MacDoppler

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MacDoppler for Cocoa was re-written from the ground up to take full advantage of all the great Cocoa capabilities in OS X on PPC as well as Intel hardware. MacDoppler will provide any level of station automation you need from assisted Doppler Tuning and Antenna Pointing right on up to fully automated Satellite Gateway operation.

MacDoppler for Cocoa carries on the rich tradition pioneered by MacDopplerPRO which is in use around the world by Amateur Radio operators, satellite spotters, educators and commercial customers from CBS News to the International Space Station Amateur Radio Hardware Management program, Delta Telemetry Tracking and Control at Integrated Defense Systems, Florida State University and the Cal-Poly Cube-Sat Project.

Features

• Automated internet download of keplerian elements.
• Track List sorted in real-time order of next pass.
• Full predictive dead spot crossing so that a pass is never interrupted by the beam heading passing a dead spot.
• Speech advisory of next satellite Rise and Maximum Elevation.
• Horizon Window shows upcoming passes on a time line.
• Built in support for Satellite Gateway using Ontrak ADR101.
• Tuning Dial Tracking allows you to tune the downlink from your radio's front panel while MacDoppler automatically adjusts the uplink.
• QSO Logging integrated with MacLoggerDX.

Acknowledgments

• Design assistance and moral support - Lou McFadin W5DID.
• High resolution Blue Marble Next Generation maps courtesy NASA.
• High resolution Natural Earth III maps courtesy Tom Patterson.
• Quesa is a high level 3D graphics library, released as Open Source under the LGPL, which offers binary and source level compatibility with Apple's QuickDraw™ 3D API. Quesa does not contain any Apple source code, and was developed without access to Apple's QD3D implementation.
Intended Audience

A familiarity with macOS, Amateur Radio, Satellite Tracking, Computer Aided Tuning (CAT) control is assumed. Further information about these topics can be found here…

- **macOS**
  

- **Amateur Radio**
  
  [http://www.arrl.org](http://www.arrl.org)

- **Amateur Radio Satellite Tracking**
  
  [https://www.amsat.org](https://www.amsat.org)

- **Computer Aided Tuning (CAT)**
  
  [http://www.9a2gb.net/interfacing-ham-radio-ep/](http://www.9a2gb.net/interfacing-ham-radio-ep/)
2D Map Panel

(Note: Make sure you have at least one satellite in the Track List to display)
MacDoppler

Controls

+ and - buttons allow you to change the map resolutions from 1024x512 up to 8192x4096.

Track List check box enables the display of all the tracked satellites rather than just the next one visible.

Follow Sat popup will choose between Follow Sat - automatically scrolling to include the geographical position of the next satellite, Follow Site - staying centered on your site (in either case you can scroll away momentarily and the map will snap back in a few seconds), or None - manual scrolling.

The disclosure triangle will hide the Horizon/Track List and Radio/Rotator Panels to allow more screen space for the map.

The virtual time slider will allow you to step forward or back in time (if you hold the Option key while moving the slider the maximum time offset will be +- 7 days instead of +- 6 hours). The radio and rotor will not be commanded while you are dragging the slider thumb but will update to the virtual time situation when you release it.

Under the MacDoppler Menu, the Bearings command will display a Heads Up Display panel with the next satellite's name, the bearing from your site to the satellite, (the length of the indicator indicates the elevation), the range and if your rotor supports it an indicator of current rotor bearing in green.
3D Map Panel

(Note: Make sure you have at least one satellite in the Track List to display)

Controls

The disclosure triangle will hide the Horizon/Track List and Radio/Rotator Panels to allow more screen space for the map.

Camera POV popup selects the camera point of view (above satellite, above site, behind satellite).

The Z slider will control the camera distance.

The A slider will control the ambient lighting level.

Dragging the mouse pointer over the display will move the camera in the X (longitude) and Y (latitude) directions.
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If you hold down the **command** key, the mouse pointer will move the camera in the X and Z (altitude) direction-
s. When you release the drag, the camera will snap back to it’s original position unless you hold down the **shift**
key at mouse up time.

**Colors**

The actual satellite sphere (which is artificially larger than scale for practical reasons) is grey when it is in eclipse -
no sunshine.

When it is illuminated by the sun and not eclipsed by the earth the satellite is shown as yellow.

The ground coverage circle and ground coverage spot colors are related to the visibility of the satellite from the
ground location. The ground coverage circle is shown in red when the satellite is visible and green when not visi-
ble.
The **Track List** panel displays the satellites in the current track list sorted automatically in the order of upcoming visibility. The Columns can be reordered or resized by dragging the column header or column header margins.

### Controls

**Add Satellite** popup allows you to add any satellite from your keplerian database to the track list.

**delete** button allows you to remove any satellite from the Track List.

**Track List** check box determines if MacDoppler will automatically switch to the next visible satellite or continue to track only the selected satellite. Disable this check box if you want to select one specific satellite to track.

If two or more satellites are all visible at the same time and the Track List is enabled the satellite with the highest priority (lowest number) will be tracked.

### Column Headings

**Check Box** Enables/Disables Satellite tracking for this satellite.

**Satellite** Satellite Name from keplerian elements.

**Priority** User assigned priority.

**Next Pass** Time till next Rise.

**Rise** Local or UTC time of next pass (Set in Options Menu: UTC Display).

**Length** Length of upcoming pass, or remaining time while visible. (hh:mm:ss).

**Azimuth** Current azimuth in degrees.

**Elevation** Current elevation in degrees.
ΔE
A + sign indicates that the satellite's elevation is increasing.

Max E
Maximum elevation during next pass in degrees.

Latitude
Current latitude of sub-satellite point in degrees.

Longitude
Current longitude of sub-satellite point in degrees.

Altitude
Current altitude of satellite in kilometers.

ΔA
A + sign indicates that the satellite's altitude is increasing.

Range
Current range from satellite to site location in kilometers or miles (see site settings).

Phase
in ticks (0-255), specifies the mean angle of the Satellite on an orbit ellipse at a particular time, assuming a constant mean motion throughout the orbit. It is the angle which describes the position of the Satellite relative to perigee. At perigee, the Mean Anomaly is zero, it increases to 180 degrees at apogee (128 ticks), then back to perigee at 360 degrees (255 ticks). For circular orbits, the Phase is the angle between perigee and the current satellite position.

Squint
If BLat and BLon values are entered in Modes preferences for this satellite, Squint Angle is the angle in degrees between the line from the Satellite to your station and the line from the satellite down the bore site of it's antenna.

Planar Cr
Time till next planar crossing.

Max Elev
Local or UTC time of Satellite’s maximum elevation. (hh:mm:ss).

Apogee
Local or UTC time of Satellite’s Apogee, or “N/A” if Apogee does not occur while the satellite is visible from your location. (hh:mm:ss). Note: This corresponds to a Phase of 128 ticks or 180 degrees.

Set
Local or UTC time of Satellite Set. (hh:mm:ss).

Velocity
of the Satellite relative to the site in km/sec or miles/sec (see site settings).

Eclipse
Sun if the satellite is illuminated by the Sun, else Drk.

ΔEclipse
Time (hh:mm:ss) until change of eclipse from Sun to Drk or Drk to Sun.

Orbit
Orbit number of the Satellite.

Path Loss
Path loss of the Satellite. Standard "Friis" equation for free space loss between isotropic radiators.

Index
Index number of satellite in keps database.
Horizon Panel

The Horizon Panel plots the tracked satellites’ upcoming elevation in the Y axis (0-90) against time in minutes in the X axis.

Colors

The color coding in the Horizon window relates to the maximum elevation of the pass - and the colors combine as they overlap.

- **Light Grey**: Satellite transponder is disabled for this pass - as in AO-27 in the morning
- **Medium Grey**: Max elevation > 0 degrees
- **Blue**: Max elevation > 30 degrees
- **Orange**: Max elevation > 60 degrees

If the satellite is disabled of not tracked during those hours the graph for that satellite will be greyed out.

The horizontal green line displays the minimum elevation that was set in the Site Preferences Panel.
Radio Panel

The Radio Enabled checkbox controls the connection to the radio interface.

If the up link/down link frequency numbers in your Modes preferences are slightly off simply disengage the VFO’s Locked check box by clicking on it. This will allow you to make fine adjustments to the up link and down link frequencies independent of one another. Several clicks on the up or down buttons are usually all that is required. The Zero Offsets button will cancel any manual offsets and will be highlighted when Tuning Dial Tracking is active. Re-engage the VFO’s Locked check box and the change you have made will track throughout that channel.

Steppers and Sliders

- Click on the up or down arrow repeatedly.
- Focus on the stepper and use the arrow keys.
- Click and hold down the up or down arrow and the control will respond continuously.
- Hover over the stepper or slider with the Magic Mouse, Track Pad (two finger scroll) or any scroll wheel mouse, without clicking, and scroll up or down.

- With the Shift Key Pressed the frequency will change 10 Hz up or down.
- With the Control Key Pressed the frequency will change 1 KHz up or down.
- With the Option Key Pressed the frequency will change 10 KHz up or down.
- With the Command Key Pressed the frequency will change 100 KHz up or down.

When the VFO’s Locked button is unchecked the VFO slider adjusts the Uplink only.

The Modes popup allows you to choose on of the modes defined in the Modes preferences panel.

the Beacon checkbox replaces the downlink frequency with the beacon frequency in the Modes database and sets the radio downlink communication mode to CW. It is only enabled when there is a beacon frequency set for that satellite in the Modes database.
Full Doppler Tuning

In accordance with common practice, in mode JA, the up link (lower) frequency is pegged and the Doppler correction for both transmit and receive is applied to the receive (down link) frequency. Conversely, in mode B the down link (lower) frequency is pegged and the Doppler correction for both transmit and receive is applied to the transmit (up link) frequency. You may also select Full Doppler to select Doppler adjustments to be made for both the up link and the down link even when in Mode JA or Mode B - this keeps the frequencies stable with respect to the transponder and no drifting through the transponder will occur. This is useful for QSO's with more than two geographical locations - but of course, all operators engaged in the QSO must be using the same method. (See 'A Recommendation for Doppler Tuning' by Ron Parsons, W5RKN, AMSAT Journal, Volume 19, #2 p 18. 1996). 'Full Doppler Tuning' is the norm for the FM birds (AO-27, UO-14 etc.) and the PacSats, so you don't have to select it from the menu when using MODE_J_FM or MODE_B_FM.
Rotators Panel

Controls

**Rotators Enabled** checkbox controls the connection to the serial port that your rotator controller is physically connected to.

**Manual Operation** checkbox allows you to remove the rotator controller from automatic control and set its azimuth and elevation manually with the **Azimuth** and **Elevation** controls.

**Manual Flip** checkbox manually sets rotor flip, but only if the **Dead Spot** has been set to **None** in the Rotator Prefs.

**Elevation:** control displays the rotators elevation (sets elevation in Manual Operation).

**Azimuth:** control displays the rotators azimuth (sets azimuth in Manual Operation).
MacDoppler

Logging Window

<table>
<thead>
<tr>
<th>Call Sign:</th>
<th>W1AW</th>
<th>Time:</th>
<th>20171207 1308:16 UTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Name:</td>
<td>ARRL HQ Operators CL</td>
<td>Satellite:</td>
<td>AO-85</td>
</tr>
<tr>
<td>Last Name:</td>
<td>ARRL HQ OPERATORS CL</td>
<td>Up:</td>
<td>435.16256 MHz</td>
</tr>
<tr>
<td>Street:</td>
<td>225 MAIN ST</td>
<td>Down:</td>
<td>145.08217 MHz</td>
</tr>
<tr>
<td>City:</td>
<td>NEWINGTON</td>
<td>Mode:</td>
<td>FM</td>
</tr>
<tr>
<td>State:</td>
<td>CT</td>
<td>Grid:</td>
<td>FN31pr</td>
</tr>
<tr>
<td>Country:</td>
<td>United States</td>
<td>Az:</td>
<td>328.27</td>
</tr>
<tr>
<td>Zip:</td>
<td>06111</td>
<td>El:</td>
<td>3.81</td>
</tr>
<tr>
<td>Email:</td>
<td><a href="mailto:W1AW@ARRL.ORG">W1AW@ARRL.ORG</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The logging Window is activated by the **Log QSO** menu item in the **Options** menu.

**Controls**

- **Lookup**
  - Will do an internet lookup on the contents of the **Call Sign:** field.

- **Log it**
  - Logs the QSO to the **log.dat** file in the ~/Documents/MacDoppler_Files/log_files/ folder. This file can be imported by MacLoggerDX.
  - Starting with Version 2.14 the QSO is also sent directly to MacLoggerDX through AppleScript.

- **Done**
  - Dismisses the Log Contact window.
Predictions Window

The Predictions Window allows you to pick a satellite, start time, optional second observer and create a tabular predictions text file...

MacDoppler Predictions: FO-29

Kep Set: 999
Times: Local Time
Location: Toronto ON Canada
Latitude: 43.7064 Degrees
Longitude: -79.2442 Degrees
Elevation: 191.0 Meters

Second Station: Las Vegas NV United States
Latitude: 36.1722 Degrees
Longitude: -115.1440 Degrees
Elevation: 0.0 Meters

Run on: 2015/03/15 07:15:51 America/Toronto

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Azimuth</th>
<th>Elevation</th>
<th>Downlink</th>
<th>Uplink</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rise:</td>
<td>2015/03/15 07:15:48</td>
<td>3.9</td>
<td>2.0</td>
<td>435.83944</td>
<td>145.96741</td>
</tr>
<tr>
<td>Max:</td>
<td>2015/03/15 07:24:41</td>
<td>299.5</td>
<td>30.4</td>
<td>435.83168</td>
<td>145.97001</td>
</tr>
<tr>
<td>Sec:</td>
<td></td>
<td>21.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set:</td>
<td>2015/03/15 07:34:14</td>
<td>233.3</td>
<td>0.0</td>
<td>435.82391</td>
<td>145.97261</td>
</tr>
<tr>
<td>Sec:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>21.2</td>
</tr>
</tbody>
</table>
# Radio Preferences

| Radio Driver: | Icom IC-9700 | Errors: 0 |
| Serial Port: | /private/tmp/dp_sym_ic_9700 | DTR |
| Baud Rate: | 115200 | RTS |

- **Enable S-Meter**
- **Enable Tuning Dial Tracking**
- **Debug Log**

**Controls**

- **Radio Driver:** Selects the driver for the type of radio you are using.
- **Serial Port:** Selects the serial port your radio interface is physically connected to.

Symbolic links to Silicon Labs CAT ports may also show up in the Port popup in italics and can be selected. These links or aliases will point to the radio CAT port and unlike the dev/cu names will not be renamed when the radio is power cycled and will be remembered in your prefs.

If the port Serial Number identifies a known radio then a symlink will be created for that radio - i.e. **tmp/dp_sym_ic_9100**, otherwise a symlink based on the port Serial Number will be created, if the port Serial Number is blank then MacDoppler will create a generic symlink for that CAT port (i.e. **tmp/dp_sym_cp_2105**)

- **Baud Rate:** Selects the baud rate your radio interface is expecting.
- **DTR/RTS**
  These check boxes should be enabled unless you are doing DTR/RTS CW Keying.
- **Icom CI-V Address:** Hex address Icom radio set to - only required for Icom radios.
- **Uplink Filter:** Seconds between uplink VFO updates in Sat mode - only required for some radios.
- **Enable S-Meter**
  Only supported on some radios.
**Tuning Dial Tracking**

Tuning Dial Tracking allows you to tune the downlink from your radio’s front panel while MacDoppler automatically adjusts the uplink. If this option is not available for a particular radio driver it will be greyed out or disabled in the Radio preferences panel. Tuning Dial Tracking will only be applied to satellite band pass USB and CW channels not single frequency FM channels. The Zero offsets button will be highlighted when Tuning Dial Tracking is available and enabled (macOS 10.10+).

Adjusting the radio’s front panel tuning dial will tune the downlink and if the **VFO’s Locked** check box is enabled, the correct uplink frequency will automatically be calculated and applied. These **Offsets** are displayed in the Radio Panel just as if they had been applied with the MacDoppler up/down buttons.

You can see what **Tuning Dial Tracking** is doing by monitoring the Offset Frequencies in the VFO Panel. At any time you can use the Zero Offset frequencies button which will return you to the doppler corrected channel frequency.

Tuning Dial Tracking reads your (filtered) changes to the downlink and changes the offsets accordingly before calculating and applying the combined doppler corrections to the uplink.

There is a filter built into **Tuning Dial Tracking** and it matters how fast you adjust the dial. Obviously this filter has more work to do when the satellite is visible and the frequency is changing rapidly than it does when it is below the horizon and we are not adjusting the frequency. MacDoppler has to read back the radio frequency and guess who is changing the frequency - you or the doppler and it does this by measuring the rate of change. The polling routines can only differentiate the source of change in frequency (front panel vs doppler correction) based on rate of deviation from the expected doppler frequency.

If you are using an Icom radio - make sure you have **Transceive Mode** turned OFF in the radio menus, the unsolicited reports will throw off **Tuning Dial Tracking**.

If **Tuning Dial Tracking** drifts, or is not working for you, you may have a communication or configuration problem with the radio or your tuning speed is being rejected by the filter. Make sure you have **DTR/RTS** handshaking enabled if your radio requires it.

If the up link/down link frequency numbers in your **Modes** preferences are slightly off simply disengage the **VFO’s Locked** check box by clicking on it. This will allow you to make fine adjustments to the up link and down link frequencies independent of one another. Several clicks on the up or down buttons are usually all that is required. Re-engage the **VFO’s Locked** check box and the change you have made will track throughout that channel. These offsets are remembered in the preferences. If you want to make the change permanent, simply edit the pairs of uplink/downlink frequencies in the **Modes** preferences.
**Quirks & Hints**

**Yaesu:**

Due to a problem with the FT-736R (see note in FT-736R manual page 36 bottom left) you may have to take MacDoppler out of CAT mode, press the REV key on the FT-736R front panel, and return to CAT mode when switching between mode U/V and V/U in Full Duplex, for example: switching from FO-20 to AO-10 and back. The SAT switch must be in one of the full duplex positions for this to work. Alternately, you could take MacDoppler out of CAT mode, use the VFO buttons to switch from U/V to V/U, and then turn CAT mode back on - this will only work if you have one VFO set to U/V and the other VFO set to V/U. If you have other modules installed in the FT-736R, you can set the 'BetweenPasses' frequencies in the modes editor to something these other modules can tune and that way allow switching from U to V and V to U automatically when the satellite changes. It does this to avoid trying to set VFO A and B to the same band. The FT-847, as originally delivered (before sn 8G052xxx), could not poll the radio for frequency and mode information. This was added beginning with the 8G05 production runs.

**Icom:**

On the ICOM radios you may have to push the 'M/S' button on the front panel to switch from from U/V to V/U and vice versa (eg from FO-20 to AO-10) when you first start the program. After that, the drivers will automatically switch the Main and Sub Bands accordingly. If due to a power glitch or crash, the ICOM gets out of sync - just push the 'M/S' button on the front panel then press the left arrow and then the right arrow on the keyboard to re-synchronize. Make sure you turn Tranceive mode Off in the radio’s menus.

To run simplex with in-band doppler correction, you must take the Icom out of Satellite mode using the front panel func-rev/nor switches. Most Icoms have trouble with in-band doppler correction while the PTT is engaged and you may have to disable the “Radio Enabled” check box while you transmit. This is not a problem with mode U/V or V/U, just U/U or V/V.

Make sure you turn off the IC-9700 AFC (Automatic Frequency Correction) when in FM Sat mode or it will interfere with MacDoppler’s frequency control.

**Kenwood:**

The TS-2000 is unable to send a tone in Satellite Mode with version 1.0.3 of the firmware and before.

Changes to the TS-2000 CAT baud rate require a radio reboot (power off and on) for the change to take effect.
Rotator Preferences

Controls

Rotator Controller: Selects the driver for the type of rotator you are using.

Serial Port: Selects the serial port your rotator controller is physically connected to.

Baud Rate: Selects the baud rate your rotator controller is expecting.

Dead Spot: Selects Norther or Southern dead spot crossing based on your rotor.

Filter Degrees: Selects a rotator degree filter. Filter Chart.

Park Rotators checkbox enables parking of the rotators between passes.

Warning Preposition rotators # minutes before pass starts.

The Azimuth: and Elevation: text edit fields allow you to set the parking position.

Park Now parks the rotators at the selected azimuth and elevation.

The Az Offset: and El Offset: will apply an offset to the calculated beam azimuth and elevation to temporarily correct for any offsets in your rotator mounting or orientation. The physical orientation should be corrected since the software offset results in a reduction of range.
Predictive Dead-Spot Crossing

If **Northern** or **Southern** is selected from the **Dead Spot**: popup Predictive Dead-Spot Crossing is enabled and it causes a line on the 2D Map window to be drawn from your location to the North pole for a Northern Dead-spot or to the South pole for a Southern Dead-spot. The line is normally blue but will switch to red if MacDoppler senses an upcoming Dead-Spot crossing (and will flip the azimuth and elevation commands it sends to the rotator controller so that the pass is not interrupted by the dead-spot crossing).

Early Warning

One minute before the satellite rises above the horizon, a warning sound and speech advisory is given (if enabled in the Site prefs) and the rotors are pre-aligned to the rising azimuth of the satellite and zero elevation in preparation for the pass.
Site Preferences

Registration

Enter your Call Sign and Registration number in the "Call Sign:" and "Registration Number:" boxes, then press return or tab out of the field. "Unregistered" will change to "Registered". Please use copy and paste to avoid typos.

Controls

+ delete and Edit buttons allow you to add to, delete or edit locations in the locations database.

Location: popup allows you to pick your location from the registration database. The location you pick will automatically set the Latitude: and Longitude:

Altitude: Site altitude defaults to 0 Meters above sea level, change with Edit button.

Defaults: Defaults button discards edits, including altitudes and new locations.

GMT Offset: is automatically determined by the location you have set in your System Settings.

km checkbox allows you to choose between kilometers and miles for all display values.

UTC checkbox allows you to choose between Local and UCT (Zulu) time for all time displays.

Speech checkbox turns the speech advisories on and off.

Sound checkbox turns the sound advisories on and off.
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**Dark Mode** checkbox enables low illumination mode (OS X 10.10+).

**Auto Update Keps** checkbox enables startup and midnight AMSAT keps download.

**Ignore passes below:** Satellite passes below the minimum elevation will be ignored.

**Map Draw Rate** popup controls the number of frames per second drawn (fps).

**Orbits** popup controls the number of orbits to display in the 2D and 3D Maps.

### Locations File

**Edit out unwanted Locations:**

1. Quit MacDoppler.

2. Edit ~/.Documents/MacDoppler_Files/data_files/user_locations.dat

3. Delete the locations you don't want and save the file (Save a copy as a backup).

4. Run MacDoppler

Note: The **Defaults** button will return the full default list to this file, without your edits.

If you have a **user_grids.dat** file in your **data_files** folder a tab-delimited list of 4 character these grids will be displayed on the 2D map if you have **Grid Squares** enabled in the 2D Map prefs or **Locations** enabled in the 3D Map prefs.

**Format:** FN03<tab>description
This preferences panel sets the frequency and mode lists for the satellites you are interested in. You can enter up to 128 frequency and mode combinations (channels) in a list for each satellite.

If no mode list record exists for a satellite a default mode list with one channel is added. You will need to edit this mode list for the actual frequencies and modes used by that satellite.

If you modify your list of satellites and mode list records you should export your mode database with the File Menu Export Modes command as a backup for possible later import.

Controls

**+** Button adds a mode entry (channel) to the selected satellite mode list.

**Delete** Button deletes just the selected mode (channel) from the satellite mode list or the entire mode list for the selected satellite (A warning is given if you try to delete the entire mode list for a satellite which is still in your active keps).

**Defaults** Button restores the “factory” default modes and keplerian elements updated periodically on our server and zeros the offset frequencies for all the satellite records. Always check the frequencies with the AMSAT web site for up-to-date frequency and mode information and download the latest keplerian elements.
**MacDoppler**

**Column Headings**

The check box indicates if the satellite is enabled for tracking in MacDoppler.

<table>
<thead>
<tr>
<th>Name</th>
<th>Channel name.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uplink</td>
<td>Base station transmit frequency in decimal megahertz.</td>
</tr>
<tr>
<td>Downlink</td>
<td>Base station receive frequency in decimal megahertz.</td>
</tr>
<tr>
<td>Beacon</td>
<td>Base station beacon frequency (CW mode).</td>
</tr>
<tr>
<td>Mode</td>
<td>Can be the following labels:</td>
</tr>
<tr>
<td></td>
<td>REPEATER</td>
</tr>
<tr>
<td></td>
<td>MIR Safex</td>
</tr>
<tr>
<td></td>
<td>J_FM</td>
</tr>
<tr>
<td></td>
<td>JA_SSB</td>
</tr>
<tr>
<td></td>
<td>FO-20, FO-29</td>
</tr>
<tr>
<td></td>
<td>B_SSB</td>
</tr>
<tr>
<td></td>
<td>AO-10</td>
</tr>
<tr>
<td></td>
<td>A_SSB</td>
</tr>
<tr>
<td></td>
<td>RS-16, non-inverting</td>
</tr>
<tr>
<td></td>
<td>SIMP_FM</td>
</tr>
<tr>
<td></td>
<td>DO-17 dove, MIR Simplex</td>
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<tr>
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<td>JA_CW</td>
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<td></td>
<td>FO-20, FO-29 CW</td>
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<td></td>
<td>B_CW</td>
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<td>AO-10 CW</td>
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<td>A_CW</td>
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<td>RS-16 CW, non-inverting</td>
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<td>AO-92</td>
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<td>AO-16 etc</td>
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<td>WIDE_FM</td>
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<tr>
<td></td>
<td>Weather Sats Downlink</td>
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<tr>
<td></td>
<td>T_SSB</td>
</tr>
<tr>
<td></td>
<td>Mode T SSB RS-12/13</td>
</tr>
<tr>
<td></td>
<td>T_CW</td>
</tr>
<tr>
<td></td>
<td>Mode T CW RS-12/13</td>
</tr>
<tr>
<td></td>
<td>AM_SIMP</td>
</tr>
<tr>
<td></td>
<td>ISS Space walk</td>
</tr>
<tr>
<td></td>
<td>SSB_SIMP</td>
</tr>
<tr>
<td></td>
<td>Terrestrial SSB</td>
</tr>
<tr>
<td></td>
<td>J_EXP</td>
</tr>
<tr>
<td></td>
<td>Echo AO-51 Mode J USB Up / FM Down</td>
</tr>
<tr>
<td></td>
<td>PACKET</td>
</tr>
<tr>
<td></td>
<td>Simplex, some radios support a separate FM Data mode</td>
</tr>
<tr>
<td></td>
<td>PACKET_DUP</td>
</tr>
<tr>
<td></td>
<td>FalconSat-3, Duplex IC-9100, IC-9700 FM Data mode</td>
</tr>
<tr>
<td></td>
<td>B_FM N</td>
</tr>
<tr>
<td></td>
<td>Narrow FM Uplink AO-85, AO-91, AO-92</td>
</tr>
<tr>
<td></td>
<td>RPT_DVM</td>
</tr>
<tr>
<td></td>
<td>IC-9100, IC-9700 DStar</td>
</tr>
<tr>
<td></td>
<td>B_DVM</td>
</tr>
<tr>
<td></td>
<td>IC-9100, IC-9700 DStar</td>
</tr>
<tr>
<td>Tone</td>
<td>CTCSS encode tone (Not supported for all radios).</td>
</tr>
<tr>
<td>CTCSS</td>
<td>CTCSS decode tone (Not supported for all radios).</td>
</tr>
<tr>
<td></td>
<td>Stored as decimal numbers in mode.dat (e.g. 67.0) MacDoppler v2.30+</td>
</tr>
<tr>
<td>Txverter</td>
<td>Transverter uplink offset.</td>
</tr>
<tr>
<td>DwnCnvrtr</td>
<td>Down converter downlink offset.</td>
</tr>
<tr>
<td>BeamW Up</td>
<td>Half power beam width of the satellite uplink antenna in decimal degrees.</td>
</tr>
<tr>
<td>BeamW down</td>
<td>Half power beam width of the satellite downlink antenna in decimal degrees.</td>
</tr>
<tr>
<td>Track Hours</td>
<td>Hours when the satellite is active 0-23 1 = active 0 = Inactive.</td>
</tr>
</tbody>
</table>
MacDoppler

These 24 characters represent the 24 hours of the day in local time. A ‘1’ signifies that the satellite is active during this hour and is eligible for tracking. A ‘0’ indicates that the satellite is inactive for this hour and if it's predicted Rise is within this hour the satellite will be ignored for that pass, and will show as light grey in the Track List.

**Speak Name:** Name for the voice advisories to "Speak".
If entered, this name will be “Spoken” instead of the designator i.e. “International Space Station” instead of “ISS”.

**BLat:** (Bahn Latitude) in decimal degrees - sometimes called "Alat".
**BLon:** (Bahn Longitude) in decimal degrees - sometimes called "Alon".
0,0 indicates the satellite antennas are pointing directly at earth at apogee

**BetweenPasses** and **OnExit**
In addition to the satellites in kepler.dat the Modes database also contains entries for Sun, Moon, **BetweenPasses**, and **OnExit**

**BetweenPasses** will set the radio between tracked satellite passes if enabled.
**OnExit** will set the radio when you quit MacDoppler if enabled.
Keplerian Elements

The TLEs (Two Line Elements) describe the satellite’s orbit, the modes describe the different frequencies and modes of operation for each satellite. MacDoppler keeps your current active TLEs and modes in the `~/Library/Preferences` folder.

The Preferences dialog displays the source of your current TLEs.

![Keplerian Elements](image)

The `~/Documents/MacDoppler_Files/data_files` file is the current (downloaded periodically from our server) factory default and is only used when you press the Defaults in the Modes prefs. This is usually only necessary if you import incorrect keps or modes or just want to throw away changes made.

The `~/Library/Preferences` keps file is updated every time you download keps either manually or automatically, the `~/Documents/MacDoppler_Files/data_files` TLE file is only updated when MacDoppler finds a newer factory default file on our server.

Kepler.dat is the satellite database. The Add Satellite popup in the Track List panel is populated directly from the current kepler.dat file. For example AO-10 is in the default mode.dat file and appears in the Modes editor but you obviously won’t find it in any recent keps. If a satellite in the keps file has no matching mode.dat entry, a default mode with 1 channel is created that can be edited in the Modes editor.

Keps are merged or overwritten based on which Import menu command you use. The Remove button removes a mode not a keplerian TLE. If you want a custom list of satellites, export your keps (or download TLE’s from some other source), edit the file and import it again in plain text format - make sure you disable automatic keps update or your list will be merged.
Gateway Preferences

This option allows you to control a gateway radio from MacDoppler using an Ontrak Control Systems ADR101 controller.

The gateway will use PA0 to control the gateway radio’s PTT and will listen to the COR on PA1 before making announcements over the gateway radio.

Pass Script

if satellite_pass.scpt is present in the ~/Documents/MacDoppler_Files/scripts/ folder it will be called at the beginning and end of every pass. As delivered in the Extras folder the script speaks the satellite name and visibility as well as posting a notification. This script can be modified to record the pass or perform any actions that can be AppleScripted.

-- aos called when satellite is first visible:

on aos(sat_name, sat_speakname)
    say (sat_speakname & " is visible")
    display notification (sat_name & " is visible")
end aos

-- los called when satellite is no longer visible:

on los(sat_name, sat_speakname)
    say (sat_speakname & " is visible")
    display notification (sat_name & " is no longer visible")
end los
2D Map Preferences

Controls

**Label Font Size**  
Popup will control the size of the satellite labels.

**Map Set**  
Popup will choose between the Planetary Image and NASA Blue Marble Next Generation Map Sets.

**Country Boundaries**  
Check box enables country boundaries display.

**Country Names**  
Check box enables country names display.

**Grid Squares**  
Check box enables site and alternate site grid square display  
(if you have a user_grids.dat file in your data_files folder a  
tab-delimited list of 4 character grids will be displayed  
eg. FN03<tab>description).

**Horizon Grids**  
Check box enables satellite coverage area perimeter grid square display.

**Show Sun**  
Check box enables sun shadow display.

**Site Sat Line**  
Check box enables line from site to satellite sub-sat-point.

**Ground Track Direction**  
Check box enables ground track direction arrow display.

**Locations**  
Check box enables named location label display.
**3D Map Preferences**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track List</td>
<td>Displays all the tracked satellites not just the next one visible.</td>
</tr>
<tr>
<td>Coverage</td>
<td>Display the satellite ground coverage areas.</td>
</tr>
<tr>
<td>Country Boundaries</td>
<td>Check box enables country boundaries display.</td>
</tr>
<tr>
<td>Grid</td>
<td>Display the latitude/longitude grid.</td>
</tr>
<tr>
<td>Labels</td>
<td>Display the satellite name labels.</td>
</tr>
<tr>
<td>Ground Track</td>
<td>Displays the path over ground the satellite will trace.</td>
</tr>
<tr>
<td>Sky Track</td>
<td>Displays the path in space that the satellite will trace.</td>
</tr>
<tr>
<td>Orbital Plane</td>
<td>Displays the Orbital Plane.</td>
</tr>
<tr>
<td>Locations</td>
<td>Displays the cities in the locations database. (if you have a <code>user_grids.dat</code> file in your <code>data_files</code> folder a tab-delimited list of 4 character grids will be displayed eg. FN03&lt;tab&gt;description)</td>
</tr>
<tr>
<td>Label Font Size</td>
<td>Popup will control the size of the satellite labels.</td>
</tr>
<tr>
<td>Texture Map Resolution</td>
<td>Popup allows the choice of several texture map resolutions. Not all video cards will be able to display the higher texture map resolutions.</td>
</tr>
</tbody>
</table>
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Menus

File

MacDoppler Web Site  Opens your web browser at www.dogparksoftware.com/MacDoppler.html.


Check for Updates  Look for newer version of MacDoppler.

Purchase  Register link on the MacDoppler Web Page.

Import Keps (merge)  Import 2 line keplerian elements file - don’t erase old keps.

Import Keps (overwrite)  Import 2 line keplerian elements file - erase old keps.

Download Keps  Update the 2-line keplerian elements from AMSAT or Celestrak.

Note: All Keps downloads merge instead of overwriting.

Export Keps  Export 2 line keplerian elements file.

Import Modes  Import a tab-delimited text modes file into the internal modes database.
Export Modes

Export the internal modes database to a tab-delimited text file. If you edit or customize the internal modes database you should make a copy of your changes.

View

Full Screen
Display the current Map (2D or 3D) in full screen mode.

Normal Screen
Exits full screen mode.

Enter Full Screen
Enter Lion full screen mode.

Options

Speech Advisories
Turn the Speech Advisories on and off.

Radio
Turn the Radio interface on and off.

Rotor
Turn the Rotor interface on and off.

Log QSO
Opens the QSO logging window.

Predictions
Opens the Predictions Window to create a tabular predictions file.
UDP Broadcast

For those wishing to interface MacDoppler to radios and rotors other than those already supported, MacDoppler now has a UDP Broadcast Radio and Rotor Driver in Version 2.19.

This same method is used by fldigi to read MacLoggerDX VFO broadcasts. MacDoppler broadcasts UDP packets over your LAN when the tracked satellite VFO uplink or downlink frequency or mode changes or a the tracking rotor azimuth or elevation changes (Select the UDP Broadcast Radio and/or Rotor driver in the Prefs). The udp_listener application (a sample application provided for illustration) will display radio report packets that MacDoppler transmits on UDP Port 9932 whenever the connected radio VFO changes. The udp_listener application is in the MacDoppler download disk image Extras folder and Source code for is available here.

Sample Packets

[AzEl Rotor Report:Azimuth:350.00, Elevation:0.00]

Revision History

• v1.01 18-October-2005  First Release.
• v1.05 20-October-2005  Fix for zero serial port crash.
• v1.07 21-October-2005  Import Keps will read Unix or Macintosh line endings.
• v1.10 29-October-2005  Disconnect IC-910 if nothing heard.
• v1.11 30-October-2005  Preliminary Manual added.
• v1.12 05-November-2005 Options menu added.
  SIMPLEX_SSB Mode added.
• v1.18 10-November-2005  Mode J_EXP added for AO-51.
  Fixed roundoff error in the modes editor.
  Defaults button added to Modes editor.
• v1.2 10-November-2005  When VFO’s are unlocked slider adjusts uplink.
• v1.21 12-November-2005  Logging and Internet call sign lookup added.
• v1.23 12-November-2005  VFO Slider resolution improved.
• v1.24 14-November-2005  Added Predictions Window.
• v1.25 16-November-2005  Added Save Panel filename defaults and Predictions file header.
• v1.27 22-November-2005  Added minimum pass elevation to the Site Preferences.
• v1.3.2 29-December-2005  Minimum elevation changed to ignore passes below min elev.
• v1.3.8 15-January-2006  Mode Preferences Defaults Button restores the "factory" default modes
  and zeros the offset frequencies for all the satellite records.
  Green line added to Horizon Panel to show minimum elevation.
  Added a button to the Radio panel to zero uplink and downlink offsets.
• v1.3.9 16-January-2006  TS-2000 Driver fix for Echo USB/FM mode
  MyCall and MyGrid added to log.
• v1.4.0 17-January-2006  Path Loss Calculations added.
• v1.4.1 18-January-2006  Virtual time slider added.
• v1.4.2 20-January-2006  Improved 3D View.
• v1.4.5 22-January-2006  Squint calculations added.
  3D 'Behind Sat' camera point of view added.
• v1.4.6 24-January-2006  City lights display added to 3D view.
• v1.4.7 28-January-2006  3D Satellite labels font size popup added.
• v1.4.8 28-January-2006  Uncluttered Map preferences.
• v1.4.9 29-January-2006  Added “cancel” to 3D Map preferences.
• v1.5.0 31-January-2006  Added draw rate site preference.
• v1.5.2 3-February-2006  Fixed Predictions Window stop button crash.
• v1.5.4 5-February-2006  Fixed International Site location decimal bug.
• v1.5.5 6-February-2006  Number of Orbits added to site preferences.
• v1.5.6 7-February-2006  Exit full screen mode keyboard equivalent fixed.
• v1.5.7 7-February-2006  Added online manual.
• v1.5.8 14-February-2006  Added AO-54 (SuitSat) to the modes file.
  Added radio and rotor menu commands.
• v1.5.9 18-February-2006  Added PrimeSat rotator controller support.
• v1.6.0 18-February-2006  Added label font size 2D Map preference.
• v1.6.2 20-February-2006  Added 12 degree greyline corridor to 3D Map.
• v1.6.3 28-February-2006  Gateway functions improved.
• v1.6.5 12-March-2006  Cutesat added.
• v2.0.0 17-March-2006  Added Blue Marble - Next Generation Maps from NASA.
  All Preferences live and non modal (Cancel and OK removed).
• v2.0.1 13-April-2006  Exit from full screen mode without quitting.
  Fixed IC-910 1.2 GHz bug.
  Added Cubesats (CO-55-58) to mode file.
• v2.0.2 14-May-2006  Added Creative Design Corp. RAC825 Rotator Driver.
   MODE_PACKET added to the FT-817 driver.
   Fixed Modes editor new mode bug.
   If Satellite is not visible set Path Loss to that of Maximum Elevation.

• v2.0.3 12-July-2006  Added Icom IC-7000 Driver.
   Improved Icom IC-706 Driver.
   Fixed Beacon mode problem.

• v2.0.4 12-May-2007  VFO and Rotor changes displayed whenPrefs window closed.
   Improved Intel USB/Serial I/O.
   Adjusted keyclick tab loop to start in the radio panel.
   Support for AO-51 L(SSB)/U(FM) mode.
   Mode B fixed for TS-2000.
   Save Serial Port Prefs by name.

• v2.0.5 27-April-2007  Full screen fixed for dual screen systems.
   Fix for duplicated sats in AMSAT keps.
   AlfaSpid native 1.0 & 0.5 degree drivers added.
   AO-16 Channel 1 mode fixed.
   Added Rotor Command Delay.
   Added M2 AzEl Driver.

• v2.0.6 14-April-2009  AC 805/825 Rotor driver.
   Download Keps from Celestrak as well as AMSAT.
   Added WM7D.net call sign lookup.
   Serial driver lookup fixed.
   Updated 3D Graphics.

• v2.0.7 11-May-2009  Updated TS-790 driver.
   Celestrak kep satellite name format change.

• v2.0.8 08-December-2009  Updated GS-232B Driver.
   Added SO-67 to default modes.
   Fixed Tone and CTCSS Data Formatters.

• v2.09 06-February-2010  Fixed Predictions bug.
   Added HO-68 (Hope Oscar 68) to default modes.
   Added Rotor Filter preference.
   Added Speed control to GS-232 Drivers.
   Last PPC Universal Binary Version.

• v2.10 29-August-2010  Fixed Moon Keps for 2010.
   Map Draw Rate fixed.

• v2.11 21-July-2011  Intel Only.
   GS-232B driver added.
   IC-910 & IC-9100 Mode A_SSB fixed.
   Adjust Port popups when device added/removed.
   Icom IC-9100 Driver Added.
   FT-847 inband doppler.
   IC-910 Tone.
   ARISSat-1 modes.

• v2.12 27-July-2012  Intel Only, OS 10.5 or later.
   Ready for OS X Mountain Lion.
   32/64 Bit.
   Code signed for Gatekeeper.
   Icom IC-9100 S-Meter.
   Added Lion Full Screen Mode.
• v2.13 15-March-2013  Intel Only, OS 10.6 or later.
MO-72 and STRaND-1 Modes Added.
Improved Modes editor.
Modes Editor Defaults button defaults keps as well as modes.
All Keps imports and downloads merge instead of overwriting.
Most recent element set used for each satellite.
Modes Import merges instead of overwriting.
Added Export Keps.
Added uplink and downlink frequencies to predictions.
Demo period extended to 15 minutes.
Speech delay fixed.

• v2.14 17-March-2014  Intel Only, OS 10.6 or later.
Direct AppleScript logging to MacLoggerDX (Requires v5.53)
Restore serial ports after USB re-enumeration.
Changes for Mavericks.
Moon pseudo keps updated.

• v2.15 12-May-2014  Intel Only, OS 10.6 or later.
Fixed $50SAT Modes editor bug.
Fixed 2D Map bug.
Import kep set when element set numbers do not match.

• v2.16 7-April-2015  Intel Only, OS 10.6 or later.
Added manual rotor flip mode.
Added Import Keps (overwrite).
Fixed 2D Map Import crash.
Fixed Locations popup bug.
Use Celestrak ISS instead of Zarya.
Added secondary observer to Predictions.
Added support for Green Heron RT-21 azel.
Updated AMSAT keps download.
Improved Tuning Dial Tracking.
Improved Virtual Time Slider.

• v2.17 26-June-2015  Intel Only, OS 10.6 or later.
M2 RC2800 Rotor driver.
Alfa Spid AzEl Rotor read-back (1200 baud+)
Alfa Spid AzEl 1.0, 0.5, 0.1 degree Rotor driver.

• v2.18 29-July-2015  Intel Only, OS 10.9 or later.
2D Follow Sat map origin scrolling added.
2D/3D Country boundaries added.
Wait 15 seconds to park rotors between passes.
Disclosure Triangle bug fixed.
Track List Table intermittent sorting bug fixed.

• v2.19 28-February-2016  Intel Only, OS 10.9 or later.
Rotor tracking while track list off fixed.
Don't interrupt radio or rotor when USB port is added.
Added UDP Broadcast Rotor Driver for Green Heron.
Added UDP Broadcast Radio Driver.
Added AO-85 (Fox 1A) to the default Modes.dat file.

• v2.20 9-June-2016  Intel Only, OS 10.9 or later.
Site Prefs locations save site altitudes.
Added display named locations on Maps.
Log to MacLoggerDX AppleScript logString replaced with importADIF.
Don't restart pass when radio is enabled/disabled.
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• v2.21 15-August-2016  Intel Only, OS 10.9 or later.
  Added option to auto-update keps at startup and midnight.
  Added Dark Mode option to Site Prefs (OS X 10.10+).
  Added Debug Log check box to Rotator prefs.
  Added support for Apple App Transport Security (ATS).
  Horizon View display problem fixed.
  OnExit mode fixed.

• v2.22 28-September-2016  Intel Only, OS 10.9 or later.
  USB device ports changed to long name. prefs will be reset, please note your radio/rotor driver/port/baud before installing.
  USB device-removed bug fixed.
  AMSAT server keps file-not-found bug fixed.

• v2.23 27-January-2017  Intel Only, OS 10.9 or later.
  Added RSTS and RSTR to log dialog.
  Added dogparkSDR (v1.07+) radio driver.
  Added choice of source for Auto Update keps.

• v2.24 28-January-2017  Intel Only, OS 10.9 or later.
  New user bug fixed.

• v2.25 2-June-2017  Intel Only, OS 10.9 or later.
  Added Yaesu FT-991 driver.
  Added Prosistel Combo azel driver.
  Added Tuning Dial Tracking to IC-910.
  Show Tuning Dial Tracking capability.
  Added Rotator Stop button.
  Display offsets in VFO panel Uplink and Downlink.
  Fixed FT-847, FT-817 in-band doppler.
  Fixed GS232B ERC Rotor Readback.

• v2.26 15-November-2017  Intel Only, OS 10.9 or later.
  macOS 10.13 (High Sierra) compatible.
  Floating Prefs window.
  2D Map site and satellite auto-scroll improved.
  Fixed FT-991 modes.
  Fixed FT-736R polling issue.
  Fixed demo timeout hang.

• v2.27 27-February-2018  Intel Only, OS 10.9 or later.
  macOS 10.13 (High Sierra) compatible.
  Added AO-92 to the defaults.
  Added Bearing HUD.
  Added non-linear Virtual Time Slider.
  Added 2D Map Grid square display.
  Added 2D Map Site to Satellite line.
  Changed IC-910 B_FM uplink mode from FM to FM-N.
  Changed IC-9100 PACKET mode from FM to FM-D.
  Added PACKET_DUP mode to IC-9100 for FalconSat.
  Replaced deprecated macOS API calls.
  Log QSO mode bug fixed.

• v2.28 12-April-2018  Intel Only, OS 10.9 or later.
  macOS 10.13 (High Sierra) compatible.
  TS-790A/E driver rewritten (TU IU1KBH).
  Added Country names to 2D map.
  Added Natural Earth III maps.
  Added 2D/3D map snap shots.
  VFO steppers improved. (manual page 11)
Delete Mode or Satellite from Modes editor.
2D Track List check box persistence fixed.
2D Draw performance improved.

• v2.29 26-September-2018 **Intel Only, OS 10.9 or later.**
  macOS 10.14 (Mojave) compatible.
  Create Radio Port symlink for Icom IC-9100.
  Added directional 2D Sat Ground Track.
  Added Prediction Sat popup.
  Added Pass Recorder AppleScript Interface.
  Enable Beacon check box based on beacon frequency.

• v2.30 14-June-2019 **Intel Only, OS 10.9 or later.**
  macOS 10.14 (Mojave) compatible.
  Notarized by Apple for Gatekeeper
  Added Icom IC-9700 driver.
  Added Radant AZV Rotor driver.
  Display selected Mode in Track List table.
  Modes Editor requires tone values (e.g. 67.0).
  Set Rotor DTR, RTS on.
  GS-232 Rotor driver improved.
  Enable multiple SiLabs symlinks based on serial number.
  Disable Tuning Dial Tracking for single frequency FM channels.
  Remember macOS Full Screen state across sessions.
  Fixed macOS 10.14.4 3D bug.
  Fixed Import Keps (merge) bug.

• v2.31 27-September–2019 **Intel Only, OS 10.9 or later.**
  macOS 10.15 (Catalina) compatible.
  Zero offsets button shows status of Tuning Dial Tracking.
  Added user grids.dat file.
  Improved Icom IC-821H, IC-910, IC-9100, IC-9700 drivers.
  Log AO-07 as AO-7 for LoTW.
  Fixed 2D Map Location label bug.
  Fixed DCU-1 rotor driver bug.
  Fixed 115,200 baud radio bug.

• v2.32 23-December–2019 **Intel Only, OS 10.9 or later.**
  macOS 10.15 (Catalina) compatible.
  Catalina 3D Retina bug fixed.
  IC-9100, IC-9700 BFMN bug fixed.
  Fix symlinks for non-admin accounts.
  AlfaSpid ROT2Prog AzEl driver bug fixed.
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