

# SatPC32 and Wisat32

## Satellite Tracking Programs Version 12.5

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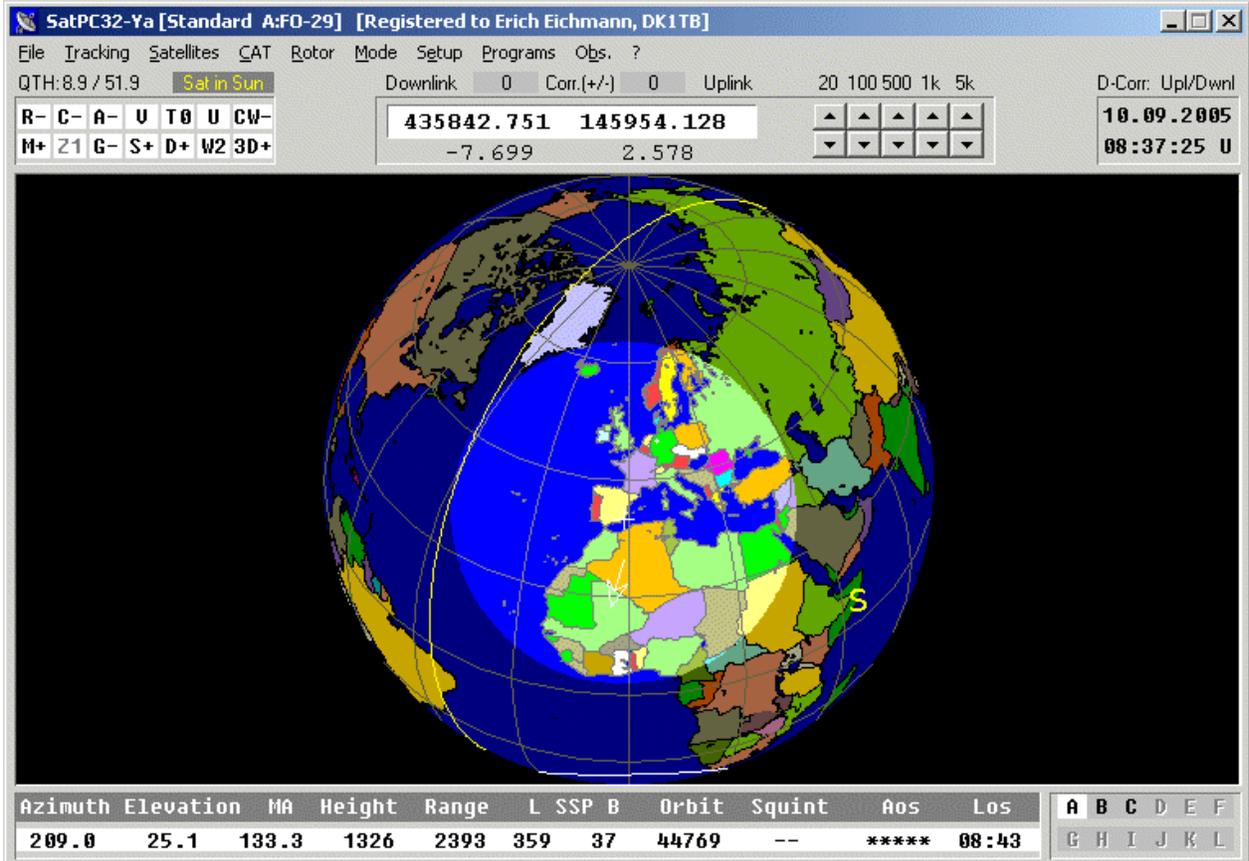
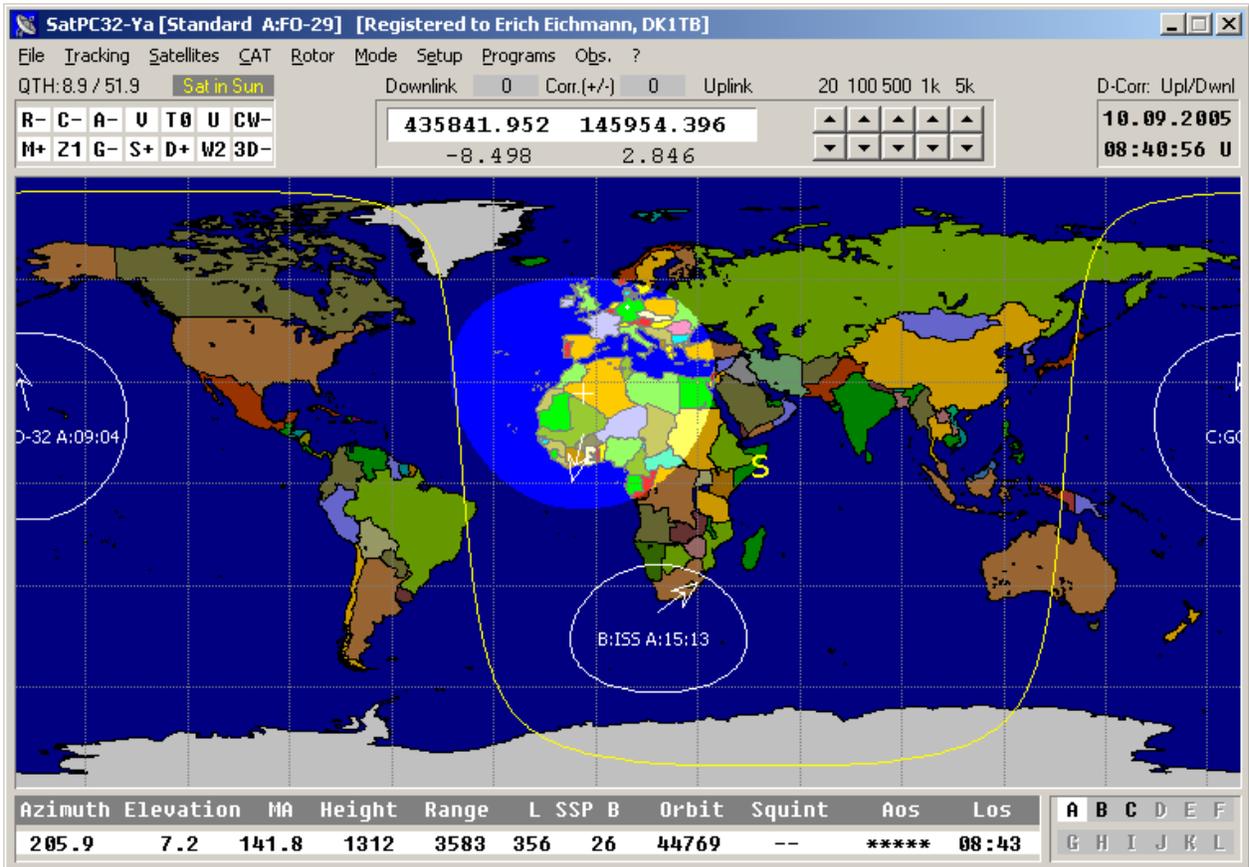
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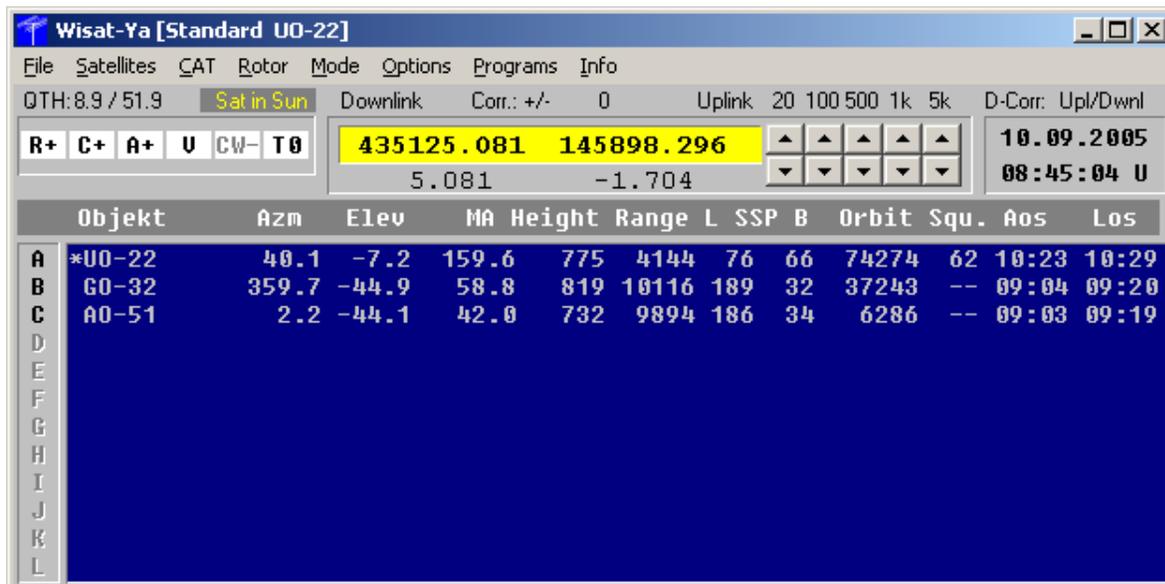
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## A. General

**SatPC32.exe** (subsequently called SatPC) and **Wisat32.exe** (subsequently called Wisat) perform orbit calculations of earth orbiting satellites. While SatPC displays the footprints of one or more selected satellites on a world map as well as related text data, Wisat shows a list of satellite positions in real time but without graphical functions. Both programs allow antenna tracking and radio frequency tuning (CAT) to compensate for Doppler effect. Through multitasking, they can work together with third party satellite programs like WISP. In such case, they control the above mentioned steering functions while the automatic satellite switching remains synchronized with the third party program.

VFO frequency tuning, as required by modes like SSB through analog transponders (FO-20, FO-29, and AO-10), is also possible.

1. The antenna tracking function is laid out for the AMSAT-DL rotor interface developed by Dr. J. Hocke and described in the AMSAT-DL journal 6/86, as well as for the ready built IF-100 interface.

The following rotor interfaces and systems are also supported:

EGIS rotors,

RIF-PC rotor interface (Orbitronics),

Winrotor parallel port and USB interfaces (Funkbox),

ARS (EA4TX),

Kansas City Tracker/Tuner,

Yaesu GS-232-rotor interface and compatibles (i.e. G6LVB Tracker, AlfaSpid controller, DL7AOT and CX6DD interfaces and the French SatDrive interface),

HalloRotor interface (DB3DH),

FODTrack rotor interface (AMSAT-CE).

SatEI rotor interface (Satellite Electronics),

SAEBRTrackBox (N8MH),

Labjack U 12 / PiggyBack (NLSA) combination,

WOLMD Tracker (Mini, Junior, Senior).

Please read the instructions in the subdirectories 'EGIS', 'RIF-PC', 'WinRotor32', 'ARS', 'KCT', 'SDX', 'HalloRotor', 'FODTrack', 'SatEI', 'SAEBRTrackBox', 'Labjack', 'W0LMDTracker'.

**2.** CAT steering is possible with

**a.** Yaesu's

FT-736R,

FT-847,

FT-817,

FT-857,

FT-897

transceivers.

**CAUTION:** Please read the file 'Readme(Yaesu).txt' in the subfolder 'Yaesu' regarding the necessary precautions when using the FT-817, FT-857 or FT-897 radios with a RX-preamplifier, before you steer the radio with SatPC32. The file can easily be opened from the menu '?| Hints for ...'.

These radios can only be controlled by SatPC32, but at present not by Wisat32.

**b.** ICOM's

IC-820H,

IC-821H,

IC-910H

and other ICOM radios using the same protocol

**c.** Kenwood's

TS790 E/A,

TS-2000.

With other radios the frequencies displayed by SatPC32 may be used for manual frequency settings (see FAQ.txt).

You will find detailed instructions on how to connect your radio to the PC and how to control it by SatPC for all supported models in the 'Yaesu', 'Icom' and 'Kenwood', subfolders ('Readme(Yaesu).txt', 'Readme(Icom).txt', 'Readme(Kenw).txt'). These files can easily be opened from the "?|" "Hints for..." menu.

SatPC comes with a DDE interface allowing third-party-programs to process the rotor and frequency data calculated by SatPC32. The data stream format is compatible with the Wisp32 (GSC) DDE output.

**3.** The programs run on a PC under Windows 95/98/ME, Windows NT 4.0, Windows 2000, and Windows XP. Please look at the read-me file on the installation CD to consider WinNT, Windows 2000 and WinXP specifics.

**4.** Standard big fonts at resolutions of 800 x 600 and higher are supported, but user defined fonts are not.

For resolutions of 800 x 600 and higher, additional graphics are available which can be used to optimize the screen layout (Menu: 'Options').

Windows' Full Screen option is not activated, as it would generate disturbing optical effects in the graphical display.

5. SatPC32 allows multiple starts in order to track different satellites. You have the option to disable the steering functions at the 2<sup>nd</sup> start to avoid multiple accesses of the same port.

Wisat32 does not allow multiple starts. Accidental multiple starts will be automatically prevented.

## B. Setup

### I. Installation

#### 1a. from CD:

The CD starts automatically, if not, start the installation by clicking 'Execute' in the 'Start' menu. Enter d: setup and follow the instructions ('d' stands for the CD drive).

#### 1b. from Internet Download:

Store the downloaded ZIP file into an empty temporary folder. After unpacking the file, this folder will show a 'Readme.txt' file, which contains important instructions. Please, read this text or - better - print it. To install SatPC32, start the setup program in the temporary folder, then follow the instructions.

2. If an error message 'EoleSysError' or similar appears, you probably need updated versions of some of your Windows System files. You may then install MS Internet Explorer (Version 3.01 and higher) or a Windows update. Subsequently, SatPC32 has to be reinstalled.

3. In addition to SatPC and Wisat, the program directory contains several auxiliary programs which can be opened from the SatPC menu 'Programs'. They contain detailed instructions themselves on how to use them.

a. **'WinAos'** calculates the AOS and LOS times for one or more selected satellites and displays them in chronological order on the screen, sends them to a printer or saves them in a file. You then have an overview of the possible contact times for packet radio or SSB transponder satellites. Please read the instructions in the 'Instructions' menu.

b. **'WinListen'** performs various calculations for a specific satellite. Results are displayed on the screen in table form and can be output to a printer or a file. You can choose between the display of all satellite positions, positions with positive elevation only and the display of AOS and LOS times. In addition, AOS times can be calculated for two different, freely selectable locations. Please read the instructions in the 'Instructions' menu.

c. **'SatRename'** can be used to replace the satellite names used in Space-Track TLE files by AMSAT satellite names.

d. **'TxController'**. This tool is helpful when 2 separate radios are to be used for Uplink and Downlink. The RX radio can then be steered by SatPC32 directly, the TX radio via the program TxController. Detailed instructions can be found in the sub folders of the SatPC32 program folder 'TxController\_D' and 'TxController\_VB'.

e. **'SortSats'** can be used to change the order of the selected satellites using 'Drag & Drop'. With SatPC32 this can be done using the 'Sort Selected Satellites' sub menu in the menu 'Satellites'. With Wisat32 the program SortSats can be used for this issue.

f. **SatSetup**: From program version 12.4 the program 'SatSetup', that was used with former versions to setup user specific settings, has been replaced by the sub menus of the SatPC menu 'Setup'. It has not been removed from the program package, however, thus it can still be used if one wants to do that.

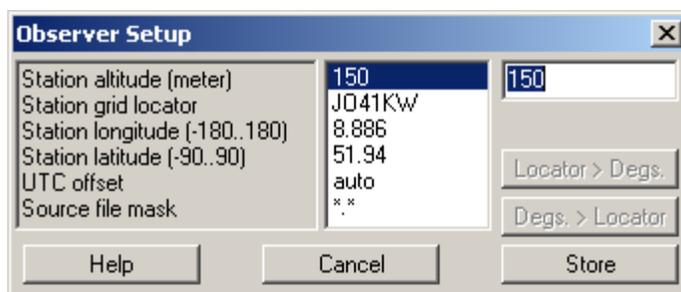


## II. Settings

After loading SatPC32 open the menu 'Setup'.and it's sub menus.

### 1. Observer

With this sub menu determine your location. Enter the location's altitude above sea level in meters and the location's geographical position. Enter either the locator (**6 digits**) or longitude and latitude. Further, enter the UTC offset (time difference between UTC and your local time). If you keep the setting 'auto' the



program will take the offset automatically from the Windows time zone setting. Leave the file filter for Keplerian Element files (default: \*.\* ) unchanged for the time being.

**Important:** All changes in this menu will take effect only after a restart of SatPC!

The menu itself contains instructions for all necessary entries. To display them, mark the value of an item in the right list and click on the 'Help' button. Additionally read the **FAQs** file (sect. 2) for instructions regarding the file filter.

### 2. Rotor Setup

In the upper section you can select the interface or controller you want to steer from a list. To select a device click on the control of the combo box. In the list that opens click on the corresponding item. Then click on the (upper) 'Store' button.

Note: In former program versions the driver files had to be copied into the SatPC32 program folder. From vers.12.4 this is no longer required.

If you are using an ARS, HalloRotor or WinRotor interface SatPC32 expects the driver files to be in the standard folder of the rotor software. If the driver file can't be found there the program will display an error message. Click on 'Search' and navigate to the

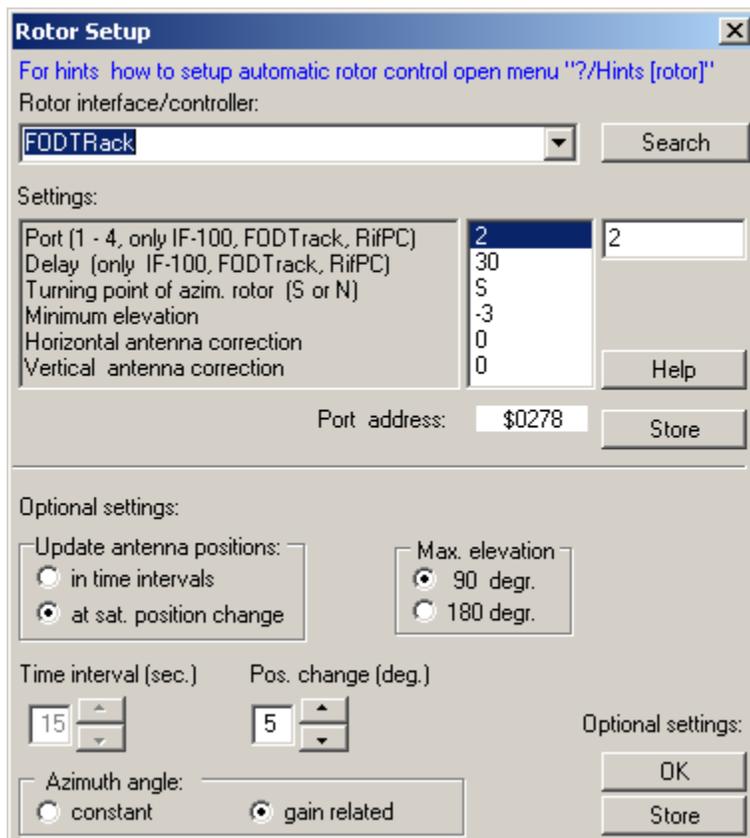
driver file and mark it's name. Then click on 'Store' to save the server file's name and path.

With some interfaces which work at the PC's parallel port (IF-100, RifPC, FODTrack) the port address and a delay value have to be set.

The item 'Rotor turning point' is evaluated only by the IF-100 and FODTrack interfaces, the KCT Tracker and the Labjack U12.

The items 'Minimum elevation', 'Antenna correction horizontal' and 'Antenna correction vertical' are evaluated by all interfaces and controllers.

With the SatPC menu '? | Hints[rotor]' you can display detailed instructions regarding all interfaces supported by SatPC, and how to setup the program for a particular interface hardware. The menu itself also contains instructions for all necessary entries in the upper section of the menu. To display them, mark the value of the particular item in the right list and click the 'Help' button.

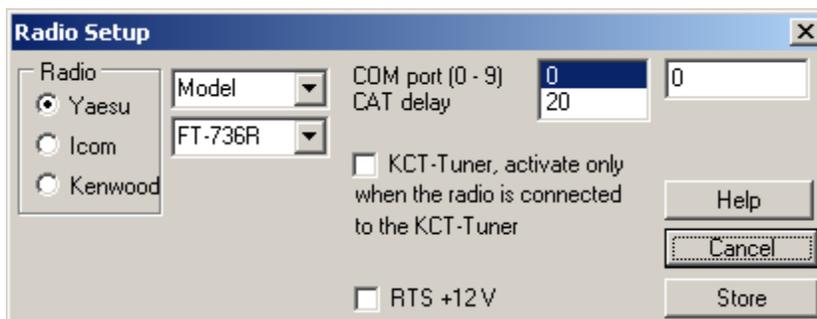


**Important:** All changes in the upper section of this menu will take effect only after a restart of SatPC!

In the lower section of the menu several optional settings can be made. For detailed information see sect. [D.7.b](#) below (menu 'Rotor Setup').

### 3. Radio Setup

a. Select the COM port to which your radio (the CAT interface) is connected. If no radio is to be steered, the CAT port has to be set to 0 to avoid timeout errors.



If the radio shall be steered via the KCT Tuner activate the option 'KCT Tuner'.

**b.** Enter a proper CAT delay value.

Try the following delay values:

Yaesu FT-736R: 20,

FT-847. 30 at 4800 or 9600 baud , 20 at higher baud rates.

FT-817/857/897: 110 at 38400 baud.

Kenwood TS-790: 70

TS-2000: 20 at 57600 Bd.

Icom IC-820H, IC-821H, IC-910H: 70 – 90 at 9600 or 19200 baud, 140 at 1200 baud.

**c.** select the brand and with the 2 combo boxes select model, baudrate and device address (Icom radios only).

**d.** Store the settings.

**Important:**

All changes become effective only after a restart of SatPC.

With the SatPC menu ‘? | Hints[Radio] ‘ you can display detailed instructions regarding the **Yaesu**, **Icom** and **Kenwood** radios, how to connect the radio to the PC and how to set the parameters for CAT control.

The Yaesu FT-736R and FT-847, the Icom IC-910H and the Kenwood TS-2000 will be automatically switched into satellite mode by SatPC32.

The Yaesu FT-817, FT-857 and FT-897 are not full-fledged satellite transceivers and do not allow duplex operation. With these radios all settings for satellite operation are performed by the program.

The Icom IC-820 and IC-821 need to be switched manually into satellite mode. You should select ‘SatL-R’ mode since most analog transponders are using a reverse frequency scheme. This setting will not be done by the program.

With the Kenwood TS-790, the "MAIN" window must contain a 70cm and the "SUB" window a 2m frequency at program start, provided the program starts with a satellite with a 2m Downlink / 70cm Uplink (AO-10, AO-40, if used with a 13cm/2m down converter). If you start with a satellite with 70cm Downlink / 2m Uplink (FO-29, UO-22) the "MAIN" window should display a 2m and the "SUB" window a 70cm frequency. The program then will automatically switch both bands to VFO A and will set the appropriate modes and frequencies.

With the FT-736R switch on satellite mode before you start SatPC32 the first time. Turn the "SAT" switch to position "RX". If you start SatPC32 with a 2m Downlink / 70 cm Uplink satellite (AO-10, AO-40, if used with a 13cm/2m downconverter) select 2m for RX. If you start with a 70cm Downlink / 2m Uplink satellite select 70cm for RX. You may switch bands with the radio's "REV" key.

When you switch between satellites with different frequency schemes while operating, for example between AO-40 and FO-29 or vice versa, a band change will be necessary (except with the Yaesu FT-847, FT-817, FT-857 and FT-897, which will accept any legal frequency sent by the program). For detailed informations see the FAQ.htm file, section "Bandswitching".

From program version 11.4 SatPC32 automatically switches bands as needed with Icom transceivers and the Kenwood TS-2000.

With the Kenwood TS-790 and the Yaesu FT-736R band change can be done only manually at the radio because the CAT system of these radios doesn't include commands for bandswitching. With the TS-790 use the "MAIN/SUB" key, with the FT-736R use the "REV" key.

#### 4. Options

With this menu you can determine settings the program shall use when it starts. Also, settings regarding the graphical screen can be chosen. For detailed instructions see section [D.7.d](#) (menu 'Options').

#### III. Keplerian data

An outdated Kepler file comes with the SatPC setup file. With the Menu item "File | Open" you may select (separately for each Satellite group) appropriate Kep files located in other directories.

**Attention:** To make sure that the selected file will remain in use in the future, you need to go to the 'Satellite' Menu after a first start and click 'OK'. This has to be done for each Satellite Group.

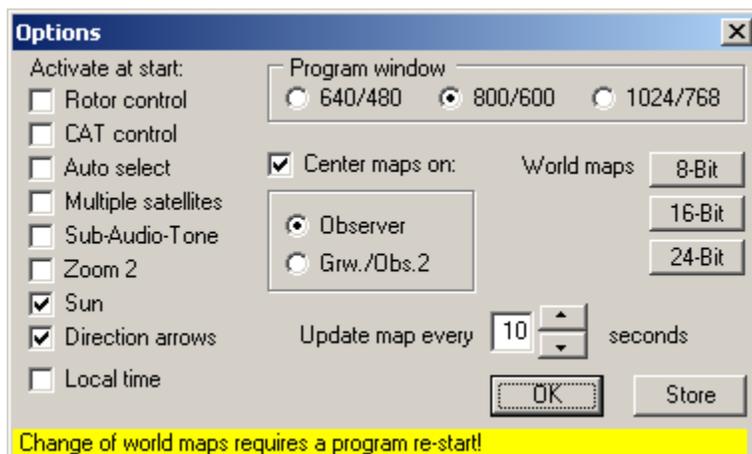
As the programs WinAos and WinListen also run in stand alone mode, they have their own menus to enter user specific data.

### C. Program functions and displays

#### 1. SatPC:

a. The program calculates the positions of all satellites contained in your satellite list and displays their footprints on a world map. Antenna tracking and radio tuning can be done for one satellite only. That one will be called the 'actual satellite' from now on. Its footprint is shown over a highlighted background and its subsatellite point is marked by a cross, the color of which changes depending on the background. The footprints of other satellites displayed on the screen are delimited by a frame and their names and AOS times are shown near their respective subsatellite points, (see below).

A smaller cross on the map identifies the observer's location.



A second location can be marked by entering its locator (to open the input window press the 'Space' bar).

If other satellites than the actual one are shown on the map, the following data are displayed around their subsatellite points:

- A letter associated with the satellite, the satellite name as published in the Kep file,
- its next AOS time (Marked 'A') in UTC or local time. For satellites in hearing range, only LOS times will be shown (Marked 'L'),
- optionally an arrow that indicates the satellites tracking direction.

When the control area 'S' is activated, the sunline is displayed. The subsolar point is marked by a yellow 'S'. A satellite is in the shadow of the earth (eclipse), when its area of visibility is completely outside the area of the sun's area of visibility.

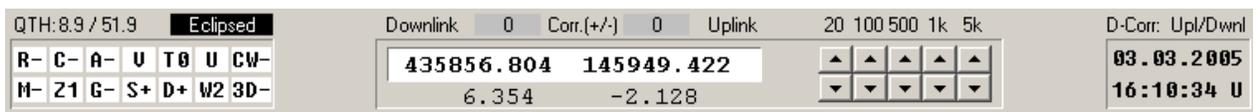
When the control 'G' is activated, the ground track of the satellite's next orbit will be displayed. The distance between 2 dots corresponds to a 2-minute time interval. Clicking the control once (the caption shows 'Gt') will display the groundtrack temporarily for a few seconds, clicking the control two times (the caption shows 'G+') will display the ground track constantly.

b. Clicking the '3D' control will display the world maps in a 3D view mode (the Earth appears as a globe). The function only works with the program window size settings of 600 \* 800 and 1024 \* 768 (with the 640 \* 480 setting the window would be too small to display the globe). The 3D view function supports all graphical options which can be chosen with the 2D maps: displaying of multiple satellites, Sun line, ground track, direction arrows, etc. The Zoom2 function is not supported, however.

c. In the Header line, the following information is shown:

- The program name 'SatPC32'. The addendum 'Ya', 'Ic' or 'Ke' indicating the brand of the radio used for CAT tuning,
- the name of the Satellite Group, of the actual satellite and its identification letter.

d. Below the menu bar you will find



- The observer's location (longitude, latitude),
- whether the satellite is in the sun or in the earth shadow,
- the transceiver frequencies in kHz,
- the Doppler correction for transmit and receive frequencies in kHz. Their value depends on the satellite frequency and the satellite speed relative to the observer. The + or - sign preceding the receiving frequency (value at the left) indicates that the satellite is moving towards the observer or moving away from him. At maximum proximity the value changes from positive to negative, at maximum distance the opposite occurs. So, if the

RX value is positive, the received signal is higher in frequency than the nominal frequency and the TX frequency has to be negative to assure that the TX signal, corrected by the Doppler effect, reaches the satellite at its nominal receiver frequency.

- the frequency adjustment in Hz via the CAT menu options.  
Frequency adjustment of the uplink frequency can be achieved with the up/down controls in the "CAT" menu, with the +/- keys on the main keyboard for 10 Hz steps or with the +/- keys on the numeric block for 100 Hz steps. The adjustment is only valid for the satellite to which it has been applied and remains in effect until it is voluntarily changed or if the program is closed.  
The Downlink adjustment can be done with the up/down controls in the "CAT" menu or with the up/down keys on the numeric block in steps of 10 Hz (with keys 8/2) and 100 Hz (with keys 9/3).  
All corrective values will be reset to 0 when another satellite is selected or for the next pass of the same satellite.
- the selected mode for Doppler correction (see remarks in the "Mode" menu)
- Date and time in UTC or local time.

Below the world map, data relating to the actual satellite are displayed in text form. If the satellite is in hearing range, the text color is enhanced.

Azimuth	Elevation	MA	Height	Range	L	SSP	B	Orbit	Squint	Aos	Los	A	B	C	D	E	F
77.9	40.1	237.9	1450	2013	27	53	38642	--	----	17:57		G	H	I	J	K	L

Here you can see:

- Azimuth and elevation of the satellite,
- its MA value. Satellite orbits are usually divided into 256 equal time slices. In practice, the MA value is essentially useful for satellites with pronounced elliptical orbits (Phase III satellites) where mode changes are performed at predetermined MA values. For such satellites MA 0 relates to perigee (closest point to earth), MA 128 to apogee (greatest distance from earth), and MA 256 is identical to MA 0.
- Satellite height over ground,
- Satellite distance from the observer in km,
- Latitude and Longitude of the subsatellite point (i.e. the point where the satellite is in zenith),  
the Squint angle. This angle is only shown for satellites allowing its calculation. After reentry of AO-13, only satellites with their Z-axis pointed directly toward the center of the earth fall into that category (KO-23, KO-25, and UO-22).
- next AOS (Acquisition of signal) and LOS (Loss of signal) times and the satellite's maximum elevation in that pass . For satellites in hearing range, only LOS is shown.

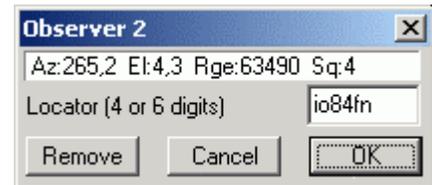
Below SatPC's graphical display, a rectangular area containing letters (A-L) is shown. By pressing these letters you can switch the active satellite. For satellites in hearing range the corresponding letters are shown in enhanced color.



Clicking on the world map with the left mouse key will display the locator of the mouse pointer position. Clicking on the map again will stop the function.



Clicking on the 'Obs' menu or pressing the 'Space' bar will display a window that allows to enter the locator of a 2<sup>nd</sup> observer. Azimuth, elevation, range and squint angle of the actual satellite, regarding to this location then will be displayed in the window.



## 2. Wisat

The program calculates the positions of selected satellites and displays the results in list form. Calculations are performed in one-second intervals. The main difference to SatPC32 consists in the lack of graphical functions as well as some restrictions regarding the CAT steering (see D4 below) and various settings (see D7 below)

The following data will be displayed:

- The program header showing the Group- as well as the selected satellite name.

In the row below the header :

- The observers location,
- whether the satellite is in the sun or in the earth shadow,
- the frequencies the transceiver is set to (in kHz),
- Doppler shift for transmit and receive frequencies in kHz,
- The frequency adjustments made through the adjustment function,
- the Squint angle,
- Date and Time in UTC or local time.

The list shows the following:

- The satellite name as it appears in the Kep file,
- Azimuth and elevation of the satellite. For satellites in hearing range, the data are shown in enhanced color.
- MA-value of the satellite,
- Height over ground in km,
- Longitude and latitude of the subsatellite point,
- the Squint angle,
- Next AOS and LOS times.

Details can be found in the SatPC instructions above (C.1)

### 3. SatPC DDE interface

SatPC includes a DDE interface (which must not be confused with the DDE interfaces that can be activated in the 'Options' menu, see below **D. 7.**)

This interface is constantly active and can be used by any third party client program to receive the name of the selected satellite, the rotor positions (azimuth, elevation), the downlink and uplink frequencies and modes and the MA value calculated by SatPC32. The DDE string is updated every second. It has exactly the same format as the DDE string of Wisp32.

With the auxiliary file "DivOptions.SQF" (to be opened from the "?"|Auxiliary files) menu, different options for the DDE output stream can be chosen:

- a. The user can select whether the interface shall send data constantly or only when a satellite is in range (elevation > 0). If the satellite is in range, the program sends the related data. If it is out of range, the program will send the message: **\*\* No Satellite \*\***
- b. The user can select whether the converter / transverter offsets should be subtracted if they are contained in the transmitted frequency.

For example, when a 13-cm beacon signal is received via a 2-m/13-cm Downconverter, the radio must be set on a 2 m frequency. When the interface outputs the 2-m frequency (instead of the satellite's downlink frequency), the client can send the frequency data directly to the radio and must not care about the offset, The file "DivOptions.SQF2 contains detailed instructions about its use.

To establish the DDE link with SatPC32 the Client has to set the DDE parameters as follows:

Server name: SatPC32,  
DDE Topic: SatPcDdeConv,  
DDE Item: SatPcDdeltem.

The program package includes demo programs (EXE-files and source code in Visual Basic and Delphi) that show how to read the DDE output of SatPC32 and how to determine the DDE-Topic and DDE-Item properties in the client program. For details see the subfolder 'DDE\_Demo' in the SatPC32 main folder.

To run the demo programs first start SatPC32, then start VB\_Client.Exe or Delphi\_Client.Exe in their subfolder, then click the 'Open Link' button.

The program "TxController" included in SatPC (from program version 12.2 on) is a client program that receives data via the DDE interface (see the subfolder "TxController" in the SatPC program folder).

## D. Program operation

Unless otherwise stated, the following instructions are valid for both programs. These make use of the Mouse to select Menu functions, mark options or enter data. Only a few functions require keyboard use.

### 1. 'File' menu

#### a. 'Open'

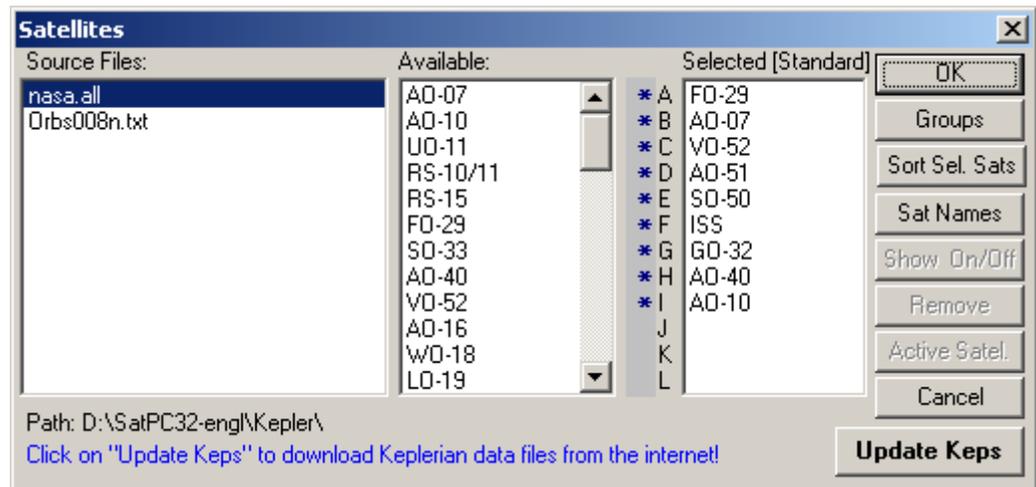
This menu pops up a dialog field where you can select a separate Kep file for each satellite Group.

For orbit calculations, the programs recognize Kep files in either AMSAT or Nasa-2-line format. Such files can be found on local packet radio mailboxes, on the Internet or can be downloaded from satellites like UO-22, KO-23 and KO-25. SatPC automatically recognizes the data format and no file editing is required.

Name and path of the selected Kep file are stored separately for each Satellite Group and remain valid for subsequent program starts.

For detailed instructions how to work with Keplerian data files read the file **FAQs**, section 2

**Attention:** To guarantee that the selected file remains in use for future starts, you must return to the 'Satellite'



Menu after a first start and click OK. This has to be done for each Satellite Group. The available Kep files in the selected directory path are also shown in the 'Satellite' menu. If a Kep file with more recent data is available, you simply select it in the 'Satellite' menu.

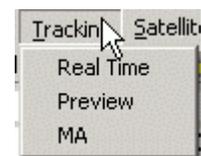
### b. 'Quit' menu

Program closing is also achieved through this menu. Then, the last window position on the screen will be saved. By using the 'Close program' cross in the upper right of the window, position saving will not occur.

## 2. 'Tracking' menu

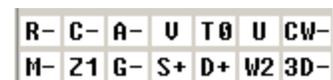
### a. Real time operation

This is the most important mode in regular practice. Calculations for the actual satellite and its data display are performed in one-second intervals. Graphics are updated at intervals dictated by the 'Options' menu settings. For other selected satellites, a one-second-interval check is made to see whether an AOS or LOS has taken place. For satellites with a priority setting (see below), a check is made to determine whether the minimum elevation angle has been reached.



Automatic antenna tracking and frequency tuning as well as the automatic switch to a satellite with a priority setting can only be done in this operating mode.

During real time operation, the following sub-functions can be enabled/disabled or controlled by clicking the "letter" buttons:



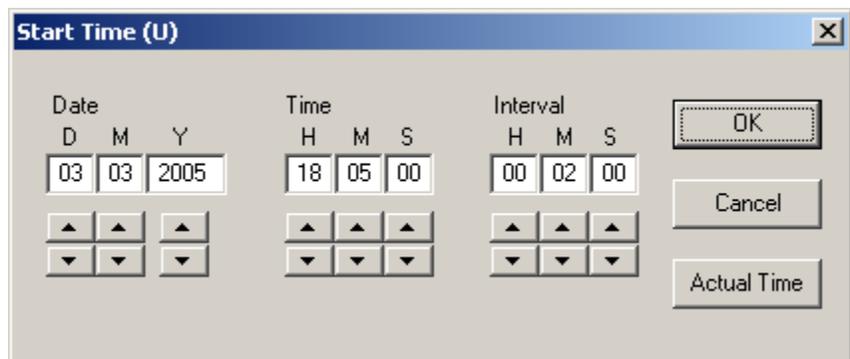
<b>R</b> Rotor control (automatic antenna tracking).	<b>C</b> CAT tuning (automatic Doppler tuning).
<b>A</b> Automatic satellite switching.	<b>V</b> VFO tuning (for tuning across the passband of a transponder while Doppler tuning is enabled).
<b>T0</b> Subaudible tone. For satellites such as SO-50 that require a subaudible tone on the uplink. Refer to the manual to determine if/how your radio model supports this function.	<b>U (or L)</b> Toggles the time display between UTC and Local time.
<b>CW</b> Toggles between SSB and CW mode. This control is deactivated when the radio is in FM mode.	<b>M</b> Multiple satellite display.
<b>Z1</b> Zoom map display.	<b>G</b> Ground Track for the next orbit. Clicking once (Gt) displays the ground track for a few seconds. Clicking twice (G+) displays the ground track continuously. The distance between 2 points corresponds to a 2-minute time interval.
<b>S</b> Sun terminator and satellite eclipse indicator.	<b>D</b> Direction arrows indicating the movement of satellite footprints.
<b>W</b> Window size. Scrolls through the 3 available program window sizes.	<b>3D</b> 3D world maps (toggles between 2D and 3D map display) The 3D map is not available when the smallest program window size is selected.

For additional Graphics choices, please refer to the instructions in the 'Options' menu (C II 7b).

By clicking on one of the letters below the graphic display, you can switch the actual satellite. Such a change may also be performed by clicking on the satellite name in the 'Satellite' menu (or by marking the satellite name in the satellite list) followed by a click on the 'act. Satellite' button in the 'Satellite' menu.

### b. Preview

With this option you can display the actual satellite's orbit evolution (and that of other selected ones) for a chosen time interval and for time steps between one second and 12 hours.

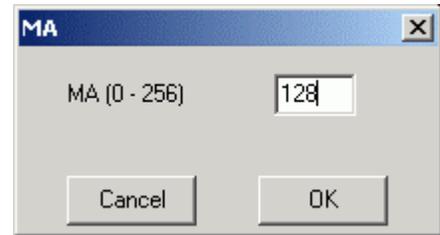


By calling up this function, a dialog field for time entries pops up. Below the menu bar in the upper left corner, a small window with two arrows appears. By clicking on the arrows, future or past orbit positions can be displayed. Further, the control 'F' is displayed. It can be activated and deactivated by clicking on it. When it is activated the time increment between the calculations is 5 times as high as normal to enable fast navigation.

Satellite switching, selected satellite and ground track display as well as zoom factor change, window size change and switching into 3D-view mode will become effective at the next time step.

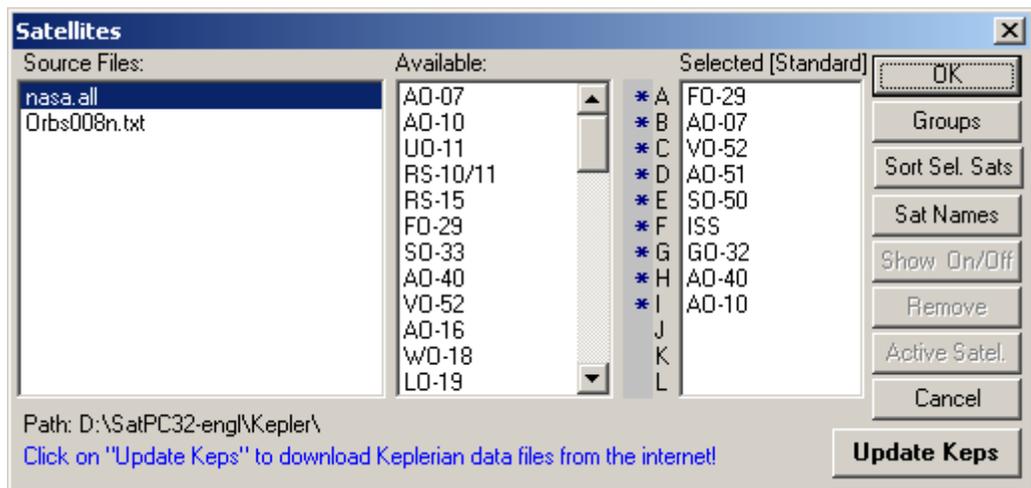
### c. MA-value preselection

This function allows you to preset an MA-value. The program calculates the precise time at which that value is reached. The MA value meaning has already been described under C.1. above.



### 3. 'Satellite' menu

This menu opens a window with three dialog fields. Instructions concerning the Kep files have already been given under 1. above.



First, select a Kep file from the list in the left field. If you mark a Kep file and click the OK button, the filename is saved for later program starts. If a new file is added, you only need to mark its name and click the OK button. If the file does not contain the name of at least one selected satellite (see below), the OK button is blocked. In that case you either need to change the Kep file or select different satellites.

The middle field displays a list of satellites for which the Kep file contains data. To transfer a satellite into the list on the right field (selected satellite list), double-click the satellite name or mark the satellite name followed by a click on any button. The same procedure applies if you decide to discard a satellite from the list.

The selected satellite list can contain a maximum of 12 satellites.

By clicking on a satellite name (highlighting) in that list, three menu options will be activated:

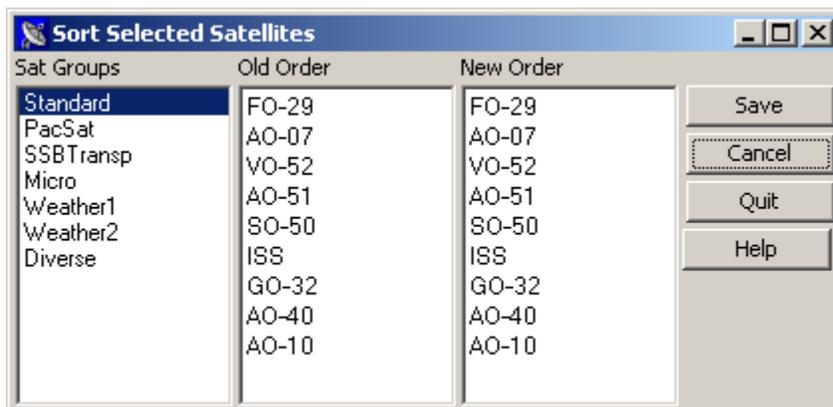
The 'Remove' button will remove a satellite from the list.

With the 'Show On/Off' button you can display the satellite on the world map provided the 'M' function (below the menu bar in the upper left of the screen) is activated. A star

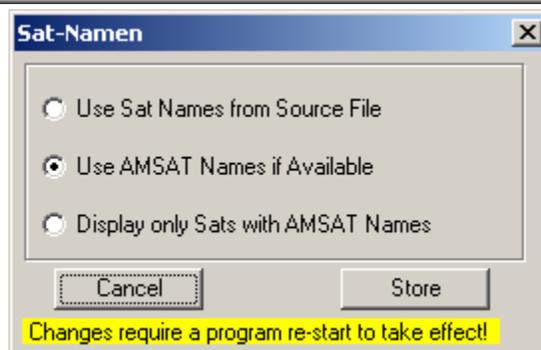
then precedes the satellite's identification letter. Clicking the OK button saves all selections.

To select the actual satellite, mark its name and click the 'act. Satellite' button.

With the button "Sort Sel. Sats" a dialog window can be opened which allows to change the order of selected satellites. Using 'Drag & Drop' a satellite can be moved to a new position in the right list of that window. The changes require a program restart to take effect.



The button 'Sat Names' will open a sub menu which provides options regarding the handling of satellite names by SatPC32. These options are intended to be used with Space-Track TLE files. The satellite names in these files are often different from the AMSAT satellite names and usually much longer and therefore rather unhandy. With the options of this menu the user can choose whether SatPC32 shall



- use the original satellite names from the source file, or
- replace these names by the corresponding AMSAT names if an AMSAT name is available and leave the original name if not, or
- display only satellites for which an AMSAT name is available.

The program takes the AMSAT satellite names from the file AmsatNames.txt in the SatPC32 program folder. This file can be opened from the SatPC32 menu '?' | 'Auxiliary Files' and edited with Notepad, for example, to update the file when a new satellite is available.

The aforementioned options can be used with source files up to 1200 data lines or 250 satellites, for example Space-Track bulk files of amateur or weather satellites. With very long files, for example the Space-Track "Full Satellite Catalog" files with thousands of satellites, use the SatRename program to create a new Keplerian data file of normal size.

By clicking the 'Sat-Groups' button, a list showing the available satellite groups is displayed. By double-clicking on a group or highlighting a name and clicking the OK button,



you can switch to another group. If you wish to edit a group, mark its name and click the 'edit' button.

The control 'Update Keps' allows to download Keplerian data files directly from the program. This is the easiest method to update Keplerian data.

When you click the button a window will open, showing the list of download addresses of some Keplerian data files. At delivery these are the Celestrak files 'amateur.txt' and 'noaa.txt' and of the AMSAT file 'nasa.all'.

To add the addresses of other files edit the text file 'Celestrak.SQF' in the SatPC32 program folder. Add only addresses of Http servers (addresses that start with 'Http'), however. The function doesn't support **direct** downloads from FTP servers (addresses that start with 'FTP'). Downloads from these servers via a Http server are possible, however. The file 'nasa.all' on the AMSAT FTP server. I.e., can be downloaded via the Http server.

For detailed instructions how to update Keplerian data read the **FAQs** file, section.

#### 4.CAT menu

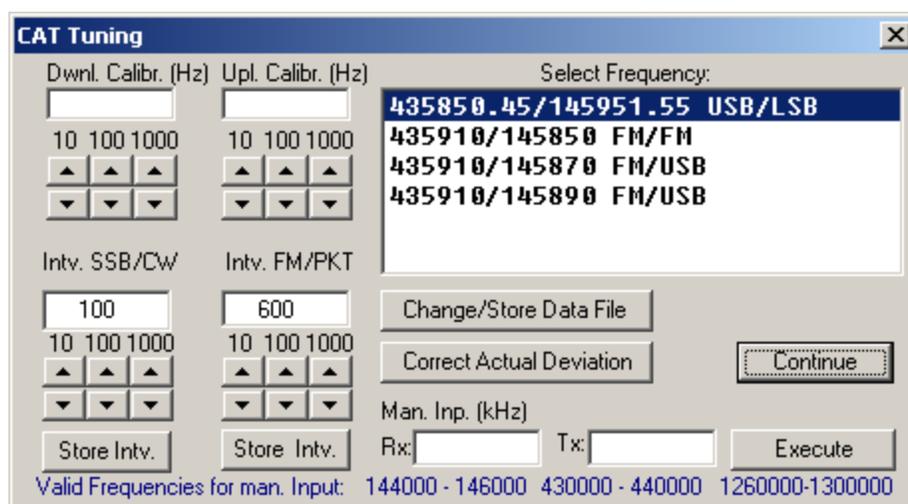
CAT tuning is only possible with satellites whose frequency settings are contained in the Doppler.SQF file. More information about that file will be given later (section "Auxiliary files").

**a.** The RX and TX frequencies can be put in manually within the indicated limits. In

that case, automatic tuning will be disabled to avoid involuntary frequency changes. Re-activation of automatic tuning is achieved by clicking on the 'C' field in the upper left corner of the screen.

**b.** Different steps of CAT tuning intervals can be selected. In FM mode, this setting is not critical. In SSB mode however, the step-value should not exceed 100 Hz because the pitch change due to such a frequency drift is already clearly audible. Values between 50 and 80 Hz seem to be a good compromise for both modes.

The satellites' Up- and Downlink frequencies are usually located in different bands. The higher of those frequencies is used by the program to determine whether the frequency interval has been reached.



The Yaesu FT-817, FT-857, FT-897 transceivers however are an exception as the program will update the lower band frequency only when the Doppler shift of this band has changed within the chosen interval. Since most satellites are using the lower band for uplink, the program needs to adjust the uplink frequency only at about every third update, hence reducing the number of VFO switching by about two thirds.

c. On the FT-736R, in FM mode the precision of automatic frequency tuning can be observed on the S-meter's centre tuning indicator. On the FT-847 in FM mode you can watch the discriminator status display selected through menu # 34.

ICOM radios use LEDs as a centre tuning indicator. However, these are not as precise as Yaesu's mechanical S-meter.

Any lack of precision can be balanced by entering a corrective value. With SSB satellites, this is done by calibrating the uplink frequency – except for the FT-817/857/897 transceivers. Since their own signal cannot be heard with these radios, the frequency calibration has to be done at the downlink frequency.

The efficiency of calibrations may also be followed on the S-meter's centre tuning indicator.

The uplink calibration can be set in steps of 10, 100 or 1000 Hz with the corresponding up/down controls in the "CAT" menu. The 10-Hz steps can also be set with the "normal" +/- keys, the 100-Hz steps with the +/- keys of the numeric block of the keyboard.

The downlink correction can be set with the 3 corresponding controls in the "CAT" menu, the 10-Hz steps with the up/down keys 8 and 2, the 100-Hz steps with the keys 9 and 3 of the numerical block.

For FM satellites, the downlink adjustment controls are deactivated.

FM satellites seldom need any frequency adjustments. For every receiving frequency correction, the transmit frequency is automatically adjusted by a corresponding amount.

Frequency adjustments through the 'CAT' menu have a different effect for Pacsat than for SSB operation. In Pacsat mode, the adjustment is made on the Downlink frequency by the indicated value. The Uplink frequency is then modified by a corresponding one. So, for a 70cm Downlink and a 2m Uplink, the Uplink frequency adjustment is only 1/3 of the indicated value. The assumption is that RX and TX frequencies, at the satellite as well as at the ground station, are derived from the same basic crystal frequency and that deviations between satellite and ground station have a similar effect on both frequencies.

The former does not apply to VFO operation over SSB satellites where the Uplink frequency is adjusted to allow you to change the pitch of your own signal coming back from the satellite (see below e).

In that respect, the extreme importance of the PC's clock setting should be kept in mind. For SSB operation it should have an accuracy of one second. For steep

overhead passes, Doppler shift may drift up to 60 Hz per second in the 70-cm band and an impreciseness of a few seconds may already significantly influence the pitch of your own signal.

It is equally important to use fresh Keplerian elements. These are published on a weekly basis by most packet radio mailboxes, the internet and satellites, for example UO-22 (for detailed information see the "FAQs" file). Keplerian elements, which are a few months old, are not suitable any more for SSB operation.

The frequency adjustments mentioned before are not permanent. They only remain in effect until the next satellite change or until the program is closed. If frequency deviations become permanent, they must be taken into account by modifying the Doppler.SQF file accordingly.

The described adjustment function may be used to find out frequency inaccuracies (see instructions for the Doppler.SQF file).

**d.** Some satellites work on multiple frequencies. If these are recorded in the Doppler.SQF file, they can be toggled by clicking them in the list shown in the "CAT" menu. This selection is not permanent either. By starting SatPC, the program always will use the first frequency pair on the list for the actual satellite. When editing the Doppler.SQF file, you should ensure that the most frequently used frequency pair is entered before any other frequency used by the satellite.

**e.** With analogue transponders (satellites which allow SSB and CW operation, for example FO-29) exact frequency data are most important to hear your own signal immediately with the right audio pitch when you select such satellite. That will probably be not the case with the frequency data that come with SatPC32. Due to hardware caused frequency deviations these data cannot be optimized for any particular equipment. Sometimes your own signal will not be audible at all with the default frequency data until you modify it slightly.

The SatPC32 CAT menu functions, however, allow you to easily determine the optimal frequency data for your equipment and to store them automatically in the Doppler.SQF file. You don't need to edit that file manually.

Please proceed as follows:

(Note: All steps aa. – ee. have to be done only ONCE! They must not be repeated at future program starts!

Note: The following does not apply to the Yaesu FT-817/857/897 transceivers. Regarding these radios, read the "Readme (Yaesu).txt" file which can be opened from the "? |Hints for..." menu.

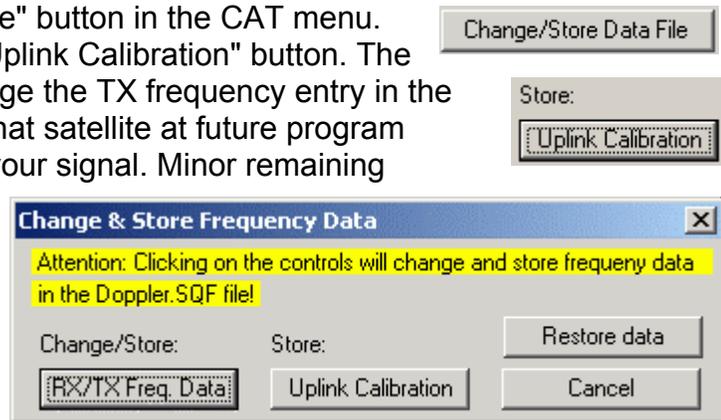
**aa.** Select the desired satellite, for example FO-29, while it is in range for your location.

**bb.** Tune the VFO to an unused frequency.

**cc.** While transmitting and whistling or sending CW signals calibrate the TX frequency with the TX correction controls of the CAT menu or the +/- keys of the keyboard until you hear your signal with the correct audio pitch. With the Yaesu FT-847 you may also use the Sub VFO knob for this step.

Caution: Do not use other methods to find your signal since the program needs to know the amount of correction to change the TX frequency accordingly.

**dd.** Click the "Change/Store Data File" button in the CAT menu. In the window that opens click the "Uplink Calibration" button. The program will then automatically change the TX frequency entry in the Doppler.SQF file. When you select that satellite at future program starts you should immediately hear your signal. Minor remaining frequency deviations may then be corrected with the +/- keys of the keyboard or the correction controls of the CAT menu. If your signal's is too high, click the "+" key, if it is too low click the "-" key



**ee.** With satellites which require an outdoor converter or transverter (at present, AO-40 with a downlink on 13 cm and an uplink on 70 or 23 cm) you will probably have to search for your downlink signal because temperature-induced frequency variations of the converter's local oscillator. These frequency variations can be 10 kHz or more.

Fortunately, SatPC32 provides a simple process to correct for daily variations in converter L.O. frequencies. The result is that you can find your signal easily on satellites such as AO-40. For this purpose the program evaluates the actual beacon frequency to determine the actual frequency deviation of the converter L.O.

Please proceed as follows:

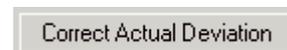
**aaa.** First select an unused frequency on the transponder. Correct your TX signal as described above (step cc) until you hear your signal with the right audio pitch. Then store the TX correction (step dd above).

**bbb.** Tune the VFO to the beacon frequency until you receive the beacon signal with zero beat. Then click the "Change/Store Data File» button in the CAT menu. In the window that opens click the "RX/TX Freq. Data".



Steps aaa and bbb typically only need to be done once, when initially calibrating the Doppler tuning for your converter(s) and transceiver.

**f.** When you select that satellite (for example AO-40) at future program starts, the program will immediately tune the RX to the expected beacon frequency (considering the actual Doppler shift). But you will likely not immediately hear the beacon signal, at least not with zero beat, due to frequency changes of the converter L.O. (caused by outdoor temperature changes).



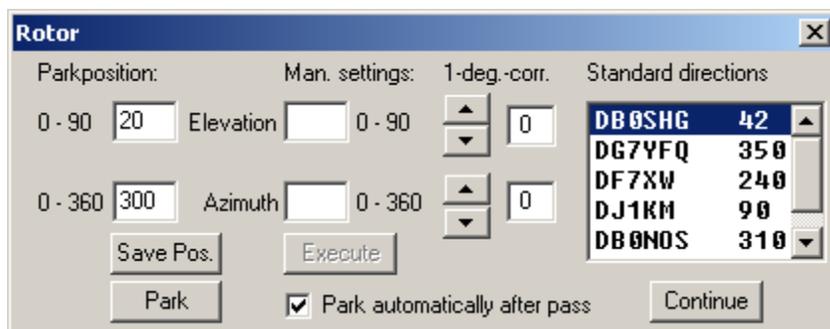
Therefore tune the RX VFO to the beacon signal until you receive it with zero beat. Then click the "Correct Actual Deviation" button in the CAT menu. The program will then automatically correct your uplink frequency (but will not store that correction value). Tune the VFO to an unused frequency. Now you should hear your signal with the right audio pitch or close to it.

Step f typically needs to be done at the beginning of every AO-40 operating session, in order to calibrate the Doppler tuning software to "today's" downconverter L.O. frequency. By using this procedure, there is no need to transmit excessively to find your signal on the AO40 downlink. Your transmit signal should be within 500 Hz of "perfect" on the first transmission if you have followed these steps carefully.

Please, see also the FAQ.htm file (section "AO-40 operation") and the explanations at the end of the Doppler.SQF file.

### 5. 'Rotor' menu

By calling up the Rotor Steering dialog field through the corresponding menu item, different antenna tracking functions can be selected.



a. You can select an antenna position by hand. Automatic tracking is then disabled in order to avoid an involuntary automatic back setting of your antenna. By clicking the 'R' button in the upper left of the screen you can reactivate automatic tracking. Antenna settings made by the program can be modified in one-degree steps in every direction. However, as the resolution of the AMSAT rotor interface is higher than one degree, the rotor does not move at every step. Moreover, rotor inertia compensation built into the program may lead to a delay in activating this function.

b. By clicking the 'Park' button you can park the antenna in a selectable position. To specify the parking position enter azimuth and elevation in the 'Parkposition' text fields. Click the 'Save' button to store the settings. When the option 'Park antenna automatically after a pass' is checked the program will steer the antenna to the parking position when the satellite's elevation drops below the 'minimum angle' (see auxiliary program SatSetup, default: -3 degrees).

c. Antenna settings made by the program can be modified in one-degree steps in every direction. However, as the resolution of the AMSAT rotor interface is higher than one degree, the rotor does not move at every step. Moreover, rotor inertia compensation built into the program may lead to a delay in activating this function. Corrections made by this function are not permanent but remain only valid until the program is closed. Permanent corrections have to be made through the 'SatSetup' menu.

This function is also used for test purposes, for instance to check the right value of the rotor steering delay in SatSetup. If the rotors correctly follow the single steps (with the

above-mentioned exception), the delay value is sufficiently high. However, it should not be set higher than necessary to avoid that the LEDs on the interface will flicker in automatic mode, even if the satellite's position did not change accordingly. You can check this by selecting 'tracking by intervals' and then track a Phase III satellite which changes its position very slowly. As long as the satellite's position does not actually change, the LEDs on the interface should not show any reaction.

## 6. 'Mode' menu

With the 'Mode' menu, different options for Doppler correction can be chosen.

### aa. Up- and Downlink frequency correction

With this setting, the frequencies at the satellite remain constant. If two stations use this setting, they basically can hear each other during an entire satellite pass without frequency adjustment, despite the fact that frequency drift due to Dopplershift is different for each of them.

The situation is basically the same as for Pacsat operation: All stations arrive with the same frequency at the satellite despite different Dopplershift values and all stations hear the same frequency transmitted by the satellite.

An additional advantage is that several stations operating at different frequencies maintain the same frequency interval between each other. The QRM to be expected is therefore smaller than with the options below.

This method should definitely be preferred to all other methods provided that both QSO partners use automatic Doppler correction.

### bb. Uplink frequency correction only

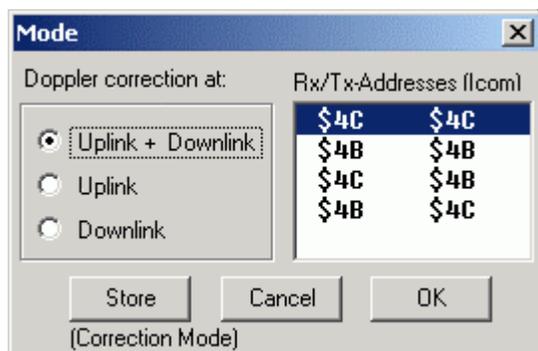
That method is widely used for QSOs with stations without automatic frequency correction. They only need to adjust the Uplink frequency but not both. In principle, no manual adjustments are needed if both QSO partners use automatic frequency correction, provided that Doppler shift drift is similar for both stations. This is the case if they are not too far away from each other.

### cc. Downlink frequency correction only

The same principles apply as in bb. above.

The setting of the correction method can be seen above the date display. The selected mode can be saved through the 'Mode' menu.

Pacsat operation is done on fixed frequencies. As the correction method under aa. is the only one to be considered, it will be set automatically if you switch to such a satellite. However, it can be modified manually. The same applies to the VFO mode (see below).



For ICOM gear, the menu comprises a list containing address pairs for different radios as shown in the IcomPar.SQF file. The selection is done by a mark in the list followed by an OK. Please read the 'Hints[Radio]' file for Icom users for information how to utilize the menu 'Mode' with separate radios for Uplink and Downlink. The file can be displayed from the SatPC32 menu '?'.

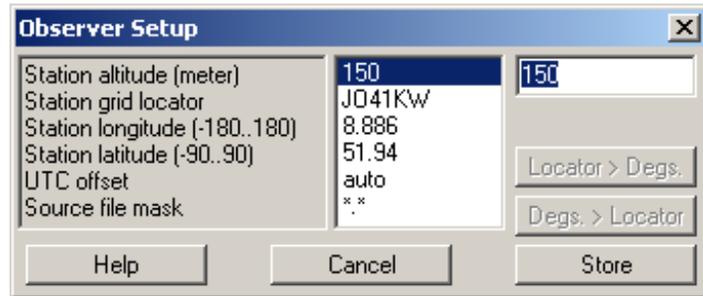
## 7. 'Setup' menu

This menu includes 4 sub menus:

Note: From program version 12.2, some options (which do not appear in the sub menus of the "Setup" menu) can be changed in the auxiliary file 'DivOptions.SQF', see D 10 and F 9 below.

### a. Observer

Opening this menu starts the auxiliary program **SatSetupObs.Exe**. Enter the location's altitude above sea level in meters and the location's geographical position. Enter either the locator (6 digits) or longitude and latitude.



The 'Observer Setup' dialog box contains the following fields and controls:

Station altitude (meter)	150	150
Station grid locator	J041KW	
Station longitude (-180..180)	8.886	
Station latitude (-90..90)	51.94	
UTC offset	auto	
Source file mask	*.*	

Buttons: Help, Cancel, Store, Locator > Degr., Degr. > Locator

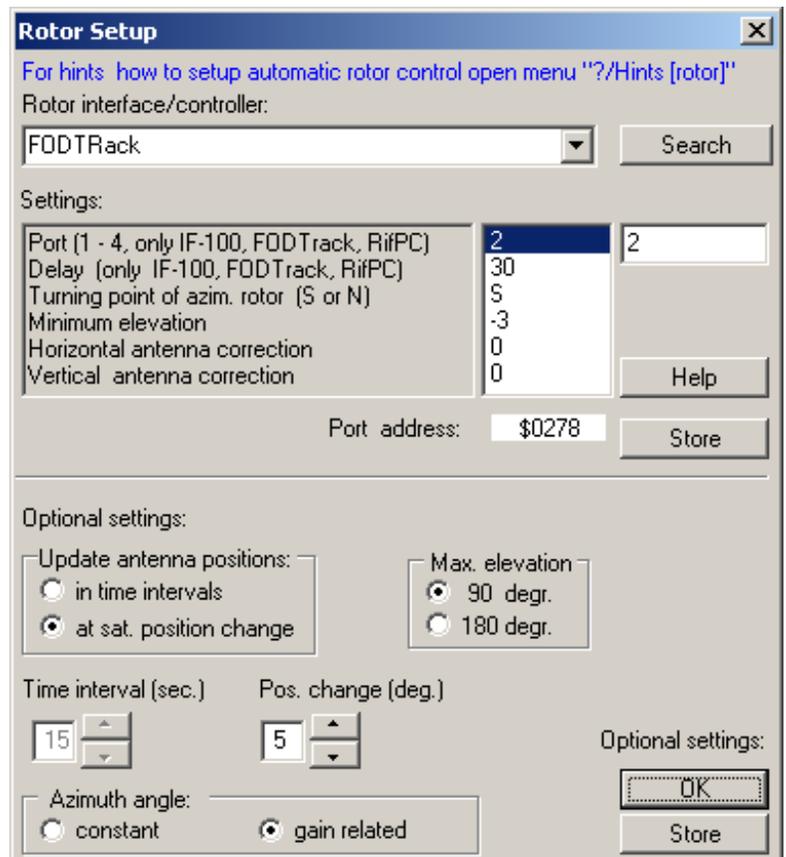
Further, enter the UTC offset (time difference between UTC and your local time). If you keep the setting 'auto' the program will take the offset automatically from the Windows time zone setting.

Finally, you may determine a file filter for Keplerian Element files. For detailed instructions mark the value of the particular item, then click on 'Help':

### b. Rotor Setup

All settings concerning rotor steering can be done in this menu.

With the SatPC menu '? | Hints[rotor]' you can display detailed instructions regarding all interfaces supported by SatPC and how to setup the program for particular rotor hardware. The menu itself contains instructions for all necessary entries in the upper section of the menu. To display them, select the value of the particular item in the right list and click the 'Help' button.



The 'Rotor Setup' dialog box contains the following fields and controls:

For hints [how to setup automatic rotor control open menu "?/Hints \[rotor\]"](#)

Rotor interface/controller: FODTRack [Search]

Settings:

Port (1 - 4, only IF-100, FODTrack, RifPC)	2	2
Delay (only IF-100, FODTrack, RifPC)	30	
Turning point of azim. rotor (S or N)	S	
Minimum elevation	-3	
Horizontal antenna correction	0	
Vertical antenna correction	0	

Buttons: Help, Store

Port address: \$0278 [Store]

Optional settings:

Update antenna positions:  in time intervals  at sat. position change

Max. elevation:  90 degr.  180 degr.

Time interval (sec.): 15 [up/down]

Pos. change (deg.): 5 [up/down]

Optional settings: [OK] [Store]

Azimuth angle:  constant  gain related

The menu contains 2 sections:

**aa.** In the upper section you can select the rotor interface or controller you want to steer from a list. To select a device click on the control of the combo box. In the list that opens click on the corresponding item. Then click on the (upper) 'Store' button.

Note: In former program versions the driver files had to be copied into the SatPC32 program folder. From vers. 12.4 this is no longer required.

If you are using an ARS, HalloRotor or WinRotor interface SatPC32 expects the driver files to be in the standard folder of the rotor software. If the driver file can't be found there the program will display an error message. Click on 'Search' and navigate to the driver file and mark it's name. Then click on 'Store' to save the server file's name and path.

With some interfaces which work at the PC's parallel port (IF-100, RifPC, FODTrack) the port address and a delay value must be entered. Since fast PCs would output the data too fast for these interfaces a delay value must be determined to slow down the data output. For proper delay values see the **FAQs** file, section 4.

The item 'Rotor turning point' has to be set with the IF-100 and FODTrack interfaces, the KCT Tracker and the Labjack U12. The other interfaces don't evaluate this item.

The items 'Minimum elevation' 'Antenna correction horizontal' and 'Antenna correction vertical' are evaluated by all interfaces and controllers.

**Important:** Changes in the upper section of this menu require a program restart to take effect.

**bb.** In the lower section of the menu 'Rotor Setup' several options for rotor control can be chosen:

You can decide whether the tracking should be initiated at certain time intervals or upon satellite position changes (angular change). Interval- as well as angular variations, at which horizontal or vertical tracking adjustments will occur, can be freely chosen. For LEO satellites I personally use 10 second intervals and a 5 degree angle (Antennas: 70cm: 2x21 el., 2m: 2x9 el.)

For horizontal tracking based on angular change, you can choose constant angle- or gain dependent triggering. At high elevations, the satellite's azimuth varies very rapidly. By choosing constant angle, the antenna will therefore be adjusted very often. This is not necessary because the horizontal beam angle of the antenna virtually gets also bigger at high elevations. The gain loss due to an azimuthal error therefore becomes smaller with increasing elevation. (At 90-degree elevation, the azimuth is without any significance). By choosing the setting 'Gain dependant', the program adapts the horizontal tracking angle to the given elevation value. Therefore, the number of tracking steps of the horizontal rotor will be drastically reduced without any gain loss.

This option should be the preferred one for LEO satellite operation. The time interval option is suited for Phase III satellites, as the rotor activation rate does not harm the

rotors. By setting the correct delay value, the interface only reacts if the satellite's position change is higher than the resolution of the interface (0.7 degrees vertical, 1.4 degrees horizontal).

Under all tracking options, the rotors are activated with a precession of one half step, either one half of the time interval or one half of the tracking angle, to ensure that the satellite moves through the antenna focus.

Any change in the tracking options is immediately effective.

With the Option menu setting "Max. Elev" you can specify whether the range of elevation rotor motion should be limited to 90 degrees or 180 degrees.

**Warning:** Do not select the '180' option unless you are sure that your antenna system allows 180 degrees elevation rotation. Problems may be caused by lack of space, short cables or moisture (if the antenna is not waterproof from the bottom side).

The '180' option enables 'Flip mode' which is helpful to minimize loss of transponder access when the satellite passes the azimuth turning end-point during a pass. Without 'Flip Mode' the azimuth rotor must rotate 360 degrees to continue tracking when the satellite crosses the azimuth rotor's end point. With flip mode enabled, the program steers the azimuth rotor to the opposite direction of the satellite's azimuth position and the elevation rotor to an elevation of 180 degrees minus true elevation. Consequently, the azimuth rotor only needs to rotate 180 degrees when the satellite crosses the azimuth rotor's end point.

SatPC32 will always begin tracking a satellite with 'normal' antenna tracking, and will only enter flip mode if the satellite crosses the azimuth rotor's end point. The color of the 'R' control changes to yellow when the rotor is in flip mode to warn that the elevation exceeds 90 degrees, and that the rotor controller's azimuth meter is 'off' by 180 degrees.

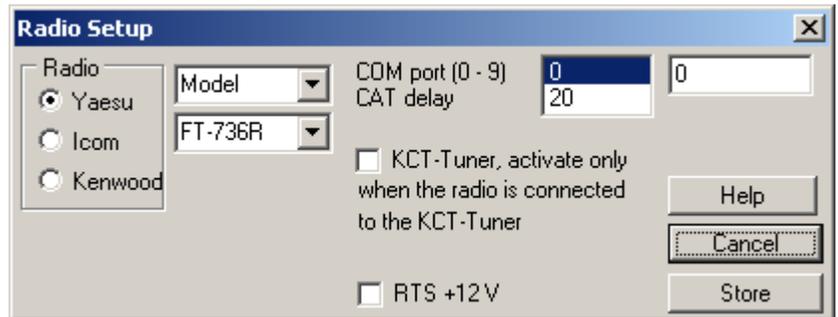
With the 450-degree-south-centered azimuth rotor Yaesu G-5500 the option '450°' can be chosen instead of Flip mode. With this setting the program utilizes the additional 90-degree-sector between North and East. This way the program avoids with several passes the 360-degree turn the rotor has to run when the satellite crosses the user's meridian in the North. The option is only available with south-centered 450-degree azimuth rotors and only when flip mode is off. The program recognizes automatically whether utilizing the additional 90 degree-sector is indicated for a particular pass or not.

**Important:** Changes in the lower section of the menu will immediately take effect. When you click the 'OK' button changes will be valid until the program becomes terminated or new options are chosen. Click the 'Store' button to save changes for future program starts.

### c. Radio Setup

All setting concerning the CAT steering can be done in this menu.

With the SatPC menu '? | Hints[Radio] ' you can display detailed instructions regarding the **Yaesu**, **Icom** and **Kenwood** radios how to connect the radio to the PC and how to set the parameters for CAT control. Additional detailed hints can be found in the **FAQ** file, section 3.



First select the COM port to which the radio is connected. If no COM port is available leave set the COM port number to 0. If you are using the KCT Tuner for CAT control check the option 'KCT Tuner'.

**Attention:** When this option is checked no CAT output will be sent to a COM port, even if a COM port is selected!

Enter the CAT delay value. For proper values see sect. [B.II.3](#) ('Radio Settings').

Then select the radio brand (Yaesu, Icom, or Kenwood) and set the particular parameters for the radio. Proceed as follows:

Click on the control of the lower one of the 2 combo boxes. The list of supported models will be displayed. In the list click on the model you want to select.

Then click on the control of the upper one of the combo boxes. In the list that opens click on 'Baud rate'. Open the list of the lower combo box and select the proper baud rate. Select the highest baud rate supported by the radio. Don't forget to set the same baud rate at the radio.

With the Icom radios the device address also has to be set. With the TS-2000 you can additionally decide whether you want the radio to start with the tracking function ('TRACE') on or off.

The option 'RTS +12V' allows to switch the RTS line (pin 7 of the 9-pin, pin 20 of the 25-pin serial port) 'high'. This voltage can be used to feed CAT interfaces which don't require an external power source.

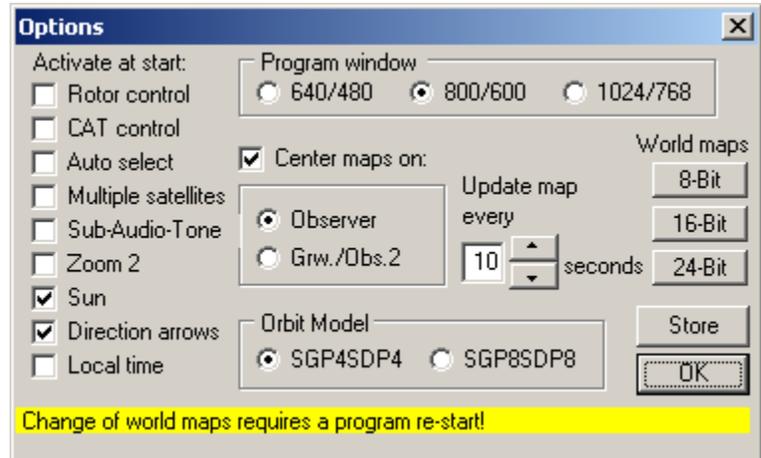
When the option 'Satellite mode' is checked SatPC32 will automatically switch satellite transceivers FT-847, IC-910H and TS-2000 into 'Satellite' mode. With the FT-847 and the IC-910H this function can be disabled by unchecking this option. When separate radios are used for Uplink and Downlink it can be useful to run these radios in non-satellite mode.

When all changes are finished click on the 'Store' button to save the settings.

**Important:** Changes in this menu require a program restart to take effect.

#### d. Options

**aa.** You can decide whether times shall be displayed in UTC or local time, whether automatic antenna steering, CAT tuning, automatic satellite change (refer to instructions for the Prior.SQF file), should be activated at program start. With SatPC, the display of all selected satellites, the sun line, the zoom factor and displaying of direction arrows and ground track can be pre selected. Any changes become effective only at the next program start.



**bb.** With screen resolutions of 800\*600 (or larger ) you can choose the window size of the SatPC main window. 3 window sizes are available (640 \* 480, 800 \* 600 and 1024 \* 768). Also, you can make the choice whether you want to use the 8-, 16- or 24-bit bitmap sets.

**cc.** For the standard display of the world map in SatPC, you can choose whether the horizontal bearing of the map should be centered on the subsatellite point of the actual satellite, the observer's location or the longitude 0 (Greenwich). These changes come immediately into effect. To become permanent, they have to be saved.

**dd.** SatPC updates the graphical window in selectable 'intervals' (default: 10 seconds). This interval can be chosen in this menu, too.

**ee.** For orbit calculations SatPC32 is using the Pascal implementation of the NORAD SGP4/SDP4 model by Dr. T.S. Kelso. At the time being the NORAD Keplerian Element Sets are based on the SGP4/SDP4 model. So, using the SGP8/SDP8 model will be no improvement. However, the option 'SGP8/SDP8' allows to use this model for test purposes.

**ff.** Changes in this menu will immediately take effect, except changes of the Orbit calculation model and the 'Activate at start...' options. Logically these options will only be evaluated at the program start.

Clicking the 'OK' button will not save changes. The program will use them until it is terminated or other settings are chosen. To use changes permanently click the 'Store' button.

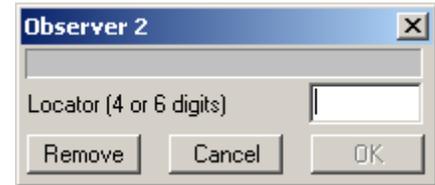
## 8. 'Programs' menu

The 'Program' menu allows other programs to be loaded. The program names are stored in the 'Program.SQF' file. They have to be located in the SatPC directory, otherwise a path indication has to be put into the Autoexec.bat file. At delivery, Notepad, SatSetup, WinAos and WinListen are present.



## 9. 'Obs' menu

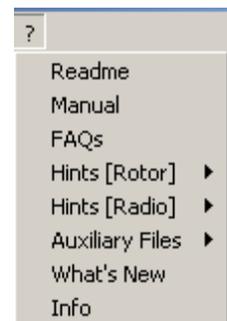
With this menu a window is opened that allows the entry of the locator for a second observer. This window can be opened by pressing the 'Space' bar. The locator has to be entered either with 4 or 6 digits. The entry is finished by clicking on the 'OK' button or pressing the 'Enter' key.



The location of the 2<sup>nd</sup> observer then will be marked in the world map by a cross. Azimuth, elevation, range and squint angle of the actual satellite, regarding to the second location, then will be displayed in the window. Clicking on the 'Remove' button or pressing the '-' (minus) key will stop the function and remove the cross from the map. Clicking on the 'Cancel' button or pressing the 'ESC' key will hide the window but not remove the cross.

## 10. '?' menu

a. With this menu the Readme text file, the Manual.htm file and the FAQ.Doc file can be opened. Hints for users of Yaesu, Icom and Kenwood radios can be displayed.



b. The menu contains a sub menu 'Auxiliary files'. The following SatPC32 auxiliary files can be edited only manually. With this menu these files can be opened with Notepad.

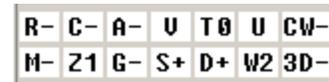
Doppler.SQF,  
Squint.SQF,  
Prior.SQF,  
ParPort.SQF,  
Program.SQF,  
Standpos.SQF,  
SatFiles.SQF,  
SubTone.SQF,  
DivOptions.SQF.

For more information see the hints in section 'Auxiliary Files'. The files themselves also contain hints how to be modified.

c. Finally, with this menu info window can be opened that contains data about the author as well as addresses about where to purchase the program.

## 11. 14 Control areas

Below and on the left of SatPC's menu bar, there are 14 small control areas. With these you can activate or deactivate



<b>R</b> Rotor control (automatic antenna tracking).	<b>C</b> CAT tuning (automatic Doppler tuning).
<b>A</b> Automatic satellite switching.	<b>V</b> VFO tuning (for tuning across the passband of a transponder while Doppler tuning is enabled).
<b>T0</b> Subaudible tone. For satellites such as SO-50 that require a subaudible tone on the uplink. Refer to the manual to determine if/how your radio model supports this function.	<b>U (or L)</b> Toggles the time display between UTC and Local time.
<b>CW</b> Toggles between SSB and CW mode. This control is deactivated when the radio is in FM mode.	<b>M</b> Multiple satellite display.
<b>Z1</b> Zoom map display.	<b>G</b> Ground Track for the next orbit. Clicking once (Gt) displays the ground track for a few seconds. Clicking twice (G+) displays the ground track continuously. The distance between 2 points corresponds to a 2-minute time interval.
<b>S</b> Sun terminator and satellite eclipse indicator.	<b>D</b> Direction arrows indicating the movement of satellite footprints.
<b>W</b> Window size. Scrolls through the 3 available program window sizes.	<b>3D</b> 3D world maps (toggles between 2D and 3D map display) The 3D map is not available when the smallest program window size is selected.

In the 'Options' menu you can determine the default state for most of these options.

In Wisat, the M, Z, G, S, D, 3D and W functions are absent as they refer to the graphical functions.

### Appendix: VFO mode

The VFO mode is only useful for SSB operation. Therefore, it will be automatically activated if an SSB satellite is selected and automatically deactivated if you switch back to a Packet satellite. The automatic setting can be changed manually.

With the VFO mode on all radios supported by SatPC32 can be tuned via the VFO knob ("transparent tuning") as well as by the PC.

There are 2 restrictions for tuning via VFO:

This function does not work with the KCT Tuner (since the module ServerKCT does not support reading functions). The radio therefore needs to be connected to a COM port. Further, the function does not work with the Yaesu FT-736R, since its VFO frequency can not be read by the PC.

The frequency adjustment by the PC has to be done through the CAT circuits. This is achieved by clicking the 5 up/down buttons with the mouse. They allow frequency steps of 20, 100, 500, 1000 and 5000 Hz.



The same frequency steps can also be entered with the keyboard. All related keys are located in the middle block:

- 20 Hz: right and left arrow keys
- 100 Hz: up and down keys
- 500 Hz: insert and delete keys
- 1000 Hz: home and end keys
- 5000 Hz: page up and page down keys

By keeping the mouse key or a keyboard key pressed, the band will be scanned at approximately 10 steps per second.

For fixed frequency operation, the VFO function is meaningless, but it can always be activated or deactivated manually.

The program also supports 'transparent' mode switching (only Icom radios, FT-847, TS-2000). When the downlink mode of the radio is changed, the program automatically corrects the uplink mode.

A different satellite can be selected by clicking on a letter in the field below the graphic display in SatPC, or on the left border in Wisat.



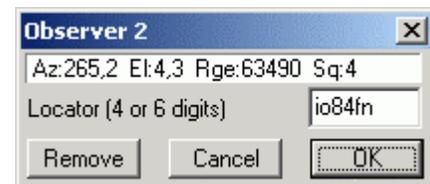
If you select a satellite while another with higher priority is present, the program switches automatically to the latter. To avoid this, this feature has to be deactivated with the (A)utomatic satellite change) function (A-).

**13.** Clicking on the world map with the left mouse key activates a function that displays the locator of the mouse pointer position in the map. To disable the function also click on the map.



**14.** To enter a locator press the 'Space' bar. An input window will be opened. Enter the locator with either 4 or 6 digits. Then press 'Enter' or click on the 'OK' button. The function will display a cross in the world map at the position of the locator.

To remove the entry press the 'Space' bar again and then the 'Minus' key ('-') or click on the 'Remove' button.

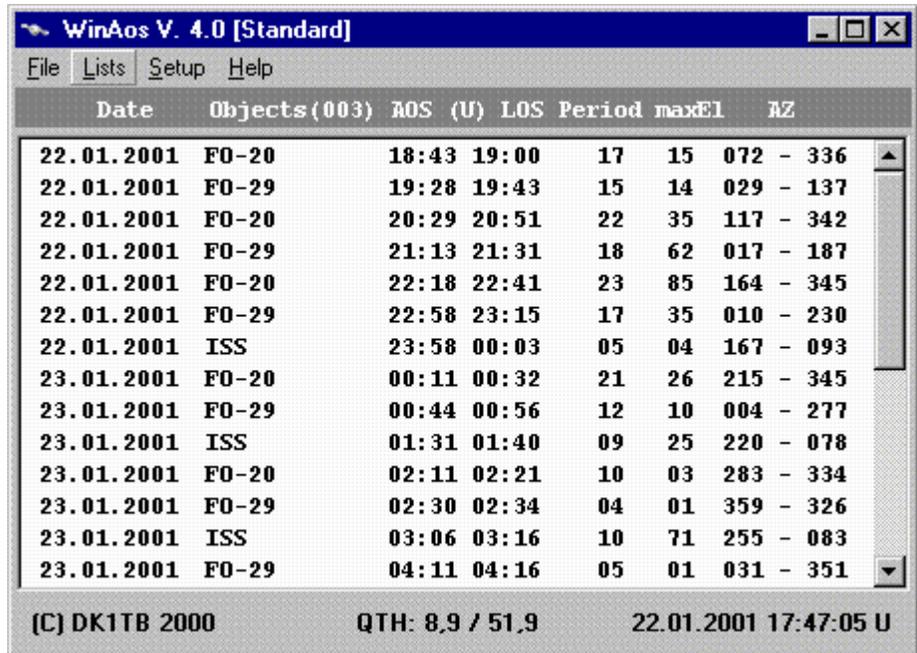


## E. Auxiliary programs

1. The **SatSetup** program is no longer needed with SatPC32. This program can be setup using the sub menus of the menu 'Setup'. Nevertheless SatSetup can still be used with SatPC32, Wisat32 and SatPC32ISS.

Changes with SatSetup will also change the settings of the SatPC32 setup menus. SatSetup contains all necessary instructions for data entries.

2. The auxiliary programs **WinAos**, **WinListen**, **SatRename**, **TxController** and **SortSats** also hold their own instructions. By closing these program with the "Quit" button, the last screen position will be saved.



The screenshot shows a window titled "WinAos V. 4.0 [Standard]" with a menu bar containing "File", "Lists", "Setup", and "Help". The main area displays a table with the following columns: "Date", "Objects(003)", "AOS (U)", "LOS", "Period", "maxEl", and "AZ". The table contains 16 rows of data for the date 22.01.2001 and 23.01.2001. The status bar at the bottom shows "(C) DK1TB 2000", "QTH: 8,9 / 51,9", and "22.01.2001 17:47:05 U".

Date	Objects(003)	AOS (U)	LOS	Period	maxEl	AZ
22.01.2001	F0-20	18:43	19:00	17	15	072 - 336
22.01.2001	F0-29	19:28	19:43	15	14	029 - 137
22.01.2001	F0-20	20:29	20:51	22	35	117 - 342
22.01.2001	F0-29	21:13	21:31	18	62	017 - 187
22.01.2001	F0-20	22:18	22:41	23	85	164 - 345
22.01.2001	F0-29	22:58	23:15	17	35	010 - 230
22.01.2001	ISS	23:58	00:03	05	04	167 - 093
23.01.2001	F0-20	00:11	00:32	21	26	215 - 345
23.01.2001	F0-29	00:44	00:56	12	10	004 - 277
23.01.2001	ISS	01:31	01:40	09	25	220 - 078
23.01.2001	F0-20	02:11	02:21	10	03	283 - 334
23.01.2001	F0-29	02:30	02:34	04	01	359 - 326
23.01.2001	ISS	03:06	03:16	10	71	255 - 083
23.01.2001	F0-29	04:11	04:16	05	01	031 - 351

## F. Auxiliary files

For data storage, SatPC uses a series of auxiliary files identified by the .SQF extension. Most of them are automatically generated by the programs; others have to be edited manually with an editor like Notepad. By editing a file, it is essential not to modify the file format. Be careful not to add blanks or blank lines, especially at the end of the file. The end of file sign has to be inserted immediately behind the last entry. For decimal markers, the point has to be used.

The comma is used to separate multiple parameters as can be seen in the DOPLER.SQF file.

The following files can only be edited manually:

### I. Files which can be opened by the SatPC32 '?' menu

The following files can only be edited manually. They can be opened in the SatPC32 '?' menu with Notepad:

Doppler.SQF	ParPort.SQF	SatFiles.SQF
Squint.SQF	Program.SQF	SubTone.SQF,
Prior.SQF	StandPos.SQF	DivOptions.SQF

These files themselves contain instructions how to be modified. The following sections contain further detailed instructions.

## **1. Doppler.SQF**

This file contains all data required for the CAT tuning to operate. CAT tuning only works for satellites whose frequencies are contained in the file. To use the program's tuning functions during VFO operation, these data are also needed.

The Doppler.SQF file delivered with the program already contains the most popular satellite data. Editing these file only becomes necessary if those data have to be changed or if new satellites have to be added.

To edit the file you need to enter:

- The name of the satellite
- The receive- and transmit frequencies in kHz
- The Up- and Downlink modes
- The frequency trend of the satellite (normal or reverse)
- The converter and transverter offset frequencies

As a general rule, all 7 parameters have to be present, even if some of them are irrelevant for a particular satellite. In that case the unused data may have any value. If the receiving frequency is the only one needed (UO-11), the transmitting frequency has to be set to 0.

For satellites using multiple frequencies or frequency pairs, the name has to be repeated each time. At program start, the first file encountered for a specific satellite will be used. By editing the file, you should therefore pay attention to put the most used frequency as a first entry in the list.

For Pacsats, their nominal frequencies can be put in.

The frequency entries for SSB transponders (FO-20, FO-29, AO-10, and AO-40) are somewhat critical.

Due to temperature influences and hardware related deviations between satellite and transceiver you probably will not immediately hear back your own signal, when you switch to the satellite.

With SatPC, however, the optimal frequency entries in the Doppler.SQF file can be determined and stored easily. To do this you do not need to edit

The Doppler.SQF file manually.

Please, read the FAQ.htm file (which can be opened with the SatPC32 "?" menu), section 5 "AO-40 operation" for detailed instructions.

With satellites like FO-20, FO-29 you probably will immediately hear your own signal (even with the right audio pitch) when you switch to that satellite later on.

With satellites that require an (outdoor) converter or transverter like AO-40 you probably will have to search for your signal at any program start, however, mainly due to the frequency changings of the converter (transverter) L.O., caused by the outdoor temperature changes. With the CAT capabilities of SatPC, however, you will find your signal easily. For detailed instructions see the FAQ.htm file, sect. 5, "AO-40 operation".

If a new satellite is available, you may copy the entry of another satellite and modify the entries for the new one. For the RX and TX frequency you may enter the nominal passband center frequencies (for FO-20, FO-29, i.e., you would have to enter 435850.0, 145950.0). After you have found your own signal, correct the uplink frequency as described above.

Furthermore, operation modes for Uplink and Downlink have to be entered by using the symbols already shown in the file. Possible mode symbols are: USB, LSB, CW, FM, and FMN.

For FM and FMN mode, VFO operation is automatically disabled, but can be reactivated manually.

**Attention:** if you operate a FT-736R with a standard FM-filter, the FM symbol has to be entered for FM operation. If you have replaced the narrow FM filter by a broader one (20kHz) as I did it like many others, you need to replace all FM symbols in the Doppler.SQF file by FMN

For the frequency evolution, the symbols NOR and REV have to be used.

The 2 last Parameters of the Doppler.SQF lines contain the converter and transverter offsets in kHz.

The FT-736R can operate on 2m and 70cm as well as on 23 cm with an optional module. ICOM transceivers operate on 2m and 70cm. For the higher bands, converters and transverters are required. In that case, the final operating frequency has to be put into the Doppler.SQF file, otherwise calculations would be wrong. As the transceiver requires a frequency in the 2m or 70 cm band, the program needs to know the frequency offset of the converter / transverter.

For 2m/70cm frequencies the offsets are preset to 0, since these bands usually don't require converters/transverters.

The entries for AO-40 contain examples of a 13cm/2m down-converter and a 70cm/23cm up-transverter.

The offset that has to be entered is equal to the crystal frequency of the converter/transverter.

## 2. Squint.SQF

This file contains the names and parameters of satellites that allow squint angle calculation. These are

**a.** the ones whose Z-axis always points to the center of the earth (i.e. UO-11, UO-22, KO-25). Enter "v" (without quotation-marks) as first parameter behind the satellites name and set the two following parameters to 0.

**b.** the spin-stabilized satellites.

Since ALON and ALAT are time dependent, the first parameter has to contain the day, to which these values refer. Use the format: ddmmyyyy. The following parameters contain ALON and ALAT.

Example: AO-40, 17032002, 337, 0 (but see the following section!)

### c. AO-40

At present, AO-40 is not a "normal" spin-stabilized satellite. Due to the "Mystery effect" its attitude is not stable but has constantly to be corrected by the command stations. Actually, the entries in the Squint.SQF file therefore would require constant updates. The file itself contains hints, how to avoid this effort. To open the file click the SatPC32 "?" menu item. In the list that opens click the "Auxiliary files" item and select "Squint.SQF".

### 3. Prior.SQF

The program performs automatic satellite switching for satellites with a priority setting. This works as follows: If no priority satellite is in hearing range, the program switches to a priority satellite as soon as that satellite's elevation reaches the minimum elevation angle, provided the satellite effectively comes into hearing range.

If during the hearing range of a priority satellite, another one with higher priority shows up, the program switches to that one, but only at elevation 0 to avoid reception time losses. If a priority satellite reaches LOS, the program switches to a lower priority satellite, provided it is in hearing range.

The file contains the names and priority degree of the satellites with a priority setting. A maximum of 9 satellites can be entered. The satellite with the highest priority 1 has to be first in the list, the satellite with priority 2, second etc. If the program is used in conjunction with WiSP, priority settings in both programs have to be the same.

### 4. ParPort.SQF

The file contains the parallel port addresses of your PC which are required for the rotor steering. The entry is done in hexadecimal form, therefore the value has to be preceded by a dollar sign (\$). At delivery, \$378, \$278, \$3BC and \$ 2BC are put in. If your system uses different values, these have to be entered in ParPort.SQF to replace the standard values. Some systems use the above values in a different order. In that case too, the file may be modified accordingly.

The port addresses as well as their assignment to LPT1, LPT2 etc. can be found

a) under Windows 95/98 and Windows 2000 in the control panel (Start- Settings - Control Panel - System - Ports - Resources)

b) under Win NT with WinMSD (Resources - I/O - ParPort -Properties). WinMSD is delivered with Windows NT and can be loaded with Start - Execute.

Only the basic value has to be entered.

Normally, your PC has not more than two parallel ports. In that case you should keep the entries in lines 3 and 4. Otherwise an erroneous setup of the port number in SatSetup may lead to an error warning of the system at program start.

### 5. Program.SQF

This file contains the names of the programs that can be called up from SatPC. The program name has to be entered without its extension and has to be present in the SatPC directory or in a directory whose path is contained in the AUTOEXEC.BAT file. A maximum of 10 programs can be entered.

## **6. StandPos.SQF**

This file contains callsigns of stations to which the antenna position should be set through the 'Rotor Steering' dialog field. The callsign and the azimuth angle have to be entered; elevation is automatically set to 0.

## **7. SatFiles.SQF (WisFiles.SQF, AosFiles.SQF)**

These files contain the names of the Satellite Groups that have been installed for the respective main program. A maximum of 12 groups are allowed for SatPC32, Wisat32 and WinAos. For each entry in the list, a file with the same name has to be present in the SatPC32 directory. Depending on which main program uses the file, its name must contain the extension '.Sat', '.Wis' or '.Aos'. The names of the satellites selected for each group are stored in these files. If you want to add a group, a file with the same name and with the related name extension has to be created. To do this, you can copy the 'Standard.sat' file, rename it and edit it in the Satellites menu.

## **8. SubTone.SQF**

This file contains the names and parameters of satellites that require a subaudible tone on the uplink signal for access. At present, the only satellites of this kind are SO-50 and AO-51. The file itself contains detailed hints how to be used.

## **9. DivOptions.SQF**

This file allows program settings in addition to those found in the "Options" menu, related to the "general" DDE interface and the use of multiple program starts.

The user can select whether the DDE interface shall output data constantly or only when the satellite is in range (default setting).

Also, he can select whether the frequency values sent by the interface will include possible converter/transverter offsets.

The file also allows to select whether the rotor and CAT steering functions will become disabled from the 2<sup>nd</sup> program instance on.

With the Yaesu FT-817, FT-857 and FT-897 transceivers the user can select, whether the program will only track the downlink (which can be useful if 2 of these radios are used) or both the downlink and uplink

The file itself contains detailed hints about the different settings.

## **10. AmsatNames.Txt**

This file contains the Amsat names of actual amateur satellites. SatPC32, Wisat32, WinListen, WinAos and SatRename evaluate this file to replace the satellite names used in the Space-Track TLE files by AMSAT satellite names. The file itself contains detailed hints how to be used.

## **II. RotorServer.SQF, CatServer.SQF**

As mentioned earlier, rotor- and CAT data can be directed to a DDE interface. These files contain the name of the respective server programs without the .exe extension. 'WinRotor32' and 'CatServer32' are preset in RotorServer.SQF and CatServer.SQF respectively.

The subdirectories of other compatible hardware contain the required files with their respective server names. You only need to copy them into the SatPC32 directory. If necessary, the server name may be modified manually.

### **III. Further auxiliary files**

In these files SatPC stores the settings for the radio (brand, model name, specific parameters).

The settings can be selected in the 'Options' menu.

#### **1. YaesuPar.SQF (for Yaesu only)**

The two first lines contain values in hexadecimal form for two frequency steering commands. The values are set automatically by the program.

The third line contains the Baud rate between PC and CAT system in decimal form.

The Baud rate for the FT-736R has to be set to 4800 Bd. For the FT-847 4800, 9600 or 57600 Bd. are allowed. The FT-847 comes with a preset of 4800 Bd. This can be changed through menu #37.

The fourth line contains the name of the Yaesu transceiver (FT-736R or FT-847).

At delivery, the programs are preset for the Yaesu FT-736R.

#### **2. IcomPar.SQF, IcomName.SQF (for ICOM only)**

These files contain the settings for Icom radios, which have been selected in the 'options' menu.

Please read the detailed instructions in the 'Readme (Icom).txt' file text in the ICOM subdirectory.

At delivery, the file comes with the settings for the IC-821H.

#### **3. KenwoodPar.SQF (for Kenwood only)**

This file contains the settings for Kenwood radios, which have been selected in the 'options' menu.

Please read the detailed instructions in the 'Readme (Kenw).txt' file in the Kenwood subdirectory.

At delivery, the file comes with the settings for the TS-2000.

\*\*\*\*\* DK1TB \*\*\*\*\*