Contents

Welcome to Spheric

Welcome to Spheric!   I hope you will like the program and find it useful. Please let me know what you like and dislike about it, so that I can keep improving it.

Spheric is shareware: have a look at the Registration and Support page. Then start from What Does Spheric Do.

In most situations pressing the F1 key will bring this help. Use it; it should answer most of your questions.

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The Main Panel


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```

This is the screen where you spend most of the time running Spheric. Click on its various widgets in the picture for more information on what they show and do.

New in this version

This page contains links to topics which are new or significantly changed in the Help updates. (This is not a complete update history; it does not include bug fixes and improvements not affecting the use of the program; see the file WHATSNEW.TXT.)

New in Version 1.00

Nothing: this is the first original release, based on Spheric 1.42 for DOS and HP Palmtops.

Credits and copyrights

Spheric is copyright © 1993-97 by J. <u>Andrzej</u> <u>Wrotniak</u>. All rights reserved.

This software has been developed using Borland's Delphi and contains parts of code copyright © 1983-96 by Borland International.

The online help has been written with the Visual Help from WinWare, Inc.

Most of the sound files used in Spheric have been created by Ted Tatman (thanks!) and are in public domain.

Spheric has inherited many design ideas and a significant amount of code from its predecessor: Spheric for DOS and HP Palmtops.I am also using a number of algorithms originally developed for Civil Aviation applications at Aerospace Engineering and Research Associates, Inc., although the ideas were actually flowing in both directions.

<u>Important: read the enclosed disclaimer before using the program!</u>

Disclaimer

This is what my lawyer told me to put here:

Spheric is licensed on the "as is" basis.

Although the author has extensively tested the software and reviewed the documentation, he makes no warrant or representation, explicit or implied, with respect to this package, its quality, performance, merchantability or fitness for a particular purpose, in any hardware or software environment.

In no event shall the author be liable for direct, indirect, special, incidental or consequential damages arising out of use, misuse or inability to use the software or documentation.

What does Spheric do?

Spheric allows you to define a number of points (fixes) on the Earth sphere and then to perform various calculations involving these fixes: distance, azimuth, arc intersections etc.

Some calculations (distance and azimuth between two points) can also be performed with greater accuracy, taking into account the ellipticity of the Earth.

The geographic coordinates can be displayed in various formats, and the distance can be expressed in various units.

The fixes are stored in a database and can be modified, deleted or added as needed. A sorting capability is provided as well.

The program is aimed primarily at those involved in navigation (whether see or air), but it can come handy for frequent flyers as well as for airmchair travellers.

See also:
The Main Panel
Geometric calculations

Geometric calculations

These operations are accessed by clicking on the buttons at the far right of the Main Panel. The top group includes distance calculations:

Distance between two fixes
Accumulated distance
Distance between a great arc and a fix
Distance between two great arcs

The remaining buttons perform other computations, described in detail in their respective pages:

Midpoint between two fixes
Azimuth from one fix to another
Fix at a given distance and azimuth from another
Projecting a fix on a great circle
Intersection of two great circles

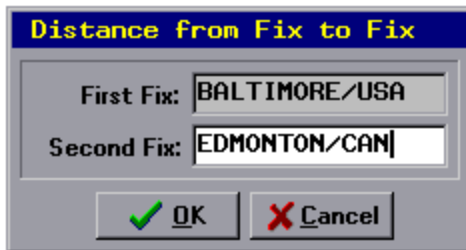The operation result is shown, along with the input data, in the Result Display and entered into the History Log so that it can be recalled at a later time. The display format depends on the current angular display mode and on the currently used distance units.

See also:
Arithmetic accuracy
Earth model

Distance between two fixes

```
Distance from Fix to Fix

   First Fix:  BALTIMORE/USA

  Second Fix: EDMONTON/CAN|

        ✓ OK        ✗ Cancel
```

Clicking on the [Fix-Fix] button will compute the distance   between two fixes. You will be prompted for both fix names.

See the <u>Entering Fix Names</u> topic for more about how this dialog box works.

The distance is defined as the length of the great arc, connecting both fixes on the Earth sphere.Within the <u>spherical approximation</u>, this is the length of the shortest line on the Earth's surface, connecting both fixes.

In the Result Display, this value is marked as (S) for "spherical".

True elliptic great arc distance

If the "Elliptic Great Arc" option in the [Options | Elliptic Distances] secondary menu choice is checked, Spheric will also compute the distance measured along the line running on the ellipsoidal Earth surface "under" or "above" the great circle arc.

In other words, this is the distance measured along the intersection line of the Earth's ellipsoid with the plane defined by both fixes and the ellipsoid center.

The geodesic distance

This distance, computed when the "Geodesic Distance" option in the [Options | Elliptic Distances] secondary menu is checked, is defined as the length of the geodesic line, i.e. the shortest line connecting two points on the Earth's surface.

This line may have quite an irregular shape (although in the first approximation it follows the corresponding great circle arc).

In the Result Display, this value is marked as (E) for "elliptic".

The U.S. Govt. NAS algorithm used to compute the geodesic distance has problems when both points are very near to the Equator   and, at the same time, almost 180 degrees of longitude apart. In such a case, Spheric will detect it and forgo the calculation, displaying only the other distance results.

See also:
   <u>Earth model</u>
   <u>Elliptic or geodesic?</u>
   <u>Accumulated distance</u>

Earth model

In the first approximation, the Earth can be treated as a sphere. This is accurate enough for many, maybe most, purposes.

With a far greater accuracy, the Earth can be represented as an ellipsoid of rotation, like a flattened sphere with the polar radius shorter than the equatorial one by about one part in 293.

In most of the navigational or cartographic applications, the ellipticity of the Earth is accounted for only by taking into account that the latitude is usually defined in terms of an ellipsoid and has to be converted to the "spherical" value before any computations on a sphere are performed. (See altitude definitions for more on this subject.)

Thus, except for some distance and azimuth computations which can, additionally, be done on a true ellipsoid, Spheric performs the calculations in three steps:

- Translating the geographic latitude into geocentric for any points on input
- Doing all calculations on the "averaged" sphere (see below)
- Translating the geocentric latitude into the geographic one for any points on output

Such a procedure accounts for most, if not all, of the Earth's ellipticity.

It is also possible to use a purely spherical Earth model, neglecting even the difference between two latitude definitions – this may be useful for the purpose of comparing the Spheric results with ones generated by a "purely spherical" algotithm, or for computations on the celestial sphere (why not? Spheric can be used for that as well!).

Therefore, depending on the current settings and on the performed operations, Spheric will use one of the two following models   of the Earth:

The elliptical model
This model, referred to in the litareture as GRS 1980, assumes that the Earh is an ellipsoid with the polar radius of 6356.7523 km and the equatorial one of 6378.1370 km.

The spherical model
In this approximation the Earth is a sphere with the radius of 6367.4357 km, which is the geometric average of both radii of the elliptical model.

Elliptic or geodesic?

"All right", you will say, "I don't care much about all this math; I juat want to compute the <u>distance between two fixes</u> on an ellipsoid; which result should I use?"

Many authors would recommend the geodesic line. This is only because they have never heard (or thought) of the true elliptic arc distance. I would recommend the latter; here are the reasons:

- The geodesic line has a shape quite difficult to visualize and follow. Most of the navigators will follow the great arc (or even a rhumb line, crossing all meridians at hhe same angle).
- The elliptic great arc accounts for almost all ellipticity of the Earth. (The real difference is between drawing the line on a sphere or on an ellipsoid.)
  The table below illustrates the differences in distance (km) between all three approximations.

From	To	Spherical	Elliptic	Geodesic
Mexico City	Houston	1208.953	1210.282	1210.282
Paris	Cairo	3213.745	3214.686	3214.686
Washington	Anchorage	5425.799	5423.159	5423.157
Chicago	Tokyo	10213.518	10208.306	10208.297
London	Auckland	18329.008	18329.925	18329.908

The largest difference between the elliptic and geodesic distance I was able to come up with in these examples was 17 meters – less than the inaccuracy introduced by the ellipsoidal approximation of the Earth (as opposed to the more accurate geoid).

Surprisingly, I was not able to find any references to the elliptic arc in the literature; it looks like I invented it (or rather stumbled upon it, as ti was there all the time!).

See also:
  Earth model

Accumulated distance

Any time afer having computed a <u>distance between two fixes</u>, you may start adding new fixes to a sequence, updating the accumulated   distance through a series of fixes. To do it, click on the [Next Fix] button.
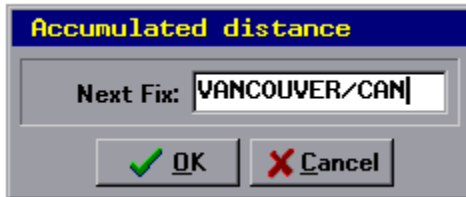
You will be asked for the name of the next fix in the sequence and then the <u>accumulated distance</u> will be computed and displayed.

You will be asked for the name of the next fix in the sequence and then the accumulated distance will be computed and displayed.
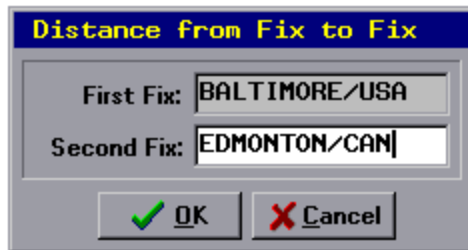
If "Elliptic Great Arc" or "Geodesic Distance" in the [Options | Elliptic Distances] secondary menu are checked, the corresponding distance values will also be computed.

See also:
   Distance between two fixes
   Entering Fix Names

Entering fix names

Distance from Fix to Fix

First Fix: BALTIMORE/USA

Second Fix: EDMONTON/CAN

✓ OK   ✗ Cancel

Some dialog boxes in Spheric ask you to enter one or more names of existing fixes. This is done by typing into the active edit field, as usual in the Windows interface.

Spheric will, however, let you enter only letters, digits and the slash separator, and all letters will be automatically brought into uppercase.
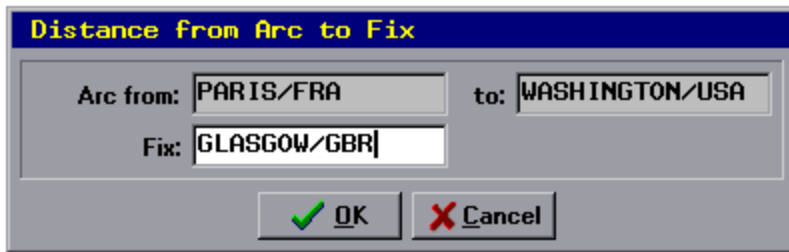
The active edit field is shown in white (as opposed to silver) for better visibility. The Tab key moves you between fields.

If you press the Space key while the name being entered is still incomplete, Spheric will find the first fix in the database matching your input so far, and complete the fix name/group for you. Pressing Space again will find the next match. When there are no matching fixes left, an error beep will sound, and then the process will start again from the top of the database.

Pressing the [OK] button will submit the selected fixes for futher processing, [Cancel] will abandon the operation. You will not be able to leave via [OK] if the entered names do not correspond to any fixes in the database.

The Escape key clears the input in the current edit field. Pressing Escape when this field is empty leaves the dialog in the same way as the [Cancel] button.

Distance between a great arc (or its circle) and a fix

This computation is invoked by pressing the [Arc-Fix] button. The three fixes you will have to enter define the arc (and its circle) and the fix. (See also <u>Entering Fix Names</u>.)

Spheric will then compute and display two values:

- The "passing distance", i.e. the distance between the fix and the point closest to it on the arc's great circle. That point will be <u>the projection of our fix</u> on that great circle.
- The "closest distance", i.e. the distance between the fix and the point closet to it on the great arc.

If the projection belongs to the great arc (i.e. falls inside its span), both values will be identical and the displayed result will be followed by the "×" character.

If the projection is on the circle outside of the arc span, the second value will be the distance from our fix to the arc start or end, and the result will be followed by the "−" or "+" character, respectively.

Distance between two great arcs

Distance between two Arcs

1st Arc from: `PARIS/FRA` to: `WASHINGTON/USA`

2nd Arc from: `MEXICOCITY/MEX` to: `LONDON/GBR`

✓ OK   ✗ Cancel

Pressing the [Arc-Arc] button computes the <u>distance between two great arcs</u>, defined by their start and end points in an input dialog. (See also <u>Entering Fix Names</u>.)

The result is defined as the shortest distance between any point on one arc and any point on the other.

Obviously, if the arcs intersect within their lengths or overlap, the computed result will be zero.

The <u>spherical approximation</u> for the distance is used here.

Midpoint between two fixes

Midpoint between Fixes

First Fix: `BALTIMORE/USA`

Second Fix: `EDMONTON/CAN`

✓ OK   ✗ Cancel
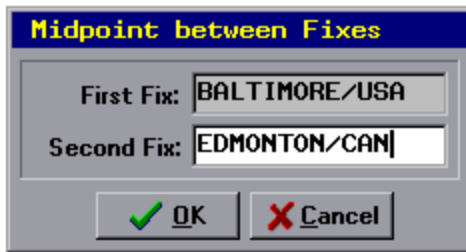
Pressing the [Midpoint] button will compute the midpoint between two fixes. You will be prompted for both fix names.

See the Entering Fix Names topic for more about how this dialog box works.

A midpoint between fixes A and B is defined as another fix, C, located on the great arc from A to B, and such that the distances A-C and B-C are equal.

An error will be reported if one of the points is exactly opposite on the sphere to the other.

If you would like to add the computed midpoint to the fix database, use [Data | Insert Fix], [Data | Append Fix] or perss the Insert or Shift-Enter key. The new fix dialog which will come up, will have the computed fix coordinates as initial defaults.

Azimuth from one fix to another

Azimuth from Fix to Fix

First Fix: `LUANDA/ANG`

Second Fix: `KINSHASA/ZAI`

✓ OK   ✗ Cancel

Pressing the [Azimuth] button will compute the <u>azimuth from one fix to another</u>. You will have to identify both fixes by their names.

See the <u>Entering Fix Names</u> topic for more about how this dialog box works.

The azimuth from fix A to fix B is defined as the angle (measured at A) between two great arcs – one running from A to the North Pole, and the other from A to B. The clockwise direction is defined as positive ("+").

The result will be between -180° and 180° or between 0 and 360°, depending on whether the [Options | Azimuth in 0-360°] menu item is checked.

If both points have the same coordinates, or if one is exactly opposite on the sphere to the other, an error will be reported.

The azimuth from the North Pole to anywhere else is 180°; from the South Pole, 0. Similarly, the azimuth from anywhere to the North Pole is 0, to the South Pole, 180°.

The geodesic azimuth

If the "Geodesic Distance" option in the [Options | Elliptic Distances] secondary menu is checked, Spheric will also compute the geodesic azimuth between fixes, i.e. the angle between the local meridian and the geodesic line running from A to B. The angle is measured at A and this is why it is often referred to as the "forward azimuth".

In the result shown, the geodesic azimuth is marked as (G) and the spherical one – as (S).

One can see that the difference between the geodesic azimuth and the spherical azimuth is usually quite negligible, a small fraction of a degree.

See also:

<u>Distance between two fixes</u>
<u>Arithmetic accuracy</u>

Arithmetic accuracy

The arithmetic accuracy of operations performed by Spheric is much higher than one might ever need, better than 16 decimal digits.

Even with error accumulation this translates into a distance error of a fraction of a centimeter, far less than the error introduced by the spherical, or even ellipsoidal, model of the Earth used in the program.

On the other hand, there is an artificial limit of about 60 cm – any two fixes separated by less than this distance will be treated as identical. For example, Spheric will refuse to compute an azimuth between two such fixes.

The Fix Database

Spheric stores a database of fixes, i.e. locations on the Earth. The data on a fix consists of fix name (including group), latitude and longitude.

In unregistered copies the database is capable of storing up to 32 fixes; upon registration its capacity is limited only by the available memory.

The database is presented as a scrolling list in the <u>Main Panel</u>. Fix names and groups are displayed without the slash separator, and the co-ordinates are shown in the current <u>angular display mode</u> and with the accuracy as currently set.

Moving around the database

The scroll bar, up- and down-arrow keys, as well as Page Up and Page Down work as one would expect, allowing you to move up or down in the fix list. The Home key jumps to the top of the list, the End key – to the bottom.

Clearing the database

Clicking on the [File | Clear Fixes] menu option clears the <u>fix database</u> after a proper warning.

See also:

[Editing, adding and deleting fixes](#)
[Finding fixes by name](#)
[Sorting fixes](#)
[Saving and loading a fix file](#)

Editing, adding and deleting fixes

A number of operations on the fix database are accessible from the Menu Bar and from the keyboard.

- To edit the selected fix, use the [Data | Edit Fix] menu option or just press the Enter key.
- [Data | Insert Fix] or pressing the Insert key will insert a new fix just before the selected one.
- To append a new fix at the end of the database, use [Data | Append Fix] or just press Shift-Enter.

The three operations above will invoke the Fix Entry Dialog, from where the fix data (name and coordinates) can be entered or modified. See Entering Fix Data for more.

- Clicking on the [Data | Delete Fix] menu option or pressing Shift-Delete key will delete the selected fix without a warning. Pressing just Delete will do the same, but requesting a confirmation.
- The last deleted fix can be restored by clicking on [Data | Undelete Fix] or by pressing the Shift-Insert key combination.

Finding fixes by name

In order to find a fix by its name, just start typing this name in.

Your input will be shown in a small pop-up, yellow entry field centered in the database list, and after each next character Spheric will jump to the first record matching what you just have typed in, making that record selected (highlighted).

If you stop typing for a second or so, it will be considered the end of the search and the pop-up entry wield will automatically disappear.

This method of search works best when the fixes are sorted in the alphabetical order by name.

See also:
   Sorting fixes

Sorting fixes

The [Sort] menu is used to reorder the fix database:

- [Sort | By Name] sorts fixes by name (if two names are the same, the fixes will be ordered by group)
- [Sort | By Group] sorts fixes by group (with the secondary sort by name)
- [Sort | By Distance] sorts the fixes by their distances from the selected fix (spherical distances being used here)

Saving and loading a fix file

The fix database can be written to, or read from, a disk file with use of the [File] menu:

- [File | Open Fix File] reads a selected fix file.The program will ask, whether you want to clear the fix database first; if not, the new fixes will be appended to the database.

- [File | Write Fix File] writes the fixes from the database to a disk file; you enter or select the file name from the Windows' file selector. If the file already exists, you will be given an appropriate warning.

The fix file has a .FIX extension and its name has to follow the conventions proper for the Windows version you are using.

Format of the fix file

The file is written as plain text (ASCII) with one line per fix. Each line contains the fix name and, optionally, group (separated by a slash), then the latitude and longitude expressed as decimal degrees with six digits after the decimal points followed by a letter; single spaces are used as separators. Here is an example:

```
ALBUQUERQUE/NM 35.083333N 106.650000W
ANCHORAGE/AK 61.216667N 149.900000W
ATLANTA/GA 33.750000N 84.383333W
```
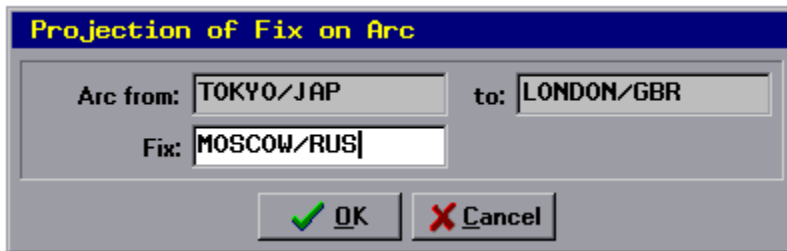
On input, Spheric will read the coordinates expressed in any of the angular display modes it recognizes. This allows for using data generated with other programs.

In particular, Spheric for Windows will read fix files produced by Spheric for DOS and HP Palmtops. The same is true in the opposite direction, except that if the fix name/group field exceeds thirteen characters, Spheric for DOS/HPLX will shave off up to two characters form the name part.

Projecting a fix onto a great circle

The projection of a fix can be defined as the point on the great circle at the closest distance from that fix. For example, the projection of (10N,5E) on the Equator will be (0,5E).

We may be, for instance, interested in finding the point on an aircraft's route (a great arc) from Warsaw to Chicago, which is closest to London. This will be exactly the projection of London on the great arc Warsaw-Chicago (or on its circle).

```
Projection of Fix on Arc

  Arc from: TOKYO/JAP      to: LONDON/GBR

       Fix: MOSCOW/RUS

              ✓ OK      ✗ Cancel
```
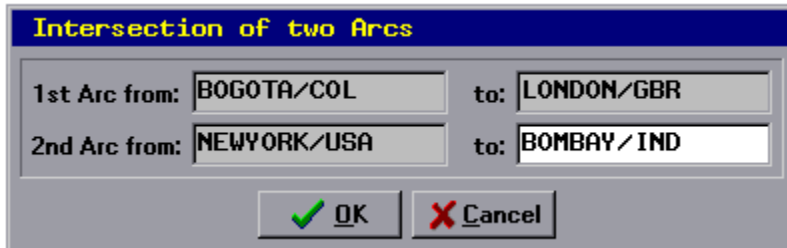
To project a fix on a great circle defined by two fixes, click on the [Project] button. You will be prompted for the names of all three fixes defining the problem. (See also Entering Fix Names.)

The displayed result will be followed with a single character: "×", "–" or "+" denoting whether the projection falls within the arc span, precedes its start, or follows its end, respectively. For example, if our fix is (10N,0) and the great arc runs from (0,5E) to (0,10E), then the projection will be (0,0) and it will precede the arc's start fix, so the solution will be marked with a "–".

Intersection of two great circles

Two great arcs may or may not intersect within their lengths, but their great circles always do (as long as they are not identical).

Spheric will find the intersection point of two great circles, defined by great arcs belonging to those circles. This operation is invoked by pressing the [Intersection] button.

The great arcs have to be entered into an appropriate dialog box; see also the Entering Fix Names topic.

Two great circles (different from each other) intersect in two points. Out of these two possible solutions, Spheric will choose the one which is closer to the arcs involved (more accurately: to the midpoint between their respective midpoints).

The result shown in the Result Display will be followed by two characters; each of them denotes the relationship of the intersection, X, to the first or the second arc:

"×" means that the intersection belongs to (falls within the length of) the given arc

"–" denotes the intersection preceding the arc's first fix

"+" means that the intersection follows the arc's second fix.

For example, let us consider two great arcs: the first one running from (5N,0) to (10N,0) and the second from (0,10W) to (0,5W). It is not difficult to predict, that the intersection point will be at (0,0). It will be marked with "+ –", as it follows the end of the first arc, but precedes the start of the second one.

On the other hand, with the first arc from (5S,0) to (5N,0) and the second from (0,5W) to (0,5E), the intersection point will be (0,0) but it will be denoted as "××", falling within the spans of both arcs.

Registration and support

Spheric is distributed as shareware: you are granted a trial license for a period of 30 days to see whether you will find the program useful and worth the price I'm asking. After that you have the options of either registering (purchasing) Spheric, or removing it from your system.

If you decide to keep Spheric, registering will bring you additional benefits: <u>enhanced features</u>, <u>free updates</u> and technical support. Last but not least, the program will get rid of the "<u>nag screen</u>" which starts showing up after one month expires.

Technical support is offered not only to registered users, but also (to a reasonable extent) during the trial period. If you have questions, problems or suggestions, feel free to send me email:

CompuServe: 70611,2552
Internet: 70611.2552@compuserve.com

You may also write to my postal address:

Dr. J. Andrzej Wrotniak
2057 Happy Lane
Crofton, MD 21114-1917
USA

And, most importantly, let me know what you like and dislike about the program: what new features would you like to see, what do you find inconvenient, confusing or incorrect. Your feedback is most valuable in making Spheric the program I want it to be.

See also:
    How to register
    Passing copies on to others
    How to get the newest version
    Vendor Information

How to register

Different ways to register Spheric are listed here from the fastest to the slowest. Click on the method title to get the details.

Registration on the CompuServe
This option can be used only by CompuServe members. You should get your key within 24 hours.

Registration on the World Wide Web
You can use this method to pay with a credit card, if you have a Web access.

Registering by phone or fax
Public Software Library (PsL) handles Spheric credit card orders by phone or fax.

Direct registration by mail
I will be glad to receive your direct registration by mail, accompanied with a check or money order. Using this method, check for available discounts!

Credit card orders by mail
Finally, you may order with PsL via mail using your credit card.

In all cases the current price is $30 for direct and CompuServe orders and $32 for credit card orders placed with PsL. Please include the following details with your order:

- Your shipping address, if you would like to have a diskette mailed (please state clearly if so, and also mention which Windows you are running).
- Your email address, if applicable, in which case I will just send you the registration key file, SPHERIC.KEY, via email – this is the fastest (and cheapest, for me at least!) way.
- The version number of the evaluation copy you have (optional).

Your registration covers both the 16-bit (Windows 3.1) and 32-bit (Windows 95) mutations of Spheric. For corporate and institutional users site licenses are available.

If your email program has problems handling file attachements or if for any other reasons you have problems with the key file, you may enter the registration data manually (use the [Help | Registration key] menu entry) and Spheric will create the key file for you.

See also:
Registered version: enhanced features

Registration on the CompuServe

Members of the CompuServe can register Spheric on-line.

To register, GO SWREG at any prompt (or click on the traffic light icon at the top of your WinCIM screen and type SWREG), then follow the directions. The registration numbers are

- For the 16-bit version: #14807, file name – SPH16.ZIP
- For the 32-bit version: #14808, file name – SPH32.ZIP

Registering either version of Spheric covers both (plus the HP Palmtop version as well); the distinction is purely for bookkeeping purposes.

The all-inclusive registration fee of $30 will be included into your next CompuServe bill.

Please note that none of the discounts mentioned elsewhere in this document are available when registering this way.

See also:
   Other ways to register

Registering on World Wide Web

The easiest way to do register with use of a VISA, Master Card or American Express on the World Wide Web, is to follow the link provided on the Spheric page. To go to the Spheric distribution site, set your browser to

http://www.freeflight.com/wrotniak/spheric.html

and when already there, click on the PsL registration link. This will take you to the Public Software Library Electronic Registration Service in Texas (small world!), directly to the Spheric order form. They now handle secure transactions (if your browser supports them), but even if not, the PsL folks are using a couple of smart tricks to make your transaction safe. Your credit card account will be charged $32.

If you wish to get a 50% discount off the Midget calculator, check the Midget option box; this will set you back for another $7.

Public Software Library provides registration services for more than 1000 shareware authors; they also run a very well stocked on-line shareware store; you may have a look at other offerings there.

PsL only processes the money side of the transaction, therefore use their link only to order; all technical correspondence and inquires (if any) about the order status should be sent to my email address.

See also:
   Other ways to register

Credit card orders by phone or fax

Public Software Library, a long-time, respectable shareware distributor from Texas, processes Spheric credit card orders received by phone or fax (the latter makes sense from overseas!). Phone orders are accepted from Monday to Thursday from 7:00 a.m. to 6:00 p.m, Friday from 7:00 a.m. to 12:30 p.m.

Voice: 800-2424-775, ext. 15163 or 713-524-6394 ext. 15163
Fax: 713-524-6398

State the product name and number: Spheric, #15163.
Please note: these phone numbers are for credit card orders only!
Do NOT use these numbers to get technical support or to check the status of your order (assuming such a need arises), or availability of the newest version. PsL handles only the money side of the transaction, passing your order to me within 24 hours; from that moment I'm your only point of contact (and a willing one, too). They are not prepared to handle any other questions or problems.

Visa, Master Card and American Express are accepted; your account will be charged $32 in the U.S. currency. Do not forget to include your address, card number and expiration date. If you wish, you may have the Midget calculator bundled in for an extra $7 (50% off).

If applicable, also include your email address which I prefer to use to supply you with your registration key. If you would rather prefer to have a floppy disk shipped to you, please clearly state so. (In this case also mention the Windows you are running: 3.1, 95 or NT, so that I can include the proper version of the program.)

Do not send me your credit card number; I cannot forward it to PsL. To stay in line with the bank requirements, PsL has to receive your order directly from you.

See also:
   Other ways to register

Direct orders by mail

To order Spheric directly from me, send a check or a money order for $30 (U.S. currency, drawn on a U.S. bank) to my mail address:

Dr. J. Andrzej Wrotniak
2057 Happy Lane
Crofton, MD 21114-1917
U.S.A.

(Sending cash is not recommended, although, of course, I will not refuse accepting it.)

Include your name and address, also your email address, if applicable. I will use the latter to email you the Spheric registration key and the information how to download the most recent version from CompuServe or World Wide Web.

If I do not have your email address, I will have to use the regular mail to ship you a floppy disk with the key and the newest version of Spheric. Please state if you are using Windows 95 or NT to get the 32-bit version; otherwise the 16-bit one will be shipped (it still runs OK on Windows 95 or NT).

Ordering Spheric this way, you will be able to use a 50% discount on the Midget calculator for just an extra $5.

See also:
   Other ways to register

Credit card orders via mail

If you live outside of the United States, you may choose to order by mail with your credit card (Visa, Master Card, American Express).

Send your order to

Public Software Library Registration Service
P.O.Box 35705
Houston, TX 77235-5705
USA

Please mention product number #15163, and include your name, shipping address, billing address (if different), card number, expiration date, phone number and your signature. The price of $32 is all-inclusive. For an extra $7 you may also get the Midget calculator bundled in.

If you have an email address, please provide it, too. I will use it to send you the registration key. If not, I will use regular mail to send you a floppy disk. Please state clearly if you are using the 32-bit Windows (95 or NT) so that I can include the proper version of the program (otherwise the 16-bit version will be shipped).

(Whichever version of Spheric you originally register, your registration key works with both the 16- and 32-bit version, so that you may switch any time.)

Upon receipt of your order PsL notifies me via email within less than 24 hours, and from that moment on I handle your order.

As PsL handles only the monetary aspect of the registration, do not try to contact them for technical support, product availability or order status information. For these purposes use my address or, better, my email address.

See also:
Other ways to register

The registered version

Really, there is no separate "registered version". Any copy of Spheric will become "registered" when it finds in its directory a small registration key file, SPHERIC.KEY. This file contains the license owner name (displayed on the program startup) and the proper verification information. It will stop working if modified in any way.

After registration, some of the additional features will become available:

- Additional digits can be shown in the display of distance and azimuth: instead of rounding distance to the nearest unit (km, mi, nm), 0.001 of that unit
  will be used and azimuth values can be shown with the accuracy of 0.001 and not just 0.1 degree.
- Greater accuracy in fix coordinates display: up to one second, 0.01 minute or 0.0001 degree of angle, depending on the angular display mode (as opposed to one minute or 0.01 degree).
- The fix database size is no longer limited to 32 points; the only limitation is now the size of available memory (and under Windows this means practically unlimited capacity).
- The operation log holds up to 128 entries (as opposed to 6 in non-registered copies).

The registration remainder ("nag screen") will, of course, no longer show up.

See also:
    How to register

Passing copies on to others

You are allowed (and encouraged!) to pass unregistered copies of Spheric along as long as you do not alter the original distribution files and do not charge money for the program.

Distributing of the original .ZIP archive (or a floppy with its freshly unpacked contents) is recommended.

Your personal registration file, SPHERIC.KEY, is not redistributable.

Where to find the newest version

The newest version of Spheric can be downloaded at no cost (other than the connection itself, that is) from one of the following sources:

- World Wide Web, courtesy of my employer, Aerospace Engineering and Research, Inc. This is the primary Spheric distribution site; the most recent version can be available here a couple of weeks before it appears anywhere else. Point your browser to

  http://www.freeflight.com/wrotniak/software.html

- CompuServe: the Science Forum (GO SCIENCE), Library 5 (Mathematics), file name: SPH16.ZIP or SPH32.ZIP (16- or 32-bit version, respectively).

My other programs can also be downloaded from these locations.

Vendor information

Non-registered copies of Spheric can be distributed by BBS operators, on-line services, disk and CD-ROM vendors after obtaining my explicit permission.

This permission is not required for vendors and BBS operators approved by the Association of Shareware Professionals. In these cases contacting me, although not required, is still recommended, as I may be able to provide the most recent version of the program.

In any case it is required that

- All files in the original distribution archive are included without alteration, as listed in the Packing List section of the accompanying README.1ST file.
- The recipient of the program is informed in advance that the distribution fee paid to the vendor is not equivalent to purchasing the program: a registration is required if the recipient continues using Spheric after the expiration of the trial period.

See also:

My address

My email address

16- and 32-bit versions of Spheric

Spheric has two parallel versions:

- 16-bit version, developed for Windows 3.1 (3.11, etc.)
- 32-bit version, running only on Windows 95 and NT (in native 32-bit code)

Frankly speaking, the 16-bit version runs just fine under Windows 95 or NT, and there are not too many reasons to move to the 32-bit version of Spheric. Putting aside cosmetic differences in appearance, there are two areas where Spheric/32 is better than its 16-bit counterpart:

- File operations (available in the registered version) use the Windows 95 file selector, and allow for long file names.
- Arithmetic operations have been speeded up more than by a factor of two. This is not really noticeable.

I am planning to provide updates and upgrades of Spheric/16 at least until May, 1998. After that the 16-bit version will be gradually phased out, with support limited to program maintenance (mostly bug fixes), unless there is an overwhelming reaction from the users of the program. Let me know.

Registered users of Spheric/16 can switch to the 32-bit version at no cost: just download the program and it will recognize your original registration file, SPHERIC.KEY.

See also:
   How to get the newest version

My other programs

There are some other shareware programs I wrote, with separate versions for Windows 3.1 and Windows 95:

- Kalkulator – the Mother of All Calculators
- Midget – a small but smart sci/eng calculator
- Mr.Matt – a quite addictive strategy game

Two other programs run on HP Palmtops (95/100/200LX) and under PC-DOS:

- Ex – a lean, mean scientific calculator (with most of the Kalkulator functionality)
- Spheric/LX – a DOS and Palmtop version of Spheric

The newest versions of all these programs can be found on my Web page; drop by and have a look – the chances are you'll find something you will like.

Fixes

We are using here the term "fix" to refer to a location on the Earth, described as a latitude and longitude, and with a name attached to it.

A fix name starts from a letter and consists of letters and digits, up to the total length of 14 characters, e.g., "WASHINGTON" or "R2D2". Spheric will raise all letters in a fix name to uppercase. No spaces or ponctuation marks (except for "/" mentioned below) are allowed.

A fix name may optionally contain an identification of a group (for example, country, state or any other category), consisting of letters and digits, and separated from the name proper with a slash. e.g. "WASHINGTON/DC", "PARIS/FRANCE" or "STARTPOINT/NEW". The group name can be of any length, as long as the total (name plus grup) fits within 14 characters, not counting the slash.

You do not have to remember all this, as Spheric simply will not allow you to enter an illegal fix name, one being too long or containing non-alphanumeric characters.

See also:
  Fix database

The History Log

The result of every geometric computation, displayed at the top of the <u>Main Panel</u>, is also appended to the <u>History Log</u>. You can scroll through records (lines) of this log with use of the arrow buttons beneath the Result Display (next to the log line number), or you may use the left- and right-arrow keys.

The currently displayed record can be deleted by clicking on the [Data | Delete Log Line] menu entry, or by pressing the Backspace key.

Unregistered copies of Spheric store up to six most recent records in the log; registered ones – up to 128. If the log capacity is used up, the oldest record will be deleted.

Menu operations

The less frequently performed operations are accessible from the <u>Menu Bar</u>.

File

- Reload Status – reloads the program status (see Exit)
- Save Status – saves the program status (see Exit)
- Open Fix File – <u>loads the selected fix file</u> into the <u>Fix Database</u>
- Write Fix File – <u>saves the Fix Database</u> to a file
- Clear Fixes – clears the Fix Database
- Clear Log – clears the <u>History Log</u>
- Clear All – clears both of the above
- Exit – exits the program. There will be a warning and an option to save the program status (fixes, History Log and all settings) to a disk file named SPHERIC.INF. The status is automatically read next time you run the program, so that you can continue the previous work.

Data

- Edit Fix – edits the selected fix
- Insert Fix – inserts a new fix before the selected one
- Append Fix – adds a new fix at the end of the database
- Delete Fix – deletes the selected fix
- Undelete Fix – inserts the last deleted fix before the selected one
- Delete Log Line – removes the displayed record from the History Log

Sort

- By Name – <u>sorts the fixes</u> in ascending alphabetical order by name
- By Group – sorts the fixes alphabetically by group (secondary sort by name)
- By Distance – sorts the fixes by increasing distance from the selected fix

Options

- Angle Format – selection of the <u>angular display mode</u> from a secondary menu: Deg/Fraction, Deg/Min/Fraction, Deg/Min/Sec, Infix
- <u>Distance Units</u> – selection from a secondary menu: Kilometers, Miles, Nautical Miles, Degrees of Arc
- High Display Accuracy – toggles two additional digits in the display of coordinates, distances and azimuth
- Azimuth in 0-360° – switches between two modes of azimuth for computation results: from –180° to +180° and from 0 to 360°.
- Show Group – a toggle allowing to suppress showing the fix group (with the preceding slash) in the result display
- Elliptic Latitude – toggles between the spherical and elliptic <u>latitude definitions</u>
- Elliptic Distances   – a cascading menu with two toggles, activating the computation and display of geodesic distance (and azimuth) and elliptic arc distance, see <u>Distance between two fixes</u>
- Balloon Hints – toggles the fly-by hints on and off
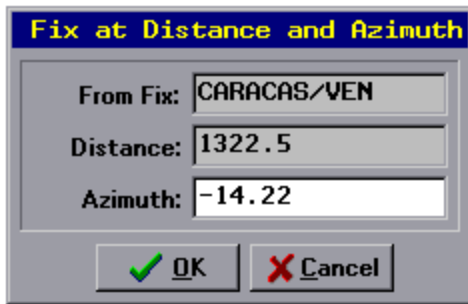- Sound – enables or disables the <u>sound effects</u>

Help

- Help – activates the online help (the one you are reading now)
- About Spheric – displays the version, copyright and registration notice
- How to Register – so that you have no excuse

- Registration Key – allows to enter the Spheric registration key manually, after you receive it from me upon registration

The last two entries are no linger visible when you register the program.

Fix at a given distance and azimuth from another

This operation is invoked with the [Fix At] button.

A dialog box will ask you for the name of the original fix (see the Entering Fix Names topic), the distance (in currently used units) and azimuth (degrees, clockwise from North).

Given a fix A, an azimuth angle a (any values between -360 and 360 degrees are allowed), and distance d, Spheric will compute a new fix B, such that the azimuth from A to B will equal a, and the distance, d.

The spherical approximation is used for these calculations.

See also:
Azimuth from one fix to another
Distance between two fixes

Spherical vs. elliptic latitude

The latitude of a point, P, at the Earth's surface can be defined in two ways:

Spherical latitude

This latitude, often referred to as "geocentric latitude", is defined as the angle between the Equator plane and the line connecting P with the Earth's center. All spherical geometry calculations use this latitude.

Elliptic latitude

This value, usually referred to as "geodetic" or "geographic latitude", is the angle between the Equator plane and the line perpendicular to the ellipsoid at P. This is the latitude usually given for a point.

For a given fix, the elliptic (geographic, geodetic) latitude is slightly greater than the spherical (geocentric) one, except at 0 and 90 degrees S or N, where it is the same. The maximum difference between the two is about 12 angular minutes, reached at the 45-degree value.

Angular display mode

Spheric displays latitude and longitude values in one of the possible modes, selectable from the nested [Options | Angle Format] menu. In the examples shown below, the last two digits are shown only when the High Display Accuracy option (available only in registered copies of Spheric) is enabled.

Degrees/Fraction

This mode, abbreviated in the mode indicator as "Deg" shows angular values as decimal degrees, e.g. 123.5832E.

Degrees/Minutes/Fraction

This mode, shown as "DMF" uses the format like 89°32.77'E.

Degrees/Minutes/Seconds

In this mode, abbreviated as "DMS", the coordinates are displayed in degrees, minutes and seconds, e.g. 12°45'32"N.

Infix DMS notation

In this notation degrees, minutes and seconds are used as well, but they are shown just as a sequence of digits with the single letter separating degrees from minutes, e.g. 12N4532.

Regardless of the current angular   display mode setting, Spheric will recognize on input coordinates in any of the formats shown above.

The angular mode does not affect the way in which azimuth values are displayed: decimal degrees will be always used for that purpose.

The fonts look bad on my screen. What's wrong?

This means that the Spheric fonts have not been loaded. The program should have complained about this with an error message. Make sure that the files KALKULP.FON and KALKULT.FON are in the Spheric directory.

If no error message about missing .FON files has been shown, then obviously Windows 3.1 is running out of resources. Close as many applications as you can, then restart Spheric. This problem should not occur under Windows 95.

Distance units

Spheric will display distance values, or accept them on input, in various units; the selection is made from the [Options | Distance Units] cascading menu.

- Kilometers (km)
- Miles (mi); 1 mi = 1.609344 km
- Nautical miles (nm); 1 nm = 1.852000 km
- Degrees of arc – this is useful for solving some problems in spherical geometry; for the Earth model used in Spheric, 1 degree corresponds to 111.132718 km.

Entering fix data

This dialog box is shown when you are entering the data on a new fix, or modifying an existing one.

The name field will accept only letters, digits and the slash separator; the letters will be converted to uppercase. Obviously there is no automatic name completion here.

The coordinate fields will accept values in any of the standards listed in the Angular Display Mode topic. Latitude is supposed to be geographic (as opposed to geocentric, see Latitude Definitions).

The degree symbol is entered by pressing Ctrl-d (i.e. hitting the "d" key while Ctrl is depressed).

If you are entering a name for an new fix, or modifying an existing fix name, the entered name has to be unique. If a fix of that name already exists in the database, the entru will not be accepted and an error message will be shown.

How do I change colors?

You don't. The Spheric panel colors are not changed from within the program; they are bound to your desktop colors, which can be changed from the Windows Control Panel.

Kalkulator
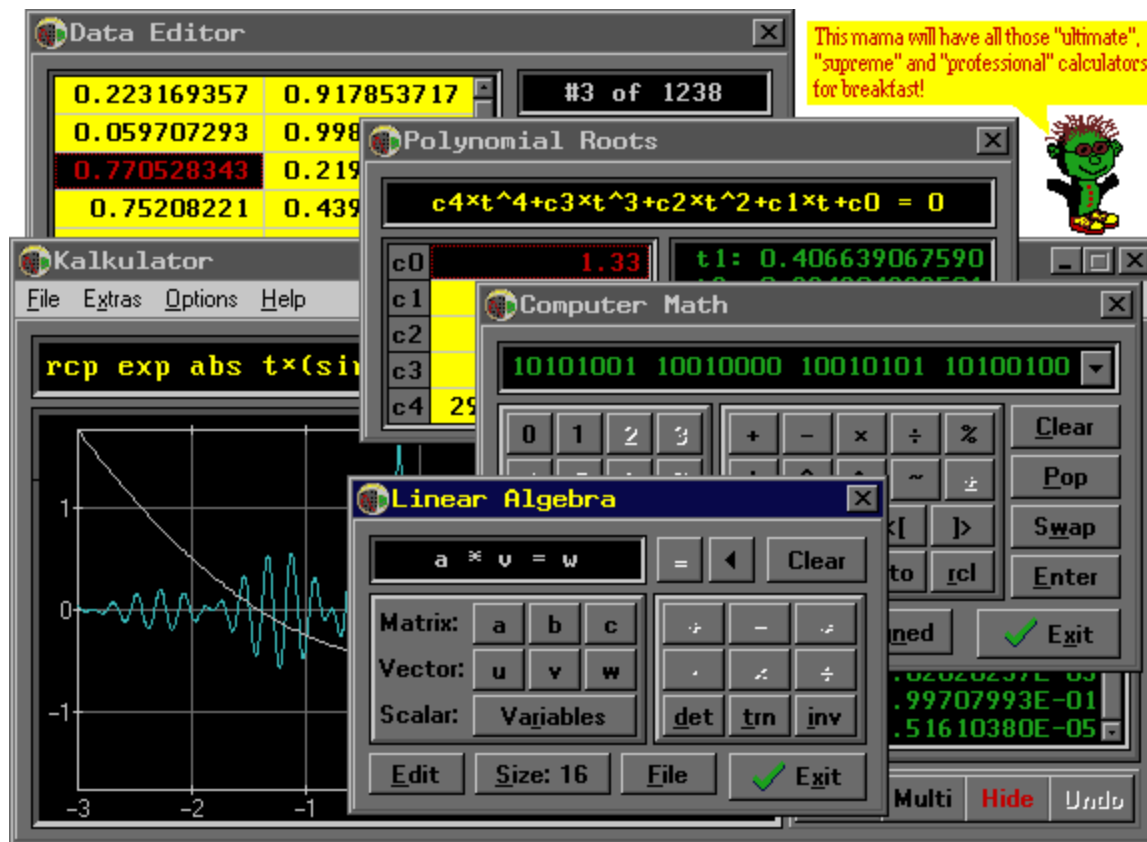
Kalkulator is probably the most powerful program of its kind on the market. It may be used as just a calculator (and a very powerful one, capable of evaluating expressions), but it also sports a number of unique features distinguishing it from the me-too crowd:

- More than 100 functions: log and exponential, trigonometric and inverse, hyperbolic, Euler, statistical distributions (including integral and inverse-integral), user-defined and conditional
- Unit conversion, pre-defined physical constants
- Numerical operations on expressions: integration, computing derivatives, finding zeros of functions, indexed sums
- Function plotting (with smart handling of discontinuities and changes in curvature)
- Statistical operations on points in a data buffer: sample parameters, histograms, polynomial regression (up to the ninth degree, with plotting), column-wise arithmetics on data
- Finding roots of polynomial equations up to the fourth degree
- Linear algebra: vector and matrix arithmetics, matrix inversion, systems of linear equations
- A computer math calculator for computer arithmetics and conversions between binary, octal, hex and decimal systems.

The more powerful, less accessed features are designed so that they do not stand in the way of someone performing simpler tasks. The program is aimed at a wide group of users, ranging from high school to graduate students and science/engineering professionals.

Press the [Arc-Arc] button to compute the
distance between two great arcs.

Press the [Arc-Fix] button to compute the <u>distance between a great arc and a fix</u>.

This indicator shows the current <u>angular display mode</u>.

Press the [Azimuth] button to compute the underlineazimuth from one fix to another.

This is the Result Display, where the computation results and <u>History Log</u> records are shown. The first two lines show the input data, the last one – the result.

Press the [Fix-Fix] button to compute the <u>distance between two fixes</u>.

Press the [Fix At] button to compute the
[fix at a given distance and azimuth from another](#).

This scrolling list is used to browse through the <u>Fix Database</u>.
You can add or delete fixes, or modify the existing ones.

Press the [Intersection] button to compute the
<u>intersection of two great circles</u> (or arcs).

This indicator shows whether Spheric is using spherical or ellipsoidal <u>latitude definition</u>.

This is the number of the <u>History Log</u> record currently displayed. The arrow buttons are used to move between records.

Press the [Midpoint] button to compute the
<u>midpoint between two fixes</u>.

Press the [Next Fix] button to compute the
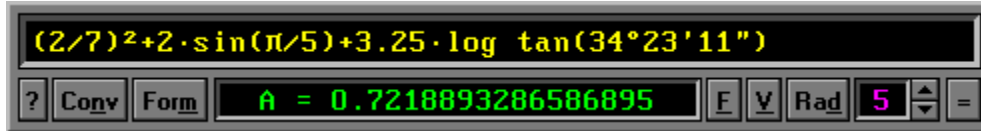<u>accumulated distance</u> to the next fix.

Number of points in the Fix Database is shown here.

Press the [Project] button to
<u>project a fix onto a great circle</u> (or arc).

This indicator shows the <u>distance units</u> used for result display and on input.

Midget

Many users of Spheric will have a need for a smart yet simple to use scientific calculator. <u>Midget</u> may serve this purpose.

```
(2/7)²+2·sin(π/5)+3.25·log tan(34°23'11")
? | Conv | Form |  A = 0.7218893286586895  | F | V | Rad | 5 | ⇕ | =
```

Midget may (and should!) be used as a handier, more powerful replacement for the calculator included with Windows (3.1, 95 or NT).

What Midget does is to evaluate expressions. It also has built-in unit   conversion. Using it is a no-brainer.Just type in what you want to compute and hit Enter.

Midget is a $10 shareware. You can download an evaluation copy from the CompuServe (the Science forum, Math Library) or from <u>my Web page</u>.

If you think Midget is not math-macho enough for your needs, then try my <u>Kalkulator</u>, probably the most advanced program of its kind (well, it is still a caclulator, not Mathematica or MathCad!). Check my Web page for an evaluation copy.

Questions and Answers

If you have a question, ask. There are no stupid questions; only the answers can be.

[Can I run Spheric from a CD-ROM?](#)
[How do I uninstall Speric?](#)
[How do I change colors?](#)
[The fonts look bad on my screen. What's wrong?](#)
[The sound effects do not work. Help!](#)

Running from CD-ROM

Yes, you can Spheric from a CD-ROM, as long as the files are not packed (zipped). You will, however, have to live with one limitation:

- You cannot save any files – Spheric will write only to its own directory, nowhere else, and this is, obviously, read-only

And yes, you can run Spheric from a floppy, too.

How do I uninstall Spheric?

Just delete the Spheric directory with all the files in it.
The program does not put any files anywhere else.

Sound effects do not work?

Your computer may be lacking a sound card – this is the case if other Windows programs are also mute (although some programs may use the built-in speaker to make feeble beeps).

A simple way to emulate a sound card is to install Microsoft's driver SPEAKER.DRV. It was written for Windows 3.1, but works just fine with Windows 95 as well and can be downloaded for free. I'm using it on one of my notebooks without any problems.)

Sound effects

Spheric uses sound   effects to denote some events. This can be turned off or on from the Options menu.

The sounds are stored as standard Windows' .WAV files in the Spheric home directory. The following files are included:

    SPH_ERR.WAV - the sound used for errors
    SPH_DON.WAV - to announce a completed calculation
    SPH_INP.WAV - accompanies an input box (numeric or not)
    SPH_QUE.WAV - accompanies a question (Yes/No or Yes/No/Cancel)

You may copy any .WAV files of your choice (renamed as above) to the Spheric directory; these sounds will be then used by the program.

Although the supplied sound files are rather small, you may want to save some disk space by deleting them from the Spheric directory. In that case it is recommended (although not required) that you turn the sounds off, as this will speed up the program operation.

See also:
    Sound effects do not work?

Updates and upgrades

For registered users of Spheric, program updates and upgrades are free for the lifetime of the program, as long as you can download the current version from <u>my Web page</u>, CompuServe or another source.

After you <u>download the new version</u>, the program will recognize your registration, provided that your registration key file, <u>SPHERIC.KEY</u>, is present in the Spheric directory (make sure to keep a safe backup of the key file!).

add or delete fixes

0,<Editing adding and deleting fixes>

Andrzej

Pronounced "Un-Jay". One of the most misspelled and mispronounced names in the United States.

highlighted

The background and foreground colors of highlighted text depend on your current Windows settings. It is desirable to have these colors set differently than the Spheric display colors (green or yellow on black).

If you think Midget is not math-macho enough for your needs

it is still a caclulator, not Mathematica or MathCad!). Check my Web page for an evaluation copy., (Global), 0,<Kalkulator>

my address

Dr. J. Andrzej Wrotniak
2057 Happy Lane
Crofton, MD 21114-1917
USA

my email address
CompuServe: 70611,2552
Internet: 70611.2552@compuserve.com

my Web page
http://www.freeflight.com/wrotniak/software.html

nag screen

Spheric will not stop working after the trial license expires. It will just display, at the program startup, the screen with licensing information, urging the reluctant user to make the choice between registering the program or removing it from his/her system.

SPHERIC.KEY

This is your personal registration key file; it will be recognized by Spheric, activating its enhanced features.

Copy this file to the same directory where Spheric is; also be sure to make a safe backup of it.

Whenever you get (download, steal, borrow) a new version of Spheric, remember to put SPHERIC.KEY together with the other files. The key file currently distributed will work with all future versions of the program.

Wrotniak

Ex-physicist, formerly specializing in computer Monte Carlo techniques applied to cosmic rays. Taught physics, numerical methods   and computer science at University of Lodz, Poland. In the U.S. since 1984, makes his life as a software engineer. Currently the Chief Scientist at Aerospace Engineering & Research in Maryland, helping to bring the air traffic control software out of its 19th century state. One day may get a real job and a haircut.