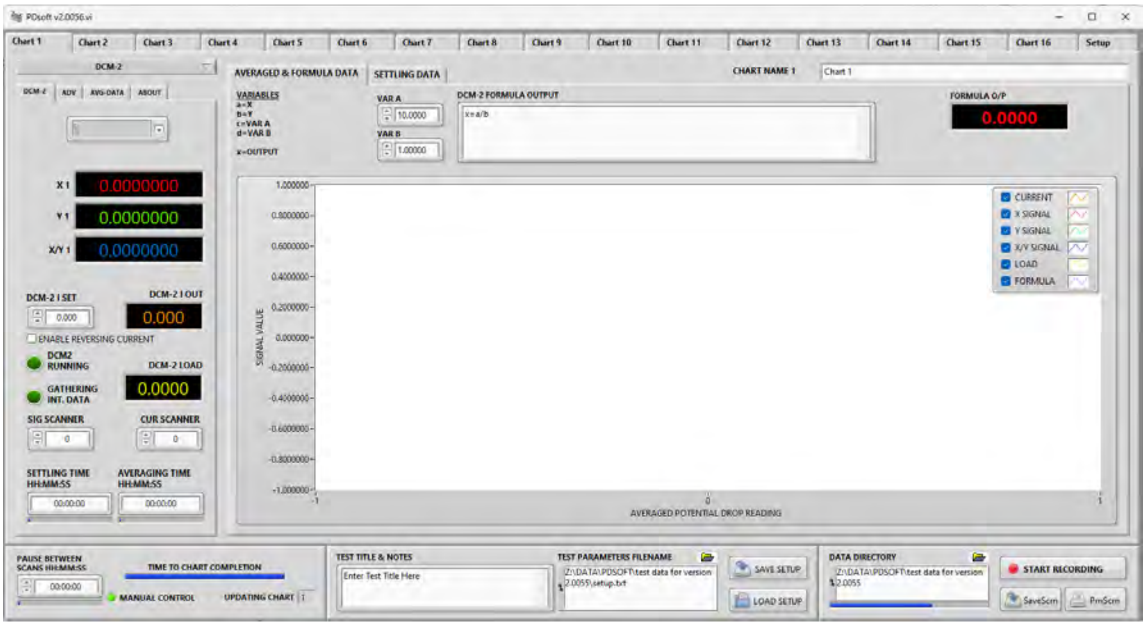
MATELECT LTD

PDsoft v2



INSTRUCTION MANUAL

Revision A (11/07/22)

INTRODUCTION TO PDSOFT V2

The primary function of PDsoft is to control and adjust the parameters of the attached and selected Potential Drop (PD) unit along with any scanner system attached to them and log the subsequent output data.

PDsoft v2 was developed to work with all of Matelect Ltd.'s PD units. PDsoft currently works with the CGM-7 and DCM-2. In the future, Matelect may add some of our legacy devices to PDsoft v2. If you need software to work with a Matelect instrument not mentioned here, please contact Matelect for a copy of PDsoft v1.

PDsoft has multiple advanced features, including formula entry, to give a real-time 'mm' output. In addition, the calculated 'mm' output can be sent to a physical analogue output on some units. Finally, load synchronisation is available as a cost option on the CGM-7 and DCM-2. If available, PDsoft will take readings in synch with the load waveform of any testing machine. There are many more unit-specific features mentioned further in the manual.

The logged data is stored in a simple comma-separated file for future visualisation in PDsoft or importation to other applications for YET further investigation.

SYSTEM REQUIREMENTS

PDsoft requires a modest PC system to work effectively. The following are the absolute minimum system requirements.

- An IBM-compatible PC running Windows 7 service pack 1 or later.
- A Pentium 4 processor or higher.
- 4 GB of system memory.
- A video resolution of 1564x800 or greater.
- 100 MB of free hard disk space.
- An internet connection required for auto updates and remote access.

TECHNICAL SUPPORT

Matelect prides itself on its technical support and willingness to help. If, at any point during the installation or running of this application, you require assistance, please do not hesitate to contact Matelect. This can be done via phone, although we prefer email:

PDsoftsupport@matelect.com

You can expect a response within 24 hours under normal circumstances.

If you would like software written to your specific requirements, Matelect is capable of providing a quick turnaround service. Please get in touch to discuss your requirements.

This manual applies to PDsoft v2 only. Manuals for earlier versions of the software can be obtained from our website.

MATELECT LTD

Telephone: **+44 (0)1895 823 334**
Facsimile: **+44 (0)1895 824 300**
E-mail: **info@matelect.com**
Web page: **www.matelect.com**

MATELECT LTD

ACPD CRACK GROWTH MONITOR
TYPE CGM7

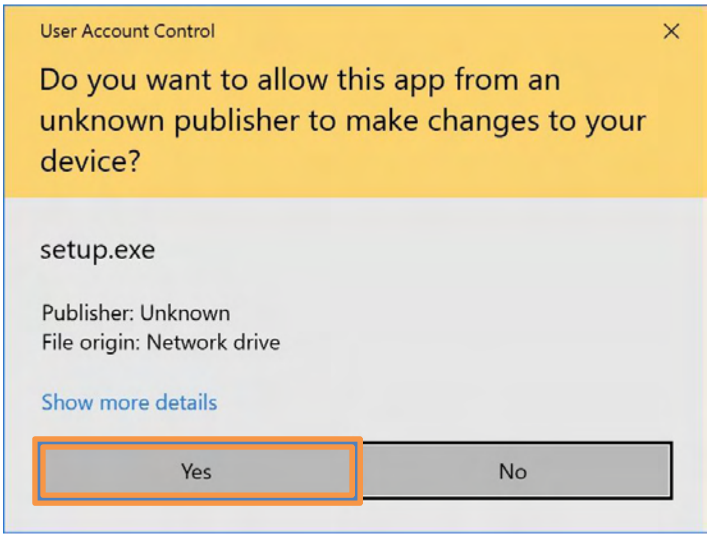
CONTENTS

1. SOFTWARE INSTALLATION & UPDATES

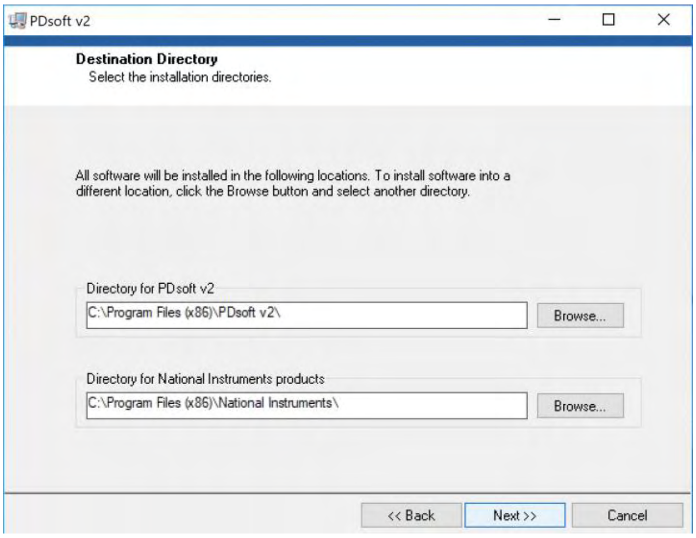
Installation

This section quickly explains the installation process. PDsoft is either supplied on a USB stick or via a download link from Matelect.

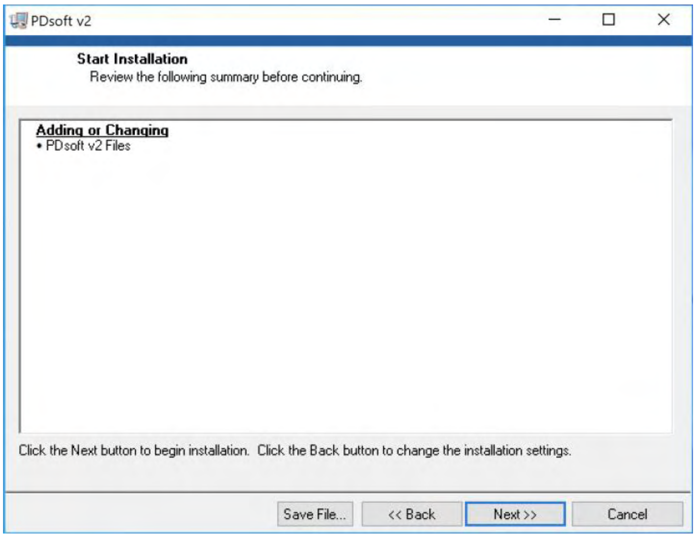
The process shown below is for Windows 10 but is fairly similar to other versions of Windows. Navigate to the installation directory, "PDsoft v2 INSTALLER >> Volume" and double click on "Setup.exe". After a short while the windows UAC message will appear, click "Yes" to proceed.



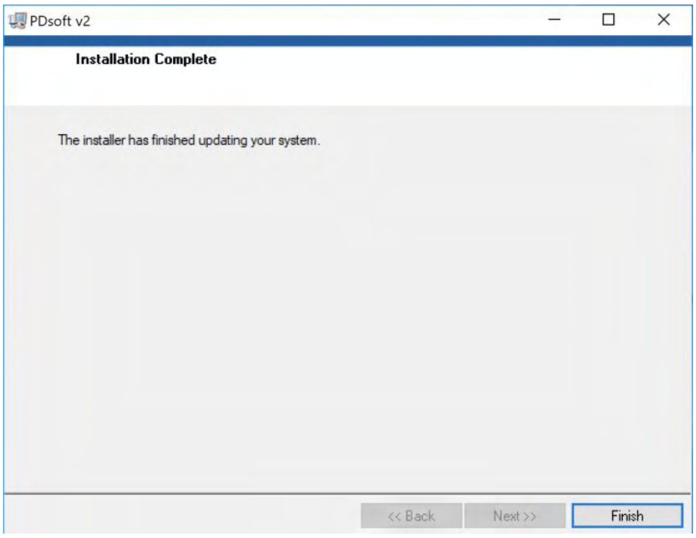
The window below will appear, and the user may either enter their own location for PDsoft to be installed or go with the default as shown, click "Next" to proceed.



Once the “start Installation” window appears click “next” to proceed.



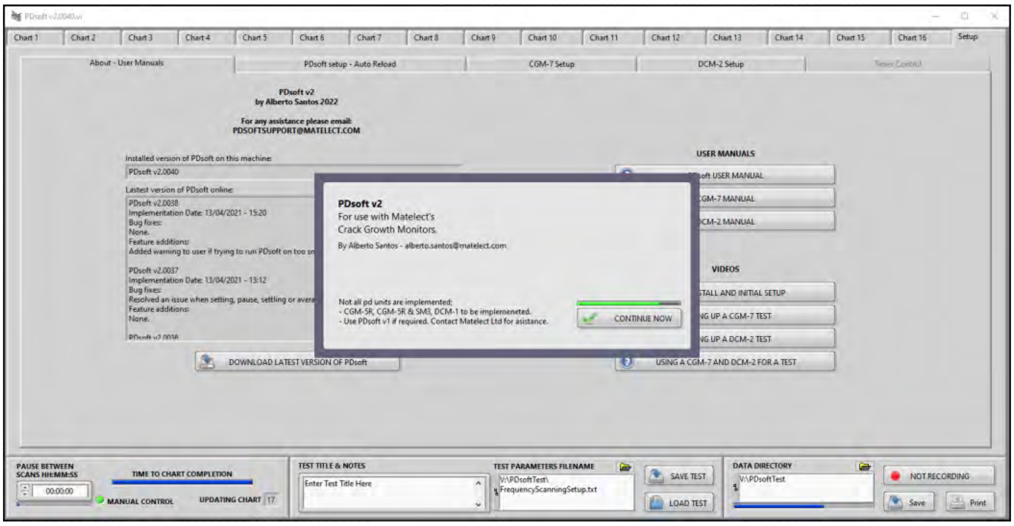
Installation may take some time depending on the PC it is being installed upon, please keep this in mind. After successful installation the screen below should appear.



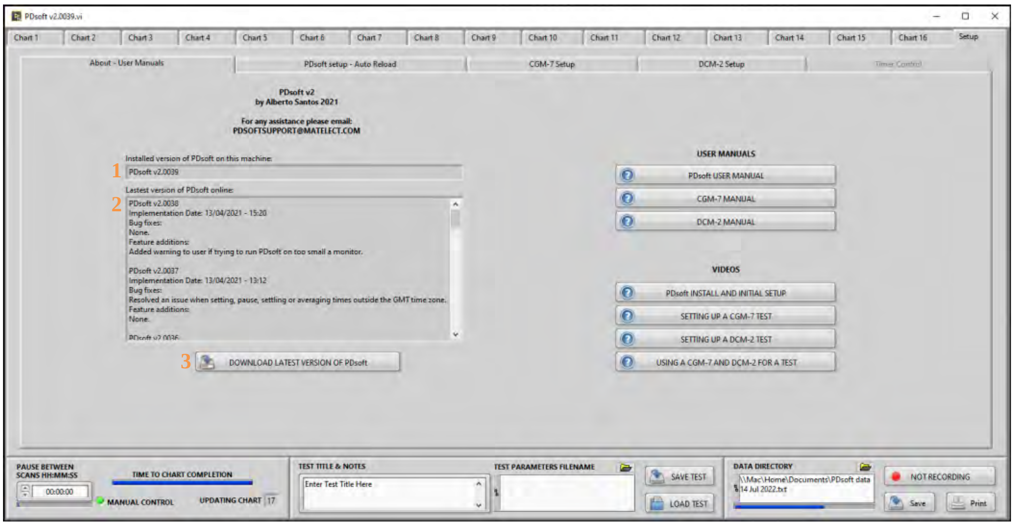
Installation is now complete, it is likely that you be asked to restart your computer especially if this is the first time you have installed PDsoft. Please start PDsoft so we may introduce you to the user interface, UI.

Software updates

If the PC, you have installed PDsoft onto is connected to the internet then you are able to take advantage of the update notification of the application. On starting PDsoft the following splash screen appears.



After a short while the splash screen disappears, and the following screen is presented showing the "About" tab.



The left-hand side of the "About" tab shows the current versions of PDsoft (1) installed and running on your PC. Below this is a list (2) of all the versions of PDsoft outlining any bug fixes and feature additions for that version. If your version is outdated the "Download latest version of PDsoft" (3) button will flash. Please press this button to be taken to our website where you will be able to download and install the latest version. Installation of newer versions of PDsoft happen a lot faster than the initial install.

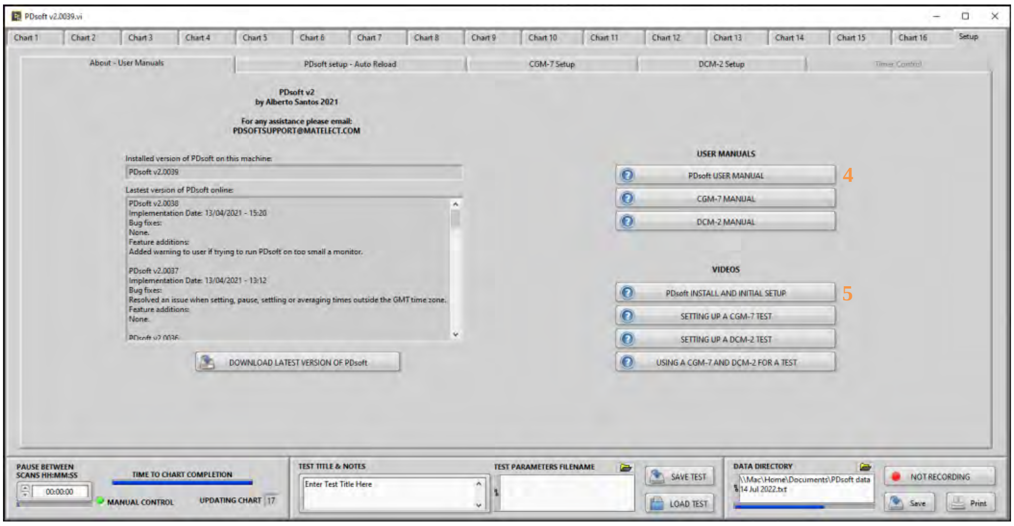
We understand that in some establishments a web connected PC is not always allowed, in this situation we strongly urge you to manually check on our website for updated versions of the software and where possible to keep your version up to date.

2. MANUALS AND INSTRUCTIONAL VIDEOS

User manuals

The right-hand side of the “About” tab shows a number of buttons (4) these are web links that take you directly to our user manuals for not only PDsoft, but most equipment used with it such as the CGM-7 or DCM-2.

If you do not have internet access on the PC PDsoft is installed on these manuals can all be accessed on our website from a PC that does.



Accessing instructional videos

We hope that you find this manual useful and easy to navigate, however we do subscribe to the notion that an image speaks a thousand words or even better a video. We have therefore prepared a number of instructional videos. These videos include basic setup and use tasks with PDsoft and as more are added they shall be added to the list. These videos can be accessed by pressing the associated buttons (5). Once again these are web links that will take you to our website to access the chosen video.

Note:
To watch the installation video of PDsoft please use the link below or QR code.

http://www.matelect.com/files/Download/SoftwareDownload/PDsoftInstallation.mp4

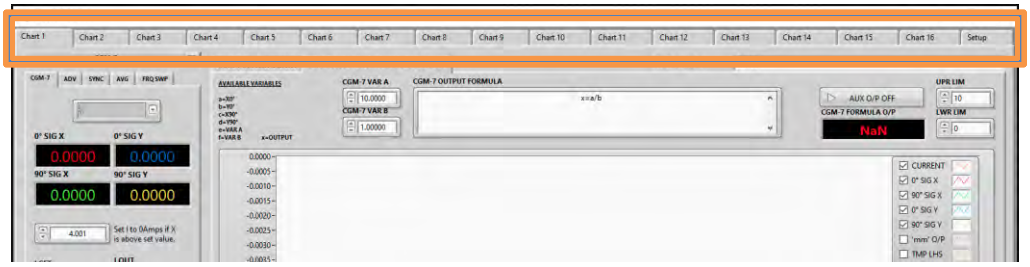
3. USER INTERFACE AND SOFTWARE SETUP

How the software works and how to use it

PDsoft was designed to work with our current range of potential drop instruments and if connected to a universal testing machine also has the ability to synchronise to its load cycle, if the required hardware has been purchased. The way in which this synchronisation works with the testing machines load cycle is different dependant on the potential drop system used and will be explained in greater detail in the relevant sections of this manual.

PDsoft can adjust all parameters of the potential drop instruments selected, such as their current, gain, frequency etc. Some potential drop parameters such as that of the CGM-7's frequency can be programmed to change automatically within a range allowing users to do advanced testing, again, these will be explained in greater detail in the relevant sections of this manual.

Once the potential drop instrument is correctly setup, PDsoft will then allow the user to control the point at which a reading is taken by allowing control of settling time, averaging time and even the point of the testing machines load cycle at which a reading should be taken.



PDsoft consists of 16 charts, selectable from the very top of the screen. Each chart can be seen as a separate test. The user can use just one chart, if for example working with a simple CT specimen and wanting to get data as quickly as possible.
If, however if the user wishes to profile the length of something such as a T-butt weld they may wish to record data at multiple locations along that weld in which case multiple charts would need to be used. A chart would be assigned to each location of the weld.
PDsoft even allows the use of multiple potential drop instruments to be used on the same specimen, although extra hardware is required for this, this special operation is explained later in the manual.

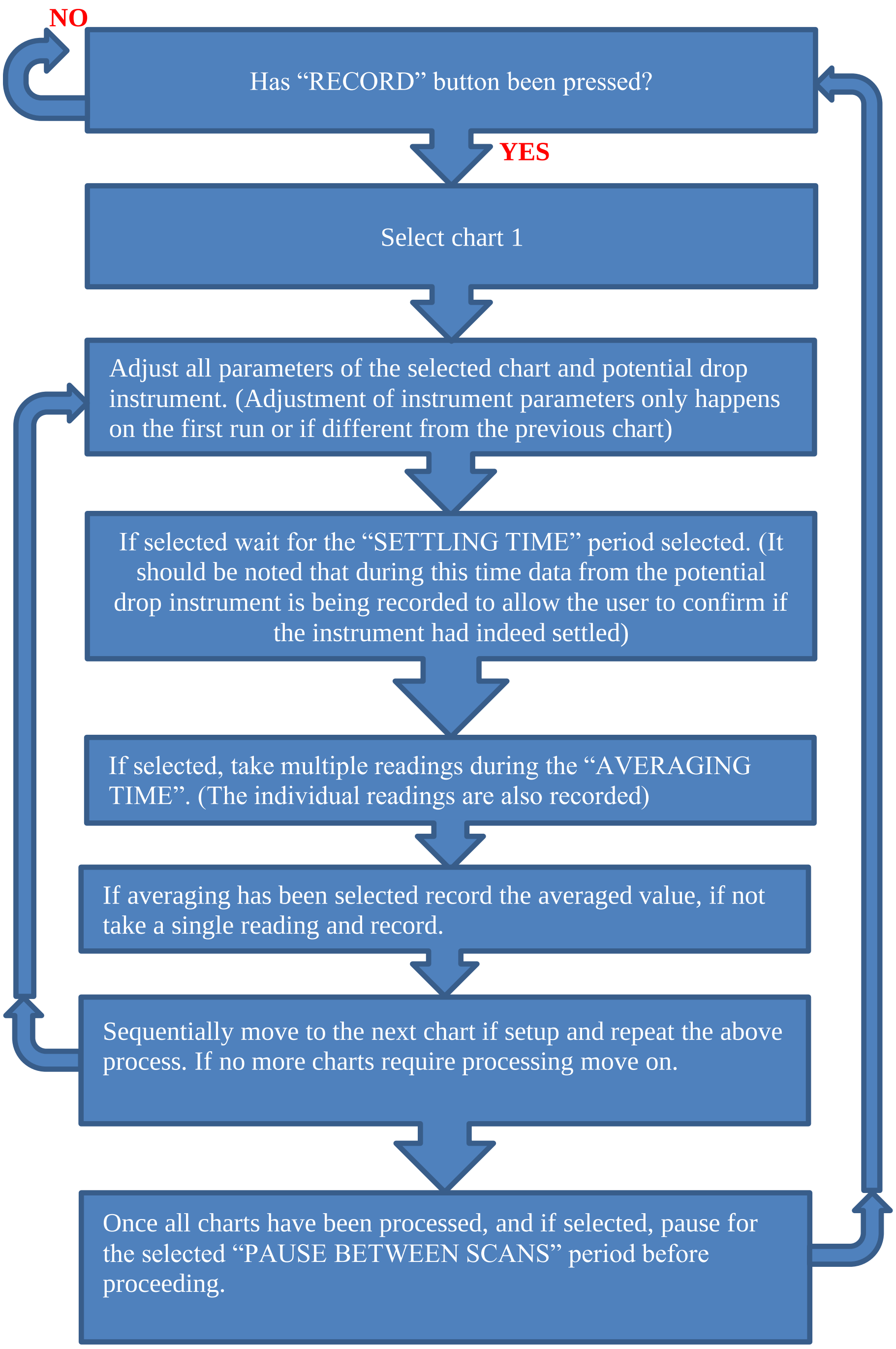
Once all charts have been setup as required the user can start gathering data by pressing the "RECORD" button. When pressed PDsoft will go to chart 1 and select the appropriate potential drop machine, adjust its parameters and if setup, wait the selected time in seconds to allow the system to settle, it will then if setup, take readings continually and average them and finally store the resultant reading. At this point the system will continue to the next chart and repeat the above process until all selected charts have been completed.

Once all charts are processed PDsoft will if set to do so, pause for the set time until restarting a scan of the charts. The above will be repeated until the "RECORD" button is pressed once more, at which point the "RECORD" button will show "NOT RECORDING" and PDsoft will eventually return to the "SETUP" tab and its idle state.

Note:
When a user presses the "RECORD" button to stop recording, the system will complete the cycle it is currently in, dependant on the time parameters set in each chart and the pause between scan time set this can take a long wait.

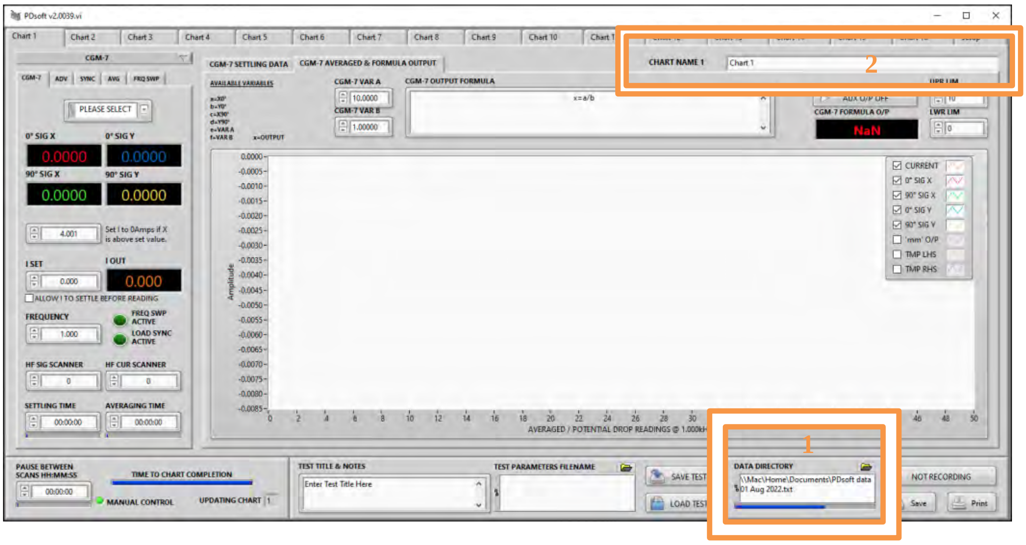
PDsoft Cycle

The flow chart below outlines PDsoft's normal recording cycle.



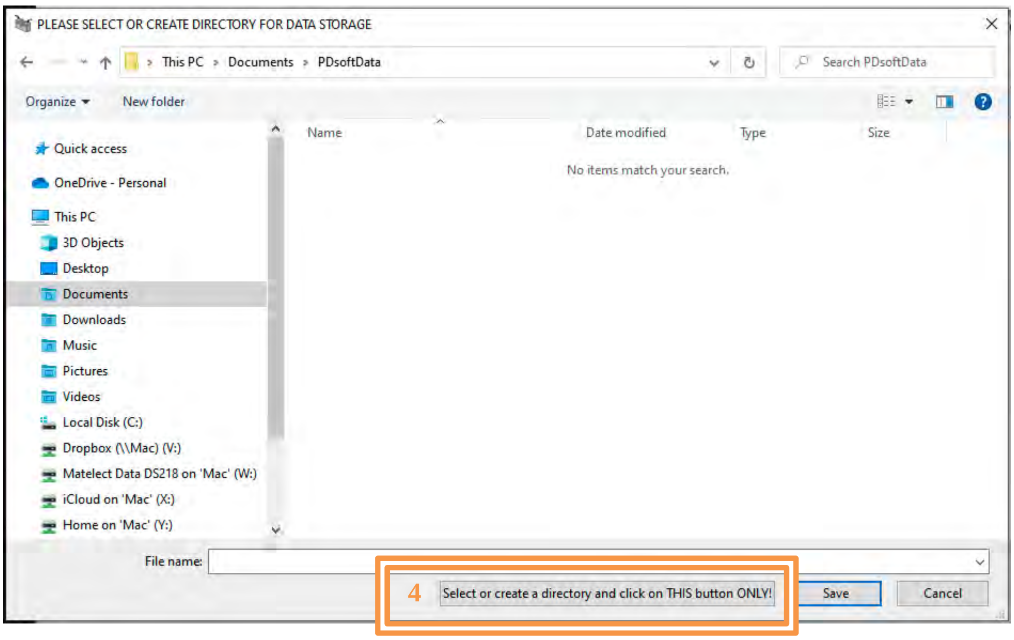
Understanding data & chart directories, and data storage

All recorded data is stored in simple comma separated text files with plain text headers, these are easy to import into applications such as Excel. We shall discuss these later in this section.



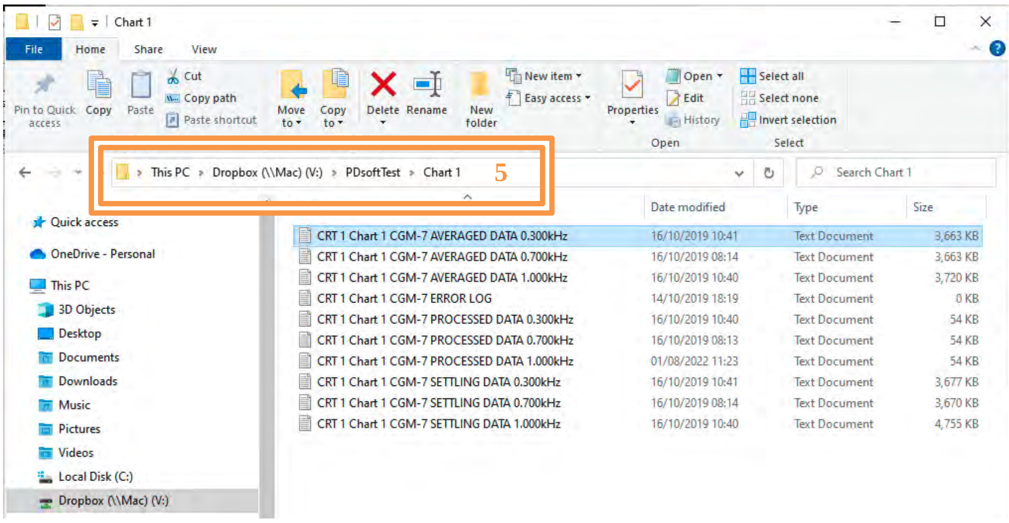
When PDsoft is first installed it automatically creates a root directory for all files in the users “Documents” directory. Of course, the user can change this to whatever they like, and all subsequent documents will be stored within this root data directory. Simply click on the folders icon (1) and enter your directory of choice.

Note:
Once you have created your root directory by pressing the folders icon (1) you must then enter the directory and click “Select or create a directory and click on THIS button ONLY” (4) for the directory to be stored as the new root directory. You can confirm this has happened by looking at the “DATA DIRECTORY” window (1).



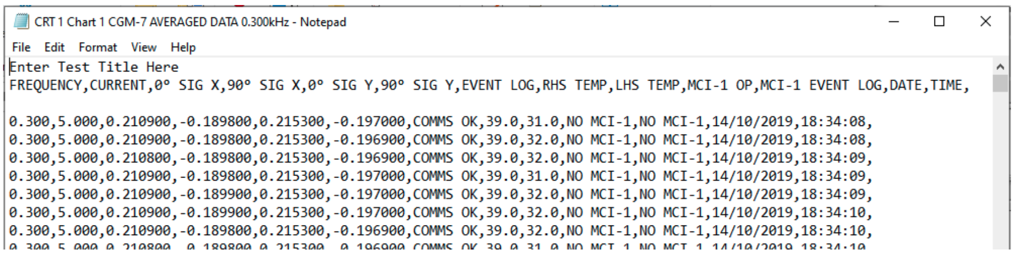
Each chart used in PDsoft is assigned a directory in which all subsequent data for that chart is stored. The name of the directory is that of the chart name (2) and as such users should not use any special characters.

When the "RECORD" button is pressed the application creates a directory with the same name as the Chart name under the root data directory previously set-up. All data relating to this chart is recorded within this subdirectory.



The image above shows a typical set of files created by PDsoft.

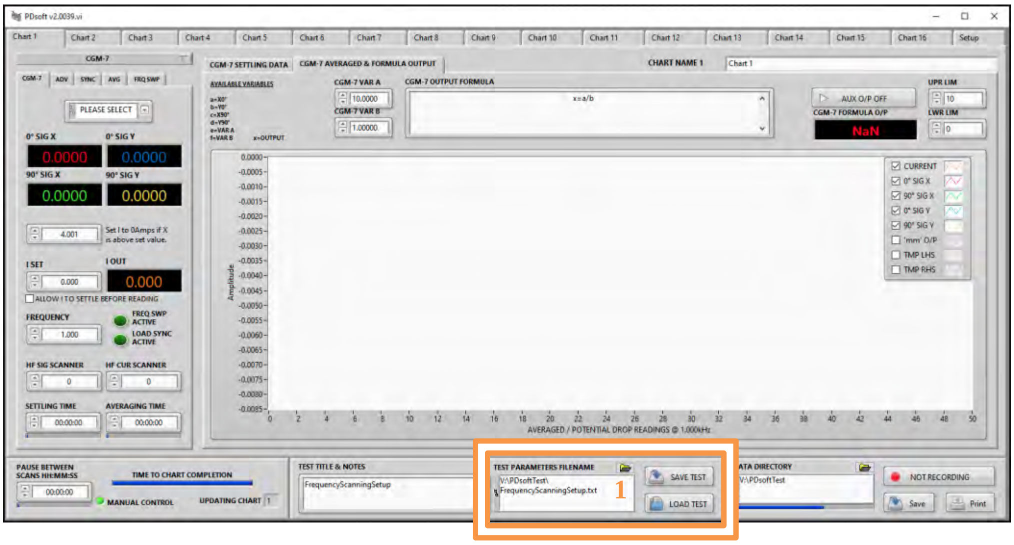
It can be derived from the data location (5) that the data directory (1) was saved as "V:\PDsoftTest" and the chart name (2) was left as default "Chart 1"
The exact files created are dependent on the potential drop instrument chosen and parameters selected within the chart.
However, all directories will have an error log, as its name implies any errors that occur during the data capture or setting of an instrument are logged in this file for review.
The names of the files are hopefully self-explanatory. However, as a quick review if the user has chosen to have a settling period, this is stored in the filename ending with "SETTLING DATA".
If the user has chosen to set an averaging time, the data gathered to produce the final averaged sum is stored in the filename ending "AVERAGED DATA".
Finally, the filename ending "PROCESSED DATA" shall either have the final averaged value or if no averaging selected a single reading from the instrument selected.
Note in this example we have three of each file this is because frequency scanning was selected with the CGM-7 and a set of files for each frequency are recorded, this is explained further in the CGM-7 section of the manual.



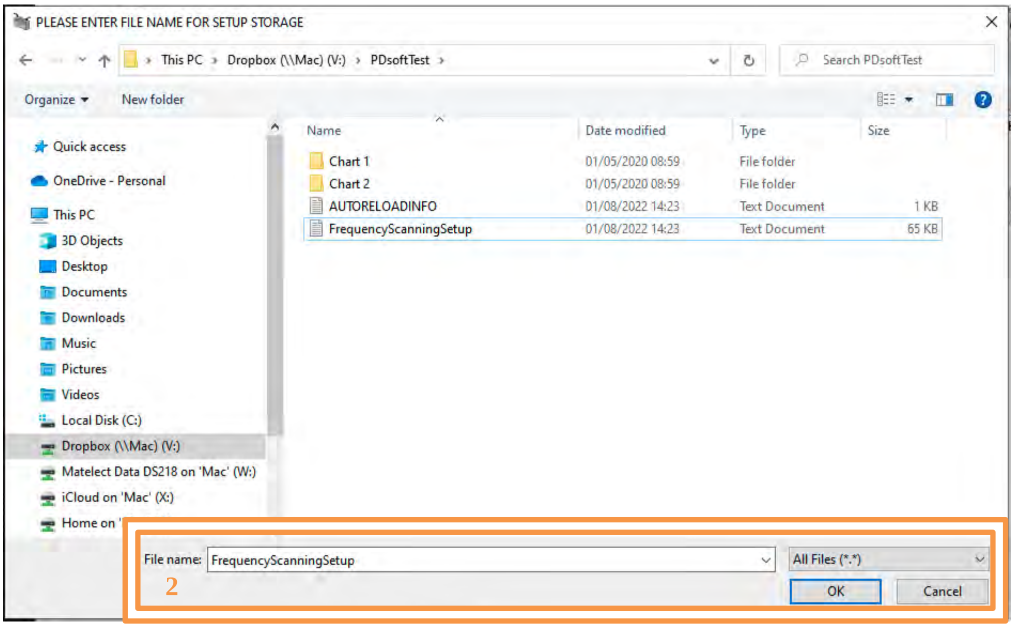
The image above shows a typical data file. The actual data stored is again dependant on the potential drop instrument chosen and parameters selected within the chart, but they all share a common structure.
All PDsoft files start with the data stored in the "TEST TITLE & NOTES window (3), this is here to help users remember the exact nature of the data stored and users are urged to use it.
This is followed by a header section, note every line is ended with a timestamp.
Finally, the data itself, with settling and averaged data there is a blank line between each settling or averaging period. The processed data is recorded continuously.

Saving test parameters and re-loading them

Once all the charts are setup it is often very useful to save the setup for future use, allowing the user to repeat the test without the overhead of setting it all up again.



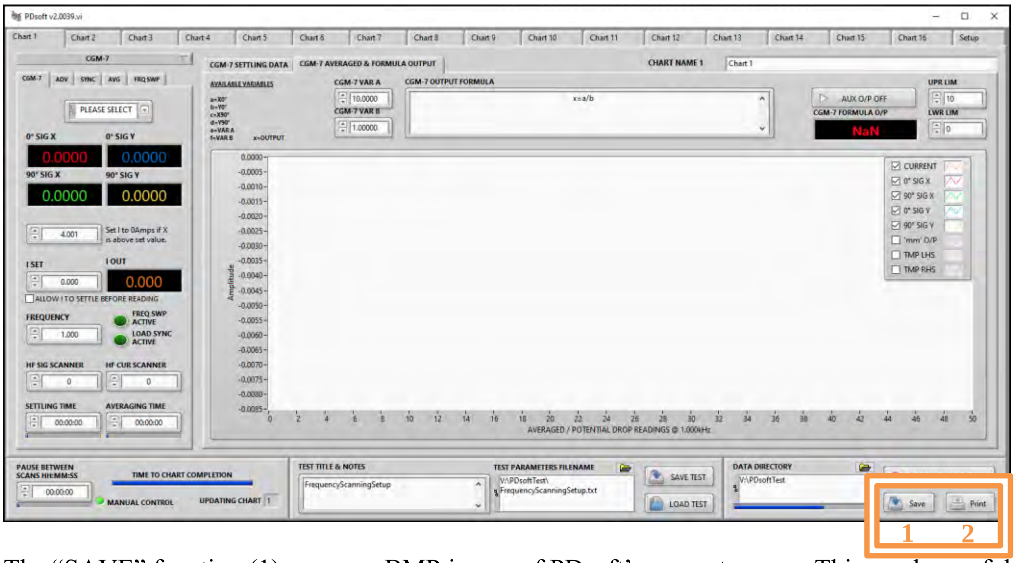
As with the "DATA DIRECTORY" setup to do this press the folders button beside "TEST PARAMETERS FILENAME" (1).



Simply enter a suitable filename for the test and hit "OK" (2).

In the future to re-load all your settings simply navigate to the setup file by pressing the folders button (1) and navigate to your saved file and hit ok (2). All parameters from within PDsoft will be re-loaded at this time.

Save & Print functions

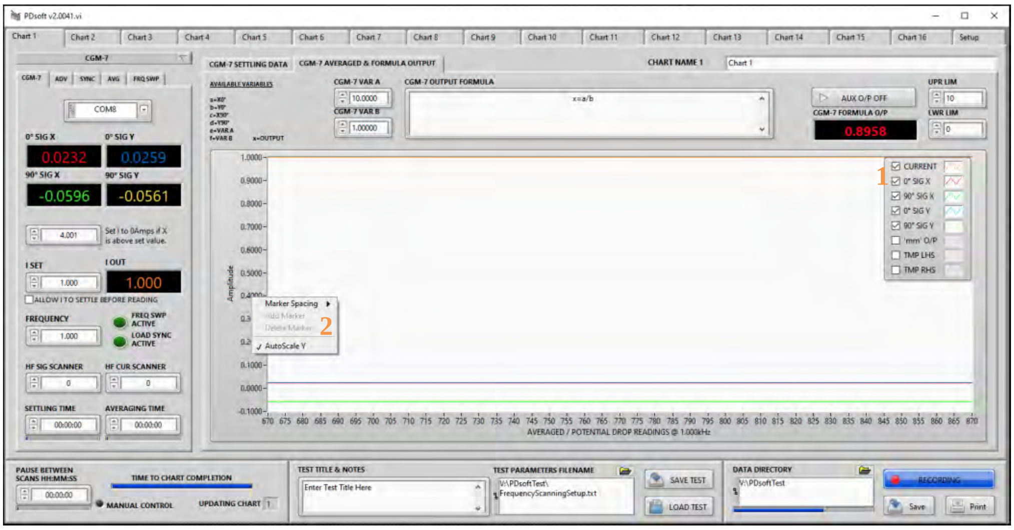


The “SAVE” function (1), saves a .BMP image of PDsoft’s current screen. This can be useful for adding to reports etc.

The “PRINT” function (2) sends a screen grab to the locally connected printer if there is one.

Selecting & deselecting plots and scaling graphs

When viewing any graph from within PDsoft a user can select or deselect any plot by simply clicking the selection box (1) beside the plot to be selected or unselected.

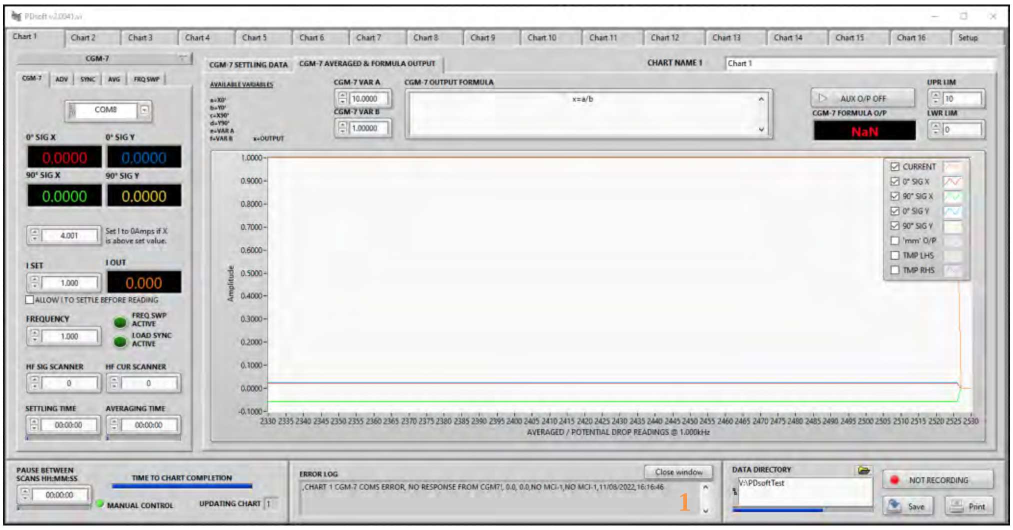


The Graph will auto scale to take into account the new plot. If a user does not wish the auto scale and want to zoom into a plot of interest, they can right click on the X or Y legend (2) and deselect “AutoScale”.

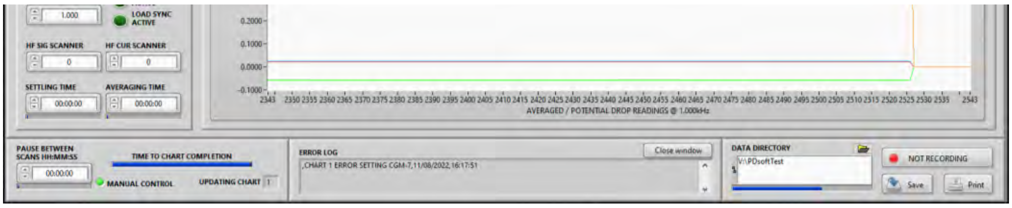
The user can then select the uppermost (3) and lowermost value and change it according to there requirements.

Error log and error handling.

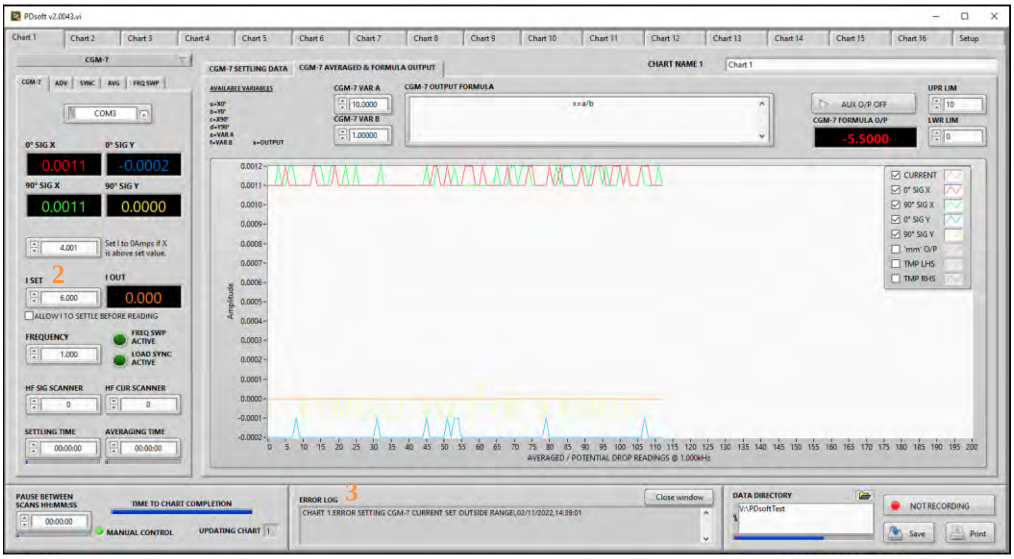
When using PDsoft, be it setting up or whilst it is recording data, if a communications error occurs then the following window will appear (1).



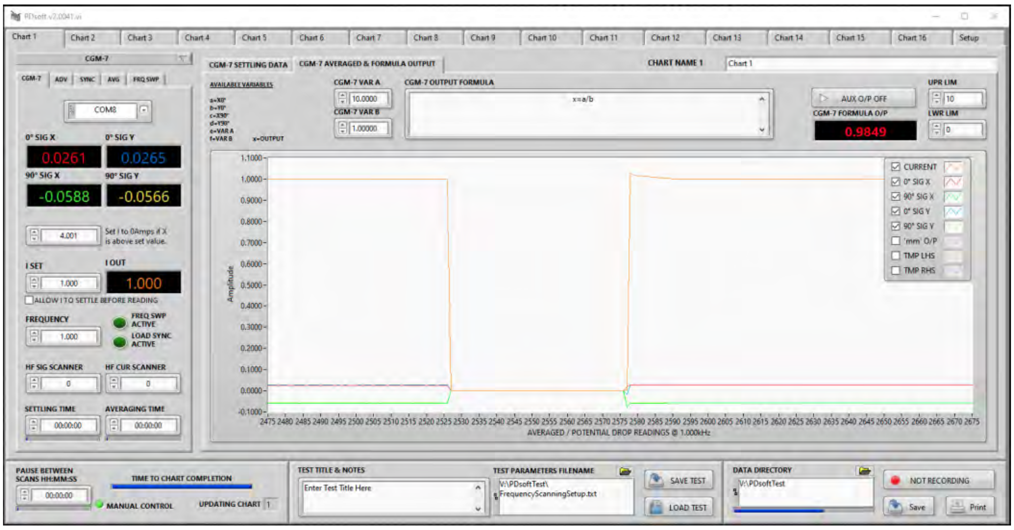
Depending where in the cycle of PDsoft it will state if it was unable to read the CGM-7 / DCM-2 or set it.



If a user attempts to enter a value outside the range of a particular input it will also display an error, in the example below a user has attempted to enter a value of 6Amps (2) when the CGM-7 connected can only provide 5Amps. Once the user enters a valid value the error message (3) will disappear automatically.



PDsoft will record these errors in the error file created for the Chart within the root directory. Once the error clears PDsoft will reset all parameters of the PD unit that was affected, such as current, gain etc. The Error log window will automatically disappear at this point as shown below and readings should return to where they were before the error.



PDsoft Auto reload on power failure & remote access & control of PDsoft

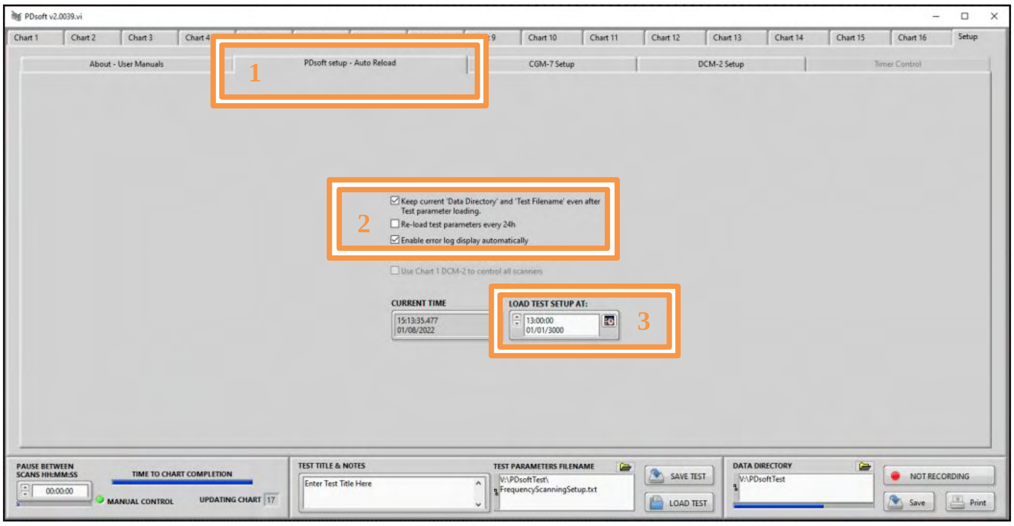
The usefulness of saving the test parameters is obviously a very helpful function as setting up tests can be a somewhat lengthy process however we have made the function yet more useful by adding the ability to auto reload your setup whenever the software starts or every 24Hours. Some potential drop tests run for days, weeks, or many months, during this time it is possible that a power failure could hit the facility, by setting up your PC and PDsoft appropriately you can make it so PDsoft restarts and automatically resets you potential drop equipment.
You need to do the following to allow this.

Set up windows to start PDsoft automatically whenever windows starts, this is somewhat beyond the scope of this manual and should you need assistance please contact your IT department. However, for windows 10 this consists of doing the following;

- Select the **Start** button and scroll to find the app you want to run at startup.
- Right-click the app, select **More**, and then select **Open file location**. This opens the location where the shortcut to the app is saved. If there isn't an option for **Open file location**, it means the app can't run at startup.
- With the file location open, press the **Windows logo key** + **R**, type **shell:startup**, then select **OK**. This opens the **Startup** folder.
- Copy and paste the shortcut to the app from the file location to the **Startup** folder.

Now every time windows starts, including after a power failure PDsoft will start. However, at the moment PDsoft will start but not do anything, it will simply sit there waiting for user control. There are two ways to get PDsoft to restart the test automatically.

The first and easiest is to select the “PDsoft setup – Auto reload” tab (1) and then click the “Re-load test parameters every 24h” box (2). This will reload the “TEST PARAMETERS FILENAME” every 24hours and set the system running.



The second approach is to enter a date in the “LOAD TEST SETUP AT” window (3) at some date in the past of the current date. Simply change the year to 2000 **AND save the test again**, this will force the software to instantly reload the setup pointed to in the program and start recording but most importantly re-initializing all connected potential drop equipment.

4. CGM-7 SPECIFIC SETUP

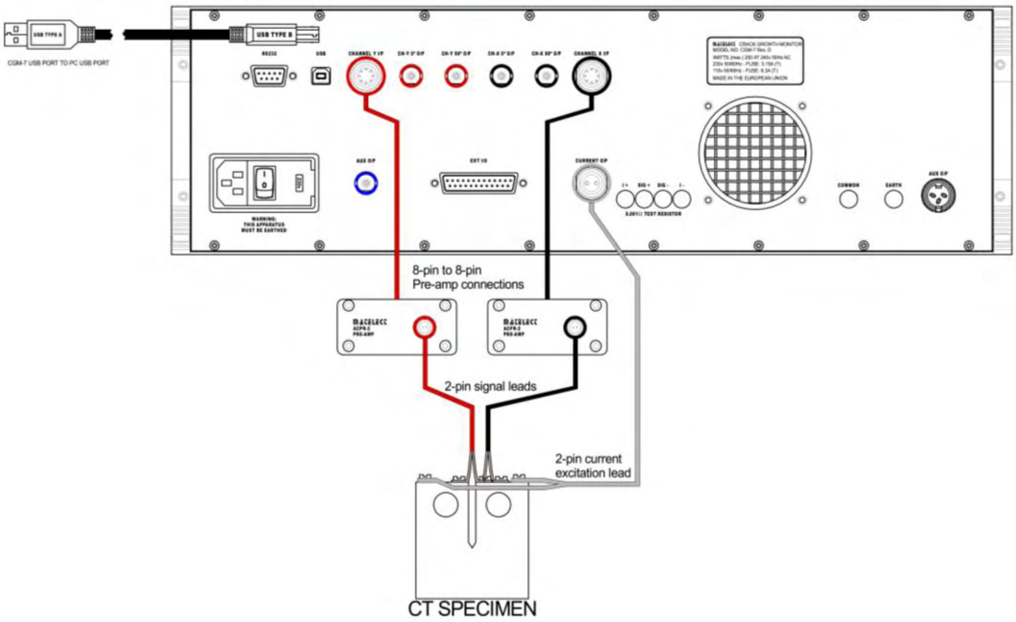
In this section of the manual we shall explain how the software is used specifically with the Matelect CGM-7, ACPD instrument. We shall go through general setup with a simple CT specimen. The use of the frequency scanning function. Followed by a more complex example using the CGM-7 high frequency scanner system SM1-HF and SM-2HF looking at multiple locations along a toe weld. Finally, we shall look at the use of the MCI-1 machine cycle synchronisation unit.

Simple CT specimen scenario, setting basic parameters

Set-up the hardware and specimen
Firstly let's look at the scenario of a simple CT specimen, in this case it is a CT50 specimen made of aluminium, the CT specimen is connected to the CGM-7 by means of an excitation current lead and two signal leads, marked as "signal X' and "signal Y".
Signal X is normally connected across the slit of the CT specimen whereas signal Y is normally connected to a non-cracked area of the specimen but in-line of the current path.
It is assumed that the CGM-7 pre-amplifiers have been connected and that a USB cable has been attached between the CGM-7 and the PC running PDsoft, See the image below for further guidance.
For further information on connecting specimens to your CGM-7 please refer to the CGM-7 manual or specimen connection guide available from PDsoft or our website.

http://www.matelect.com/files/Download/ACPDTechnique%20v3.3b.pdf

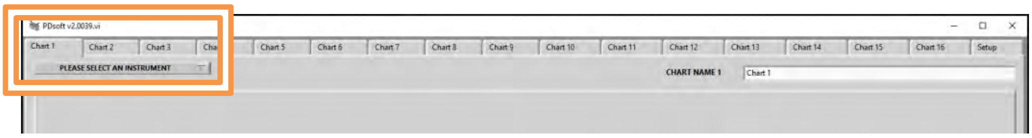
http://www.matelect.com/files/Download/CGM7v25.pdf



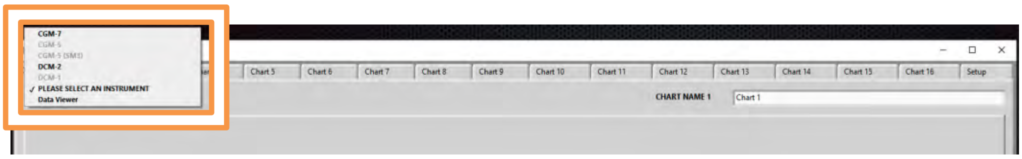
Wiring diagram of CT specimen connected to CGM-7 and a PC.

Select the chart to run experiment in

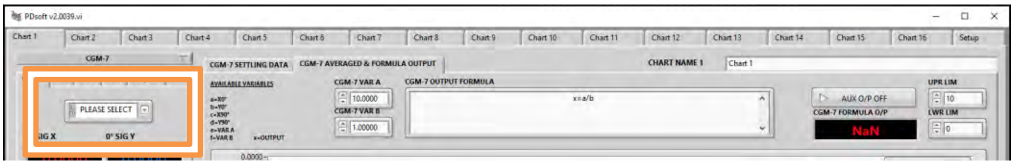
Firstly click on the “Chart 1” tab at the top of PDsoft, as shown below.



Now select the “CGM-7” from the drop-down menu labelled “PLEASE SELECT AN INSTRUMENT”



When the screen below appears users will notice that a box in the top right of the screen is flashing, with the message, “PLEASE SELECT”, this is because PDsoft needs to know which com port the CGM-7 has been connected to.



Selecting the com port of the CGM-7

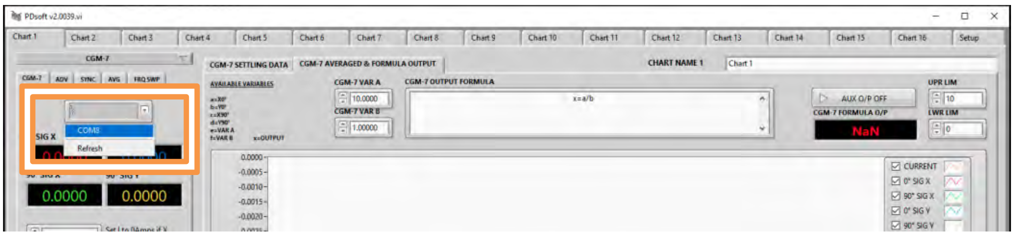
Note:

The CGM-7 has an RS232 communications protocol, as such the USB connection on the rear of the unit is in fact seen as a virtual com port by the attached PC.

Usually if your PC is connected to the internet when you first plug in your CGM-7, Windows will go off and download the required driver if required. If this does not happen, users will need to install the Virtual Com Port driver manually. Instructions for this can be found in the back of this manual.

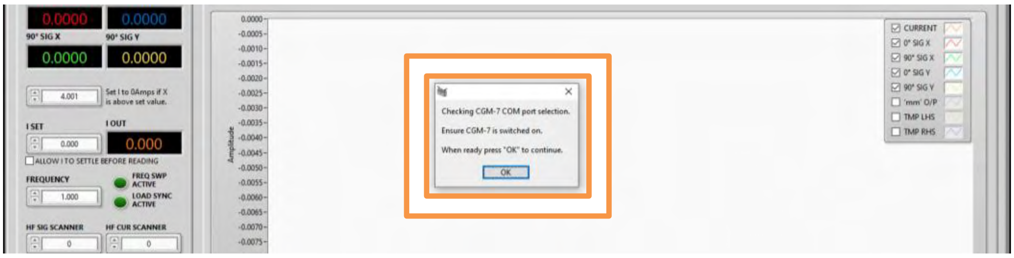
Once the com port driver is installed please take note of the com port number assigned to the CGM-7 this will be required in the following section. If not known don’t worry it may just take a few extra steps

Press the down arrow to the side of the text “PLEASE SELECT” and a list of COM ports connected to the PC should appear, as shown below.

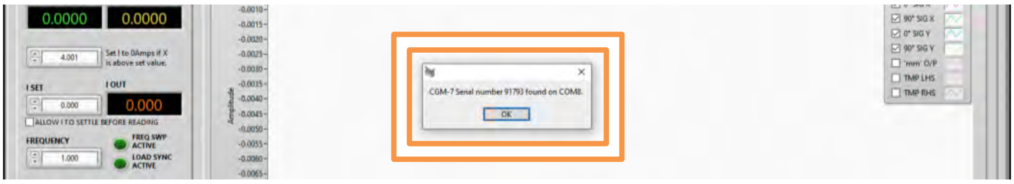


In this case only one COM port is available. If you do not know the com port of your CGM-7 you will be able to go through them systematically until getting a confirmation message as explained below.

Click on the correct COM port for the CGM-7 connected, the following message is displayed.

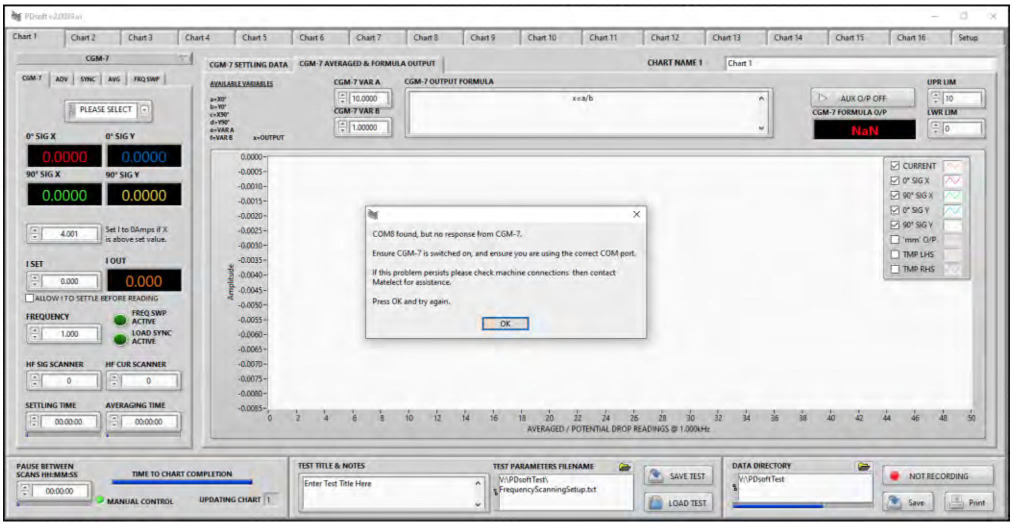


When ready click “OK”, ensuring the CGM-7 is switched on as advised, and ensure the CGM-7 no longer shows its splash screen. If the CGM-7 is successfully found on the COM port selected the message below will be shown.



Click “OK” to continue.

If the CGM-7 was not found on the selected COM port an error message will be displayed as shown in the image below. The user may now select a new com port from the drop-down list as outlined above and try again.

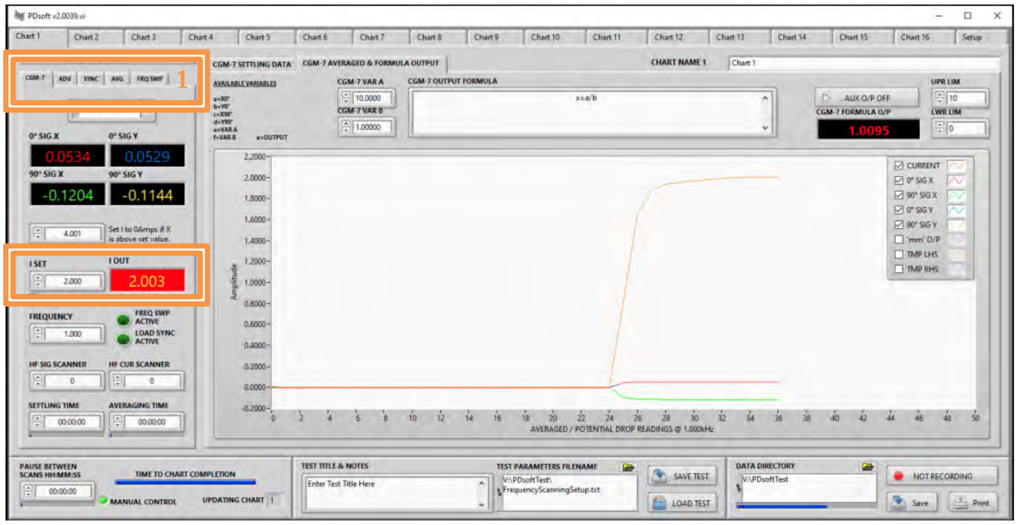


Users will now notice data from the CGM-7 being gathered and displayed on the main graph. The digital displays for both signal channels as well as Current will also be populated. In normal operation updates will occur roughly 3 times a second.

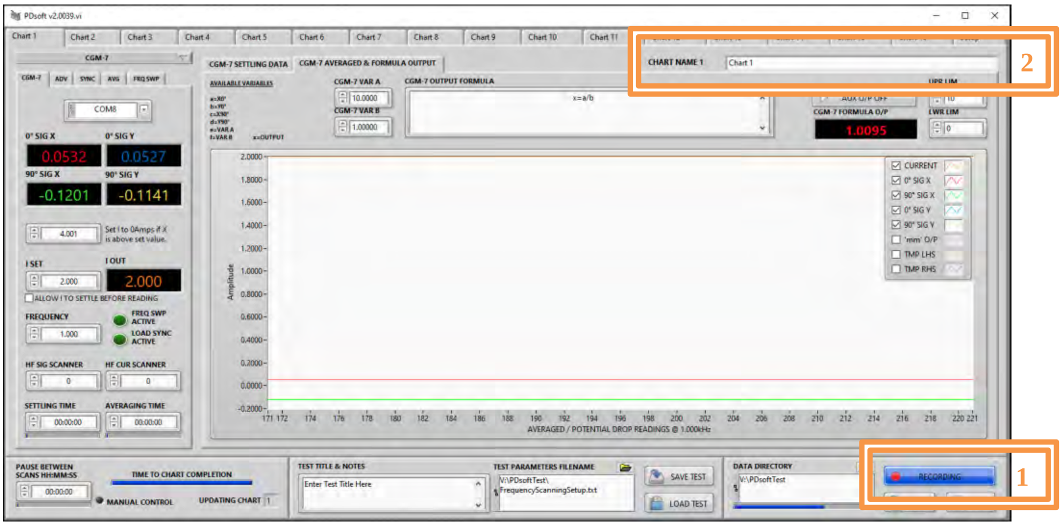
Note:
If you see dropouts in the data set go to the section of the manual intitled, “what to do if dropouts are noticed” at the back of this manual for instructions on how to deal with this scenario.

Setting a CGM-7 parameter

Lets try our first parameter setting, click in the "I SET" box and enter a value of 2.000 amps, this will set the current to 2.000 Amps on the CGM-7. Notice how the "I OUT" display is flashing red, whenever a display flashes red it indicates a compliance or overload situation. In this case as the current was set to 2.000 amps and it overshot by 2mA it informs us of this, after a very few readings the current stabilizes and the display stops flashing red.



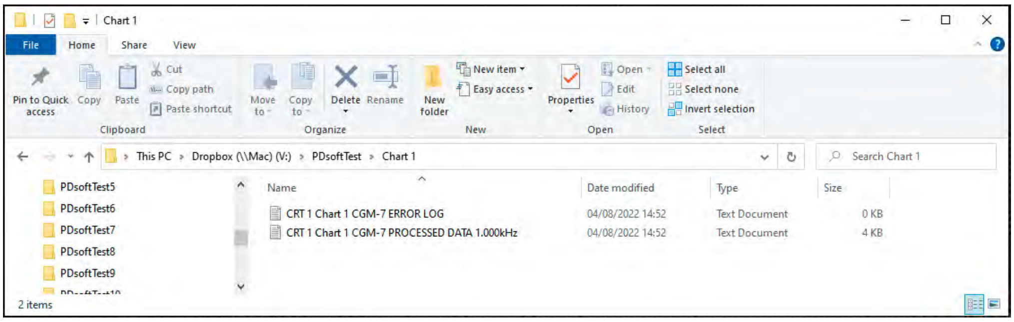
The CGM-7 in its simplest form has just two parameters to change, the set current as just demonstrated and the frequency of excitation, just below the set current box.
Once these have been set a user could now click the "RECORD" (1) button and commence gathering data from the CGM-7 at a rate of roughly 3 readings a second.



Data files will be stored in the subdirectory of the same name as the chart name, in this case "Chart 1" (2) under the root directory of "V:\PDsoftTest" in the above presented setup.

Once the experiment is over users can press the "RECORD" (1) button once again and once the final set of readings have been recorded PDsoft will return to the "Setup" tab.

Users can now view the data recorded, navigating to the DATA DIRECTORY they will see the following sub directory named "Chart 1" entering this directory they should see:



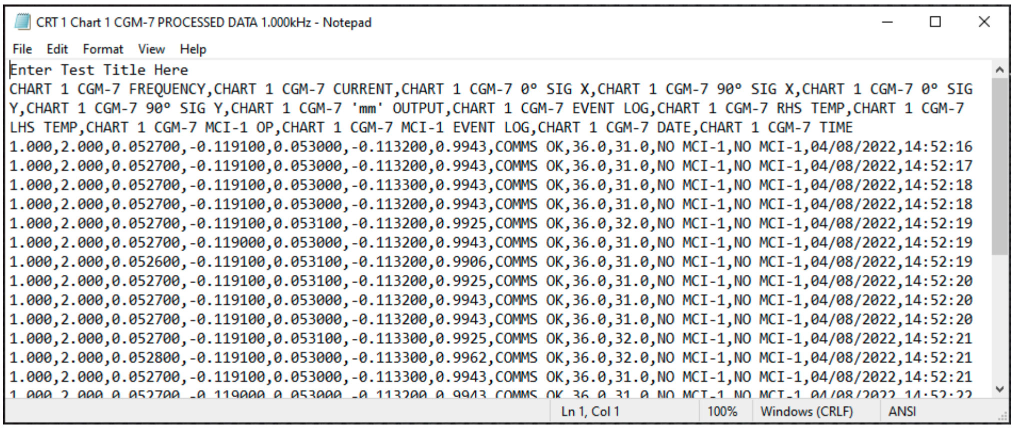
As there were no errors during the recording session the error log file is empty as shown by the 0 KB file above.

The second file contains the saved data from this very quick test.

Note:
Note the construct of the file it is called,
"CRT 1 Chart 1 CGM-7 PROCESSED DATA 1.000kHz.txt"
Lets take this apart and see what each section means.

- "CRT 1" – Shows us it was from chart 1
- "Chart 1" – Is the username of the chart. "Chart 1" is the default but you can name it as you please, for example "aluminium CT no: 001"
- "CGM-7 PROCESSED DATA" – Shows us this is from a CGM-7 unit and the final data set.
- "1.000kHz" – Shows us the readings were taken at 1.000kHz excitation frequency. If you have multiple frequencies as done during a frequency sweep you would have a file for each frequency.

If we open the CRT 1 Chart 1 CGM-7 PROCESSED DATA 1.000kHz.txt file we will see the following;




```
Enter Test Title Here
CHART 1 CGM-7 FREQUENCY,CHART 1 CGM-7 CURRENT,CHART 1 CGM-7 0° SIG X,CHART 1 CGM-7 90° SIG X,CHART 1 CGM-7 0° SIG
Y,CHART 1 CGM-7 90° SIG Y,CHART 1 CGM-7 'mm' OUTPUT,CHART 1 CGM-7 EVENT LOG,CHART 1 CGM-7 RHS TEMP,CHART 1 CGM-7
LHS TEMP,CHART 1 CGM-7 MCI-1 OP,CHART 1 CGM-7 MCI-1 EVENT LOG,CHART 1 CGM-7 DATE,CHART 1 CGM-7 TIME
1.000,2.000,0.052700,-0.119100,0.053000,-0.113200,0.9943,COMMS OK,36.0,31.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:16
1.000,2.000,0.052700,-0.119100,0.053000,-0.113200,0.9943,COMMS OK,36.0,31.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:17
1.000,2.000,0.052700,-0.119100,0.053000,-0.113300,0.9943,COMMS OK,36.0,31.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:18
1.000,2.000,0.052700,-0.119100,0.053000,-0.113200,0.9943,COMMS OK,36.0,31.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:18
1.000,2.000,0.052700,-0.119100,0.053100,-0.113200,0.9925,COMMS OK,36.0,32.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:19
1.000,2.000,0.052700,-0.119000,0.053000,-0.113200,0.9943,COMMS OK,36.0,31.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:19
1.000,2.000,0.052600,-0.119100,0.053100,-0.113200,0.9906,COMMS OK,36.0,31.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:19
1.000,2.000,0.052700,-0.119100,0.053100,-0.113200,0.9925,COMMS OK,36.0,31.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:20
1.000,2.000,0.052700,-0.119100,0.053000,-0.113200,0.9943,COMMS OK,36.0,31.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:20
1.000,2.000,0.052700,-0.119100,0.053000,-0.113200,0.9943,COMMS OK,36.0,31.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:20
1.000,2.000,0.052700,-0.119100,0.053100,-0.113300,0.9925,COMMS OK,36.0,32.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:21
1.000,2.000,0.052800,-0.119100,0.053000,-0.113300,0.9962,COMMS OK,36.0,32.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:21
1.000,2.000,0.052700,-0.119100,0.053000,-0.113300,0.9943,COMMS OK,36.0,31.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:21
1.000,2.000,0.052700,-0.119000,0.053000,-0.113200,0.9943,COMMS OK,36.0,31.0,NO MCI-1,NO MCI-1,04/08/2022,14:52:22
```

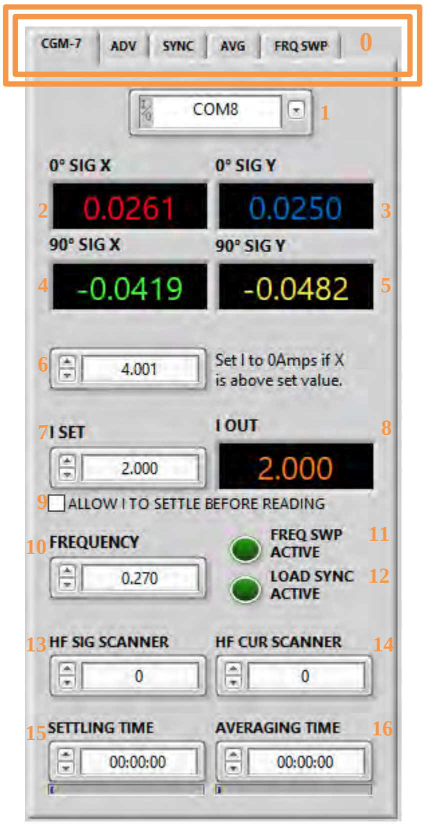
Let's analyse each line and explain what is shown.

1. This currently states "Enter Test Title Here", this is the default, but a user can enter what they wish, such as "Testing of aluminium specimens 1 to 6" it is available to help understand the data set in the future.
2. The second line is a header in comma separated format. All should be relatively easy to understand from the text, however the items marked "… CGM-7 RHS temp" and "… LHS temp" are internal temperature readings for fault finding by Matelect and can be ignored by most users.
3. Subsequent lines are the data itself, all ended with a time stamp.

Detailed function and display description

In the first example we only set the current of the CGM-7 however as could be seen there are a number of other parameters available, selectable from the tabs (0). These are explained in detail in the next sections. The synchronisation and frequency sweeping tabs are given their own sections as they require more detailed explanation.

CGM-7 TAB



1. COM Port - CGM-7's selected com port

2. 0^0 SIG X - 0-degree component of X signal

3. 0^0 SIG Y - 0 degree component of Y signal

4. 90^0 SIG X - 90 degree component of X signal

5. 90^0 SIG Y - 90 degree component of Y signal

6. Auto I OFF
   This allows the user to automatically set the CGM-7 current to 0. When the CGM-7 is set to 0 amps as it is when switched on, it physically disconnects the current output of the CGM-7 from the specimen by means of relays.
   This has been implemented as users have reported pre-amp failure if CGM-7 is left connected after a specimen has broken. Setting this to just under 4.000v automatically turns off current when specimen is about to break.

7. I SET - Value excitation current is set to.

8. I OUT - Actual current being sent out.

9. Allow I to settle - Ticking this box stops any recording of current until the set current has been reached.

10. Frequency - Value excitation frequency is set to.

11. Freq sweep - If illuminated indicates a frequency sweep is in progress.

12. Load sync - If illuminated indicates load sync has been activated.

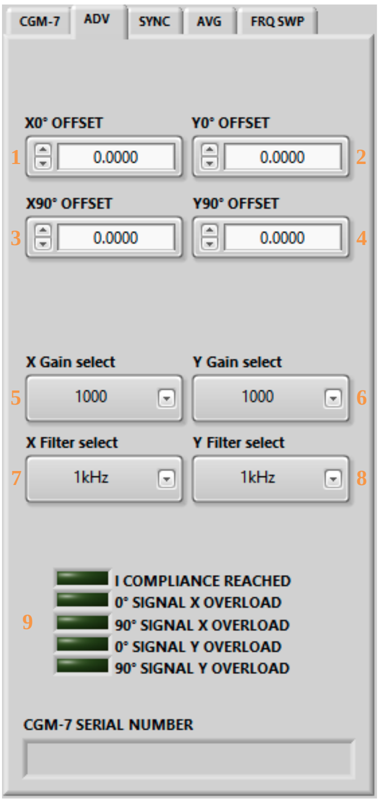
13. Signal scanner - Setting this changes the signal scanner.

14. Current scanner - Setting this changes the current scanner.

15. Settling time - Setting this allows the CGM-7 to settle before taking a reading for logging or averaging, useful when using scanners and switching from one location to another. It should be noted changes this to anything but 00:00:00 causes PDsoft to create a settling file in the chart directory.

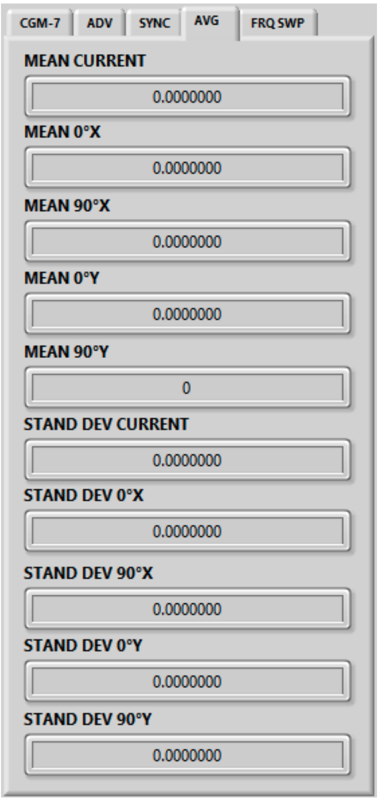
16. Averaging time - In certain situations signals may be noisy, or a greater degree of resolution may be required. In these circumstances' users can set an averaging time. During this period readings are taken from the CGM-7 continually and stored to a separate settling file in the chart directory. At the end of the settling period the average value of all readings is stored in the processed file.

ADV TAB



1. X0^0 OFFSET – An offset of +/- 4v can be applied here to the X0^0 signal.
2. Y0^0 OFFSET – An offset of +/- 4v can be applied here to the Y0^0 signal.
3. X90^0 OFFSET – An offset of +/- 4v can be applied here to the X90^0 signal.
4. Y90^0 OFFSET – An offset of +/- 4v can be applied here to the Y90^0 signal.
5. The gain of the X signal can be adjusted here from 1000 (default) to 30,000.
6. The gain of the Y signal can be adjusted here from 1000 (default)to 30,000.
7. The filter setting of the X signal can be adjusted here. Options are 1kHz (default), 80Hz, 01.Hz and None.
8. The filter setting of the Y signal can be adjusted here. Options are 1kHz (default), 80Hz, 01.Hz and None.
9. Should a compliance or over-range situation occur with any signal then they will be highlighted here. In general, this is not required as they are shown on the CGM-7 tab by flashing the relevant display boxes.

AVG TAB



This tab is more of an information screen than a settings section. Indeed, there are no settings to be made in this section.

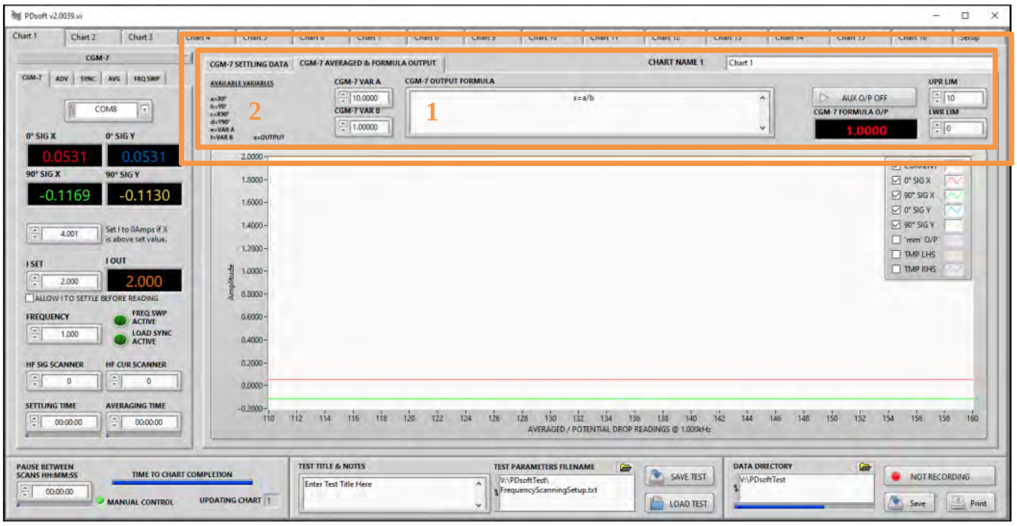
If a user set an averaging time in the CGM-7 tab, then PDsoft will for the duration of the "AVERAGING TIME" take continuous CGM-7 readings. In real time after each reading the mean and subsequent standard deviation for every measurable parameter is updated and displayed in this section.

All readings are stored in a comma separated file under the chart directory.

The final averaged value for each parameter is stored in the "… PROCESSED DATA …" file.

Note:
The averaging tab auto displays itself whilst averaging is taking place and then reverts back to CGM-7 tab whilst recording. A user can however click on the tab at any time to view the data.
Averaging only occurs whilst recording not during set-up.

Using the Formula Output window to drive the CGM-7 AUX Output

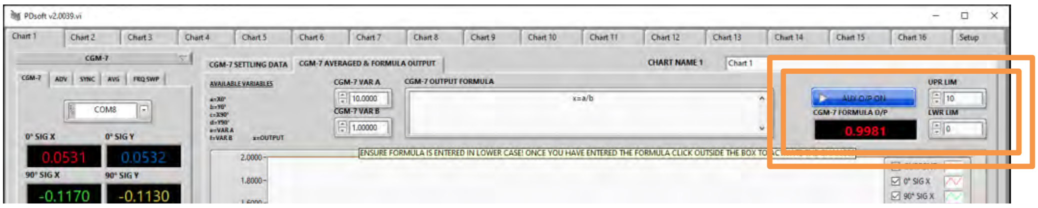


The CGM-7 has an AUX O/P BNC connector on the back panel. This has been provided to allow users to send processed analogue signals to other instruments, such as UTM's, in order to control parameters such as a UTM's load. Usually the UTM would require a value in proportion to crack size in millimetres.

The CGM-7 does not output a "mm" output, instead it provides a voltage that is proportional to the crack size. Various formulas are available to give an output in millimetres, and these can be entered into the window labelled "CGM-7 FORMULA OUTPUT" (1). The variables from the CGM-7 are shown on the left-hand side (2).

Simple tasks such as compensating for temperature change can also be achieved by simply dividing the cracked region of the specimen to an uncracked region, this is the default formula shown "a/b" where "a" is the cracked area and "b" the uncracked.

To send this value out to the AUX O/P of the CGM-7 users will need to turn on its output by pressing the "AUX O/P" button as shown below.



Note:
It should be noted that once a user has finished entering a formula they must click outside the 'OUTPUT FORMULA' window for the changes to take effect and everything must also be written in lower case.

WARNING!
If the output is being used to control a UTM's load extreme care must be taken that the signal coming from the CGM-7 will not damage the UTM in any way. It is the USERS responsibility to ensure this does not happen! Note the UPR LIM and LWR LIM values outlined above this allow you to set the upper and lower DC values coming from the BNC connector, ENSURE these are set to a level that will not damage your UTM!

A list of mathematical expressions allowed are shown on the next page.

The following expressions may be used with the formula entry system in PDsoft.

Function	**Description**
abs(*x*)	Returns the absolute value of *x*.
acos(*x*)	Computes the inverse cosine of *x* in radians.
acosh(*x*)	Computes the inverse hyperbolic cosine of *x*.
asin(*x*)	Computes the inverse sine of *x* in radians.
asinh(*x*)	Computes the inverse hyperbolic sine of *x*.
atan(*x*)	Computes the inverse tangent of *x* in radians.
atan2(*y*,*x*)	Computes the arctangent of *y*/*x* in radians.
atanh(*x*)	Computes the inverse hyperbolic tangent of *x*.
ceil(*x*)	Rounds *x* to the next higher integer (smallest integer *x*).
ci(*x*)	Evaluates the cosine integral for any real nonnegative number *x*.
cos(*x*)	Computes the cosine of *x*, where *x* is in radians.
cosh(*x*)	Computes the hyperbolic cosine of *x*.
cot(*x*)	Computes the cotangent of *x* (1/tan(*x*)), where *x* is in radians.
csc(*x*)	Computes the cosecant of *x* (1/sin(*x*)), where *x* is in radians.
exp(*x*)	Computes the value of *e* raised to the *x* power.
expm1(*x*)	Computes one less than the value of *e* raised to the *x* power ((*e*^*x*) – 1).
floor(*x*)	Truncates *x* to the next lower integer (largest integer *x*).
getexp(*x*)	Returns the exponent of *x*.
gamma(*x*)	Evaluates the gamma function or incomplete gamma function for *x*.
getman(*x*)	Returns the mantissa of *x*.
int(*x*)	Rounds *x* to the nearest integer.
intrz(*x*)	Rounds *x* to the nearest integer between *x* and zero.
ln(*x*)	Computes the natural logarithm of *x* (to the base of *e*).
lnp1(*x*)	Computes the natural logarithm of (*x* + 1).
log(*x*)	Computes the logarithm of *x* (to the base of 10).
log2(*x*)	Computes the logarithm of *x* (to the base of 2).
max(*x*,*y*)	Compares *x* and *y* and returns the larger value.
min(*x*,*y*)	Compares *x* and *y* and returns the smaller value.
mod(*x*,*y*)	Computes the remainder of *x*/*y*, when the quotient is rounded toward –Infinity.
pow(*x*,*y*)	Computes *x* raised to the *y* power.
rand( )	Produces a floating-point number between 0 and 1 exclusively.
rem(*x*,*y*)	Computes the remainder of *x*/*y*, when the quotient is rounded to the nearest integer.
si(*x*)	Evaluates the sine integral for any real number *x*.
sec(*x*)	Computes the secant of *x*, where *x* is in radians (1/cos(*x*)).
sign(*x*)	Returns 1 if *x* is greater than 0, returns 0 if *x* is equal to 0, and returns –1 if *x* is less than 0.
sin(*x*)	Computes the sine of *x*, where *x* is in radians.
sinc(*x*)	Computes the sine of *x* divided by *x* (sin(*x*)/*x*), where *x* is in radians.
sinh(*x*)	Computes the hyperbolic sine of *x*.
sizeOfDim(*ary*,*di*)	Returns the size of the dimension *di* specified for the array *ary*.
spike(*x*)	Generates the spike function for any real number *x*.
sqrt(*x*)	Computes the square root of *x*.
step(*x*)	Generates the step function for any real number *x*.
tan(*x*)	Computes the tangent of *x*, where *x* is in radians.
tanh(*x*)	Computes the hyperbolic tangent of *x*.

Frequency sweeping

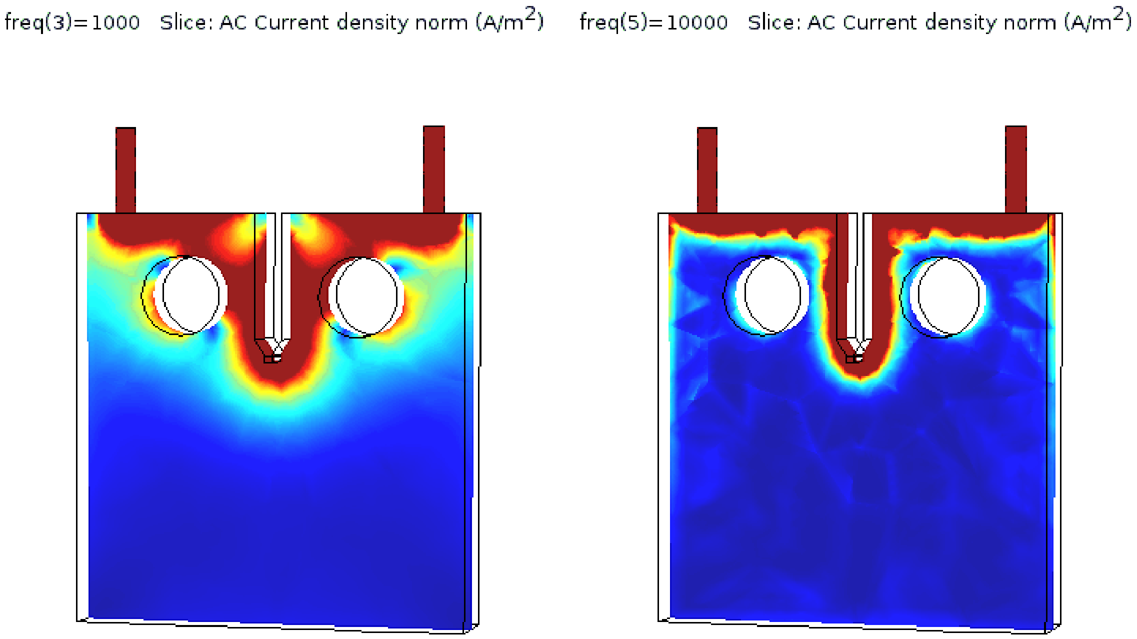
It may have been noticed by some readers that in the last simple aluminium CT example the readings from the specimen at 2 Amps where very low, in the region of 0.05v if the frequency was set to 1kHz. These values are far too low, for good practice we would be looking for readings in the region 0.5v, otherwise any noise may swamp our signals of interest, SNR. We have a number of ways of increasing the starting voltage, we shall show these below, for a full understanding of why it should be done this way please refer to the "Setting up a test" chapter in the CGM-7 manual.

- First set the desired frequency according to the material.
- Then increase current until circa 0.5v is achieved on the active channel.
- If current is maxed out increase gain to achieve 0.5v or as close as possible.

Obviously the first thing in the list, "Set the desired frequency" has to be decided.

"But what frequency to use?"

We can see in the CT frequency simulations below that if we go from a lower frequency of 1kHz to a higher frequency of 10kHz the current is confined to the surface of the specimen, this is known as the skin effect. We use this skin effect to our advantage, by increasing the frequency we get a higher starting voltage, reducing our SNR, and because the current is confined to this top surface, we also get greater sensitivity to crack initiation.



"Great so we will set the frequency to the maximum available then?"

Well no, we shouldn't. As is often the case there is a price to pay for the increased sensitivity to crack initiation, we get greater sensitivity to noise, from a number of sources, too great to go into in this document, see CGM-7 and ACPD Technique manuals on our webpage for further information.

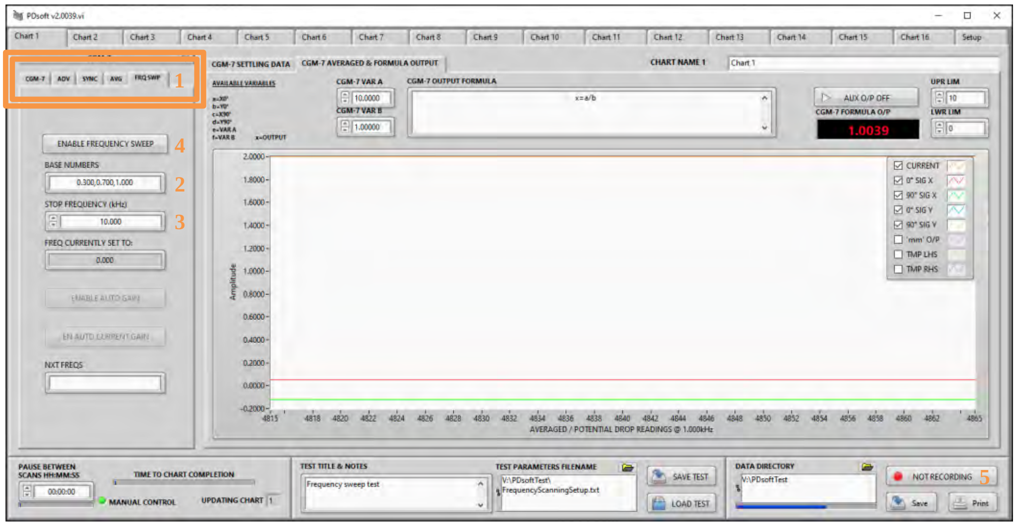
We actually need to choose a "sweet spot" or compromise between greater sensitivity to crack initiation and the goal of a 0.5v starting voltage and noise.

This is where frequency sweeping comes in.

In order to find our perfect frequency, we can run a series of tests starting at a low frequency and building up to a high frequency and then evaluate the results in order to choose the best compromise between highest sensitivity and noise.

We could use a separate PDsoft chart for each frequency, but this would take a while to setup, and we could not have enough charts available anyway, instead we have a frequency sweep function.

Firstly select a sensible current to start, say 1 to 2 Amps. Then click on the “FRQ SWP” tab (1), the following will be presented.



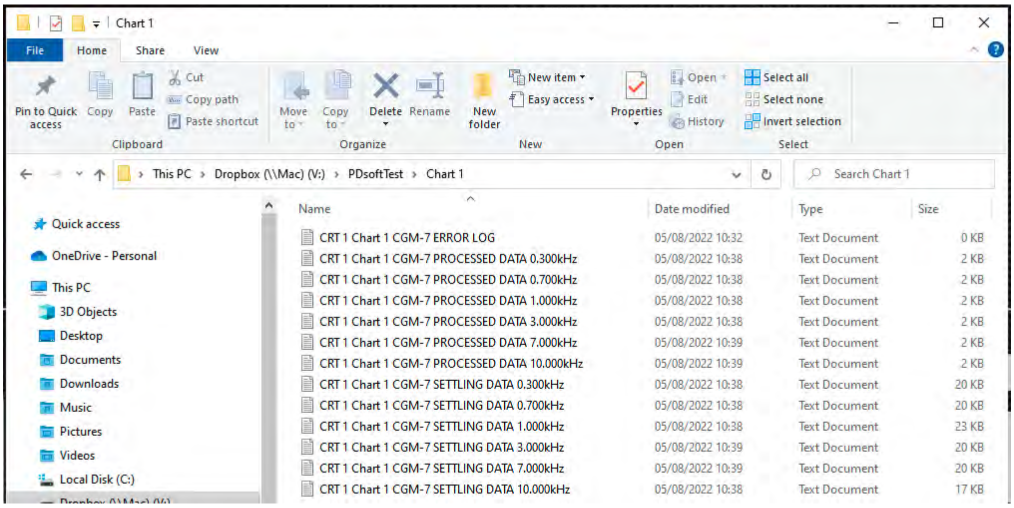
In this setup we are going to look at frequencies between 300Hz and 10kHz. This is done by setting the base frequencies to 300Hz, 700Hz and finally 1kHz (2), the system will continue to multiply these base values by ten until reaching the stop frequency set by the user (3), in this case 10kHz.

Note:
It must be noted that when frequency sweeping users must set a settling time on the “CGM-7” tab, as the CGM-7 goes from one frequency to another the system takes some time to settle down and give stable readings, this must be accounted for. A value of say 5 seconds is recommended but this must be evaluated by users as it is dependent on a multiple of factors, specimen size type etc.

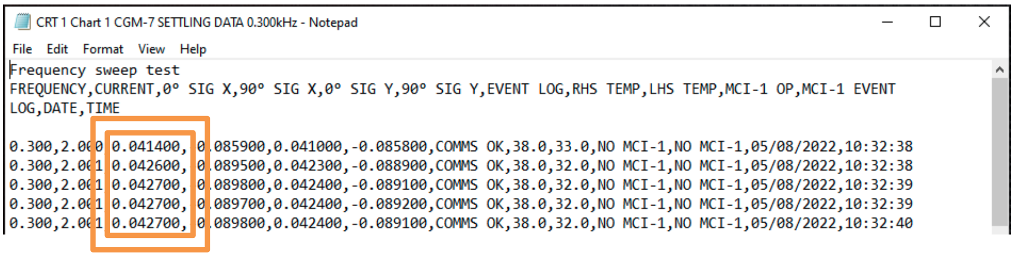
Once ready to proceed users will need to select the “ENABLE FREQUENCY SWEEP” button (4). Now the “RECORD” Button (5) needs to be pressed as before for the recording process to commence.

PDsoft will work through all frequencies as outlined above saving all data in separate frequency data files. As before once testing is over the user will need to press the “RECORD” button (5) once more and wait for all testing to complete and the “setup” tab to be presented.

Once frequency sweeping has been completed navigate to the chart directory and the following files will be available.

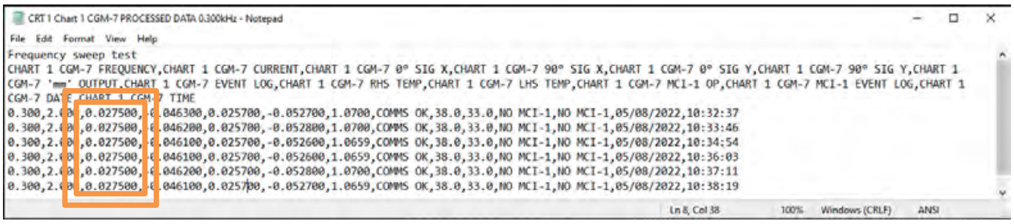


Two files were created for each frequency as shown, a settling data file and a processed data file. If we look at the settling data file first, specifically the active signal X0, we can see that it actually settled down very quickly in the region of 3 to 4 readings so we could in fact reduce the settling time to maybe 2 seconds.



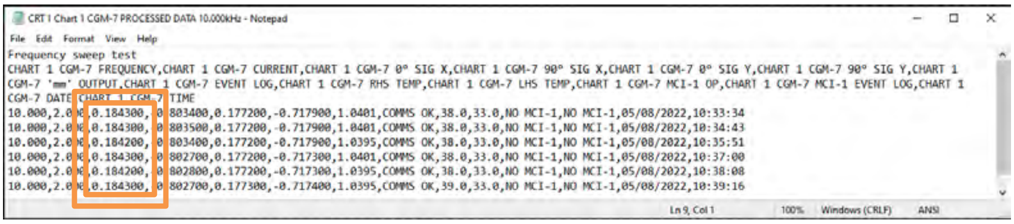
Note:
The settling data file has a blank line between one block of settling data and the next.

The processed data file also shows that the readings between one scan and the next were giving identical values further assuring us that we had plenty of settling time enabled. Now let us compare the processed readings between 300Hz and 10kHz and see how this changed our readings.



300Hz Readings

Notice how the readings for X0 as outlined are one very low but also very clean and consistent, this setup is very good but this will not always be the case and these very low signals are susceptible to being corrupted by noise.



1kHz Readings

If we compare the 300Hz readings to the 1kHz readings above, we can see that the X0 signal has risen substantially from 0.0275v to 0.1843 volts. It is very slightly noisier as expected, with around 1 digit of noise but this is still totally acceptable.

Although we haven't reached 0.5v as initially required we can see from the readings that the noise level is pretty much non-existent and so this would be a good starting level to set the frequency to for our tests from hence fourth with this type and size of specimen in this particular set-up.

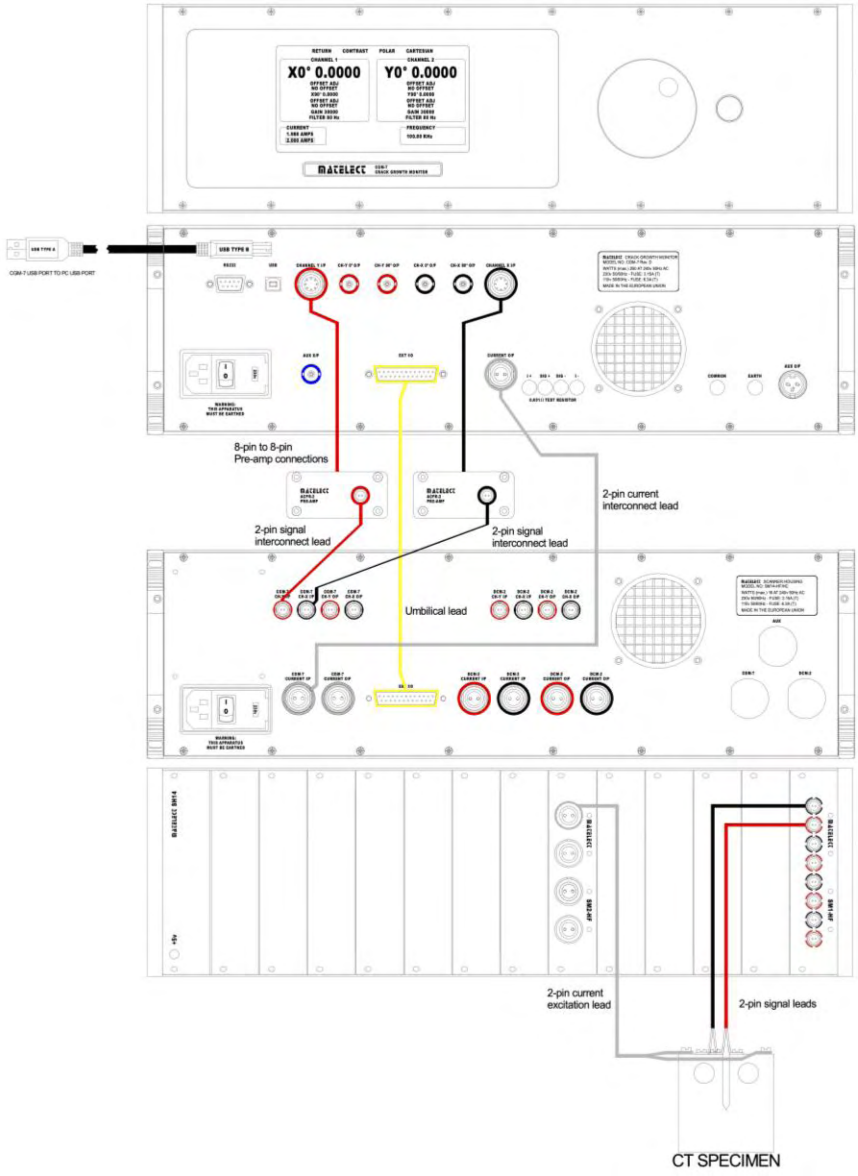
Hopefully you can see we are being careful to say with this set-up, if anything changes the user should re-assert if the setup is still good and do tests to confirm this.

Note:
Users may wish to set an averaging time in the "CGM-7" tab, this will create a separate averaging file for each frequency allowing the user to evaluate the standard deviation of the signals and gauge the increase of noise for the increase of frequency. As mentioned, it is a compromise between sensitivity and noise.

Using HF scanners and multiple charts

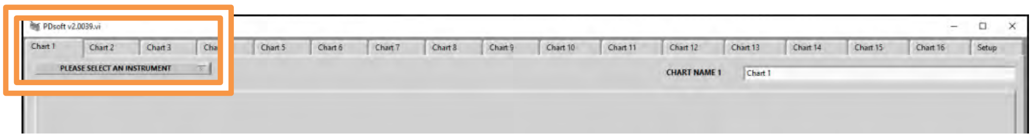
When needing to look at multiple locations on a single specimen or indeed across multiple specimens we can attach signal (SM1HF) and current (SM2HF) scanners to the CGM-7. These are available in either self-contained units if only one or two are required or if many are required, they can be housed in the SH10 housing unit.

In this scenario we will look at connecting the CGM-7 to a T-weld through an SM1HF and SM2HF both housed in a SH10 housing. Four locations on the T-weld are individually connected to the scanners by means of an excitation current lead and two signal leads, marked as “signal X’ and “signal Y”.
Signal X is connected across the weld of the T-weld and signal Y is connected to a non-cracked area of the specimen but in-line of the current path.
As before it is assumed that the CGM-7 pre-amplifiers have been connected and that a USB cable has been attached between the CGM-7 and the PC running PDsoft. An umbilical lead is connected between the SM10 housing and the CGM-7 and both a current interconnect and signal interconnects are connected between the CGM-7 and the SM10. See the image below for further guidance.

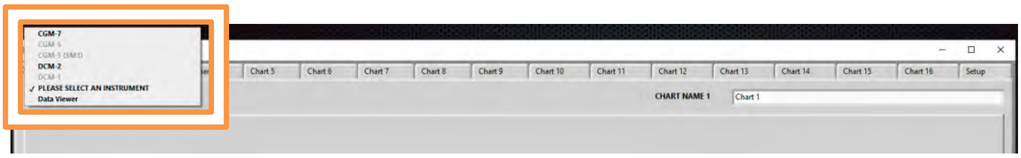


CGM-7 to SH14 and specimen wiring

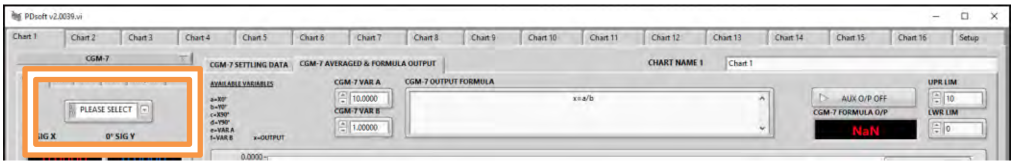
We shall now set-up four charts, each chart shall look at one location on the T-weld. As with the CT example firstly click on the “Chart 1” tab at the top of PDsoft, as shown below. As this is the same we will not go into as much detail, but simply look at the simple CT example for further information.



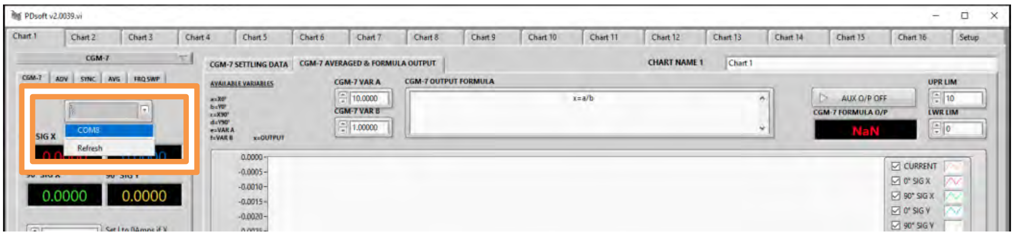
Now select the “CGM-7” from the drop-down menu labelled “PLEASE SELECT AN INSTRUMENT”



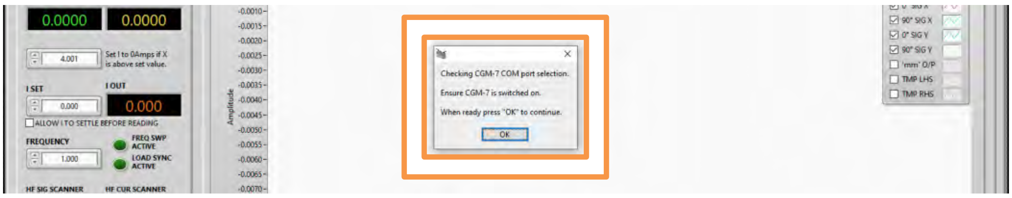
When the screen below appears select the com port of the CGM-7.



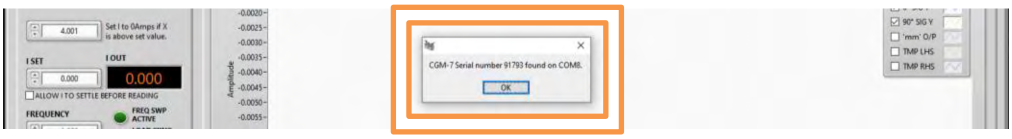
Press the down arrow to the side of the text “PLEASE SELECT” and a list of COM ports connected to the PC should appear, as shown below.



Click on the correct COM port for the CGM-7 connected, the following message is displayed.

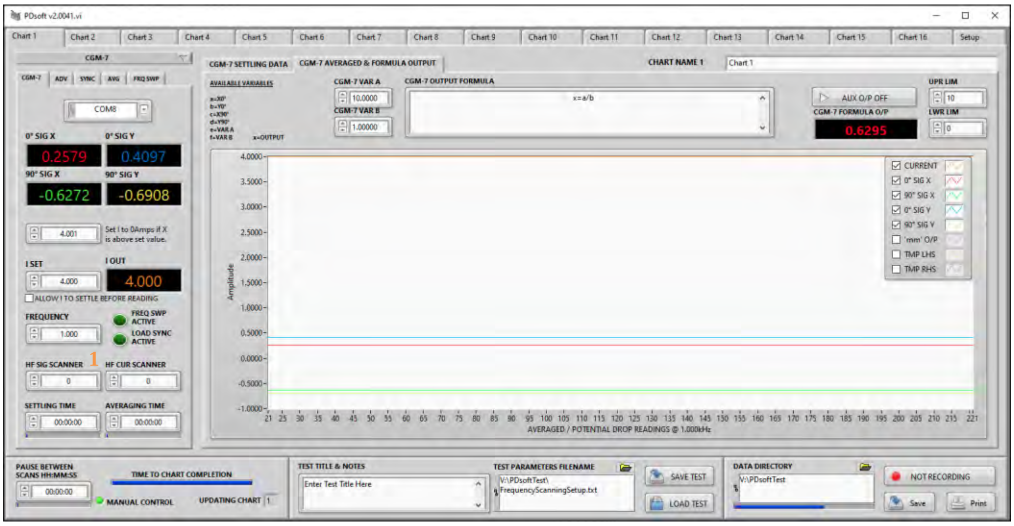


When ready click “OK”, ensuring the CGM-7 is switched on as advised, and ensure the CGM-7 no longer shows its splash screen. If the CGM-7 is successfully found on the COM port selected the message below will be shown.



Click “OK” to continue.

As before we can now set the desired current and frequency, you should now be seeing data from the specimen being read by PDsoft something as shown below.

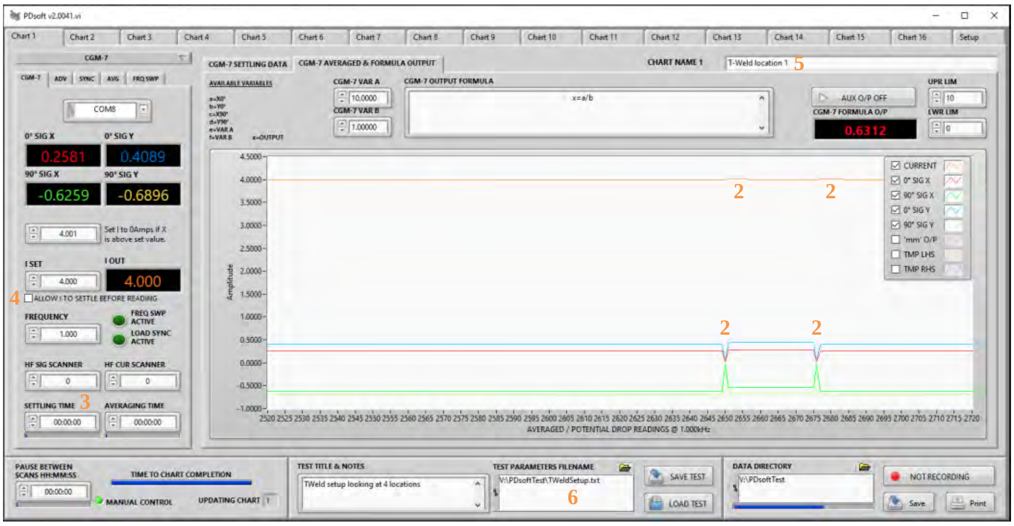


As default PDsoft has set the current signal and current scanner (1) to channel 0, as shown above. The relevant LED will be lit on the front of the signal and current scanner as in the picture below.

We can look at a different location by changing both channels to 1, users will hear a click when changing the signal and current (more pronounced on the current scanner) and the LED’s will reflect this as shown.

Set both scanners back to 0 for now. It may have been observed (2-see screengrab on next page) that when you changed the channel there may have been a small variation in the current and it took a little time to settle down this must be observed and accounted for in the setup.

Simply enter a “settling time” (3) that is a little more than the required time to settle in order to ensure your reading will take place once the current is stable, alternatively you may wish to use the “Allow current to settle before reading” box (4), which does as its name suggests. Users are encouraged to experiment with these different settings and choose appropriately.

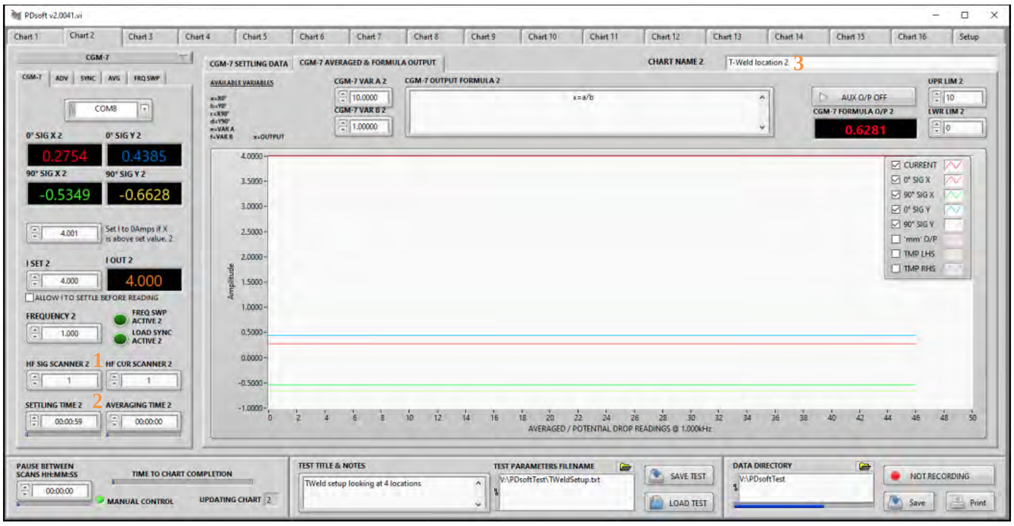


As we are going to use multiple charts it is important to label each chart (5) sensibly so we can find our data easily later.
This setup will take some time and effort, so it is very worthwhile saving the setup (6) again with a sensible name so we can use it in the future.

Now we will need to select Chart 2 and repeat the above process but this time selecting location 2 on the specimen by changing the signal and current scanner to channel 1!

Note:
Due to a historical oddity the scanner channels are labelled from 0 to 3 NOT 1 to 4! This takes a while to remember but users should always refer to the LED on the scanners to ensure they have chosen the channel they want.

Once setup chart 2 should look similar to the image below.



Note the scanner channels (1), the “Settling time” (2) and the “Chart name” (3). These have all been adjusted to reflect we are looking at location 2 on the specimen.

Once all charts are setup users may start the recording process by pressing the “Record” button as usual. PDsoft will now scan through the charts setting the correct scanner channel for the desired location and waiting the set settling time before taking a reading.

Using the MCI-1 load synchronisation device

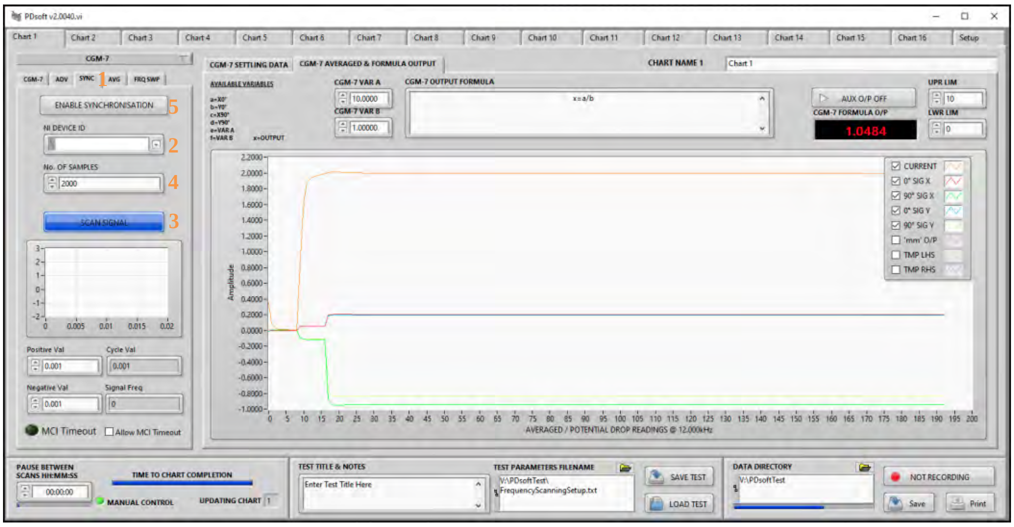
In this scenario we are going to synchronise the CGM-7 readings with that of the maximum load position using the load waveform of the UTM.

Firstly, connect the MCI-1 to the PC via a micro USB cable supplied with the unit.
All required drivers where installed when installing PDsoft.
Once the MCI-1 is successfully connected to the PC and communicating a blue LED is visible beside the USB connection on the MCI-1.

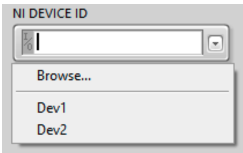
Connect a BNC cable again provided with the MCI-1 to the machine cycle load signal, this must be in the range of +/-10v. Exceeding this voltage range will damage the device.
In our example here we have used a sinewave signal at 66Hz and 5v peak to peak.
Connect the CGM-7 to the specimen by means of an excitation current lead and two signal leads, marked as “signal X’ and “signal Y”.

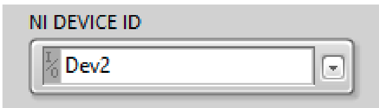
Signal X is normally connected across the slit of the CT specimen whereas signal Y is normally connected to a non-cracked area of the specimen but in-line of the current path.
It is assumed that the CGM-7 pre-amplifiers have been connected and that a USB cable has been attached between the CGM-7 and the PC running PDsoft, See the image below for further guidance.

Start PDsoft as before and selecting chart 1, select the CGM-7 from the dropdown menu and go through the COM port selection as outlined previously. Set the current to 2Amps and the frequency to 12kHz. Select the "SYNC" tab (1), you should have a screen as shown below.



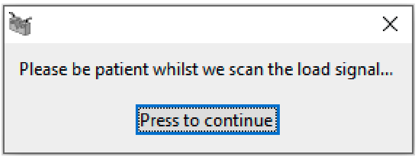
Now select the MCI-1 device connected to the PC, this is done by pressing the "NI DEVICE ID" drop down box (2) and selecting the correct device. In our case this is Dev2, once selected it should appear in the box.





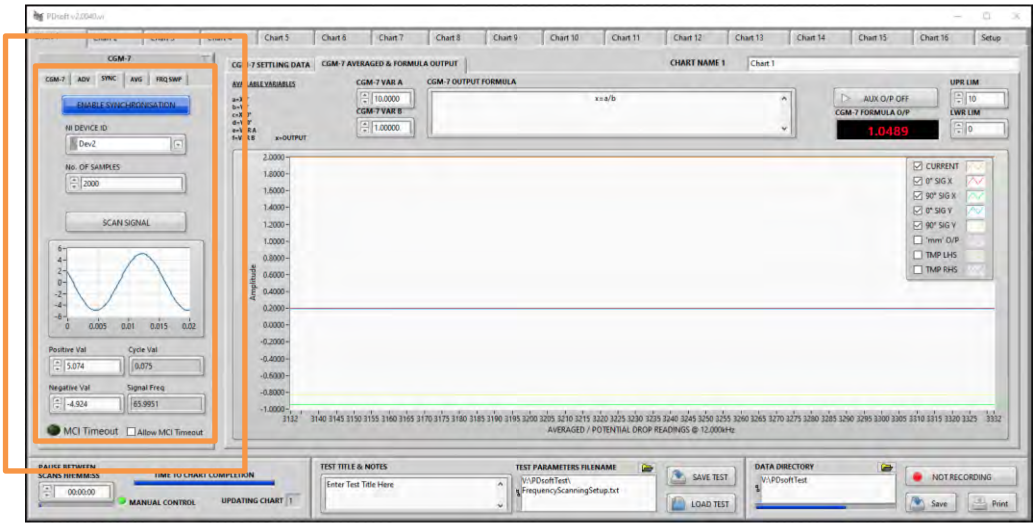
Leaving the "No. OF SAMPLES" (4) as is for now, and noting that "SCAN SIGNAL" (3) has been pre-selected for us, we are now ready to scan the load signal to obtain the maximum and minimum values of the signal as well as its frequency, this is done automatically whenever the "SCAN SIGNAL" button is selected and we enable synchronisation.

Press "ENABLE SYNCHRONISATION" (5), the following message will appear;



Click "Press to continue", after a short moment all four LED's on the front of the MCI-1 will light up, these remain on during scanning and when complete will go out.

Once scanning is complete the “START SCAN” button (3) will go out. The graph will show the waveform detected and the max positive and negative values will be pre-populated, along with other signal data. As mentioned, we are using a sinewave signal of +/-5V with a frequency of 66Hz as shown in the image below.



After a short while the LED’s will start to light sequentially from left to right, they signify the following;

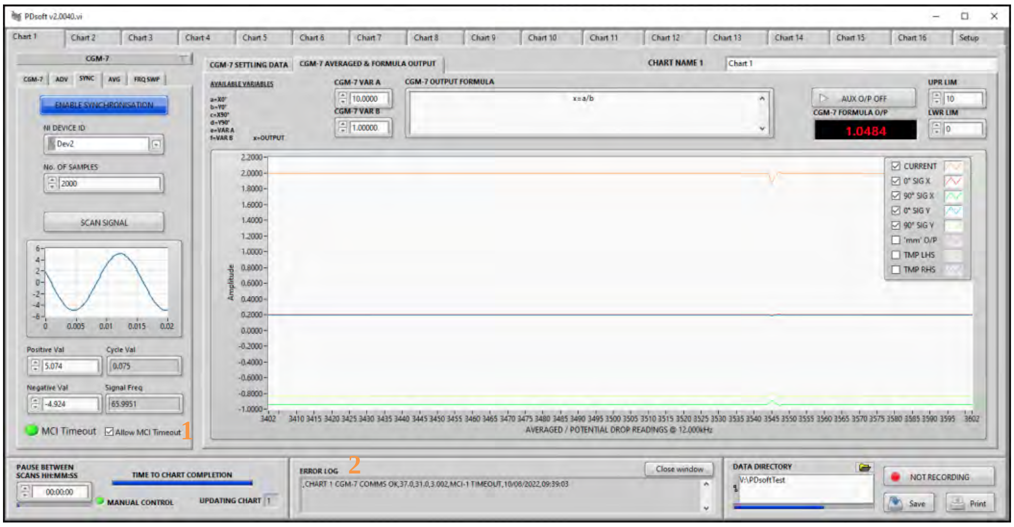
LED1 – Looking for max negative value.
LED2 – Looking for max positive value.
LED3 – CGM-7 reading being taken.
LED4 – MCI Timeout has occurred.

PDsoft will now only take a reading immediately after the positive peak has been detected.

MCI-1 Timeout scenario

If the load signal from the UTM should stop for whatever reason PDsoft will pause reading until the peak of the load signal is detected. LED4 will light up and the MCI Timeout will also light on PDsoft.

It should be noted that in this mode PDsoft will sit here indefinitely until a peak is detected on the load signal. As this can be unwanted by the user an option is available.



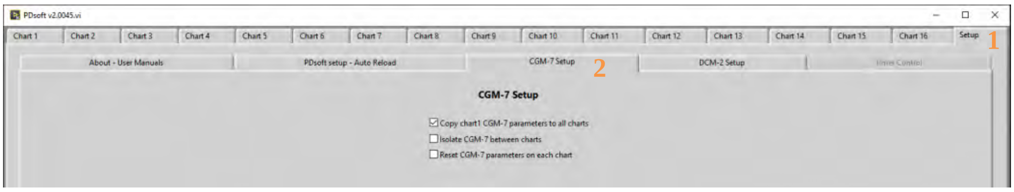
The “Allow MCI Timeout” (1) box when selected will wait a number of seconds (dependant on the load signal frequency scanned initially) and if no load signal is detected will record the error in the “error” file for the chart, show the error in the onscreen error log (2), highlight the MCI Timeout signal and finally take a CGM-7 reading and continue.

Once a load signal is re-detected the system will continue as normal, and the error log screen will disappear.

Note:
The MCI-1 has the following specifications
Frequency range 8 – 1000Hz
Max amplitude +/- 10v
Number of samples per sec 200-2000
Max samples per rate 10000

CGM-7 Setup options

Under the “Setup” tab (1) of PDsoft can be found the “CGM-7 Setup” tab (2). This has some CGM-7 specific controls as outlined.



1. Copy chart1 CGM-7 parameters to all charts – copies all the user selectable variables such as current setting etc to the remaining charts, this helps speed up chart setups and defaults to on.
2. Isolate CGM-7 between charts – The CGM-7 is capable of isolating its output current, by selecting this the CGM-7 isolates itself when moving from one chart to another this can be useful in situations when more than one Potential Drop unit is being used, such as when using DCPD at the same time as ACPD to measure a specimen.
3. Reset CGM-7 parameters on each chart – This forces PDsoft to set all parameters when moving from one chart to the next.

5. DCM-2 SPECIFIC SETUP

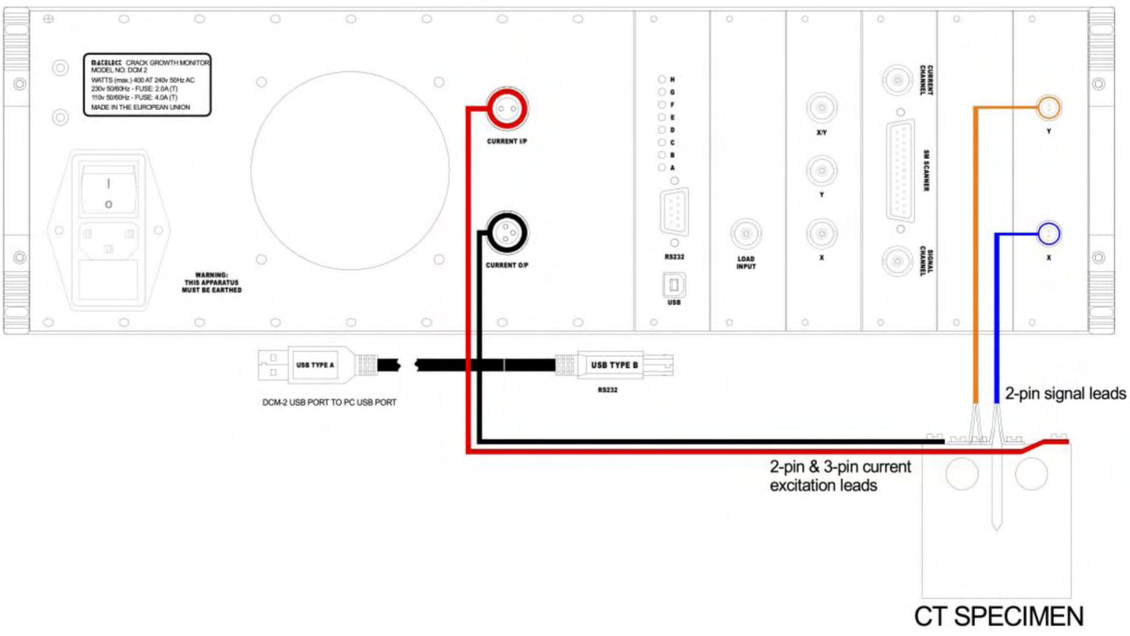
In this section of the manual we shall explain how the software is used specifically with the Matelect DCM-2, DCPD instrument. We shall go through general setup with a simple CT specimen. The use of the DCM-2 with a scanner is not described in great detail as it generally follows the setup as described previously for the CGM-7 scanner system, but as with ACPD the SM1-HC and SM-2HC can be useful when looking at multiple locations along a toe weld. Finally, we shall look at the use of the DCM-2's built in load synchronisation (dependant on model) for machine cycle synchronisation.

Simple CT specimen scenario, setting basic parameters

Set-up the hardware and specimen

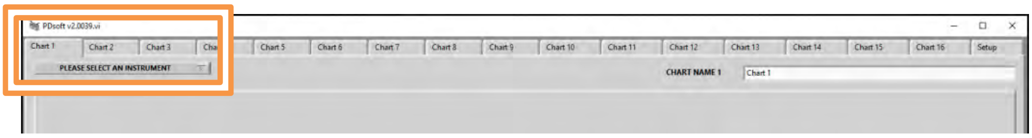
Firstly let's look at the scenario of a simple CT specimen, in this case it is a CT50 specimen made of aluminium, the CT specimen is connected to the DCM-2 by means of an excitation current lead and two signal leads, marked as "signal X' and "signal Y".
Signal X is normally connected across the slit of the CT specimen whereas signal Y is normally connected to a non-cracked area of the specimen but in-line of the current path.
It is assumed that a USB cable has been attached between the DCM-2 and the PC running PDsoft, See the image below for further guidance.
For further information on connecting specimens to your DCM-2 please refer to the DCM-2 manual available from PDsoft or our website.

http://www.matelect.com/files/Download/DCM2Web.pdf

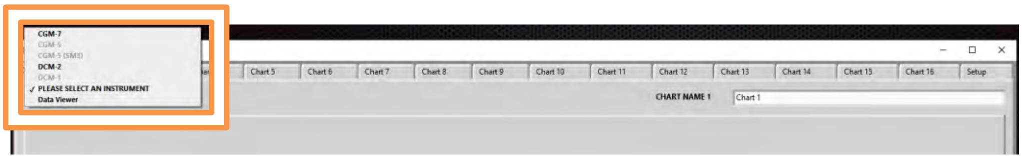


Wiring diagram of CT specimen connected to DCM-2 and a PC

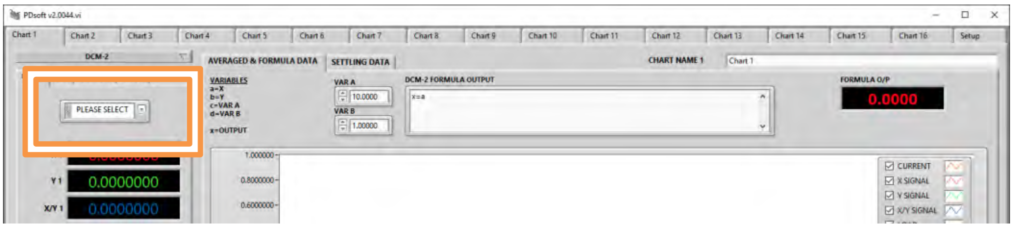
Select the chart to run experiment in
Firstly click on the “Chart 1” tab at the top of PDsoft, as shown below.



Now select the “DCM-2” from the drop-down menu labelled “PLEASE SELECT AN INSTRUMENT”



When the screen below appears users will notice that a box in the top right of the screen is flashing, with the message, “PLEASE SELECT”, this is because PDsoft needs to know which com port the DCM-2 has been connected to.

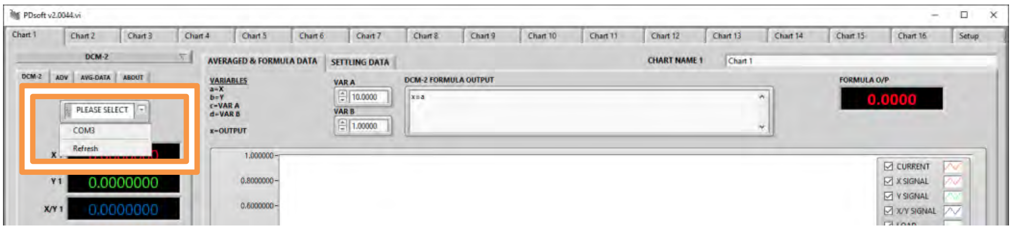


Selecting the com port of the DCM-2

Note:
The DCM-2 has an RS232 communications protocol, as such the USB connection on the rear of the unit is in fact seen as a virtual com port by the attached PC.
Usually if your PC is connected to the internet when you first plug in your DCM-2, Windows will go off and download the required driver if required. If this does not happen, users will need to install the Virtual Com Port driver manually. Instructions for this can be found in the back of this manual.

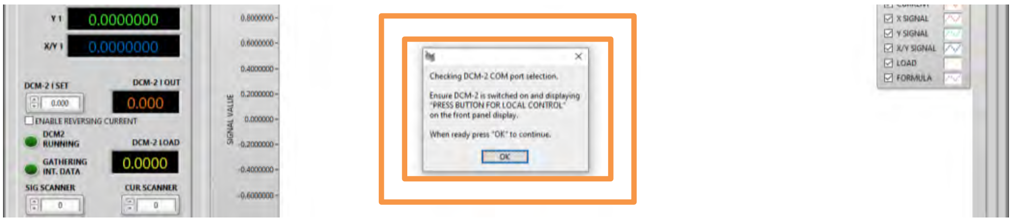
Once the com port driver is installed please take note of the com port number assigned to the DCM-2 this will be required in the following section. If not known don’t worry it may just take a few extra steps

Press the down arrow to the side of the text “PLEASE SELECT” and a list of COM ports connected to the PC should appear, as shown below.

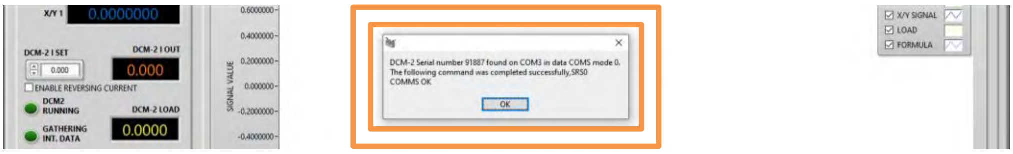


In this case only one COM port is available. If you do not know the com port of your DCM-2 you will be able to go through them systematically until getting a confirmation message as explained below.

Click on the correct COM port for the DCM-2 connected, the following message is displayed.

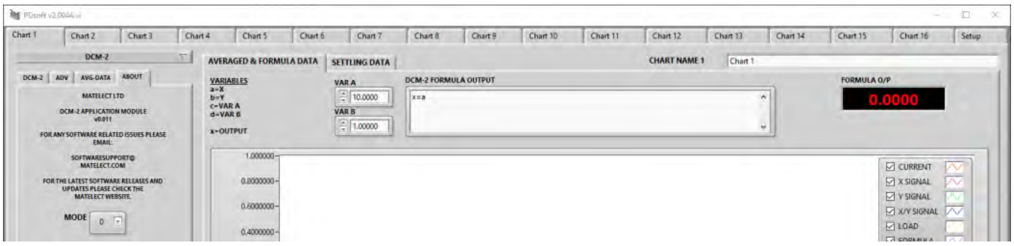


When ready click "OK", ensuring the DCM-2 is switched on as advised and most importantly displaying "PRESS BUTTON FOR LOCAL CONTROL" on the very top of the DCM-2's LCD display. If the DCM-2 is successfully found on the COM port selected the message below will be shown.

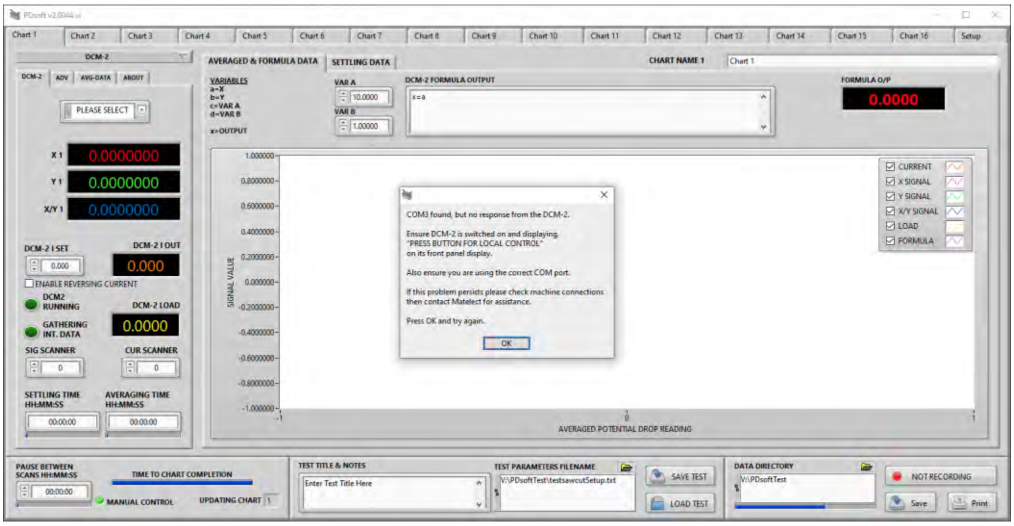


Click "OK" to continue.

Note:
The DCM-2 has various COMS modes which are factory programmed, the software should pick up which COMS mode your DCM-2 is in, however if this does not happen, users can manually set the COMS mode under the "ABOUT" tab, as shown below.

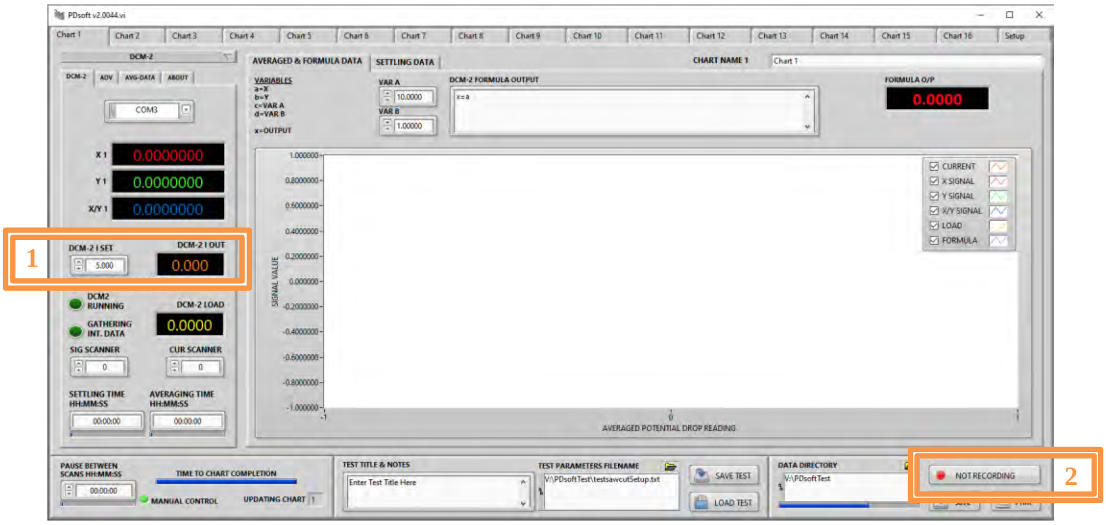


If the DCM-2 was not found on the selected COM port an error message will be displayed as shown in the image below. The user may now select a new com port from the drop-down list as outlined above and try again.



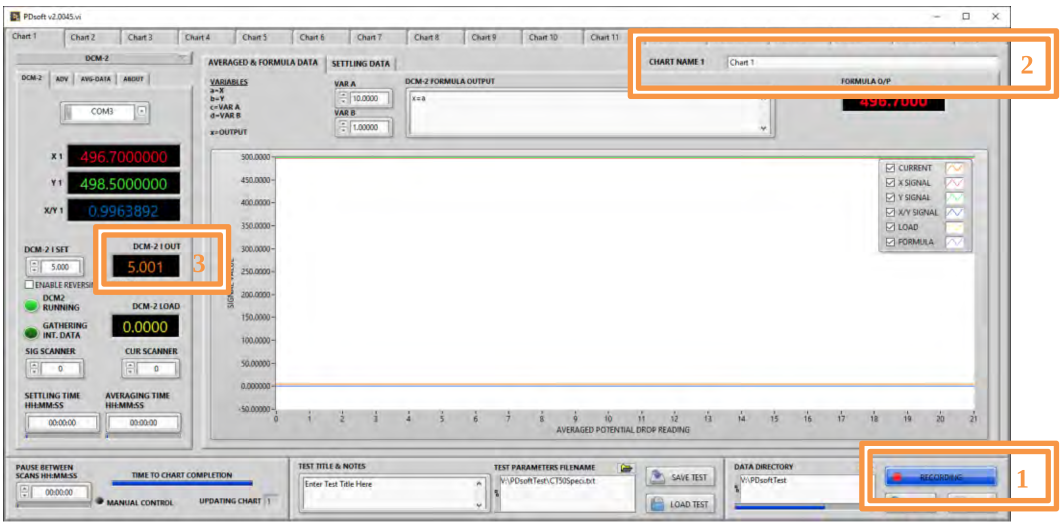
Setting a DCM-2 parameter
Lets try our first parameter setting on the DCM-2, click in the “DCM-2 I SET” (1) box and enter a value of 5.000 amps, this will set the current to 5.000 Amps on the DCM-2 and can be confirmed by looking at the DCM-2’s LCD display.

Note:
Unlike the CGM-7 that gives a live update the “DCM-2 I OUT” (1) display will only show the current when the “RECORDING” (2) button is pressed, this starts the DCM-2 running, in other words the DCM-2 is not passing current unless the “RECORDING” (2) button is pressed, hence it showing 0.000 amps at the moment.



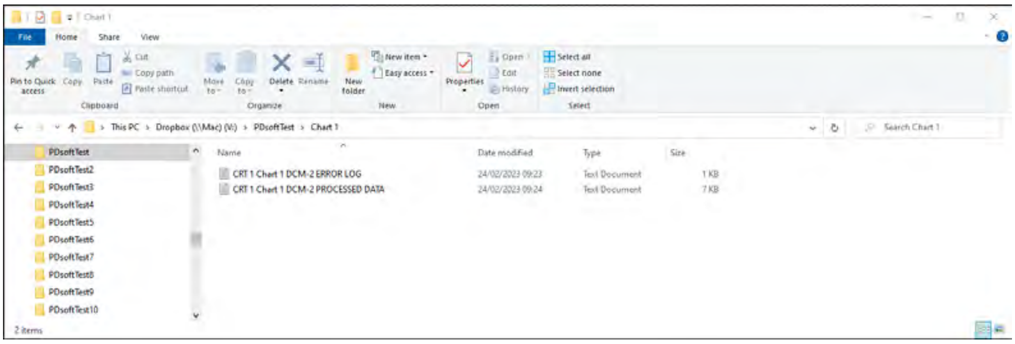
The DCM-2 in its simplest form has just one parameter to change, the set current as just demonstrated.

Once this has been set a user could now click the “RECORD” (1) button and commence gathering data from the DCM-2 at a rate of roughly one reading every 3 seconds, if all other parameters have been left at default, the actual update rate is dependent on filtering, mode of operation and synchronisation signal if attached. The remaining parameters and functions will be described later. Data files will be stored in the subdirectory of the same name as the chart name, in this case “Chart 1” (2) under the root directory of “V:\PDsoftTest” in the above presented setup. Notice how the “DCM2 RUNNING” (3) icon is now on indicating current is being passed, the current display now shows the actual current being passed.



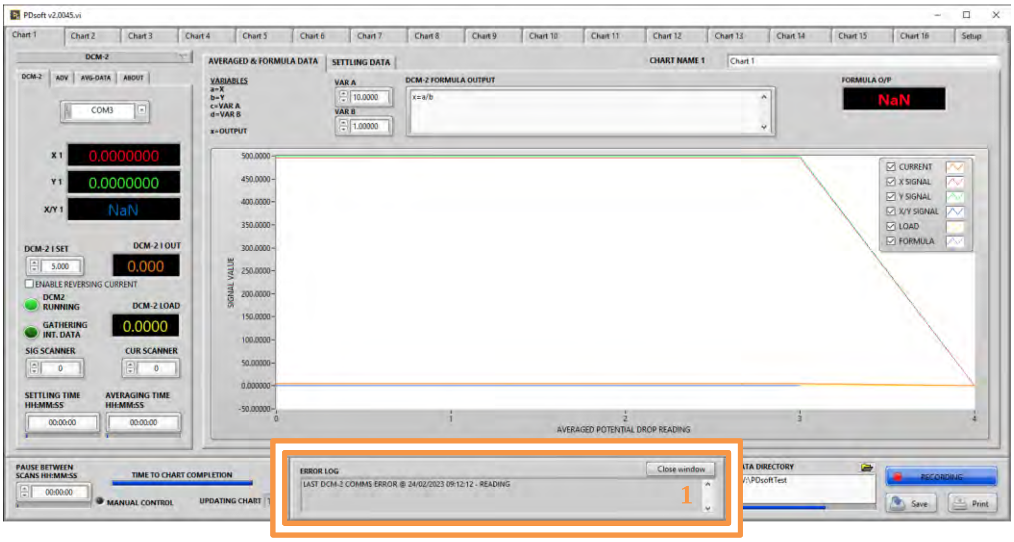
Once the experiment is over users can press the "RECORD" (1) button once again and once the final set of readings have been recorded PDsoft will return to the "Setup" tab.

Users can now view the data recorded, navigating to the DATA DIRECTORY they will see the following sub directory named "Chart 1" entering this directory they should see:



An error was introduced during the reading on purpose to show users what would happen, the USB cable was removed for a single reading, as you can see the "CRT 1 Chart1 DCM-2 ERROR LOG" has a single entry in it as shown;

Should the error persist further entries would be made to the error log file. Whilst the error was being recorded in the error file it was also displayed on PDsoft as shown below (1).



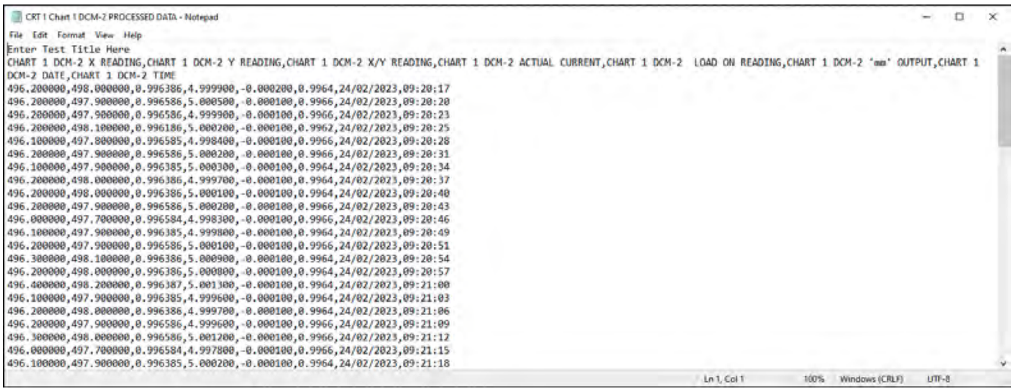
Once the error is resolved the "ERROR LOG" window disappears.

The second file contains the saved data from this very quick test.

Note:
Note the construct of the file it is called,
"CRT 1 Chart 1 DCM-2 PROCESSED DATA"
Lets take this apart and see what each section means.

- "CRT 1" – Shows us it was from chart 1
- "Chart 1" – Is the username of the chart. "Chart 1" is the default but you can name it as you please, for example "aluminium CT no: 001"
- "DCM-2 PROCESSED DATA" – Shows us this is from a DCM-2 unit and the final data set.

If we open the CRT 1 Chart 1 DCM-2 PROCESSED DATA.txt file we will see the following;



CRT 1 Chart 1 DCM-2 PROCESSED DATA - Notepad

File Edit Format View Help

```
Enter Test Title Here
CHART 1 DCM-2 X READING,CHART 1 DCM-2 Y READING,CHART 1 DCM-2 X/Y READING,CHART 1 DCM-2 ACTUAL CURRENT,CHART 1 DCM-2  LOAD ON READING,CHART 1 DCM-2 'mm' OUTPUT,CHART 1
DCM-2 DATE,CHART 1 DCM-2 TIME
496.200000,498.000000,0.996386,4.999900,-0.000200,0.9964,24/02/2023,09:20:17
496.200000,497.900000,0.996586,5.000500,-0.000100,0.9966,24/02/2023,09:20:20
496.200000,497.900000,0.996586,4.999900,-0.000100,0.9966,24/02/2023,09:20:23
496.200000,498.100000,0.996186,5.000200,-0.000100,0.9962,24/02/2023,09:20:25
496.100000,497.800000,0.996585,4.998400,-0.000100,0.9966,24/02/2023,09:20:28
496.200000,497.900000,0.996586,5.000200,-0.000100,0.9966,24/02/2023,09:20:31
496.100000,497.900000,0.996385,5.000300,-0.000100,0.9964,24/02/2023,09:20:34
496.200000,498.000000,0.996386,4.999700,-0.000100,0.9964,24/02/2023,09:20:37
496.200000,498.000000,0.996386,5.000100,-0.000100,0.9964,24/02/2023,09:20:40
496.200000,497.900000,0.996586,5.000200,-0.000100,0.9966,24/02/2023,09:20:43
496.000000,497.700000,0.996584,4.998300,-0.000100,0.9966,24/02/2023,09:20:46
496.100000,497.900000,0.996385,4.999800,-0.000100,0.9964,24/02/2023,09:20:49
496.200000,497.900000,0.996586,5.000100,-0.000100,0.9966,24/02/2023,09:20:51
496.300000,498.100000,0.996386,5.000900,-0.000100,0.9964,24/02/2023,09:20:54
496.200000,498.000000,0.996386,5.000800,-0.000100,0.9964,24/02/2023,09:20:57
496.400000,498.200000,0.996387,5.001300,-0.000100,0.9964,24/02/2023,09:21:00
496.100000,497.900000,0.996385,4.999600,-0.000100,0.9964,24/02/2023,09:21:03
496.200000,498.000000,0.996386,4.999700,-0.000100,0.9964,24/02/2023,09:21:06
496.200000,497.900000,0.996586,4.999600,-0.000100,0.9966,24/02/2023,09:21:09
496.300000,498.000000,0.996586,5.001200,-0.000100,0.9966,24/02/2023,09:21:12
496.000000,497.700000,0.996584,4.997800,-0.000100,0.9966,24/02/2023,09:21:15
496.100000,497.900000,0.996385,5.000200,-0.000100,0.9964,24/02/2023,09:21:18
```

Ln 1, Col 1 100% Windows (CRLF) UTF-8

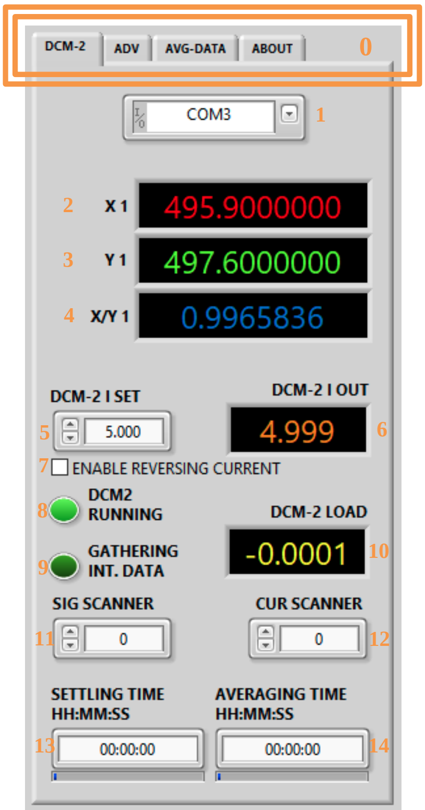
Let's analyse each line and explain what is shown.

1. This currently states "Enter Test Title Here", this is the default, but a user can enter what they wish, such as "Testing of aluminium specimens 1 to 6" it is available to help understand the data set in the future.
2. The second line is a header in comma separated format. All should be relatively easy to understand from the text.
   However as we have not mentioned it yet the "CHART 1 DCM-2 LOAD ON READING" represents the load signal from a testing machine should you have it connected to your DCM-2 (This is a cost option on the DCM-2 and may not be available on all units).
   The "CHART 1 DCM-2 'mm' OUTPUT" is controlled from PDsoft and allows a user to enter a formula in order to get real time 'mm' readings, this shall be explained later in detail.
3. Subsequent lines are the data itself, all ended with a time stamp.

Detailed function and display description

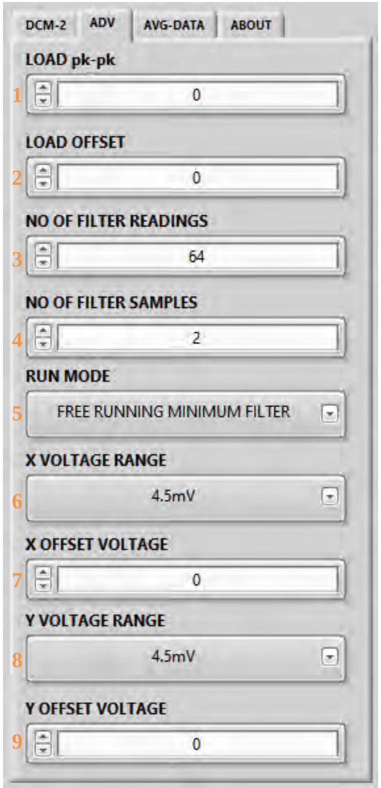
In the first example we only set the current of the DCM-2 however as could be seen there are a number of other parameters available, selectable from the tabs (0). These are explained in detail in the next sections. The synchronisation and frequency sweeping tabs are given their own sections as they require more detailed explanation.

DCM-2 TAB



1. COM Port – DCM-2's selected com port
2. X – Signal normally connected to active point
3. Y – Signal normally connected to reference point
4. X/Y – Signal X divided by Signal Y
5. DCM-2 I SET - Value excitation current is set to.
6. I OUT - Actual current being sent out.
7. ENABLE REVERSING CURRENT – For those DCM-2's enabled with the feature, ticking this box allows the current to be reversed sequentially.
8. DCM-2 RUNNING – When illuminated shows that the DCM-2 is in running mode and passing current.
9. GATHERING INT. DATA – Under the "DCM-2 Setup" tab under the main "Setup" tab can be found a tick box labelled "Record internal DCM-2 variables", this is usually for internal Matelect use.
10. DCM-2 LOAD – If fitted to the DCM-2 this shows the LOAD signal coming from the testing machine.
11. SIG SCANNER – Setting this changes the signal scanner channel.
12. CUR SCANNER – Setting this changes the current scanner channel.
13. Settling time - Setting this allows the DCM-2 to settle before taking a reading for logging or averaging, useful when using scanners and switching from one location to another. It should be noted changes to this to anything but 00:00:00 causes PDsoft to create a settling file in the chart directory.
14. Averaging time - In certain situations signals may be noisy, or a greater degree of resolution may be required. In these circumstances' users can set an averaging time. During this period readings are taken from the DCM-2 continually and stored to a separate settling file in the chart directory. At the end of the settling period the average value of all readings is stored in the processed file.

ADV TAB

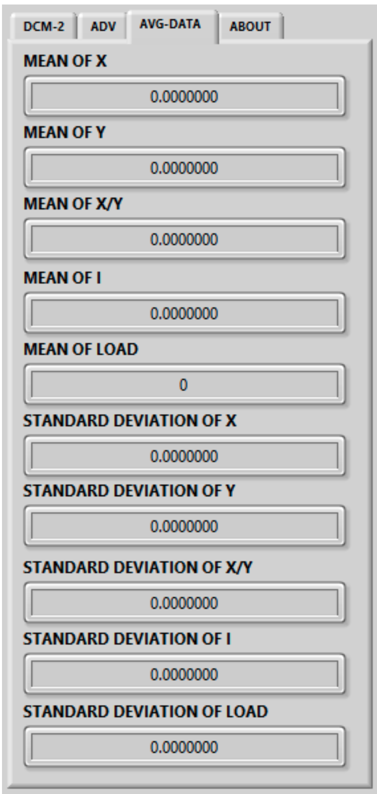


1. LOAD PK-PK – Defines the peak to peak voltage of the external load waveform.
2. LOAD OFFSET – Defines the midpoint of the voltage of the external load waveform.

   Note: Items 1 and 2 above are concerned with load synchronisation, which is beyond the scope of this manual users should access the DCM-2 User manual for further information.

3. NO OF FILTER READINGS – This defines the number of readings that make up a sample.
4. NO OF FILTER SAMPLES – This defines the number of samples that make up a measured and displayed value on the DCM-2 screen and subsequently recorded by PDsoft.
5. RUN MODE – This relates to the synchronisation feature available in some DCM-2 units. Again this is beyond the scope of explanation in the software manual users should read the DCM-2 manual for further information. However it should be noted that changes in this section will adjust the READINGS and SAMPLES parameters above automatically and hence affect update rates of the system.
6. X VOLTAGE RANGE – Voltage range setting of X signal.
7. X OFFSET VOLTAGE – Offset range setting of X signal, +/-4500uV in 1uV steps.
8. X VOLTAGE RANGE – Voltage range setting of Y signal.
9. Y OFFSET VOLTAGE – Offset range setting of Y signal, +/-4500uV in 1uV steps.

AVG TAB



This tab is more of an information screen than a settings section. Indeed, there are no settings to be made in this section.

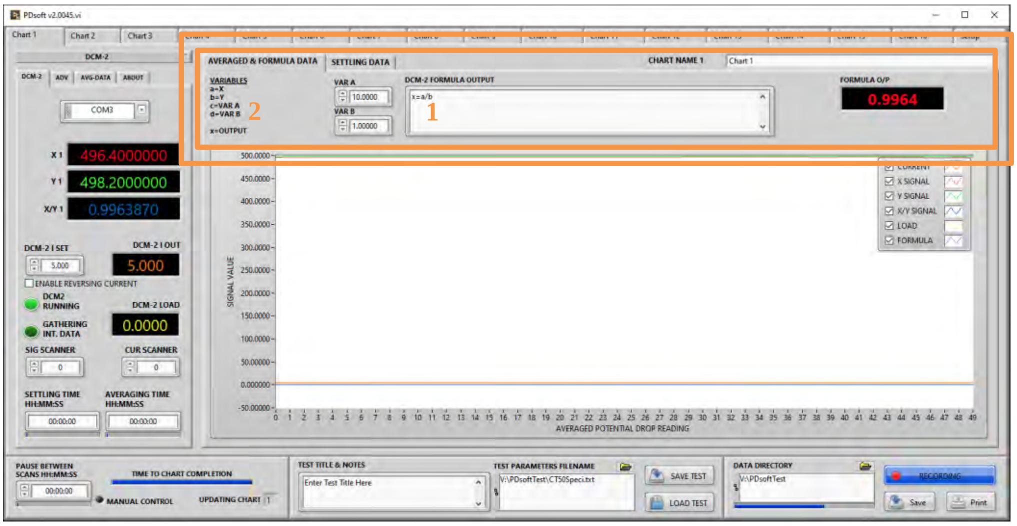
If a user sets an averaging time in the DCM-2 tab, then PDsoft will for the duration of the "AVERAGING TIME" take continuous DCM-2 readings. In real time after each reading the mean and subsequent standard deviation for every measurable parameter is updated and displayed in this section.

All readings are stored in a comma separated file under the chart directory.

The final averaged value for each parameter is stored in the "… PROCESSED DATA" file.

Note:
The averaging tab auto displays itself whilst averaging is taking place and then reverts back to DCM-2 tab whilst recording. A user can however at any time click on a tab of interest to view the data.

Using the Formula Output window with the DCM-2



The DCM-2 does not output a "mm" output, instead it provides a voltage that is proportional to the crack size. Various formulas are available online from such sources as the ASTM to give an output in millimetres, and these can be entered into the window labelled "DCM-2 FORMULA OUTPUT" (1). The variables from the DCM-2 are shown on the left-hand side (2).

Simple tasks such as compensating for temperature change can also be achieved by simply dividing the cracked region of the specimen to an uncracked region, this is the default formula shown "a/b" where "a" is the cracked area and "b" the uncracked.

Note:
It should be noted that once a user has finished entering a formula they must click outside the 'OUTPUT FORMULA' window for the changes to take effect and everything must also be written in lower case.

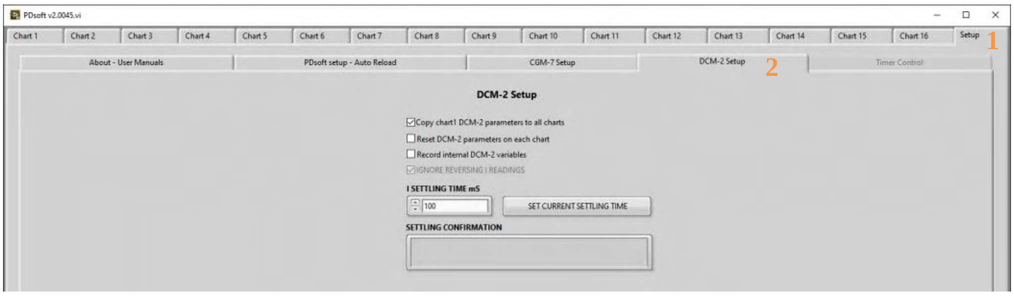
A list of mathematical expressions allowed are shown on the next page.

The following expressions may be used with the formula entry system in PDsoft.

Function	**Description**
abs(*x*)	Returns the absolute value of *x*.
acos(*x*)	Computes the inverse cosine of *x* in radians.
acosh(*x*)	Computes the inverse hyperbolic cosine of *x*.
asin(*x*)	Computes the inverse sine of *x* in radians.
asinh(*x*)	Computes the inverse hyperbolic sine of *x*.
atan(*x*)	Computes the inverse tangent of *x* in radians.
atan2(*y*,*x*)	Computes the arctangent of *y*/*x* in radians.
atanh(*x*)	Computes the inverse hyperbolic tangent of *x*.
ceil(*x*)	Rounds *x* to the next higher integer (smallest integer *x*).
ci(*x*)	Evaluates the cosine integral for any real nonnegative number *x*.
cos(*x*)	Computes the cosine of *x*, where *x* is in radians.
cosh(*x*)	Computes the hyperbolic cosine of *x*.
cot(*x*)	Computes the cotangent of *x* (1/tan(*x*)), where *x* is in radians.
csc(*x*)	Computes the cosecant of *x* (1/sin(*x*)), where *x* is in radians.
exp(*x*)	Computes the value of *e* raised to the *x* power.
expm1(*x*)	Computes one less than the value of *e* raised to the *x* power ((*e*^*x*) – 1).
floor(*x*)	Truncates *x* to the next lower integer (largest integer *x*).
getexp(*x*)	Returns the exponent of *x*.
gamma(*x*)	Evaluates the gamma function or incomplete gamma function for *x*.
getman(*x*)	Returns the mantissa of *x*.
int(*x*)	Rounds *x* to the nearest integer.
intrz(*x*)	Rounds *x* to the nearest integer between *x* and zero.
ln(*x*)	Computes the natural logarithm of *x* (to the base of *e*).
lnp1(*x*)	Computes the natural logarithm of (*x* + 1).
log(*x*)	Computes the logarithm of *x* (to the base of 10).
log2(*x*)	Computes the logarithm of *x* (to the base of 2).
max(*x*,*y*)	Compares *x* and *y* and returns the larger value.
min(*x*,*y*)	Compares *x* and *y* and returns the smaller value.
mod(*x*,*y*)	Computes the remainder of *x*/*y*, when the quotient is rounded toward –Infinity.
pow(*x*,*y*)	Computes *x* raised to the *y* power.
rand( )	Produces a floating-point number between 0 and 1 exclusively.
rem(*x*,*y*)	Computes the remainder of *x*/*y*, when the quotient is rounded to the nearest integer.
si(*x*)	Evaluates the sine integral for any real number *x*.
sec(*x*)	Computes the secant of *x*, where *x* is in radians (1/cos(*x*)).
sign(*x*)	Returns 1 if *x* is greater than 0, returns 0 if *x* is equal to 0, and returns –1 if *x* is less than 0.
sin(*x*)	Computes the sine of *x*, where *x* is in radians.
sinc(*x*)	Computes the sine of *x* divided by *x* (sin(*x*)/*x*), where *x* is in radians.
sinh(*x*)	Computes the hyperbolic sine of *x*.
sizeOfDim(*ary*,*di*)	Returns the size of the dimension *di* specified for the array *ary*.
spike(*x*)	Generates the spike function for any real number *x*.
sqrt(*x*)	Computes the square root of *x*.
step(*x*)	Generates the step function for any real number *x*.
tan(*x*)	Computes the tangent of *x*, where *x* is in radians.
tanh(*x*)	Computes the hyperbolic tangent of *x*.

DCM-2 Setup options

Under the “Setup” tab (1) of PDsoft can be found the “DCM-2 Setup” tab (2). This has some DCM-2 specific controls as outlined.



1. Copy chart1 DCM-2 parameters to all charts – copies all the user selectable variables such as current setting etc to the remaining charts, this helps speed up chart setups and defaults to on.
2. Reset DCM-2 parameters on each chart – This forces PDsoft to set all parameters when moving from one chart to the next.
3. Record internal DCM-2 variables – Selecting this causes PDsoft to record extra internal variables of the DCM-2, not normally required by end users but in certain circumstances users may be asked by Matelect to use this option to help fault find scenarios.
4. IGNORE REVERSING I READINGS - Currently when using the reversing mode on the DCM-2 PDsoft does not record these negative readings, this is being reviewed, users experiencing problems or requiring this feature are to contact Matelect for assistance.
5. I SETTLING TIME mS – By default the DCM-2 allows current 100mS of settling time before taking any readings this can be increased by the user to resolve noise issues, please consult the DCM-2 manual for further information on this.

6. USING A CGM-7 AND DCM-2 ON THE SAME TEST.

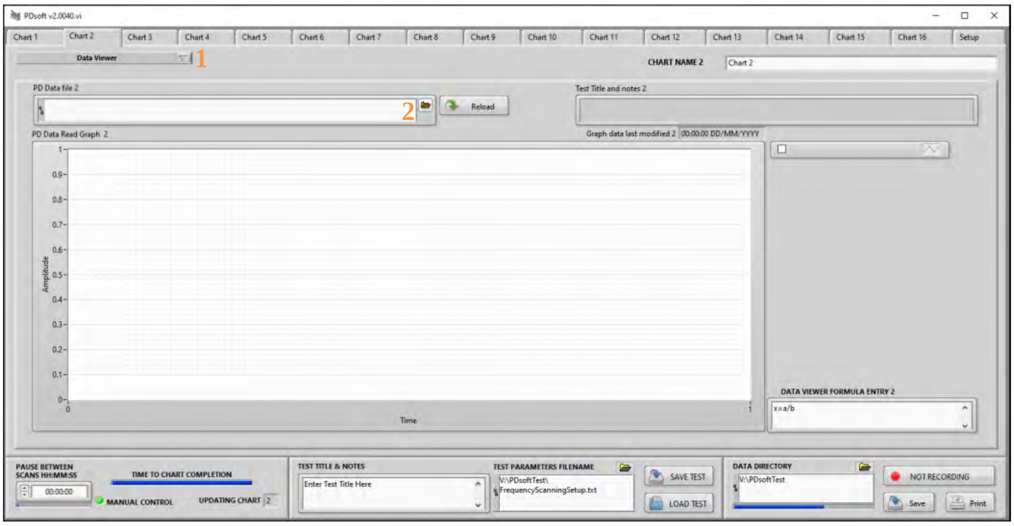
It is currently possible to connect a CGM-7 and DCM-2 to the same specimen during a test in order to record both ACPD and DCPD readings. In order for this to happen users obviously require both a CGM-7 and DCM-2 as well as a scanning system from Matelect.
A lot of work has been done at Matelect in this field and a few papers written on the results. Results have shown very promising results and although not fully ready for end users in the field, not much further work is required to allow this.

Users interested in using ACPD and DCPD on the same specimen during a test are encouraged to contact Matelect for further information. A full explanation on how to do this will be added to this manual in the near future.

7. LOADING DATA FILES AND VISUALISING DATA.

PDsoft currently has a simple data viewer for all recorded data. As mentioned, all data recorded by PDsoft is stored in simple comma separated text files for easy import to spreadsheets. However sometimes it can help to quickly look at the data within PDsoft.

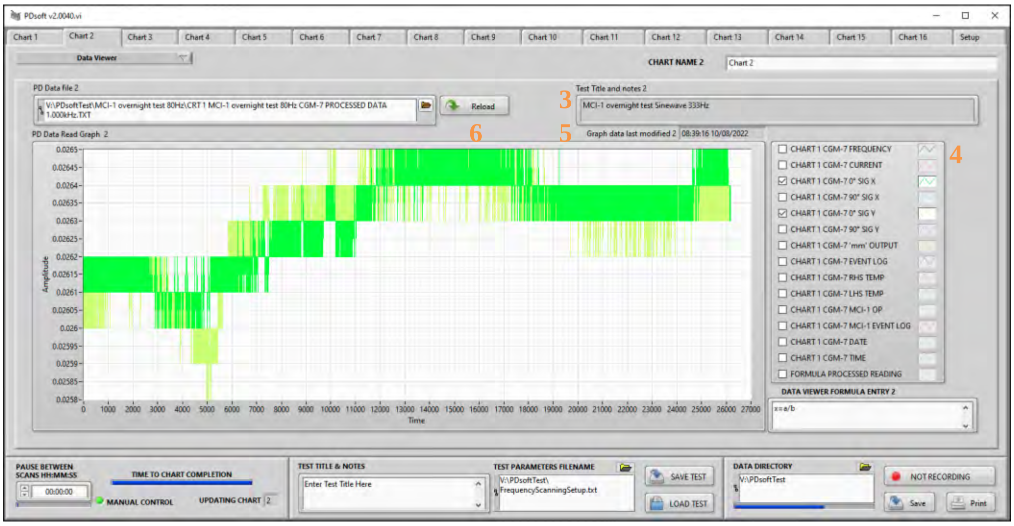
To do this navigate to an unused chart and select “Data Viewer” (1) from the drop-down menu.



Click the folder icon in the “PD data file” box (2) and navigate to the data file for viewing. In this case we are reviewing some data recorded during a synchronisation test.

Note:
If your data file has more than 30,000 data points it can take a very long time for PDsoft to load, we are actively looking for a workaround but for now users are advised to load this data into a spreadsheet.

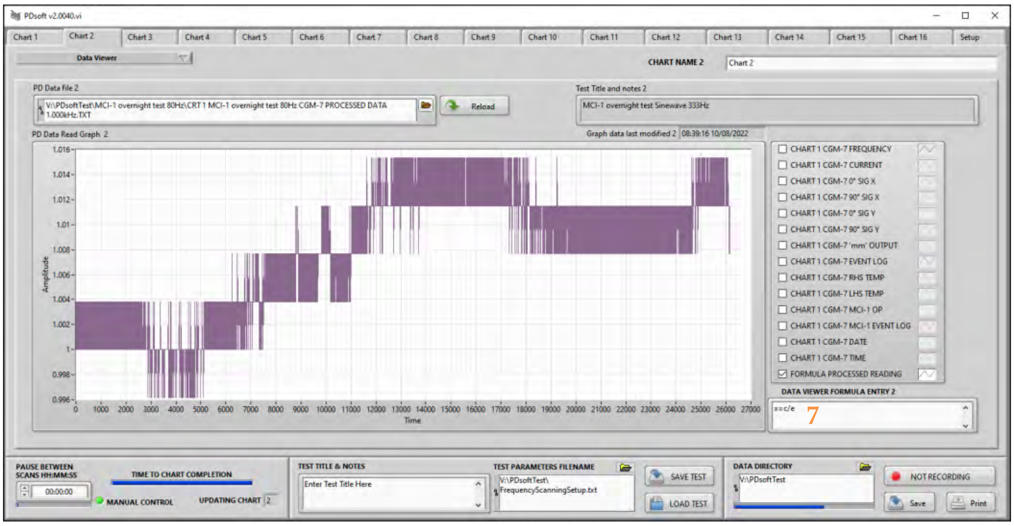
Once the data is fully loaded the “Test Title and notes” (3) window will be populated, as mentioned above this may take a while depending on the file size.
As the file is being loaded the plot legend (4) will auto populate with all the available plots. For a user to view them they simply need to click on the tick box for the desired plot to enable and disable as required.



Whilst selecting plots the graph will auto scale accordingly, alternatively users may set their own scale as described at the beginning of the manual.

If a data file is being updated whilst being viewed, this is allowed, then the “Graph data last modified” box (5) will auto update with this information. The new data should auto populate but users can force it to by pressing the “Reload” button (6).

User can perform simple mathematical operations on the data by using the “Data viewer formula entry” box (7), the available commands are the same as those outlined in the formula entry section previously in this manual. The formula constants a,b,c etc are the plot selections as they appear top to bottom so in this example b=CHART1 CGM-7 CURRENT, c=CHART1 CGM-7 O^0 SIG X etc



To use users, need simply enter the desired formula, in the example above we have simply divided the X signal from the Y. Once the formula has been entered simply click outside the formula entry box and wait for the results to be computed, again this may take some time dependant on the amount of data points.

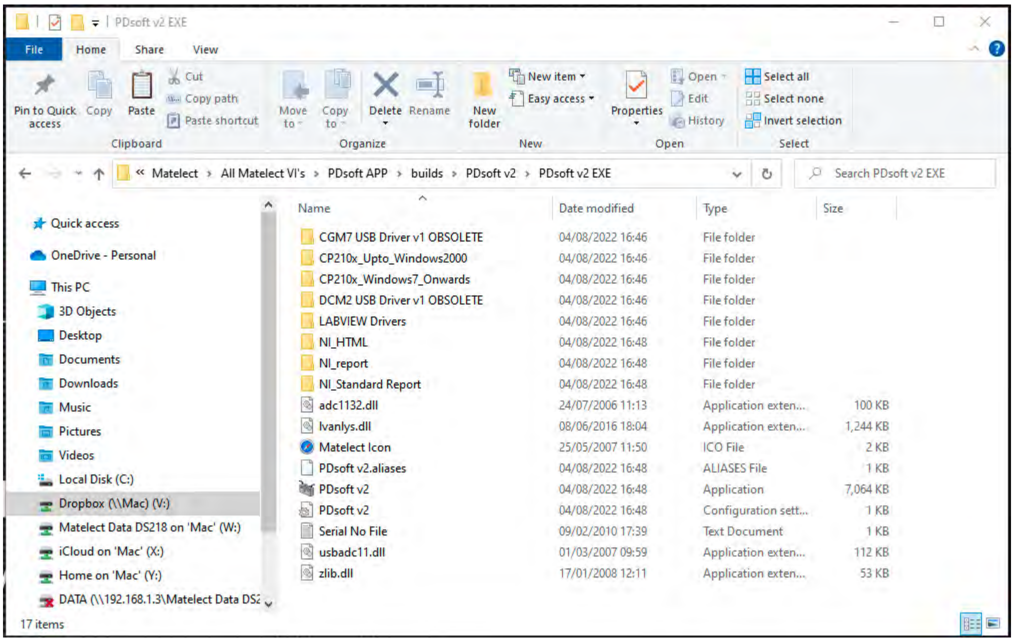
Note:
Remember to select the “Formula processed reading” plot at the end of the plot legend.

8. VIRTUAL COM PORTS, INSTALLATION & DROPOUTS

Virtual COM port installation

If Windows hasn’t picked up the virtual com port automatically or the user is using a PC not connected to the internet they may need to install the virtual com driver manually.

To do this navigate to the install directory of PDsoft, it should look as shown below.



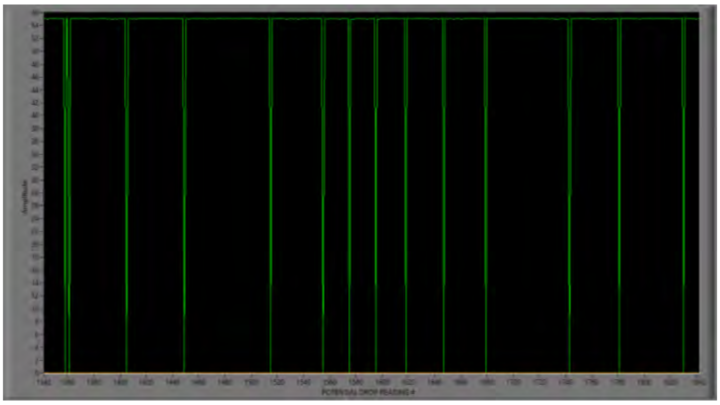
If using Windows7 and above navigate to CP210x_Windows7_Onwards

Once in this directory click on either “CP210xVCPInstaller_x64.exe” or “CP210xVCPInstaller_x86.exe” depending on your version of windows, most people will be using x64.

If help is required with installing virtual com port drivers’ users should contact their own IT department as a first call, alternatively Matelect can offer limited assistance with this upon request.

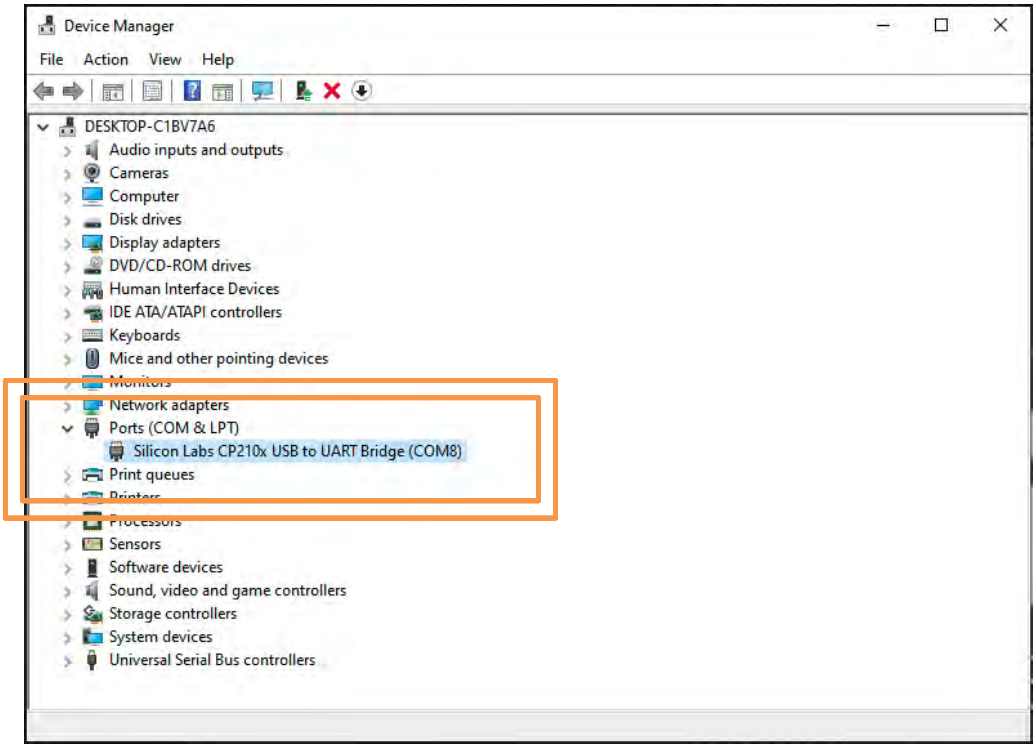
What to do if dropouts are noticed

If the user notices dropouts in the readings, that is to say the readings go to zero as shown here in a previous version of PDsoft.

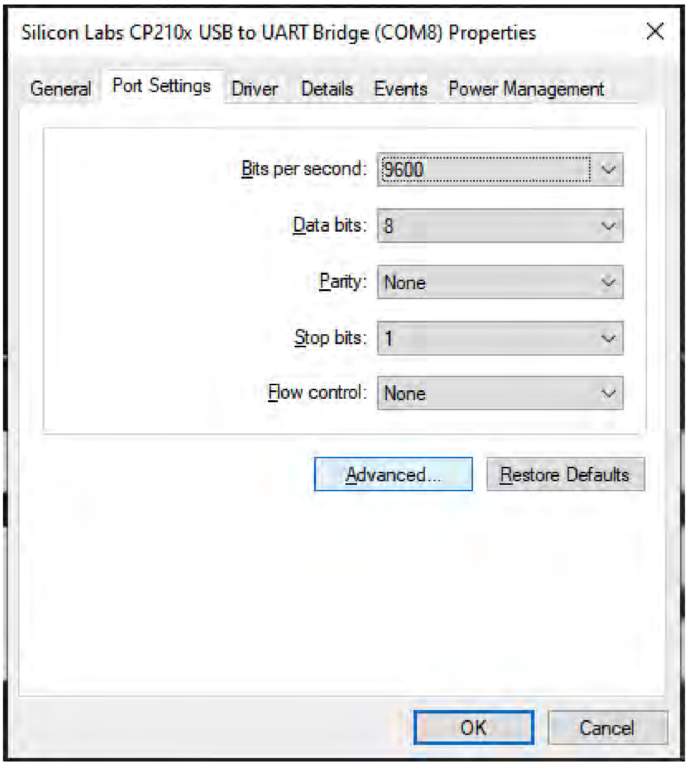


They will need to reduce the FIFO buffer settings of the virtual com port. In windows 10 this is done as outlined below.

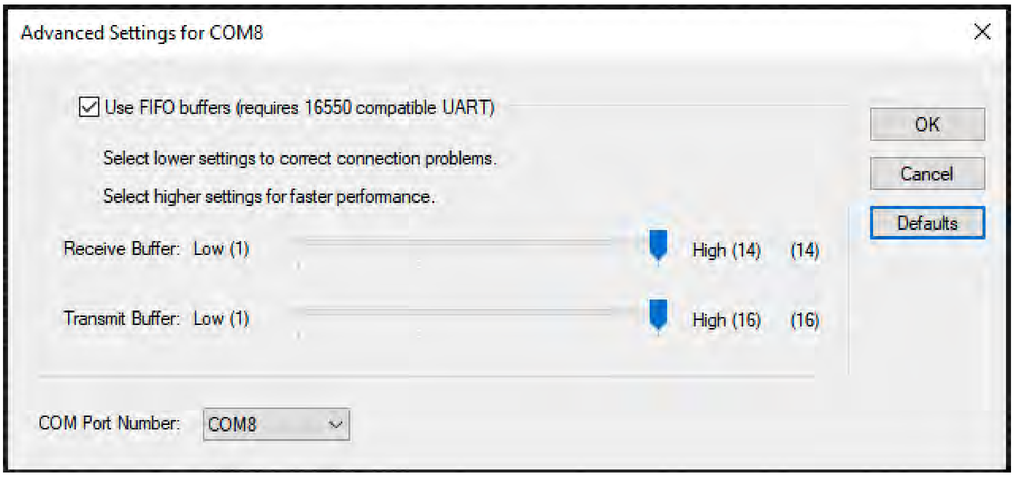
In the "Windows search box" type "Device Manager" and start the application, the following window should appear.



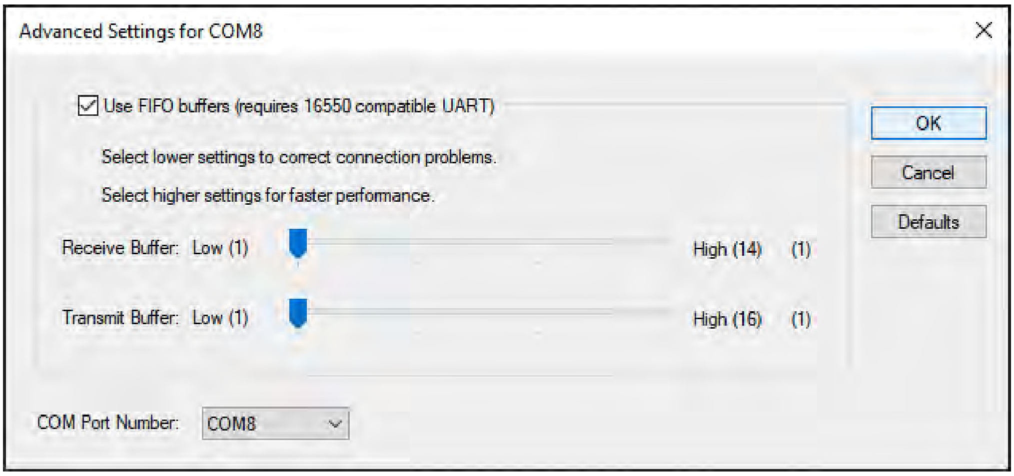
Select the Ports (COM & LPT) tab. The following window should appear.



Select the “Port Settings” tab and then select the “Advanced…” button, the following window should appear. You will note that the receive and transmit Buffers are set to max as default.



Reduce the buffers to minimum as shown below.



Hit “ok” and “ok” again. You can now close the “Device Manager” window. Run PDsoft again and you should now not see any dropouts in your readings.
If you do you can try to deselect “Use FIFO buffers” this can help on some PC’s but should only be used as a last resort.

If dropouts persist, please contact Matelect for further assistance.

MATELECT LTD

Telephone:	**+44 (0)1895 823 334**
Facsimile:	**+44 (0)1895 824 300**
E-mail:	**info@matelect.com**