



Virtual Reality Kneeboard

Quick start guide

Version	Date	VRK Version	Changes
1.3.3	22/04/2020	1.3.3.20	WinTab notes about Relative Mode New features in DCS integration
1.3.2	23/03/2020	1.3.3.14	Multiple pen tablets and hands emulation
1.3.1	29/02/2020	1.3.3.07	Kneeboard positioning and switching
1.3.0	11/02/2020	1.3.3.01	Double kneeboard Removed client/server
1.2.3	20/01/2020	1.2.3.08	Configuration Profiles
1.2.2	31/12/2019	1.2.3.05	Oculus and DCS support, new features, chapters re-arrangement
1.1.1	14/09/2019	1.1.3.11	Custom driver, new functions
1.1.0	17/08/2019	1.1.1.00	Form notes, Programmable Buttons, Gestures, WinTab
1.0.1	10/08/2019	1.0.1.37	Network auto-discovery
1.0	07/08/2019	1.0.1.36	First revision

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1. Concept

VRK is a Windows application that is capable to project its content into a VR scene. It is designed to act as kneeboard for flight simulation and it can contain documents as well as hand written notes.

The two available kneeboards can be positioned anywhere in the virtual world and can be of any size. A “focused” mode is used to change the default dimensions and opacity of the kneeboard when you directly looking at it. This is extremely useful to have a small and less intrusive panel in all situations, but when you really need to read details it may increase in size and opacity to be more readable.

The application is intended to be used in *standalone* mode where the PC that run the VR is the same that manages the documents. Hand-writing and other operations are performed by means of a pen tablet (a.k.a. digitizers).

VRK was originally designed to be used mainly in client/server mode. After some months appeared clear that the use of the tablet strapped on a leg is less than optimal because of weight, thickness, accuracy and the risk of damaging the tablet and the standalone mode became the preferred option by users. The decision to remove the support for client/server modes from version 1.3 was taken in consideration of the much lower effort in developing and maintaining new features also given the little interest in client/server.

Version 1.2 will continue to be maintained with its current feature set, but no new features will be added.

VRK is a free tool, no money is asked to use it for non-commercial purposes. If you want to support its development, you can donate via Paypal:

Donate

<https://tinyurl.com/vrk-donate>

2. Installation

VRK comes with two self-installing executables. The VRK-CustomDriver-Setup is used to install the custom driver required for using Huion pen tablets. See Appendix A for details.

VRK-Setup is the one to be used for tool installation.

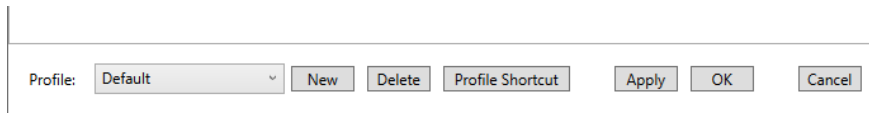
No configuration is needed on the simulator side. Oculus support is integrated into the application for DX11 and OpenGL (experimental) simulators but requires some preparation to work properly. Please refer to the Supported Platforms chapter to verify this requirement.

3. Profiles

Tool configuration is stored into a configuration profile. Each profile contains the complete configuration.

Profiles are meant to easily select different “configurations” without the need of manually changing the values each time.

The *Default* profile must always exist and it is the one automatically loaded when the tool starts.



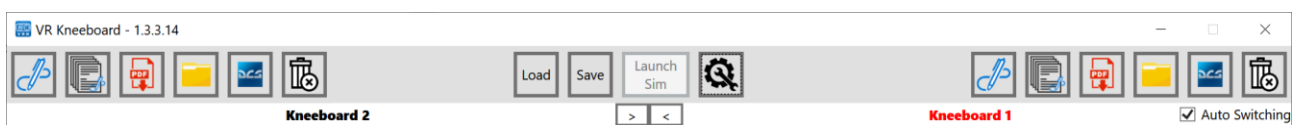
Profile management is on the lower part of the Configuration Window.

The *New* button creates a new profile. The profile can be created from a default set of values or from the current selected one. *Delete* removes the current selected profile, except when the current one is *Default*.

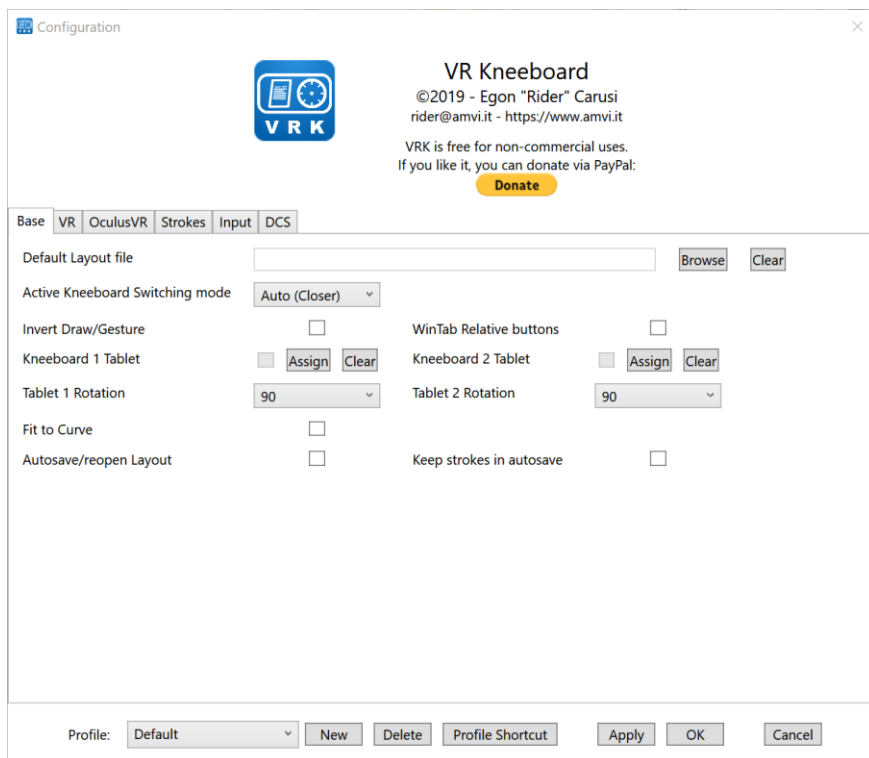
Profile Shortcut will create a windows shortcut that automatically starts VRK with the selected profile.

4. Configuration

Configuration panel is opened by clicking the “gear and wrench” icon in the middle of the application toolbar.



A configuration window will be opened



All setting will be confirmed by pressing the OK button. Using Cancel will revert everything to previous values.

The config window has some tabs. The first one, named *Base* contains parameters for setting the default layout to load, stylus and tablet options as well, the logic to switch pen action the active kneeboard, including the possibility to bind multiple tablets to the two kneeboards.

VR tab contains the parameters to set the VR configuration, to change kneeboards position, size and general appearance.

OculusVR tab is used to configure the parameters to run Oculus hardware. Most notably the simulator executable and 3D API.

Input is to configure tablet/stylus buttons, keyboard and input devices (joysticks, pads, button boards, etc.) to VRK functions.

DCS is to configure options for integration with Digital Combat Simulator.

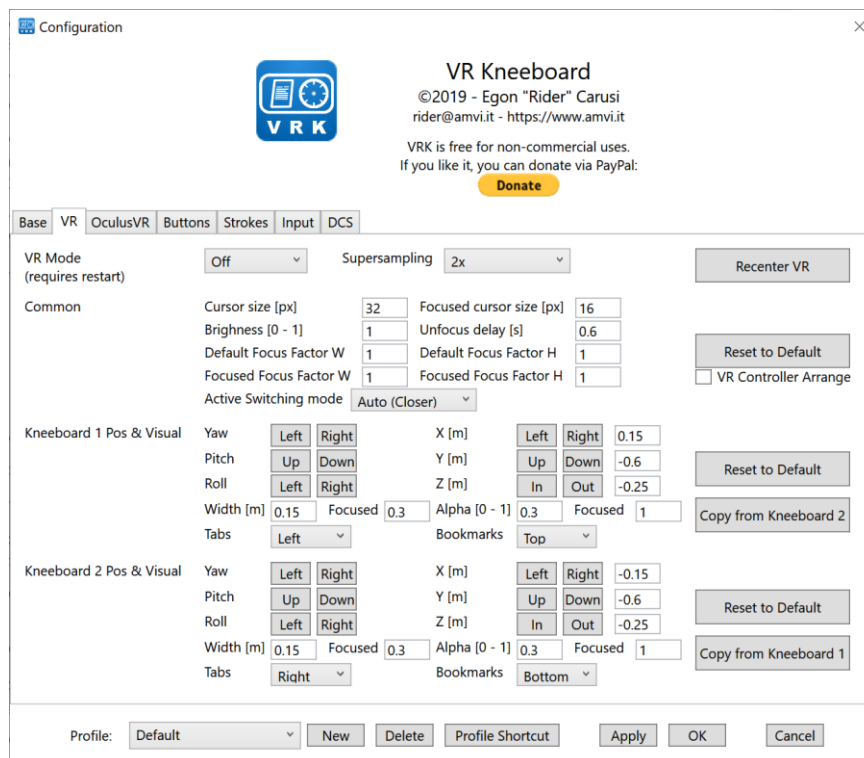
4.1. VR and Kneeboard position

VRK comes with kneeboard already positioned over the left and right leg.

Note: If you are upgrading from a version that only support a single kneeboard (1.2 or earlier) then take some time to go to “VR configuration”, copy the Kneeboard 1 parameters into Kneeboard 2 (using the button “Copy From Kneeboard 1”) and invert the value of Kneeboard 2 X, Yaw and Roll.

The VR mode can be selected from the combo-box right to the “VR Mode” label. It can force SteamVR (HTC, Valve, PiMax, WMR, etc.), OculusVR and Off.

Note: some simulators (like IL-2) will run Oculus hardware in SteamVR mode.



If you want to reposition the kneeboard to match your preferences you can try changing *X*, *Y*, *Z*, *Pitch*, *Roll* and *Yaw* parameters of the configuration.

X: is the lateral offset in meters (positive is left)

Y: is the vertical offset in meters (positive is up)

Z: is the depth offset (**negative** is forward)

The reference (zero position) is the center of the visor.

Warning: using SteamVR the kneeboard is not visible, literally “disappears”, if you look it from the back. If you can’t find it after changing parameters, try to revert them back to original values.

Default Width: controls the width of the kneeboard when not focused (height is derived from the aspect ratio).

Focused Width: controls the width of the kneeboard when focused.

Default Alpha: controls the opacity of the kneeboard when not focused. 1 means fully opaque, 0 fully transparent

Focused Width: controls the opacity of the kneeboard when focused.

Tabs Location: sets the border where the document tabs will appear.

Bookmarks Location: sets the border where the bookmarks tabs will appear.

(Focused) Cursor size: is used to set the size of pen cursor both in normal and focused (Focused Cursor Size) condition.

Brightness: is the default brightness of the kneeboard. Brightness can also be changed at runtime by Buttons or Input

Unfocus Delay: is the time to wait before passing from focused to unfocused size. It is great to minimize kneeboard shrinking when quickly look at instruments.

Active Switching mode: controls the Active kneeboard switching logic. The Active kneeboard is the one where pen and inputs is directed to. Three modes are available: Automatic (closer), Automatic (focused) and Manual. The two automatic differs for the fact that the kneeboard will become active if the look direction is closer respect the other kneeboard or based on the last focused one. The manual mode requires the Active switch function to be bound to a keyboard or button (see **Errore. L'origine riferimento non è stata trovata.**).

VR Controller Arrange: let you move the kneeboard with the VR controller. After this option is enabled, grab the controller, look at one of the kneeboards and squeeze the controller trigger. From now on the kneeboard will move with the controller until the trigger is released. Changing this option does not require Apply or Ok to become active.

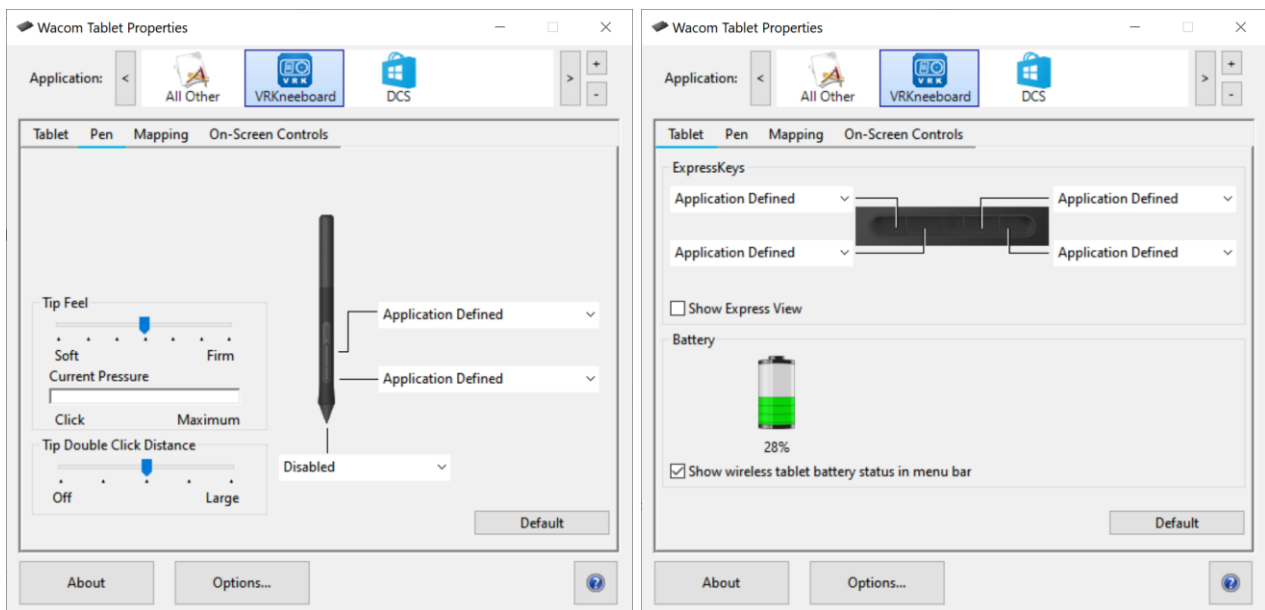
4.2. Tablet Configuration

4.2.1. WinTab (Wacom) hardware setup

WinTab is a driver developed by Wacom to let pen tablets being accessed by software. Usually, the tablet is meant to be used with paint, photo or CAD software and it is expected that pen actions will interact with the windows cursor. This usually creates a lot of problem with flight simulators, so VRK will use WinTab in a transparent way and captures all actions without letting windows to know.

To complete the scenario, all the WinTab buttons, except the tip, must be configured in “Application Mode” in the driver control panel. The tip is expected to set to “Disabled”.

An example configuration for the Wacom tablet is:



Warning: to avoid problems set this configuration as default in your driver (All or All Other). To have a specific configuration for VRK (if you want to use the tablet to pain) you need to create multiple profiles: one pointing to VRK and one simulator with the same configuration (see above).

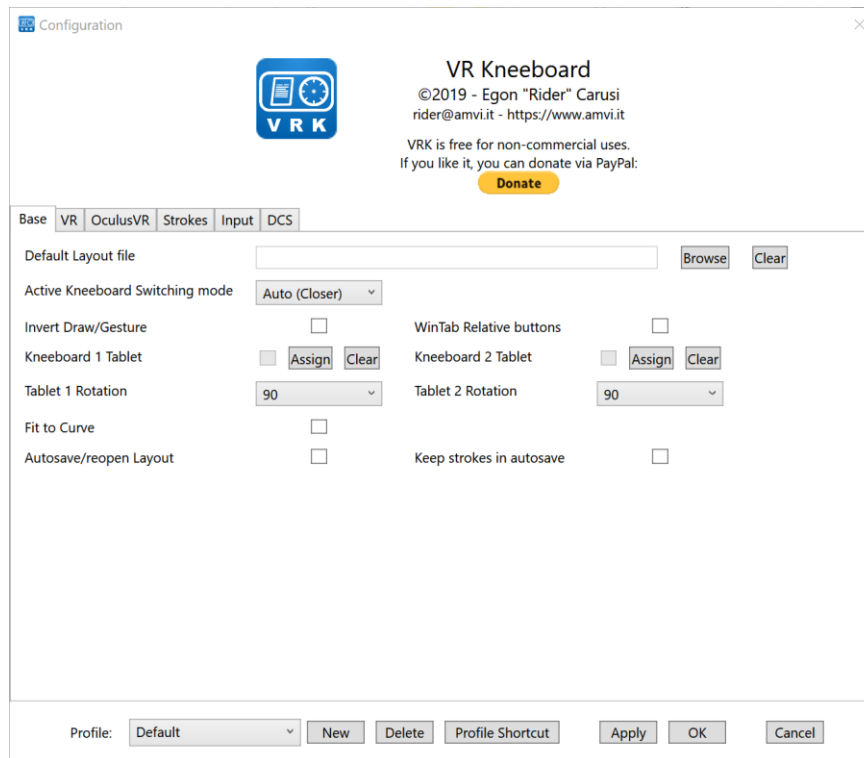
Note: activating the Relative Buttons mode is not suggested. At the current state the normal logic is reliable and provides better result. If sensitivity is not good enough, the solution is to tune it from Wacom Tablet properties (Tip Feel slider) starting from middle position and using one or two notches.

4.2.2. Custom driver hardware setup

Huion tablets implementation of WinTab is not complete enough to support VRK. To use devices from this manufacturer, the custom driver is required (see Appendix A) and this mode must be enabled.

4.2.3. Configuration for single pen tablet

The tablet configuration in VRK is mainly in the Base tab of the configuration window.



The option for disabling relative buttons is mostly for compatibility with devices not supporting the relative mode, if the device buttons work there's no need to change it. A side effect of the relative buttons mode is that the pen tip hysteresis is disabled when it is turned on. If you have difficulties in drawing or clicking, try enabling this mode.

No special configuration is required if a single pen tablet is used to control VRK. Just be sure that the two binding functions (*Kneeboard 1 Tablet* and *Kneeboard 2 Tablet*) are not checked (assigned). And to select the preferred *Active Kneeboard Switching Mode*. This parameter will control how the pen input is routed to kneeboards.

Tablet 1 Rotation is used to match the pen tablet orientation when is strapped to the leg.

The *Invert Draw/Gesture* inverts the drawing and gesture modes, so gesture is default and drawing only happens when the gesture function is activated.

The *Fit to Curve* rounds the stroke to a nicer appearance, this option will increase CPU usage.

Once done, the stylus and tablet buttons can be configured to perform specific functions. See chapter 4.1 for details.

Errore. L'origine riferimento non è stata trovata.

4.2.4. Configuration for dual pen tablet

If two pen tables are connected and you want to assign each one to a specific kneeboard, the procedure is like the single tablet configuration except:

1. That the *Tablet 2 Rotation* must be configured accordingly

2. Each tablet must be bound to the corresponding kneeboard. To do so just click the assign button and, when asked, tap the stylus on the corresponding tablet. The checkbox will become checked indicating that the binding is completed.
3. Set the *Active Kneeboard Switching mode* to Manual.
4. Mind that stylus and tablet buttons are assigned per tablet, you will have to assign the function for the second tablet too.

Warning: the support for dual pen tablet is preliminary as I still don't have all the hardware to completely debug it. Please report any malfunction via Discord or ED forum.

4.1. Input binding

VRK functions can be activated from stylus buttons (a.k.a. barrel buttons), tablet buttons, keyboard and joystick buttons/POVs. This allows also chaining of voice activation or any other tool that can generate keypresses and/or vJoy button clicks.

To create a new function binding:

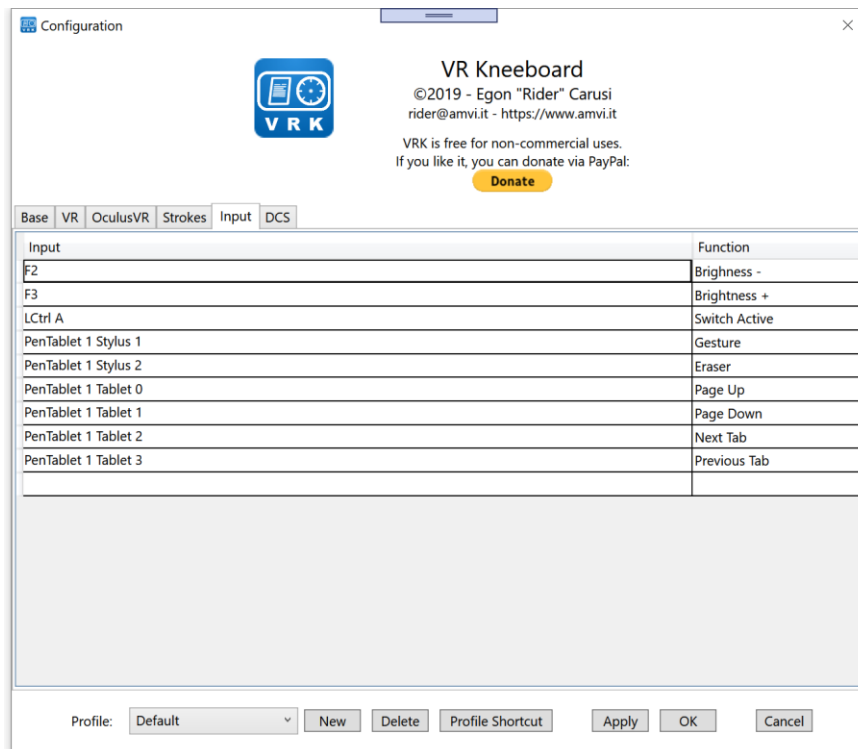
1. Open the configuration and go to the Input Tab
2. Click on the Input column of the last line (the empty one).
3. Click again on the Input column: the cell switches to red to indicate that is listening for a keypress or stick button
4. Once the combination is valid click on the Function cell to disable the combination listener (Input cell return blue)
5. Click again in the Function cell (right) to activate the drop-down menu
6. Select the function you want to activate

The combination binding can be changed in any moment:

1. Click on the cell (Input/Function) of the row you want to modify
2. Click again
3. Change the value.

To delete an existing combination:

1. Click on the anywhere on the row you want to delete
2. Press the *Delete* key on your keyboard



Keyboard binding supports modifiers (Alt, Ctrl, Shift, ...) in any combination, but only one key.

Available functions are:

Function Name	Action
<i>Nothing</i>	No action performed
<i>Brightness +/-</i>	Increase or decrease the kneeboards brightness to match cockpit illumination
<i>Eraser (hold)</i>	Switch tip from draw to eraser
<i>Gesture (hold)</i>	Switch tip from draw to gesture recognition. No ink will be drawn in this mode. Available gestures are described in Chapter 6 (hold)
<i>Page Up/Down</i>	Change page of the current tab
<i>Sizing Mode</i>	Switch between the three sizing modes of the panel (an icon will be displayed in the VR on mode change) <ul style="list-style-type: none"> • Normal: will switch size and opacity when looking at the kneeboard • Force un-focused: the kneeboard stays in the un-focused size/opacity • Force focused: the kneeboard stays in the focused size/opacity
<i>Pan Left/Right/Up/Down</i>	Pan the document when zoomed
<i>Switch Active</i>	Triggers a manual switch of active Kneeboard. If Active Switching mode is Automatic this function will cycle through the KB1, KB2 and back to the automatic mode
<i>Toggle VR</i>	Switches kneeboards visualization on/off
<i>Next/Previous Tab</i>	Change active tab in the kneeboard
<i>Zoom Reset</i>	Un-zoom the current page to native size
<i>Zoom In/Out</i>	Increase or decrease document zoom

5. Supported Platforms

VRK is a Windows application written in C#, it should run in any Windows machine with latest .NET runtime installed (which is for granted if your Windows is properly updated). If not, you can download the .NET installer here:

<https://support.microsoft.com/en-gb/help/4073120/microsoft-net-framework-4-7-2-for-windows-10-version-1709-and-windows>

Both SteamVR and Oculus systems are supported. This covers almost all the HMDs available on the market.

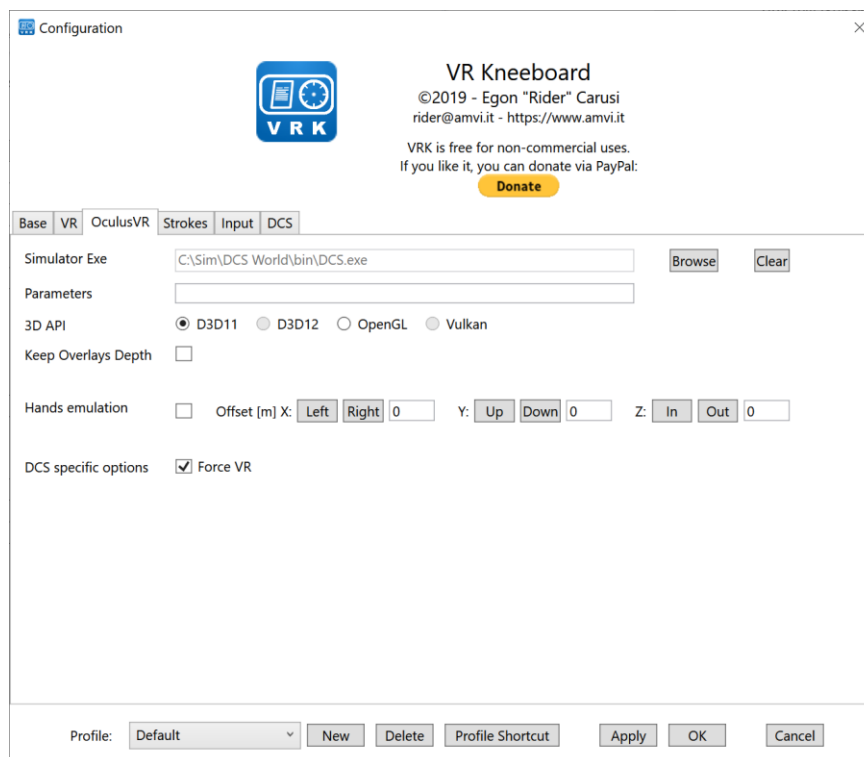
While SteamVR natively support the use of 3D overlays of applications into the main game, OculusVR doesn't and a complex technique is used to inject VRK in the simulator. The next chapter will explain the basics of usage for Oculus users.

Warning: if you plan to use VRK with a laptop, please be sure to assign VRK to the discrete video card and not to the Intel one. This is because of a limitation in Intel drivers to create textures in the way VRK does.

5.1. OculusVR HOWTO

Since version 1.2 Oculus native support is integrated in VRK, still, the simulator must be started from VRK.

VRK will launch the simulator if its executable is specified in the OculusVR tab.



Parameters field is passed to the simulator commandline.

3D API is used to select the kind of 3D library used by the simulator. It is specific of the simulator. Most common are:

- DCS: D3D11
- X-Plane: OpenGL (experimental)
- IL-2: SteamVR mode also for Oculus HW. Set SteamVR in VR tab and don't change anything here.







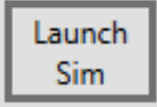


Hands emulation is used to enable and configure Leap Motion hands to emulate VR controller. See Appendix A 2 for details.

Some simulator-specific options are present to ease the configuration, more will be added if relevant.

6. Usage

The application let you create tabs with different name and content. You can import a PDF document or create a blank set of pages to take notes on. You can also add notes on the imported PDF if you wish.

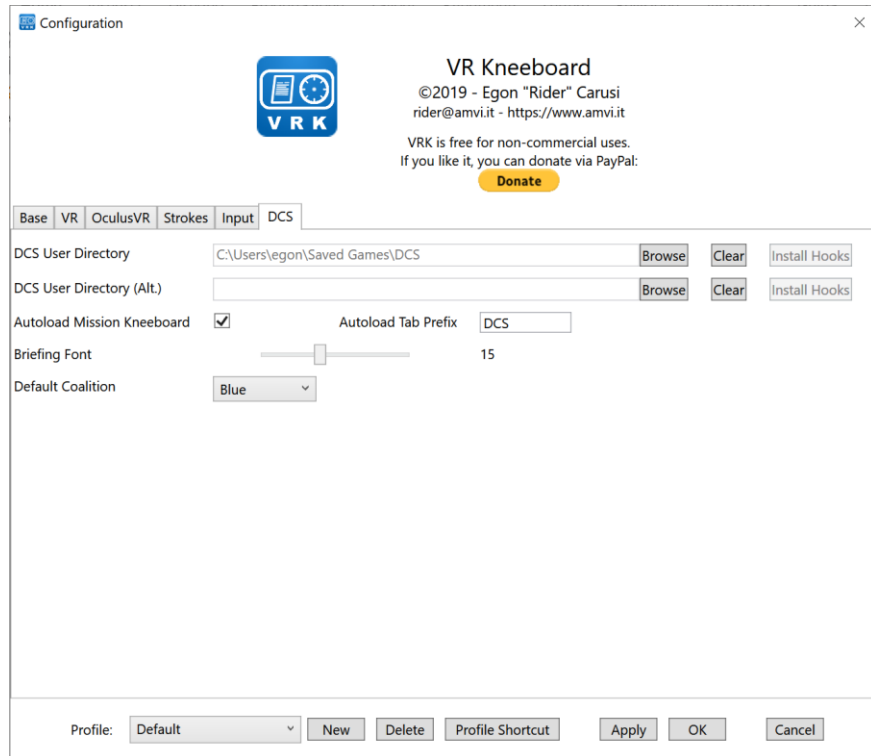
The main GUI commands are:

Button	Function
	Adds an empty note tab. The tab will be created with a single empty page where you can write your notes.
	Adds a form-based notes. The form may be a single image (jpg, png, bmp, etc.) or the first page of a PDF document. This “background” will be cloned for each white page added.
	Imports a PDF document. The process will require some time depending on the document complexity and machine CPU. The imported PDF accept also writing notes.
	Imports all the images and PDF from a directory.
	Opens a Kneeboard from DCS miz file.
	Deletes the current tab. No confirmation asked!
	In Oculus mode, restarts the simulator without restarting VRK. Useful in case of simulator crashes to keep the current kneeboard and notes.
	Saves/Loads a .vrkl file which contains the tabs configuration and content. Useful to create reusable kneeboards for sceneries, missions, etc.
	Opens the configuration window.

Just below button bar the kneeboards header is located. Kneeboards labels are clickable and it can used to manually switch active kneeboard. The manual switching is available only is switching mode is set to manual or *Auto Switching* checkbox is un-checked.

7. DCS kneeboard integration

Because many users requested the possibility to automatically import DCS kneeboards from running mission, a specific part of VRK has been developed to import them.



Although VRK was already capable of reading kneeboard from DCS mission files with the specific button in the main interface, doing so for multiplayer missions was tricky.

To configure this feature, open the DCS tab in configuration then:

1. Configure the *DCS User Directory* (the "Saved Games" one) by clicking Browse. The *(Alt.)* is required only if you have multiple DCS installations (i.e. Stable and Open Beta).
2. If the Install Hooks button is lit, press it. This will install a lua file to enable communication between VRK and DCS.
3. Enable *Autoload Mission Kneeboard*
4. Close the configuration

When *Autoload Mission Kneeboard* is enabled VRK will constantly monitor DCS activity. When a mission is started VRK opens the miz file and imports the embedded kneeboards. In multiplayer the specific aircraft kneeboard is automatically selected while the ones for other aircrafts are dropped.

The Mission briefing will be loaded as a separated Tab. In multiplayer session the coalition will be automatically selected, while in SP/campaign the *Default Coalition* parameter will be used.

Briefing will be rendered using a fixed font size which is controlled from *Briefing Font* parameter

8. Document navigation

Tabs can be switched by clicking on the name like normal applications. Click can be done through mouse or stylus.

Note: pan is activated only when not zoomed in to avoid confusion between the action of panning and scrolling pages.

Pages can be added (blank or forms) or deleted using the buttons in the lower-right part of the interface.



The add function adds at the end of the “document” (i.e. current tab) and selects it.

The delete function deletes the current page.

8.1. Gestures

Beside the touch and pen navigation actions describe above, there are some gestures that can be used to navigate. This function is extremely useful when using a non-touch digitizer tablet.

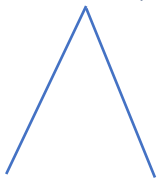
When a button with the *Gesture* action associated is kept pressed, the following gestures are available. The gesture is expected to be drawn as a single stroke in a limited time.

Circle and Square



Used to zoom in. The zoomed area is approximately the area inscribed in the shape drawn. Maximum zoom factor is 4.

Chevron up



Used to reset the zoom and go back to display the full page. Note that when you are in high zoom level the chevron should be

Lines

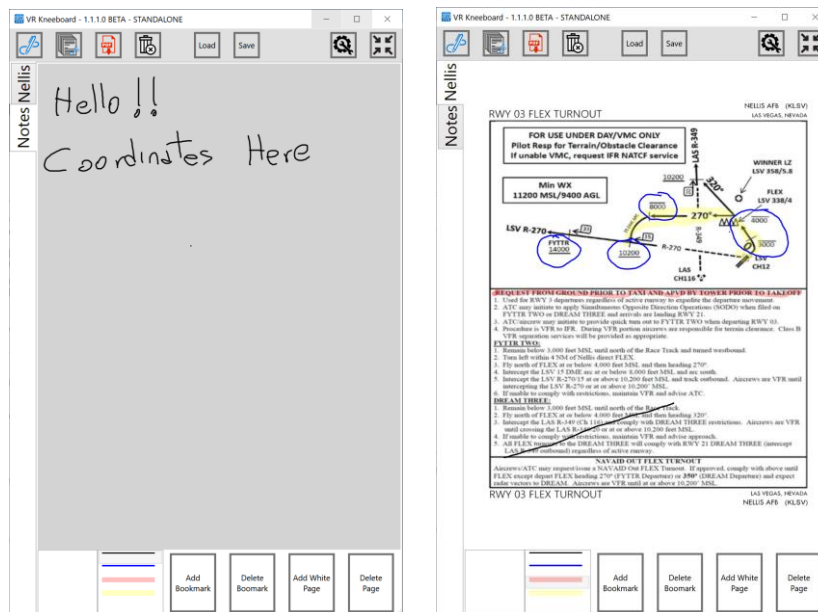
Up and Down straight lines, if no zoom is applied, will move page up and down just like swiping with the finger.

When zoomed, dragging a line will pan the visible area in the direction of the drawn line.

9. Writing

If you properly set up the tablet you can take notes on pages by just start writing into the page.

Please note that in standalone mode it is not expected that the pen interacts with the mouse cursor, if this happens then the tablet has not been properly configured. Check for proper WinTab/Custom pen selection in configuration. If you are using custom driver check also that it is properly installed (see Appendix A 1 for details).

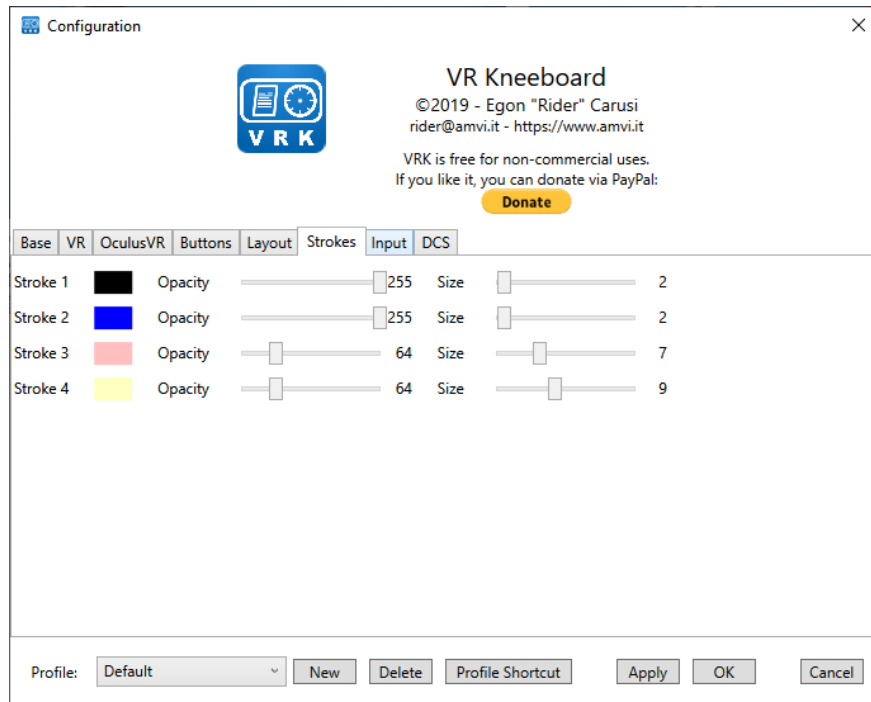


Stylus actions are divided and memorized as strokes.

Strokes can have sizes and colors: a selectable list is in the lower center of the interface.

To delete a stroke, hold the button configured as *Eraser* and pass over the stroke to delete it.

In configuration you can select the color, size and opacity for any of the four available strokes:



Mind that stroke changes does not affect already created tabs.

10. Contacts, support, ideas, etc.

This tool has been designed and developed by Egon "Rider" Carusi. The main download location is:

<https://www.amvi.it/download429-vr-kneeboard.html>

You can reach me via:

Email: rider@amvi.it

AMVI forum: <https://www.amvi.it/forum/> (username Rider)

ED forum: <https://forums.eagle.ru/showthread.php?t=246970>

Discord: <https://discord.gg/mxqSSa4>

A 1. Custom Driver

In many circumstances the fact that the pen tablet behaves like a mouse creates problems to the simulator, so, VRK requires that the tablet pen and buttons will not generate mouse and keyboard simulated events. WinTab is an open standard (specifications are free to download and use) and, among many other things, it provides the possibility to developers to get full control of the tablet. Wacom devices are perfectly supporting WinTab, but others were not so accurate with their implementations.

At the current date Huion and XP-Pen devices have failed the WinTab compatibility tests at a level that the tablet were not usable at all.

I'm on contact with XP-Pen tech support and they are willing to investigate the WinTab compatibility.

The custom driver is required to support pen tablets which does not comply with the WinTab specifications for pen and buttons management.

Warning: The installation of the custom driver will make the pen tablet not usable for drawing outside VRK.

Compatibility

The custom driver has been tested with the following devices:

- Huion HS64: OK
- Huion H640P: OK
- Huion H950P: OK
- XP-Pen G640S: Fail

XP-Pen devices, when properly initialized, are working with the custom driver. Sadly, this initialization is not possible from the custom driver at the current stage and I had to drop XP-Pen compatibility from the list.

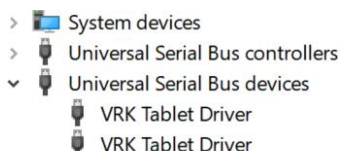
Huion tablets works perfectly and I expect other models to work out of the box.

Installation

The safest procedure to install the driver is:

1. Disconnect the tablet
2. Completely uninstall the table drivers and software
3. Reboot (do it, please!)
4. Install VRK-Custom-Driver-Setup package
5. Reboot (yes, again!)
6. Connect the tablet

At this stage, by opening the device manager you should see something like:



The “Universal Serial Bus devices” subtree is usually closed, open it to show VRK devices.

Now the driver is properly installed, you can start VRK and configure the “Custom Driver” mode.

Note: sometimes, after driver installation, you need to disconnect the tablet and reconnect it to make it work.

A 2. Hands emulation

Hands interaction with the cockpit may be a complementary and useful function for VR pilots. Many technologies for the hand tracking are available on the market, one of the most mature is the Leap Motion sensor (<https://www.ultraleap.com/>). This sensor uses depth cameras to detect and locate hands and fingers.

Some simulators are now implementing some cockpit interaction with controllers and DCS allows the clicking of buttons with the tip of the index finger. This is extremely interesting, and I hope that more feature will comes in the future!

Before continuing, the Leap Motion Orion Beta 4.0 must be installed. Download location:

<https://developer.leapmotion.com/releases/leap-motion-orion-400>

Place the Sensor is in front of the visor.

Oculus

At the current state, SteamVR allows to use drivers to emulate controllers from any hardware, but Oculus doesn't allow any third-party device to be integrated.

If you own a Leap Motion sensor, by enabling the *Hands Emulation* option from its configuration, VRK will automatically use the Leap Motion data to override VR controllers. Your hands will become VR controllers. You can also give some offset to the hands to compensate for the location of the sensor.

Place the sensor in front of the HMD as suggested by the manufacturer.

Hands support will be simulator based: VRK will not interfere with the implementation of features provided by the simulator.

SteamVR

SteamVR already support the integration of third-party hardware and the Leap Motion driver is already available and supported from an open source project: https://github.com/SDraw/driver_leap

This is the most reliable fork of an original project I've found so far, but it lacks an automated installer. My contribution to their work is the setup exe you can find in VRK. It will take care of locating the SteamVR configuration, add the driver and set the required parameters. Binaries are directly coming from SDraw releases.

Please refer to the original project documentation for details about this implementation and how to change its behaviour.