APPENDIX A TERMS OF REFERENCE

An Assessment of Groundwater Resources on selected islands of the Salomon and Peros Banhos Atolls, BIOT.

The Government of the British Indian Ocean Territory (BIOT) have commissioned a staged study of the physical, economic, social and environmental feasibility of establishing permanent re-settlement on the Salomons and Peros Banhos atolls ("the islands") by the former inhabitants, the Ilois. Following the recommendations of the Stage 1 Study, further more detailed work is to be undertaken, part of which will involve the establishment of equipment and sensors on the islands to record meteorological, hydrological and hydrogeological parameters. The data will be used to establish a water balance, the relationship between the ocean tides and the variation in groundwater levels and other parameters.

Investigation of Water Resources

Fresh groundwater believed to be in the form of a lens in hydraulic contact with underlying groundwater is known to exist on the larger islands of the Salomon and Peros Banhos atolls, but little is known quantitatively of the extent of this potential resource or the degree to which it may be safely exploited and developed as a permanent potable water supply for a resident population.

The objective of Stage 2a work is to establish equipment and sensors on the islands to record meteorological, hydrological and hydrogeological parameters. The data will be recorded and made available for subsequent studies to establish a water balance, the relationship between the ocean tides and the variation in groundwater levels and other parameters.

The consultant will undertake the following work:

Carry out site visits and investigations on the islands to establish and test sensors to record meteorological variables and fluctuations in ocean, and groundwater levels, including under simple pumping conditions. Some additional investigations will be undertaken where possible within shallow peizometers (tubewells).

The site visits will entail the following activities:

- Install and operate an Automatic Weather Station in an appropriate position on one island
- Install and operate a recording tide gauge on the lagoon shores of Ile Boddam in the Salomon Islands and Ile du Coin in Peros Banhos Atoll and one ocean side shore on one island for a duration sufficient to establish a sea level datum for both coasts (provisionally 1 year)
- Carry out instrument and site levelling as necessary to relate inland water table (and ground level) elevations at well sites to lagoon and open sea levels.
- Install and operate water level recorders on selected shallow wells to derive tidal efficiencies and other aquifer properties from the response of the lens to lagoon and open sea tides
- Carry out initial pumping tests on selected existing shallow wells and other field investigations to investigate freshwater lens characteristic and safe abstraction rates.
- Where possible, hand-auger and establish shallow peizometers to derive tidal efficiencies and other aquifer properties including electrical conductivity from the response of the deeper part of the lens to lagoon and open sea tides. Investigate the applicability of auguring or lightweight drilling for subsequent tubewells.

APPENDIX B ITINERARY

9th March Flew from London Heathrow at 17:30 on flight SQ319 to Singapore.

10th March Arrived in Singapore at 15:30. Attempted contact with RNLO Singapore to conform arrival of freight and transfer to Paya Labar Military Airport. Took taxi and checked into Hilton Hotel.

11th March Rest Day. Sought equipment and geotechnical suppliers in Singapore via telephone directory.

12th March Minor Equipment Purchase. Contacted RNLO Singapore to confirm arrival of freight. Confirmed 'showtime' and arrival of Travel Orders with Air Movements Command staff Paya Labar Military Airfield. Checked out of hotel and transferred by taxi to Paya Labar Military Airfield. Did not get place aboard flight. Contacted British XO by telephone and returned by taxi to re-check into hotel.

13th March Confirmed 'showtime' with Air Movements Command. Checked out of hotel and transferred by taxi to Paya Labar Military Airfield. Departed Singapore on Flight MCF7 at 14:30 arriving Diego Garcia at 17:30. Met and accompanied through customs by Maj Mike Blyth RN. After a brief tour by car through the main accommodation area of Diego Garcia checked into Bachelor Officer Quarters and subsequently joined Maj. Blyth, Captain Rob Edie, Training Officer and Mne. Barry Jones, Brit Ops Team Leader for a meal at the Officers Club to discuss the forthcoming joint Brit Ops/ Water Survey to the Chagos Islands.

14th March Brief Meeting with British XO and Mr John Topp, FCO Environmental Advisor. Meeting with US Navy and DG21 (contractor) Water Engineers led by Cmdr Jim Souba. Held general discussions including brief details of intended work in the Chagos Islands and likely similarities with the groundwater regime in DG with the PWD staff and Seabees. Arranged to tour DG facilities and meet separately with key staff to discuss particular hydrogeological issues on return from trip to islands. Attempted to install data handling software on Training Officer's computer. Joined British Marines on liaison visit to US Freighter Franklin Phillips. Discussed vessel water production, supply and transfer systems with Master and Chief Engineer and toured desks to view other 'hardware'. Later went by shuttle bus to small boats harbour to check air-freighted equipment was complete and had been loaded onto FPV Pacific Marlin. Walked in Cantonment area to inspect US installed horizontal gallery system.

15th March Joined Mr Topp and Cmdr Souba for breakfast and discussed forthcoming trip. Visited Water Plant to refer to file reports. Joined Maj. Blyth and Mne.. Jones for a Briefing Meeting to confirm time requirements for the water survey tasks during the 'Brit Ops'. Packed and transferred to the FPV Pacific Marlin. Met other team members, Master and crew. Received safety briefing and tour of vessel. Checked and set electronic equipment and tools. Vessel departed at 16:00 for overnight passage to the Salomon Atoll.

16th March Arrived and anchored off the Salomon Atoll at dawn. Loaded equipment to Marine's Raider craft and transferred to Ile Boddam with four marines and three FPV crew. Offloaded equipment supplies and camping gear. Toured island with Mne. Jones and Mne. Bullivant to investigate wells, structures and tracks. Attempted to find location of Doppler point. Temporarily placed monitoring units into main well and off jetty to check responses and dataloggers. Set up camp.

17th March Identified likely 'host wells for monitoring equipment and examined jetty for secure fixture for tide gauge. Conducted well water and rain tank salinity survey. Explored for additional wells in centre of island. Cleared vegetation from Well 3 for recording water levels. Downloaded

first 24 hours data.

18th March Established Weather Station. Bailed first shallow borehole Boddam LS1 and completed datalogger testing. Completed simple pump-test to test changes in conductivity and drawdown. Secured tide gauge to jetty

19th March
Bailed second shallow borehole Boddam LS2 and completed datalogger testing. Completed simple single rate pump test to investigate changes in conductivity and drawdown

20th March Repeated downloading routines. Levelled gauges using survey equipment. Downloaded all logging equipment. Photographed wells and monitoring installations. Packed and transferred equipment to FPV. Downloaded PSION and AWS Datalogger data to ships computer.

21st March Sailed into Peros Banhos Atoll anchoring off Ile due Coin. Transferred equipment to Ile du Coin and unpacked. Toured island with Mne. McGuiness to investigate wells, structures and tracks. Temporarily placed monitoring unit into main well (Well C1) to record groundwater fluctuations overnight.

22nd March Revisited wells, tested salinity and marked with id tags. Established Tide Gauge on island side of the outer Jetty structure. Cleared vegetation out of Well C2 and tested depth sensor in well overnight.

23rd March. Completed installation of depth sensor in Well C2. Photographed wells and monitoring installations. Levelled gauges using survey equipment. Supervised Downloading procedures for logging equipment by Marines. Downloaded PSION Datalogger data to ships computer. Sailed for Diego Garcia.

24th March. Arrived at small boats harbour Diego Garcia. Unloaded equipment to Marines Stores for drying and cleaning and checked into Bachelor Quarters. pm Rest

25th March. am rest. pm Short debrief with XO. Computing aboard FPV Pacific Marlin

26th March. Computing in DG Library and aboard FPV Pacific Marlin. Installed software for downloading data in Library for testing.

27th March. US Water Engineers and DG21. Data Handling Software onto XO's computer (failed)

28th March. Data Handling Software onto Brit Rep Secretary's computer. Computing in Library. Packing and transfer to Terminal for 2am (29th March) flight to Singapore. Depart

APPENDIX C CONTACTS

Diego Garcia

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Major Mike Blyth RN. Executive Officer Officer, PO Box 4, Nzega. Tel. 269 2349 / 269 2301. Fax #246 370 3943. e-mail: BritXo@dg.navy.mil

Commander Jim Souba USN

Lt Commander Patrick Hochstein USN

Lt Commander Steve O'Hara USN

CPO Dale Korn USN

Ms Linda Corpus Command Environmental Engineer NSF Tel #246 370 4542 Fax #246 370 4511 e-mail: Corpusl@dg.navy.mil

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Mr Brian Little. FCO Water Resources/Engineering Advisor Development e-mail: brianlittle@cwcom.net

Singapore

RNLO Singapore (Attn POWTR Steve Platt) RNSTO Senoko Fuel Depot, Admiralty Road West Singapore 270 000. Tel #65 Fax #65 754 4124

APPENDIX D DATALOGGER DOWNLOADING GUIDES

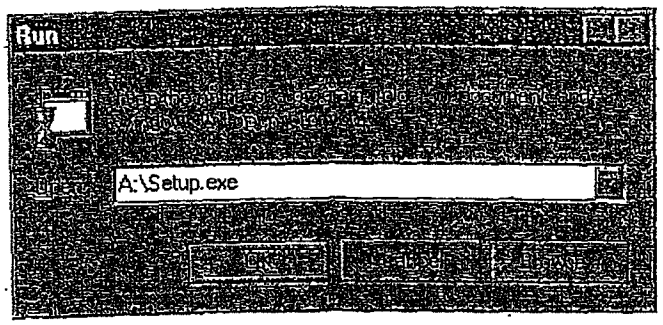
1: AWS Datalogger

2: Depth Sensor Dataloggers

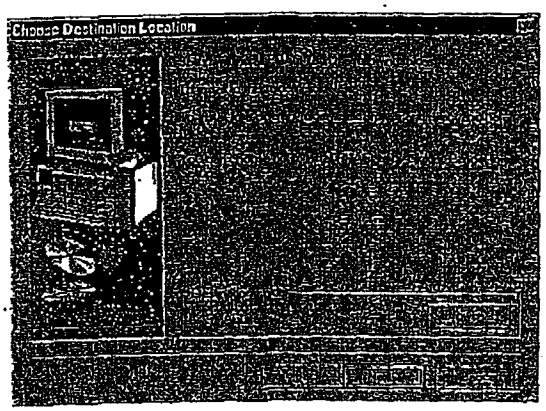
Contents

Installation of the Software

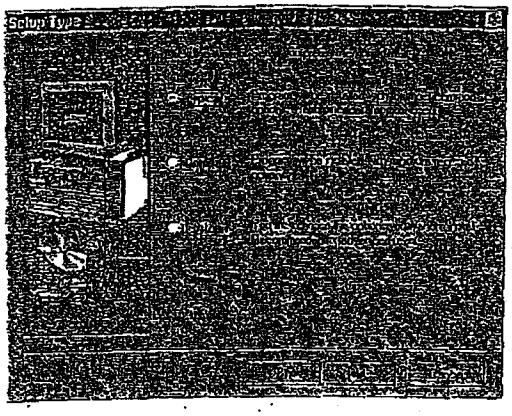
Insert installation disk 1 into the floppy disk drive of your computer, on most computers this will be drive A:. Using the mouse pointer click on the "Start" button (Windows 95) and then the "Run" icon, this will produce the window shown below.



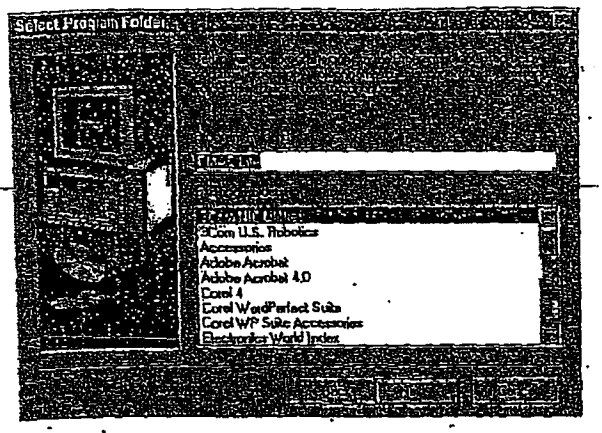
At this point you can either type in from the keyboard " **A:\Setup.exe**" as shown above, (without exclamation marks) or use the "Browse button" to find the file Setup.exe on the relevant floppy disk drive. (Note if your floppy drive is B: type "B:" in place of "A:") When this has been completed click on the "OK" button, the window below should now appear.



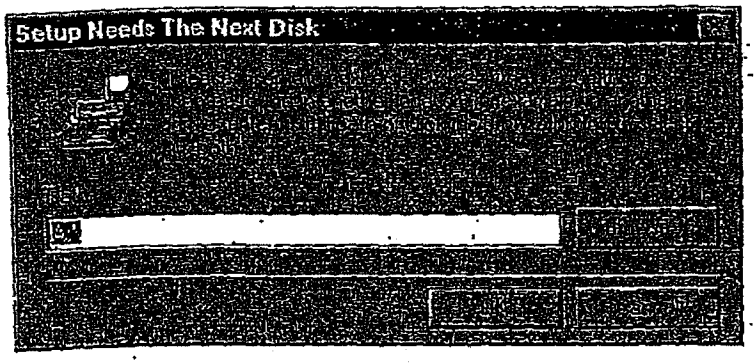
For 99% of installations all that is required at this point is to click on the "Next" button and the window below will appear. Again for 99% of installations the default setting "Typical", shown in the window below can be left as it is and simply click on the " Next" button once again.



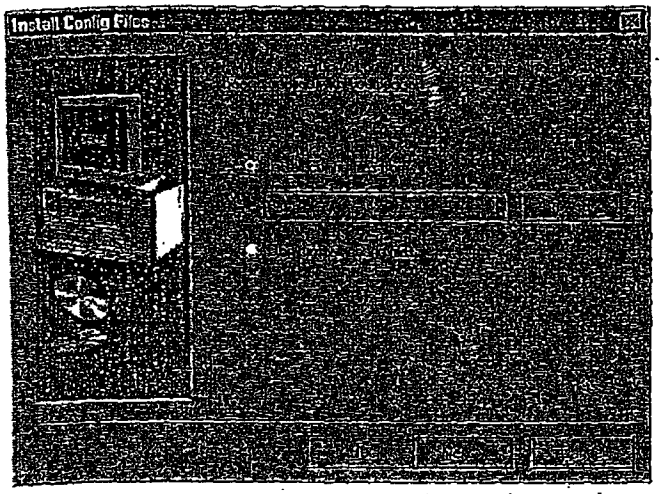
The installation program now indicates to which Program Folders it is going to add the program icons by displaying the window shown below, once again it is simply a matter of clicking on the "Next" button.



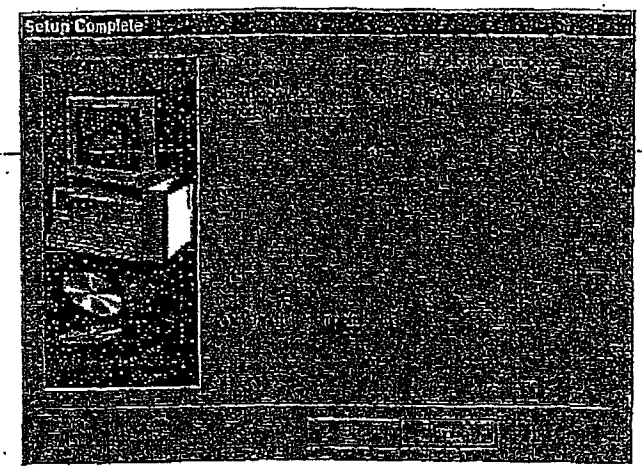
The window below will appear prompting you to insert the next disk, simply insert disk 2 and click on the "OK" button.



When disk 2 has finished copying files to the computer, the window below will appear, if you have also been given a disk with configuration files, remove disk 2 and insert the configuration files disk and click on the "Next" button. Disks containing configuration files are not supplied as standard and if you do not have a disk simply click on the "Next" button.

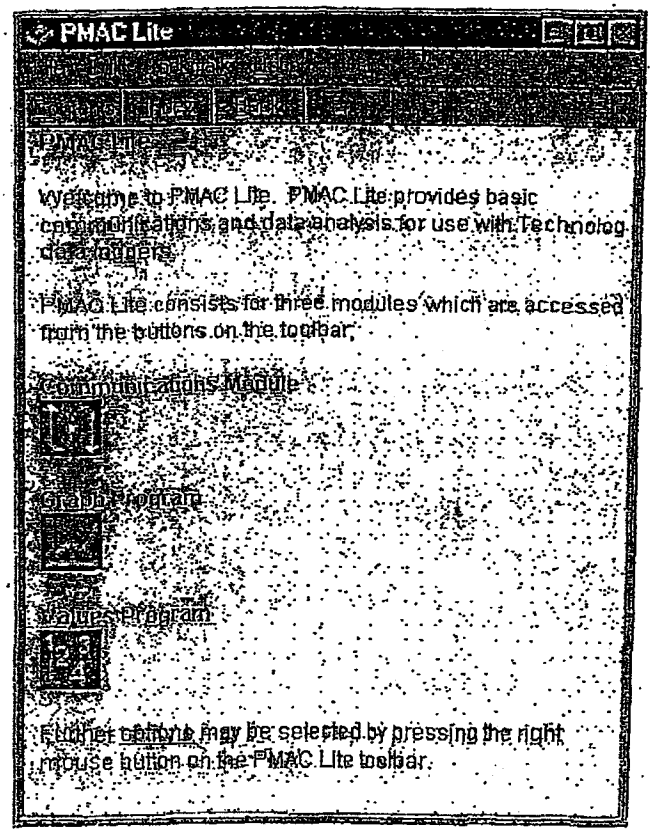


The following window will appear stating that the installation is now complete, prompting the user to now click on the "Finish" button.



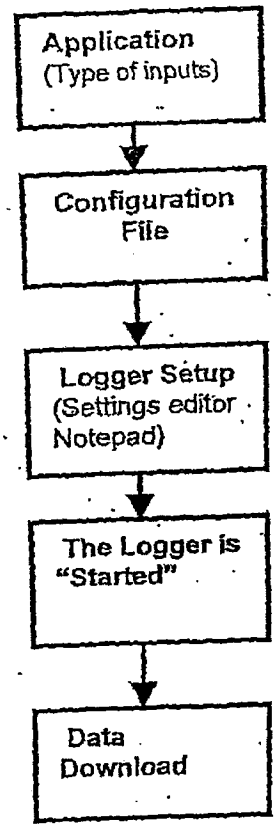
.e program PMAC Lite can now be run by clicking on the PMAC Lite icon on the Windows desktop, or by clicking .e Windows **"Start"** button then **"Programs"** and then selecting the program PMAC Lite in the usual Windows manner.

The on line help can be accessed by pressing the **"F1"** button which produces the Window shown below.



5 Steps to using a datalogger

The flow chart shown below guides the user through the basic steps of putting a logger into service and highlights Considerations required at each step before moving onto the next.



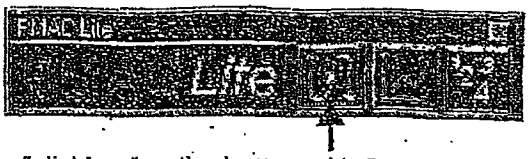
} Number of inputs ?
} Type of inputs, Voltage, 4-20mA loop, Switch closure, Frequency

} The configuration file is downloaded into a logger having been chosen
} to suit the application i.e. number of inputs & type of input.

} At this point the user enters information identifying the logger, i.e.
} It's location (site name), the rate and scaling information.

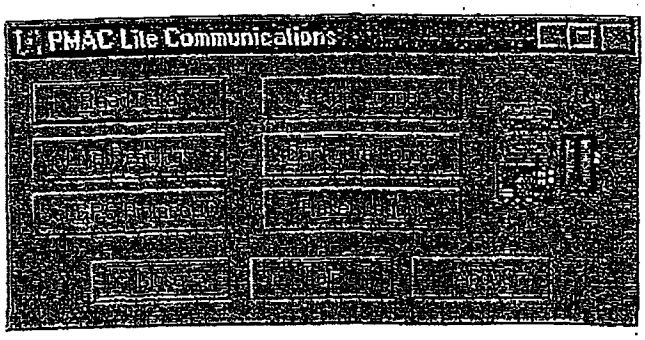
} The Logger is started i.e. set logging

} The logger has been running for a set period and data can now
} be downloaded by using either a laptop or Psion.

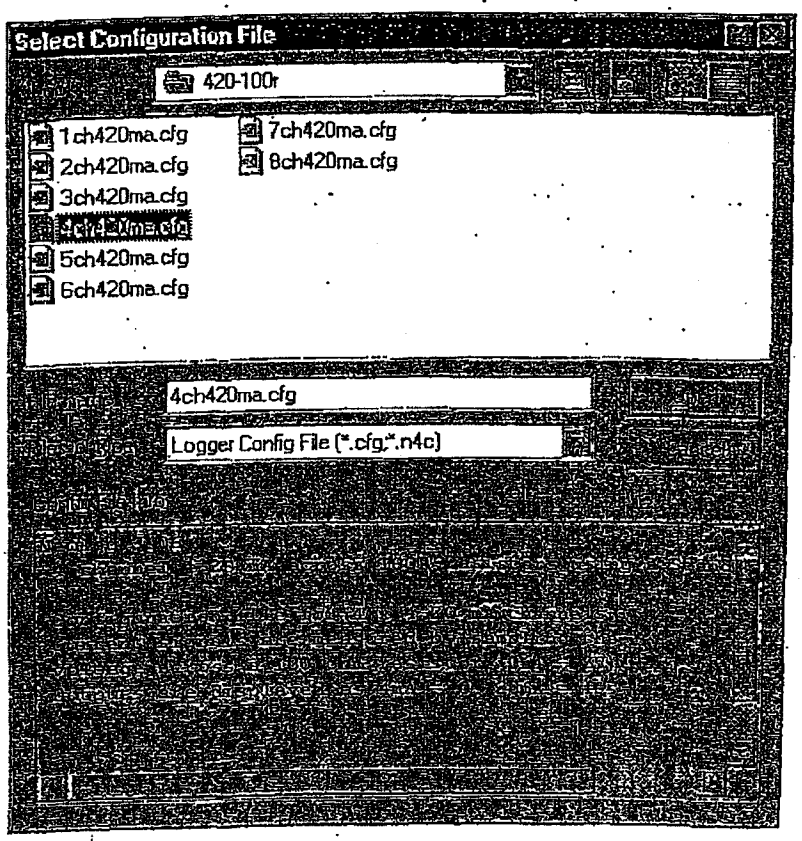


Configuring a logger

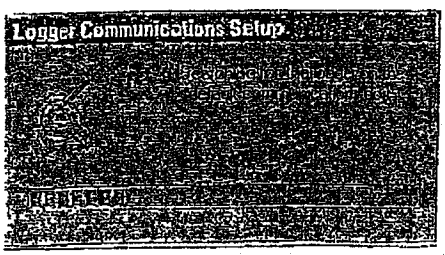
To configure a logger, enter the communications menu by "clicking "on the button with 2 arrows and a dot and then clicking on the "Configure logger" button.



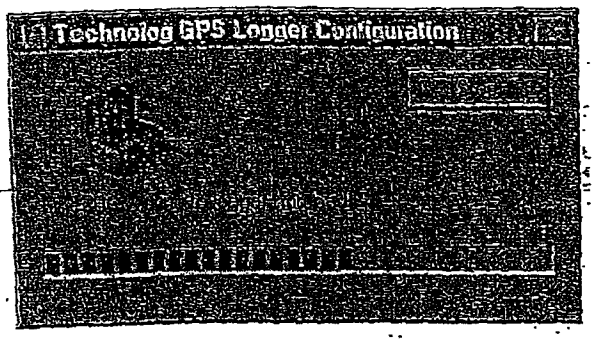
The following menu will appear, allowing you to choose a configuration file and giving a brief description of the ction of the configuration file selected. The description is in the lower window of the menu.



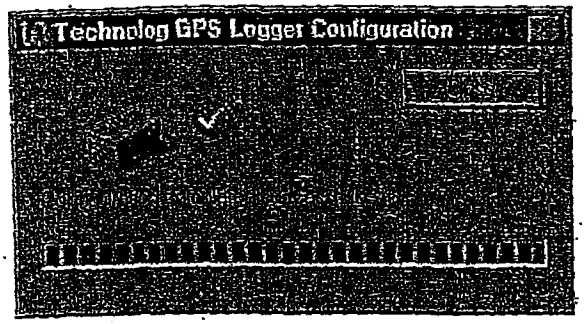
Select the required configuration file and click on the "Open" button and the following window will appear.



As the computer establishes communications the following window will be displayed whilst the logger is being configured.



Followed by the confirmation of transfer window indicating a successful configuration process.

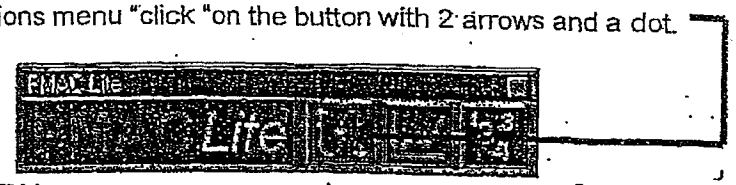


At this point the logger has now been successfully configured for the application and is now ready to be setup.

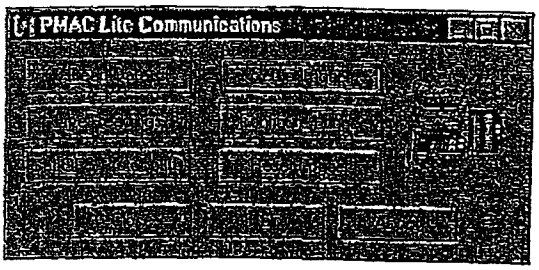
Logger setup is basically editing or setting the "site name ", channel names or numbers and scaling factors / measurand units.

Logger setup

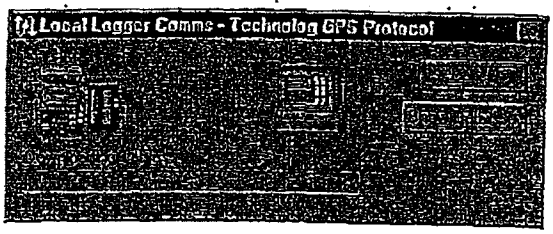
To enter the communications menu "click "on the button with 2 arrows and a dot.



The menu shown below will then appear, now click on the button labelled "setup logger"



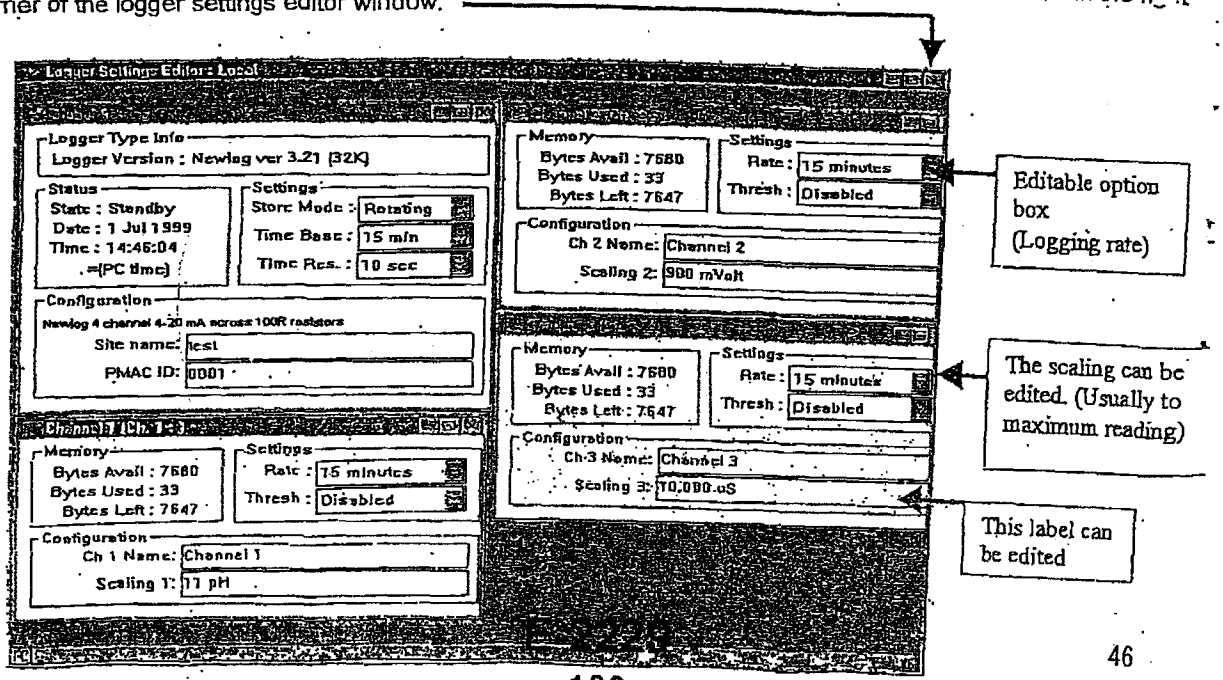
The software will now display the window shown below whilst it downloads the current Logger settings.



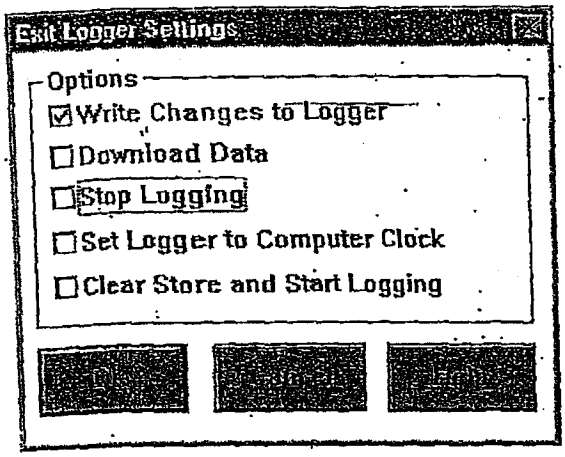
When the above has been completed the logger settings editor will be displayed as shown below. This can simply be edited by using the mouse pointer to select the required "tiled" window and clicking to place the cursor in any of the option boxes surrounded by the configuration box.

The settings options may also be altered at this point. This is carried out in the usual window manner, by clicking the option boxes down arrow and selecting the required option by clicking on it with the mouse pointer.

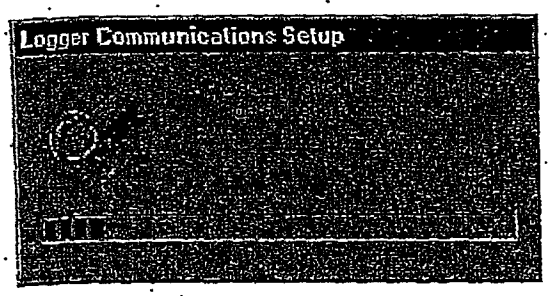
When all the required alterations to each tiled window have been made, i.e. each channel and the global setting window, the logger settings editor can now be closed in the usual windows fashion by clicking on the cross in the right hand corner of the logger settings editor window.



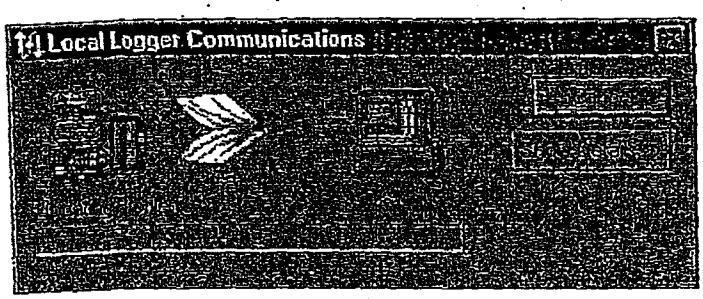
The options menu shown below will now appear.
Th[illegible] the point at which, all the previous changes that were made using the logger settings editor will be stored.
Us[illegible] the mouse pointer click on the "write changes to logger" check box, this will insert a tick in the box.
(It may also "tick" other boxes, if you wish to change these, just re-click on them to "set" or "reset" the option)
Now "click" on the "OK" button.



The following window will appear whilst PMAC Lite establishes communications with the logger.



Followed by the updating logger window.



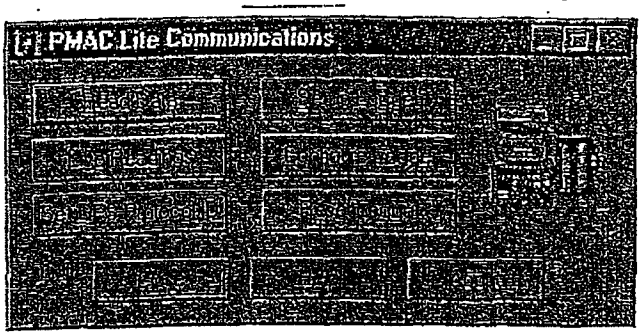
The updating will then be completed and communications will finish.

The logger at this point is now set with the required channel names (descriptions), scaling, site name and PAMC ID.

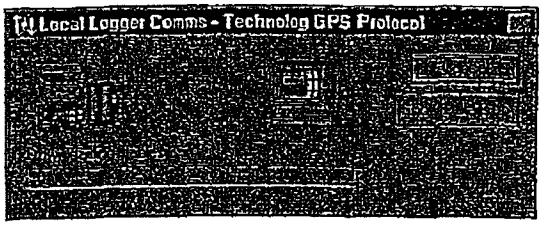
Reading Data

(Downloading data from the logger)

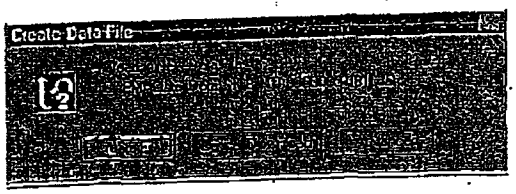
Enter the communications menu by "clicking "on the button which has 2 arrows and a dot, then "click" on the button labelled "Read Data"



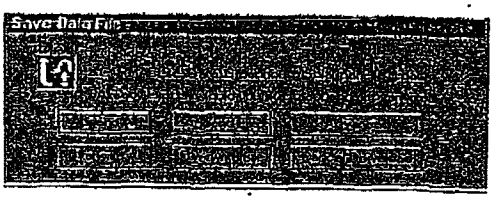
a following window will be displayed.



Followed by



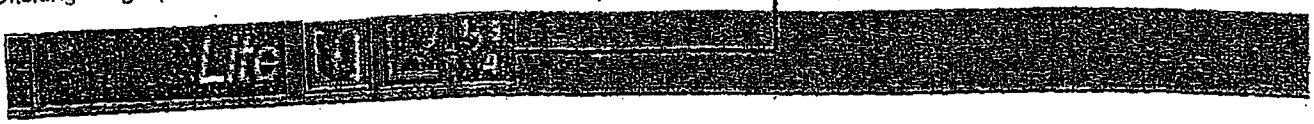
OR



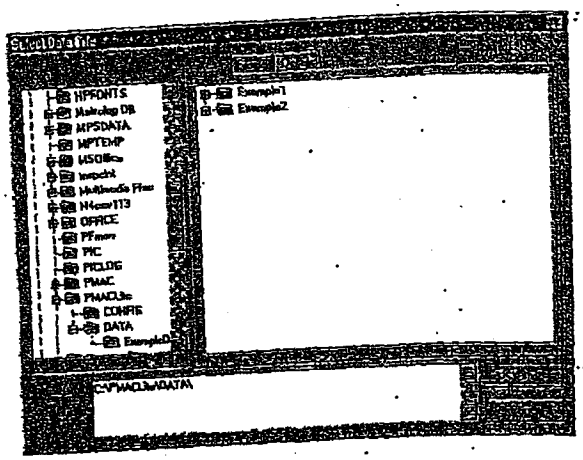
The window on the left is typical of the first time a site is downloaded as there is no file to update and the program creates a new file. If there is an existing site with data the new data can be appended to the existing file, this allows graphing of on going data without gaps.

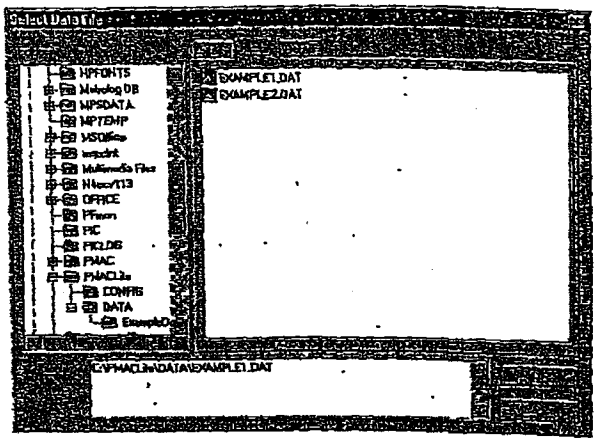
Graphing Program

Clicking the graph icon shown below opens the graph program.

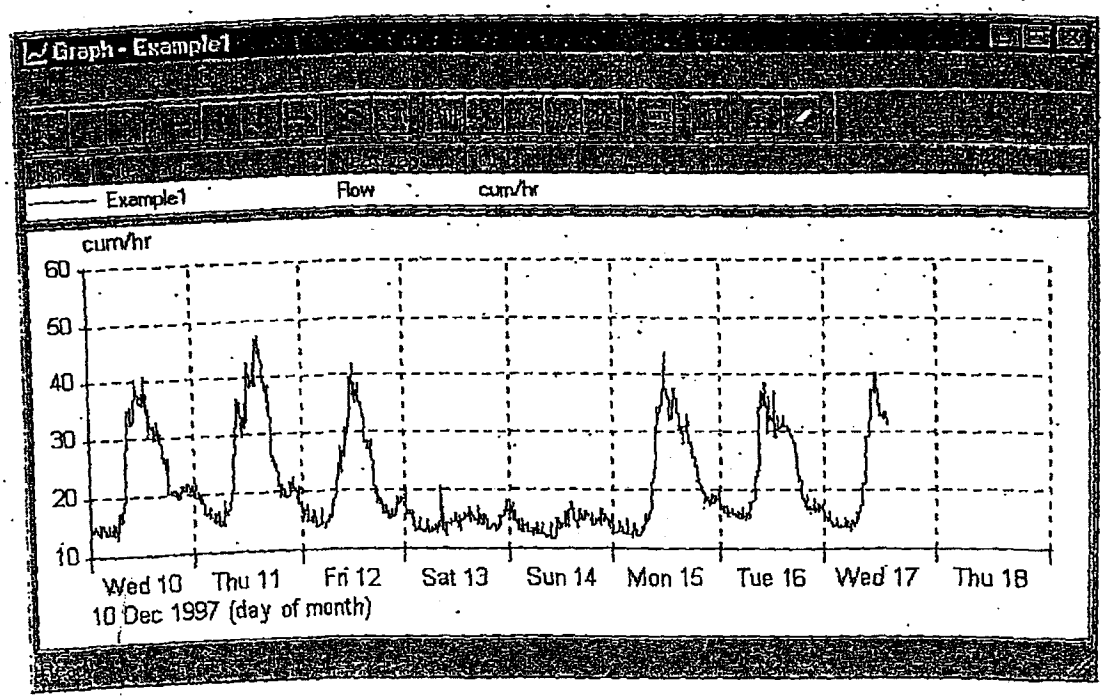


The following window will then be displayed allowing you to choose the file to be graphed.



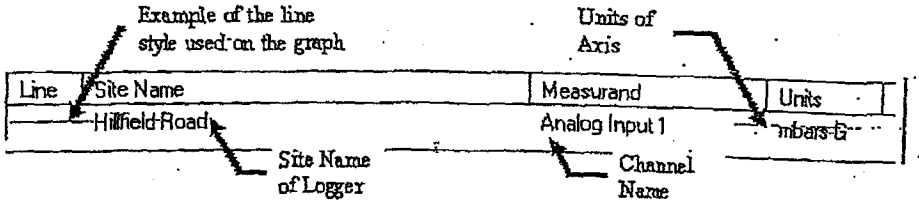


The "Sites" or "Files" tab can now be clicked allowing a selection of sites or files to be graphed by simply double clicking on them, this will bring up a graph as shown below.

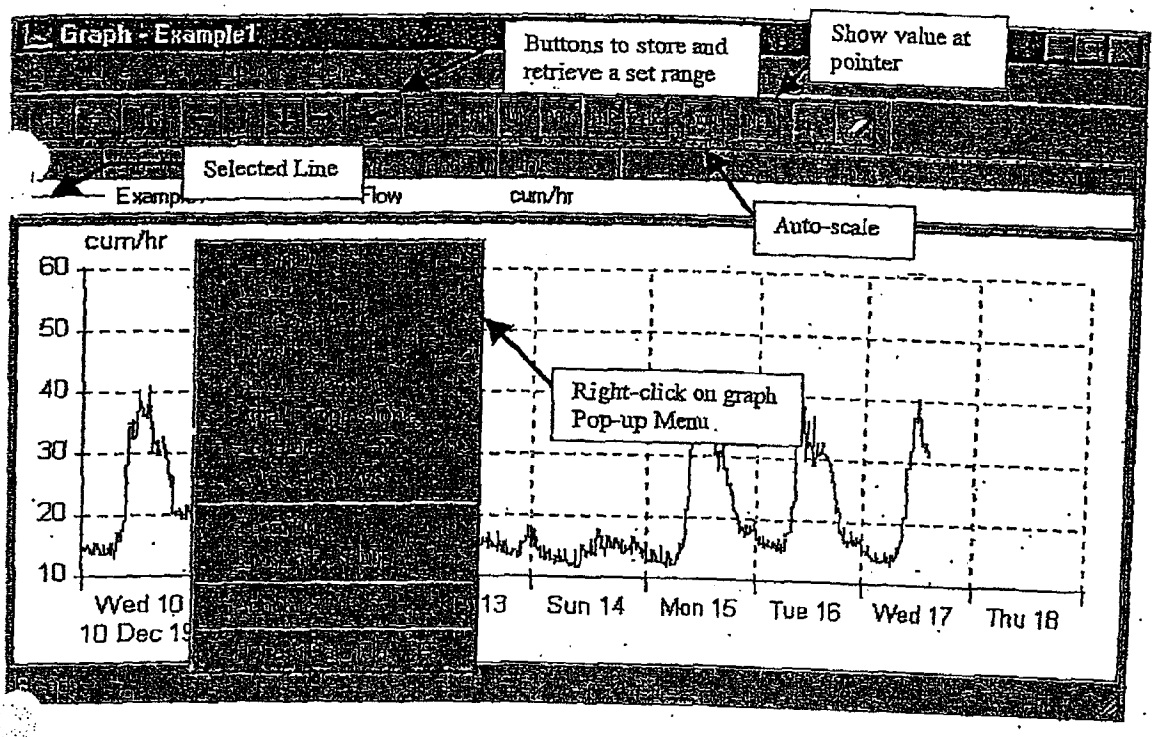


Line Key

The Line key shows details of all lines displayed on the Graph.



There will be multiple lines displayed for a channel for statistical data channels



Zoom Out Increases the range of the X-axis, Y-axis or both axes (graph is made smaller in the selected axis or axes)

Move Moves the display left, right up or down as required.

Time Scale Enables time scale unit to be set as month, week, day, 4 hours or 2 hours.

Divisions Provides the following options:

Add Time Division (Ctrl + 1)
Remove Time Division (Ctrl + 2)
Add Y Division (Ctrl + 3)
Remove Y Division (Ctrl + 4)

Small Expansion Expands the time (F3) or Y-axis (+) by one factor (i.e. time scale from day to week).

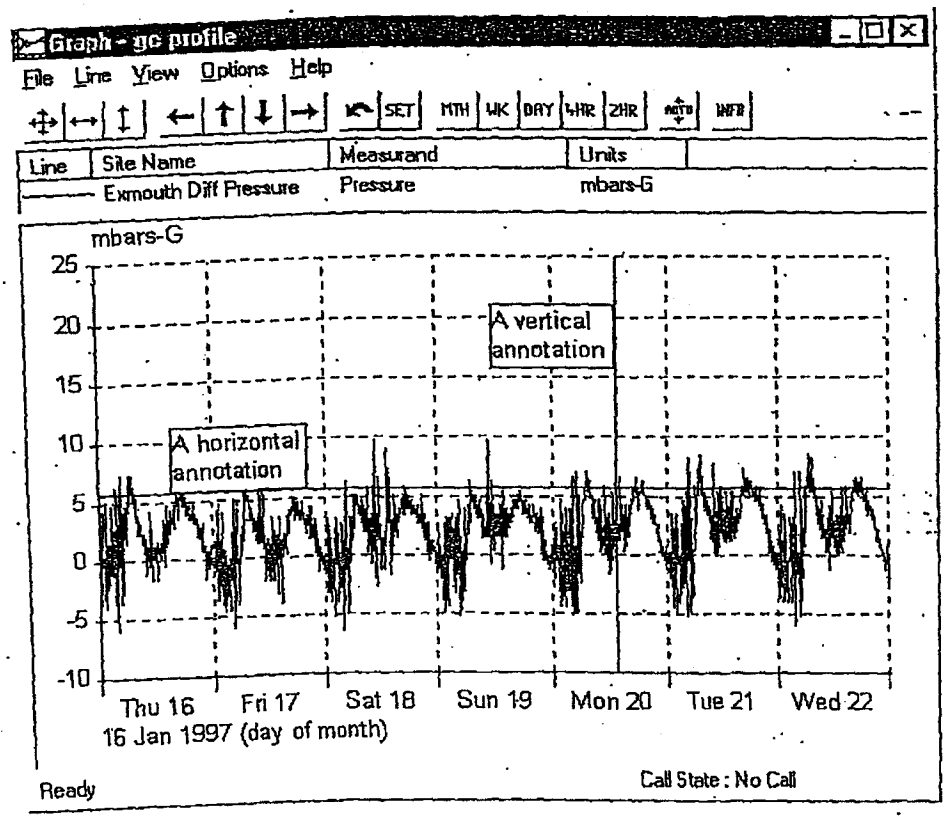
Small Compression Compresses the time (F4) or Y-axis (-) by one factor (i.e. time scale from week to day).

Set State Set - Temporarily stores the present program settings (i.e. the X-axis and Y-axis scales).

	Recall - Recalls program settings temporarily stored by the Set command (above). This function is particularly useful if you wish to take a close look at a data point then return to a broader view.
Autoscale Y-Axis	Automatically scales Y-axis to best fit in window for current data.
Zoom On	Enables zoom (decreases range of selected axis - graph is made bigger) on Left axis, Right axis or Both axes.
Division Resolution	Enables resolution to be changed to Low, Medium or High as required for optimum reproduction on your printer.
Annotate	Generates vertical or horizontal annotation boxes - text can be inserted or edited and boxes can be re-positioned as required. See Annotations, later in this section for further detail.

Annotations

Horizontal or vertical annotations can be added to a graph by right clicking on the graph and selecting the appropriate type.

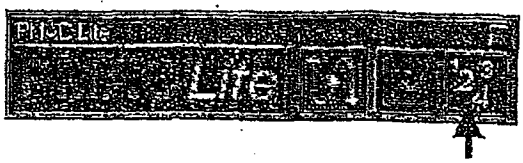


The position of the annotation can be changed by dragging the line or flag. The text can be changed by double-clicking on the flag or by right-clicking on the flag and selecting properties. The text in the box can be on multiple lines press CTRL-ENTER to start a new line.

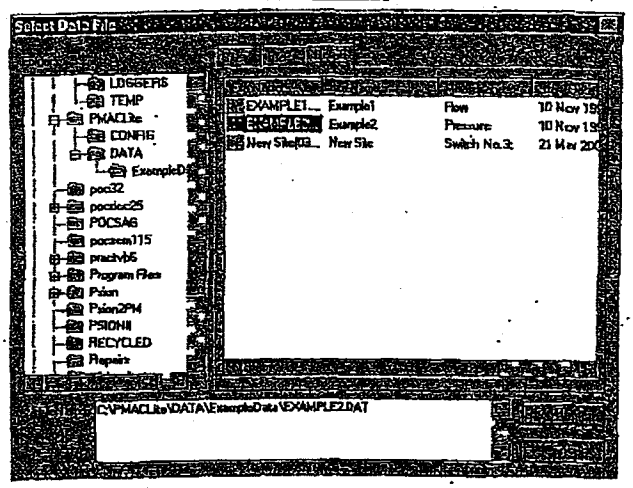
An annotation can be deleted by right-clicking on the flag and selecting delete.

Annotations are saved with a PMG file and can be printed with a graph.

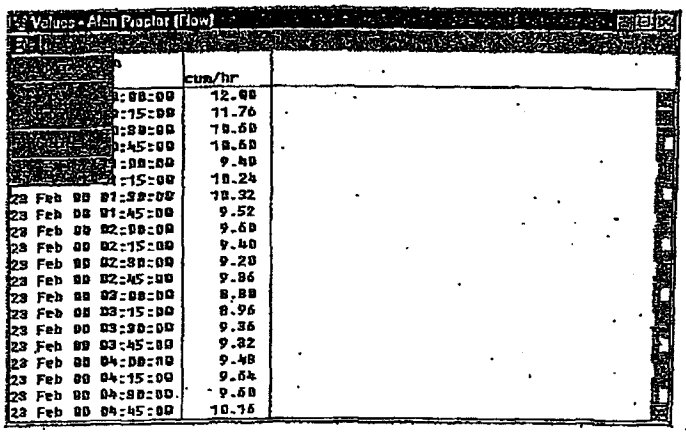
Values & Exporting Data



Clicking on the "numbered" button as shown above, will open the menu shown below allowing access to the Values & Export menus.

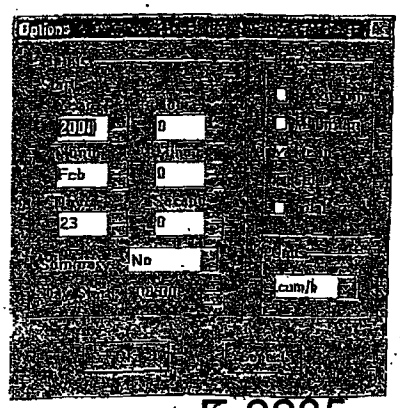


After selecting a file and clicking **"ok"** the menu shown below will appear.



File Menu

Options Opens the Options window -- enables definition of the displayed range and units. If Summary is selected, it enables selection of summary period and lines. (if not already enabled)

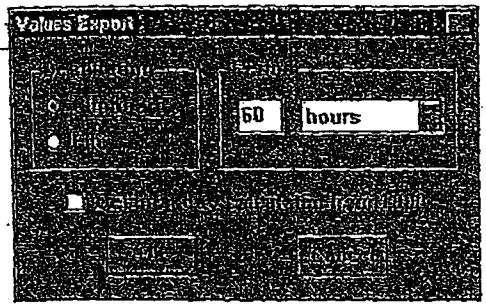


P

Prints the current table. Available options include insertion of a subtitle and setting of the period to Print.

Export

Opens the **Values Export** window – enables configuration of selected data into .CSV format for export either to a file or to the Windows Clipboard.



ıph

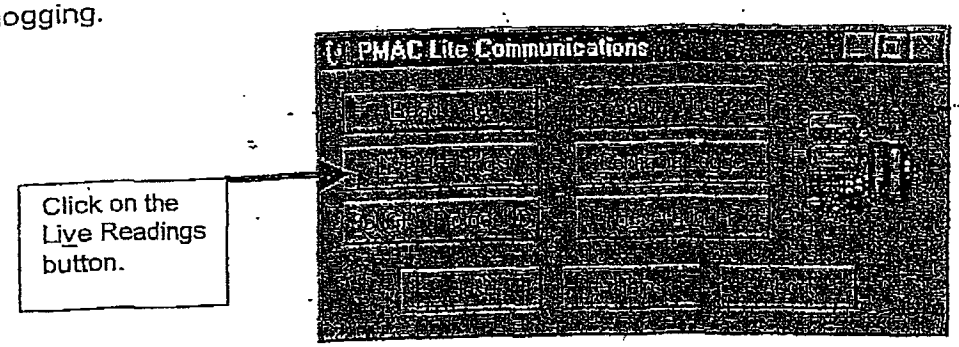
Opens the **Graph** window with the data displayed as a graph.

Exit

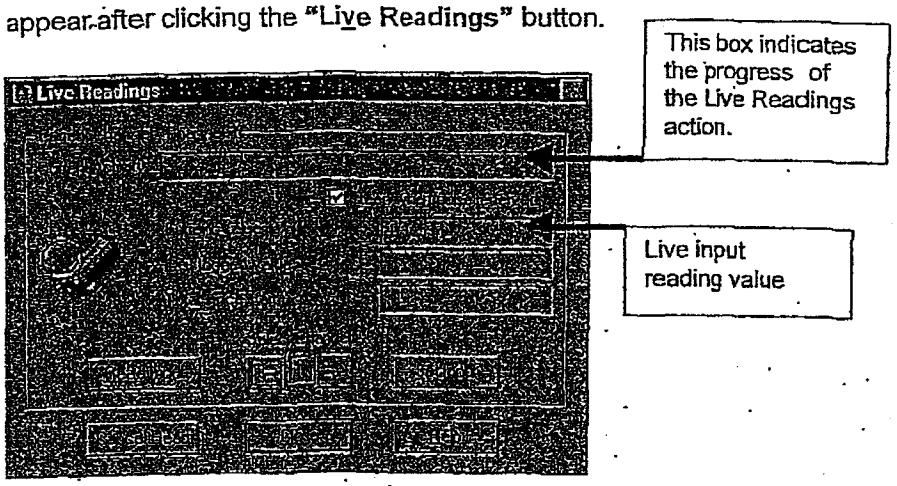
Closes the **Values** window.

Live Input Readings

The "Live Readings" button is an excellent way of checking the installation wiring prior to setting the logger logging.



The menu shown below will appear after clicking the **"Live Readings"** button.



Note

If the logger has just started logging and is logging at a rate greater than 1 sec, when you attempt a live input reading the software will report "Not Available yet" as the logger has not taken a reading.

ect Channel:	When using multi-channel loggers this option allows selection of the channel to be read.
Read Input	Initiates a Read on the selected Input.
Set Input	Allows an Offsets to be set.

Quick Reference Flow chart of Menu's for Logger communications