SediMeter™ Software Manual

version 4.1

Formalities

Document Scope

This is a user manual for the SediMeter™ software, version 4.0. It is intended as a reference to assist users in getting the most out of the software. It is, however, not exhaustive, as the application inherits many features and shortcuts from its development platform (LabView) that are not documented here. Right-clicking on different parts of the user interface brings up context sensitive menus that provide a wealth of options that are beyond the scope of this manual to document.

Document Version

Present version rev. 4.1, 2018-08-22.

Software Scope

SediMeter.exe ver. 4 is the communication and data management application for SediMeter™ SM3 instruments having firmware revision 2, as well as for SM4 instruments. SediMeter.exe 3.7 is the last version that supports SM3 firmware revision 1.

Supported Operating Systems

The application has been developed and tested under Windows 10.

Installation

Insert the memory stick or CD and follow the instructions. Do not change the default directories, as it may prevent the software from working properly. You will get warnings that the software has not being certified; this is normal (it would be cost prohibitive to certify the software, since every time an update or customization was made it would have to be re-certified).

Drivers

The communication with the SediMeter™ instrument is through a USB to RS-485 adapter. Download and install the driver from http://www.ftdichip.com/Drivers/VCP.htm

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Warranty

This software is supplied for free. No express or implied warranty is made regarding the usefulness for a specific purpose, beyond to communicate with Lindorm's SediMeter™ instruments.

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Please Note

Changes from version 4.0 to version 4.1

Data Flow

In 4.1 the Data window is the center of operations as regards the analyzis of data and monitoring. Opening files, editing files, exporting files, real time monitoring; all of it is done, initiated, terminated in this window (or in windows opened from and closed back to this window). *The data in memory is not automatically sent back to the Control window* when the Data window is closed.

In comparison, the Control window was the center of all operations in version 4.0. Now it is only used for communication to the instruments, and for initiating contact for master monitoring (the actual monitoring being started subsequenctly from the Data window).

Slave Monitoring

Version 4.1 can read raw memory files (i.e., direct copies of the SediMeter data record saved to file by a third party logger or application) and present the data in real time. The master monitoring mode from version 4.0 is of course also available. This allows users to connect the SediMeter to third party loggers, side by side with other sensors, and still take benefit of the SediMeter software for analysis.

Web Server, Auto Rotate

The web server has been reactivated, and an auto rotate between IDs has been added to make it more useful in a network.

Window Behavior

Windows in this application are "modal," which means that you have to close the last window opened to return to the previous window (the control is passed to the last window, so the underlying window is non-responsive). Use the File → Close method to close a window; do *not* try to close it using the Windows operating system (the **X** mark is turned off for that reason).

Turbidity Units

Throughout the manual and the software, a number of units for turbidity are mentioned. They are all variants of FTU and the use of different abbreviations is done in order to distinguish between measurement methods, since different methods (light wavelength, and angle of measurement in relation to incident light) affects the results.

Standard units

FTU = Formazin Turbidity Units, signifies that the instrument has been calibrated using Formazin, regardless of measurement method.
NTU = Nephelometric Turbidity Units, as FTU but measured according to the EPA method, i.e., white light scattered at 90º angle.

FNU = Formazin Nephelometric Units, as FTU but measured according to the ISO 7027 method of near infrared (NIR) light scattered at 90º angle. The wavelength should be centered around 850 nm.
FBU = Formazin Backscatter Units, as FTU but measured as close to 180º scattered back to towards the light source. In the SediMeter this is measured with NIR light centered around 945 nm.

Proprietory units

FNMU = Formazin Nephelometric Mixed Unit, this is a mixture calculated in the software from the SediMeter SM3 data by taking the average of the top 6 straight backscatter measurements, and the top 6 oblique (nephelometric) measurements, all taken in 945 nm NIR light, and combined so that at low FTU only the oblique values are used, at high FTU only the straight values, and in between they are smoothly mixed.

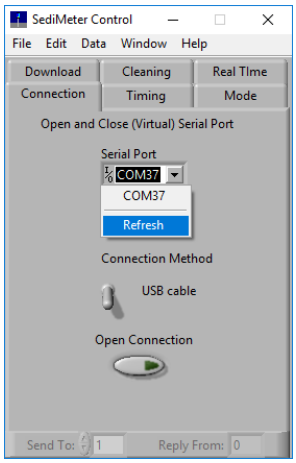
NFU = Nephelometric Fluorescence Units, this unit is used for measurements where UVA light (365 nm) is measured as 90º scattered visible (white) light and calibrated using Formazin. The UVA LED emits some visible light above 400 nm, and the photodetector is somewhat sensitive to wavelengths shorter than 400 nm, why the NFU value may be larger than zero even in the total absence of fluorescence. This value should be evaluated in conjunction with the NTU value (which is measured coaxially and using the same photodetector) and BFU (see below).

BFU = Backscatter Fluorescence Units, this unit is used for measurements where UVA light (365 nm) is measured as 180º backscattered visible (white) light and calibrated using Formazin. The UVA LED emits some visible light above 400 nm, and the photodetector is somewhat sensitive to wavelengths shorter than 400 nm, why the BFU value may be larger than zero even in the total absence of fluorescence. This value is measured using the same photodetector as the NFU value (see above) but a different UV LED.

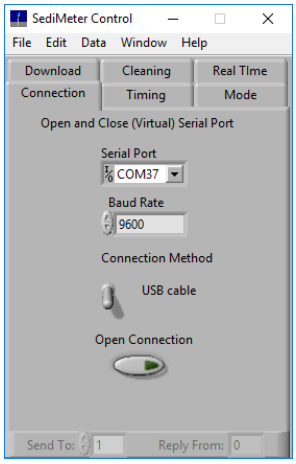
The Two Essential Windows

SediMeter Control window

When starting the application, the SediMeter Control window appears. The Connection tab is open, and the other tabs are inaccessible until a connection is established as described below.



Connection tab



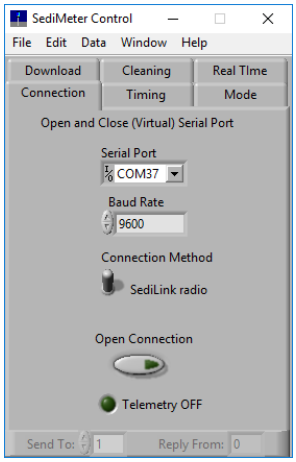
Serial Port pull-down menu

Select the COM port the SediMeter is connected to. Use the Refresh option if you connect the cable after the application was started.

Baud Rate

The default baud rate of the SediMeter after a Reset is 9600. If you have set an instrument to another baud rate previously, then you must set that baud rate here before connecting.

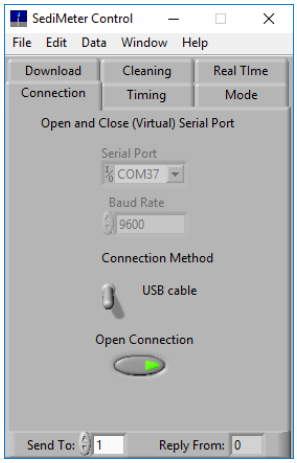
Connection Method



Select USB cable (which is actually an adapter to RS485) or SediLink radio, depending on how you have connected the SediMeter(s). If you select radio an indicator for successful establishment of Telemetry connection will appear.

Open Connection button

Click to open the serial port after plugging in the USB connector of the cable or the radio. If there is no error the remaining tabs get unlocked, and the footer of the window becomes un-dimmed.



Footnote

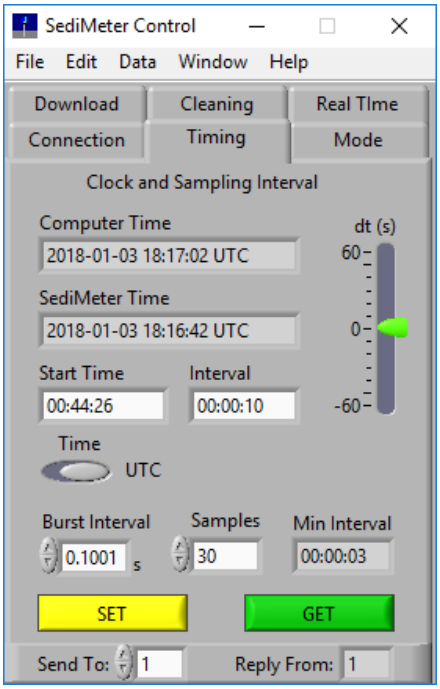
Most users can ignore the footer. Only those using real time monitoring with more than one instrument need to bother.

Every message that is transmitted starts with a one-byte address code, the NetAddr (aka SediMeter ID, or RS485 ID). A value of 0 (zero) signifies a broadcast to all connected instruments. A value of 1 to 255 is used to address a specific SediMeter.

Use 0 for broadcast commands (e.g., if you want to synchronize the time of all connected units). However, to get a reply from an instrument, you must enter that SediMeter's NetAddr in the Send To field. The Reply From field will show which unit replied.

Timing tab

As this tab is opened, the software automatically performs a GET operation (similar to the user pressing the GET button) and populates the indicators with the values from the SediMeter.



Computer Time indicator

This indicates the present date and time that the computer is set to.

When you click SET, the software always updates the SediMeter clock from the computer clock, so make sure your computer clock is set correctly.

SediMeter Time indicator

This indicates the date and time in the SediMeter.

dt (s) indicator

When the SediMeter clock is read, the difference compared to the computer clock is calculated and the number of seconds is shown in this indicator. A positive value means that the SediMeter is ahead of the computer clock.

You can click the end values (60, -60) and edit them using your keyboard to adjust the scale. Click elsewhere in the window to effectuate the change.

Start Time control/indicator

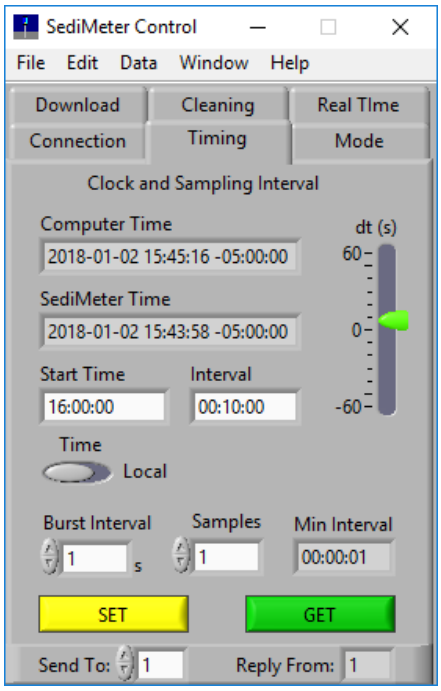
The start time for self-timed logging in the format hh:mm:ss. The next time that the SediMeter clock reaches this time, and it is in Logging Mode, it will start logging. Each time a measurement is made, this setting in the SediMeter will be increased by the amount specified as the Interval. As an indicator, it always shows the time of the *next* measurement.

Interval control/indicator

The interval between measurements in hh:mm:ss. The minimum value you can set is 1 s. However, the software will not allow you to set a shorter value than the Min Interval that it calculates (see below). Since in SM4 the burst sampling of accelerometer data is fixed (in the calibration), the minimum is typically 2 or 3 seconds. In SM3 you can set it to 1 s but it is not recommended, since you will have a very short time window for re-establishing control over the instrument (as it does not listen to commands while measuring).

Time switch

Selects whether to display the time as UTC or local time. This affects the values in Computer Time, SediMeter Time, and Start Time. (Internally in the SediMeter the time is always stored as UTC to avoid having to deal with time zones or seasonal time changes).



Burst Interval and Samples controls/indicators

SM3 instruments

The number of burst samples to take per measurement, and the time interval between them. The interval can be from 1 to 16 seconds, and the number of samples can be from 1 to 20.

The samples are taken *after* the start of the measurement, and the measurement does not end until all the samples have been taken. During this time, the instrument will be not listen to commands.

SM4 instruments

These are indicators only since the values are determined by the calibration file. In SM4 these refer to accelerometer measurements. These samples are taken *before* the end of the measurement. This is to allow a measurement to be triggered by an accelerometer event, and the triggering event to be captured in the data.

Min interval

This indicator shows the necessary minimum measurement interval. The software will not permit a shorter interval to be used.

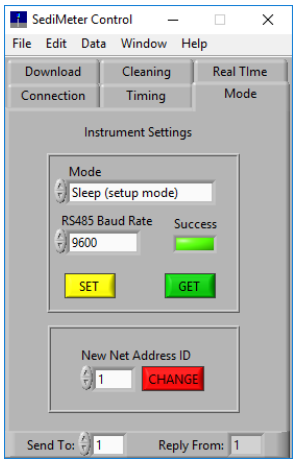
SET button

Sends the timing values from the controls to the instrument in the Send To field, or to all connected instruments if the Send To field equals 0.

GET button

Retrieves the settings from the instrument whose NetAddr is selected in the Send To, and updates all the indicators. When this tab is opened, a GET command is sent automatically.

Mode tab

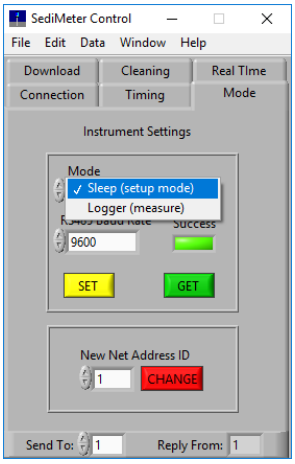


The main use of this tab is for turning Logger mode on and off in the SediMeter. The settings are grouped in two groups. Mode and baud rate are changed in the instrument using the SET button, while the instrument's Net Address is changed using the CHANGE button.

Mode control/indicator

SediMeter SM3 and SM4 have two modes, Sleep which is the universal mode, and Logger, which is only used for stand-alone self-timed logging with data stored to the internal memory.

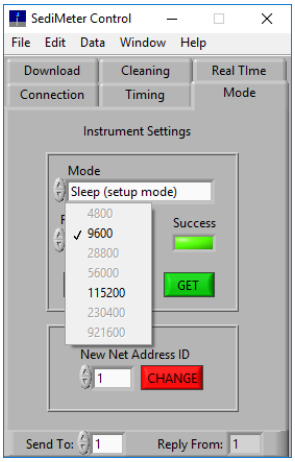
To start logging, select Logger here and click SET. After you switched to Logger mode you can no longer change timing or cleaning settings, nor can you empty the memory, so all of that you should do first. Changing mode is the very last step.



RS-485 Baud Rate control/indicator

This refers to the baud rate in the instrument. The default is 9600 baud (with 8 data bits, 1 stop bit, and no parity). You can change this to 115,200 baud. The software will automatically switch to 115,200 baud as well. However, if the software does not switch you will lose communication. If so, return to the Connection tab, disconnect, change the baud rate in the software there, and click Connect again.

The higher baud rate allows for faster data download, and less current drain when using radios.



The lower baud rate gives greater range when using radios, and allows for longer cables when doing real-time monitoring in a physically connected network.

If you are servicing an instrument used for stand-alone logging you will also want to charge the battery. Charging the battery takes about as much time as downloading data over 9600 baud, so you might as well use the lower baud rate in that case.

SET button

Clicking this button sends the values of the mode and baud rate.

Success indicator

The Success indicator turns green if the instrument accepted the changes, but it turns red (and the mode setting reverts) if the change was not accepted.

GET button

Clicking this retrieves the mode and baud rate setting from the selected SediMeter and updates the respective fields. This command is sent automatically when the tab is opened.

New NetAddr control

This changes the NetAddr (aka SediMeter ID) in the instrument. Each instrument on an RS-485 network must have a unique number in the range $1 \leq \text{NetAddr} \leq 255$.

CHANGE button

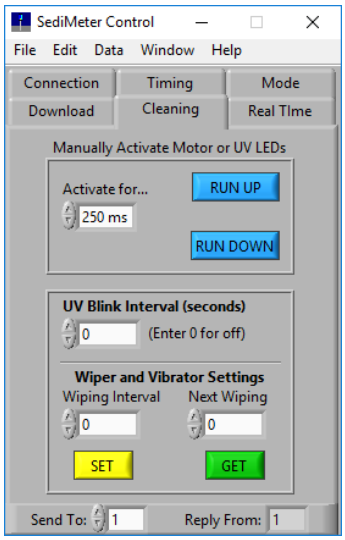
Click to change the NetAddr in a SediMeter. The usage depends on how you are connected, as follows. The new NetAddr number remains in the instrument even after a Reset. Only change this if you need to have more than one instrument on the same real-time network. **WARNING**: Clicking this button may cause you to lose contact with the instrument! You must follow the instructions below to the letter if you decide to change ID.

Method for changing NetAddr (SediMeter ID) in an instrument:

1. Enter the new value in the New NetAddr field.
2. Enter the old value in the Send To field.
3. Click SET. The Reply From field will say 0, since no reply is sent.
4. Enter the new NetAddr in the Send To field.
5. Click the GET button, which updates the Reply From field.
6. Verify that communication works by checking that Reply From equals Send To.

Cleaning tab

This tab contains the control for the UV LEDs of SM4, the vibrator of SM4 and SM3C, and the mechanical cleaning shuttle of SM3B. The usage depends on the type of cleaner on the instrument.



Manually Activate Motor or UV LEDs

These buttons permits manually running the motor in SM3B, or blinking the UV LEDs in SM4.

UV Blink Interval (seconds)

In SM4, the UV lights will blink with the interval in seconds selected here. They are programmed to not activate when the instrument is lying down, only when it is withing 45 degrees from vertical (this is to protect the operator's eyes and not to waste battery on land).

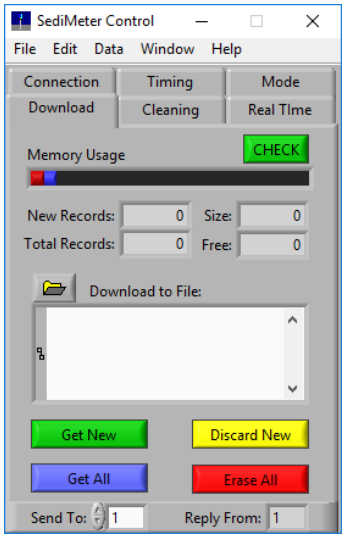
Wiper and Vibrator Settings

In SM3B, this is the setting for the mechanical wiper, while in SM3C and SM4 it refers to the vibrator motor. Wiping Interval is in units of measurements. That is, if set to 2, it will activate every second measurement. 0 means no wiping or vibration.

The Next Wiping allows specifying an initial period without cleanings. If set to 0, there will be no activation; 1 means it will activate at the 1st measurement, and so on.

Download tab

This is for downloading data from the instrument, and for erasing the memory. Broadcasts are not supported for any action on this tab.



CHECK button

Click this to request information from the SediMeter and update the associated indicators (unlike in other panes, this command is not sent automatically when opening the pane). The following indicators are populated by this command:

Memory Usage indicator

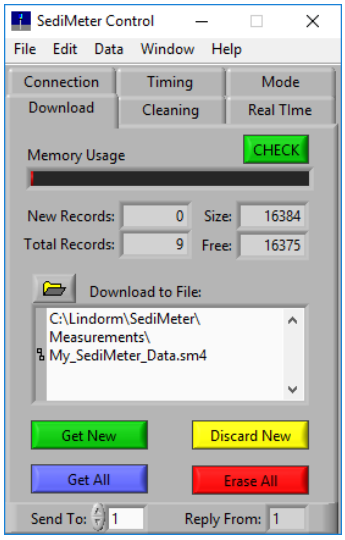
Blue color indicates new data, whereas red color indicates old data (blue = new, red = read). Data may be marked as old in three ways: by being downloaded, by being discarded (see below); or after an instrument Reset.

Total Records indicator

The number of records currently in the internal memory.

New Records indicator

The number of records that have been recorded but not yet marked as read. When full, the instrument stops recording.



Size indicator

The total number of records the memory can hold.

Free indicator

The number of records that are still unused.

Download to File control

The full path and file name (including extension) for where to save data to be downloaded. You may type in the path and filename, or simply use the browse button. The default extension is *.sm4.

Enter a path and file **before** clicking on any of the download buttons below this field.

Also Save Raw LogData checkmark

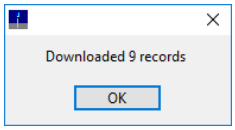
If you mark this box the data will also be saved as a raw copy of the instrument memory using an *.sd2 file extension, with a file name based on the instrument model, serial number, and assigned ID (the "Send To" number), and a letter added to distinguish different files from the same instrument in the same folder (A, B, etc). Example: "SM4-0001 ID1 A.ld2". It will be saved in the same folder as the *.sm4 file. This is the most compact way to save data. (This control is not shown on the illustrations above since it is new for version 4.1.)

Get New button

Clicking this button downloads the new records from the selected SediMeter to the indicated file.

Get All button

Clicking this button downloads all records from the selected SediMeter to the indicated file. Download starts with the first record, number 0. After the download is finished a dialog indicates how many records have been downloaded.



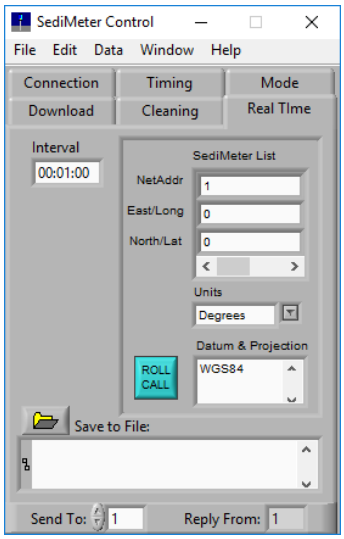
Discard New button

This marks all records in the SediMeter memory as "read". Use this button to discard data rapidly, without having to download. When all data are "read" then you can erase the memory to free up space.

Erase All button

This erases all records, freeing up the memory. It can not be executed while there are new data in memory. If you don't want to download the new data, use the Discard New button.

Real Time tab



This tab contains a list of the instruments that will be interrogated for data in real time monitoring. As the default instrument ID (NetAddr) is 1, the default SediMeter list contains a single record with NetAddr 1, for convenience. However, if you change the instrument NetAddr or add additional instruments with other IDs, then you must edit this setting. The setting is stored as a separate file, and can also be edited in the Edit menu (see below) so that you don't have to redo it every time you open the application.

You can also press the Roll Call button to automatically populate the records with the NetAddr (ID) list.

The location of the instruments is optional to enter. If entered, they permit you to see a map of the instruments (it is available as a menu item in the Data View window).

Interval

Removed from version 4.1. The master mode monitoring interval must instead be entered in the Monitoring tab of the Data window.

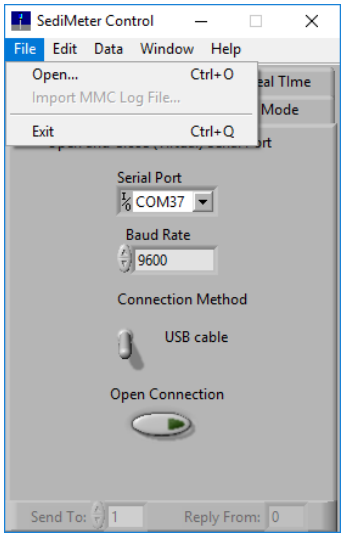
Save to File control

Removed from version 4.1. The file path must instead be entered in the Monitoring tab of the Data window.

Menus

NB: Some menues have changed from version 4.0 to 4.1, but these changes are not reflected in the illustrations below.

File menu



Open… Ctrl+O

This is the file open command. You can open SediMeter files with extensions *.sm4, *.sm3, and *.sm2, albeit data from the optional analogue sensors in the older files are not treated correctly. Use version 3.7 or older for those older files.

Import Memory Log File…

This is the command for importing an *.ld2 raw data file as saved if the "Also Save Raw LogData" was checkmarked during data download.

Exit Ctrl+Q

Quits the application.

Edit menu

Cut Ctrl+X

Removes the selected text from a field and places it in the clipboard.

Copy Ctrl+C

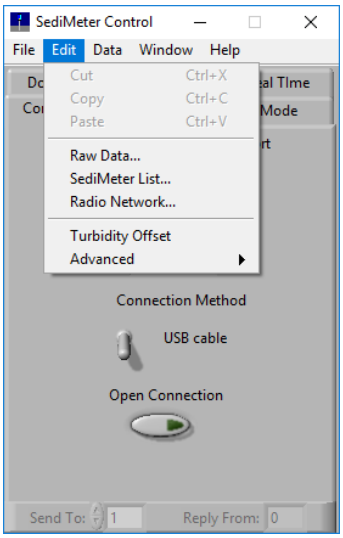
Creates a copy of the selected text in the clipboard.

Paste Ctrl+V

Creates a copy of the text in the clipboard in the selected field at the place of the insertion cursor.

Raw Data…

Opens the File view window (see below) with the data presently in memory. If there are no data in memory, it opens as untitled.sm4.



SediMeter List…

Opens the SediMeter List window, for editing the list of connected instruments (see below).

Radio Network…

Opens a window for changing settings in the radio in connected SediLink radio modems. The radios are XBee radios from Digi, and for commands refer to their documentation. If Telemetry is not connected (i.e., you are using a cable and not radio) then this dialog will serve no purpose.

Turbidity Offset

Opens the Turbidity Offset window (see below). Allows for recalibration of the turbidimeter offset without changing the slope. This can be done by the operator and even in the field if a suitable tank is available (known FTU, sufficiently large, darkness).

Advanced > Recalibrate Instrument…

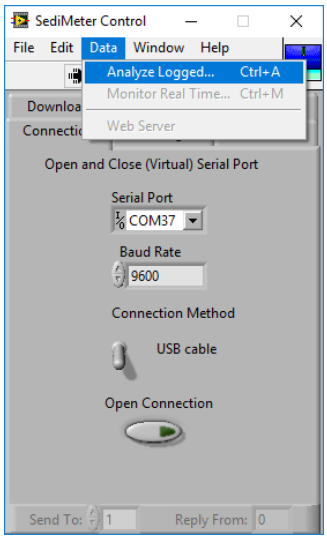
Opens the Recalibrate Instrument window. The Recalibrate window is password protected, allowing for access being limited to only authorized personnel.

Advanced > Listen to Communication Port…

The window that opens (see below) is intended for debugging an RS-485 network between some other master, and one or more SediMeters. The software passively displays the data on the communication port.

Data menu

Monitor and Display… Ctrl+M



Opens the SediMeter Data window (see below). For real time monitoring in Master mode, you must Connect to an instrument or instrument network *before* opening this window.

Window menu

The content of this menu is a list of the currently open windows of the application. Do not use this menu to switch between windows. You must instead close the last opened window from its File menu in order to return to the previous window.

Help menu

Show Tip Strips Ctrl+T

Turns off or back on the tip strips that appear when you idle the mouse above a control or indicator.

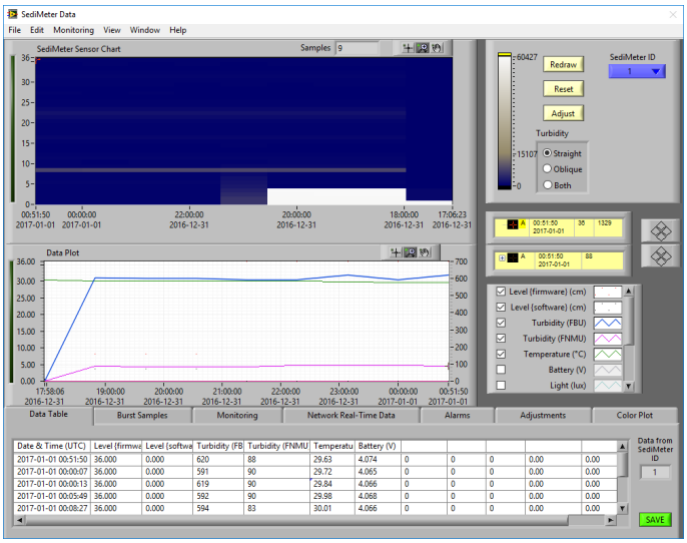
Show Context Help Ctrl+H

Turns on or back off a context-sensitive help window. It displays more in depth help about the items you idle over with the mouse, than the tip strips provide.

About…

Shows the About window. Click anywhere in it to close it.

SediMeter Data window



This window is for viewing and interacting with SediMeter data, whether downloaded data from the logger, or for real time monitoring.

SediMeter ID control

If data from more than one instrument is analyzed simultaneously, this control is used for selecting which instrument to display.

Auto Rotate IDs

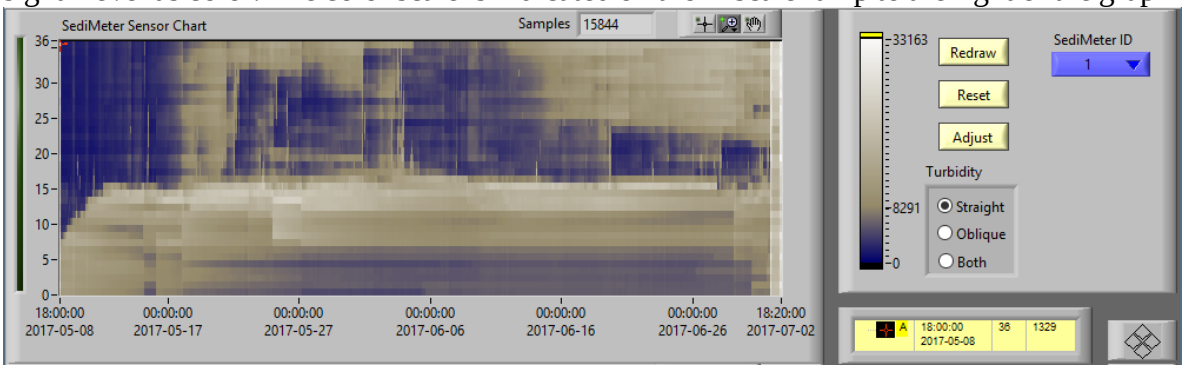
Rotates through the IDs with the rate selected in the control that opens when active.

Graphs

The window is dominated by an intensity chart and a data plot graph. They have the same X-axis time scale to be comparable. They also share many features, which will be presented below in the section Graph controls.

SediMeter Sensor Chart

This graph shows the SediMeter data with time on the X-axis, turbidity detector on the Y-axis, and signal level as color. The color scale is indicated on the Z-scale ramp to the right of the graph itself.



The color scale is editable. Move the mouse over a scale marker. When the cursor changes to a double arrow you can drag the scale marker up or down. You can also right-click it and change its color. If you drag from the end markers you get new intermediate points.

In the top margin of the window the number of samples is shown. In real time monitoring, the date and time appears to the left of Samples.

Redraw, Reset, Adjust buttons

Redraw simply redraws everything. Reset changes the color scale of the Z-scale ramp to the default and redraws. Adjust changes the color scale to the range present in the straight backscatter data and redraws.

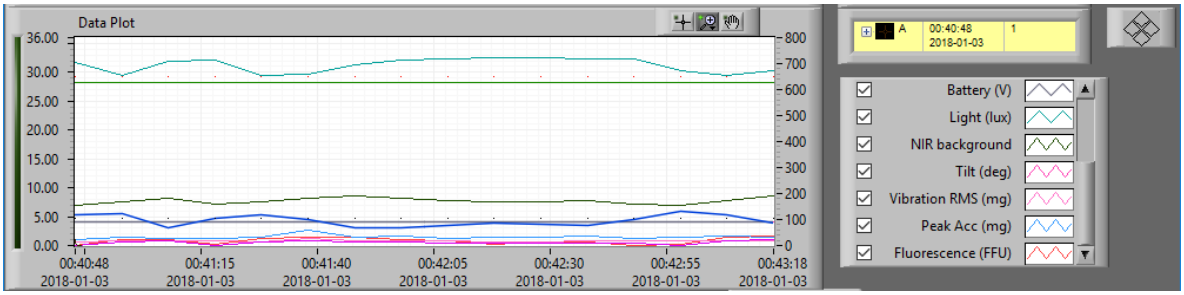
Turbidity radio buttons

Select whether to display only the straight backscatter (36 values), only the oblique scatter (35 values), or both (71 values).

Data Plot

This graph plots the measurement data with one value per measurement. The parameters are listed in the legend to the right. Each parameter can be turned on and off in the plot, its color and type changed, and the Y-axis on which it is plotted can also be changed.

As default, Level, Temperature, Battery are plotted on the left scale, which is fixed as 0 to 36. Turbidity and other values are plotted on the right scale, which automatically scales to the values at hand. The autoscale feature can be turned on and off by the user.



Note that the level is calculated both in the instrument firmware and in this software. The software is by default automatic but can be changed to interactive mode (see Adjustments tab).

Graph controls

A number of controls are common for the two graphs in the data window. They are explained here.

Graph cursor

One cursor is defined for each graph in a light yellow field (the cursors are named "A"). To the right of the cursor name and icon there are columns for the cursor's current X position, Y position, and in the case of the intensity graph, the Z value at that point.

If the cursor is not visible in the graph, right-click the cursor (+) in the cursor control and select "Bring to Center". To be able to drag the cursor in the chart, make sure the cursor symbol (+) is selected in the Graph Palette (see below). You can also move the cursor by clicking on the diamond-shaped controls to the right of the cursor control.

The cursor for the line graph will snap to a line. Right-click on the cursor in the cursor control to bring up the context-sensitive menu and select which line to snap to.

Graph Palette

In the top or bottom right corner of each graph there is a palette with three choices; cursor, magnifying glass, and a hand for dragging. The magnifying choices are, from left to right on the first line: Zoom in in both dimensions, zoom in in the X dimension, zoom in in the Y dimension. On the second line: Fit all data to the graph, zoom in to the point of clicking, zoom out around the point of clicking.

Changing X and Y axis scales

The X-axes all have auto scale as default. To be able to zoom in in the X dimension, you must first turn off auto scaling. Right-click on the graph or on the X-axis to bring up a menu where you can turn off "AutoScale X."

The intensity graph has manual scaling on the Y-axis, from 0 to 36. If you change the scale and want to restore it, simply click the green bar to the left.

The Data Plot has double Y-axes. To turn AutoScale on or off on either one of them you must right-click on one of the scale values of the scale in question.

Other features

You can change the legend color, line type etc., and edit the names in the legend.

The intensity graph can be exported as an image by using the Copy Data command in the context-sensitive menu. The exported image includes all items that presently are visible. You may

wish to turn off the Graph Palette and the Cursor Legend prior to copying the image. You do that by bringing up the context-sensitive menu (right-click) and de-select them under Visible Items.

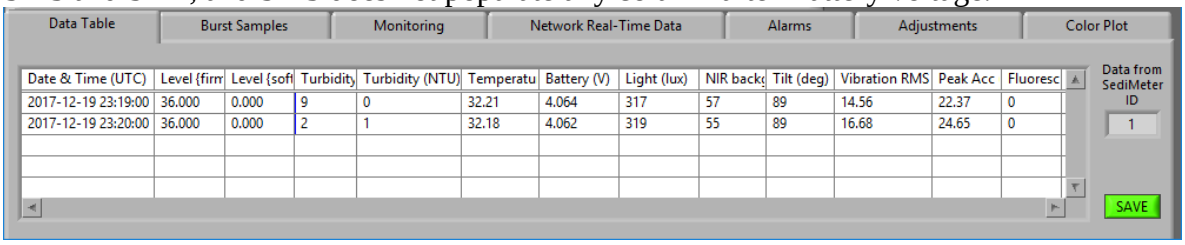
The other graphs can be exported as a simplified image (better for including in a report) in a similar way.

Each graph also has a Scale Legend, although it is off as default. The scale legend provides a graphical user interface for setting AutoScale, to scale-to-data once, and for accessing menus for changing a number of settings of the graphs. To turn it on, right-click the graph and select Visible Items -> Scale Legend.

The line graphs have an Annotation feature. Right-click on a line to bring up a context-sensitive menu with Create Annotation as one choice. After you have created it you can change its color and other attributes. This may be used for marking in the graph when certain things happened, such as taking a calibration reading with another method.

Data Plot tab

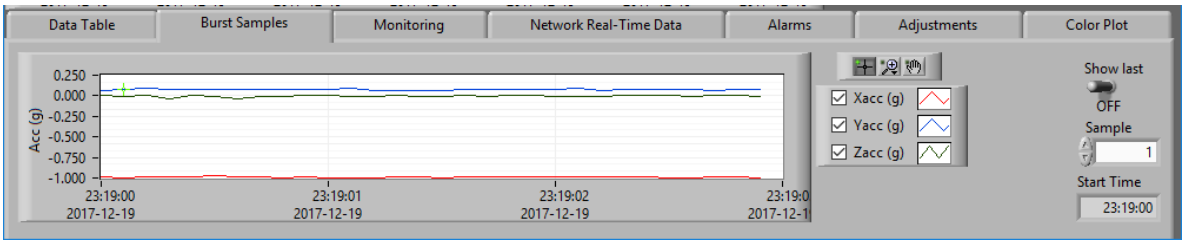
This is a table of the same data as in the Data Plot. The column labels for turbidity are different in SM3 and SM4, and SM3 does not populate any column after Battery voltage.



You can save the contents of this table at any time as a tab-delimited text file by clicking the SAVE button.

Burst Samples tab

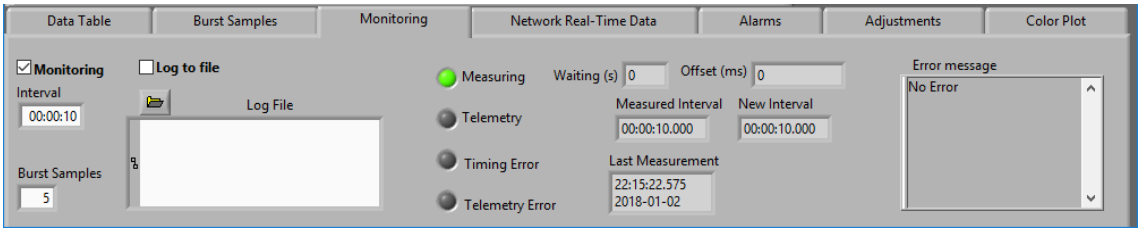
In the case of SM4, this graph contains the accelerometer data in 3D from one measurement at a time. Select which one to see by using the Sample control.



In the case of SM3, this tab contains burst samples provided that the number of Samples is larger than 1. If Samples is set to 1, this plot remains empty. The data shown will be Level from the instrument firmware, and FBU turbidity from OBS #37.

Monitoring tab

The monitoring tab, along with the two following, is relevant only for real time monitoring.



Slave indicator

Indicates that the window is in slave monitoring mode, reading raw data files from one or many SediMeters. The files would typically be periodically updated by software of a third party data logger.

Master indicator

Indicates that the window is in master monitoring mode, controlling a network of one or many SediMeters.

Log to File checkbox

A combined control and indicator for saving master monitoring data to file.

Log File control

The Log File path control is used for creating or selecting a file to which to write master monitoring data. The file is written in *.sm4 format, which allows for storing data from several instruments to a single file with synchronized measurements.

Measuring indicator

This is green during a measurement, and grey in between, in real time monitoring.

Telemetry indicator

This is green when telemetry is on (communication via SediLink radio modem).

Timing Error indicator

This is a warning for timing errors. It is only visible during real time monitoring.

Telemetry Error indicator

This is a warning for telemetry errors. It is only visible during real time monitoring.

Waiting, Offset, Measurement Interval, New Interval, Last Measurement

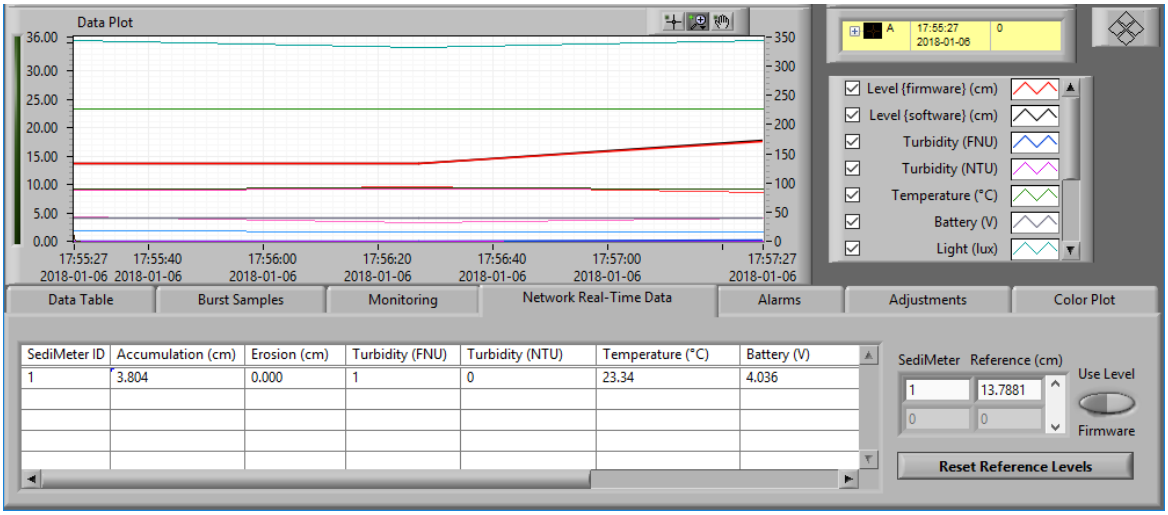
These aids for debugging telemetry are only visible during real time monitoring.

Error message

Any “soft” errors during real time measurements are displayed here. Soft errors are those that the software can ignore and continue anyway.

Network Real-Time Data tab

This tab shows the last measurement from each connected instrument in a real-time monitoring network. Whereas the Data Plot tab shows all the data from the one instrument, this tab shows one measurement from all the instruments.



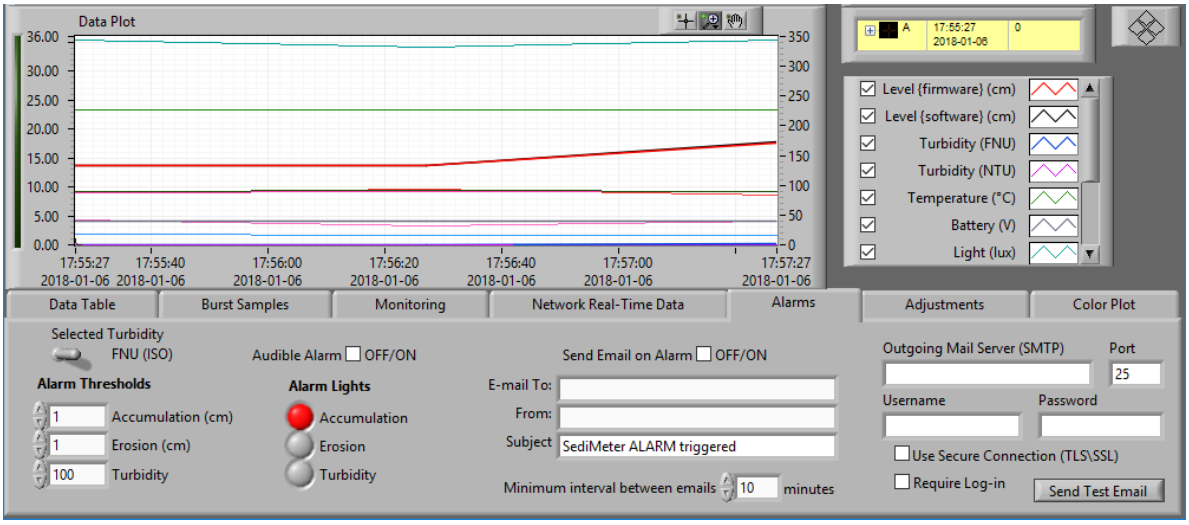
It calculates the change in elevation from a reference level, and displays it as either accumulation or erosion (see illustration). Select with the switch whether to use the values from the instrument firmware, or the ones calculated in software (when using software values, the displayed accumulation and erosion values reflect the *previous* measurement). Click the Reset Reference Levels button to use the value from the first record in memory as reference, or edit the reference levels manually in the table.

When using SM4, the 4th column will display the FNU value from the ISO style nephelometric turbidimeter, and the 5th column will display the NTU value from the EPA style nephelometric turbidimeter. When using SM3, the 4th column will display the FBU value from OBS #37, and the 5th column the FNMU value calculated as a composite of the 6 topmost straight and 6 topmost oblique FTU values from OBS array.

Alarms tab

This tab is for defining alarm conditions and what to do in case they are triggered.

The Alarm Thresholds refer to the accumulation and erosion values from the Network Real-Time Data tab (see above). The switch for Turbidity selects which turbidity value to use; from the 4th or from the 5th column in the Network Real Time Data table.



When any instrument in the network exceeds the set threshold, the corresponding alarm light goes red. If the Audible Alarm checkbox is ticked, the computer will also beep for each measurement when an alarm is triggered.

If the Send Email on Alarm checkbox is ticked (and the relevant fields filled in) an email will be sent the first time any instrument triggers an alarm. The email will say which alarm was triggered, and by which instrument. To avoid having an email sent too often, a minimum interval between emails can be specified. Contact your network administrator if you need help with the server settings.

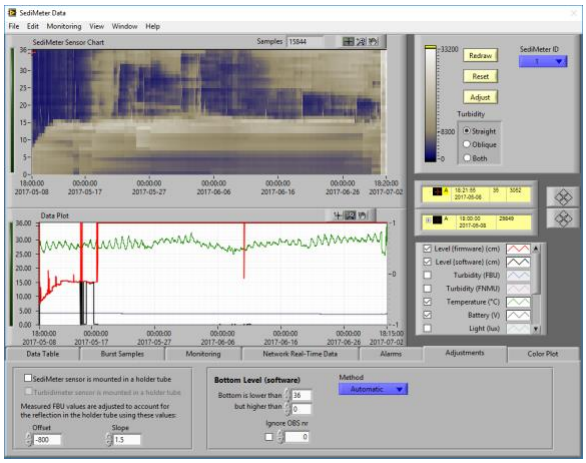
Adjustments tab

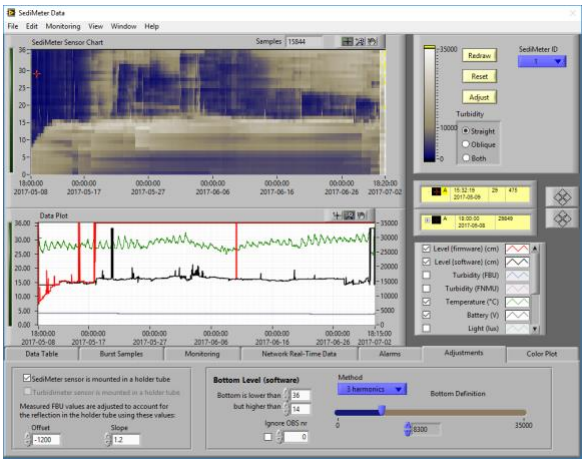
The left part of the tab offsets the FBU values in the SediMeter Sensor Chart by compensating for the reflections and signal loss in the holder tube, mostly for esthetic reasons. It is better to use a turbidimeter located above the holder tube for turbidity measurements.

The right part of the tab contains settings for estimating the level, and changes how "Level {software} (cm)" is calculated. The default is automatic bottom detection but you can set this to manual and enter the turbidity value you chose as the definition of bottom in the Bottom Definition control. The software will start looking from lower to higher and the first time it encounters an OBS with less turbidity value than the threshold, it will assume that to be the bottom.

In many cases there are complications such as anoxic black sediment below the surface with very low reflectivity (in the example below, such a dark layer developed during the deployment), or dirt on the sensor that gives a high turbidity reading up in the water. Using the settings for "Bottom is lower than … but higher than …" it is possible to constrain the software to the interval where the user knows the bottom to be. In the example above, the bottom (black line) was constrained to between 12 and 22 cm, based on a visual inspection of the intensity chart. Of course, initially the level was below 12 cm, but in that period the instrument had no problem finding the bottom without help (red line).

It is also possible to ignore a single OBS detector, replacing its value with the interpolated values from the detectors above and below it. To do so, check the mark and enter the number.

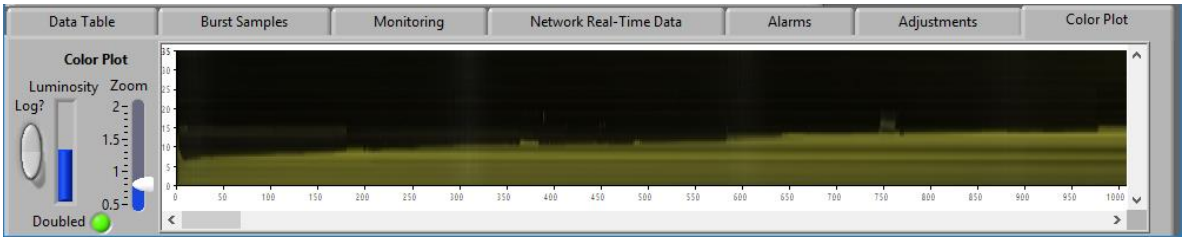




The two graphs illustrate how the software level can be obtained by forcing the program to look only above the anoxic and dark bottom layer (the vertical spikes in the bottom were made by sea urchins; they liked to congregate at the base of the sensor, and are thought of being responsible for the periodic cleaning of the sensor from algae).

Color Plot tab

The false color plot is created by combining the straight and oblique scatter turbidity into a single image with 5 mm vertical resolution, where yellow represents straight backscatter and blue represents oblique scatter. Due to the total reflection against air, an exposed sensor will create a blue image. This color plot is therefore an easy visual aid for those who deploy the instruments in the intertidal zone.



You can zoom in and out. When zooming out the vertical scale is automatically doubled. You can also change the luminosity, and make the color scale logarithmic.

Menus

The biggest change from 4.0 to 4.1 is in the operation of this window, as evidenced by the menu system. Rather than depending on the Control window as the data hub of the application, the Data window is now the hub for data management. Data are no longer being sent back to the Control window. Rather, this window now has the tools for deleting records, saving, exporting, importing, and opening files.

File menu

Open… Ctrl+O

Opens an *.sm4 file. Also works for importing older *.sm2 and *sm.3 files to some extent.

Save

Saves changes to the open (sm4) file.

Save As…

Save data in memory as an *.sm4 file to a new path or with a new name.

Import Memory Log File…

Imports a raw data file of type *.ld2 (see Download tab).

Custom Import Formats

This submenu is for customized import formats. Contact us if you require a customization.

Export Data from this SediMeter…

This item exports the data from the selected instrument as a tab-delimited file. The columns vary depending on instrument version. This is an example from SM4 (most of the repeated columns with OBS and accelerometer data have been hidden).

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	CG	CH	CI	FR	FS
1	SediMeter ID	1	Burst sample interval (s)	0.1																	
2	Date & Time (UTC)	Level {firmware} (cm)	Level {software} (cm)	Turbidity (FNU)	Turbidity (NTU)	Temperature (ºC)	Battery (V)	Light (lux)	NIR background	Tilt (deg)	Vibration RMS (mg)	Peak Acc (mg)	Fluorescence (FFU)	#0	#1	#2	#71	X g #1	X g #2	Z g #29	Z g #30
3	2018-01-06 17:55	13.788	13.762	0	0	23.29	4.076	345	90	88	17.56	42.16	88	3929	3563	3780	0	-1	-1	0	0
4	2018-01-06 17:56	13.786	13.769	0	0	23.33	4.078	332	91	89	16.82	30.93	93	3945	3548	3762	0	-1	-1	0	0
5	2018-01-06 17:57	17.592	17.713	1	1	23.34	4.036	344	89	89	16.7	40.16	84	3920	3557	3766	1	-0.984	-0.984	0	0
6	2018-01-06 17:58	17.597	17.724	0	0	23.36	4.039	335	92	89	16.22	33.65	95	3917	3550	3766	0	-1	-1	0	0
7	2018-01-06 17:59	17.604	17.736	0	0	23.38	4.082	359	90	89	14.96	26.89	88	3915	3553	3761	0	-1	-1.016	0	0

Close… Ctrl+W

Closes the window. This item is not active during an ongoing monitoring. First stop the monitoring (in the Monitoring menu).

Edit menu

Cut, copy, and Paste work as previously described.

Raw Data

Opens the file view window with the data currently in memory.

Monitoring Definitions → Network Definition…

Opens the SediMeter List window for updating the network definition. The main use is for defning the IDs to be used in Master Monitoring mode.

Monitoring Definitions → Memory Log Files For Slave Mode…

Opens a dialogue for selecting the raw data files (*.ld2) that contain a copy of SediMeter data records downloaded and saved by a third party logger. For each file you must also select an ID (typically 1, 2, 3, etc). After updating this information the Network will automatically update to reflect the new list of IDs. If you want to assign coordinates to the IDs, do this step first, and the Network Definition… next.

Monitoring menu

This menu has two items, one for each monitoring mode. Regardless of which is selected, a number of menu items will be dimmed during the duration of the monitoring.

Master

Starts or stops master monitoring mode. You must define the network first, and connect to the instrument network. To save the data to file, you must also specify a file and start logging in the Monitoring tab.

Slave

Starts or stops slave monitoring mode. You must specify the files to read first.

Share menu

Web

This item turns on and off the web server with default port 8000. A checkmark indicates when it is on.

When on, the web server presents the SediMeter Data window as an image, automatically updated every 10 seconds. The page can be viewed from any web browser by entering the domain or IP of the computer in the browser address field. For instance, if the IP is 127.0.0.1, type http://127.0.0.1:8000/SediMeter.html to view the web page.

The actual document is C:\Lindorm\SediMeter\www\SediMeter.html (provided that C: is the Windows volume). You can edit that document in a text editor to put in your custom information before and after the SediMeter Data window.

URL

This menu item displays the address to enter in a local browser to see the data from the web server: http://localhost:8000/SediMeter.html.

View menu

3D View…

Opens the 3D display window.

Network Map…

This opens the Map of SediMeters window. The coordinates are the ones entered in the Network window (or imported from file in that window).

Window menu

The content is as previously described.

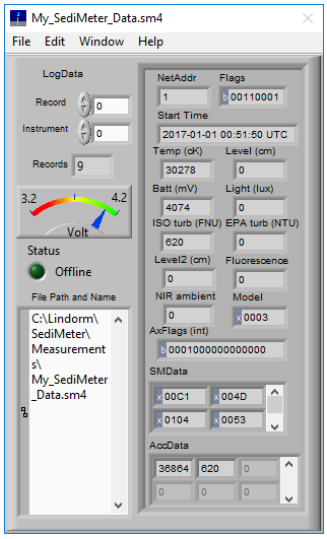
Help menu

The content is as previously described.

Other Windows

File window

This window shows the raw data files type *.sm4 (it can also open files from with extension *.sm2 and *.sm3). To open it, select Raw Data… from the Edit menu in the Control window.



Front panel objects

An *.sm4 file may contain data from a single instrument, or from a network of up to 255 SediMeters. For each instrument there is one record per measurement. This creates a 2D matrix of measurements, which occupies the main portion of the front panel. The right-hand side of the window represents a single record.

Record selector

Use this to step through the records from one and the same instrument. To find the last record, right-click in the white field to open a context-sensitive menu and select "Show Last Element".

Instrument selector

Use this to step through synchronous records from different instruments (such as created by a real-time monitoring network).

Cluster indicator

Each record is a cluster of various elements. This is an indicator, meaning that the data are not editable. The only possible edit in this window is to remove records from both ends (see below). This is by design, so as to preserve data integrity.

You don't need to know what these values mean. They are translated to human-readable form in the Data View window. If you still want to see what each thing represents, either turn on tip strips (Ctrl-T) or help (Ctrl-H) and hover over each field.

Records

The total number of records per instrument.

Volt meter

This indicates the minimum voltage in all the records. If the voltage falls close to 3.2 V the SediMeter will turn off monitoring. If so, you may not have data from the entire deployment period.

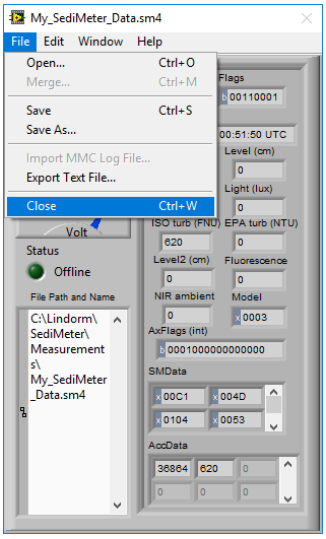
Status

This indicator is currently not used.

LogData Path

The full path and filename of the present data.

Menus



File menu

Open… Ctrl+O

Use this to open a previously created *.sm4 file.

Merge… Ctrl+M

Not presently supported, the purpose is to join files from different instruments recorded with the same timing settings.

Save Ctrl+S

Saves the current data to the same file as last time. Use this to save the data after deleting records since the edits are not automatically committed to file.

Save As…

Opens a browser dialog for picking a new path and file where to save the current data.

Import Memory Log File…

Use this for importing data from the SD or MMC card of a LogDator logger, or *.ld2 files saved in the Download tab of the Control window.

Export Text File…

This item is mainly provided for development and debugging purposes. A more user-friendly export method is provided in the Data View window (see above).

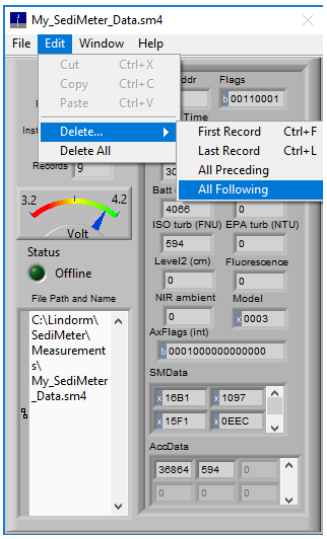
This method exports the SediMeter data table as a tab-delimited ASCII file (in decimal, not hexadecimal, number format). Column one is the FTU value of the straight backscatter data at levels 0 cm, 1 cm, etc. Column two is the FTU value of oblique backscatter at levels 0.5 cm, 1.5 cm, etc. Row one is OBS #1, row 36 is OBS #36, of the first measurement of the first SediMeter. If there are more than one instruments in the *.sm4 file, the first measurements of all the instruments are first output, followed by the second measurements of all the instruments.

Close Ctrl+W

Closes the window (while keeping the data in memory).

Edit menu

Cut, Copy, and Paste function as previously described.



Delete submenu

These commands permit removing records in either end of the monitoring period. It is useful if you have data recorded before deployment or after retrieval. To commit any change to disk, you must select Save or Save As after the deletion.

First Record Ctrl+F

Deletes the first record (with index 0).

Last Record Ctrl+L

Deletes the last record (with index [Records – 1]).

All Preceding

Deletes all records before the one currently showing.

All Following

Deletes all records after the one currently showing.

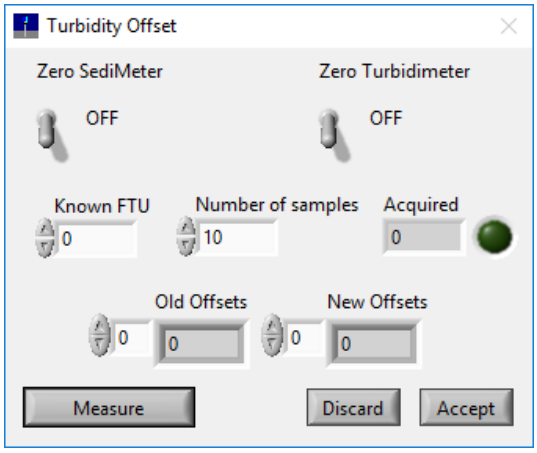
Window menu

The Window menu functions as previously described.

Help menu

The Help menu functions as previously described.

Turbidity Offset window



This window allows for adjusting the offset of the turbidimeters, both in the SediMeter array, and in the #37 OBS of SM3, as well as the ISO and EPA turbidimeters of SM4.

You will need a calibration tank with a liquid of known turbidity, such as pure, filtered, and de-gassed water. The tank needs to have at least 20 cm of water in front of the backscatter detectors and ambient NIR light must be kept out. A suitably sized tank is a 50-gallon black garbage bin (round, for strength), or a bathtub lined with black garbage bags (with the instrument suspended horizontally near the surface, sensors facing down). The black color is an additional protection against reflection.

Important Notice

You must close this window by clicking either Discard or Accept. If you close the window or the application by any other means, the instrument will be left uncalibrated. Therefore, you should finish this operation as soon as possible, for the sake of safety.

Instructions

To zero the OBS array of the SediMeter sensor, as well as the ISO turbidimeter of the SM4, turn on Zero SediMeter. To zero the #37 turbidimeter of SM3, or the EPA turbidimeter of SM4, turn on Zero Turbidimeter.

Known FTU

Enter the FTU value of the liquid in the tank. It is 0 for pure water. Depending on your standard operating procedures you may want to enter a small positive value to create a deliberate bias. Let us say that there is ±2 FTU in noise. Negative values get reported as 0, which means that you cannot calculate a meaningful average when the real value is 0 since half the measurements have been truncated to 0. If you instead introduce a +3 FTU bias, so that 0 is reported as 3, and you get values from 1 to 5 with the normal noise, then you will know from the data that there was no truncating and you can calculate a true average.

Number of Measurements

Enter the number of measurements you wish to include in the average. Each measurement takes a few seconds.

Click Measure to start measuring. When the green light turns on it is ready and you can inspect the values. Notice that the offset is not in FTU units but in raw bits, which is a numerical value about 2 to 10 times larger than the FTU offset value, depending on the scaling of each sensor.

Discard or Accept

Finish by either discarding or accepting the new values. YOU MUST DO ONE OF THE TWO.

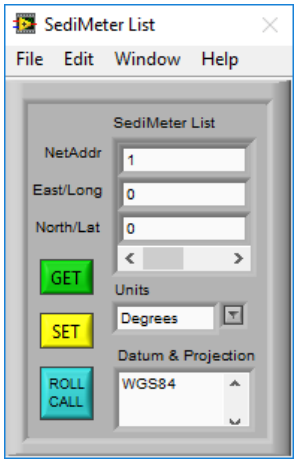
SediMeter List window (aka Network window)

When the application is started it reads the contents of the file C:\Lindorm\SediMeter\SM_Network.smnt. The contents of that file can be inspected and edited in this window, although it is also available in the Real Time tab of the Control window.

The *.smnt file contains a definition of the SediMeter network, for the purpose of real time monitoring. The SediMeters listed here will be polled during master monitoring. If one of them is not on the network, a time-out error will result. If a SediMeter on the network is not listed here, it will not get polled.

Front panel objects

SediMeter List



This is a one-dimensional table that you can navigate through using the horizontal scroll bar. In the right-most position, you see the next unused position, where you can make a new entry.

NetAddr

The NetAddr of a SediMeter on the network.

East/Long (optional)

The easting or longitude of this SediMeter.

North/Lat (optional)

The northing or latitude of this SediMeter.

Units

The units for East/Long and North/Lat. The options are degrees and meters.

Datum & Projection

A free text description of the projection parameters associated with East/Long and North/Lat.

GET button

Reads the NetList in an attached LogDator logger and updates the SediMeter List accordingly. The coordinates are not affected.

SET button

Writes the NetList to an attached LogDator logger based on the NetAddr values in the SediMeter List. The coordinates are not copied.

ROLL CALL button

This button queries each of the possible 255 NetAddr values, and updates the SediMeter List. If a SediMeter in the list does not respond, it is removed; if one responds that was not in the list, it is added to it; and finally, the list is sorted in NetAddr order. Newly added NetAddr entries get coordinates (0,0).

You can use this feature to automatically edit the list, and to verify that all units communicate.

Menus

File menu

Open… Ctrl+O

Opens a *.smnt file that you choose. Use this and the Save Copy As… commands to maintain records of different networks on the same computer.

Save Ctrl+S

Saves the data to the file C:\Lindorm\SediMeter\SM_Network.smnt (provided C: is the Windows startup volume).

Save Copy As…

Saves a copy of the data to a file and path you select.

Close Ctrl+W

Closes the window (but leaves the data in memory).

Edit menu

Cut, Copy, and Paste work as previously described.

Delete All

Deletes all entries in the SediMeter List (but leaves Units and Datum intact).

Window menu

As previously described.

Help menu

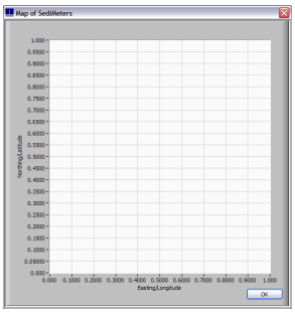
As previously described.

3D display window

This window contains an Active X control showing a 3D view of the SediMeter straight backscatter data.

Dragging with the mouse changes the point of view. Dragging with the Alt key depressed zooms in and out. Dragging with the Shift key depressed pans the image.

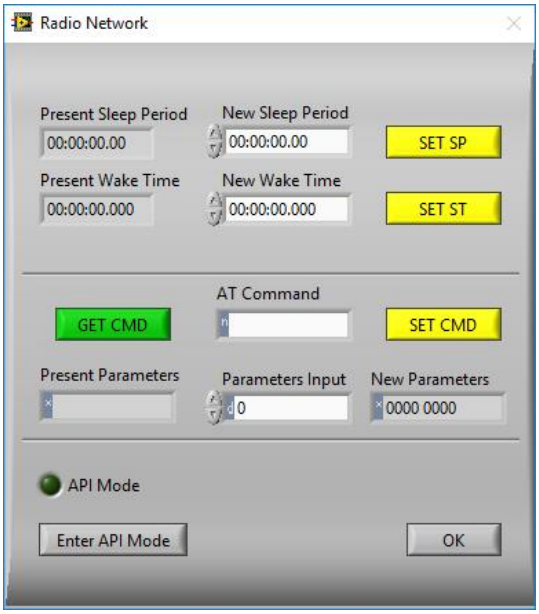
Map of SediMeters window



This window contains a single object, a map showing the relative position of the SediMeters in the network. The positions are those entered in the SediMeter List window (if no coordinates are entered, the map will be empty as in this example).

Radio Click OK to close.

Radio Network window



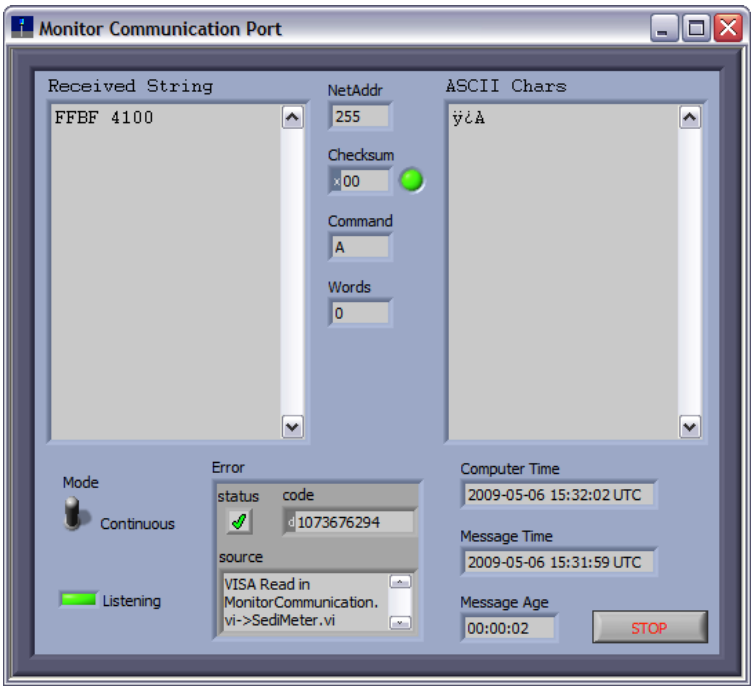
This window allows the settings in the SediLink radios to be changed from the SediMeter application. Refer to the SediLink documentation for settings.

Sleep period and wake time affects the communication and also the blinking rate of the white LEDs in the SediLink.

The bottom half of the window allows generic commands to be sent and settings to be queried.

The button Enter API Mode and the indicator above it are used to enable API communication. When done, click OK. Note that if no radio is present, an error will result.

Monitor Communication Port window



The purpose of this window is to monitor the traffic on an RS-485 network. It can be used for debugging when setting up communication between a third-party logger and the SediMeter (note that it can *not* be used to monitor the communication between the same instance of SediMeter.exe and a SediMeter instrument). The traffic is displayed in hexadecimal code to the left, and as ASCII characters to the right.

The first 4 bytes are the message header. In the center these 4 bytes are decoded, although the checksum is analyzed so a value of 00 indicates a valid checksum. The indicator turns green for valid, and red for invalid checksum.

The window can operate in two modes, continuous and one shot. In continuous mode, it replaces the content as soon as a new message is received. In one-shot mode, it displays the latest message until it is rearmed. When the rectangle is green and reads Listening it is waiting for new traffic.

When the rectangle is red and reads Rearm it is keeping the last message displayed. It is still receiving messages in the background, queuing them until the rearm button is pressed. One can thus step through the messages one by one.

Recalibrate

Since the recalibration functions are password protected in order to be accessible only by qualified and trained personnel, they are left out of this user manual on purpose.

Demo File

Calpe, Spain, 2018

The folder ../Lindorm/Measurements contains an example file recorded with an SM3.2 instrument off Spain in 2018. The screen capture below shows data from that file, for reference.

