

SDB QUICK START GUIDE

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Summary

The aim of this document is to present the software interface used in monitoring of the sport hall.

Introduction

Sensor Basics

You should create a Sensor entry for each Sensor installed in your structure. For example for every standard SOFO Sensor you will need a corresponding Sensor entry in the database.

Session Basics

Sessions are used to relate Measurements on different Sensors that refer to the same state of the structure. In a Session you will find all the Measurements taken on the structure at about the same time or at a given loading level. Organizing your Measurements in Sessions will help you to represent and analyze the data more easily.

Measurement Basics

Measurements are the central piece of data in SDB. The single scans of the SOFO reading unit and the Measurements from other types of Sensors are stored in the Measurements. The Measurement table also contains additional information useful at the data analysis stage.

Agenda Basics

Agendas are used to program Measurement Sessions that are executed either manually or automatically. Agendas can also be used for scheduled execution of Measurements.

An Agenda is a list of Sensors that have to be measured in a given order and a series of parameter indicating how the execution must be carried out. Agendas are stored in the same database containing the Project they refer to. Multiple Agendas can exist for a single Project allowing different types of Measurement Sessions (manual, automatic, scheduled, partial, redundant,...).

Capabilities

- Scheduling, downloading, measuring of sensors
- Save the measurements on a MS Access database
- Visualize the history of a sensor on graph or table
- Set zero measurement
- Simplify real-time interpretation Possibility to combine real sensors using mathematical functions to create more powerful sensors
- Real-time calculation and presentation of indirectly measured parameters such as
 - curvature
 - average shear strain
 - thermal strain
 - load etc...
- Visualization and analysis of calculated measurements
- Compatible with all the SMARTTEC Sensors
- Automatic data export of
 - Selected group of sensors
 - Selected monitoring periods
- Complete data visualization of selected group of sensors over selected monitoring periods in form of

- Tables (Time - Deformation)
- Diagrams (Time - Deformation)
- Values presented on structure's photo, schema or plan
- Automatic elaboration and visualization in real-time environment
- Pre-Warnings and Warnings in form of
 - Yellow and red fields in tables or structure's photo, schema or plan
 - Perform action on critical situations (E-mails, SMS, Run Software)



Fig. 1 - SDB Interface

View output formats

Show Table and Graph

The graphical output from each View is obtained by double clicking on the View and activating the menu item **View / Open View**.

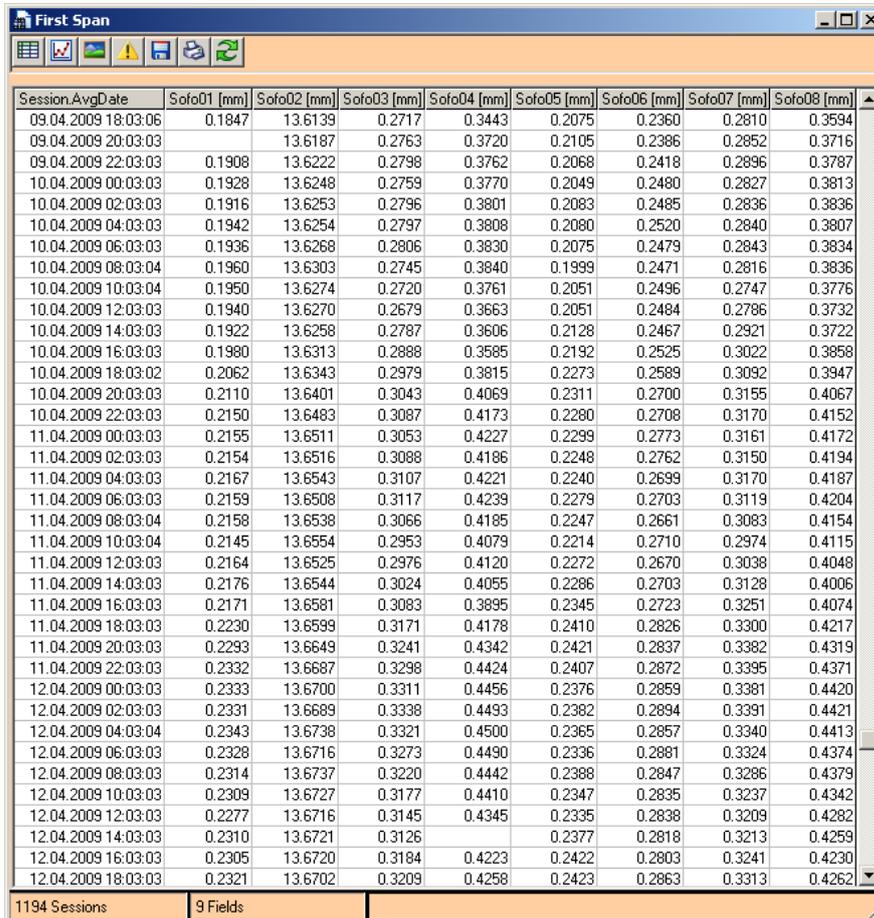
The graphical output is a window with the name of the View in the title bar (in this case "Fist Span") with the number of Sessions treated and the number of fields displayed given on the status bar (1194 Sessions and 9 fields in the example below).

Once the above window has been displayed it is possible to select a group of cells with a mouse pointer and then send them to the Clipboard using the menu function **Edit / Copy**. It is possible to select an entire column by simply clicking on the column header.

The graphical output shows a window containing the desired graph. The window includes the name of the View in the title bar (in this case "First Span") with the number of Sessions treated and the number of fields displayed given on the status bar (1194 Sessions and 9 fields in the example below).

On a graph view it is possible using the mouse to execute a zoom and a scroll. To zoom in on a graph, press the right mouse button at the top left hand corner of the area you wish to zoom in on and, maintaining the mouse button pressed, drag out the rectangle to the bottom right-hand corner of the zoom area. Release the

mouse button and the graph will redraw the area selected. To undo the zoom, press the left mouse button anywhere on the graph area and drag up and left with the mouse button depressed. Release the button and the graph will redraw to the originally defined graph area.



Session	AvgDate	Sofa01 [mm]	Sofa02 [mm]	Sofa03 [mm]	Sofa04 [mm]	Sofa05 [mm]	Sofa06 [mm]	Sofa07 [mm]	Sofa08 [mm]
09.04.2009	18:03:06	0.1847	13.6139	0.2717	0.3443	0.2075	0.2360	0.2810	0.3594
09.04.2009	20:03:03		13.6187	0.2763	0.3720	0.2105	0.2386	0.2852	0.3716
09.04.2009	22:03:03	0.1908	13.6222	0.2798	0.3762	0.2068	0.2418	0.2896	0.3787
10.04.2009	00:03:03	0.1928	13.6248	0.2759	0.3770	0.2049	0.2480	0.2827	0.3813
10.04.2009	02:03:03	0.1916	13.6253	0.2796	0.3801	0.2083	0.2485	0.2836	0.3836
10.04.2009	04:03:03	0.1942	13.6254	0.2797	0.3808	0.2080	0.2520	0.2840	0.3807
10.04.2009	06:03:03	0.1936	13.6268	0.2806	0.3830	0.2075	0.2479	0.2843	0.3834
10.04.2009	08:03:04	0.1960	13.6303	0.2745	0.3840	0.1999	0.2471	0.2816	0.3836
10.04.2009	10:03:04	0.1950	13.6274	0.2720	0.3761	0.2051	0.2496	0.2747	0.3776
10.04.2009	12:03:03	0.1940	13.6270	0.2679	0.3663	0.2051	0.2484	0.2786	0.3732
10.04.2009	14:03:03	0.1922	13.6258	0.2787	0.3606	0.2128	0.2467	0.2921	0.3722
10.04.2009	16:03:03	0.1980	13.6313	0.2888	0.3585	0.2192	0.2525	0.3022	0.3858
10.04.2009	18:03:02	0.2062	13.6343	0.2979	0.3815	0.2273	0.2589	0.3092	0.3947
10.04.2009	20:03:03	0.2110	13.6401	0.3043	0.4069	0.2311	0.2700	0.3155	0.4067
10.04.2009	22:03:03	0.2150	13.6483	0.3087	0.4173	0.2280	0.2708	0.3170	0.4152
11.04.2009	00:03:03	0.2155	13.6511	0.3053	0.4227	0.2299	0.2773	0.3161	0.4172
11.04.2009	02:03:03	0.2154	13.6516	0.3088	0.4186	0.2248	0.2762	0.3150	0.4194
11.04.2009	04:03:03	0.2167	13.6543	0.3107	0.4221	0.2240	0.2699	0.3170	0.4187
11.04.2009	06:03:03	0.2159	13.6508	0.3117	0.4239	0.2279	0.2703	0.3119	0.4204
11.04.2009	08:03:04	0.2158	13.6538	0.3066	0.4185	0.2247	0.2661	0.3083	0.4154
11.04.2009	10:03:04	0.2145	13.6554	0.2953	0.4079	0.2214	0.2710	0.2974	0.4115
11.04.2009	12:03:03	0.2164	13.6525	0.2976	0.4120	0.2272	0.2670	0.3038	0.4048
11.04.2009	14:03:03	0.2176	13.6544	0.3024	0.4055	0.2286	0.2703	0.3128	0.4006
11.04.2009	16:03:03	0.2171	13.6581	0.3083	0.3895	0.2345	0.2723	0.3251	0.4074
11.04.2009	18:03:03	0.2230	13.6599	0.3171	0.4178	0.2410	0.2826	0.3300	0.4217
11.04.2009	20:03:03	0.2293	13.6649	0.3241	0.4342	0.2421	0.2837	0.3382	0.4319
11.04.2009	22:03:03	0.2332	13.6687	0.3298	0.4424	0.2407	0.2872	0.3395	0.4371
12.04.2009	00:03:03	0.2333	13.6700	0.3311	0.4456	0.2376	0.2859	0.3381	0.4420
12.04.2009	02:03:03	0.2331	13.6689	0.3338	0.4493	0.2382	0.2894	0.3391	0.4421
12.04.2009	04:03:04	0.2343	13.6738	0.3321	0.4500	0.2365	0.2857	0.3340	0.4413
12.04.2009	06:03:03	0.2328	13.6716	0.3273	0.4490	0.2336	0.2881	0.3324	0.4374
12.04.2009	08:03:03	0.2314	13.6737	0.3220	0.4442	0.2388	0.2847	0.3286	0.4379
12.04.2009	10:03:03	0.2309	13.6727	0.3177	0.4410	0.2347	0.2835	0.3237	0.4342
12.04.2009	12:03:03	0.2277	13.6716	0.3145	0.4345	0.2335	0.2838	0.3209	0.4282
12.04.2009	14:03:03	0.2310	13.6721	0.3126		0.2377	0.2818	0.3213	0.4259
12.04.2009	16:03:03	0.2305	13.6720	0.3184	0.4223	0.2422	0.2803	0.3241	0.4230
12.04.2009	18:03:03	0.2321	13.6702	0.3209	0.4258	0.2423	0.2863	0.3313	0.4262

Fig. 2 - SDB Measurement Table

On a graph view it is possible using the mouse to execute a zoom and a scroll. To zoom in on a graph, press the right mouse button at the top left hand corner of the area you wish to zoom in on and, maintaining the mouse button pressed, drag out the rectangle to the bottom right-hand corner of the zoom area. Release the mouse button and the graph will redraw the area selected. To undo the zoom, press the left mouse button anywhere on the graph area and drag up and left with the mouse button depressed. Release the button and the graph will redraw to the originally defined graph area.

To scroll a graph across, press the left mouse button and, maintaining the mouse button pressed, drag the mouse in the direction you wish to scroll the graph. When you release the mouse button the graph will remain at the new location. To undo the scroll, press the left mouse button anywhere on the graph area and drag up and left with the mouse button depressed. Release the button and the graph will redraw to the originally defined graph area.

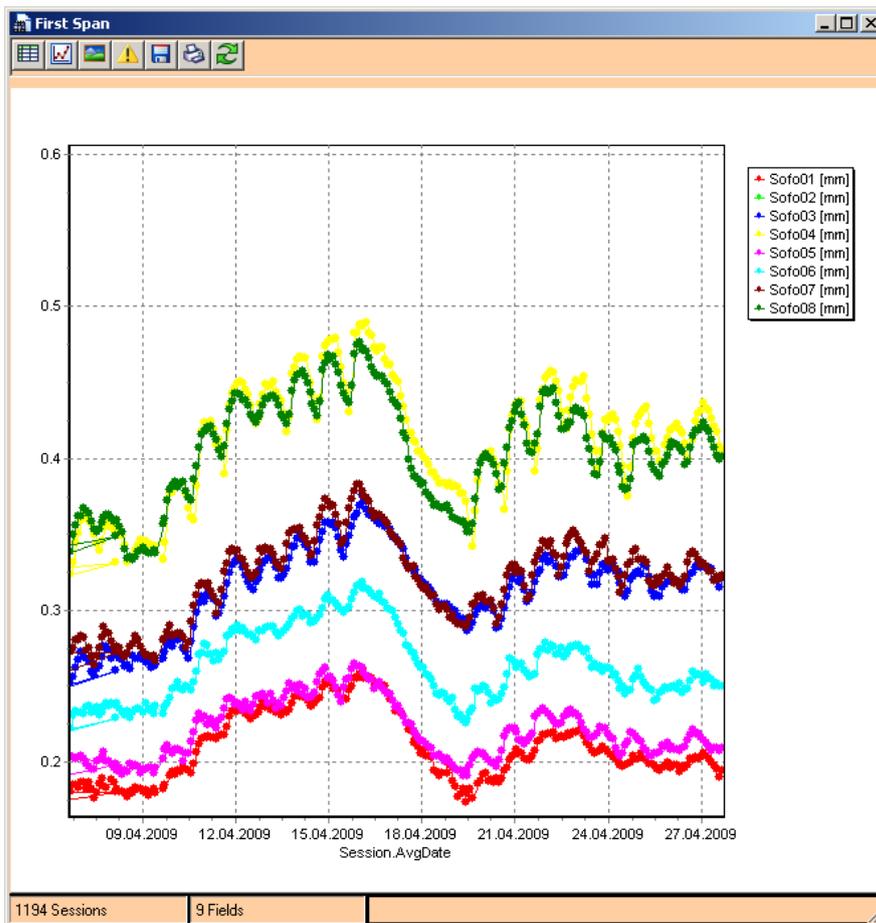


Fig. 3 - SDB Measurement Graph

Show Warning Status on Table

In this example are visible some colored cells. These are the cells that are outside the thresholds. This output is generated because the option "Show Warning on Table" has been selected.

The graphical output is the same window as the "Show Table" one but with exceeding data displayed in the relevant color. Data reaching the pre-warning level is displayed in yellow. Data reaching the warning level is displayed in red.

Note that it is also possible to select and copy groups of cells from the resultant table but the Warning indicators will not be copied to the Clipboard.

A red or yellow colored cell doesn't mean that a Warning or Pre-Warning is generated. This only means that the Measurement exceeds the defined warning threshold for this Sensor.

Session.AvgDate	A_Int_B	A_Int_T	A_Out_B	A_Out_T	B_Int_B	B_Int_T	B_Out_B	B_Out_T
19.01.2005 20:03:30	-0.0434	-0.0845	-0.0387	-0.0716	-0.0980	-0.0792	-0.0999	-0.0864
19.01.2005 21:03:30	-0.0437	-0.0877	-0.0379	-0.0755	-0.1008	-0.0794	-0.1011	-0.0903
19.01.2005 22:03:30	-0.0451	-0.0885	-0.0402	-0.0768	-0.1041	-0.0832	-0.1043	-0.0933
19.01.2005 23:03:30	-0.0472	-0.0913	-0.0443	-0.0778	-0.1062	-0.0841	-0.1074	-0.0951
20.01.2005 00:03:30	-0.0481	-0.0940	-0.0466	-0.0809	-0.1090	-0.0871	-0.1084	-0.0964
20.01.2005 01:03:30	-0.0498	-0.0955	-0.0469	-0.0837	-0.1127	-0.0916	-0.1153	-0.1018
20.01.2005 02:03:30	-0.0507	-0.0976	-0.0492	-0.0856	-0.1142	-0.0931	-0.1158	-0.1050
20.01.2005 03:03:30	-0.0522	-0.1000	-0.0505	-0.0881	-0.1156	-0.0960	-0.1179	-0.1074
20.01.2005 04:03:30	-0.0525	-0.1010	-0.0531	-0.0900	-0.1175	-0.0963	-0.1206	-0.1093
20.01.2005 05:03:30	-0.0534	-0.1030	-0.0538	-0.0925	-0.1215	-0.0972	-0.1219	-0.1118
20.01.2005 06:03:30	-0.0552	-0.1047	-0.0536	-0.0941	-0.1211	-0.0998	-0.1233	-0.1133
20.01.2005 07:03:29	-0.0564	-0.1072	-0.0556	-0.0942	-0.1224	-0.1012	-0.1265	-0.1169
20.01.2005 08:03:30	-0.0569	-0.1078	-0.0566	-0.0976	-0.1262	-0.1024	-0.1280	-0.1179
20.01.2005 09:03:30	-0.0574	-0.1099	-0.0584	-0.0977	-0.1252	-0.1022	-0.1281	-0.1189
20.01.2005 10:03:29	-0.0565	-0.1073	-0.0573	-0.0968	-0.1233	-0.1018	-0.1272	-0.1169
20.01.2005 11:03:30	-0.0538	-0.1032	-0.0517	-0.0907	-0.1193	-0.0966	-0.1222	-0.1099
20.01.2005 12:03:30	-0.0516	-0.0988	-0.0469	-0.0838	-0.1138	-0.0920	-0.1169	-0.1017
20.01.2005 13:03:30	-0.0470	-0.0938	-0.0421	-0.0797	-0.1078	-0.0852	-0.1113	-0.0933
20.01.2005 14:03:30	-0.0428	-0.0881	-0.0386	-0.0730	-0.1021	-0.0786	-0.1049	-0.0869
20.01.2005 15:03:30	-0.0401	-0.0826	-0.0336	-0.0679	-0.0972	-0.0742	-0.0971	-0.0806
20.01.2005 16:03:30	-0.0399	-0.0802	-0.0299	-0.0642	-0.0936	-0.0718	-0.0944	-0.0768
20.01.2005 17:03:30	-0.0383	-0.0806	-0.0320	-0.0668	-0.0949	-0.0733	-0.0967	-0.0794

1002 Sessions | 9 Fields

Fig. 4 - SDB Measurement Table with color status

Show Warning Status on Graph

To have the graphical output with the Pre-warning and Warning lines the option “**Show Warning on Graph**” has to be selected.

In this example colored lines are visible. The red one corresponds to the Field selected in the View and the others lines represent the Threshold levels.

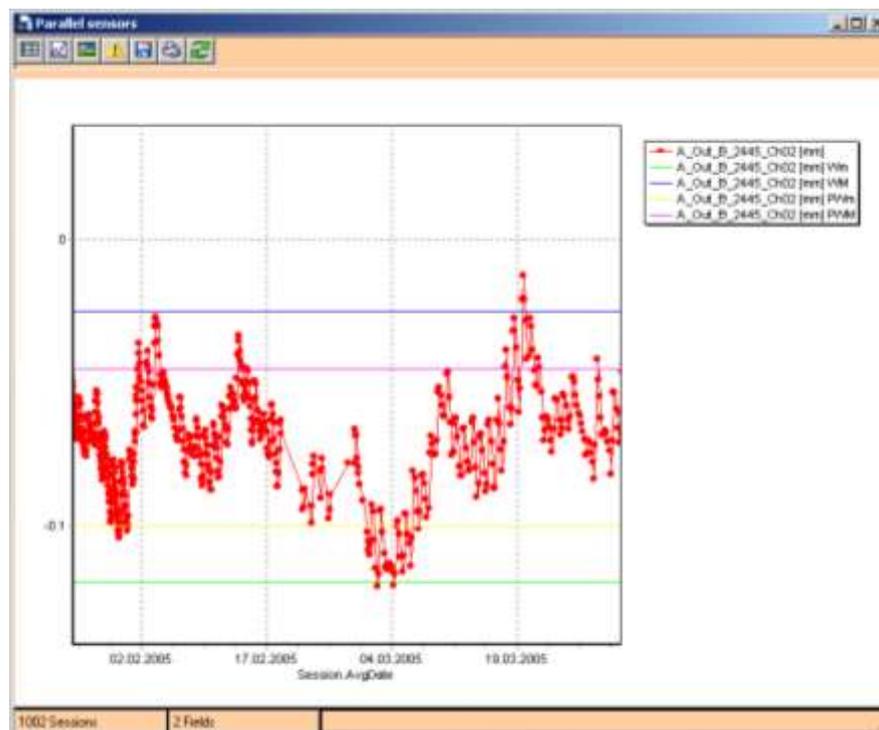


Fig. 5 - SDB with warning status on Graph

Four possible Thresholds are available:

WM: means **Warning Maximum**

Wm: means **Warning minimum**

PWM: means **Pre-Warning Maximum**

PWm: means **Pre-Warning minimum**

Please note that an outgoing curve doesn't mean that a Warning or Pre-Warning is generated. This only means that the Measurement exceeds the defined warning threshold for this Sensor. The condition to generate a Warning is to have n channels outside the range in the last m Sessions. So if one curve exceeds the thresholds this only means that a critical situation has happened for this Sensor.

How Map works

The first time the Map is loaded all Fields are placed in its center. To move them in more meaningful positions, for example at their real positions on the map, it is necessary to place the mouse over the textbox, press and hold the CTRL key, drag the textbox to the desired position and release the mouse button. The name of the field is indicated on every box.

Since all fields are initially superposed in the center of the screen, the second textbox will be visible only when the first is moved, and so on.

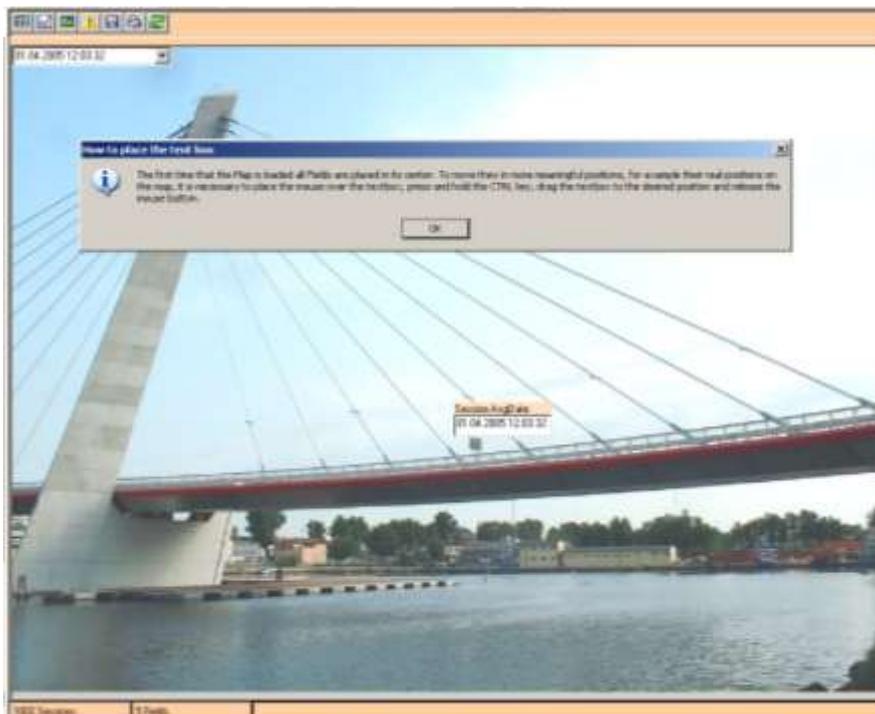


Fig. 6 - SDB with map

Please note that after a textbox has been moved, its new position is stored in the DB. This means that in the future, when the Map will be activated, the position of the box remains the same of its previous position before closing the View. When Map is resized, the position of all the Sensors will be scaled accordingly to the new dimensions.

In the example below it is possible to observe the values for all the selected fields, session by session with a combo box indicating the currently displayed Session. Each time the map is loaded the plotted values are

displayed for the last Session. It is possible to select another Session using the combo box at the top left corner.

To view whether a Sensor has exceeded the Warning or Pre-Warning thresholds or not two methods are available

- Select to view the results on the map and activate the option "show warning / pre-warning on map" on the definition view form.
- Click on the icon . If the Warning and Pre-Warning thresholds have been defined then the results will be exposed in white, yellow or red color accordingly to the level of Warning reached.

In this example is possible to observe which Sensors have exceeded the thresholds values.

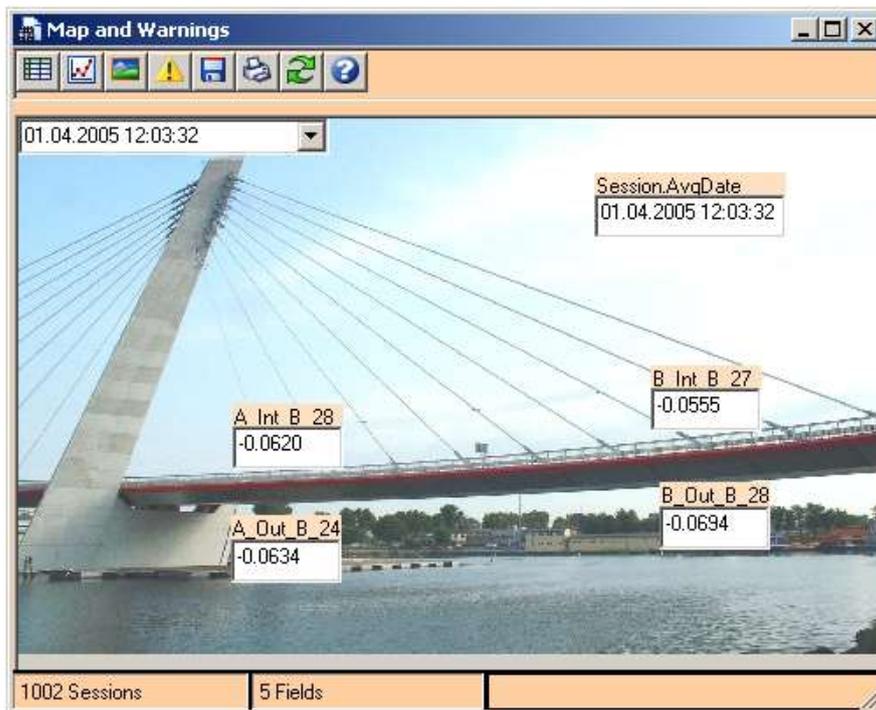


Fig. 7 - SDB with values

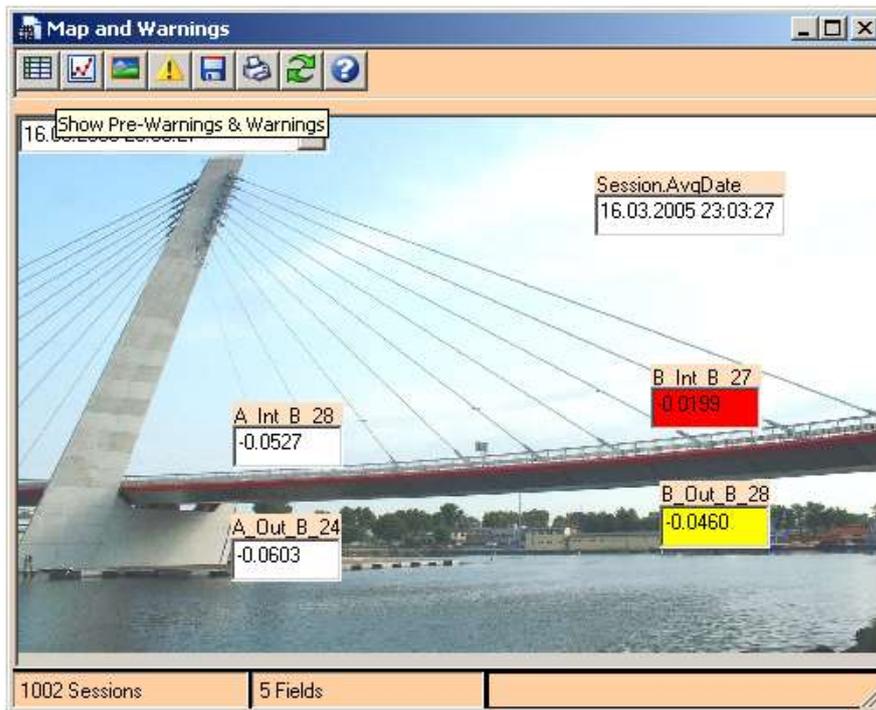


Fig. 8 - SDB display Pre-Warnings & Warnings

Warning check after every scan

In SDB View, It is possible to update all the views after every cycle of an Agenda. This is useful for many reasons:

- Store the result after every cycle (in a text file or a picture)
- View in real-time what is happening
- Check if there are new critical situations and run programs or send Emails

To perform all this operation it is necessary to set a flag of the Agenda properties form, on the pane Options as shown in the figure next page.

Leaving unchecked the option "Don't update the views after each run" the Agenda will execute an update of all the views after each agenda run. This means that every operation related to each view will be performed (save to file, alarm...).

Please note that the update will be done only for the views that are opened. The other views present on the right list but closed won't be updated.

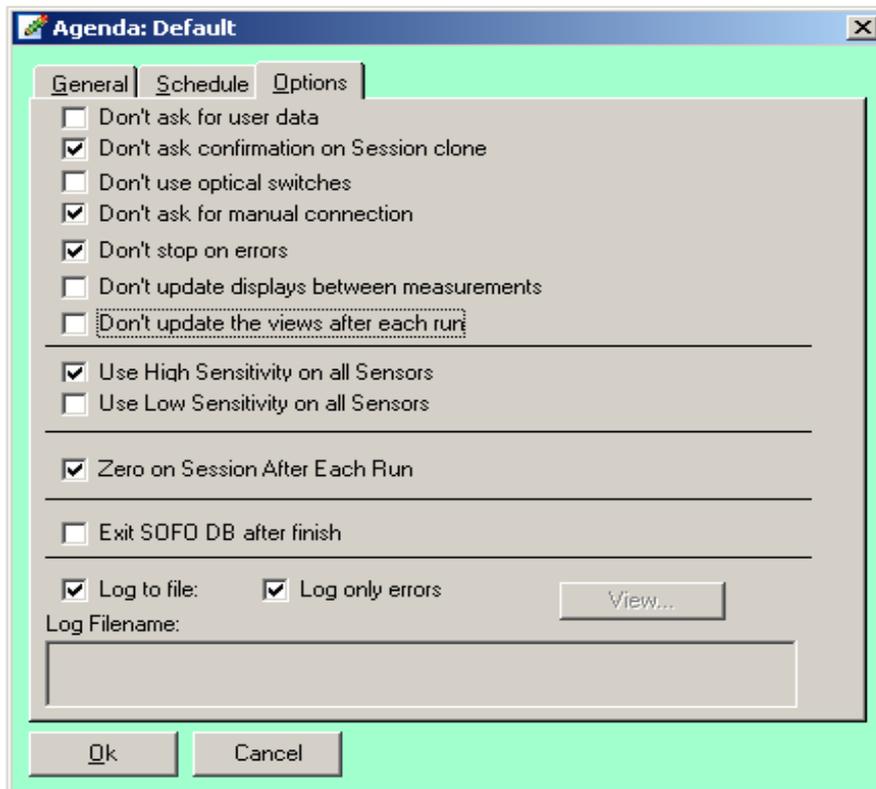


Fig. 9 - SDB agenda properties

Switching between Output formats

In every View there is a small navigation tool bar:



Using these icons, it is possible to switch between different types of views without modifying the View information stored in the SDB.

The icon  gives the possibility to generate a graphical output in table form. When this Icon is selected, the table will not show the Warnings and Pre-warnings but only the values.

The icon  gives the possibility to generate a graphical output in graph form if the fields to show are of the same type.

The icon  gives the possibility to view the result on the Map.

The icon  saves the content of the window in a file. If in the window contains a graph, then a window appears and allows the selection of the filename and of the format (jpeg, gif, bmp, wmf...). If the window contains a table, then you will be asked the filename and the format for the output numeric file (excel, txt,...).

The icon  redraws the active graph or table showing the Warning and Pre-warning thresholds. This means colored cells for tables and colored lines graphs.

The icon  gives the possibility to print the active window.

The icon  refreshes the information of the current view. This means that if new Measurements have been performed, these will appear in the view after the refresh.

Data export

The data shown in the **History table** can be exported to other programs like spreadsheets and text editors by selecting the History Table window (click on it) and then selecting **Edit / Copy** or pressing **Ctrl + C**. The table can then be pasted in another program (e.g. Excel).

The data shown in the **Session Overview table** can be exported to other programs like spreadsheets and text editors by selecting the Session Overview Table window (click on it) and then selecting **Edit / Copy** or pressing **Ctrl + C**. The table can then be pasted in another program (e.g. Excel).

COMPLEX MATHEMATICAL FUNCTIONS

The SDB software is based on the Macro-Sensor concept. The Macro Sensor is a user-defined Sensor calculated as a function of other Sensors.

Create sensors based on complex mathematical functions

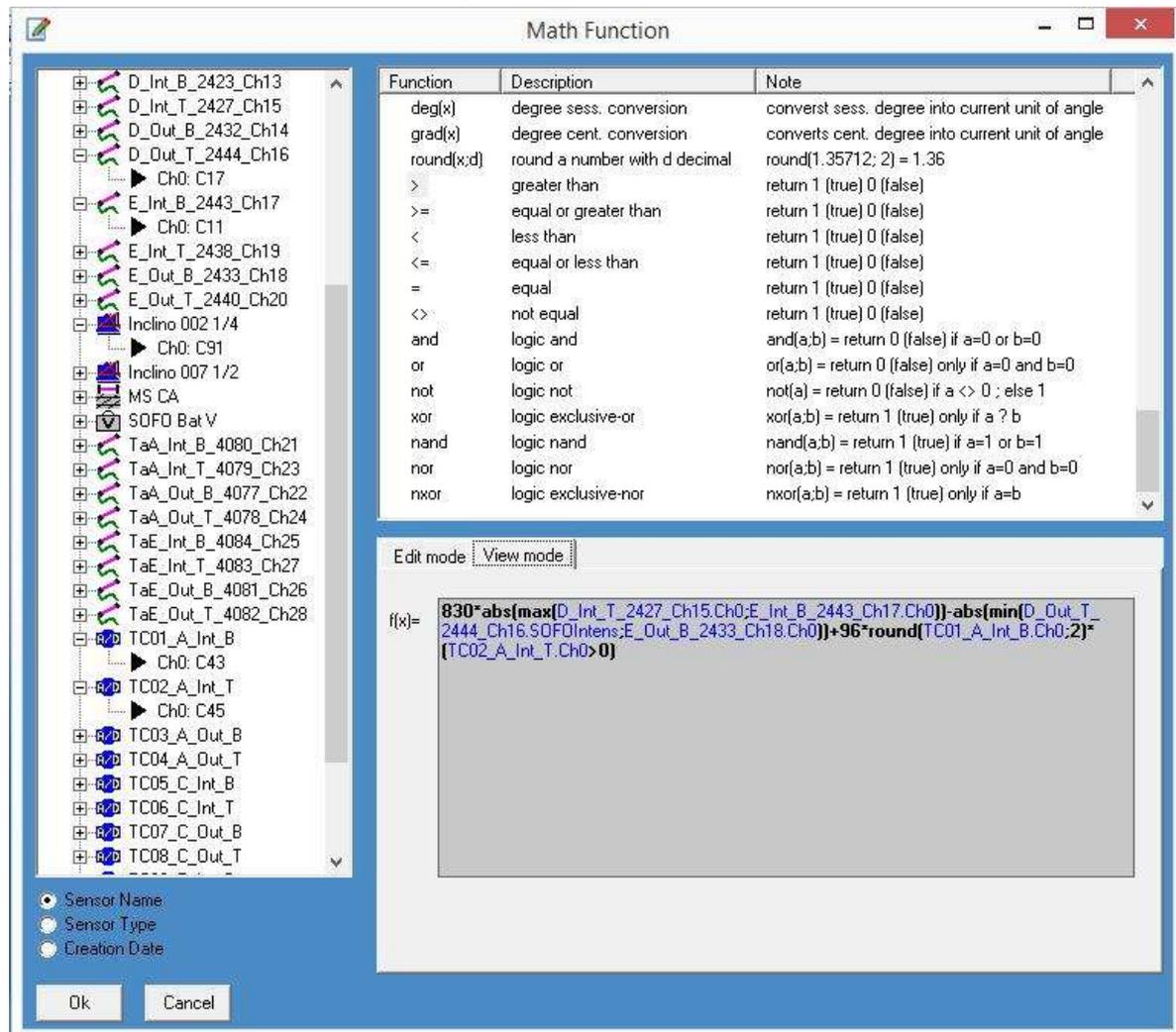


Fig. 10 - SDB complex mathematical functions

FAQ - Macro Sensor Potential Problems

These critical situations can appear in the use of the Macro Sensors:

Some or all the Measurements are not available

If some Measurements are not available, the functions Sum and Product will not have a meaningful value and so the Macro-Measurement will not be stored in the DB. For the other function: Min, Max and Average there will be a valid and significant value if there is at least one available Measurement. This means that if there is at least one Measurement the value will be calculated using the available Sensors.

What happens when a new Macro Sensor is created

When a new Macro Sensor is created a routine starts to calculate its value from the first Session to the last, using the F(s) function. Only valid values are stored in the DB.

What happens when a Macro Sensor component has to be deleted

As long as a Sensor is used as component of a Macro-Sensor, it is not possible to delete it. To remove it, it is necessary to first to remove all the Macro-Sensors that use it as a component.

When and how are Macro Sensor values updated

The update may be done in two ways:

- *Manually*: the update phase of the stored values is executed on operator request and in a specific Session range. The update will be done for all the Sessions that fall in the specified range chosen with an opportune form.
- *Agenda*: the Macro-Sensor is added to an Agenda. It has to be put in the right order, that is, after its components have been measured. Otherwise it is possible that some components may not be present for the F(s) calculation. It is usually a good idea to place the Macro-Sensors at the end of an Agenda.

In *Manually* and *Agenda* updates, it is important to underline that if there is more than one Measurement for each components in the Session, the more recent Measurement is used for the calculation.

How are circular references handled

Sometimes, when a Macro Sensor has been modified, circular references between its components can arise. These cycles could generate infinite loops at calculation time.

One example may be the following:

$$Fs_1 = S_1 + S_2$$

$$Fs_2 = Fs_1 + S_2$$

$$Fs_3 = Fs_2 + S_1$$

In this example there are three Macro Sensors. The first consists of two standard Sensors and the other two are consist of a Macro Sensor and a standard Sensor. If now first F(s) is modified:

$$Fs_1(s) = S_1 + S_2 + Fs_3$$

What it is obtained is a circular reference. To avoid the presence of these cycles, a check is executed automatically after each change.

What to do when the calibration of a Macro Sensor component has been changed

When the calibration of a Sensor is modified all the Macro Sensors that have this Sensor as component should be updated,. This should be done by the user using the updating menu.