



LOVATO ELECTRIC S.P.A.

24020 GORLE (BERGAMO) ITALIA
VIA DON E. MAZZA, 12
TEL. 035 4282111
TELEFAX (Nazionale): 035 4282200
TELEFAX (International): +39 035 4282400
Web www.LovatoElectric.com
E-mail info@LovatoElectric.com

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DMK40 DATA-LOGGER

SOFTWARE MANUAL

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Introduction

Using the DMK40 series multimeter data setting and acquisition software, you can:

- Set the measurements to be sampled according to sampling time.
- Display the data unloaded by the DMK40 in MS-Access format.
- Display the measurements in graphic format.
- Convert the MS-Access tables acquired by the DMK40 multimeter in ASCII or MS-Excel text format.
- Plot graphs of the measurements sampled.
- Display a 'virtual' representation of the front panel of the multimeter with the possibility of accessing all the measurements and of activating the buttons.
- Display and modify the set-up parameters of the multimeter with the possibility of saving the settings on disk, of recalling and printing these.
- Change the language of the program menus and commands selecting either Italian or English.

Minimum resources of the PC

- Windows® 95/98/2000 operating system
- Graphic card with a minimum resolution of 800x600; 1024x768 or higher is recommended
- A free standard RS232 serial interface (COM:)
- 64Mb of RAM
- Pentium® class or higher processor
- CD-ROM drive for installation

Installation

For installation, 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.

The software is delivered on a CD with two different installation procedures. The standard installation procedure used with the first releases of the Win 95 and 98 operating systems is held in the *Setup1* directory. The *Setup2* directory contains a new installation procedure for the latest releases of the Win 98 operating system and for Win 2000.

Setup1:

1. Close all applications running
2. Insert the CD in the drive
3. From the Setup1 directory, start the Setup.exe program
4. Press the button with the PC icon to start the installation procedure.
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 provided. If a message is displayed indicating that there are more recent files present on the PC than those being installed, maintain the files already present (answer YES or 'keep' to the prompt)

Setup2:

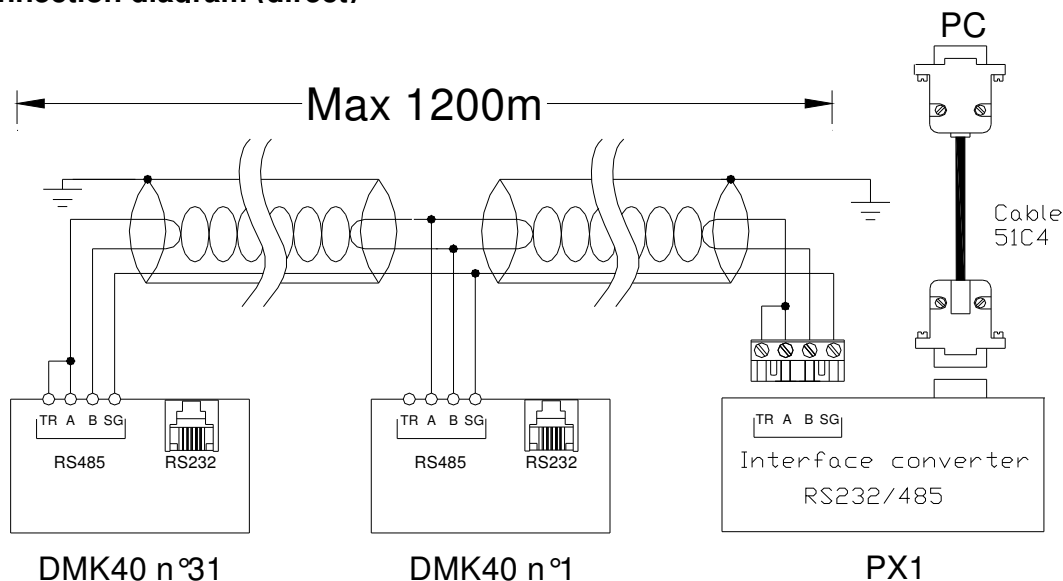
1. Close all applications running
2. Insert the CD in the drive
3. From Setup2 directory, start the Dmk.msi program
4. If your PC does not recognize the .msi (microsoft installer) files, start the InstMsiA.exe program and then go back to point 3.
5. A window is displayed asking you to specify the directory in which you want to install the program. To change the directory, enter the new name in the specific box.
1. If rebooting of the system is requested following installation, carry out the procedure

Activation of the PC - DMK connection

To run the program, the PC and the DMK multimeters must be able to exchange data on the serial link. To activate the connection, carry out the following operations:

1. Make sure that the PC you intend to use has an available and free RS-232 serial interface port. The serial ports are usually identified with the COM: code and usually range from COM1: to COM4: even though most of the PCs available on the market have only two serial ports (COM1: and COM2:) which can be identified by their 9-pin male receptacle connector. To use the program, you must first of all identify which port of your PC you intend to use; remember that, in some cases, one of the serial ports may already be occupied by the mouse
2. Configure the software for use of the port selected; you can do this during the initial installation phase or subsequently using the *Configuration-Options-General* menu (see the specific paragraph). The default serial port is COM1: set to 9600 baud, no parity.
3. Set up the RS-485 network, i.e. connect the Rs232/Rs485 converter to the PC and then all the multimeters to each other and to the converter as indicated in the *Connection diagrams* paragraph below. Comply scrupulously with the polarity of the Rs485 cables.
4. We recommend use of a Rs232/Rs485 converter furnished by Lovato. If you intend to use another type of converter, Lovato will be unable to provide assistance in the case of wiring problems and to assure correct functioning of the 485 network. In any case, the converter must be insulated and must have an enable line automatic control circuit.
5. From the keypad of each multimeter, access the parameters of the serial interface (see the *Addendum* to the manual furnished with the appliances) and set a different serial address for each DMK starting from 01 onwards. Check that the speed and parity settings all the multimeters match those of the PC.
6. At this point, you can run the program. If the wiring and the settings are correct, the connection with the DMK 01 will be activated automatically.

Connection diagram (direct)



In the case of problems...

If the connection does not work (when you try to switch to Online, the program issues a beep and switches automatically to Offline), check the following points carefully:

- The number of the COM: port of the PC used must match that programmed in the *Configuration-Options-General-Serial port settings* window.
- If several DMK are connected, they must be programmed with different serial communication addresses (01, 02, 03 etc.). To set the serial communication address of the DMK, program parameter P.41.
- The communication speeds set on the PC and on the DMK must match. For the PC, the speed is selected in the *Configuration-Options-General-Serial port settings* window while, for the DMK, it is selected with parameter P.42 (see *Addendum*).
- The connection polarity of the DMKs and of the converter to the RS-485 bus must be correct (all the A terminals on one conductor and all the B terminals on the other).

- The maximum distance between the two most distant devices on the RS-485 bus must not exceed 1000m.
- All the converters must be correctly powered and configured (see the instructions sheets attached to the appliances). In particular, the PC side converter must be programmed in automatic switching mode (data).

Basic principles

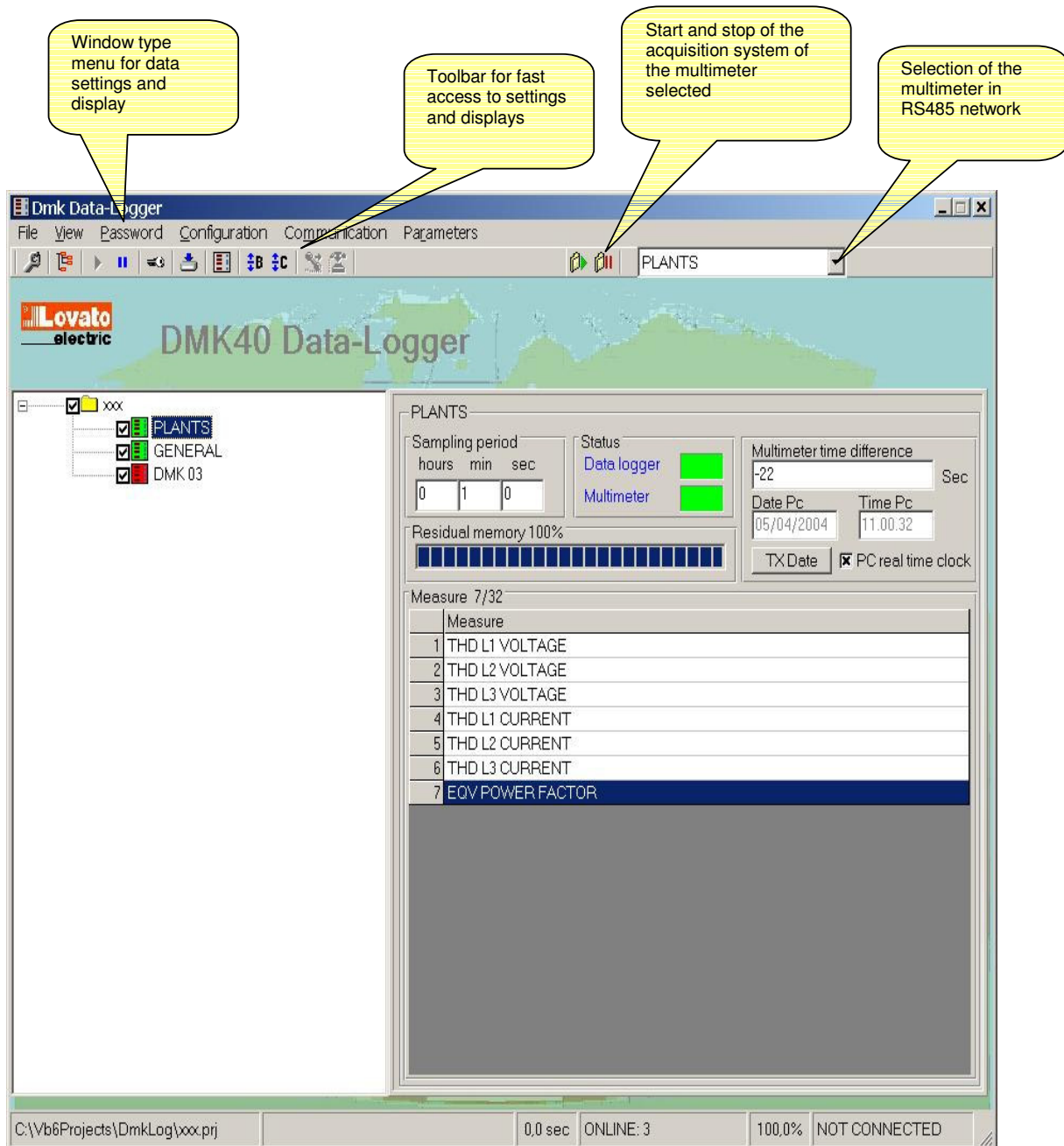
To function correctly, the data logging system must be set correctly and this setting must be transferred to the multimeter (on the RS232 link) or to the network of multimeters connected in the RS485 network. The data saved in the flash memory of each multimeter can be recalled and saved in an MS-Access format project file and converted into other formats (ASCII or Excel).

The graphs of each individual measurement can be displayed and printed.

Main window

The main window of the program contains all the menus and the toolbars for access to the various functions. As they may modify the configuration of the software, some of these functions are protected by a password and are therefore disabled when the program is started. The main window is illustrated in the figure below showing the most frequently used controls.

Fig 1.1 – Main window



System configuration

To configure a data logging system, a project must be opened or a new project must be created.

To do this, open the 'File' window and select New or Open. Create or open the file required. The file opened is in Ms-Access format and contains all the information regarding the data logging system.

To access configuration, enter the password which, after installation of the program is, by default, *LOVATO*. Click on the password menu, enter Lovato and then confirm with OK.

System configuration is a very important phase as regards definition of software functioning. In particular, if several multimeters are connected, attention must be paid to programming the parameters of each DMK connected to the network.

Before explaining the various functions of the program, the configuration window is illustrated below listing the function of all the settings. A more detailed explanation of the purpose of each setting will be provided in the following chapters.

Fig. 2.1 - Configuration-Options-General

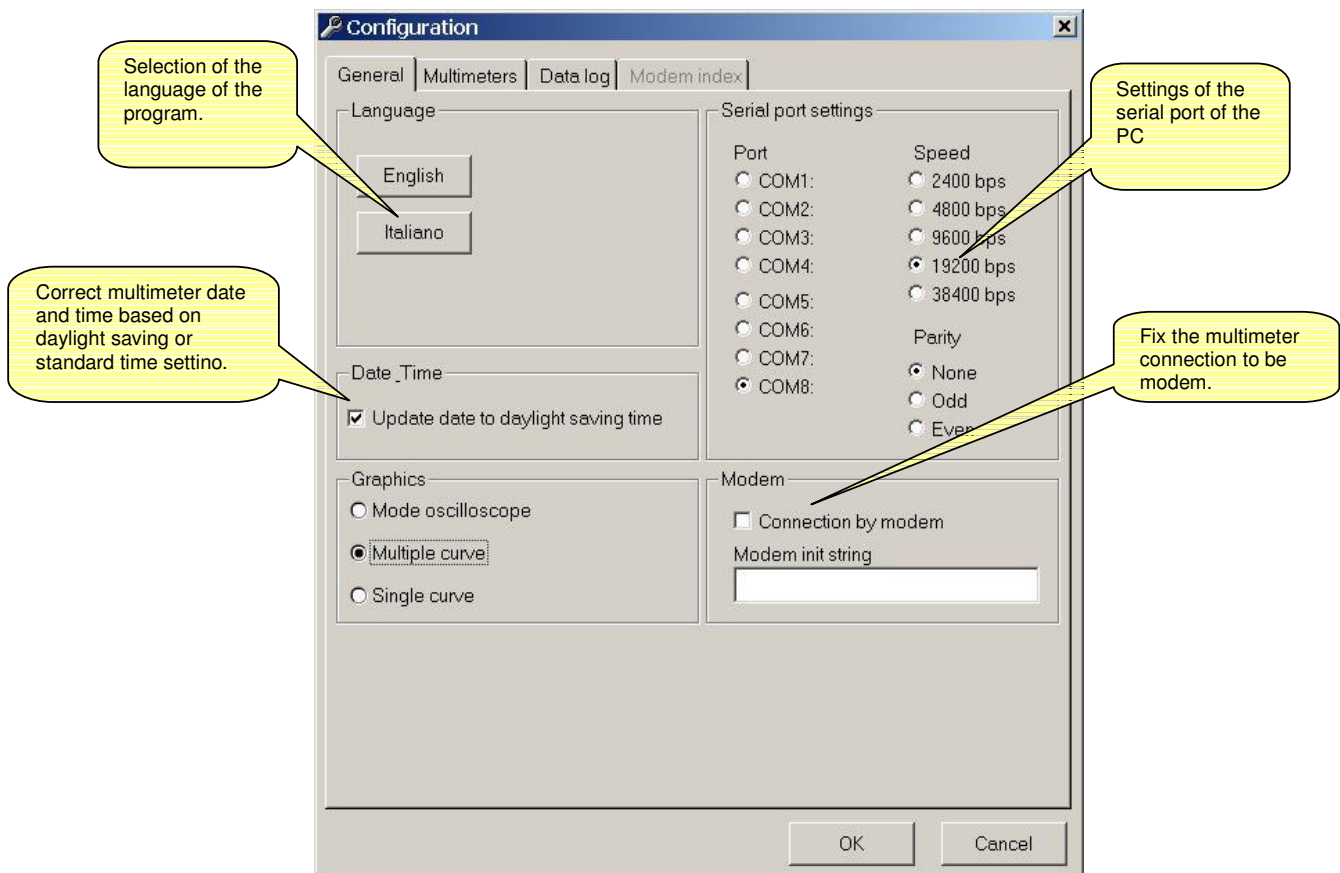
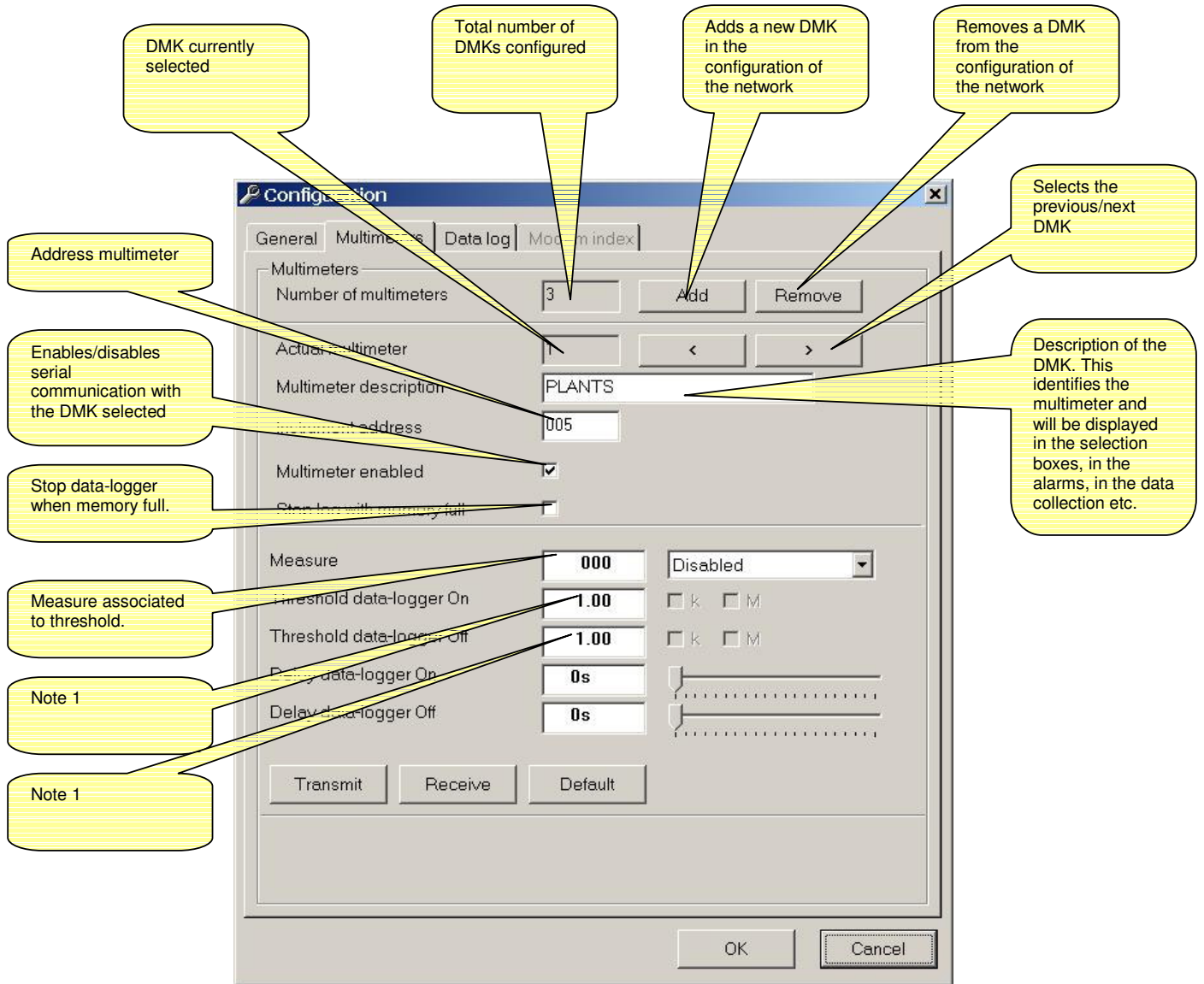


Fig. 2.2 - Configuration-Options-Multimeters



Note 1: For example if threshold 1 is greater than threshold 2, the datalogger begins recording when threshold 1 is exceeded. When the value of the selected measure is less than threshold 2, the datalogger is stopped. The two thresholds can be inverted. In that case, the datalogger will trigger when the value of the selected measure is less than threshold 1 but when it increases to greater than threshold 2, the datalogger will stop. If the selected measure indicates all three phases, it is sufficient the measure value of one of the three phases is greater than threshold 1 to trigger the datalogger. The same procedure is done to stop the datalogger.

Fig. 2.3 - Configuration-Options-Data collection

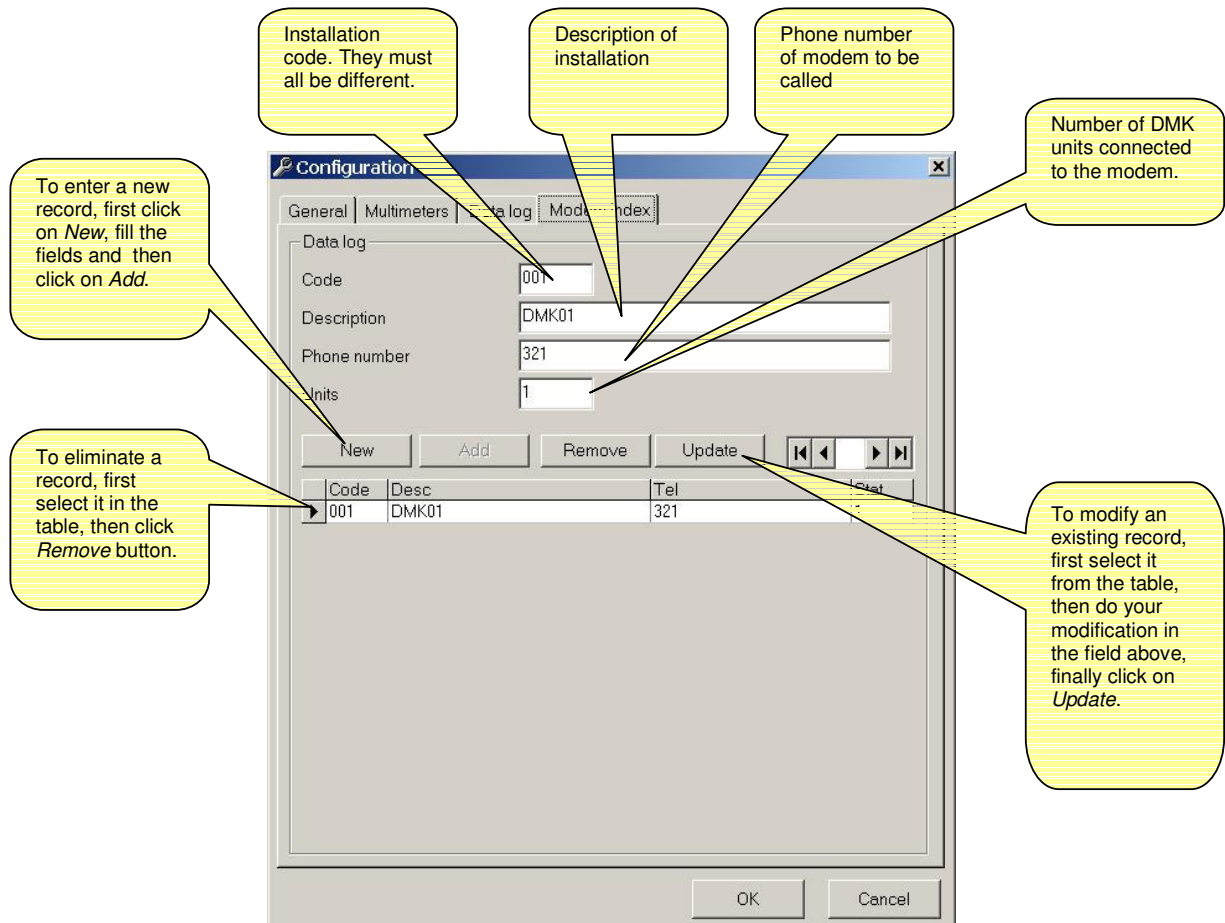
The screenshot shows the 'Data log' configuration window with the following settings and callouts:

- Sampling period:** 0 h, 0 min, 5 sec. Callout: "Interval of time between saving of one record and the next".
- Synchronize with PC clock:** . Callout: "If this checkbox is selected, the energy samples will be carried out in synchronization with the real-time clock of the PC. For instance, if the sampling time is 1 hour, the sampling will be done at 0:00, 1:00, 2:00 etc. If this checkbox is not enabled, the sampling could be done at 0:33, 1:33, 2:33 etc." and "View the DMK real time clock." (pointing to the PC Time field).
- Time to memory full:** 2 Days, 15 Hours. Callout: "Time used by the memory to be filled according to the set measures and the sampling time." and "Setup Real time clock of DMK" (pointing to the DMK Time field).
- Select multimeter:** DMK 01. Callout: "Selects the multimeter from which to sample".
- Select measure:** L1 PHASE VOLTAGE. Callout: "Selects the data item to be sampled".
- Measure list:**

1	EQV. PHASE-TO-PHASE VOLTAGE
2	L1 CURRENT
3	L2 CURRENT
4	L3 CURRENT
5	EQV. ACTIVE POWER
6	EQV. REACTIVE POWER
7	EQV. APPARENT POWER
8	EQV. POWER FACTOR
9	ACTIVE ENERGY - IMPORT
10	REACTIVE ENERGY - IMPORT
11	FREQUENCY
- Buttons:**
 - Add:** Callout: "Eliminates the item selected from the list. Note: if a field is eliminated from the structure of the Data collection database, the currently saved record is lost".
 - Remove:** Callout: "Eliminates the item selected from the list. Note: if a field is eliminated from the structure of the Data collection database, the currently saved record is lost".
 - Transmit:** Callout: "Transmits the settings made. Note: on transmitting the settings, all the data saved in the DMK40 will be lost".
 - Receive:** Callout: "Receives the settings saved in the DMK40".

Figure 2.4 - 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 DMK 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.



Important note:

Normally the user connects its DMK network to the PC without modem. This allows to configure each multimeter, defining the name, the full-scale value for all the measurements etc (this are the configurations that are entered in the *Configuration-Options-Multimeters* window, see figure 2.2).

When using modem connection, all this setting can be used only if the remote connection is done always to the same DMK network, that is, if there is only one record in the *Modem index* because the user dials always the same number. In this case, the couple of modems are used to reach a longer distance, but the communication is the same as for direct connection.

The concept changes if there are more than one DMK networks in the field. In this case, each network may be different from the other, having different number of DMKs, working with different voltage etc.

The user can select one installation, connect to it and see the DMK status, then disconnect and dial another phone number to connect to another DMK network.

Display menu

Data collection

The variables defined in the *Data collection* configuration page (Fig. 2.3) are unloaded from the multimeter by pressing the 'Start Rx data' key. The same data are saved in an Ms-Access format database.

The data collected can be displayed in table form with the *Display-Data collection* menu or clicking on the matching icon on the toolbar.

Fig. 3.1 – Display-Data collection

The screenshot shows a window titled 'Data... 00068' containing a table of data. The table has the following columns: Date, Time, VL1 [V], VL2 [V], VL3 [V], VEQV [V], and Hz [Hz]. The data rows show a consistent pattern of values for VL1, VL2, VL3, and VEQV, and a constant value of 50.0 for Hz. Below the table is a toolbar with buttons for 'Select period', 'View all', 'Export', 'Delete', 'Start Rx Data', and 'Graph'. The status bar at the bottom indicates '68/1 records' and '12 sec'.

Callouts provide the following information:

- Sampling date and time:** Points to the Date and Time columns in the table.
- Number of records selected:** Points to the '68/1 records' status bar.
- Values of the variables sampled:** Points to the VL1, VL2, VL3, and VEQV columns.
- Display period selected. Extracts the values within a specific interval of time from the database.** Points to the 'From' and 'To' date/time fields.
- Opens the window for specification of the interval of time to be selected** Points to the 'Select period' button.
- Displays all the record of the database** Points to the 'View all' button.
- Permits export of the data selected in ASCII or Excel text files** Points to the 'Export' button.
- Deletes the data selected from the database** Points to the 'Delete' button.

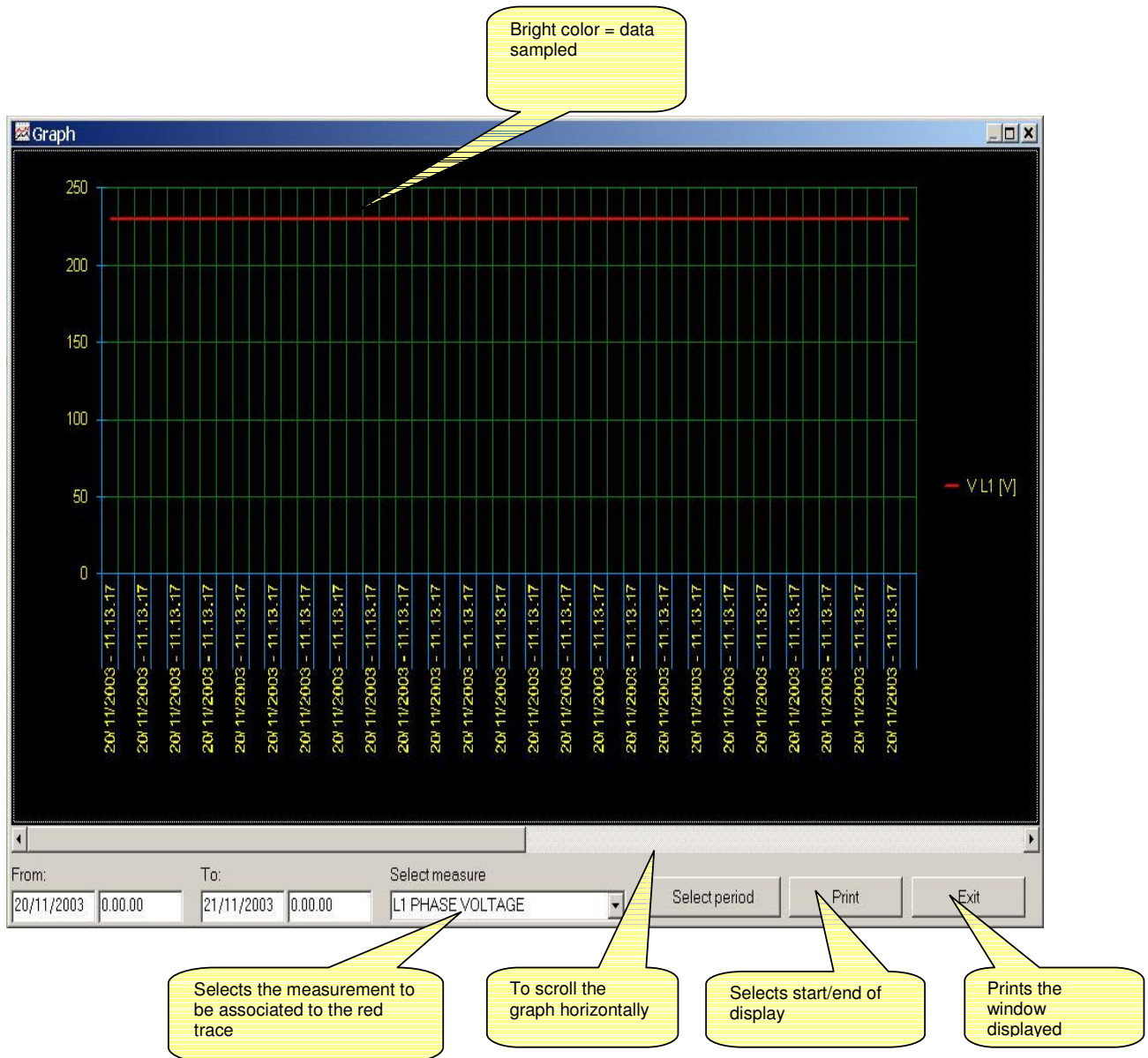
Graphs

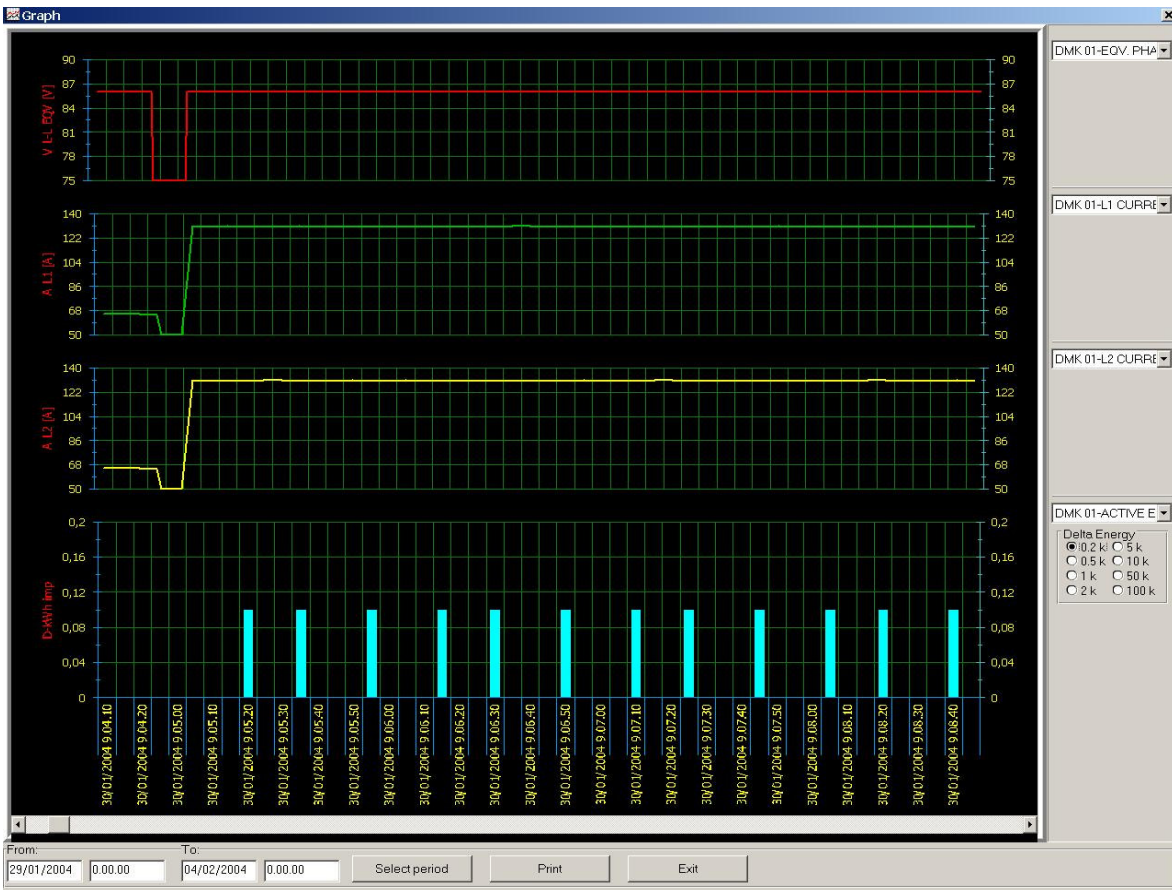
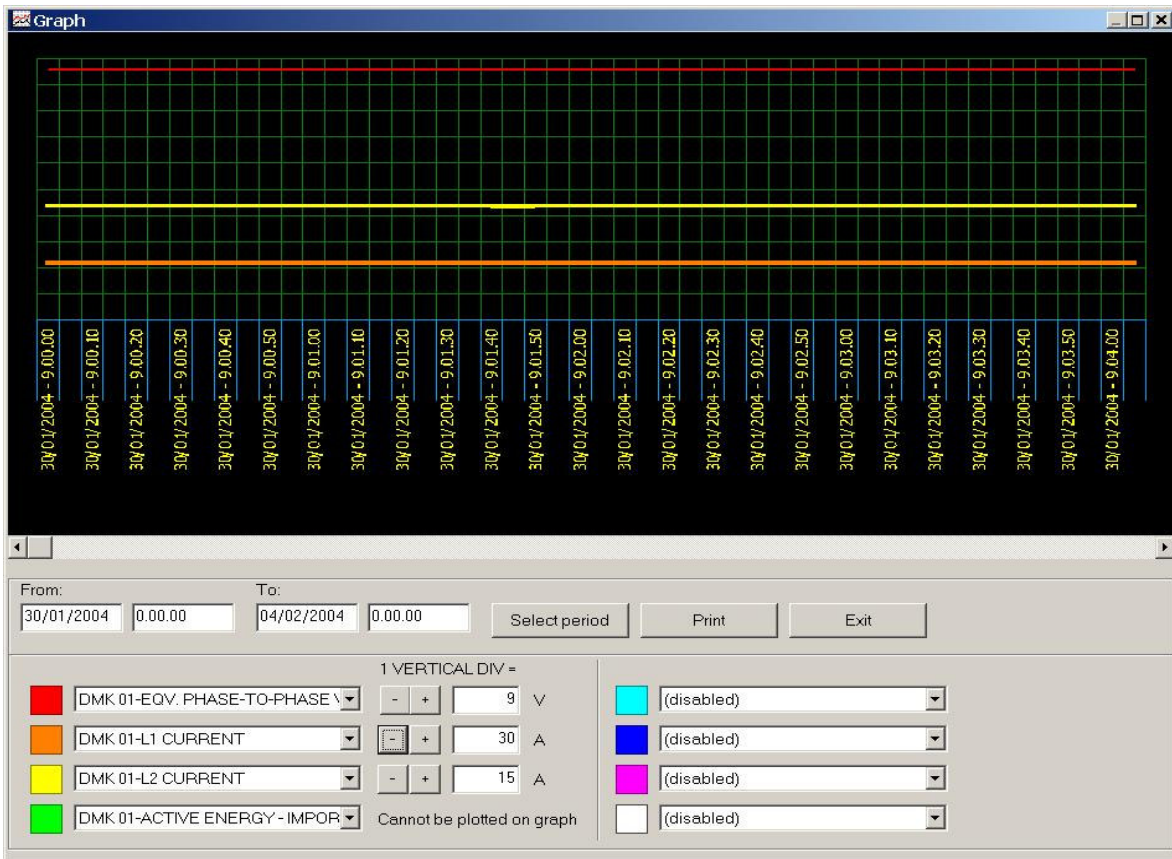
The data collected in the *Data collection* databases can be displayed in the form of graphs (trend). This provides an immediate view of the trend of the most important measurements or the possibility of comparing the values of two different parts of the system in the same graph. To open the window of the graph, select the *Display-Graph* menu or click on the matching icon of the toolbar.

This type of graph is very similar to that of an oscilloscope. The time is indicated on the X (horizontal) axis. The horizontal time scale is common to all the measurements displayed and is shown with indication of the sampling date and time.

Using the specific *Select period* button, you can select the display start and end period.

Fig. 5.1 – Display-Graph





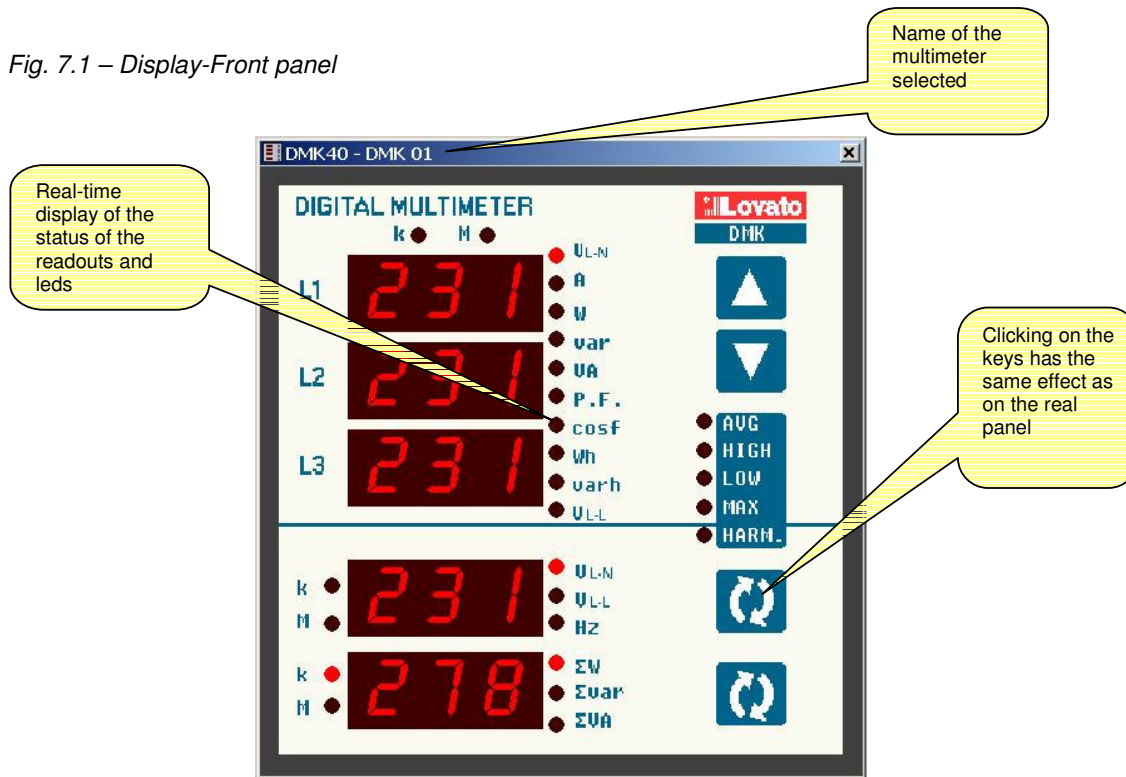
Front panel

You can display a 'virtual' representation of the front panel of the DMK on the monitor of the PC using the remote control software. When you access this window from the *Display-Front Panel* menu, the front panel of the DMK is shown, with real-time display of the readouts and leds in their current status. Clicking with the mouse on the keys, you can select the measurements and functions in the same way as on the physical multimeter. However, you cannot access those functions (such as parameter programming, reset counters, etc.) that require simultaneous pressing and/or holding down of the keys.

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.

Fig. 7.1 – Display-Front panel



Password

When the program is started, some of the functions are disabled. You can enter the password that permits access to all the functions, in particular those listed below, from the *Password* menu:

- Modification of the settings of the remote control
- Modification of the password
- Elimination of records from the *Alarms* and *Data collection* databases
- Access to the page editor
- Modification of the setup parameters of the DMK connected

Fig. 8.1 – Password



At the time of initial installation, the password is *LOVATO*. You can record a new, personalized password subsequently, clicking on the *New password* button and then entering the new password you have chosen twice consecutively.

Fig. 8.2 – New password



Communication menu

Online

The *Communication-Online* menu allows to re-establish the serial link after it has been stopped by the user with the Offline command. When clicking Online, the software executes a complete scan of all configured DMK, to verify their status.

Offline

With communication-Offline the user has the possibility to temporarily suspend the serial communication link between the PC and the DMK network.

This command is to be used when, for instance, it is necessary to modify the network wiring or when DMK are to be switched off. The System Offline status is displayed on the main page Toolbar (at the bottom of the main window).

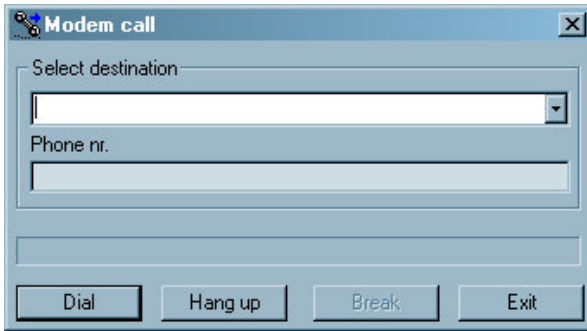
The system passes automatically in Offline mode when the user opens the *Configuration* window.

Modem Call

To connect to one or several DMK via a couple of modems, it is necessary to select the Modem connection checkbox in the *Configuration-Options-General* window. Selecting modem communication will automatically change the communication protocol used by the software, from the standard Modbus RTU to Modbus ASCII, which can be used with modems. From the user point of view, the difference between those two protocols is only a little slower speed in case of the ASCII protocol, due to its length that is double than the RTU and the modem modulation that requires also a certain amount of time.

When the program is configured for modem communication (see *Configuration-Options-General* window) it automatically shows the modem call dialog after it has been started, because it is not possible to communicate with the DMK before dialing the phone number of the remote modem. The same window can be opened manually using *Communication-Modem call* menu or the dedicated pushbutton on the toolbar.

Figure 8.3 - Communication-Modem call



Once the window illustrated has been opened, from the pull-down box choose the name of the installation with which you want to be connected. The names entered in the *Modem index* during configuration will be displayed. Once the choice has been made, the corresponding phone number appears in the box below. Click the *Dial* button to start the connection procedure.

At this point the program will instruct the modem to make the call. While waiting, the sliding blue bar of the maximum time allowed for making the connection will be seen (1 minute). The modem called will take the line and exchange the usual handshaking messages with the answering modem. At the end of this procedure, if everything has been carried out correctly, the PC status bar will show a message informing the user that connection has taken place and the program will switch automatically to the *Online* mode. If any errors occur, carefully check the connections and if necessary follow the *Troubleshooting guide* given in appendix A of this manual. Normally connection is not critical since very common and absolutely standard procedures are used. With the *Break* button it is possible to block the calling procedure, while *Hang up* ends a communication already in progress.

Hang up

This command interrupts a modem connection, closing the telephone line. It is the equivalent of hanging up the handset in an ordinary phone call. It is carried out automatically every time you exit the program.

Parameters menu

You can view and modify the setup parameters of the multimeters from the specific *Parameters* menu. This method of accessing DMK settings is handier and more immediate compared with direct access from the front keypad of the multimeters as, using the PC; the following are displayed:

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

The parameters have been grouped in four menus that reflect the organization described in the operations manual and in the Addendum of the DMK. The following four menus are available:

- Basic setup (basic settings such as CT, VT ratio, etc.)
- Advanced setup (settings of the digital outputs)
- Capacitor overload setup (parameters relating to the capacitor protection function).

Basic setup

Fig. 9.1 – Parameters-Basic setup

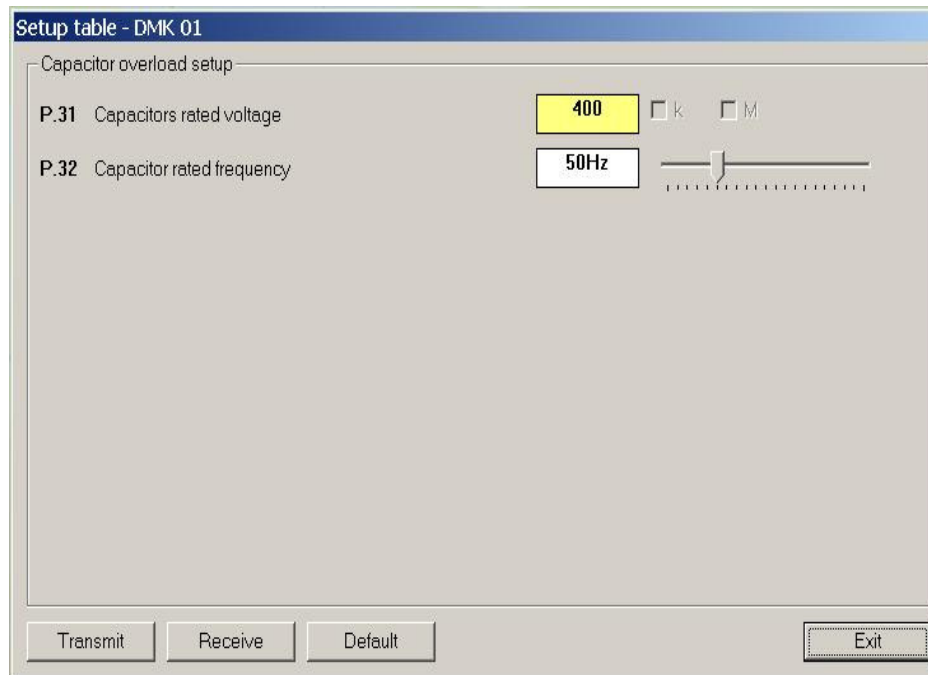
The screenshot shows a software window titled 'Setup table - DMK 0'. It contains a list of parameters (P.01 to P.07) with their descriptions, numeric values, and graphical controls. Callouts provide detailed explanations for each element:

- Code of the parameter:** Points to the parameter ID (e.g., P.01).
- Description:** Points to the parameter name (e.g., CT ratio).
- Numeric value of the parameter:** Points to the value field (e.g., 1.0), noting it is highlighted in yellow if different from the factory default.
- Graphic bar:** Points to the slider control for parameters P.01, P.02, P.03, and P.04.
- Drop-down box with possible options:** Points to the dropdown menus for P.05 (Wiring system), P.06 (Frequency acquisition), and P.07 (Harmonic analysis).
- Transmits the values displayed to the DMK and saves them. Enabled only with password:** Points to the 'Transmit' button.
- Receives the values from the DMK and displays them in the window:** Points to the 'Receive' button.
- Resets the factory default values:** Points to the 'Default' button.
- Closes the setup window:** Points to the 'Exit' button.

Code	Description	Value	Control Type
P.01	CT ratio	1.0	Slider
P.02	VT ratio	1.0	Slider
P.03	Max power integration time	15min	Slider
P.04	Average filter	10	Slider
P.05	Wiring system	003	Drop-down (Three-phase)
P.06	Frequency acquisition	000	Drop-down (Aut)
P.07	Harmonic analysis	001	Drop-down (On)

Capacitor overload setup

Fig. 9.3 – Parameters-Capacitor overload setup



Save-Load-Print

You can save the values of the setup parameters (of all four menus) on your hard disk in ASCII text file for fast, easy reloading in another multimeter. This function is particularly useful when programming a set of multimeters with the same settings or when you want to file the original settings of a system. To save the parameters on disk, select the *Parameters-Save to file* menu and enter the name of the file. This type of file has an .PAR extension. To reverse the operation, i.e. to transfer a file from PC to the DMK, use the *Parameters-Load from file* menu.

Using the *Parameters-Print* menu, you can also print the settings and then file these together with the other documentation of the system

APPENDIX A – Connection modes

Connection via standard modem

To make a remote connection via a switched telephone line the use of a pair of modems is necessary. Lovato Electric guarantees correct operation of the connection using modems of the following type:

- 3-Com U.S. Robotics 56K model 5630

Though correct operation is possible also with modems of other types, in this manual all the configuration commands (variables depending on the manufacturer) and the connection diagrams will refer to the above-mentioned modem model.

Though very simple in conception, connection via modem requires that the installer have a minimum of experience concerning the problems connected with serial communication, modem programming, types of telephone lines, etc. In an attempt to simplify the configuration procedure as far as possible, we have subdivided the operations to be carried out in the following steps:

1. Modem configuration at the DMK end

From the DMK end the modem must be configured before it can be used. Configuration serves to implement the following functions:

- Disable the echo
- Set a communication speed (this must be the default speed for DMK also)
- Permanently store the two previous settings as default at switch on

To make these configurations, the modem to be connected to the RS232/RS485 converter will have to be momentarily connected to the PC with its standard cable. Then start the PM.EXE program (supplied together with this software) and press the *Program modem* button. Wait for the confirmation message and then disconnect the modem from the PC and connect it to the DMK. The PM.EXE program transmits the following configuration string to the modem:

AT E0 &N6 &U6 &W0 <CR> (commands valid for modem model 5630)

To select higher baud rates in the modem, digit Nx & Ux, whereas x is the rate code to be obtained. Take into account the rate to select is the one at the multimeter end.

If the program PM is used, the AT&Nx and AT&Ux string must be changed in the modem.txt file found in the same directory where the PM program is installed.

If the user is familiar with terminal emulation programs (such as Windows Hyperterminal) this programming can be done manually without the aid of the PM.EXE program. In this case, it will be necessary to set the serial interface at 9600 Baud, 8 bit, No parity, 1 stop bit and type in the above string from the keyboard. On pressing return the modem will answer with OK confirming that programming has taken place.

2. DMK configuration

Also the DMK needs a configuration to be able to converse with the modem.

- From the front panel of each DMK, enter the serial communication setup menu (see the DMK Addendum Manual)
- Check the serial address (parameter P.41). If several DMKs are connected to a RS-485 bus, set each of them with a progressive serial address starting from 001.
- On each unit, select the Modbus ASCII protocol (parameter P.44 set to ASC).
- If you want the DMK to answer when modem rings (modem without auto-answer) then set parameter P.45 to 001, only for the DMK with serial address 01.
- Otherwise, if you want the modem to answer automatically itself, then enable the modem auto-answer, setting its parameter S0 to 001 (with command ATS0=1 &W0) and leave the first DMK with P45 to 000.

3. System connection

- Connect the DMK-side modem to the RS232/RS485 interface converter using 51C9 cable.
- Connect the RS232/RS485 interface converter to the DMK network using a shielded twisted pair cable (see wiring diagram in the following page).
- Connect the second modem to the PC with the standard cable provided with the modem. The PC-side modem does not require any particular programming (it must be left at factory defaults).
- Connect both modems to the respective telephone lines. For the first tests you are advised to use two internal lines in the same office to keep the call under control.

4. Configuration of the DMKLOG program

- Start the DMKLOG program from the PC with the modem already connected and powered.
- Choose the *Configuration-Options* menu
- Set the *Connection via modem* box from the *General* table.
- If the *Modem Index* table is empty, enter a record with the name of the installation and the phone number corresponding with the telephone line of the modem connected to the DMK.
- Click on *OK* to close and save the *Options* window.

5. Online Connection

- Choose *Call with modem* from the *Communication* menu
- From the pull-down box choose the name of the installation to be called. The corresponding telephone number (previously loaded in the *Modem index*) will be shown in the box below.
- Click on *Dial*
- At this point, the modem at the PC end calls the DMK modem. After a few rings the DMK modem and the program switch automatically to the online mode.
- To end the connection, choose *Modem-Hang up* from the *Communication* menu

In the event of problems...

If during the attempted call the modem connected to the DMK does not 'ring', this means that the call fails to reach its destination. In this case, carry out the following checks:

- Try dialing the telephone number of the line to which the DMK is connected using a normal telephone. The modem called should give off sounds that ought to be heard in the handset. If this does not happen, there are problems on the telephone line or on the switchboard.
- Check that PC modem is powered and connected with the cable to the correct serial port (the one set in *Communication-Serial port*)

If the modem called rings repeatedly but the connection fails to be established

- Check the DMK programming (in particular about auto-answer, see previous point 2)
- Check modem programming (in particular about auto-answer, see previous point 2)
- Check the integrity and the polarity of DMK-Converter RS-485 twisted-pair cable
- Check the integrity of modem-converter cable 51C9
- Check if when the phone rings, the yellow LED on the interface converter blinks briefly. This means that the modem is sending the RING message to the converter and this is sending the message to the DMKs.