Help File

for software

Alemma

Author: Helmut Sonderegger

Software ALEMMA.exe calculates many different types of analemmatic sundials.
It is freeware and can be downloaded for free from the author's website
www.helson.at

Software Alemma.exe

Content

Help File for Software
"Alemma.exe" (Version 2.6)

Content of Help File

Hint: Texts with yellow background are LINKs which are activated by left mouse click !

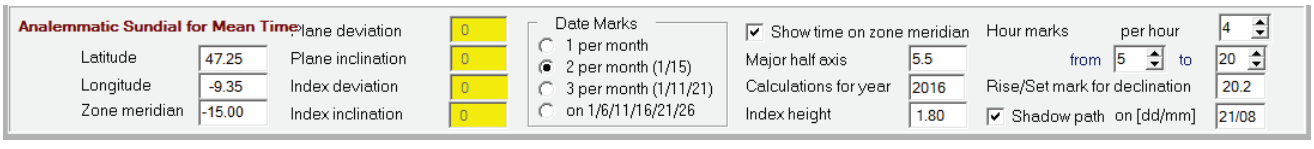
1. Types of Calculated Analemmatic Sundials

Since version 2.0 of Software 'ALEMMA' the following types of analemmatic sundials are calculated:

1) **Horizontal dials** with vertical index (most popular, 'classical' type)
2) **Horizontal dials** with inclining (-> z) and/or deviating (-> D) index
3) **Dials with inclining and/or deviating dial-plane** with vertical index
4) **Vertical dials**, South oriented with index rectangular to dial plane (= horizontal)
5) **Vertical dials**, from South deviating dial (-> Az), index rectangular to dial plane
6) **Analemmatic Sundials for mean time,** dial plane horizontal, index vertical

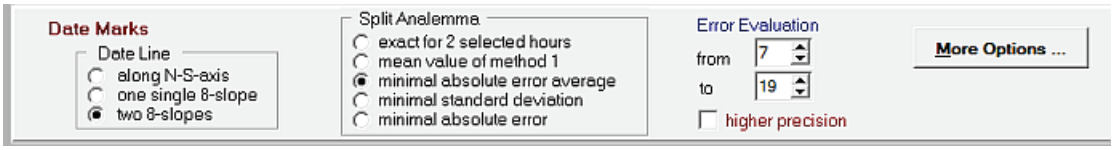
The selection of sundial types is done in Menu **"Type of Sundial"**

Input for all sundials is done in the panel at the bottom (= panel 1) of the window.



More information about parameters and their definition are given in the glossary or can be found by index search in this help file:

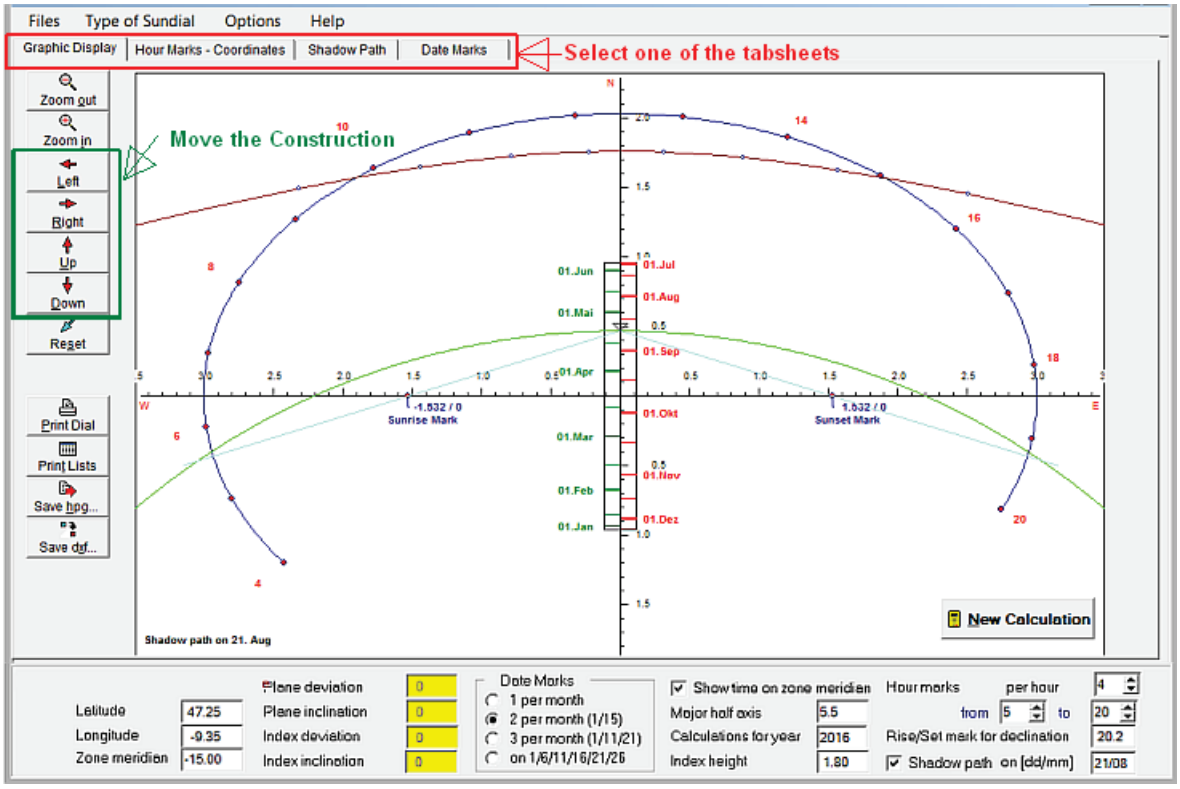
Additionally, if sundials of type 6 are selected, the button *<More Options …>* is displayed on the right half of the panel (see panel 2 below). It allows change to the other-panel (=panel 2) where additional input for mean time sundials must be be done. Also, in this case a right mouse click changes the display from one panel to to the other.



1.1 General Annotations

This software shows all results in graphic display and in tables. All results can be printed on any printer installed in Windows.

The image below shows the start screen, if a "common" analemmatic sundial (horizontal plane, vertical index) is selected.
Start screen, at the bottom panel 1 for data input.



A click into the titles of the **different tabsheets** (on the top of the window, just below the main menu), **changes the tabsheet**. The tables in the tabsheets can be printed and also saved in Excel format *.cvs

The buttons on the left (green rectangle) **move the construction**. Additionally, one can **Pull and Drop** the construction with left mouse key.

Input of sundial parameters is done in the panel at the bottom (= Panel 1). Depending on the selected dial type some input areas show a yellow background. These areas enclose the characteristic values for the selected dial and cannot be changed.

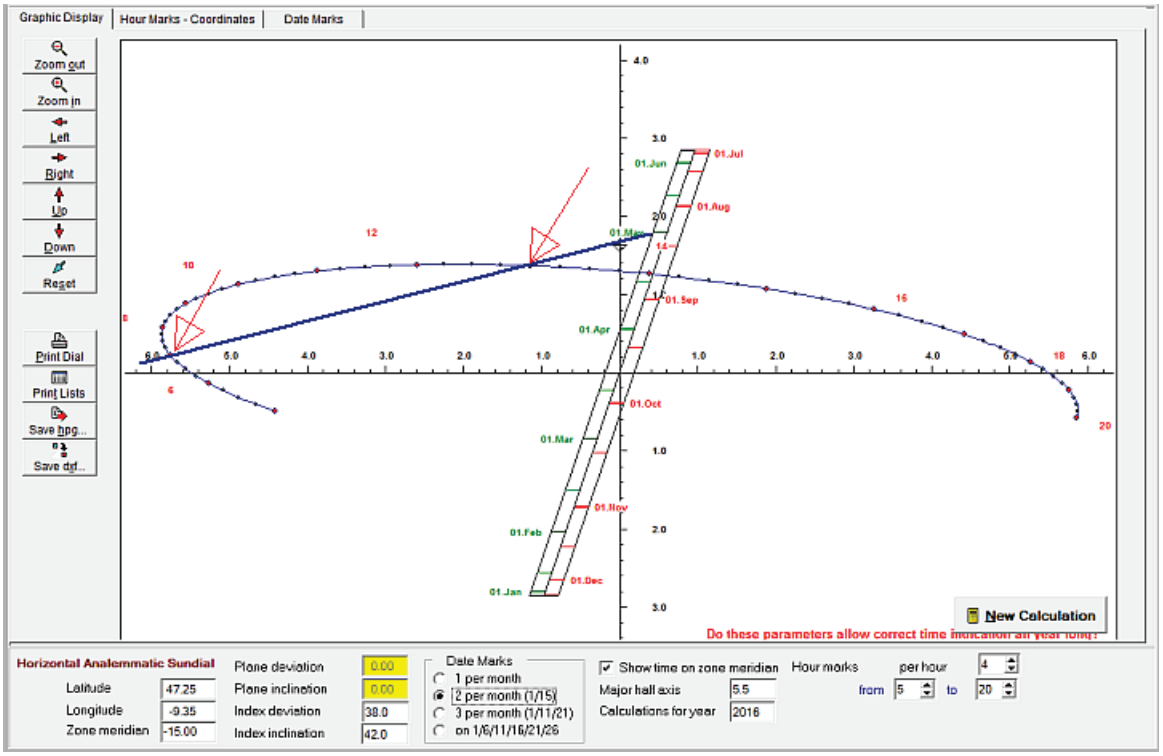
More hints and definitions of parameters are given in the glossary or can be found by index search in this help file:

Key code <Ctrl>+<d> changes the language of the program and the help file to German, <Ctrl>+<e> changes to English.

1.2 Reading the Time and Possible Problems

Analemmatic sundials show always hour points along an ellipse and a straight date line.If a person or a (liniear) index stands on the actual date of the date line then its shadow points to the actual time.

The example below demonstrates, that reading of time can become problematic or even impossible on some special analemmatic sundials.



Here the shadow (blue line) shows, that indicated time is not unique at the begin of May. Time could be eigther 7 a.m. or (about) 1 p.m. Reading of time becomes even impossible at calendar dates near May 13th or Aug. 20th. Then the shadow's direction is nearly tangential to the line of hour points.

2. Program Menu

Following the Menu of "Alemma.exe"

Menue **Files**
- ≥ **Printer Setup**
- ≥ **Print Graphic**
- ≥ **Print List Displayed**
- ≥ **Save Actual List**
- ≥ **Quit**

Menue **Type of Sun Dial**

Menue **Options**
- ≥ **Change Input Panel**
- ≥ **Save Parameters**
- ≥ **Save as Start Configuration**
- ≥ **Load Parameters**
- ≥ **Language**
  - **German**
  - **English**

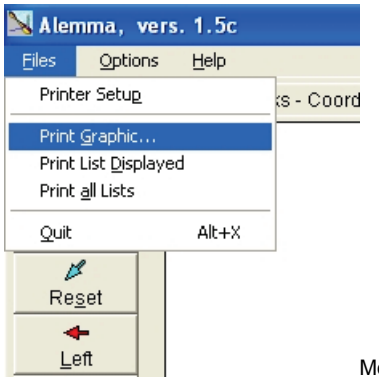
Menue **Help**
- ≥ **Help Information**
- ≥ **About**

2.1 Main Menu Files

Main Menu Files shows following submenus:

Submenu **Printer Setup:** You can select any printer which is installed in your Windows version.

Submenu **Print Graphic:** The construction of the analemmatic sundial is printed in Format DIN-A4. It is printed as it is displayed on screen.



Mouse click or successive keys **<Alt$_{left}$> , <F> , <RETURN> , <G>**

Submenu **Print List Displayed :** The table which is shown on screen is printed. If the dial construction (graphic) is displayed on screen but no tabsheet with tables, then nothing is printed in this menu, but an information message is displayed.

Submenu **Save Actual List:** This prints the actual list displayed in the visible tabsheet. This saved list with file format *.csv can be imported to Excel. As separation character within the saved csv-file you can select the comma or the semicolon.

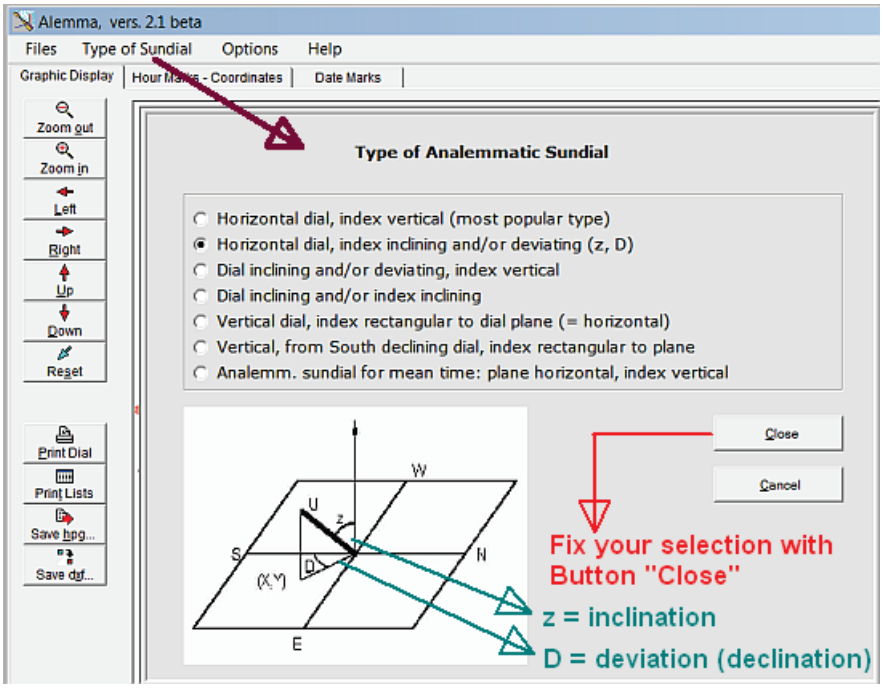
Submenu **Quit:** Closes the program.

The menus can be selected with mouseclick or key-sequence.

Main Menu: keypress **<Alt$_{left}$>** (left key) and afterwards key for underlined character followed by key **<RETURN>**

2.2 Main Menu Type of Sundial

Click on „Type of Sundial“ shows the following Subwindow. Here can select the analemmatic sundial type of your special interest



To confirm your selection, press the button "Close".This is ***necessary to initiate the parameters for the new selected dial:***

Subsequently the selected construction is displayed. Some notes about the opened window can be found in "General Annotations"

2.3 Main Menu Options

Main Menu Options has following submenus:

Submenu	**Change Input Panel:** The change from one input panel at the bottom of the window to the other one is executed. Clicking button **< More Options... >** in the input panel at the bottom of the window also changes the displayed panel. input in the second panel is only for analemmatic mean-time-sundials.
Submenu	**Save Parameters:** Saves the actual configuration. The program asks for the name of the file before saving, but extension *.ini” should not be changed. If your input is just the file name without a point at the end, then automatically this extension is added.
Submenu	**Save as Start Configuration:** The actual configuration is saved as file ”Alemma.ini”, which is in the same directory as ”Alemma.exe”. (Earlier program versions used ”start.adt”.) This file is loaded automatically at every program start. If ”Alemma.ini” is missing or if there are errors in it, then the program uses default values.
Submenu	**Load Parameters:** The configuration which has been saved in menu ”Options / Save Parameters” is loaded. The program asks for the name of the saved file and offers a search possibility for its name. Also in the newer versions of ALEMMA.EXE files with the older extension *.adt can be loaded.

2.4 Main Menu Help

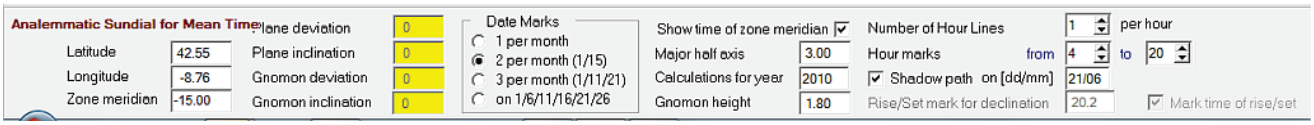
Main Menu Help with following submenus:

Submenu	**Help Information:** The installed help file is displayed. It uses the same language as the language in the program itself. Pressing key <F1> starts the help file too. Since version 1.5 help file has format - chm.
Submenu	**About:** Information about program version and download-address is displayed.
Submenu	**Language:** English and German are selectable. The selection is done in the displayed submenu. Key code **<Strg>+<d>** for German and **<Strg>+<e>** for English changes the language too.

3. Data Input for the Different Dial Types

Data Input is done in the two different panels at the bottom of the window. Panel 2 is only used in dials for mean time

In panel 1 (see image below) all input is done for all data which are needed for the construction of the analemmatic sundial.



Input for Southern **latitudes** must be negative, for Northern latitudes positiv.
Longitudes Western of Greenwich must be positiv, Eastern are negativ.
The declination for the **rise/set mark** is needed for the construction of the "Bailey points". They are useful to find approximately time and azimuth of sun rise or set.

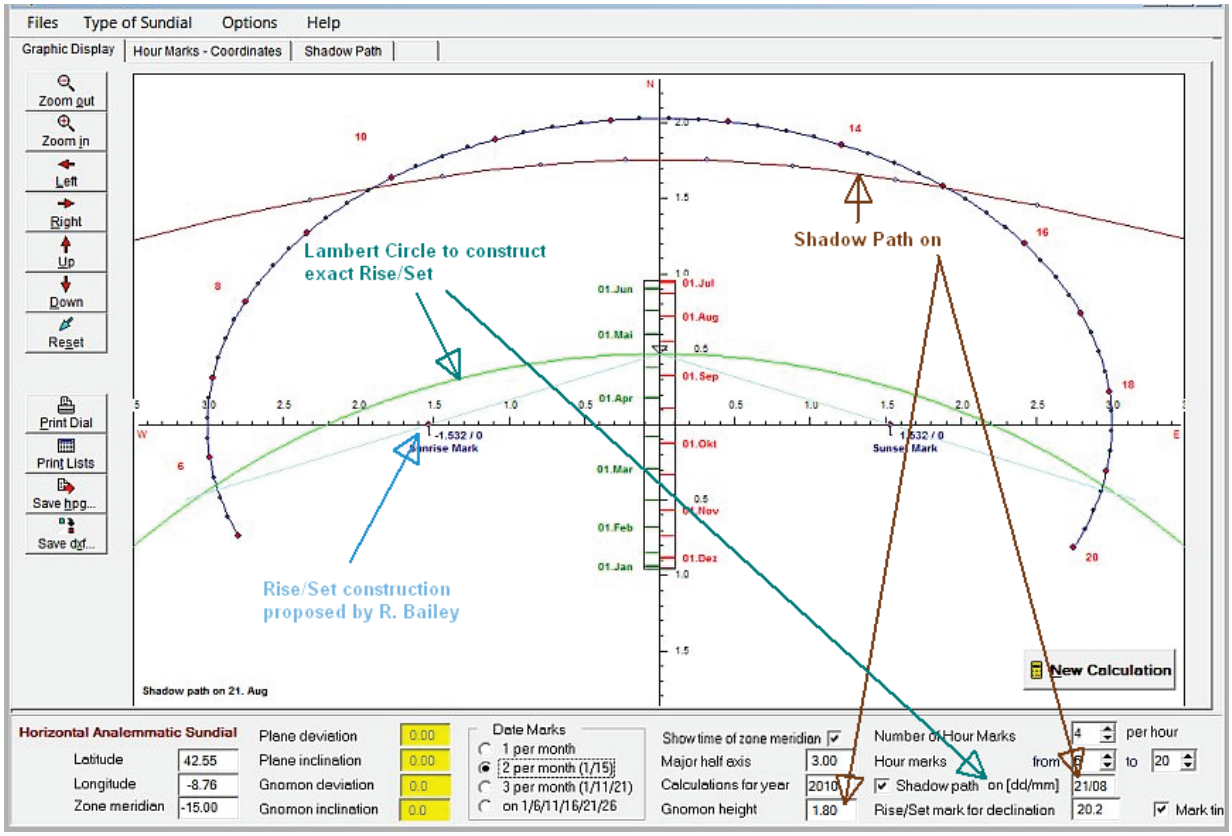
The "**Shadow path**" ca be switched on/off n the checkbox **"Shadow Path on ..."**.
A yellow background shows blocked input areas with fixed values which are substantial for the selected dial type and no change is allowed.

3.1 'Classical' Analemmatic Sundial

Analemmatic sundials consist of a vertical index which can be moved along a horizontal date scale on the minor North-South-axis.The marks of all hour points are situated on an ellipse. If a person or a index is positioned on the actual date point in the analemmatic sundial, then the shadow line points to actual time on the ellipse. The marks of the hour points can show local apparent time or the apparent time at the zone meridian.

We name an analemmatic sundial "classical" if its dial plane is horizontal and the movable vertical (human) index points to the zenith.

The Sun's shadow path is displayed by software ALEMMA only in such "classical" sundials with vertical index.

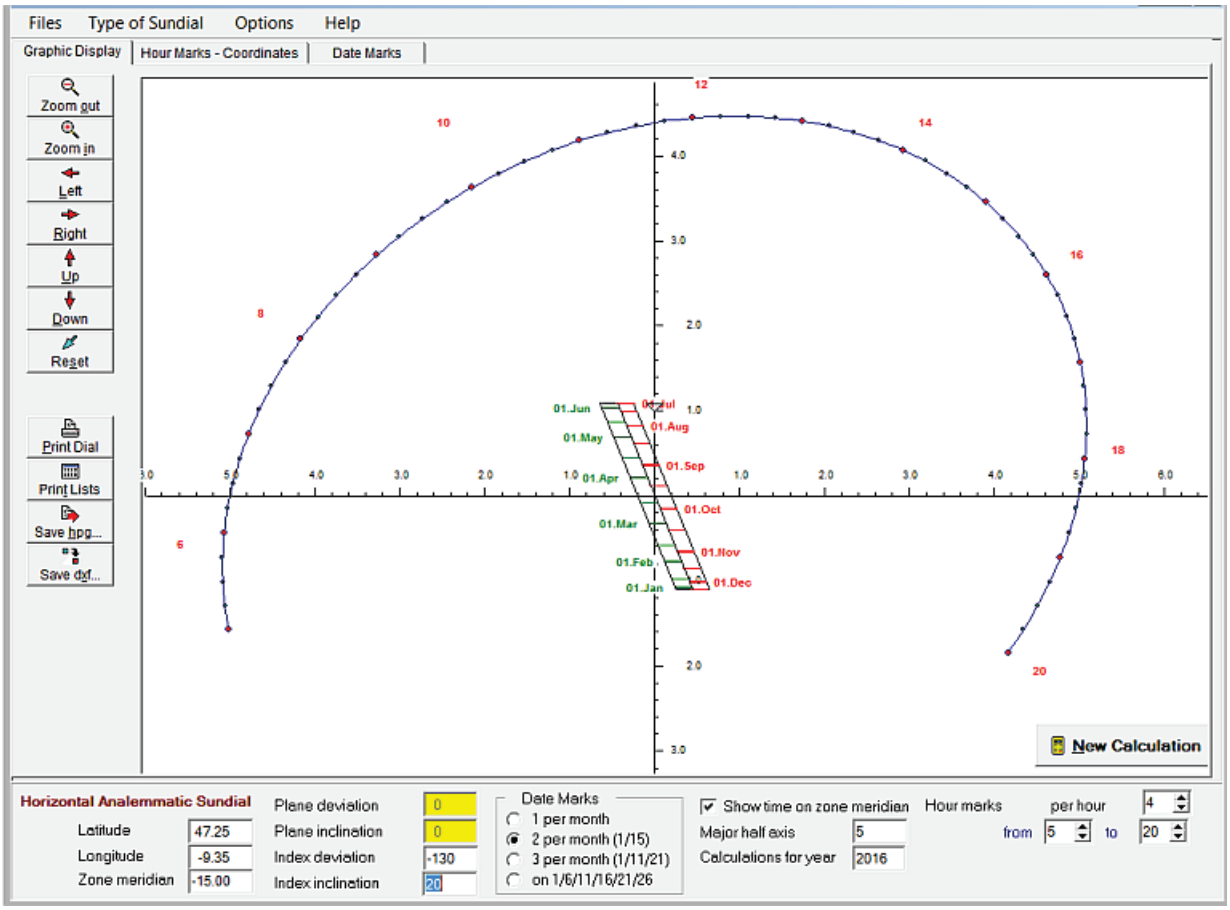


Software "ALEMMA" can show the exact construction for finding the times of Sun rise/set in classical analemmatic sundials. This construction has been suggested by Lambert: A circle with its centre on the N-S-axis running through the date point of the day and the focuses of the hour ellipse intersects the ellipse exactly at the time of Sun rise/set. But this is only valid for horizontal sundials with vertical index.

A very simple but splendid approximation has been suggested by Roger Bailey: He found that all straight lines from any date point on the N-S-axis to its Sun Rise/Set time intersect the horizontal main axis in nearly the same point. Iif one of these intersection points on the horizontal axis is selected as "Seasonal Marker" we easily can find time of Rise/Set with good approximation: A Graphic in Tabsheet 'Date marks' shows the differences between the exact construction and Bailey's really good approximation.

3.2 Horizontal Dials, Index Inclining or Deviating

This is an example of a horizontal analemmatic sundial with incliniing and deviating (=declining) index. Plane inclination and deviation must be 0 deg. (Yellow areas show the fixed values which are characteristic for this dial type.)



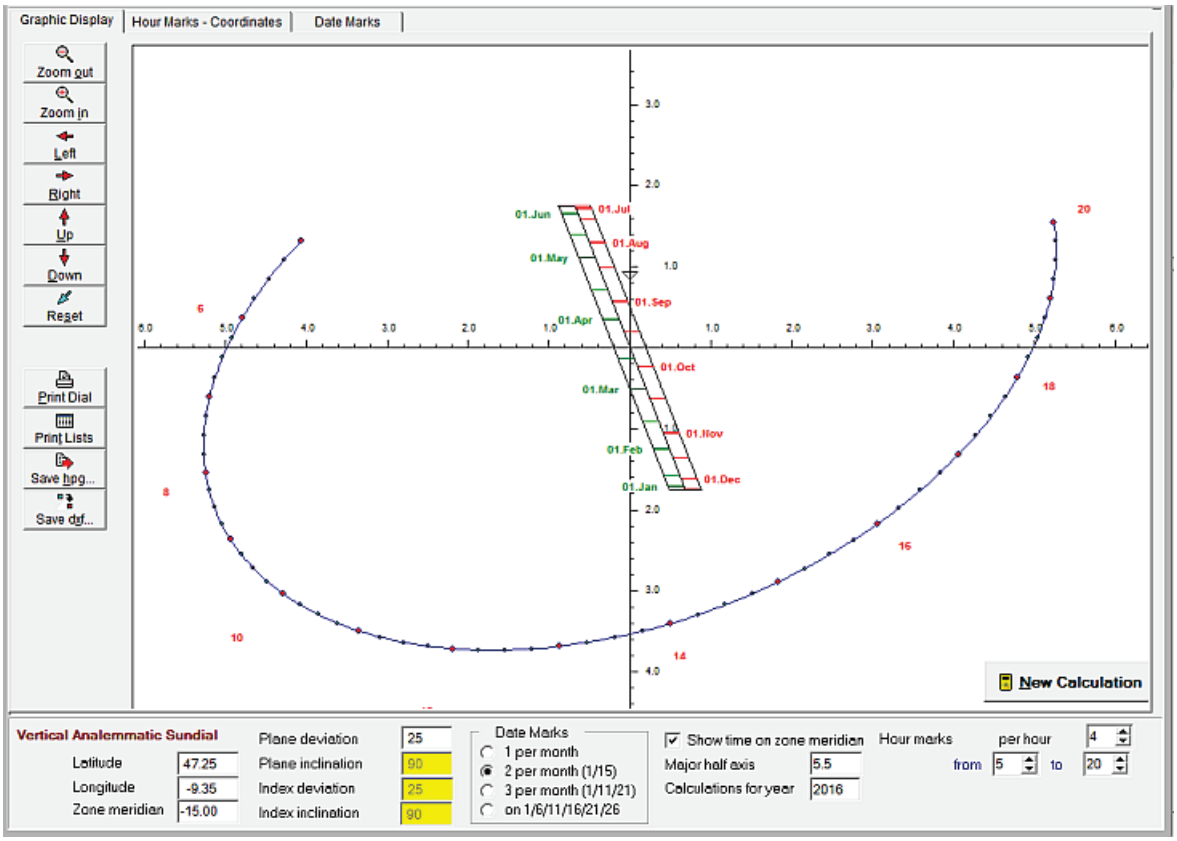
ALEMMA does not calculate the shadow-path of this sundial type and no help-construction for Sunrise/-set is offered.

3.3 Dial Plane Inclining and/or Deviating, Index Vertical

Calculations are done only if the index is vertical (see the deactivated yellow input areas in panel 1).

3.4 Vertical Analemmatic Sundials

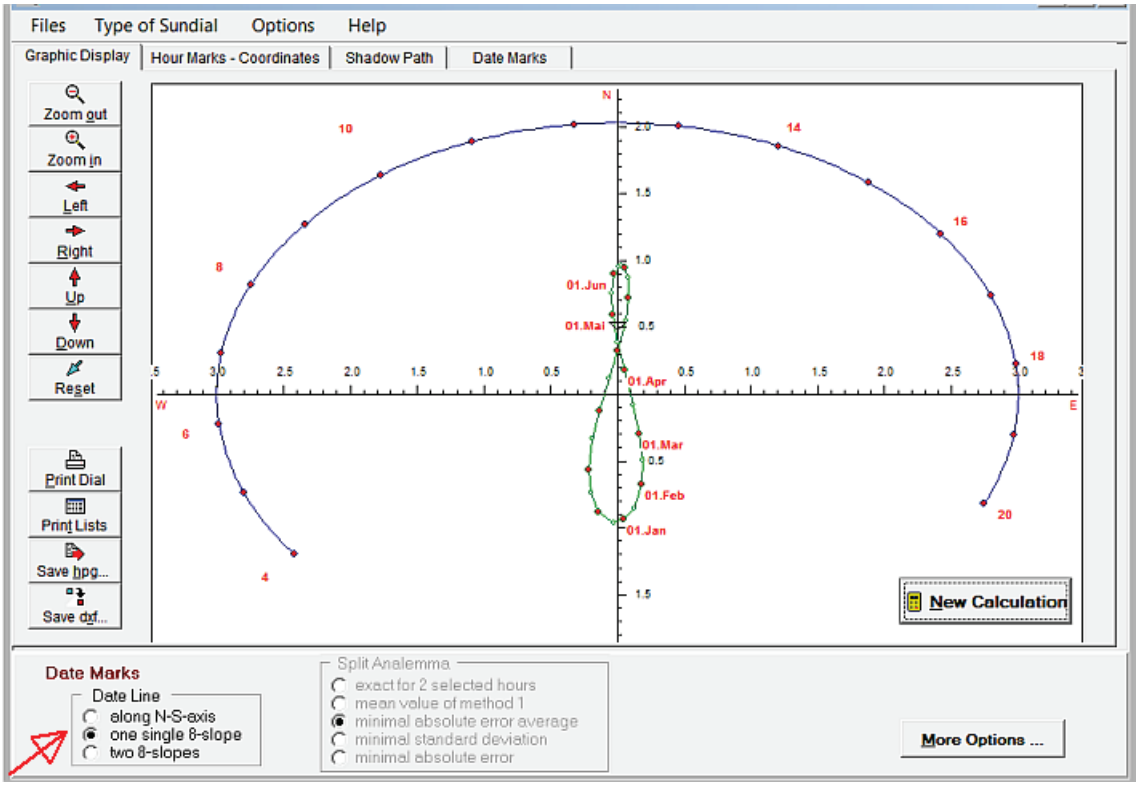
Calculations for vertical analemmatic dials are done only for an index which is ractangular to the dial plane. Also, sundials with deviating vertical dial planes can be calculated. In the screenshot below the dial deviates 25 deg to West



3.5 Analemmatic Sundials for Mean Time

3.5a Analemmatic Sundials with one 8-slope as date line

2 possibilities are offered to calculate a horizontal analemmatic sundial which indicates mean time. The index has to be vertical in both options. In this first case a type of dial is selected in Box **Date Marks "one single 8-slope"** as date line (see image below).



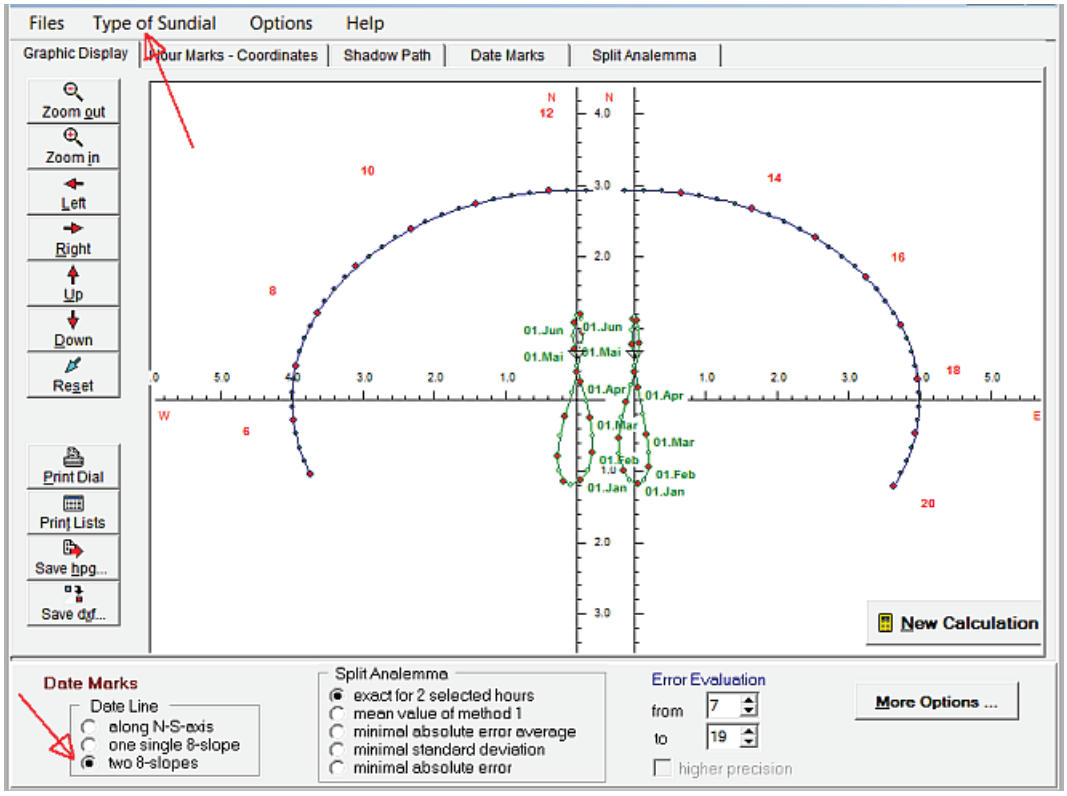
Such dials can register mean time exactly at noon. Then the 8-slope is a mirrored analemma with all different values of EoT all year long. (Here we define EoT = local apparent time – local mean time).

But this type of dial has a fundamental problem to indicate mean time reading all day long. Indication of mean time is only correct at noon. With increasing differences from noon the indication of mean time becomes more and more inaccurate. Actually, this error becomes bigger than EoT at times before 6 am or after 6 pm.

P.S.::If **'along the N-S-axis'** in box **Date Marks** is selected then the classical horizontal analemmatic sundial is displayed: More information on that "classical" dial type can be found at point 3.1.

3.5b Split Analemmatic Sundials

The selection of split analemmatic sundials (with two 8-slopes) is done in main menu "Type of Sundial" and afterwards in radio group **Date Marks - "two 8-slopes"**.



Button **'More Options ...'** changes to the other input panel 1

As the screenshot shows, split analemmatic sundials consist of to halves of the ellipse and two 8-slopes, one for the morning hours and one for afternoon. Two separated 8-slopes are drawn to avoid confusions and then of course, also two separated halves for the hour points are necessary. Calculations show, that standing on the date point of such an 8-slope allows to read mean time all day long with very good approximation, and this even for the whole year.

This software offers **5 different methods** to read mean time (or Standard time). The selection of the different methods is done in the second "radio group" named **"Split Analemma"**. For more details on these methods see chapter **"Split Dials - Additional Input"**. Additionally, a detailed discussion of different methods is given in an essay which is offered on the author's webpage **www.helson.at**.

***Only in mean time sundials**: If panel 2 is not visible but panel 1 then click button <More Options.> which is in German <weitere Eingaben....>*

Also, right mouse click on the panel displaye changes to the second panel (= panel 2).

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4. Tabsheets

4. The different Tabsheets

Tabsheet "Graphic Display"	Graphic Display, Second Part
Tabsheet "Hour Marks - Coordinates"	Tabsheet "Shadow Path"
Tabsheet "Date Marks"	Tabsheet "Split Analemma

4.1 Tabsheet "Graphic Display"

shows the construction of the sundial. Nearly all input parameters for the construction on an analemmatic sundial are done in panel 1 and panel 2. For time marks one can select 1, 2, 3, 4 or 6 points per hour in panel 1. Also input of index height and inclination, ... etc. can be done in this panel.

The brown colored line shows the shadow path for the day which is input in panel 1 in field "Shadow path on [dd/mm]" (image). In all dial types the shadow path of the analemmatic sundial with linear date line along the N-S-axis is displayed, i.e. for the index position on the minor axis (in N-S-direcion)

If **"mark time for rise/set"** is checked, then a circle through the date point and the Sun rise/set time is diplayed. In horizontal sundials with vertical index this circle is a so called Lambert circle which also runs through the ellipse focuses. Additionally Roger Bailey's linear approximation through the Sun rise/set Marks is displayed (see also glossary) .

Lambert circles only exist in horizontal analemmatic sundials with vertical index. Yet a circle for showing Sun rise/set is also drawn for dials with an inclining index. In split dials and in dials with inclined dial plane the circle and its linear approximation are not displayed on screen. Then checkbox "mark time for rise/set" is deactivated.

If input data are changed then, automatically the construction is redrawn.

Clicking the buttons on the ***toolbar left***

- zooms in / out
- changes to the original size ("Reset")
- shifts left
- shifts right
- shifts up
- shifts down
- prints graphic (in nearly the same way as displayed) on paper format DIN-A4

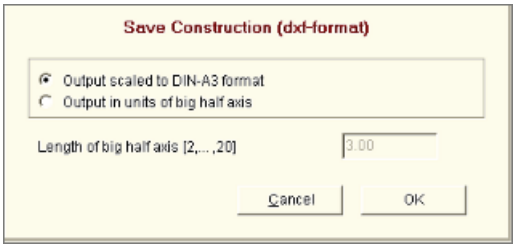
Instead of clicking the buttons one can hold down left **<Alt$_{links}$>** and press the key for the underlined Character in the text there.
To zoom out for instance keys **<Alt$_{left}$> + <O>**

It is also possible to drag and pull the whole construction in the usual way.

4.2 Tabsheet GrafikSave

Saving the construction is done by

- Clicking button ***< Save hpg…>*** saves the construction as hpgl-file. The size of the construction can be fixed in the window opened after clicking the button (displayed below).
- Clicking button ***< Save dxf …>*** saves the construction as dxf-file (for import to AutoCAd, DeltaCad,…). The size of the construction can be fixed in the window opened after clicking the button (displayed below).



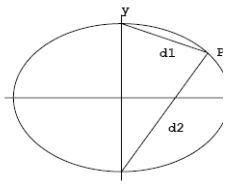
a)If **"Output scaled to DIN-A3 format"** is selected then the output of the construction on scren is scaled to correspond with DIN-A3-format. As the scaling factor of the construction is not displayed, it is a bit complicated to read the true measures in this output. But of course, in most software this output construction can be scaled by the user to the size wanted. The output is scaled but not distorted.

b)If **"Output in units of big half axis"** is selected then output enables you to read true measurement of all distances in the construction. Numeric values of the construction are now the same as the dial dimensions. In this case the Length of the big half axis must be input in the yellow marked field. Allowed values of input are 2.0 < half axis <= 20.0.

4.3 Tabsheet „Hour Marks – Coordinates"

shows the coordinates of the hour marks which are displayed in the construction. The number of time marks per hour can be fixed in panel1. Selection of 1, 2, 3, 4, or 6 time marks per hour is possible.

On top of this tabsheet you can select the type of date in the table (image below):



a) if **"x/y-coordinates of hour points"** is selected then the coordinates of all hour points ar displayed. Positive x-coordinates are direction east (right on screen), positive y-values are towards north (up on screen). The origin of the coordinates is the intersection of the two rectangular main axis.
b) If **"distance to end points of vertical ellipse axis"** is selected then d1 is the distance from the hour point to the end of the positive N-S-axis (i.e. point for 12:00 true local time) and d2 ist the distance from the hour point to the other end of the N-S-axis (i.e. point for 12:00 true local time mirrored on the coordinates origin).

Print displayed table

Menu < *Files / Print List Displayed* > prints the table together with all parameters of the sundial.

Save displayed table

Pressing button < *Save Table …* > or selecting menu < *Files / Save Actual List* > saves the table if it's visible on screen together with all parameters of the sundial in Excel format *.cvs. As separation character within this file format one can select the comma or the semicolon.

4.4 Tabsheet „Shadow Path"

shows the coordinates of the shadow path (at least 3 points per hour). ***The shadow path is always given for the index position marked on the date point. Shadow paths are calculated in horizontal dials with vertical index***

Print displayed table

Menu < *Files / Print List Displayed* > prints the displayed table together with all parameters of the analemmatic sundial.

Save displayed table

Pressing button < *Save Table …* > or selecting menu < *Files / Save Actual List* > saves the table if it's visible on screen together with all parameters of the sundial in Excel format *.cvs. As separation character within this file format one can select the comma or the semicolon.

4.5 Tabsheet „Date Marks"

shows the coordinates of the date points on the date line along the minor axis or on the 8-slope. In panel 2 the number of date points per month can be fixed (1, 2, 3, or 6 points per month are possible). Additionally the table shows the Sun's declination and the Equation of Time for the particular day.
If no split dial is selected, then this table also shows graphically the error size if R. Bailey's Sun rise/set marks are used.

4.6 Tabsheet „Split Analemmatic Sundials"

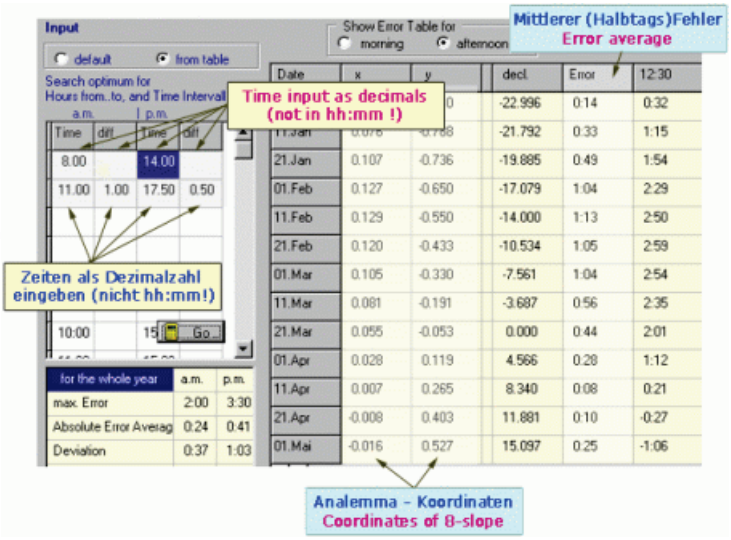
This tabsheet is important for special input if split analemmatic sundials are calculated.

To see the construction of a split dial click here

The upper left **white table** in this tabsheet is used to input the time points, needed for the special calculation method. The input varies with the 4 methods and is explained later. In the example above the two analemmas are calculated according method 2. The values in the white table are time points in hours.

All times must be input in hours and decimals of hours as hh.hhhh and not in hh:mm !

Results and error evaluation can be found in the **yellow tables** of this tabsheet:



- The table at the left bottom shows the maximal error of all time points from "begin" to noon, and from 12:30 to "end" for the whole year. "begin" and "end" are fixed in panel 2 The second line in this table shows the average of all absolute error values and the third line their standard deviation. All values here are calculated for the whole year, but the errors in the yellow tables on the right show the values for the different days.
- The table in the right part of the image shows the coordinates of the 8-slope for different dates, the Sun declination for these dates and the average of the absolute error-values at this day. In the following columns the errors in min:sec for mean time reading are listed for all hours fixed by the user and for all the different days of the year. The error calculation is only done, if the Sun is above the horizon. The hour points for error evaluation can be fixed by the user in one of the input panels at the bottom of the window ("Error evaluation from … to …"). The table which is shown here displays the data for afternoon. Switching to the table for the morning hours is done on the top of the tabsheet by mouseclick to 'morning'.

After the special input for split dials in the left top of this tabsheet you must start recalculation with key <Return> or by clicking button < Go.. > to recalculate the construction.

The structure of the yellow tables is the same in all 4 methods!

Print displayed table

Menu *< Files / Print List Displayed >* prints the displayed table together with all parameters of the analemmatic sundial.

5. Split Dials - Additional Input

The program offers 5 different input methods for split analemmatic sundials:

General Remarks

Four different methods for calculating split sundials are depicted in the general introduction mentioned in the beginning of the help file. The same 4 methods are offered in this program. An additional fifth method is offered since version 1.2. The **necessary input** for the different types is done in tabsheet "Split Analemma". It varies for each of the 5 different methods. If **"Input default"** is marked or if no input is done, then the program uses default values.

If you do not want to use your own values, you should mark **"Input from table"** on the top of the tabsheet and to input your own values in the white table afterwards. In this white input table the change from one cell to another is done either by using the cursor keys or key *<TAB>* or by mouse click to another cell. The new calculation is started after the last cell input by clicking button *< Go >* or key *<Return>* . Also, the same ist done by mouse click on the button *<new Calculation>* in one of the panels at the bottom of the window same.

For an image of tabsheet "**Split Analemma**" with included short descriptions click here and here an image of the construction.

In **method 3 to 5** the program searches in refined grids for those points on the 8-slope, which come nearest to the optimized condition of the selected method. The grid search is refined down to a distance of 1/6000 of the major ellipse axis. If for instance the major semi axis is 3 m = 3000 mm (and its diameter 6 m), then the coordinates of the points on the 8slope are exact to within 3000mm/6000 = 0,5 mm. If checkbox **"higher precision"** in panel 2 is marked then the points on the 8-slope are exact to within 1/35000 of the major semi axis.

Split dials are only shown, if the date line of the analemmatic sundial stays within the ellipse of hour points. If the base point of the index is very near the endpoint of the minor axis, time reading can become impossible or very faulty. The shadow lines become very short or the intersection of the shadow line and the hour points on the ellipse are very flat. If the date point is not within the hour point ellipse, then for some part of the day the shadow is going "backwards".

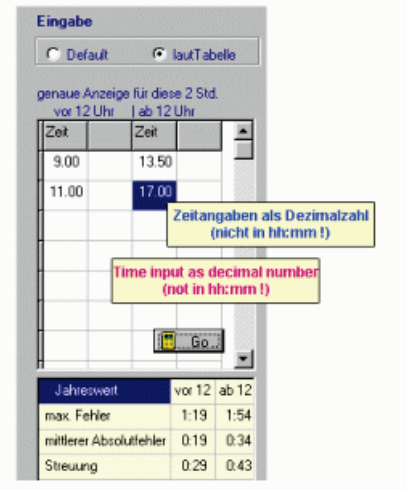
5.1 Method "exact for 2 selected hours"

With this method split analemmatic sundials are calculated, which register exact mean time for 2 time points in the morning and or 2 time points in the afternoon.

The special Input is done in the white table of tabsheet "split Analemma". In panel 2 at the bottom of the window "**Date Line** – *two 8-slopes*" and in the right rectangle "**Split Analemma** – exact for 2 selected hours" must be selected.

The input for this method is done in tabsheet "Split Analemma" if dial type **"two 8-slopes"** was selected in panel 2.

To see the panel 1 for all general input parameters click here
The necessary special input is done in the left part of this tabsheet which is shown below.



The first two lines in column 1 must contain two hour points for morning and the first two lines in column 3 two hour points for afternoon. If "Default" is selected (in the rectangle above the table) , then the program selects default values.

After table input the calculation is started by clicking to button *< Go >* or by finishing input in the white table with key *<Return>*.
A mouse click to button *<new Calculation>* in one of the panels at the bottom of the window also starts the new calculation.

The program only uses your personal input, if input is error free and if "Input from table" is marked.

In this image above a dial is calculated, which registers exact Standard time for 9:00 and 11:00 in the morning and for 13:50 and 17:00 in the afternoon.

5.2 Method 2 for "mean value for selected hours"

This is done in the white table of tabsheet "split Analemma". In panel 2 at the bottom of the window "**Date Line** – two 8-slopes" and in the right rectangle "**Split Analemma** – mean value of method 1" must be selected.

This calculation method builds a weighted average of analemma points of method 1: The white input table of the tabsheet must contain more than two time points for morning and for afternoon.

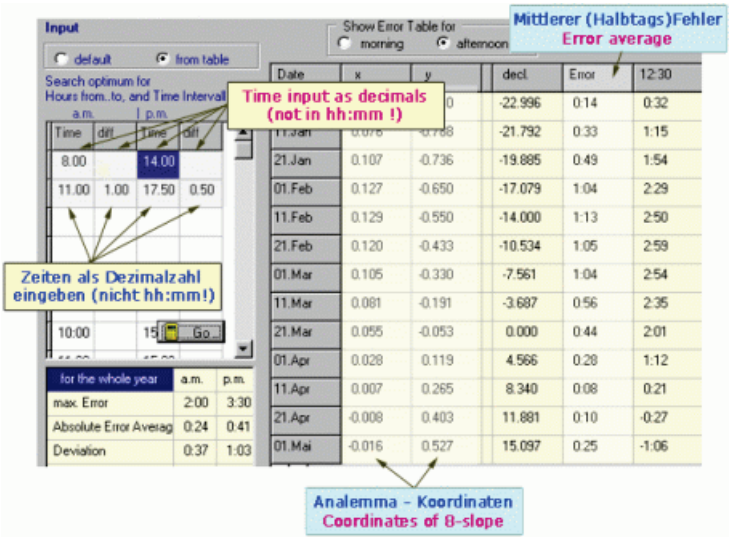
*Here an **example for input:***

For noon the program expects input of start time and end time in the first two lines of column 1 and in column 2 the time difference between the consecutive times. In column 3 and 4 the analogous input must be done for afternoon.This input selects the times 8:00, 9:00, 10:00, 11:00 for the calculations as times in the morning and the times 14:00, 14:30, 15:00, …, 17:00, 17;30 in the afternoon. Of course it would be possible to select the hour points in a different way. But another input possibility for method 2 is not installed in this program version.

(***Input of hours must be in decimals and not hh:mm***, for instance: correct input fort he time 15 minutes to 6 p.m. is not 17:45 but 17.75)

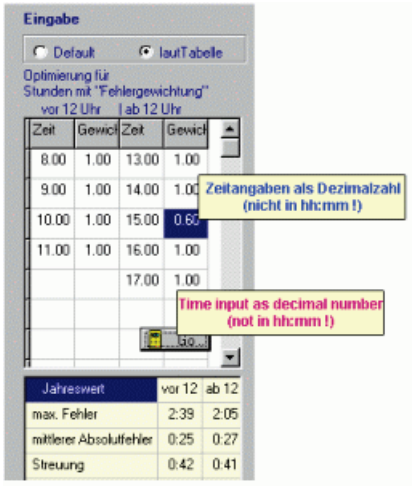
The program only uses your personal input, if input is error free and if "Input from table" is marked.

Line 3 and 4 are always empty and in the following lines all times are shown which are used in the error calculation.



5.3 Methode 3 and 4

5.3 Special Input for Method 3 ("minimal average of absolute error")



Input is done in the white table of tabsheet "split Analemma". In panel 2 at the bottom of the window "**Date Line** – two 8-slopes" and in the right rectangle "**Split Analemma** – minimal absolute error average" must be selected.

The program only uses your personal input, if input is error free and if "Input from table" is marked.

Times before Sun rise and after Sun set are excluded in all error calculations.

If this method is selected then the program searches for each selected day the 8-slope-point with the smallest weighted average of all absolute errors for the times, which are input in column 1 and column 3 of the white table on the left. In column 2 and 4 ("weight") the error can be weighted. If a cell of column 2 or 4 is empty, then default weight = 1.0 is used. The number of input times is up to the user. All times of column 1 and 3 are used as far as to the first empty row in column 1 or 3.

5.4 Special Input for Method 4 ("minimal standard deviation")

uses the same way of input. But here the grid search is done for points with minimal standard deviation of the absolute errors for all time points input in this table. The search is done for the whole year (actually for all dates which are marked on the 8-slope) (To see the special input window click here.)

5.5 Method 5 (Input for "minimal absolute error")

This is done in the white table of tabsheet "split Analemma". In panel 2 at the bottom of the window "**Date Line** – two 8-slopes" and in the right rectangle "**Split Analemma** – *minimal absolute error*" must be selected.

If this method is selected then the program searches for each selected day the 8-slope-point with the smallest absolute time reading error for the times, which are input in column 1 and column 3 of the white table on the left. The number of input times is up to the user. (To see the input window click here.)

- All times of column 1 from the first row as far as to the first empty row are times for the morning.
- All times of column 3 from the first row as far as to the first empty row are times for the afternoon.

Times before Sun rise and after Sun set are excluded in all error calculations.

The program only uses your personal input, if input is error free and if "Input from table" is marked.

6. Configuration File

The configuration file (INI-file) contains all parameters used in the program (e.g. latitude, index height, index inclination, size and type of dial, ...).

- Menu **"Options / Load Configuration"** loads an earlier saved configuration.
- Menu **"Options / Save Configuration"** saves the actual parameters.
- Menu **"Options / Save as Start Configuration"** saves the parameters to "Alemma.ini". An already existing file with this name will be overwritten automatically.

Automatically, at the program launch "Alemma.ini" is loaded. If this file is not found or if it is erroneus then the program selects its own default values.

7. Hardware & Distribution

7a. Hardware

'Alemma.exe' is running together with all Windows versions up from Win95/98,... . to Windows 10 and on 64-bit systems

Since version 1.5 help files are changed to chm-type. So they are fully compatible with all newer Windows systems..

For display on screen 1024 x 768 pixels and big font is recommended.

7b. Distribution of the Program

Software ALEMMA.EXE is freeware. Everybody is allowed to copy and use the program without paying any fee. Information to the author's email-address would be appreciated, especially in the case of professional use. Free download of the newest version of this software from address

- **http://www helson.at**

This software is portable and can be started from flash drive, ...The installation of the zipped file needs about 3 MB.

In case of using this program there are no warranties expressed or implied. Suggestions for improvements and hints at errors would be appreciated very much to my email-address below.

Author: Helmut Sonderegger, Sonnengasse 24, A-6800 Feldkirch, Austria
email: h.sonderegger@gmx.at
Homepage: http:// www.helson.at

The author wishes to thank Brian Albinson, Fer de Vries and Peter Kunath for their hints and suggestions to improve ALEMMA.EXE.

8. Some Changes since version 1.1 (parts in German):

Version 1.2: Bei den geteilten analemmatischen SU wurde eine 5. Berechnungsmetho.1de angefügt. Sie sucht nach jenen Punkten auf der 8er-Schleife, bei denen der maximale absolute Anzeigefehler für die angegebenen Stunden möglichst klein ist. Weiters wurde die Möglichkeit vorgesehen, in den Berechnungsmethoden 3 bis 5 bei der Genauigkeit der Punktberechnungen zwischen 2 Genauigkeitsstufen zu wählen. Natürlich erfordert das genauere Verfahren auch etwas mehr Rechenzeit.

Die Bildschirmdarstellungen in der Hilfe-Datei wurden verbessert und gleichzeitig wurde die Hilfedatei „AlemmBild-hlp" verkleinert.

Version 1.3: Die Konstruktionen können jetzt nunmehr als hpgl-Datei oder als dxf-Datei gespeichert werden. Damit können die Konstruktionen auch mit anderen Programmen (wie AutoCad, CorelDraw, DeltaCad,…) weiter bearbeitet werden.

Version 1.4: Die Zahlentabellen können (mit Ausnahme des Tabellenblattes 'Schattenweg') im Excelformat *.csv gespeichert werden.

Version 1.5: Format of help files changed from *.hlp to *.chm.Version 1.5: Format of help files changed from *.hlp to *.chm.

Version 1.6: Improved help files. Construction can be adapted to changed window size.

Version 2.0: Many additional types of analemmatic sundials (index inclining/declining, dial plan inclining/declining)

9. Glossary A - C

(Parts out of the "Sundial Glossary" from the websites of the British Sundial Society are put in quotation marks.)

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altitude (of the Sun) {elevation} = "the angular distance of the (center of) the Sun's disk above the observer's horizon (negative values indicate that the sun is below the horizon)…."

analemma = "in modern use it is a graphical plot with the Equation of Time on one axis and the Sun's declination on the other. In appearance, a tall thin figure of eight. The dates of various points around the curve are often shown. The shadow of a point falling onto an arbitrary plane at the same clock time each day will trace out an analemma over the course of the year. Normally seen on the noon line of a dial, but can be on any hour line." In this program such 8-slopes are drawn as date lines, which allow reading mean time exactly or in quite good approximation.

Instead of the word "analemma" here usually we use the word "8-slope".

azimuth (of the Sun) = "the angle of the Sun, measured in the horizontal plane from true south. Angles to the west are positive, those to the east, negative."

north= -180°...<...east= -90°...<...south=0°...<..west= +90°...<...north= +180°.

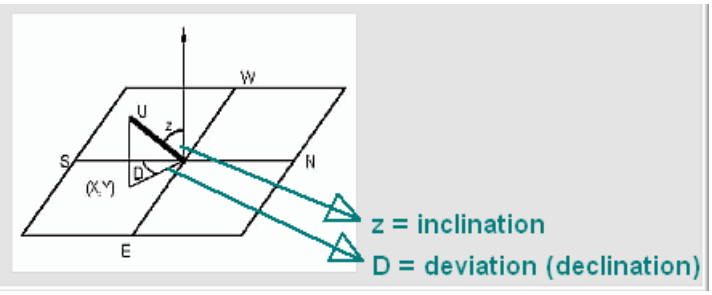
Nowadays often the azimuth is measured from direction north. Then the azimuth is 180 degrees greater than the angle used in the program.

Bailey Points: Look at "Sun rise/set marks".

coordinate system of the dial: The positive x-axis is horizontal to the right (major axis, direction east), the positive y-axis goes upwards from the origin (minor axis, direction north).

declination of the index = deviation of the index = the angle measured in the horizontal plane, that the index makes with the true South. (i.e. a index in the meridional plane has d = 0° if it is pointing southward and d=180° if it is pointing to the North). A index declining to West has positive declinations.

declination of a sundial = deviation of the sundial ="the angle measured in the horizontal plane, that a dials's perpendicular makes with the true South. (i.e. a wall facing S has d = 0°). Dials declining westward have positive declinations."



declination of the Sun = "the angular distance of the Sun above or below the celestial equator. At the equinoxes d = 0° at the solstices 623.44° (approx.). It has positive values when the Sun is above the celestial equator (summer in northern hemisphere)."

deviation of the sundial plane: look at "declination of a sundial"

Equation of Time (EoT) = Local Apparent Time (apparent solar time) - mean solar time.
Watch out, very often the sign of EoT is changedi n the literature!

gnomon = usually an index which is rectangled (orthogonal) to the dial plane. Additionally, only the shadow of its tip is the point for time indication.

index = the shadow casting object. The index may be inclining and/or deviating in this program. For time reading in analemmatic sundials only the direction of the shadow is important, but not its length and not the shadow of the index tip. This is different in common flat sundials with fixed index.

index inclination. Its inclination is always measured as the angle distance from the zenith (and not in relation to the dial plane!) to the direction of the index. Zenith distances to North are negative, to South positive. The inclination of a vertical index is 0 deg.

inclination of sundial*:* angle between the horizontal plane and the dial plane. Positive angles are from horizontal direction north upwards, negative angles from horizontal direction north downwards. Possible values can vary from – 90 degrees to +90 degrees. Equivalently the inclination is fixed by the angle distance of its rectangular vector to the zenith.

Lambert circle: Lambert found for horizontal analemmatic sundials with vertical index, that a circle through the date point on the N-S-axis and through both focuses of the ellipse intersects the ellipse in the time points of Sun rise / set. This Lambert circle is drawn in the graphic of the program, if „**Mark time for rise / set**" in panel 1 is checked and if the dial plane is horizontal. Lambert circles do not exist in split analemmatic sundials.

latitude*:* Input for southern latitudes is negative, for northern latitudes positive.

local apparent time = WOZ = (apparent) "solar time as derived from the real Sun at any particular location."

local mean time = MOZ = "solar time which has been corrected for the EoT but not for the longitude."

longitude: Input for eastern longitudes is negative, for western longitudes positive.

longitude correction = "the correction required to local apparent time to translate it to the local apparent time for the central meridian of that time zone." For the difference of every 1° the correction is 4 minutes.

mean solar time = (local) mean time = "a measure of time based conceptually on the diurnal motion of the fictitious mean Sun, …."

rise/set point – declination: This is the Sun declination which is used for calculation of the Sun rise/set marks, i.e. the Sun's declination for Roger Baileys "Seasonal Markers". It is input in Panel 1 and the Rise/Set Marks are displayed in the graphic if a horizontal analemmatic sundial is selected and if the index is vertical.

Seasonal Marks = Sun rise/set marks by Roger Bailey

Standard Time = ”mean solar time at the central meridian of a given time zone” = mean time of the zone meridian**.**

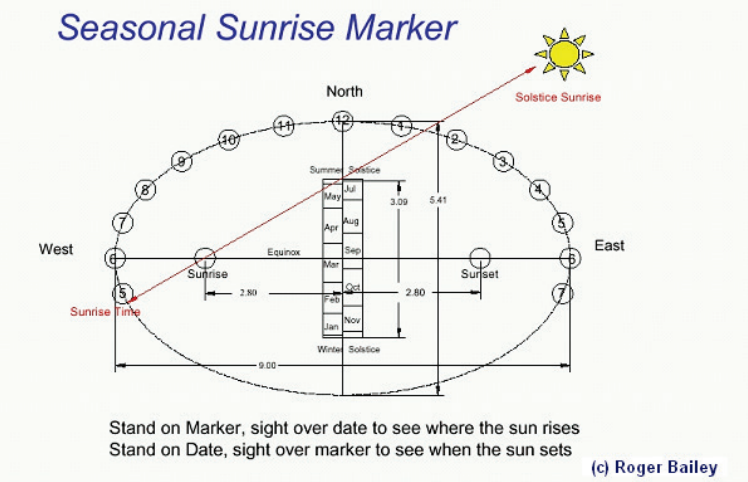
Sun rise/set marks:

For the input of any Sun declination Sun rise/set marks are calculated and displayed. These marks allow to find Sun rise /set and azimuth of Sun rise/set for all days of the year. According R. Bailey’s proposal (look at [1]): ”Stand on Marker, sight over the date to see where the sun rises. Stand on Date, sight over marker to see when the sun rises.” These marks are only drawn horizontal analemmatic sundials with vertical index.

The approximation by Seasonal Marks gets more inaccurate with increasing latitudes (in the Northern hemisphere).

sunrise, sunset time = Time, when the altitude of the Sun’s center is 0 degree. Here the iInfluence of atmospheric refraction, temperature,…is neglected.

zone meridian = standard meridian of a time zone = meridian for Standard Time.



10. Shortkeys

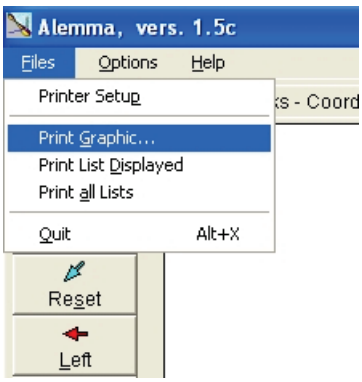
Selection of menues:

*Selection of **main menu** with mouseclick or shortkeys*

Press first key **<Alt$_{left}$>** (left) and afterwards (!) key of underlined letter:

Menu " Files ": Press **<Alt$_{left}$>** and then **<F>**
Menu " Options ": Press **<Alt$_{left}$>** and then **<O>**
Menu " Help ": Press **<Alt$_{left}$>** and then **<H>**

Submenues: Example



Mouse click or successive keys **<Alt$_{left}$> , <F> , <G>**

Shortkeys to move the displayed construction:

Selection is done with mouseclick or shortkeys:

Key **<Alt$_{links}$>** must be hold down while the second key is pressed:

For bultton " Reset" (see image above) **<Alt$_{links}$> + <S>**
For bultton " Left " (see image above) **<Alt$_{links}$> + <L>** or **<Alt$_{links}$> + <Cursor ← >**
For bultton " Right " press **<Alt$_{links}$> + <R>** or **<Alt$_{links}$> + <Cursor → >**
For bultton " Up " press **<Alt$_{links}$> + <U>** or **<Alt$_{links}$> + <Cursor ↑ >**
For bultton " Down " press **<Alt$_{links}$> + <D>** or **<Alt$_{links}$> + <Cursor ↓ >**

After change of the window's size:

Press also key **<Reset>** or **<Alt$_{links}$> + <S>** to resize all to the new window's size.

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[9] Sundial Mailing List: Contrubutions from Roger Bailey, Mike Deamicis-Roberts, Fer de Vries, et al.

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