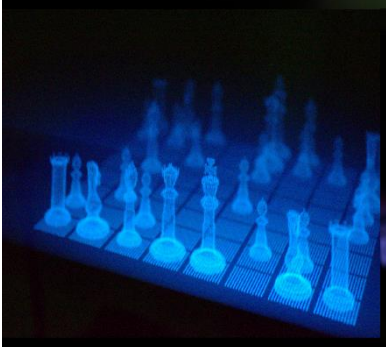
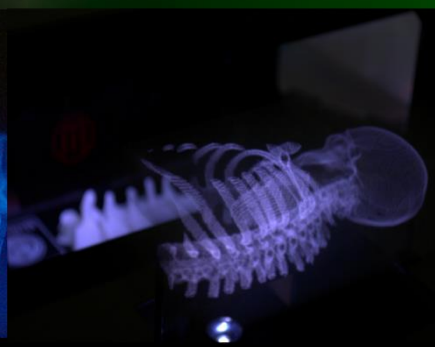
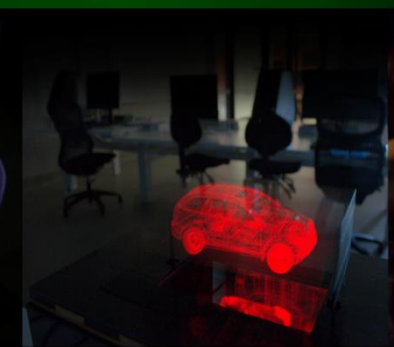
VOXON PHOTONICS

VOXON VX1 USER GUIDE







Creators of the world's most
advanced 3D volumetric display.

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Introduction

Welcome to world of 3D volumetric data. Using the VX1 (or simulator), we will show you how to explore different types of 3D data, play games and even write your own software. The VX1 comes with a software development kit which includes several sample programs. These programs will introduce you to the numerous graphical functions that are available via the SDK. The demo programs allow you to many functions including loading your own 3D files, or files that you have downloaded from the internet, browsing 3D maps, playing games and visualising mathematical formulae. In this section, we will go over each of the included programs and teach you all the keyboard shortcuts so that you can get the most out of each. We will start by covering the technical specification and included controllers.

The Voxon VX1 - Technical Description

The VX1 is technically described as a “swept surface volumetric display” and is powered by the Voxon Photonic Engine. The engine comprises an ultra-high-speed digital projection system, Windows 10 PC, 64-bit Volumetric runtime library and reciprocating light diffuser. Volumetric images are created by projecting slices of light at 4,000 frames per second onto a moving screen, so that they diffuse at precisely the right position in physical space. Through persistence of vision, the human eye blends the slices together, and the result is a true three-dimensional digital object that can be viewed in the same way as one would view a real object, from any angle, and without special goggles or glasses. Users are able to manipulate, and focus on specific areas of any 3D model in intricate detail – with vector files, zooming in right down to the vertex level of the underlying data. The display also supports multi-user interactivity for gaming and other interactive applications.

Software and Content Creation

All software on the VX1 is driven by our proprietary Core Graphics Engine (CGE), which is provided to developers (on a single user license basis). In addition to the CGE, units will be shipped with;

- VoxieOS – the Voxon VX1 operating system which allows for browsing 3D content
- Voxiedemo – a collection of volumetric demo programs and games with source code
- Sample 3D models and animations
- Sample applications, maps and games

The programs provide the functionality to view user generated 3D models, maps, animations and games out of the box. Source code for ‘Voxiedemo’, together with several other applications and games, has been provided to help developers gain an understanding of the numerous volumetric function calls available in the API. The CGE is compatible with many existing 3D file formats and workflows, enabling users to experiment and interact with their own content.

Creators of the world's most advanced 3D volumetric display.

Hardware Specifications

Display Volume size	18cm x 18cm x 8cm
Display Resolution	Approximately 1,000 x 1,000 x 200 (200 million voxels)
Display Refresh Rate	30 volumes per second
Fill Rate	500 Million Voxels /sec
Ports	Seven USB 3.0 ports
3D Controller	3Dconnexion SpaceMouse included
Keyboard	Logitech keyboard with trackpad
Multi-User Capability	Supplied demo software supports up to 4 XBOX Controllers
Peripheral Support	Native support for XBOX Controllers, 3Dconnexion SpaceMouse and Logitech keyboard. Compatible with any windows supported peripheral such as Leap motion, Intel RealSense, Microsoft Connect and Emotive EEG headset.
Product Dimensions	39cm x 39cm x 42cm
Operating Voltage	110- 240V 50/60Hz. External 12V DC power supply included
Brightness	Light projection at 350 lumens
Shipping Dimensions	TBD
Warranty	12 Months limited warranty from date of delivery
Shipping Weight:	TBD

Software Specifications

3D Media types	Static 3D models, animations, dynamic content & interactivity
3D workflow support	3DS Max, Maya, Blender, Solidworks, Fusion 360, Inventor, RealFlow, Sketchup,123D Catch, Meshlab and many others
File Type Support	Native support for STL and KV6, (OBJ & 3DS supported via POLY2VOX Conversion), PNG/JPG height maps
Volumetric Functions	Volumetric function calls using 64-bit DLL (voxel, sphere, cone, sprite, line, polygon, mesh, plane, cube, elevation map, text etc.)
Rendering	High resolution monochrome R, G, B, C, M, Y, W colour support through spatial and temporal dithering

Safety Warnings

Photosensitive seizure warning

A very small percentage of people may experience a seizure when exposed to certain visual images, including flashing lights or patterns that may appear on a 3D Volumetric Display. Even people who have no history of seizures or epilepsy may have an undiagnosed condition that can cause these “photosensitive epileptic seizures” while watching a 3D Volumetric Display.

These seizures may have a variety of symptoms, including light-headedness, altered vision, eye or face twitching, jerking or shaking of arms or legs, disorientation, confusion, or momentary loss of awareness. Seizures may also cause loss of consciousness or convulsions that can lead to injury from falling down or striking nearby objects.

Immediately stop playing and consult a doctor if you experience any of these symptoms. Parents or guardians should watch for or ask their children about the above symptoms. Children and teenagers are more likely than adults to experience these seizures.

The risk of photosensitive epileptic seizures may be reduced by not using the 3D volumetric display if drowsy or fatigued. If you or any of your relatives have a history of seizures or epilepsy, consult a doctor before playing.

Servicing warning

NO USER SERVICEABLE PARTS INSIDE. Do not remove the VX1 case, any issues requiring the removal of the case should be referred to Voxon Photonics for diagnosis and repair as necessary. Service is only to be performed by authorized personnel.

Operating Procedure

Connections

Note – The Power Plug has a retractable sheath that must be pulled back before inserting it into the 12V socket. When unplugging the VX1, ensure that you pull the sheath back to avoid damage to the plug or socket.

The VX1 is supplied with an external power supply which connects to a standard 110-240V AC outlet. A round four pin plug then connects to the rear of the VX1 adjacent to the VX1's on/off main power switch.

Power up procedure:

First, plug the supplied external power adapter DC connector to the VX1 DC connector on the rear of the VX1.

Press the round button on the front of the VX1 and log into Windows (default password is "Oliphant" named after the famous South Australian physicist, Sir Mark Oliphant).

Note – The VX1 has two air vents, one on either side of the unit. Please ensure that these vents are not covered or obstructed in any way. The VX1 has a temperature sensor that will disable the projection engine should the airflow be compromised.

Voxon VX1 Quick Start Guide

Turn on the VX1

- Push the round silver button on the front of the Voxon display.
- Ensure keyboard is turned on (switch on back), has batteries and that the keyboard wireless dongle is connected to the USB port in the front of the Voxon VX1.
- When you see Voxon Photonics appear on the screen, press any key on the keyboard.
- Enter the password provided to login to Windows.

Display a demonstration 3D model

- Press the Windows button on the keyboard to display the Windows Tile Menu
- Press the Voxiedemo icon on the screen and wait for the display screen to start moving. The first default image should then display.
- Use the ; and , keys on the keyboard to browse through the demonstration images provided.

- Alternatively, you can browse through the images by selecting ‘Model Anim’ tab on the screen and them select ‘Prev’ and ‘Next’ buttons on the screen to move through the images.
- Use the 3D SpaceMouse to move a selected image or zoom in and out (see full controller instructions in the User Guide to learn more about the 3D SpaceMouse).
- To return to the desktop press escape.

Display one of your own 3D models from a USB (STL or KV6 file)

- Press the Windows button on the keyboard to display the Windows Tile Menu
- Press the VoxieOS icon on the screen and wait for the display to start moving.
- Insert your USB drive into any one of the available USB slots. The software will automatically open and browse media on your USB drive.
- Use arrow keys on keyboard to browse through the folder and images on your drive.
- Use the Enter key to select the image you wanted to display.
- Use the 3D SpaceMouse to move a selected image or zoom in and out (see full controller instructions in the User Guide to learn more about the 3D SpaceMouse).
- To return to the directory press escape.
- When you remove the USB drive, VoxieOS will return to browsing the default directory.

Controllers

The VX1 is supplied with a 3DCONNEXION SpaceMouse. The SpaceMouse is compatible with the supplied software and provides a natural and intuitive way of interacting with the Volumetric data on the VX1. The SpaceMouse sits on a desk or on top of the VX1 and allows you to rotate, scale, move and pan content.

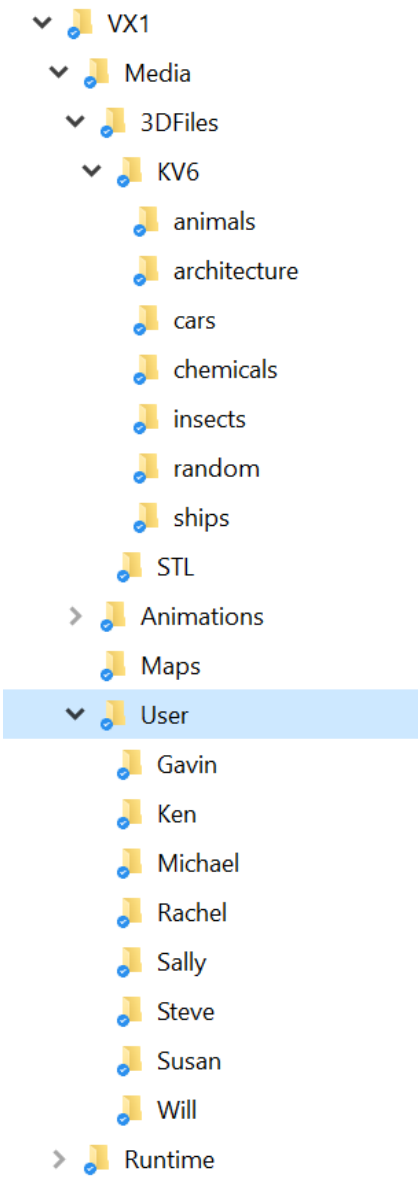
Most of the supplied software is also compatible with Microsoft XBOX Controllers. If you wish to program games and apps, you can find code examples of how to support both the SpaceMouse and Xbox Controllers in the VX1 SDK (http://voxon.co/developer-kit/).

The VX1 also comes supplied with a Logitech K830 wireless keyboard. The USB wireless dongle for this keyboard is located in the front of the VX1 (Please note that we cannot replace lost dongles if you remove or misplace it).

Note: To use the Function Keys on the keyboard, you need to press the FN key. To turn on the keyboard back light, press FN + SPACE BAR.

The keyboard needs to be charged with the supplied MICRO-USB cable.

Supplied Software



The programs are located in the “Runtime” subdirectory which is within the “VX1” Directory on the desktop. You are free to create any folder structure that you like, but we recommend the default one as it will be easier for us to support if you have any problems.

The default folder structure is as follows.

The **Media** subdirectory is where you will find some example 3D files. These are a mixture of KV6, STL, Elevation maps and Animations.

The **Runtime** folder contains all the sample programs and configuration files required to make the VX1 work. Please do **NOT** delete anything from the runtime folder. The VX1 may stop working if any of the files in this directory are missing. If you do accidentally delete something, you can restore that folder using the **Voxon.zip** backup in the documents directory. You can delete or rename any of the subdirectories in the **User** folder

Software Development Kit (SDK) and VX1 Simulator

In order to allow multiple people to develop and learn on the VX1 at the same time, we have written a simulator that enables the supplied software to run on any 64-bit windows PC when no VX1 is present. Software written on the simulator will run exactly the same on the real VX1 as it does on the simulator. Whether you run the example programs, or write your own, the results will be rendered to your screen and will be visually similar to the real hardware, but in 2D as opposed to being fully volumetric 3D. The VX1 menus that are displayed on the LCD screen are simply displayed on your computer screen when running the simulator.

You can download the SDK at http://voxon.co/developer-kit

Interact with us and other innovators

We would love you to be part of our journey and would like developers and enthusiasts to interact with each other and the company to share concepts, ideas and suggested improvements as we continue to further advance the underlying technology.

You can join our community at www.voxon.co/community

Please feel free to contact us if any questions at all at contact@voxon.co

Source Code

Most of the VX1 example programs come with their Source Code written in C/C++. If you are a programmer or want to learn programming, you can you use the source code to help you explore the various volumetric functions that are available using the 64-bit voxiebox.dll

You will need to set up a compiler (see minGW.org as an example of an open source compiler).

In the meantime, if you are already a programmer, you can get started using one of the sample programs and the voxiebox.h header file which includes all the available volumetric functions.

You can use any language that is compatible with a Windows 64-bit DLL such as C#, Java, or VisualBasic. The following source code is available for you to experiment with.

voxieatom.c
voxiedemo.c
voxieleap.c
voxiemin.c
voxiesimp.c
voxietst.c

For more information please read voxiebox.txt which details all the functions in more detail.

Unity integration

Unity is the most popular game and app development environment in the world, with over 5 Million registered users. We are working on a plugin for Unity that will allow games and apps writing in Unity to run on the VX1. We will keep you posted on our progress and look forward to sharing details with you.

3D Media formats

Using the wide range of volumetric graphics functions in the SDK, you should be able to write programs to interpret any existing documented file type such as DICOM, FBX, VRML, OBJ etc.

The supplied programs and viewer have built in support for STL and KV6 file formats. You can export STL files from most 3D software packages and it is the file format that is most commonly used with 3D printing.

3D File Conversion Process

File Type	Display Natively on VX1	Color Support	Proccess for Conversion
STL Files	YES	NO	None Required
KV6	YES	YES	None Required
OBJ Files	No (we're working on it)	YES	Convert to KV6 with Poly2vox
3DS	No	YES	Convert to KV6 with Poly2vox
Other	No	YES	Export as OBJ then convert to KV6 with Poly2vox
Diacom	No (we're working on it)	NO	Import into Slicer (Free Program) convert to STL

Whilst it is possible to create games and applications using only primitive graphics function calls to render voxels, spheres and lines, much more detail is possible by using 3D objects that can be created in existing 3D workflows. The VX1 currently supports 2 file formats natively and these are;

1. KV6 - Volumetric Data Format that supports colour
2. STL - Vector File Format (monochrome)

STL does not need to be converted, and so putting it on the VX1 is simply a case of putting the STL file on the VX1 or a network drive where it can be found and then displaying it either using one of the 3D viewer applications that are included, or by referencing it in your own program using the voxie drawspr function. Examples of using this function are included in the SDK (see voxiedemo.c)

If wanting to display a number of 3D files at once in a particular order you can edit the voxiedemo.exe file. To display an STL in voxiedemo.exe, simply edit voxiedemo_user.ini and add a reference to the file.

E.g. animfile=C:\bobs3d\models\cars\Nissan.stl

KV6 Volumetric File Format

KV6 is a file format written by Ken Silverman. It is also known as Ken's Voxlap 6 and was used by games with the Voxlap engine. It contains model and texture information for game objects. A KV6 file resembles a Minecraft structure in that when you zoom in, you will see lots of tiny cubes. When converting to KV6, you can select a scale value which determines the level of detail that you wish to maintain. The VX1 has a vertical resolution of around 200 lines so if creating a sprite that will not be scaled bigger than the display itself, then a KV6 file of 200 vertical cubes would be perfectly adequate. The best way is to experiment with the size and see what they look like when zoomed in to a level that you think will be used in your game / application. For animated KV6 Files, keep in mind that the space used for the animation will be the sum of all the frames added up, so loading an animation will be slow if each of your frames is over 10Mb in size.

Tools for creating KV6

Poly2vox - Download from here http://www.advsys.net/Ken/download.htm
PND3D - Download from here http://advsys.net/ken/voxlap/pnd3d.htm

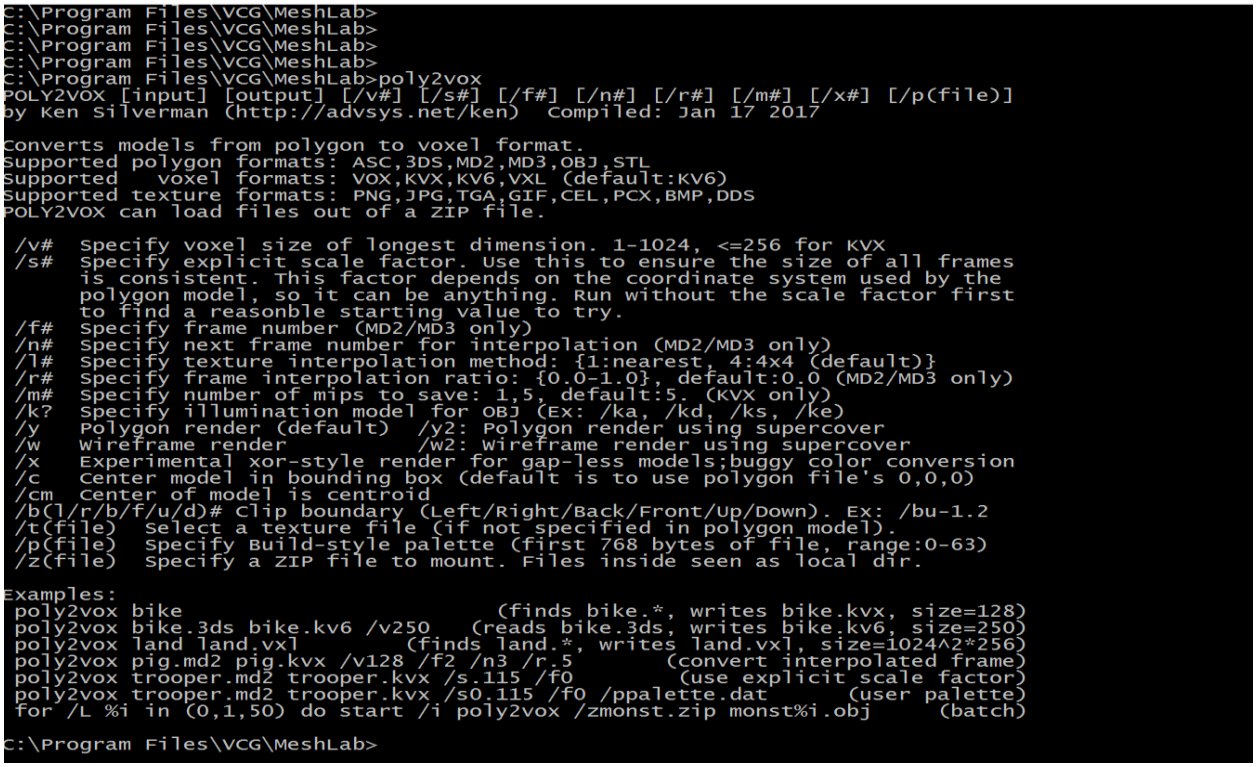
We will use Poly2vox to convert polygon 3D objects to KV6 and PND3D to convert KV6 files to KVS.

Instructions for both of these programs are in .TXT files in their downloaded zip files, but we will go over their basic usage here.

To make it simpler to use these two programs, download them to a folder on your PC and then add that name of that folder to your PATH variable. (See here for instructions https://www.howtogeek.com/118594/how-to-edit-your-system-path-for-easy-command-line-access/)

Once your path is set, you can call the programs from any CMD prompt. Let's start by converting our first model to a KV6.

Step 1) Open a CMD prompt. Press the windows key and type "CMD" and you should get a CMD prompt. Try typing "poly2vox" to check your path has been set up correctly. You should see something like this.



Step 2) Find something to convert.

Poly2vox can convert several Polygon file types, but the most likely that you will be using are 3DS, OBJ and STL. Start by designing a 3D file or downloading one from the Internet. Then save it in a directory on your PC. We will use a file called caffine.obj which is a model of a caffeine molecule. This is included in the files provided.

Step 3) Open a CMD prompt and navigate to where your 3D file is.

```
 Directory of D:\3ds\Molecules

21/02/2017  06:58 PM    <DIR>          .
21/02/2017  06:58 PM    <DIR>          ..
21/02/2017  05:25 PM            16,989 caffine.mtl
21/02/2017  05:25 PM         3,202,215 caffine.obj
               2 File(s)      3,219,204 bytes
               2 Dir(s)  1,703,639,175,168 bytes free

D:\3ds\Molecules>
```

For an OBJ, you will need a .mtl file (and optional texture maps) if your model has colour data.

Step 4) Use Poly2vox to convert the file
(in this case using the /V command to set the longest side to a resolution to 200). You will see a message telling you what the size of the model has been created.

```
D:\3ds\Molecules>poly2vox caffine.obj /v200
Reading caffine.obj
Reading caffine.mtl.... found
Scale factor used (voxel/polygon units):25.014704
x:0..199, y:0..174, z:0..68
Writing caffine.kv6 (200x175x69)
0.12 seconds
Done.

D:\3ds\Molecules>
```

Step 5) Check the model using PND3D

```
D:\3ds\Molecules>poly2vox caffine.obj /v200
Reading caffine.obj
Reading caffine.mtl.... found
Scale factor used (voxel/polygon units):25.014704
x:0..199, y:0..174, z:0..68
Writing caffine.kv6 (200x175x69)
0.12 seconds
Done.

D:\3ds\Molecules>pnd3d caffine.kv6
```

If the model appears to have missing colour data, then it may because you have used the wrong Texture channel when using Poly2vox. The .mtl file contains information about which channel colours are stored in. To find the correct channel, simply us the up and down arrows to recall your poly2vox command and us the /k option to try different channels. The available channels are as follows.

/ka - ambient
/kd - diffuse
/ks - specular
/ks - self illumination

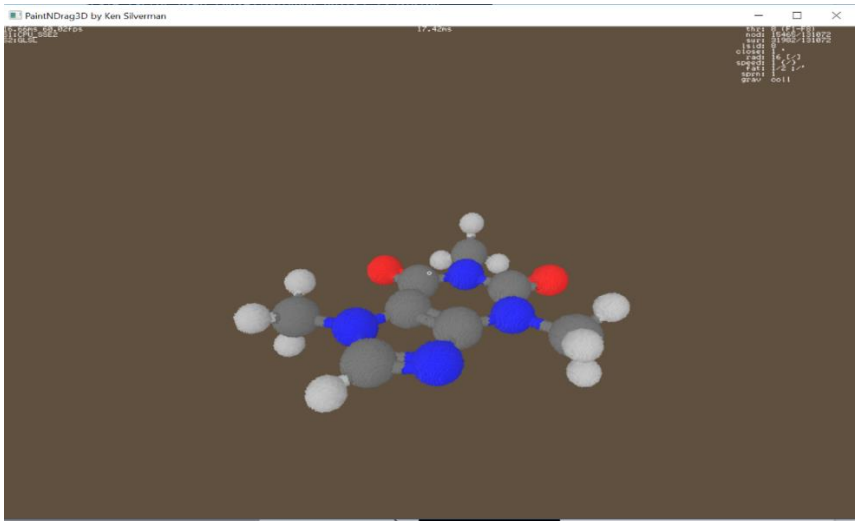
```
D:\3ds\Molecules>poly2vox caffine.obj /v200
Reading caffine.obj
Reading caffine.mtl.... found
Scale factor used (voxel/polygon units):25.014704
x:0..199, y:0..174, z:0..68
Writing caffine.kv6 (200x175x69)
0.12 seconds
Done.

D:\3ds\Molecules>pnd3d caffine.kv6

D:\3ds\Molecules>
D:\3ds\Molecules>poly2vox caffine.obj /v200 /kd
Reading caffine.obj
Reading caffine.mtl.... found
Scale factor used (voxel/polygon units):25.014704
x:0..199, y:0..174, z:0..68
Writing caffine.kv6 (200x175x69)
0.12 seconds
Done.

D:\3ds\Molecules>pnd3d caffine.kv6
```

Here we used the /kd option to use the diffuse channel. The object is now converted to KV6 and opens in pnd3d.

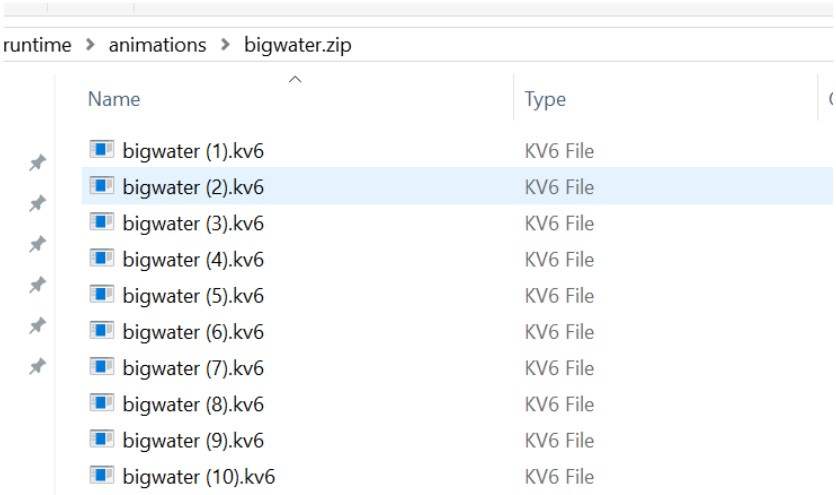


You can now use this KV6 as a sprite in your programs or in the ModelAnim mode of Voxiedemo.exe. You can now load the KV6 on the VX1 by editing voxiedemo_user.ini and adding a reference to the file.

animfile=caffine.kv6

Step 6) Create Animation

You can make animated sprites by placing them in a ZIP file. The contents of the zip should look like this. For an animation called “bigwater.zip”



And then in voxiedemo_user.ini, you can reference it using the following syntax

```
mountzip=../animations/bigwater.zip
animfile=bigwater (%d).kv6
animmode=0;   // Mode 0 = repeat , Mode 1 = ping pong back and forth
animfps=-20.0; //animation frames per second
```

To convert lots of files using poly2vox, you can use a loop as follows.
E.g. To convert 20 files called “crowd%%” you would do the following.
D:\3ds\crowd>for %i in (*.obj) do poly2vox %i /v200

You can then rename the files to the format shown in the zip above, by using windows explorer. Select all the files using SHIFT, and then right click and select rename and enter “crowd”, windows will automatically add the numbers and brackets.

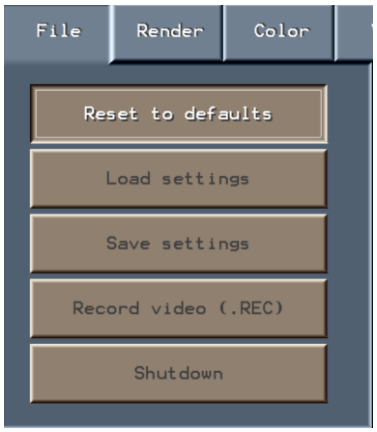
VX1 Menu

The Runtime directory contains several programs (along with their source code) to allow you explore different types of content and play games. Any program running on the VX1 can have certain parameters changed using the LCD touchscreen on the front of the VX1. To access this menu, you can press the LCD touchscreen or hit the \ key on the keyboard.

To close the VX1 menu, either press the TAB heading of the open menu, or press the \ key on the keyboard again, or by clicking any black area on the LCD screen.

The following menu tabs are available from the VX1 menu.

File



Reset to defaults - If you make any mistakes, you can reset it to the default settings.

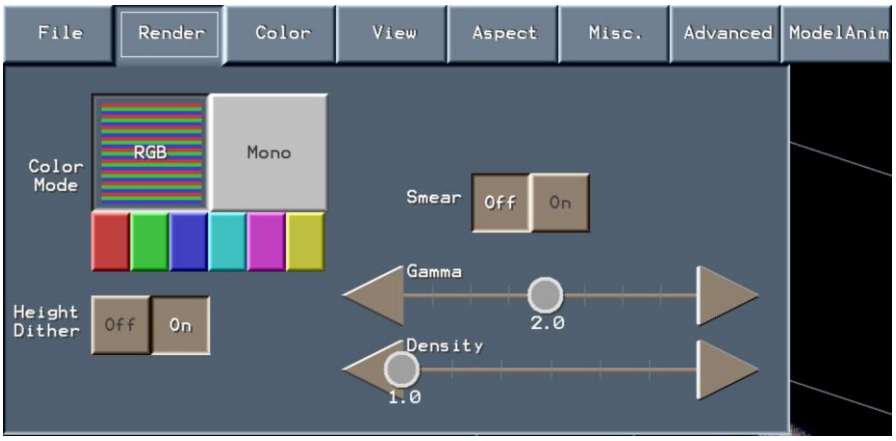
Load settings - Loads the previously saved user settings.

Save Settings - Saves the current settings of the display appearance.

Record video - Records user controller input, such as Keyboard, mouse and Joypad to a .REC file. This can be used to record user input where a user manipulates a file, such as zooming and rotation. The .REC files can then be played back and looped, using the Voxieplay.exe program.

Shutdown - Stops the VX1 Display.

Render



RGB - Enables Colour mode on the VX1. In this mode, you can look at media that has colour information such as height maps and KV6 files.

Mono - Enables monochrome mode on the VX1. This mode is the brightest and highest resolution mode. In monochrome mode, you select the colour used from the Colour tab. In Monochrome mode, you will notice higher resolution zooming is possible when using STL files. This is because STL files are vector files and can be zoomed in without “blockiness”.

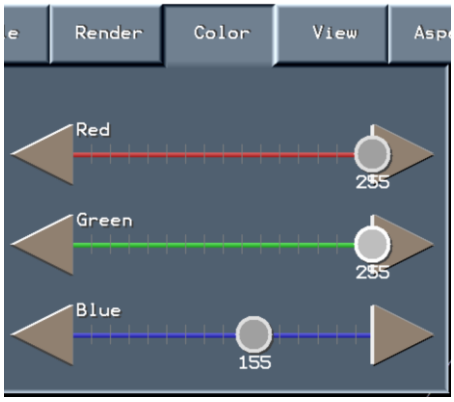
Height Dither - Height dithering uses blending of vertical slices to make contours look less “steppy”.

Smear - Enabling smear makes the projected slices slightly thicker which increases brightness, but lowers colour quality.

Gamma - Increasing gamma makes any colour imagery more colourful and higher contrast. Reducing the gamma will make the colour imagery look whiter and more washed out.

Density - The density slider will affect the number of voxels that are rendered when drawing triangles. This will be noticeable when viewing STL files, which will look brighter and denser. For very hi resolution STL files, setting this value too high might cause a slowdown in the STL file rendering.

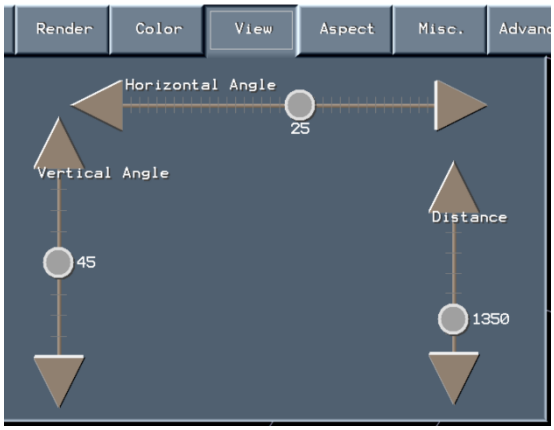
Colour



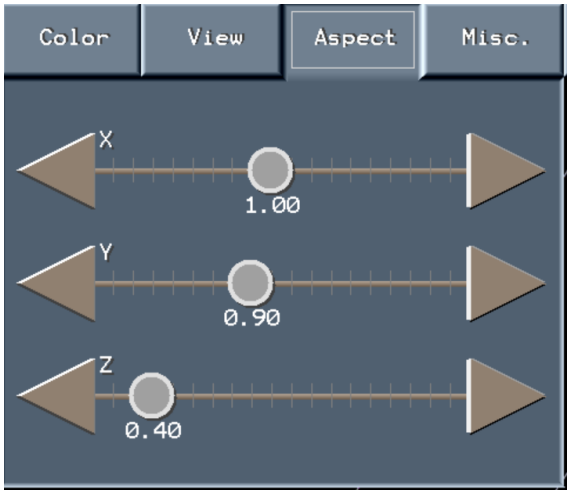
Red, Green, Blue - Sets the monochrome colour using a mix of Red, Green and Blue

View

Vertical Angle, Horizontal Angle, Distance – This is for the simulator on PC only. Changes the view of the simulator on the PC screen.



Aspect



X,Y,Z - Changes the aspect ratio of the volume. If objects looked squashed, then you can use this menu to make adjustment.

Misc

Audio Volume - Changes the PC Volume for sound effects

Advanced (only viewable for systems administrators)

This menu is used to make fine tuning adjustment to the height of the volume. Care must be taken when using this menu to avoid mechanical damage. This menu is used at VX1 calibration time, but in some troubleshooting situations, it may be necessary to access this menu. For details contact support@voxon.co

Show stats - Turns off various system information

Keystone - Toggles the Keystone correction

Drawstroke - Toggles the up and down rendering

Capture Volume - Exports volume frames for debug purposes

Actuator Volume Sliders - Used to selectively tune screen moment. (Note – to avoid possible damage, this option should only be used with the guidance of Voxon Photonics Technical Support)

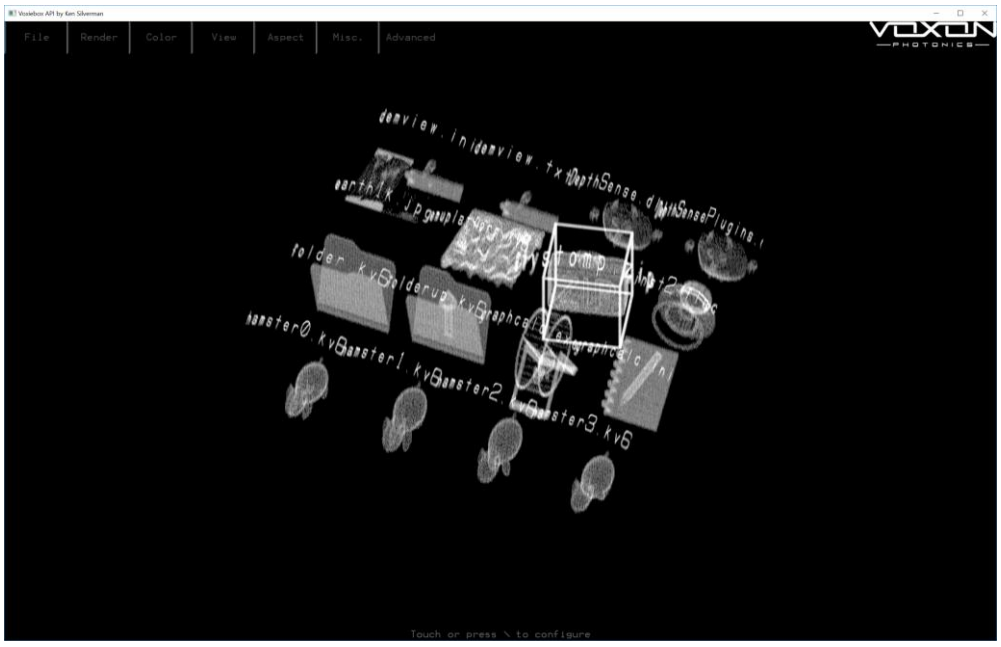
Sample Programs

The VX1 comes with a range of sample programs which can be used to explore 3D data or play games or as a template for writing your own software. The programs are all located in the runtime folder. You can quit any of these programs by pressing ESC, except for VoxieOS which requires you to press SHIFT+ESC

Sample Program - VoxieOS

VoxieOS is an example of a volumetric file browser that allows you browse directories and visualise 3D files as icons. When you can launch VoxieOS, you will be presented with a graphical representation of the VX1 directory. Supported file types will be displayed as Icons and can be opened and manipulated. Directories can be browsed as you would with windows file explorer. When you run VoxieOS, you will start browsing in the VX1 directory. You can also run other programs from within VoxieOS, and if you press escape when in that program, you be back in the file explorer. To exit VoxieOS, press shift+escape.

When browsing 3D files with this utility, you will notice that STL files can be zoomed in further than KV6 files. This is because STL files are just lists of 3D triangles. When creating your own media, use STL if there are no colour textures if you want to zoom in and explore fine detail.



VoxieOS can open any of the file types mentioned in the Media Formats section of this guide.

When looking at 3D objects, you can use the VX1 menus for Model/Anim and Rotation

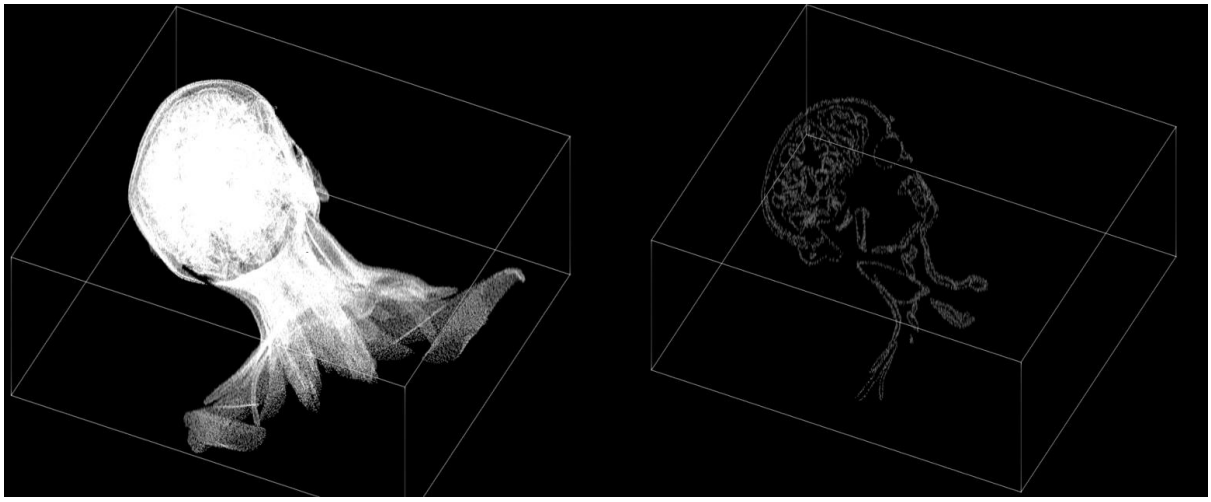
Pause - When displaying an animation, this pauses the animation.

Prev Frame - When an animation is paused, this steps through the frames backwards.

Next Frame - When an animation is paused, this steps through the frames forwards.

Draw stats - Turns on information about the selected file.

Cross section - Enables “MRI” mode which allows you to highlight a slice of the 3D volume using the 3D mouse to manipulate the slice tool. The thickness of the slice tool can be changed using the buttons on either side of the 3D mouse.



AutoRot – Allows you to rotate the models on any access.

Reset pos&ori - Resets the position of the current file to the last set position.

Loading 3D media from a USB Drive

Run VoxieOS and simply insert your USB drive into any one of the available USB slots. The software will automatically open and browse media on your drive which you can then open. When you remove the USB drive, VoxieOS will return to browsing the directory you were in previously.

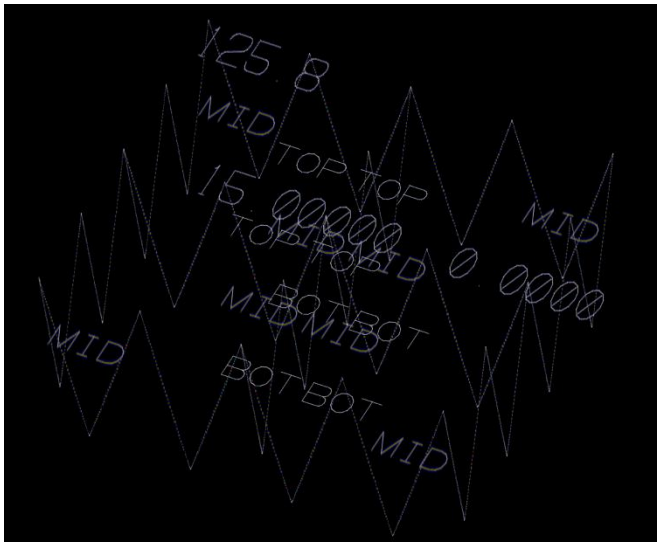
Sample Program – Voxiedemo

Voxiedemo is a suite of utilities and games with its own 3D menu system that will allow you to explore many features of the VX1. There are 14 separate programs in voxiedemo that can be accessed from the 3D menu.

The Menu can be displayed by using the ~ key (which is next to the number 1 on the Keyboard)

Each of the icons represents a different utility or game. Use the ARROW KEYS to change the selected icon. Then press ENTER to select that item.

The different modes of Voxiedemo are described below.



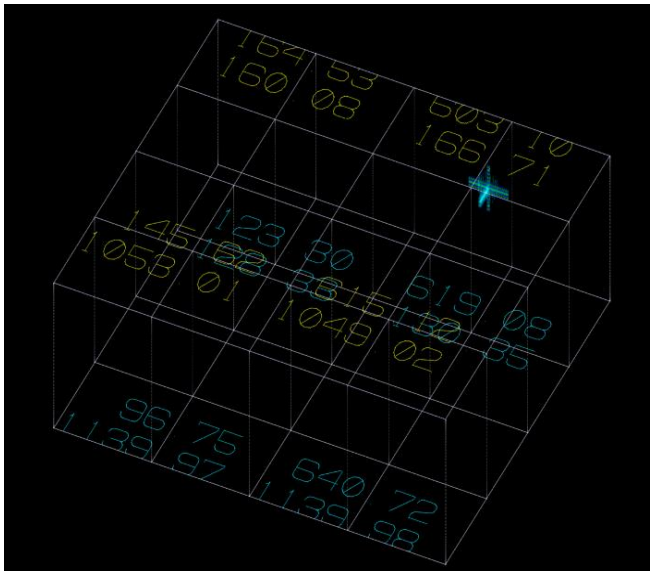
Phase Sync

This is used to calibrate the VX1 and should be used by system admins only. The graph is used to ensure that the up and down strokes of the screen are correctly in phase so that volume "ghosting" is minimised.

Use the **VX1 menu** setting to change the following options.

Wireframe – Choose between zigzag or sine wave

Hump Level – Change the number of waves



Keystone Cal

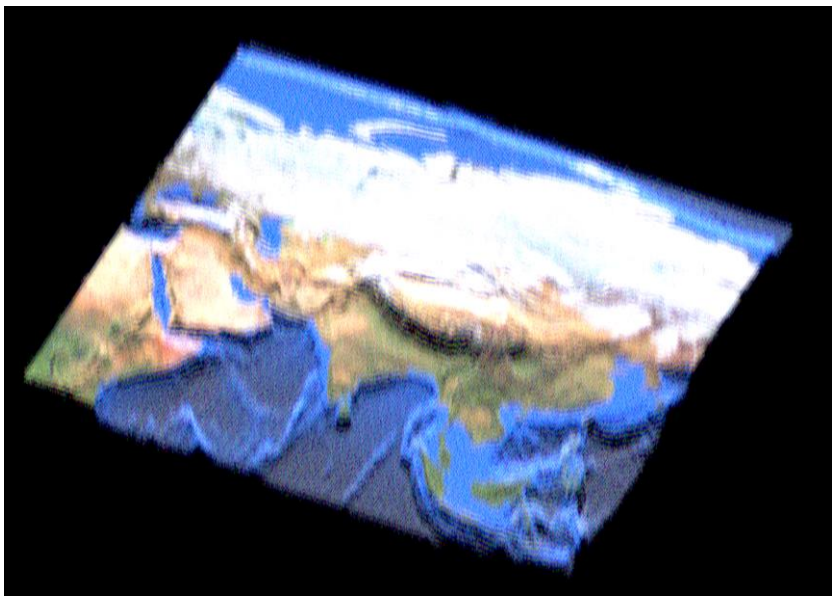
This is used to calibrate the VX1 and should be used by system admins only. Keystone calibration is used to warp the volume so that projected images which are at the top of the volume are scaled appropriately so that 3D geometry is not distorted. Use the mouse to move the icon around the volume and right click to swap between the top and the bottom. Click and drag corners using the left button to calibrate, ensuring the volume looks straight and not distorted. Finally save the settings so that they are set the next time you turn on the VX1.

Use the **VX1 menu** setting to change the following options.

Ceiling - Move the 3D cursor to the top of the volume

Floor - Move the 3D cursor to the bottom of the volume

Height Map



Use the VX1 menu setting to change the following options.

Prev - Go to the previous map

Next - Go to the next map

AutoCycle – Cycles through the maps automatically

Slice Dither – Softens the contours

Texel Filter – Applies filtering

Texture – Toggles the colour texture maps

Reset Camera – Moves the viewport to the original location

Height Map mode lets you explore Elevation Maps that you have created or downloaded from the internet. You can use the 3D SpaceMouse to Zoom, Rotate and Pan the map. You can also use the Arrow Keys to move around and comma and full stop (period) to rotate. The terrain Z Scale Value can be changed using S and X. Changing the Z Scale Value is useful for showing geographical features such as mountains or ocean floors.

You can add your own maps to voxiedemo_user.ini

To make a map, you must use a paint program such as GIMP or Photoshop and create a .PNG image. You can use two images or combine the elevation and colour data into a single image.

An example of a single image is:

Media/maps/finalworld5400.png it has two halves. The left is a greyscale image that represents height, and the right side that represents colour.

A reference to the file in voxiedemo_user.ini is needed to set the default scale settings and looks like this.

demfile=../Media/maps/finalworld5400.png|

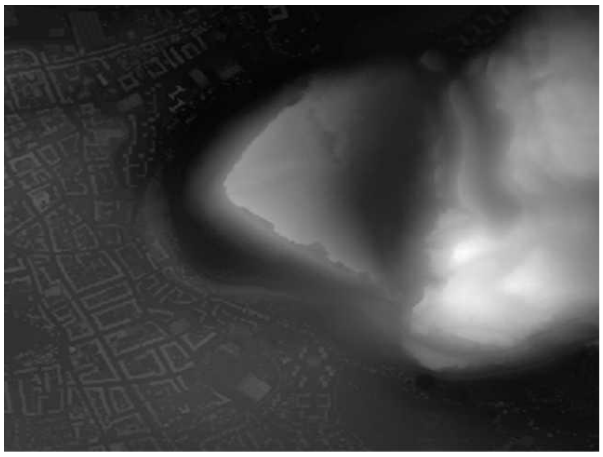
demscalez=1.0;demscalex=2; demheimin=-255;demsidebyside=1;

The "|" symbol means that both the elevation data and colour data is in the same file.

You can also use 2 separate images to represent a height map.

An example of this technique is

Media/maps/Arthur_col.png and Media/maps/Arthur_hei.png



The two images hold the colour and height separately and must be referenced in voxiedemo_user.ini as follow

demfile=../Media/maps/arthur_col.png|../Media/maps/arthur_hei.png

demscalez=3.0;demscalex=2; demheimin=-255;demsidebyside=0;

Voxie Player

This plays **.REC** files which are created from the **File** tab of the **VX1 menu**. You can list the .REC files in **voxiedemo_user.ini**

e.g.

recfile=xwing.rec \\ name of the rec file

recmode=1; \\ play mode 1=ping-pong 2=reverse

recrep=2; \\ number of repeats before advancing to next REC file

Use the **VX1 menu** setting to change the following options.

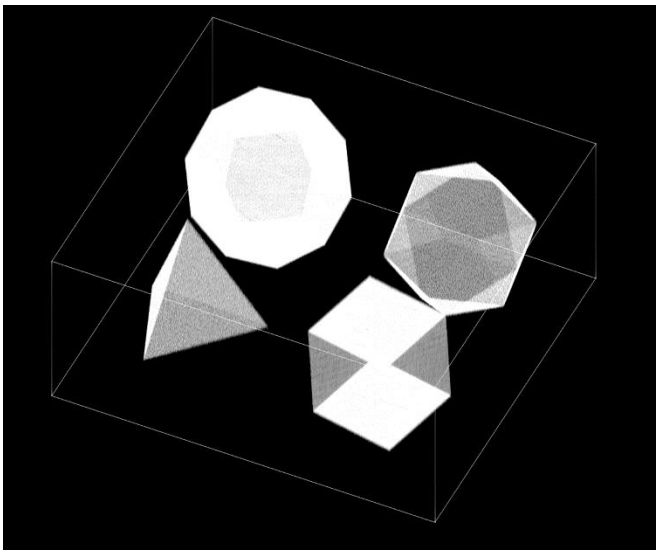
Prev - Go to the previous REC file

Next - Go to the next REC file

Cycle all Demos - Loop through all .REC files or just a single one.

Platonic Solids

This mode shows the various rendering modes that the VX1 can use for rendering polygons. Using the LEFT and RIGHT arrows will toggle between Vertex Mode, Face Shading and Solid Shading. This mode is useful for demonstrating how Face Shading gives the best look results in most cases.



Use the VX1 menu setting to change the following options.

Vertices – Show only vertices (dots) that are part of the geometry

Wireframe – Render just the lines not the surfaces

Surfaces – Render just the surfaces

Solid – Fill the entire object with light

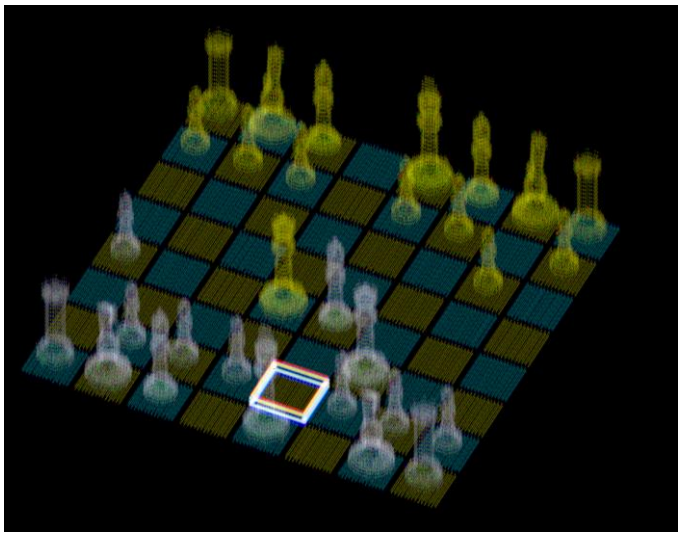
Pause – Stops the objects rotating

Flying Stuff

This mode shows flying text which can be edited by using backspace to delete the existing text and typing your own.

Chess

Use the arrows or a controller to select a piece and then hit enter to activate it then choose a square to move to and hit enter.



Use the VX1 menu setting to change the following options.

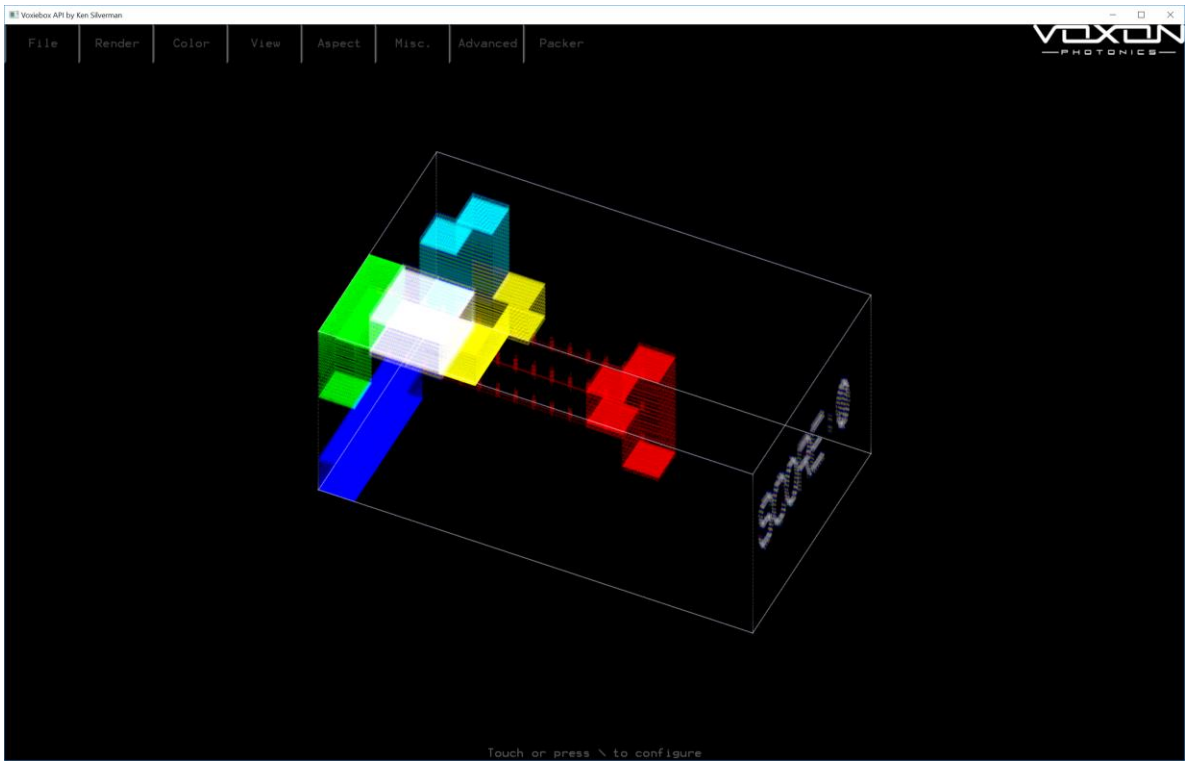
Hint – Suggest a move

Automove – Make the computer play against itself

Difficulty – Increasing the difficulty will make the game harder but increase wait time

Packer

This is best played with the 3D SpaceMouse. You have to rotate the pieces to make solid planes.



Use the VX1 menu setting to change the following options.

Render Mode - These options change the rendering style of the blocks

Board X** - These make the playing volume bigger and the game harder.

Paratrooper

This is best played with a regular 2D mouse.

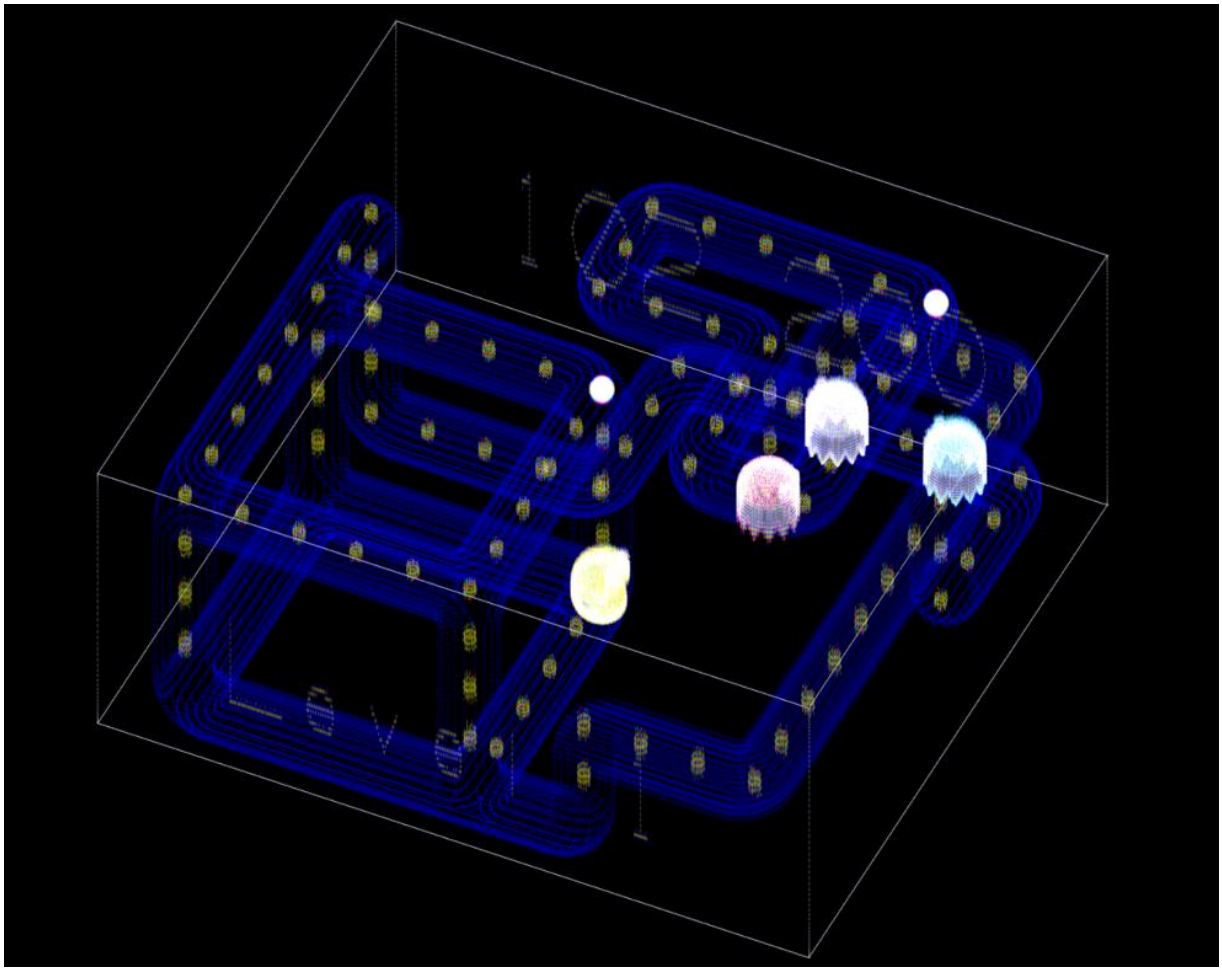
Defeat the invading robot zombies by neutralising their helicopters with blasts from your Electromagnetic pulse cannon. The left mouse button on the standard 2D mouse is used to fire, or you can also use the left button on the 3D SpaceMouse if using this.

Use the VX1 menu or backspace on the keyboard to reset the game.

Dotmunch

Eat all the dots in the maze without being eaten by the ghosts. You can eat the ghosts if you eat powerup ball first. Use the **3D SpaceMouse** or **Xbox Controllers** to control the Muncher. You can also use the **Arrow Keys** and **Shift** and **CTRL** to go up and down.

This game can also be used as a very simple introduction to programming and problem solving. There is a text file in the **Runtime** folder called **voxiedemo_dotmunch.ini** which holds the **maze designs**. You can design your own mazes to test your logic skills and then test them on your friends.



Use the **VX1 menu** setting to change the following options.

Prev Level – Play the previous level

Next Level – Play the next level

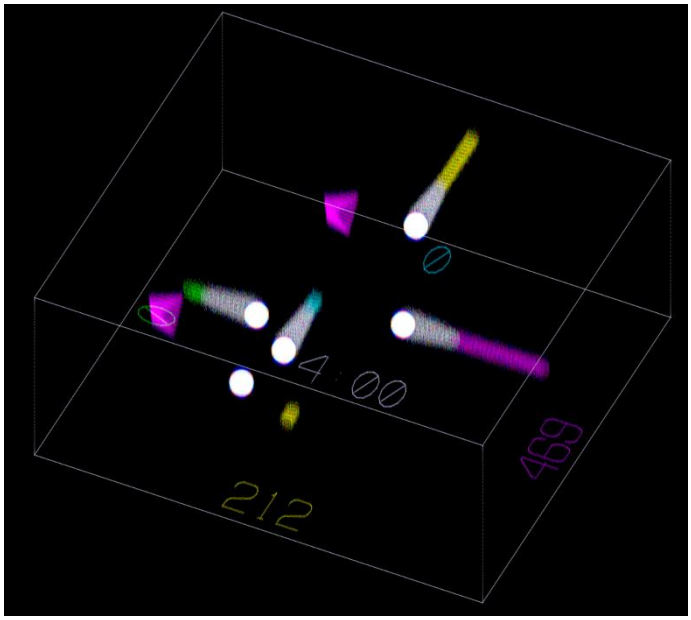
The following is an example of the default maze created (voxiedemo_dotmunch.ini). Note that the mazes with a **munzsiz > 1** have multiple text parts.

munxsiz=27; munysiz=19; munzsiz=1; munxwrap=1;
munboard=

```
....Mxxxxxxxx.xxxxxxxxM....
....P...x...x.x...x...P....
....xxxxxxxxxxxxxxxxxxx....
....x...x.x.....x.x...x....
....Mxxxx.xxx.xxx.xxxxM....
........x...x.x...x........
........x.xxxxxxx.x........
........x.x.....x.x........
xxxxxxxxxxx.....xxxxxxxxxxx
........x.x.....x.x........
........x.xxxxxxx.x........
........x.x.....x.x........
....xxxxxxxxx.xxxxxxxxx....
....P...x...x.x...x...P....
....xxx.xxxxxSxxxxx.xxx....
......x.x.x.....x.x.x......
....xxxxx.xxx.xxx.xxxxx....
....x.......x.x.......x....
....xxxxxxxxxxxxxxxxxxx....
```

SnakeTron

This is a fun 4 player game where you have to control your snake and eat the pellets. Eating the pellets makes your snake grow longer and your score increases more when your tail is longer. Don't crash into the purple tetrahedrons or other snakes, or even your own tail! You can control the snakes with the **3D mouse**, **Xbox controllers**, or **keyboard arrows** and **shift / CTRL**



Use the **VX1 menu** setting to change the following options.

Pellet Speed – Speed up the pellets to make the game more difficult

Reset Game – Start a new game

FlyStomp

This is a 2-player game where you have to flap your wings and land on your opponent's back to score a point. You can control the flies with the Xbox controllers, or keyboard

Player 1 – Arrow Keys and CTRL to flap

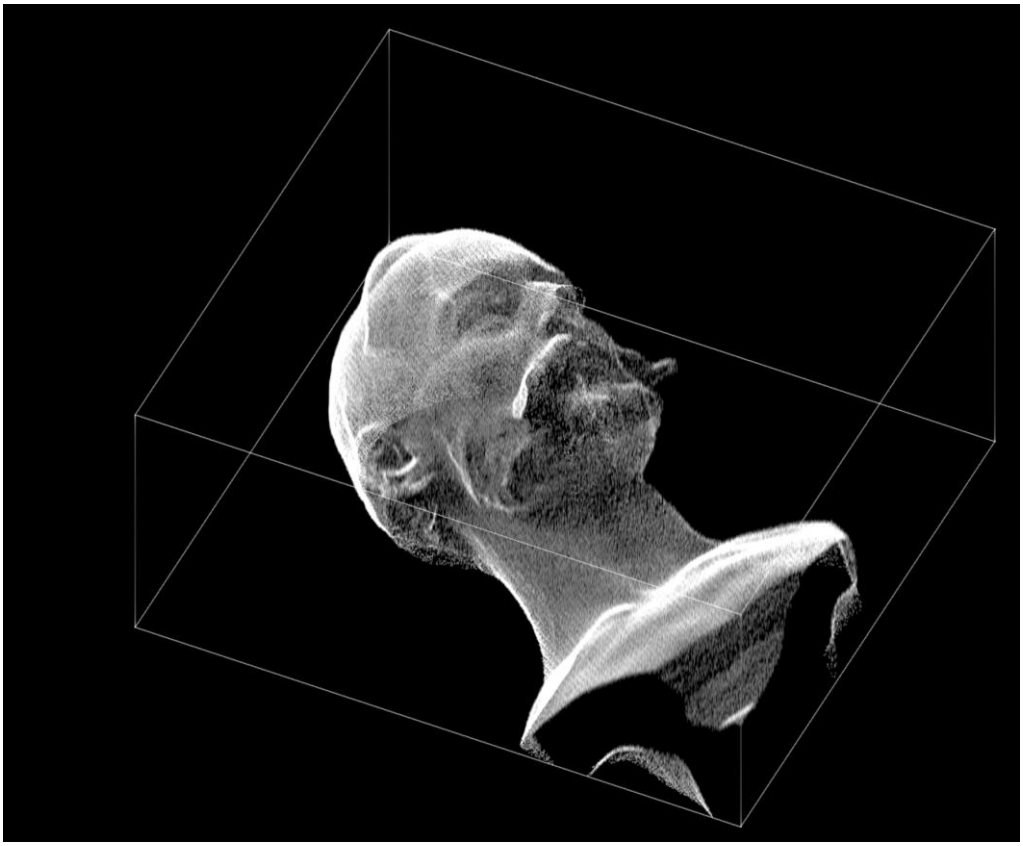
Player 2 – J,K,L,I and Z to flap

Use the VX1 menu setting to change the following options.

Reset Game – Start a new game

Model/Anim

This is a 3D model and animation player that is much like VoxieOS, except that you can list models in a user file and get the software to cycle through them automatically. You can add references to your own media to the voxiedemo_user.ini in the Runtime folder.



Use the VX1 menu setting to change the following options.

Prev Model - Displays the previous model in the list of models in voxiedemo_user.ini

Next Model - Displays the next model in the list of models in voxiedemo_user.ini

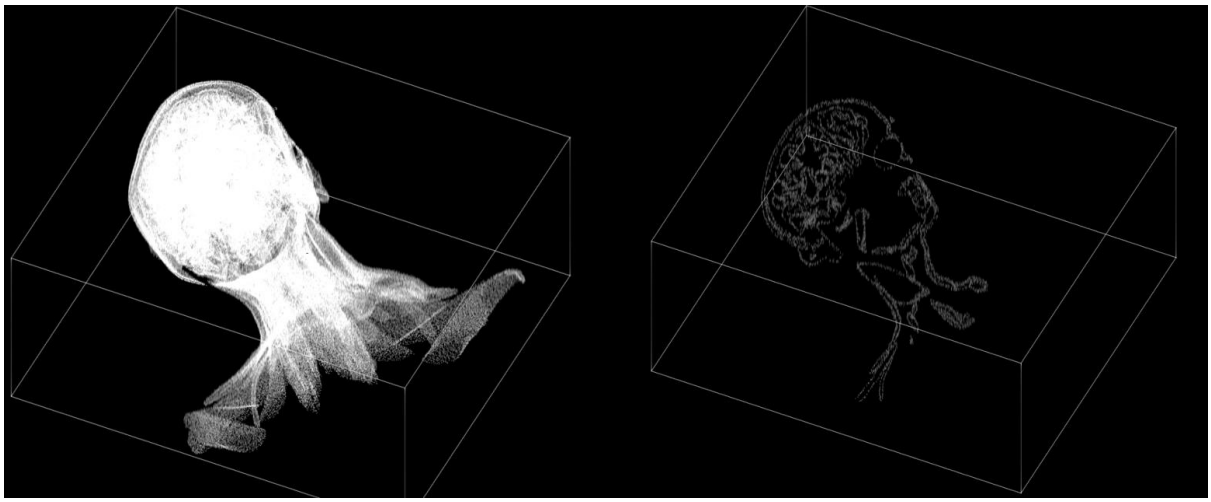
Pause - When displaying an animation, this pauses the animation

Prev Frame - When an animation is paused, this steps through the frames backwards

Next Frame - When an animation is paused, this steps through the frames forwards

Draw stats - Turns on information about the selected file

Cross section - Enables "MRI" mode which allows you to highlight a slice of the 3D volume using the 3D mouse to manipulate the slice tool. The thickness of the slice tool can be changed using the buttons on either side of the 3D mouse.



AutoCycle - Enabling Autocycle will make the model viewer cycle through each of the models or animations listed in voxiedemo_user.ini

AutoRot – Allows you to rotate the models on any access

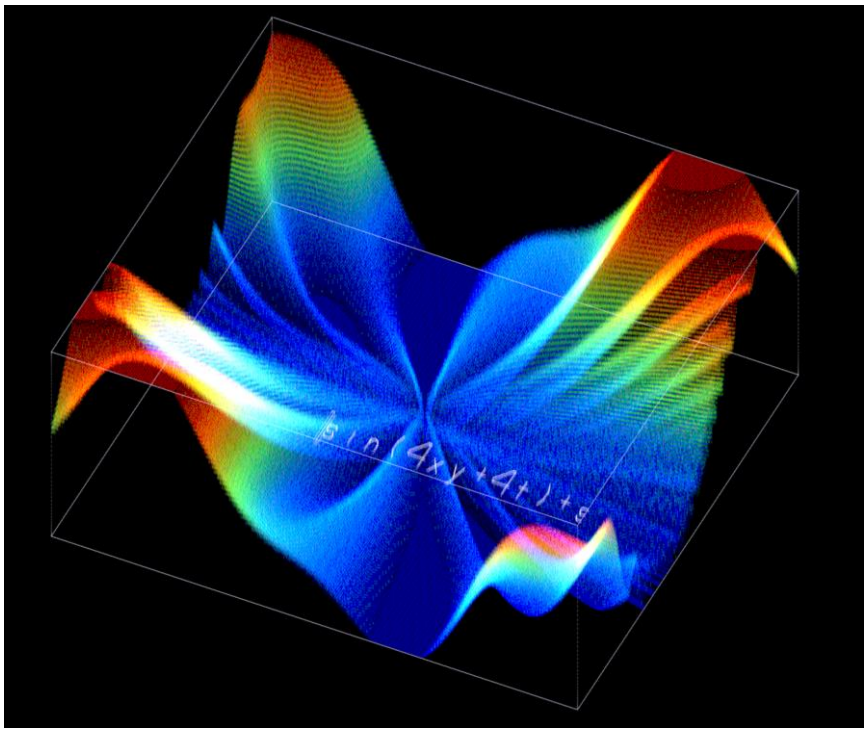
Reset pos&ori - Resets the position of the current file to the last set position

Load All pos&ori - Loads the last saved position, orientation and scale of all the 3D files

Save All pos&ori - Saves the current position, orientation and scale of all the 3D files

Sample Program - Graphcalc

Graphcalc is a Mathematical simulator that lets you create volumetric animated formulas.



You can type a formula using the keyboard or try altering one of the 36 pre-set formulas.

The VX1 menu options for this mode are as follows.

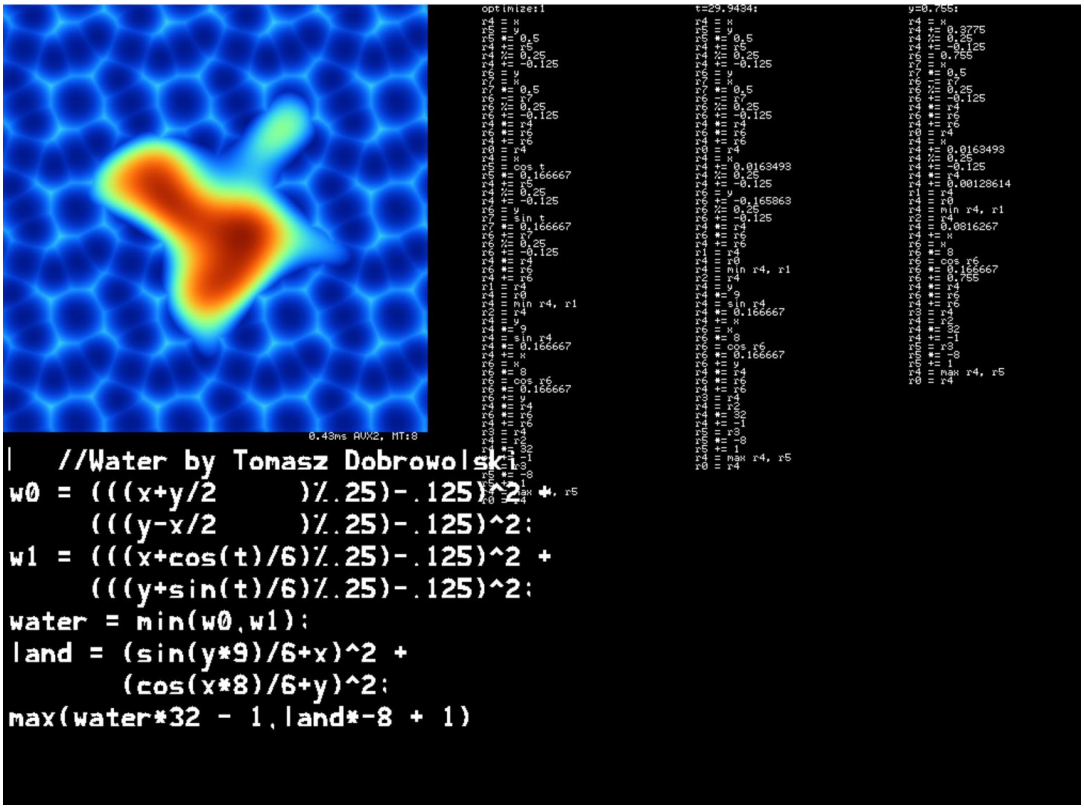
Prev Formula - Select the previous pre-set formula

Next Formula - Select the next pre-set formula

AutoCycle - When enabled – loops through all the pre-set formulas

Host on TCP Port 32123 - This is an advanced option that lets you edit the formula from a remote PC (see Graphcalc_pc for more details)

Sample Program – Graphcalc_pc



Graphcalc PC allows you to edit and create formulas on the PC rather than the VX1, giving you the ability to see the entire formula and all the variables. Both versions of Graphcalc allow you to load pre-set formula using (F1 to F12), SHIFT (F1 to F12) and CNTL + SHIFT (F1 to F12) for a total of 36 pre-sets.

You can write your own Graphs using the following syntax.

Trig functions:	cos()	sin()	tan()	acos()	asin()	atan()	atan2(	)
Log functions:	sqrt()	exp()	log()	pow()				
Quantizing functions:	int()	ceil()	floor()	sgn()	unit()			
Other functions:	min()	max()	fabs()	abs()	fmod()			
Random functions:	rnd ()	nrnd ()						
Condition:	if (exp) { .. } (else { .. })							
Logical:	<	<=	==	!=	>=	>	&&	||
Arithmetic:	+	-	*	/	%	^ (power)		
Assignment:	=	+=	-=	*=	/=	%=	++	--
Statement separators:	,	;						
Built-in variables:	PI	t (time)	x	y	z			
User variables: Note: must not start with:	t	x	y	or z.				

You can control a VX1 from within Graphcalc_PC so that a student or teacher on a PC can create or edit formulas on their own PC and have what they are doing mirrored on the VX1.

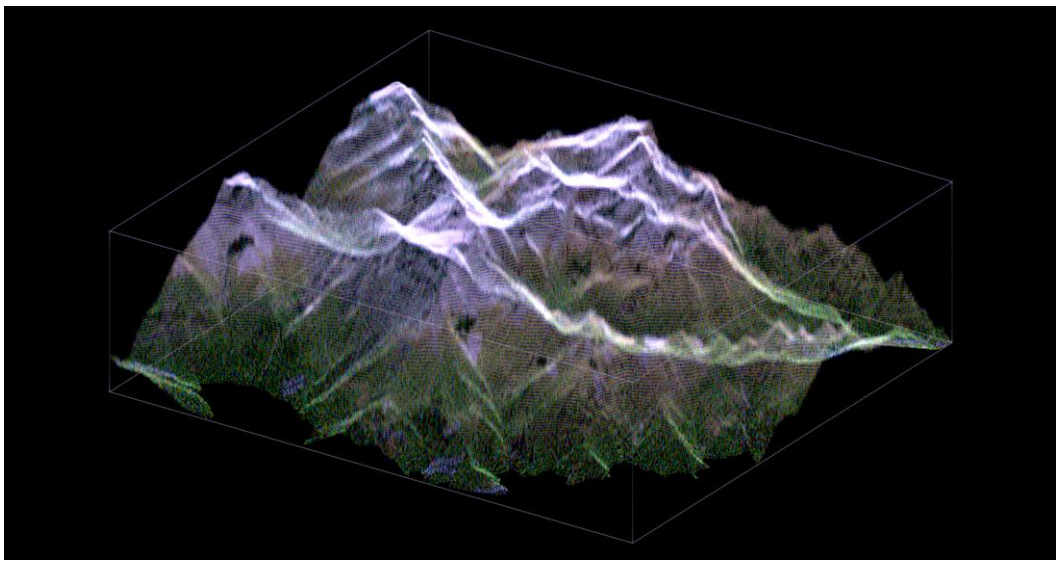
1) Find the IP address of the VX1 on your network by typing IPCONFIG from a command prompt. You will see a line starting IPv4 Address. Take a note of the numbers, e.g. 10.85.12.123
2) On the VX1 when running Graphcalc go to the graphcalc tab on VX1 Menu and simply click the Host on TCP button once. (Note: you may have to click ok to accept a message from windows about allowing the VX1 on your network)
3) On a different PC, run Graphcalc_pc.exe by navigating to the runtime folder in a CMD prompt and typing the following (changing the IP address to the one you saved earlier. graphcalc_pc.exe/join:10.85.12.123
4) You can then edit and create formulas and see the results on the VX1 at the same time.

Sample Program – Demview

Demview is an experimental 3D world map browser. It requires an internet connection to work.

DEM stands for "Digital Elevation Map" which is a format for storing 3D information about a map using a combination of colour map and a greyscale image that represents the height of each pixel.

Downloads elevation data from Mapzen.com and road/satellite data from various sources (configurable in DEMVIEW.INI)



Control the map using the 3D SpaceMouse or keyboard.

Navigate - Arrow keys or 3D mouse

Zoom - Up and down on 3D mouse or A & Z on keyboard

Scale Z Height - S & X on Keyboard

Map Layer - You can change the MAP overlay by pressing keys 1 to 9

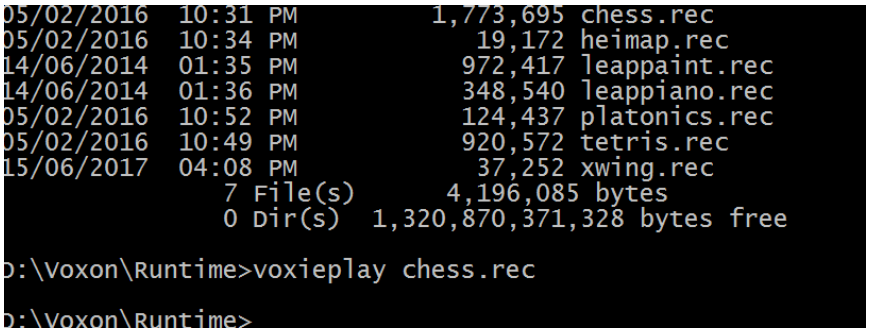
The layer maps are selected from various servers such as google and openstreetmap.

Saved Locations - You can cycle through a list of saved locations using the keyboard ; and ' keys. You can also add your own locations by editing demview.ini and adding new locations in the format shown below.

```
loc=+2.17       ,+41.39,0.0,"Barcelona"
loc=+12.57      ,+55.68,0.0,"Copenhagen"
loc=+11.26      ,+43.77,19.0,"Florence"
loc=+24.94      ,+60.17,0.0,"Helsinki"
loc=-0.13       ,+51.51,0.0,"London"
```

Sample Program - Voxieplay

You can use Voxieplay to play back .REC files that you make using the RECORD VIDEO option on the VX1 menu file menu. To play a .REC file, you need to invoke Voxieplay from a command window (Press the windows key and then type cmd to get to the command window) as below.



Sample Program – Voxieleap

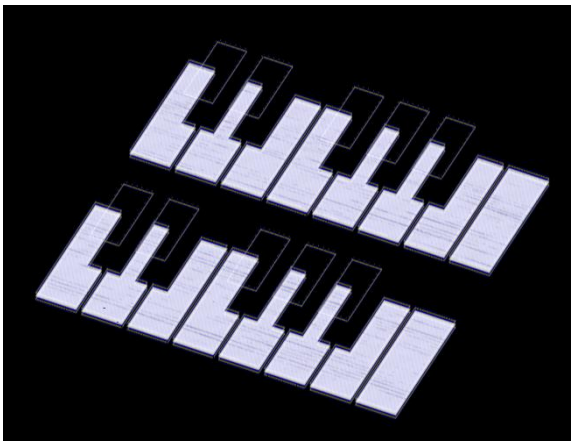
Voxieleap is a program that requires a **Leap Motion** controller (not included) to work. The Leap Motion is an infra-red stereo camera that can track your finger movement and allow you to interact with 3D data.

Voxieleap has 3 Modes which can be selected using the **keyboard keys 1,2 & 3**

1 – 3D drawing

2 – Leap Piano

3 – Ball pit



Sample Program – Voxiesimp

Voxiesimp is a test program to demonstrate programming techniques and a good starting point if you wanted to develop your own application.

More to come!

The VX1 is a completely unique way to explore and share 3D information. We love hearing about new software ideas, new types of data and new ways of interacting with the VX1. We want to share your experiences, listen to your comments, and help develop the software and hardware and make it available to more and more people.

Photographing and Videoing the VX1

Capturing the VX1 on camera is tricky and this is because of the ultra-high-speed video projection that is used to render the data. If you have an SLR camera, you can capture great photos by using manual settings and setting the shutter speed to $1/15^{th}$ of a second. Its best to use a tripod unless your camera as good image stabilisation. Video is harder to capture because few cameras allow you to video at 15 fps. There are a few options such as the FILMIC PRO app for iPhone and Android which allows you to set a custom recording speed.

Social Media

Feel free to share your experiences, ask us questions, challenge us. We would love to hear from you and will always listen to your comments and feedback. We would love hear how you are using the VX1 and would love to share some photos and video of you doing so! Help us develop the software and hardware and make it available to more and more people.

Follow us | mention us | send us photos & videos | chat to us | share the love

Twitter: https://twitter.com/voxonphotonics

Facebook: https://www.facebook.com/voxonphotonics

LinkedIn: https://www.linkedin.com/company/voxonphotonics

YouTube: Voxon Photonics YouTube Channel

Troubleshooting

The image disappears off screen and I can't get it back

If you lose the image off one of the sides of the display, then use the / key to return it to the original position.

The image looks like it's turned inside out or you see multiple images

Occasionally the Windows video drivers get out of sync with the display. To fix this, use the HW Sync tab and change the vertical sync by one position left or right, until the display is in sync. Then go to FILE and Save Settings.

The display goes all bright

This may occasionally happen if too many programs are running simultaneously. Hold down the Windows key and the D key to take you back to the desktop. Then double click the 'Stop All' button.

For any other support issues please contact us at **support@voxon.co**