Operating Instructions for ELIT 4 & 8-Channel Ion Analysers

First Public Version CCR/HK/YYC 20 May 2003   Last Update: 06 Aprl 2016

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A) INTRODUCTION

This software is capable of recording up to 100,000 data points and can be used with any Windows operating system, including Win 10

Important: The software must run on the Windows' English platform, which uses a Decimal Point instead of a Comma to separate the decimals.
If the computer has been setup for using non-English platform, please change the Language to English (United Kingdom) in "Regional and Language Options".

The Ion Analyser can be connected to any type of Ion Selective, pH or Redox electrode which has a BNC connector. The software contains several Help files and on-screen hints and warnings which duplicates much of this manual and should enable the operator to perform the analyses easily and reliably.

For 4 Channel operation, **please ignore any references to channels 5 to 8**.

Please see separate **Electrode Operating Instructions** for details of how to use Ion Selective Electrodes

B) SOFTWARE INSTALLATION.

1) System Requirements

 300 megahertz or higher processor clock speed recommended; 233 MHz minimum required (single or dual processor system), Intel Pentium/Celeron family, or AMD K6/Athlon/Duron family, or compatible processor recommended
256 megabytes (MB) of RAM or higher recommended (128 MB minimum supported; may limit performance and some features)
500 MB of available hard disk space
Super VGA (800 W 600) or higher-resolution video adapter and monitor
CD-ROM or DVD drive
One free COM port
Keyboard and mouse are required.

2) Running Setup
a) Insert the software disc into the CD-ROM drive of your computer.
b) The installation (Setup) software should then run automatically – simply follow the on-screen instructions.   If the installation fails to start when you insert the CD, go to My Computer and double Click CD-ROM disc (Usually the D drive unless a second hard drive is installed) or Click on Start and then Run D:\Setup.exe, then follow the on screen instructions.
c) The running executable file for the 32 bit version is: 4-chan32.exe or 8-chan32.exe
d) When installation is completed you will be given the option to create a new icon on your desktop. Double clicking on this will start the programme.

C) Hardware Installation

C1) Connect the computer interface/ion analyser to the Serial (COM1) port of the computer using the cable provided.   Connect the mains adaptor to an appropriate power outlet.

For computers with no Serial port, a Serial/USB converter is included with the hardware. This must be installed according to the instructions in the appendix at the end of this document before the analyser is connected to the system.

C2) If you are using ELIT 8mm ISEs with ELIT 8mm Reference electrodes housed in ELIT electrode head system you must connect the electrodes to the interface using the BNC plug(s) attached to the electrode head(s). Similarly, any conventional combination electrodes must also be connected to the BNC conectors. However, if you wish to use separate conventional reference electrodes then these can only be used for channels 1 to 4 and must be plugged into the 2mm jack-plug sockets provided.

C3)   If simultaneous pH and ISE measurements are required in the same solution then the ISE must be connected without a separate reference electrode. In this case both the ISE and the pH voltage is measured relative to the internal reference system of the standard combination pH electrode.

But note that pH electrodes generally cause a slight contamination of the test solution with K, Cl, and traces of Ag because of slow leakage of the filling solution of the reference system through the liquid junction. Thus simultaneous pH measurement may cause anomalous high readings in the measurement of low concentrations of ions for which K, Cl or Ag is a significant interfering factor: e.g. K, Cl, Ag, NH4, NO3, Cd, ...

C4) A maximum of four temperature probes can be connected to the appropriate sockets on the front panel of the interface, and any one of these can be selected to monitor the temperature changes corresponding to any of the electrode channels.

D) SOFTWARE OPERATION

D1) Setup Screen.

D1a) The first screen allows you to enter all the details necessary for setting up your experiment / measuring system and producing a complete documentation for archiving and GLP procedures.
Most of this should be self-explanatory. If any of the required data is not available, e.g. electrode serial numbers, then the software will accept any single character or groups of characters as a default. Move the cursor using the Tab key or click with the mouse.

NB: You will not be able to proceed to the Measuring screen until all relevant data is entered here, including calibration. Thus, if only the mV data is required, irrespective of which sensor is connected, then "Redox" must be selected from the drop down boxes in the appropriate channels on the Setup screen. You can then proceed directly to the measurement screen without having to calibrate the electrodes first, and mV will be plotted against time on the graphical output.

D1b) The **View Data File** button at the bottom of the screen will give immediate access to old stored data files for review and printing without having to go through any of the setup procedures.
See section D4 in this manual and the View Data Help file for details.

D1c) The **Port Setting** box has a normal default for the interface to be connected to Serial Port (COM1) of the computer and you must make sure that this is correct for your setup.

D1d) The **Signal Averaging Number** is the number of readings to be taken (at 2 second intervals) and averaged to produce the final value for the millivolts produced by each electrode. The higher the number of readings, the more stable and precise the measurement.
The value displayed on the screen is the result of a 'gliding average' which produces a stable value which is the average of a number of readings but is updated frequently as each new reading is taken.

D2) Calibration Procedure.

D2a) Once the Hardware Setup has been completed and the correct electrodes have been allocated to the appropriate channels they must be calibrated with standard solutions of known concentration (or pH) before being used to measure unknown samples. This can be done individually, if a number of different electrodes are being used (click on the appropriate **Calibrate** button), or simultaneously for any number of identical channels (use **Simultaneous Calibration**).

Operational notes:

1) For the most accurate stable measurements with ISEs it is recommended to wait at least 2 minutes after the ISE is immersed in the sample or standard before taking a reading. Low concentrations (below 1 ppm) may take up to 10 minutes to reach a completely stable reading. It is also useful to increase the Signal Averaging Number (see D1d, above) to 10 to 30, which means the system takes 10 to 30 measurements at 2 second intervals and displays the average of these measurements. This procedure reduces the influence of electromagnetic noise and chemical instabilities. For fast measurements when highest precision is not required, the waiting time and average number can be reduced.

2) Calibration is not required for Redox electrodes which simply record the measured voltage. After assigning Redox to a particular channel, click **Measure** to start data recording.

3) Once a channel has been calibrated, the data are stored for later use and the time and date of the calibration is recorded above the Calibrate button. The next time the software is used it is then possible to go straight to the Measure screen without performing a new calibration. However it must be stressed that this facility is only recommended for making a rough check before starting a completely new batch of samples in order to find the best range for the new calibration standards. Large errors can be introduced if you start a new batch of samples on a new day (or even a few hours later) without making a new calibration.

D2b) For individual calibrations you are presented with a calibration window in which you must select the number of calibration solutions (default is 2, maximum 6) and the concentration units you wish to use. To define the slope of the calibration graph, you must use at least two standards, preferably spanning the range of concentrations in your samples. If the sample range is greater than one order of magnitude then it is recommended that at least three calibration standards are used in order to confirm the linearity of the calibration.

D2c) You must then immerse the electrode in the first calibrating solution (to minimise cross contamination, use lowest concentration first, then work up sequentially), type in the concentration and click on the **Read** button (or press Enter).

D2d) After a short time the millivolt reading will appear on the screen and you can watch and wait until the electrode voltage stabilises. Alternatively, you can take a reading after a uniform length of time after immersion if you prefer to have a quicker result; but this may possibly mean a decrease in precision and accuracy, depending on the particular electrode system you are working with..
Note that whichever method is preferred, standards and samples should be treated in the same way.
D2e) Then click on the **Record** button to take a reading.

D2f) The cursor will then move to the next calibration point to repeat the process until all calibrating solutions have been measured.

D2g) When the calibration procedure is completed you must click on **Finish.** You will then see a summary of the results including the calculated slopes of the calibration line between each of the data points. These can be used to evaluate the linearity and quality of the data and hence reveal any problems with the calibration. Clicking on **Finish** again will return to the main **Setup** screen. Selecting **Finish** at any other time will give you the option to return to the main screen without completing the calibration.

D2h) **Simultaneous Calibration** works in the same way, except that you are initially presented with a table from which to select which channels to calibrate at the same time. During calibration, you need only type the concentration once and must immerse all the electrodes in the same solution at the same time.
D2i) Selecting **Calibrate** for an electrode which has already been calibrated will reveal a summary of the existing calibration data.

D3) Sample Measurement.

D3a) Once calibration has been completed for all the channels to be used, the sample measurement screen is accessed by clicking on the **Measure** button**. It is important to note here that all sample measurements should be made in exactly the same way as standards, e.g.: same waiting time, Average Number, stirring conditions, temperature etc.**
This screen displays data for all eight channels but indicates which channels are not in use.
For repeated measurement of different samples, data are recorded manually, at the click of a button. Alternatively, for continuous process monitoring of the same solution, data can be read automatically. In this mode the interval (in seconds) between each

measurement must be entered in the **Frequency** box, after selecting **Automatic** from the drop-down menu.

D3b) On first entering the screen there is a short delay, and the data channels are blank, whilst the interface takes the first set of readings, but thereafter there is a continuous display of the voltage, the calculated concentration (in ppm and moles, or pH) and temperature, if appropriate.

D3c) to make a manual sample measurement, ensure that **Manual** Data Recording is selected from the drop down menu, immerse the electrode(s) in the appropriate solution(s), wait for a stable millivolt reading (or for a specified time) and click on the **Record** button
The first time **Record** is used you will be presented with the standard Windows 'SaveAs' box in which you must create a file name in which to store the data. Thereafter, each time you click **Record**, the data will be automatically saved in this file. If you wish to enter any sample numbers or comments to accompany this set of data then these must be typed into the **Comment** line before clicking on **Record**.

D3d) Alternatively, for continuous process monitoring in automatic mode, simply immerse the electrodes in the appropriate test solutions and click on **Record** and, after creating a data file, the data will continue to be read and saved at the specified time interval until you click **Stop**. Comments can be added during data aquisition by clicking on **Stop**, typing in the comments, then clicking on **Record** again – or they can be added to the data table later using the **View Data File** facility.
D3e) A counter in the **Stored Records** box continuously displays the number of data lines in the current data file.

D3f) If necessary, the **Average Number** can be changed during manual sample measurement. (see section D1d)
D3g) At the end of a measurement session you can either go **Back** to the calibration/setup screen or click **Exit** to close the programme.

D4) Data Recording and Viewing

D4a) The saved data can be viewed at any time using the **View Data File** button - but note that initial use of this function, during data acquisition, will require the **Update/Update Now** option from the tool bar to be activated before the current data file will be displayed.

D4b) The data are initially displayed in graphics mode. This shows the electrode output plotted against the data number for all active channels.
The output from individual electrodes can be plotted separately or any combination can be shown together by choosing **Chan Selector** from the **View** menu. There are options in **Chan Selector** to plot mV, pH, ppm or moles/l as appropriate and you can also choose to plot the output from the temperature sensors.   **Update** has an **Automatic** option which permits continuous and simultaneous display of the change in signal in all the selected channels during automatic data acquisition.

D4c) The graphics screen will display up to 50 data points at a time. During Automatic Recording, this will automatically jump forward in blocks of 50. If viewing of earlier data is required then this can be done by switching off the automatic update option (re-click

on **Automatic**) and then using the scroll bar at the bottom of the screen. Note that a message in the title bar will inform you of the last data point to be plotted as the scroll box is dragged along the bar. Note also that this will only stop the automatic data display update – the data acquisition and saving will not be affected.

D4d) The graphics screen also includes several standard graphic tools to enable the operator to produce a customised display (including changing scales, inserting ticks and labels, producing 3 D bar charts, etc etc.) – these are available via the Graph Control window which is opened by clicking any of the graph Icons above the display.

Once you are satisfied with the re-formatted graph, click on the "System" Tab in Graph Control window and type a new file name in the Graph Template File "Browse" box - NOT the "Name" box! This file name can be the same as the original .4ch data file if you wish. Then be sure to tick the "Save Data" box before clicking on Save. The file will be saved with a .gsp termination in the same folder as the .4ch data files.

To retrieve this file for later modification, printing or exporting, Click View Data Files / File / Open and select the original .4ch data file. When this is open, click any graph icon (or, specifically, the green printer icon fourth from the right) to open the Graph Control and select the System tab. Then Browse the Graph Template File box or type in the file name and click "Load".
If you want to save this graph as an image file then check the Image/Bitmap and Target/File buttons under the Export label and then click Browse.   You will then be presented with a standard Save As window where you can type/select the file name and destination folder for the image. This can then be converted to, for example, .gif or .jpg format using standard image handling software.

D4e) The data can also be viewed in tabular form by clicking on the **Text** label and using the vertical scroll bar to select particular lines. Note that each data table will only take about 4000 records, hence the **List1** label. When this is exceeded, a new table is started with a new **List** label.

D4f) Individual records can be quickly accessed by record and channel number using **Record Search** from the **Tools** menu. This menu also gives quick access to the Windows **Calculator** and **Notepad.**

D4g) Choose **File/Close** to exit the View Data File screen.

D4h) Old data files can be reviewed using **View Data File** from the setup screen or from the data acquisition screen. Choose **File/Open** to see all existing data files.

D4i) Once a data file has been opened, **File/Print** will allow you to print either the current data table (click on **Text**) or the graph. Note that the graphics printing is limited to a maximum of 1500 data points (ie. number of records times number of channels), thus for large data sets it is important to choose a limited range of records (rather than **All)** before trying to print the graph. Note also that for large data sets, **Print/Text** will only print the current **List.** Thus, for a full data printout, each List must be selected and printed individually.

E) EXPORTING DATA TO OTHER SOFTWARE:

Data are stored in ASCII text files which can be read by other applications such as MS Notepad or Excel etc. The files have an operator defined name and a

.4ch or .8ch extension: e.g. "Test1.4ch" or Test2.8ch They are normally saved in C:\Program Files\4(or 8)Channel Interface(32)\Data\ (unless the initial installation was made into a different folder).
WARNING: If you wish to save a data file in a new format, remember to use Save As to save it with a different name or in a different folder - to avoid confusion and avoid corrupting the original file.
For Example: to open with Notepad, first launch Notepad then click File/Open and select "Any File".
Find the folder and the file you wish to open and double-click it.

To open with Excel, launch Excel and follow the procedure above to find the file.
In this case, on double clicking the file name, you will see the "Text Import Wizard", where you must select "Delimited", then click on Finish.

F) CLOSEDOWN
The software can be closed down by choosing Exit from the Data Acquisition or Setup screens or by clicking on the red " X " in the top right hand corner of the screen.

G) APPENDIX:

Installation of USB to RS232 Serial Converter

If your computer has a serial port, connect the Analyser (or other instrument) direct to this port without using the USB to RS232 converter.

If your computer has no RS232 port, you have to use an USB port via a USB to RS232 converter.

To get the USB to RS232 conversion working properly, there is a standard procedure:

1) Please note that the operating software is not supplied with the USB converter. The correct version for the type of converter you are using must be obtained from the Converter Manufacturer. The converter supplied with your Analyser uses the proven and reliable FTDI-Chip from Future Technology Devices International Ltd.
You can find more information on: http://www.ftdichip.com/ and download the driver free from: http://www.ftdichip.com/drivers/vcp.htm

2) AFTER INSTALLING THE CORRECT DRIVER SOFTWARE, Connect the USB to RS232 converter to your computer; this can be done while the computer is switched on. Only connect the USB to RS232 converter, not the Analyser.
Usually a message comes up: "Found new hardware - USB.........- ready to use"

3) Unfortunately the USB to RS232 converter software selects random COM numbers and usually not the COM 1 number, which we want for our Analyser / Instrument.
We have to change the COM port number to 1

4) The procedure for Windows 8, Win 7 and Vista is very similar:

In the Start menu select Control Panel, click on Hardware and Sound, in Devices and Printers click on Device Manager.

For Win. XP you need Control Panel / System / Hardware / Device Manager.

Double click on Ports, "USB Serial Port (COM 4)" or any other COM number which comes up.
Right mouse click on "USB Serial Port (COM 4)", a menu comes up: click on Properties.
Click on Port Settings: it will show: 9600, 8, None, 1, None. Click on "Advanced", select COM 1, neglect when it says (in use).
When you click OK a warning appears: ....Do you want to continue? click Yes.
Click OK and the Device Manager shows now: "USB Serial Port (COM 1)". You can test it by double clicking on it:
The Device status says: "This device is working properly"

6) Connect the Analyser / Instrument to the USB to RS232 converter. Make sure that in the Analyser / Instrument software also COM 1 is selected.