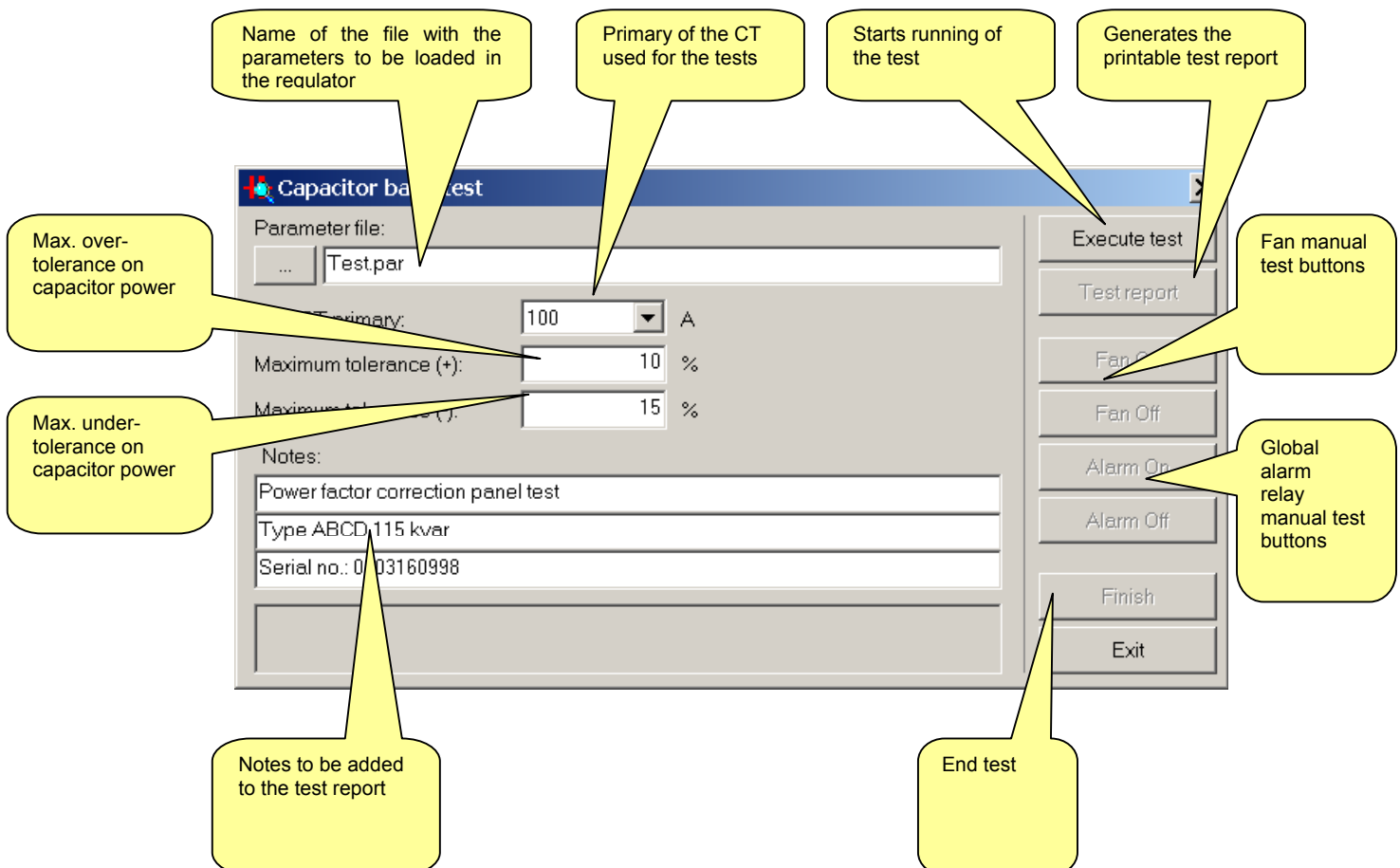
- Check on of the correctness of the connections to the regulator
- Check on functioning of the entire circuit of each step (internal relay, wiring, contactor, fuses, etc.)
- Check on the power of the banks of capacitors, defining the permitted tolerance
- Automatic loading of a file with all the settings defined for a particular type of panel.
- Printout of a test report

Procedure to run the capacitor test:

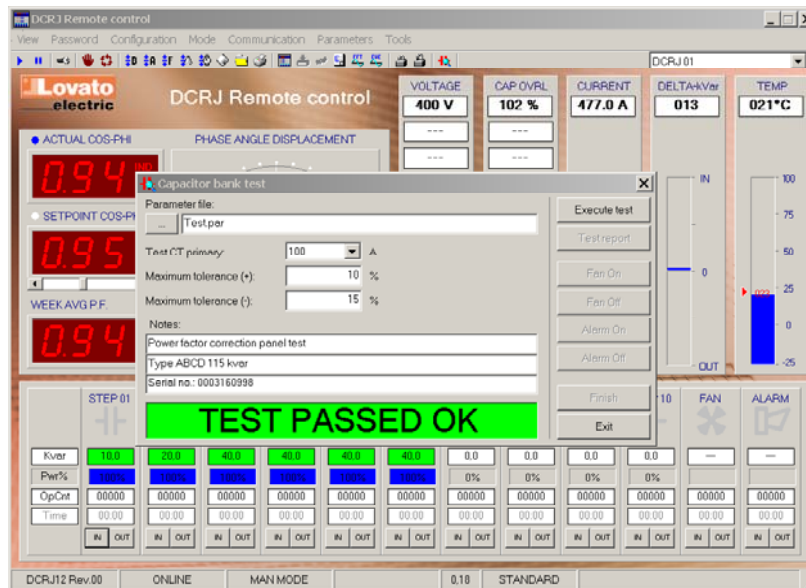
1. Prepare a file with suitable setup parameters for the type of panel to be tested, containing the data of the steps (smallest power step, nominal voltage, coefficients of each step). Once you have created this file, it can be re-used for other panels with the same characteristics.

Note: It is not necessary to set the value of the primary of the CT (parameter P.01) in this file as this parameter is not used in the test phase. For example, if you intend to use the *Fast setting of the CT* function (see DCRJ operations manual), P.01 can be left set to OFF.

2. Prepare a complete, powered electrical panel with an external CT connected to the ammeter inputs of the DCRJ so that the variations in reactive power imposed by activation of the steps can be read by the regulator. The CT connection sense must be checked manually (only the first time the test bench is prepared) since during the test phase the automatic CT connection recognition is not active.
3. Activate the capacitor test by clicking on the *Instruments-Capacitor test* menu. The window shown in the figure below will be displayed.



4. Specify the name of the file to be loaded (point 1.) in the *Parameters file* box.
5. Specify the primary of the CT used for testing in the *Test primary CT* box
6. Specify the permitted percentage tolerance on the measured power of the capacitors. To pass the test, the power on all the banks of capacitors, compared with the nominal power specified in the file, must be within these margins.
7. Compile any notes to be added to the test report, such as total power, serial number etc.
8. Click on *Run test* to start the test. The software will load the parameters required in the DCRJ, and connect each bank for a few seconds, measuring the reactive power generated. The result of the test will be displayed in the main window. For each step, a green box will indicate that the value is within the parameters while a red box will indicate that the power is not correct.
9. If steps programmed as fan or global alarm are specified in the file, these can be checked manually using the specific buttons.



10. At the end of the test, if this has been passed, you can generate a test report by clicking on *Test Report*.
11. The test report can be printed (to attach it to the panel) or saved in a file.

Keyboard lock-Unlock

Using this function it is possible to lock or unlock the front panel keyboard of the device, preventing unauthorized access to setup settings, memory clearing etc. (see DCRJ operation manual).

Reset menu

By means of the Reset menu it is possible to clear various items stored in the non-volatile memory of the DCRJ. The Reset menu is available only after entering the password.

Items that can be cleared are:

- Measures MAX values
- Weekly average power factor memory
- Steps operation counters
- Steps working time
- Event log memory
- Harmonic event memory

In case the DCRJ *Step trimming* function is enabled, it will be possible to restore the steps original power (set in the base setup) using the dedicated command Restore step original power.