HD VISION
high dimensional vision systems

LumiScan Calibration

User Guide

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Imprint

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1 Introduction

1.1 About This Manual

This document contains important information about the installation and operation of the LumiScan Calibration application. Please read the manual carefully before using this software.

1.2 Formatting Convention

This guide uses special formatting to highlight certain words and phrases:

- Keywords/important information and buttons are highlighted in bold (e.g. **XXX/capture/ready**).
- Links and references are highlighted in green (e.g. info@hdvisionsystems.com).
- File and path names are highlighted in a special font (e.g. `hdvisionsystems/lumiscan-calibration/reset/ready`).

1.3 Disclaimer

NOTE: By accessing or using these commercial software products, you expressly agree to the following terms and conditions.

Any attempt to use a debugger to examine, analyze, or tamper with the software provided by HD Vision Systems is strictly prohibited and may have immediate and irreversible consequences.

If the software detects the presence of a debugger, security protocols will be activated to protect the intellectual property, functionality and stability of the software. This may result in, among other things, immediate suspension of the associated Software license, loss of data, and, in extreme cases, forced termination of all instances of the Software operating under the same license, as well as legal consequences.

By using the Software, you acknowledge that you have read, understood and accepted the terms of this Disclaimer (see also General Disclaimer).

2 LumiScan Calibration

2.1 Description

LumiScan Calibration is an application that improves the accuracy of position and orientation information for objects found in the scene by scanning a mapping provided as a TIFF file. This enables the use of cameras in combination with robots for bin picking and object placement tasks.
LumiScan Calibration is installed from the App Store and configured via a settings file. It runs on ctrlX CORE and the user interface is ctrlX Data Layer.

2.3 Requirements

- Calibrated data files (2D to 3D mapping as a TIFF file provided by HD Vision Systems)
- ctrlX CORE

2.2 General Concept of Handshake

The communication process in the LumiScan Cam Driver application is based on the general concept of handshake. The naming convention for handshake parameters usually consists of the **functionality** and the names **-ready** or **-request** (Table 1).

Table 1: General Concept of Handshake: Address

Address	Description
<parent address>/<functionality name>/ready	Read-Only, controlled by our app to indicate whether the relevant functionality is allowed to be executed.
<parent address>/<functionality name>/request	Writable. It is used by user to trigger our application to execute relevant functionality.

Some of these functions require input parameters and provide additional output results. In this case:

- the address for the input is: **<parent address>/input/<input argument name>**
- the output results can be found at **<parent address>/output/<output result name>**

2.3.1 Functionality Execution

NOTE: To avoid repeating the entire address, in this section the **invariant part** containing the parent address and the **variable functionality name** have been replaced by **XXX**.

Thus, the address: **hdvisionsystems/lumiscan-calibration/<transform module name>/control/reset/ready** will be written as **XXX/ready**.

Accordingly, the address: **hdvisionsystems/lumiscan-calibration/<transfom module name/control/request** will be written as **XXX/request**.

NOTE: The above rule does not apply to addresses containing input and output, which are given only with the omission of the parent address, so in the form: **XXX/input/<argument name>**. Example: **XXX/input/x-coordinate**

In order to execute a functionality, you need to run the following steps (See also image *Functionality Execution Steps*):

1. Wait until XXX/ready is set to **True**.

2. Set corresponding input arguments:
   Set <parent address>/input/<argument name>
   i.e. Set XXX/input/x-coordinate to 2.0 and Set XXX/input/y-coordinate to 2.0

NOTE: For the corresponding input arguments of functionalities, please refer to table Table 2.

3. Set XXX/request to **True**.

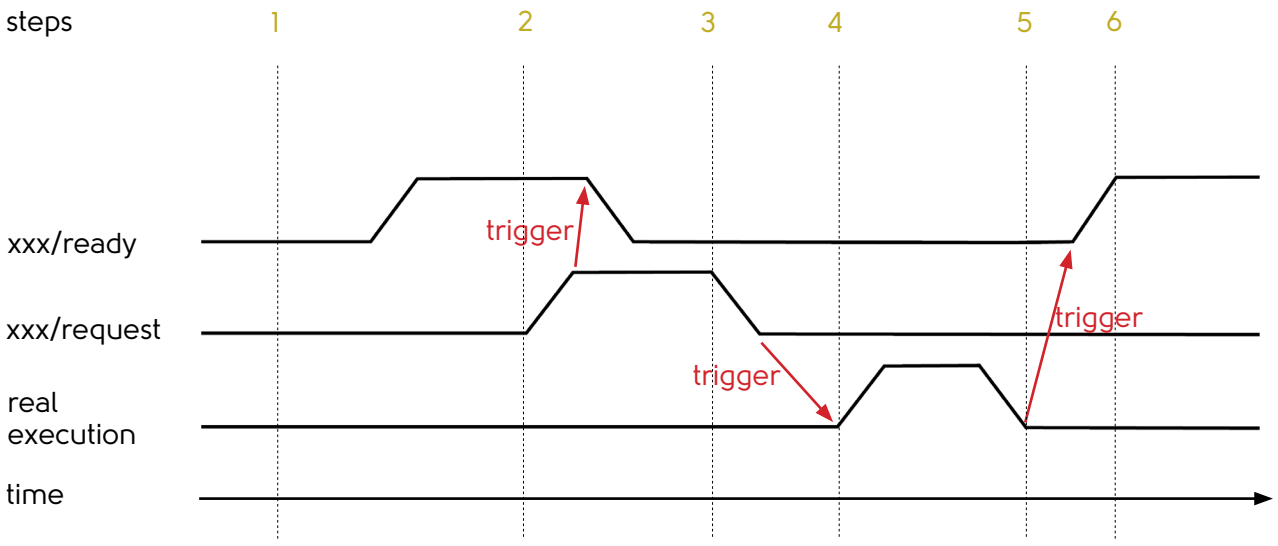
NOTE: Make sure there is only one process is accessing XXX/request at a time. The result of execution is **undefined** when:

a. ProcessA set XXX/request to True.

b. ProcessB set XXX/request to False without considering ProcessA.

c. Our application might therefore miss XXX/request from ProcessA.

4. XXX/ready changes to **False**.
5. Set XXX/request to **False**.
6. Start executing relevant functionality.
7. Execution finished.
8. XXX/ready is automatically set to **True** again.
9. If functionality has an output parameter, you can read the result from <parent address>/output/<output result name> (for example, **<parent address>/output/x-coordinate**).



Functionality Execution Steps

2.4 Functionalities

2.4.1 Convert a 2D point to a 3D point

2.4.1.1 Addresses

Table 2: Functionality Addresses

Functionality	Permission	Address
reset	Read-Only	hdvisionsystems/lumiscan-calibration/<transform module name>/control/reset/ready
	Writable	hdvisionsystems/lumiscan-calibration/<transform module name>/control/reset/request
transform	Read-Only	hdvisionsystems/lumiscan-calibration/<transform module name>/control/transform/ready
	Read-Only	hdvisionsystems/lumiscan-calibration/<transform module name>/output/x-coordinate
	Read-Only	hdvisionsystems/lumiscan-calibration/<transform module name>/output/y-coordinate
	Read-Only	hdvisionsystems/lumiscan-calibration/<transform module name>/output/z-coordinate
	Writable	hdvisionsystems/lumiscan-calibration/<transform module name>/control/transform/request
	Writable	hdvisionsystems/lumiscan-calibration/<transform module name>/input/x-coordinate
	Writable	hdvisionsystems/lumiscan-calibration/<transform module name>/input/y-coordinate
	Writable	hdvisionsystems/lumiscan-calibration/<transform module name>/input/z-coordinate
Status	Read-Only	hdvisionsystems/lumiscan-calibration/control/status/code

2.4.1.1 Convert a 2D point to a 3D point

NOTE: To avoid repeating the entire address, in this section the **invariant part** containing the parent address has been replaced by **XXX**.

Thus, the address: **hdvisionsystems/lumiscan-calibration/<transform module name>/control/reset/ready** will be written as **XXX/reset/ready**.

Accordingly, the address: **hdvisionsystems/lumiscan-calibration/<transform module name>/control/reset/request** will be written as **XXX/reset/request**.

1. Check the availability of transform functionality:
   a. Prerequest: transform mapping file TIFF exists and is loaded successfully.
   b. Check XXX/transform/ready = True

NOTE: If is false, check if the TIFF file configured in the setting exists and restart the application.

   c. Set XXX/input/x-coordinate := <x pixel coordinate>
      Set XXX/input/y-coordinate := <y pixel coordinate>
   d. Set XXX/transform/request := True
   e. Check XXX/transform/ready = False

NOTE: If the application hasn't seen that the variable has changed:

i. Make sure that only one process is accessing XXX/transform/request at a time.
ii. Check that you are using the same data layer version as the application.
iii. Contact hdvisionsystems.

   e. Set XXX/transform/request := False
   f. Check XXX/status/code (Camera) = 0 (ready*) -----> Camera is initialized, and ready to capture image

* The meaning of all status code values is explained in the Status Code Values table at the end of this chapter.

2.4.2 Status Code Values

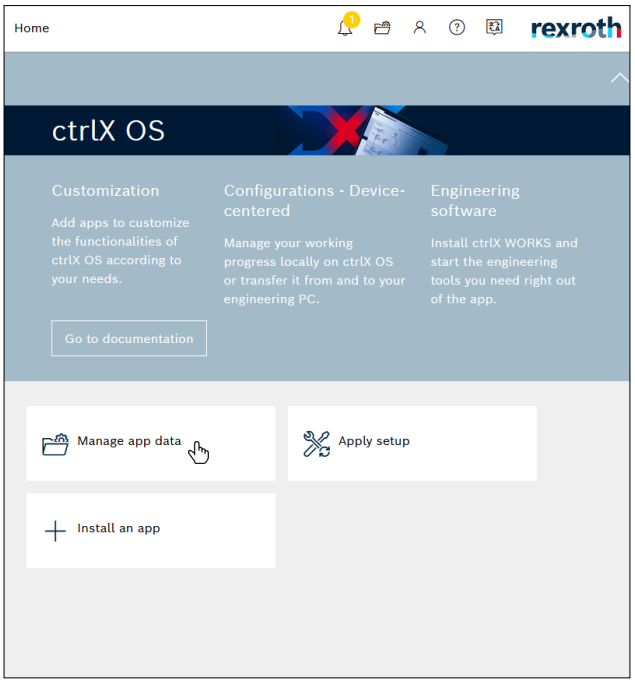
Table 3: Status Code Values Description

Status Code Number	String	Meaning
0	"ready"	The last functionality is successfully executed, the application is ready to execute the next functionality.
1	"settingUp"	The module or function is still setting up.
2	"running"	The function is currently running.
3	"waitingForClient"	Waiting for the client (usually to acknowledge the start of the function).
-1	"undefinedError"	Something went wrong and we did not create a special error code for it.
-2	"invalidSetting"	The supplied settings file could not be loaded.
-3	"invalidInput"	One of the input fields was not valid.
-4	"missinglicense"	Make sure you have the correct license installed.

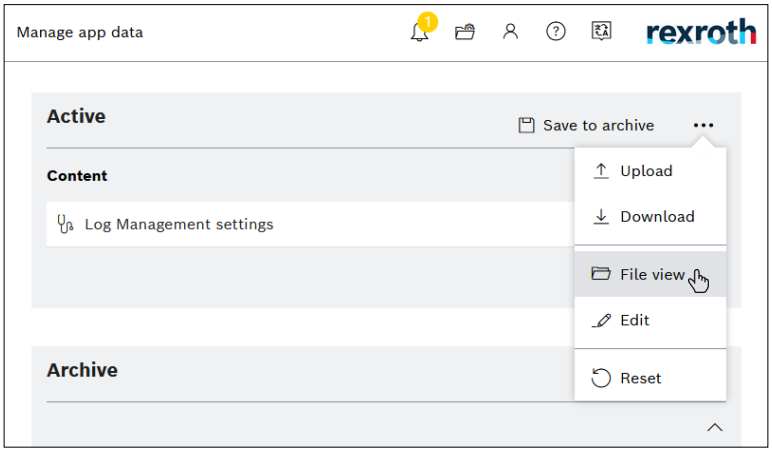
2.5 LumiScan Calibration Folder Structure

2.5.1 Edit with Built-In Website

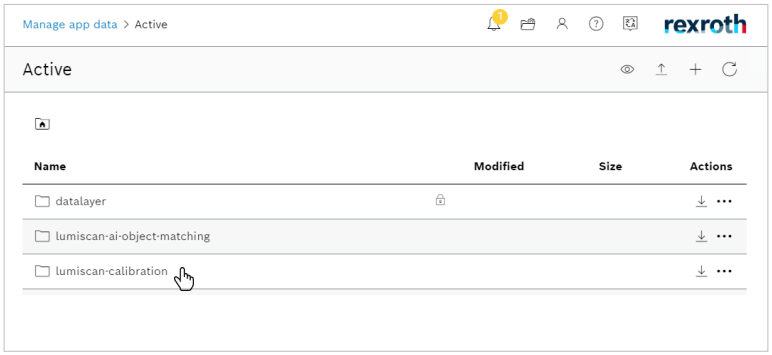
1. Log in to the ctrlX OS website.
2. Go to **Home.**
3. Select **Manage app data.**



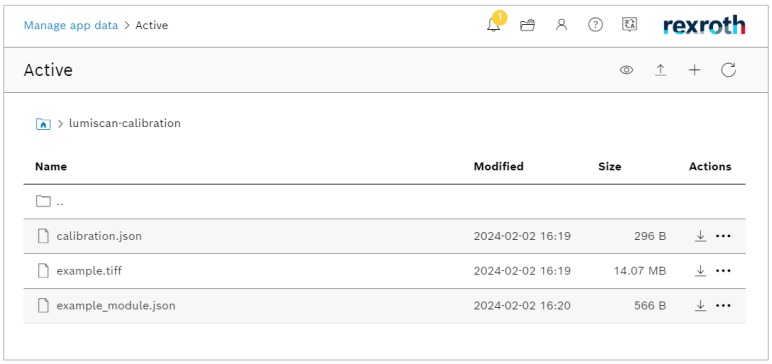
3. Click the three dots and select **File View.**



4. Go to the relevant application folder.

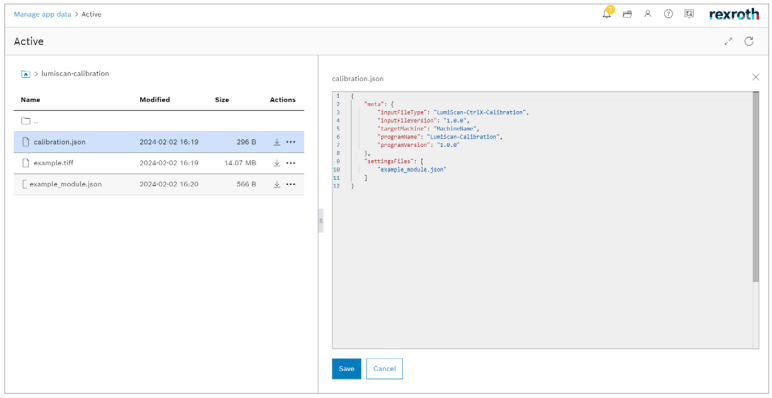


5. There are three files by default (You can add new files later).



- **calibration.json** contains general settings of this application.
- **< file name>.json** (here as example: example_module.json) contains settings for a specific module.
- **<file name>.tiff** contains calibrated data files provided by HD Vision Systems.

6. Left-clicking on the desired filename will automatically open the JSON Settings window.



NOTE: More detailed information about each file can be found in the corresponding sections later in this manual.

2.6 Application Settings File

The settings of the Lumiscan Calibration application are located in the **calibration.json** file.
An example of such settings is shown below.

```
{
    "meta": {
        "inputFileType": "LumiScan-CtrlX-Calibration",
        "inputFileVersion": "1.0.0",
        "targetMachine": "MachineName",
        "programName": "LumiScan-Calibration",
        "programVersion": "1.0.0"
    },
    "settingsFiles": [
        "example_module.json"
    ]
}
```

The description of the parameters mentioned above can be found in the following Table 4.

Table 4: Application JSON Settings File Description

Parameter	Description
meta	Place to set meta information: inputFileType and inputFileVersion are required.
inputFileType	In this case it must be: `LumiScan-CtrlX-Calibration`
inputFileVersion	Currently, only version 1.0.0 is supported.
targetMachine	Optional. Enter the name of the machine in use here to indicate that the current application configuration is being used for this particular machine.
programName	Optional. This parameter indicates by which application the current file is used. In this case: `LumiScan-Calibration`
programVersion	Optional. Currently used program version.
settingsFiles	Contains created module settings files.

NOTE: After changing the parameters, the LumiScan Calibration application should be restarted.

2.7 Module Configuration File

The module configuration settings are located in the **<file name>.json** file (in this example, **example_module.json**), and are used to convert 2D points to 3D points on the calibrated plane.

An example of module configuration JSON settings is shown below.

```
{
    "meta":{
        "inputFileType": "LumiScan-CtrlX-Calibration-Module",
        "inputFileVersion": "1.0.0",
        "targetMachine": "MachineName",
        "programName": "LumiScan-Calibration",
        "programVersion": "1.0.0"
    },
    "transform": {
        "name": "PlanarProjectionExample",
        "type": "from2dTo3d",
        "subtype": "lookUpTable",
        "relativePathToTiff": "example.tiff",
        "interpolationMethod": "linear4Neighbors",
        "offsetX": 0.0,
        "offsetY": 0.0,
        "scaleX": 1.0,
        "scaleY": 1.0
    }
}
```

The description of the parameters mentioned above can be found in the following Table 5.

Table 5: Module Example JSON Settings Description

Parameter	Description
meta	Place to set meta information: inputFileType and inputFileVersion are required.
inputFileType	In this case it must be: `LumiScan-CtrlX-Calibration`
inputFileVersion	Currently, only version 1.0.0 is supported.
targetMachine	Optional. Enter the name of the machine in use here to indicate that the current application configuration is being used for this particular machine.
programName	Optional. This parameter indicates by which application the current file is used. In this case: `LumiScan-Calibration`
programVersion	Optional. Currently used program version.
transform	Top level that contains transform configuration parameters.
name	Module name on Data Layer **hdvisionsystems/lumiscan-calibration/<transform module name>**.
type	Currently supports only "`from2dTo3d`"
subtype	"`lookUpTable`"
relativePathToTiff	Related path to TIFF file used to transform 2D point to 3D point.
interpolationMethod	Selects the method to interpolate points: "`closestPixel`" or "`linear4Neighbors`"
offsetX	Default is 0, used for advanced mapping resolution improvement scenario.
offsetY	Default is 0, used for advanced mapping resolution improvement scenario.
scaleX	Default is 1, used for advanced mapping resolution improvement scenario.
scaleY	Default is 1, used for advanced mapping resolution improvement scenario.

NOTE: After changing the parameters, the LumiScan Calibration application should be restarted.

2.8 Tiff File

This file contains calibrated data in .tiff format that is used to convert 2D points to 3D points. It is required to run the LumiScan Calibration software. It is available from HD Vision Systems.

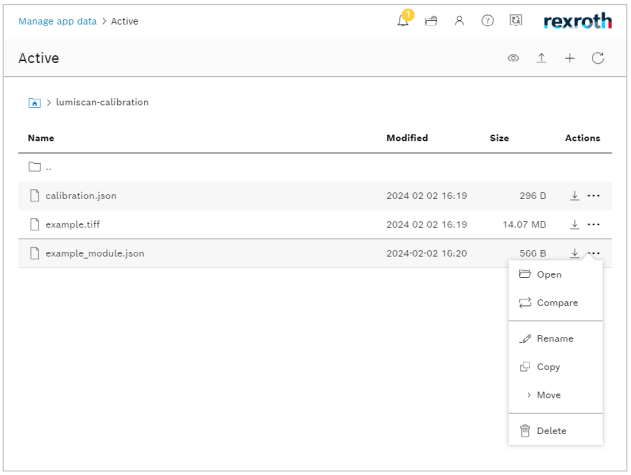
To obtain a TIFF file:

1. Contact HD Vision Systems to obtain a calibration plate.
2. Place a calibration plate on the plane you want to calibrate.
3. Take at least one image with your camera.
4. Send the images to HD Vision Systems GmbH.
5. You will receive a TIFF file.

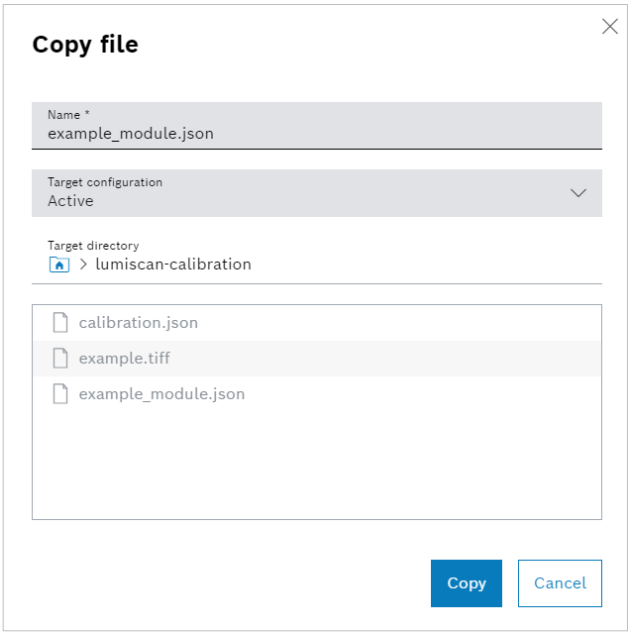
2.9 Adding New Module

You can create a new module file simply by duplicating an existing file. To do this:

1. Click the triple dots you see to the right of the file name.



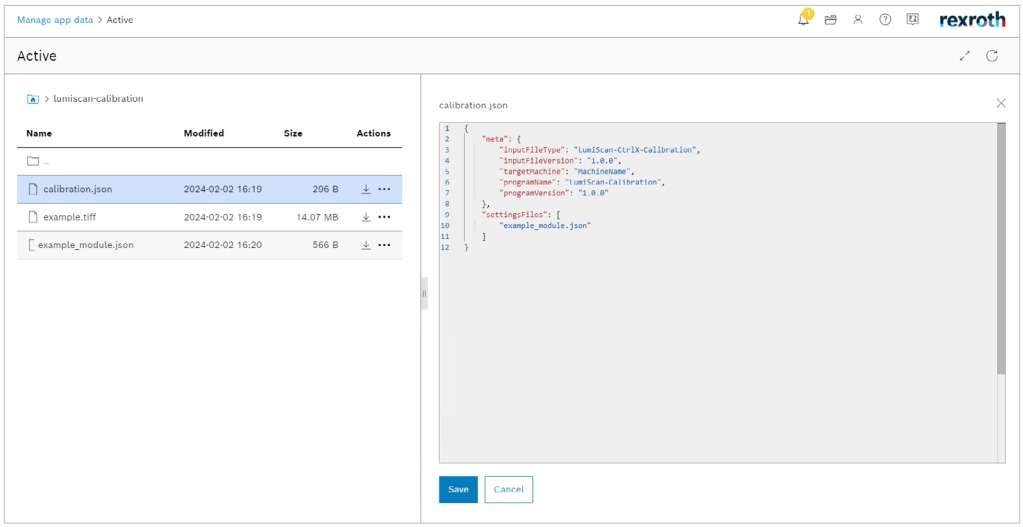
2. Select **COPY**
3. The copy file window appears.



4. Set new file name*

*NOTE: You can also rename the new file later by clicking the triple dots to the right of the name and selecting **Rename** from the expanded list.

5. Confirm with clicking on **Copy.**
6. New camera settings file is created.
7. Now you can specify the newly created file name in the application settings (calibration.json):
   a. Left-click on the calibration.json file name.
   b. The JSON settings window will open on the right.



   c. Enter the name in the `settingsFiles` field.

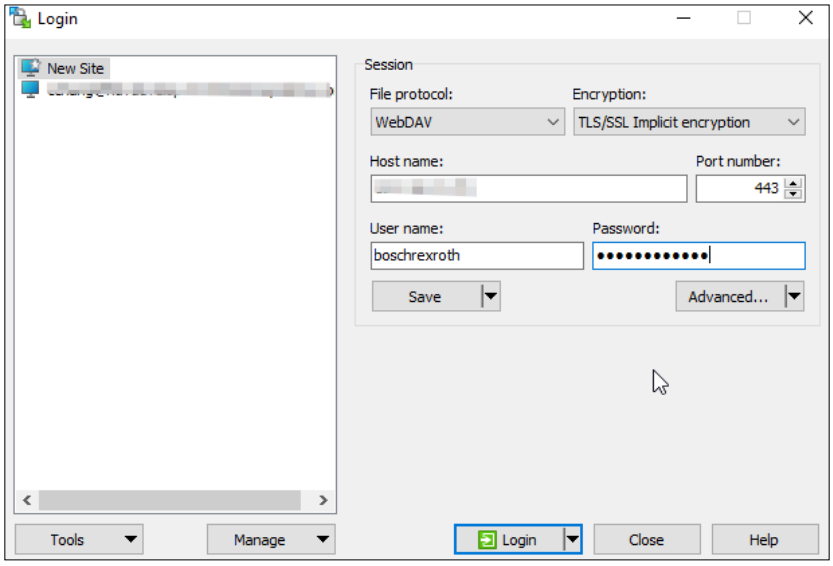
2.10 Uploading Data with WebDAV

NOTE: Uploading a Tiff file is required to use the software.
Optionally, if the user wants to use his own settings, an application configuration upload is also possible.

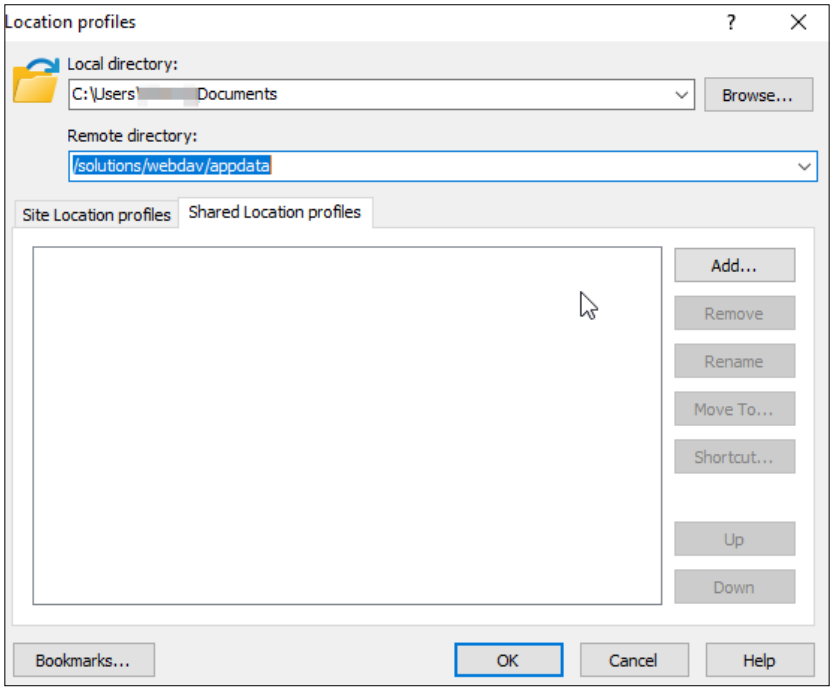
To upload the data files:

1. Go to the WinSCP website.

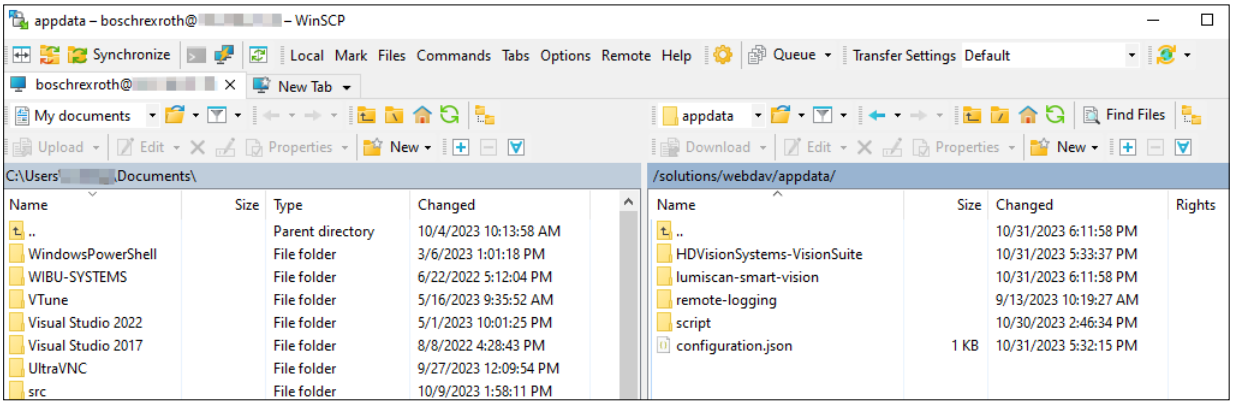
2. Download the latest software version.
3. Install it on your device.
4. Start WinSCP.
5. Login page will open.



6. Select WebDAV as the **File protocol**.
7. Select TLS/SSL for **Encryption**.
8. Enter **user name** and **password**.
9. Navigate to **/solutions/webdav/appdata.**



10. You can see folder structure as below on the right panel.



You can drag and drop data, settings into the corresponding folder with the application name.

3 General Disclaimer

1. The manufacturer is not liable for damage to life, body or health or damage to property resulting from improper use. Please note that operating and/or connection errors are beyond our control. We cannot accept any liability for damage resulting from this.
2. Any damage caused by unauthorized debugging activities to inspect, analyze or manipulate the software provided by HD Vision Systems is the sole responsibility of the user. Any attempt to use a debugger is strictly prohibited and may result in irreversible consequences such as loss of data, interruption of service, and even legal action. The manufacturers, developers and distributors of the software are not liable for any damage or loss resulting from the user's failure to comply with this warning.
3. Claims for damages on the part of the purchaser arising from culpa in contrahendo, breach of secondary contractual obligations and tort are excluded, unless they are based on intent or gross negligence on the part of HD Vision Systems GmbH itself or one of our vicarious agents.
4. Recourse claims in the sense of §12 of the Product Liability Act (Produkthaftungsgesetz) are excluded, unless the party entitled to recourse proves that the defect was caused by HD Vision Systems GmbH and was due to at least gross negligence.
5. If any provision of this Agreement is or becomes invalid or unenforceable, the validity of the remaining provisions shall not be affected. The invalid or unenforceable provision shall be replaced by a valid and enforceable provision whose effects come as close as possible to the economic purpose pursued by the parties with the invalid or unenforceable provision. The foregoing provisions shall apply mutatis mutandis in the event that the contract proves to be incomplete. German courts shall have exclusive jurisdiction over all disputes arising in connection with this disclaimer.
6. For more information about the warranty, please contact the manufacturer of the product.

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