Contents

1. Introduction

Thank you for choosing a DAVID product! In order to setup and run your 3D scanner safely, please read the following safety instructions. This manual is part of this product. In case of passing this product, please enclose this guide.

1.1. Intended Purpose

With your DAVID SLS-3 Structured Light Scanner, you can quickly and accurately capture object surfaces three-dimensionally.

1.2. Safety Instructions

Place the appliance on a stable surface. Dropping the unit may severely damage it, and the glass calibration panels may break. Caution: Risk of cuts!

Do not place the device on a vibrating surface to prevent damage of internal components and battery leakage.

Operate the device only in a dry environment.

Do not operate the device in potentially explosive atmospheres.

Never look directly into the projector lens when the lamp is turned on. The bright light may cause serious damage to eyes.

Do not face the projector lens to the sun. It can result in fire.

Do not attempt to disassemble this projector. There are dangerous high voltages inside the unit.

Do not use the device if it is broken or has been dropped. In this case, contact your dealer for inspection.

Stop using the device when there is smoke, unusual noise or smell. That could result in fire or electric shock. In this case immediately disconnect the power plug, and contact your dealer.

Do not insert any objects into the openings of the projector chassis. That way you might come into contact with dangerous voltage points or create a short circuit between the parts. That could result in fire or electric shock.

Do not spill liquid of any kind onto or into the device.

8. CE-Konformitäts-Erklärung

DAVID Vision Systems GmbH
Rudolf-Diesel-Str. 2a
56070 Koblenz
Germany

erklärt in alleiniger Verantwortung, dass das Produkt DAVID-SLS-3 konform zu den nachstehenden Standards oder standardisierten Dokumenten ist:

USB-Stick:
EN 55022:2010
EN 55024:2010
EN 61000-3-2:2006+A1:2009+A2:2009
EN 61000-3-3:2008

Projektor mit Netzteil und Fernbedienung
EN 55022:2006/A1:2007 Class B
EN 55024:2010
EN 61000-3-2:2006+A1:2009+A2:2009 Class A
EN 61000-3-3:2008
EN 60950-1:2006+A11:2009+A1:2010+A12:2011
EN 50581:2012
EN 62301:2005
Regulation (EC) No. 1275/2008

Kamera:
EN 61000-6-3 (06.2005), Class B
EN 55022 (09.2003) / IEC CRISPR 22
EN 61000-6-2 (08.2002), Class A
EN 61000-4-2 (12.2001)
EN 61000-4-3 (11.2003)
EN 61000-4-4 (07.2005)
EN 61000-4-6 (12.2001)

gemäß den Bestimmungen der Richtlinien **2006/95/EC, 2011/65/EC, 2004/108/EC, 2009/125/EC**

David Heckner, Geschäftsführer
Koblenz, im Januar 2014

Wir sind stets bestrebt, unsere Produkte zu optimieren und behalten uns das Recht vor, die Produktspezifikationen ohne vorherige Benachrichtigung zu ändern.

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Do not insert any objects into the openings of the projector chassis. That way you might come into contact with dangerous voltage points or create a short circuit between the parts. That could result in fire or electric shock.

Do not spill liquid of any kind onto or into the device.

The projector's power adapter is equipped with a three-wire grounded plug. The plug only fits in a grounded power outlet. Make sure that the power outlet is properly grounded before inserting the AC adapter plug. Do not insert the plug into a non-grounded socket. Please contact your electrician for details.

Warnings! The grounding pin is a safety feature. Using a not properly grounded socket may result in electric shock and/or injury.

Do not make any changes to any components.

Repairs to the device must be performed only by an authorized dealer or qualified service personnel of DAVID Vision Systems GmbH.

Observe the safety instructions of the projector manufacturer. These can be found separately on the accompanying ACER projector CD.

1.3. Scope of Delivery

- Structured-Light Scanner pre-assembled, consisting of:
  – LED video projector
  – Camera with lens
  – Base rail with camera slide
- Tripod with protective bag
- Glass calibration panels + 2 fixing brackets 90°
- USB flash drive with DAVID 3D Scanner Pro Edition and camera drivers
- Projector Accessories
  – External power supply and power cable
  – Remote control
  – Adapter VGA to Universal I/O
  – VGA cable
  – HDMI cable
  – Protective bag
  – User Instructions
- Adapter kit for power supply worldwide
- USB cable for camera
- Cable strap

Technical changes are subject to change without prior notice.

1.4. System Requirements

- Windows Vista, 7 or 8 (32-bit or 64-bit)
- Microsoft. NET Framework 4.5 (32-bit or 64-bit)
- 3D-capable graphics card
- Free VGA or HDMI port
- Two free USB ports
- Recommended: Dual-core processor, 2 GHz, Windows 7/8 64-bit, 8 GB RAM, NVIDIA or AMD graphics card

2. Initial Setup

2.1. Installing Software and Drivers

Before you connect any DAVID device to the PC, please install the DAVID software and drivers:

1. Connect the USB flash drive to your PC, then select „Browse“ or Explorer / My Computer.
2. Start „DAVID_Setup_xxxx.exe“ (administrator rights required).
3. Choose „Full installation“ or „DAVID SLS-3“ as profile.
4. Follow the instructions on the screen.

2.2. Position of the Camera

The camera can be mounted on the right or left side of the projector:

Size of the scan object / scan area	Position of the Camera (seen from rear)
up to 110 mm	to the left of the projector
110 to 350 mm	optional, better to the left
from 350 mm	to the right of the projector

If necessary, mount the camera slide to the corresponding side. The exact position of the slide (distance from the projector) is set later in operation. The distance between the camera and projector optics will be similar to the size of the object / region to be scanned.

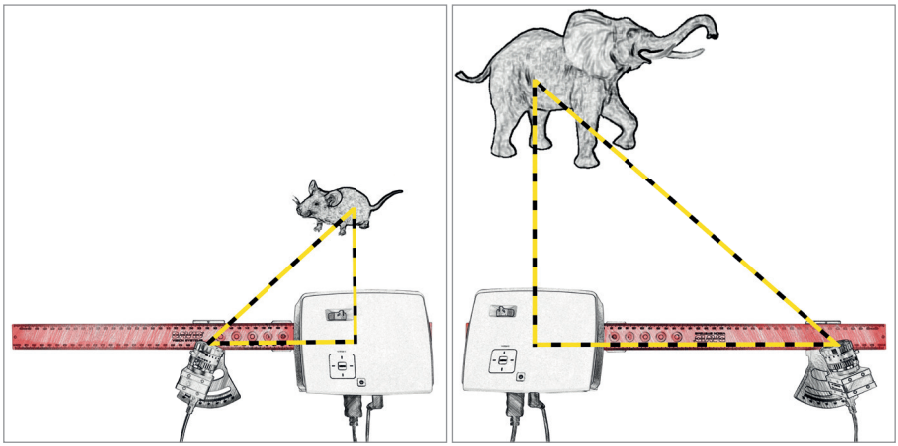


Figure 2.1: Left: Small object → short distances; Right: Large object → greater distances

2.3. Rotation of the Camera

Rotate the camera by about 22° such that it aims at the projection area. (Fig. 2.2) To do this, loosen the thumbscrew under the camera. Set the rotation angle by means of the degree scale on the camera slide, then fix the thumbscrew.

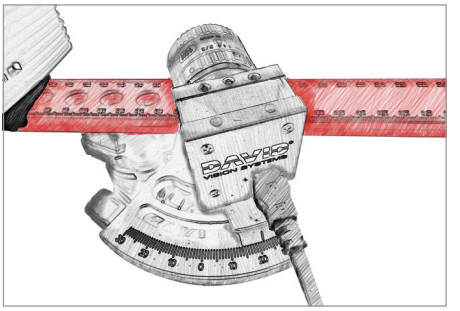


Figure 2.2: Setting the camera angle

TIP: For very large objects, or objects with deep cavities, a smaller camera angle may be necessary. Angles less than 20° result in reduced scan quality (noise, inaccuracies). A very large camera angle (> 30°), may improve the scan quality a little, but is only suitable for very flat objects. Large camera angles are usually impractical and reduce the depth of the measurement range.

2.4. Connection

Connect the camera, the projector and the DAVID USB flash drive according to the wiring diagram to your computer (Fig. 2.3). To connect the projector to your computer, you can use HDMI (recommended) or VGA.

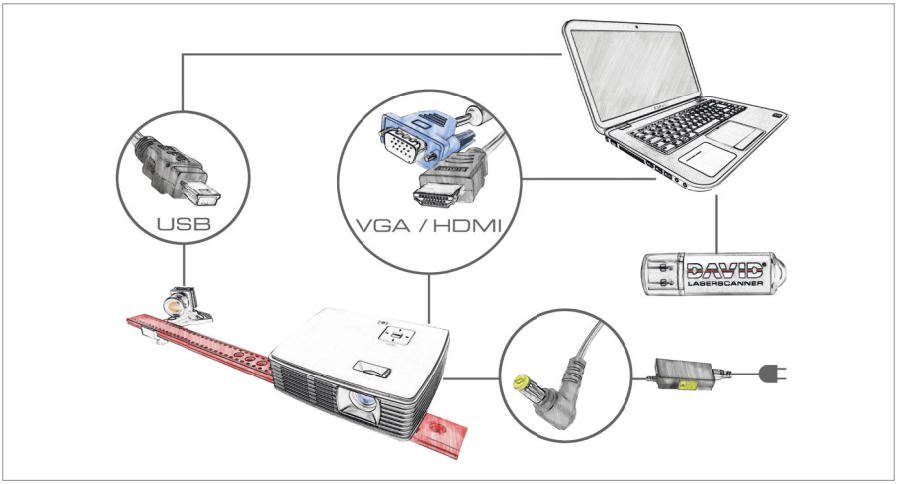


Figure 2.3: Connection diagram

TIP: If you want to change the video source (e.g. HDMI to VGA), follow these instructions:
1. Press Source key (↑ key) on projector.
2. Select desired video source using ↑ and ↓ keys.
3. Press → key to confirm selection.

2.5. Setting up the Projector

The projector is already delivered with optimal settings, we recommend not to change anything in the menu.

Note: You can restore the recommended settings in the projector's menu at any time as follows (See Figure 2.4.)

1. Select "Reset"
2. Turn the "Auto Keystone " off, and set the manual value "Manual Keystone" to 0
3. As "Projection Location", select the icon for desktop use, not "AUTO"

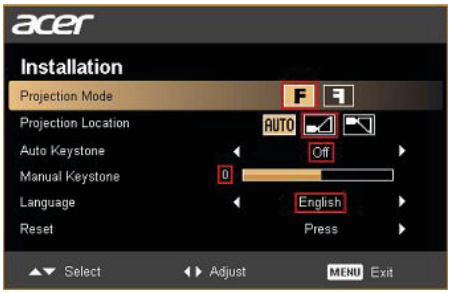


Figure 2.4: Projector settings

Note: You can activate the "Eco-Mode" if you do not need the maximum intensity of light.

For details, please read the manual of the projector.

2.6. Setting up the Projector as Extended Desktop in Windows

Click the right mouse button on a blank area of your Windows desktop, select "Screen resolution" or "Properties" (depending on your Windows version).

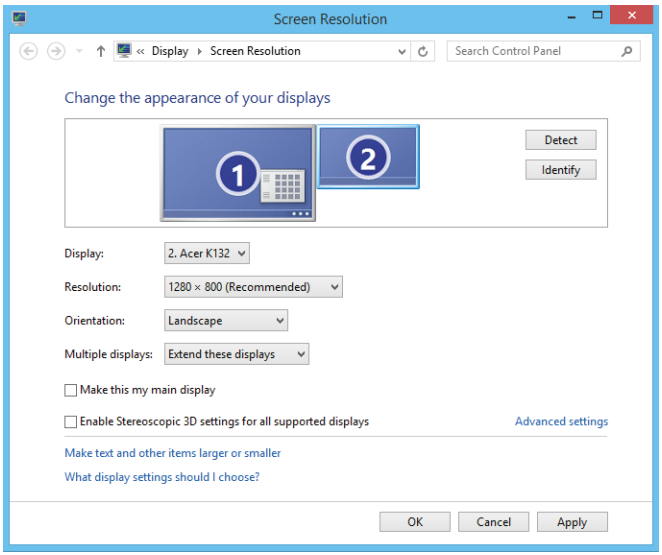


Figure 2.5: In this window you can separately configure your two "Displays", the monitor and the projector. (Image may vary)

Your screen should be set as "primary monitor". Make sure the projector (usually "Acer K132") is set as extended desktop ("Extend these displays"). This is necessary so that DAVID can project the stripe patterns, while the user interface is displayed on your screen.

The resolution of the projector must be set to its native value (usually 1280 * 800 pixels) Furthermore, you should make sure the projector is set to 60 Hz. Choose the Projector and click "Advanced", here you should set the refresh rate to 60 Hz in the "Monitor" tab.

When these settings are correct, your monitor and projector will show the same desktop wallpaper, but otherwise different contents. You can move your mouse pointer sideways between the monitor and the projector image. The Windows Start menu and most of the desktop icons are only displayed on the monitor. Any window can be moved between monitor and projector back and forth.

So in case the main DAVID window is displayed on the projector, please grab its title bar with the mouse and drag it sideways onto the monitor.

3. The Scan Software DAVID

Manual

1. Offline manual: Open „DAVID4_en_Manual.html" located on your DAVID USB stick.
2. Online manual: You can find a manual for the current DAVID 4 version at

http://www.david-3d.com/support

Updates

Updates within the master version number are free. Therefore, use the automatic update feature, or download updates manually from our website.

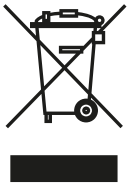
4. Disposal / Recycling

The electronic components of the DAVID 3D scanner, including disused batteries or accumulators, may not be disposed of as household waste. Every consumer has a statutory obligation to properly dispose of these items at officially designated points of disposal. In accordance with the EU Directive 2002/96/EC on waste electrical and electronic equipment this must be disposed of in accordance with local regulations. You can dispose of the product at your local public point for collection of electronic waste. You can also return the product to us for disposal. In that case, please use the following address:

DAVID Vision Systems GmbH
c/o RECYCLING
Rudolf-Diesel-Str. 2a
56070 Koblenz
Germany

Batteries containing hazardous substances are marked with the symbol of a crossed out wheelie bin. Below that symbol the appropriate chemical name of the pollutant is given. The terms have the following meanings:

Cd = battery contains cadmium
Pb = battery contains lead
Hg = battery contains mercury



5. Troubleshooting

5.1. Problems with the Scan Quality

Problem	Cause / Solutions
The scans are noisy (rough surfaces)	Adjust the camera aperture (f-stop) so that the red intensity curves are well-adjusted and not being cropped. (*)
	Set the projector's brightness to maximum.
	Increase the camera angle (at least 20°) and the distance between the camera and projector. (*)
	Set the value "Gain" in the camera properties to minimum (*)
	Select pattern parameter "Default" or better "Quality".
	Reduce the ambient light.
The scans show a regular wave pattern	Make sure that the red intensity curves are neither overdriven nor too weak. Flattened sine waves cause waves in the scan. (*)
	Reduce the ambient light. Avoid fluorescent lights and all flickering light sources.
	Make sure that in the projector's menu, all filters are adjusted to neutral (default values) and no artificial contrast enhancement, etc. is active. (*)
	On shiny objects, direct reflections of the light projector in the camera should be avoided. The object must be matted with spray if necessary. We recommend our Coating Spray, order number: COATING-SPRAY-500
	Make sure that the camera image does not flicker, meaning that the exposure time of the camera fits to the frame rate of the projector (usually 60 Hz and 1/60s).
	During the scan, nothing is allowed to move (scanner, object). A scanned person should lean against sth. as comfortably as possible, and hold their breath.

(*) Requires recalibration

Other possible problems and their solutions can be found on our website in the FAQ: ***http://www.david-3d.com/support/faq***

5.1. Problems with the Scan Quality

Problem	Cause / Solutions
The scans are smooth / fine details are missing	The shorter the distance between the scanner and the object, the more detailed are the scans. Set up the scanner at the smallest possible working distance, so that the scan size is just sufficient.
	Make sure that the distance between scanner and object is the same as during the calibration.
	Make sure that both, projector and camera, are well focused on the scanned object.
	The scanner can capture only details that are not finer than 0.1% of the scanned surface (min. 0.06 mm).
The scans contain irregular distortions / outliers	Make sure that the ambient light is constant.
	Make sure that nothing moves in view of the camera, not far behind the object as well.
	Make sure that the object and scanner do not move.
	On shiny objects reflections should be avoided. The object must be matted with spray if necessary. We recommend our Coating Spray, order number: COATING-SPRAY-500
	Use a dark background / table cover, which reflects almost no light (e.g. black fabric).
	If outliers can not be avoided, you can remove them later in the Shape Fusion menu ("Cleaning tool"). Often, the most comfortable way is to clean up all scans at the same time before aligning them.
	Small outliers will be automatically removed in the final processing step, Fusion.
The color textures do not look good	Open the "Texturing" menu and perform a new white balance.

Other possible problems and their solutions can be found on our website in the FAQ: ***http://www.david-3d.com/support/faq***

5.2. Problems with Alignment / Fusion

Problem	Cause / Solutions
Shape Fusion: The scans are aligned completely wrong	DAVID aligns the scans such that the overlapping areas are maximized. That maybe causes wrong solutions if there are more than one matching overlapping areas.
	Start the alignment again. The algorithm is in part randomized and therefore it can find another solution next time.
	Use the "Contact Pair Selection" to define by mouse a pair of regions which are supposed to overlap.
	The scans should overlap at least about 30%. The more overlap there is, the more likely the correct alignment is found.
	If you have rotated the object only about the vertical axis (parallel to the axis of the calibration corner) and if you have not tilted the scanner after calibration, you can choose the "Around Y-Axis" alignment mode.
	If you know the approximate angle of rotation between scans, enter it in the "Rotation Angle" field. Depending on the direction of rotation you may have to enter a negative value.
	If the object has color transitions or markings, take a texture with each scan, and activate "Use Texture" when aligning.
	In difficult cases, you can manually align the scans: Click on the scan to be moved, then hold down the Ctrl key and move/rotate the scan with the mouse (left/right mouse button). Release the Ctrl button temporarily to change your viewing direction. With practice, this can be achieved quite quickly. When you have reached an approximate alignment with some overlap, use the mode "Pairwise fine registration" in order to perfect your solution.
Shape Fusion: The alignment is inaccurate / the scans do not match exactly together	Make sure that your scans are not distorted. This can easily happen if something was changed on the scanner after calibration. Calibrate again in case of doubt.
	Create more scans, so that neighboring scans have more overlap and thus can be aligned more precisely.
	Make sure that all around, all scans are aligned very accurately to their respective neighbors, otherwise an error is easily continued. Align a new scan only when all previous scans are precisely aligned.
	Especially for smooth objects, a texture can help to find a good alignment.

5.3. Other Problems and Solutions

Problem	Cause / Solutions
The exported 3D model has an incorrect scaling	During calibration, make sure you have entered the correct scale value of the calibration pattern. (*)
	The unit of the 3D data corresponds to the unit of scale value (usually mm).
The resolution / file size of the exported data is too high	Fuse the scans with a lower value in the "Resolution". But try not to re-import and fuse your Fusion result again, instead fuse the original aligned scans.
	Import your Fusion result into the List of Scans, click the entry with your right mouse button and select "Reduce mesh density." Then save it with the Save button below the list – do not Fuse it again.
Software crash / unexpected behavior	The most common problem is lack of memory. If possible, use a 64-bit system and the 64-bit version "DAVID_x64". In 32-bit it can help to occasionally restart DAVID and not work with too many scans simultaneously.
	In the Advanced Settings under "Service", you can enable the "Debug Console". It may show some useful information about the error.
	Report the problem to the developers, e.g., on the website in the forum "Bug Report", if it is not known there yet.

(*) Requires recalibration

Other possible problems and their solutions can be found on our website in the FAQ: ***http://www.david-3d.com/support/faq***

6. Warranty Terms

This device was manufactured using the latest production methods and has been carefully inspected. All DAVID products are subjected to rigorous quality control. If this device nevertheless fails to perform faultlessly, this is something we regret and we ask you to consult your supplier. The following conditions apply to warranty claims:

*This warranty is valid for a period of **24 months** from the day of purchase. Please keep the receipt carefully as proof of purchase when making a warranty claim.*

The defective product may be returned to your supplier during the warranty period. If the warranty claim is valid you will be entitled to the repair of your device or a new device will be given to you. This is free of charge. Alternatively a warranty claim can be settled through reimbursement of the purchase price. After the warranty period has expired you still have the option of sending the defective device to your supplier or to the DAVID after-sales service for repair. Repairs made after expiry of warranty will be subject to a charge. Your statutory rights are not affected through this warranty.

Damage caused through improper handling, use, storage, changes to the electronics, lens or housing, or through Acts of God or other external influences or any operation outside of the technical specifications are not covered by this warranty.

Before returning the device please contact your supplier to ensure your warranty claim is processed as efficiently as possible. If it is not possible to process your warranty claim through your supplier, you may as an exceptional case contact the DAVID after-sales service directly.

7. Copyright

8. CE Declaration of Conformity

DAVID Vision Systems GmbH
Rudolf-Diesel-Str. 2a
56070 Koblenz
Germany

hereby declares under sole responsibility that the product DAVID-SLS-3 is in conformity with the following standards or standardized documents:

USB flash drive:
EN 55022:2010
EN 55024:2010
EN 61000-3-2:2006+A1:2009+A2:2009
EN 61000-3-3:2008

Projector with power supply and remote control
EN 55022:2006/A1:2007 Class B
EN 55024:2010
EN 61000-3-2:2006+A1:2009+A2:2009 Class A
EN 61000-3-3:2008
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in accordance with the provisions of Directives **2006/95/EC, 2011/65/EC, 2004/108/EC, 2009/125/EC**

David Heckner, Managing Director
Koblenz, in January 2014

We are always striving to improve our products, and we reserve the right to change product specifications without prior notification.