

Coordinate Transformation

Plug-In



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Version 6.2.2
Neckarstraße 76-1, 71686 Remseck, Germany

Phone: +49 (0) 7146 - 89 56-0
Fax: +49 (0) 7146 - 89 56-29
E-Mail: info@neurocheck.com
Web: www.neurocheck.com

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Introduction

The functions in this plug-in DLL allow to perform a 2-dimensional coordinate transformation for the center points of objects found in the current image.

This is useful for robot pick-and-place application where the robot expects to receive the coordinates in its own coordinate system. The transformation is determined by displaying a calibration object that has two marks, e.g. holes (or other objects that can be located by image processing functions in NeuroCheck). The robot can use these two marks as reference for a calibration run. Equally the camera system needs to perform a calibration run on the same marks. The transformation and pixel calibration data determined during the calibration run can be saved to registers which will be used during the "ordinary" runs of the system.

The transformation then will be applied to the objects of interest that are located in the image. The result will be X and Y coordinates in the robot system. They can be transmitted, for instance, using the serial interface, or through an output file.

About NeuroCheck plug-in DLLs in general

A plug-in DLL is a .NET assembly that serves to enhance NeuroCheck with user-defined image processing functionality. The NeuroCheck Plug-In Interface offers the opportunity to integrate user-defined check functions for image processing and data handling. A Plug-In can contain an arbitrary number of self-developed check functions.

These check functions have full access to the NeuroCheck runtime data objects such as Images, ROI Lists or Measurement Lists. The Plug-In check function can be added to a check as well as the built-in standard check functions of NeuroCheck.

Please note that for integration of a plug-in check function into your check routine, a Premium license is required. The completed check routine then can be run with any NeuroCheck license (except the Demo Version).

Installation

Installation

Copy the following files from the zip archive to the plug-in directory within the desired NeuroCheck project (e.g. 'C:\Users\Public\Documents\NeuroCheck\6.2\Default\Software Extensions\PlugIns\').

- All files inside the `Binaries` directory
- All *.chm files inside the `Documentation` directory

Loading a Plug-In

In order to use a Plug-In the Plug-In assembly must be loaded in NeuroCheck. The management of Plug-Ins takes place within the Software Settings dialog. The Software Settings dialog can be found in the System menu of NeuroCheck.

Please note that it is impossible to load or unload a Plug-In as long as a check routine is opened that contains the Plug-In check functions. If the currently opened check routine contains Plug-In check functions then close the check routine first.

Within the Software Settings dialog please select the node Plug-Ins and the sub-node Plug-In in the tree to the left. The loaded Plug-In assemblies are shown in the List of Plug-Ins. Press the Add button to open a file selection dialog in order to select a further Plug-In assembly.

Inserting a Plug-In check function to a check routine

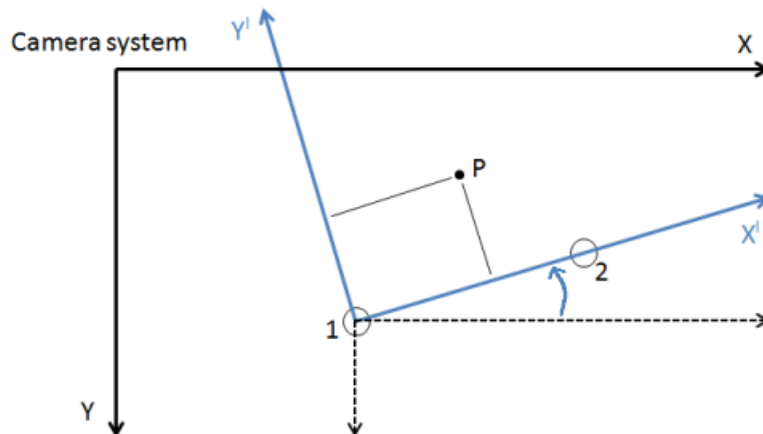
A Plug-In check function is inserted using the Check Function Select dialog. All check functions of loaded Plug-Ins are listed in the Plug-In category of the Check Function Select dialog. Within the Plug-In category the check functions are ordered in sub-categories where each sub-category represents the check functions of one Plug-In.

Besides the category the user will hardly notice any difference between the usage of Plug-In check functions and built-in check functions.

How to Use Coordinate Transformation

1. Determine transformation data

Two points are needed to determine the transformation data. The first point determines the origin (translation) of the new coordinate system (blue). The second point gives the direction with a specific angle (rotation) in relation to the camera system. The X offset, Y offset and the reference angle are 3 of 5 values of the transformation data.



The 4. and the 5. value of the transformation data is the calibration factor in X and Y direction. These factors are determined by the "**Determine Transformation from ...**" functions as well. In case of the determination from ROIs the calibration factors can be adjusted in the check functions parameter dialog. In case of determination from coordinates the function "**Calibrate measurements**" is needed before the determination of the transformation data (see below in the example check routine) is executed.

These values are saved in five floating point number registers.

2. Modify transformation data

This step is an optional step in the coordinate transformation. Modify the values in the registers with the check function "**Modify register**".

Change the value for the reference angle to rotate the target coordinate system to a specific angle.

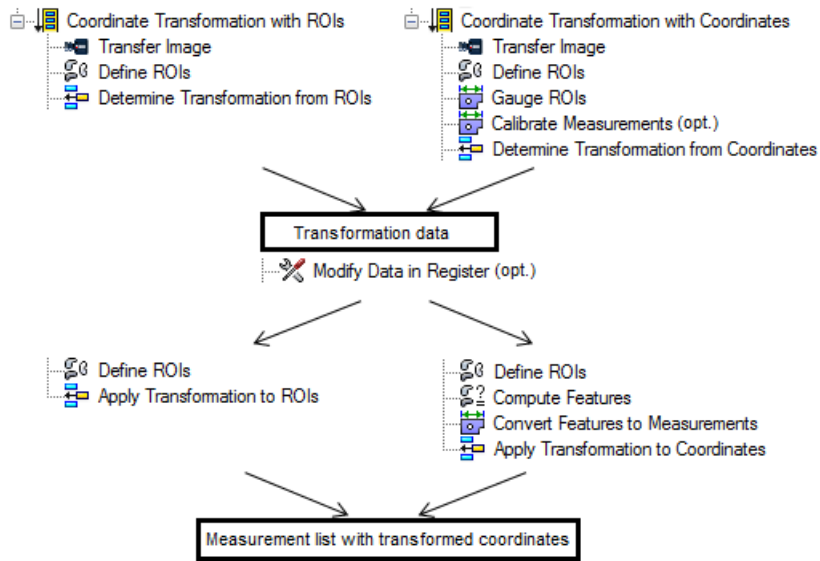
Change the value for the calibration factor Y. Multiply the register content with -1 to get a left-hand coordinate system as target system.

3. Apply transformation to points

The "**Apply Transformation to ...**" check functions in this plug-in use the values from the registers. So it is irrelevant from which "Determine Transformation" function the values are created. The "Apply" functions transform the coordinates into the new coordinate system (blue). That means the distances from the point (P) to the transformed axes (X' and Y') are computed.

The following check routine example shows two check routine side by side. The example shows the needed and optional check functions to perform a coordinate transformation.

[Check Routine Example](#)



Determine Transformation from ROIs: Introduction

Function overview

This check function determines the parameters for a coordinate transformation (translation and rotation) from the input objects (ROIs). The parameters of the transformation are written into 5 floating point number registers. The parameters can be used by the "Apply Transformation to ..." check functions from this plug-in.

See "[How to Use Coordinate Transformation](#)" for additional information.

Input data

This check function requires an image (for future visualization) and a list of ROIs with two ROIs as input data objects. The center points of the ROIs in the input list are used as reference points for the new coordinate system. The points are interpreted as follows:

- The first point (ROI) determines the origin of the new coordinate system.
- The second point (ROI) gives the direction of an axis in the new system. The angle of the axis is specified by a reference angle (0°-360°) with respect to the positive X axis of the new coordinate system. For instance, for a reference angle of 0° the second point specifies the direction of the positive X axis, for a reference angle of 90° the positive Y axis.

Only the center points of the ROIs are considered. If a model geometry "Circle" is calculated for the object, the center point represents the center of the circle. The check function "Compute Features" can be used before the "Determine Transformation from ROIs" check function to improve accuracy by computing the center points explicitly.

Output data

The check is function does not create any output data objects. The transformation parameters are written into 5 registers (floating point number).

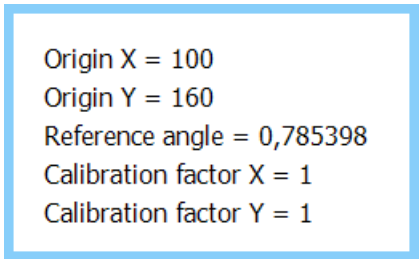
Origin X/Y: This is the X and Y offset of the new coordinate system in relation to the old camera coordinate system. This point will also be used automatically as pivot for the rotation.

Reference angle: The new system is mathematical positive (right-hand system), i.e. if the positive X axis directs to the right, then the positive Y axis directs to the top. For a left-hand system, the Y axis is in the inverse direction. NeuroCheck uses a left-hand system. If the target coordinate system should be a left-hand system multiply the "Calibration factor Y" with -1. See "[How to Use Coordinate Transformation](#)" for additional information.

Calibration factor X/Y: The transformation data contains this calibration factors for a calibration into metrical units and changing the coordinate system into a left-hand system.

Result view

The result view shows the transformation data which is also written into the registers.




```
Origin X = 100
Origin Y = 160
Reference angle = 0,785398
Calibration factor X = 1
Calibration factor Y = 1
```

Error behavior

If there are not exactly two ROIs in the input list, or if the center points of the ROIs are closer than 10 pixels next to each other, then the function will abort with an error. Also make sure the "register start ID" points to 5 floating point number registers. In case of an error, the result view specifies the cause of the error.

Properties

 Check function group Plug-In.

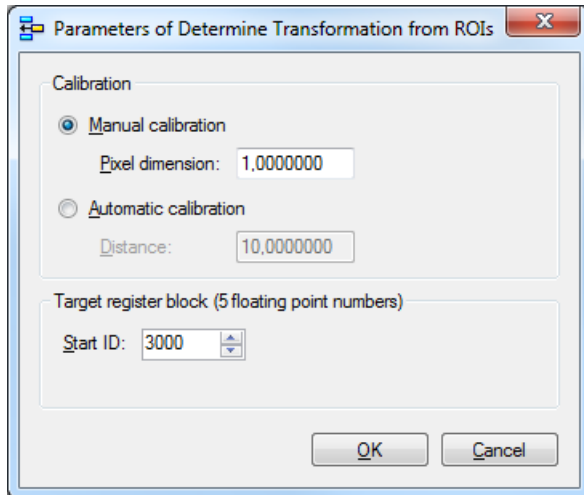
 The check function has a [Parameter Dialog](#).

The check function has own result Visualizations.

Determine Transformation from ROIs: Parameter Dialog

This plug-in check function has a **Parameter** dialog.

☑ [Screenshot of Parameter Dialog](#)



The **Parameter** dialog contains the following elements:

Element	Description
Pixel dimension	This parameters describes how many of the preferred physical units (e.g. millimeters of inches) correspond to one image pixel, just like in check function Calibrate Pixel Size .
Distance	Here you can enter the distance in physical units between the center points of the two input objects. The calibration factor will be computed automatically.
Start ID	Number of the first register for the target register block.

Determine Transformation from Coordinates: Introduction

Function overview

This check function determines the parameters for a coordinate transformation (translation and rotation) from the input objects (measurement list). The parameters of the transformation are written into 5 floating point number registers. The parameters can be used by the "Apply Transformation" check functions from this plug-in.

See "[How to Use Coordinate Transformation](#)" for additional information.

Input data

This check function requires a measurement list with at least 4 measurements. The measurements in the input list are used as reference points for the new coordinate system. The points are interpreted as follows:

- The first point (X1/Y1) determines the origin of the new coordinate system.
- The second point (X2/Y2) gives the direction of an axis in the new system. The angle of the axis is specified by a reference angle (0°-360°) with respect to the positive X axis of the new coordinate system. For instance, for a reference angle of 0° the second point specifies the direction of the positive X axis, for a reference angle of 90° the positive Y axis.

Output data

See check function [Determine Transformation from ROIs: Introduction](#).

Result view


See check function [Determine Transformation from ROIs: Introduction](#).

Error behavior

See check function [Determine Transformation from ROIs: Introduction](#).

Properties

 Check function group Plug-In.

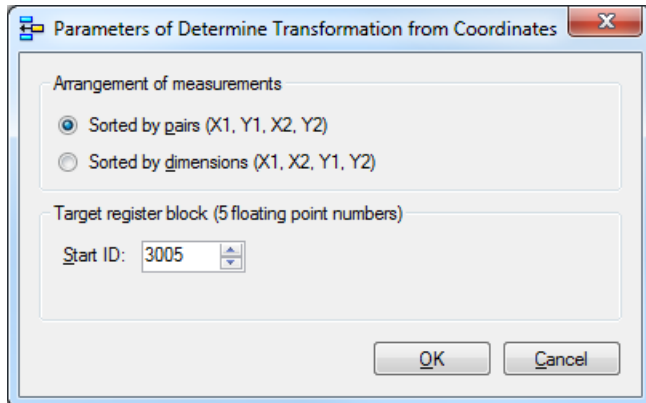
 The check function has a [Parameter Dialog](#).

The check function has own result Visualizations.

Determine Transformation from Coordinates: Parameter Dialog

This plug-in check function has a **Parameter** dialog.

☑ Screenshot of Parameter Dialog



The **Parameter** dialog contains the following elements:

Element	Description
Sorted by pairs	Check this property if the measurements for the determination are sorted by pairs (X1, Y1, X2, Y2).
Sorted by dimensions	Check this property if the measurements for the determination are sorted by dimensions (X1, X2, Y1, Y2).
Start ID	Number of the first register for the target register block.

Apply Transformation to ROIs: Introduction

Function overview

This function applies a coordinate transformation to the input objects (ROIs) and lists their center points (X and Y coordinate) in the new coordinate system.

See "[How to Use Coordinate Transformation](#)" for additional information.

Input data

This check function requires an image (for future visualization) and a list of ROIs as input data objects. Also, this function needs the transformation data from the registers. The data is provided by the "Determine Transformation" check function from this plug-in.



Starting with version 6.2.2 of the plugin, features "Center X" and "Center Y" must also be computed through the NeuroCheck check function "Compute features" prior to the transformation procedure, otherwise an error will occur.

Output data

This function provides a measurement list with the transformed center points (X and Y values) from the input ROIs. The measurements of each point are always sorted by pairs.

Properties



Check function group Plug-In.

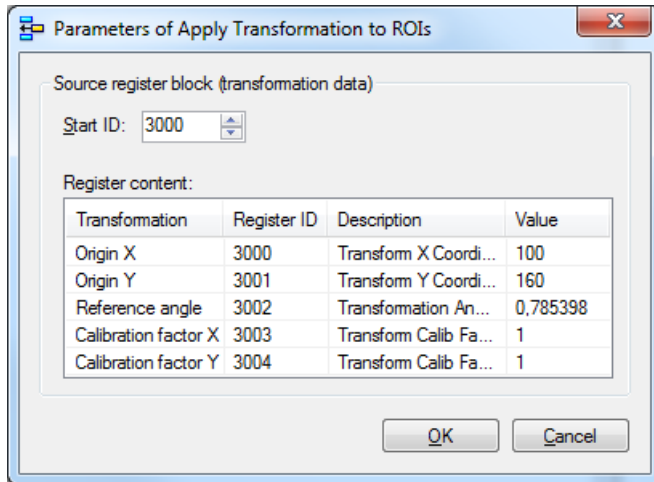


The check function has a [Parameter Dialog](#).

Apply Transformation to ROIs: Parameter Dialog

This plug-in check function has a **Parameter** dialog.

☑ [Screenshot of Parameter Dialog](#)



The **Parameter** dialog contains the following elements:

Element	Description
Start ID	Number of the first register for the source register block.

Apply Transformation to Coordinates: Introduction

Function overview

This function applies a coordinate transformation to the values of the input measurement list. This allows to use artificial points, e.g. an intersection point determined by Gauge ROIs.

See "[How to Use Coordinate Transformation](#)" for additional information.

Input data


This check function requires a measurement list with the X and Y coordinate values of points as input data object. Also, this function needs the transformation data from the registers. The data is provided by the "Determine Transformation" check function from this plug-in.

Output data

This function provides a measurement list with the transformed points (X and Y values) from the input measurements. The measurements of each point are always sorted by pairs.

Properties

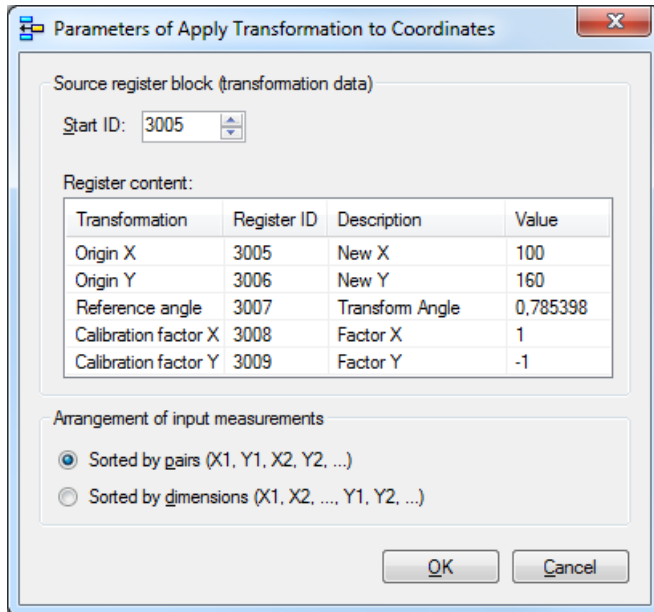
 Check function group Plug-In.

 The check function has a [Parameter Dialog](#).

Apply Transformation to Coordinates: Parameter Dialog

This plug-in check function has a **Parameter** dialog.

☑ Screenshot of Parameter Dialog



The **Parameter** dialog contains the following elements:

Element	Description
Start ID	Number of the first register for the source register block.
Sorted by pairs	Check this property if the measurements to be transformed are sorted by pairs (X1, Y1, X2, Y2, X3, Y3, ...).
Sorted by dimensions	Check this property if the measurements to be transformed are sorted by dimensions (X1, X2, X3, ..., Y1, Y2, Y3, ...).

Support Services

For technical support, please contact your local NeuroCheck partner or NeuroCheck GmbH:

Phone: +49 (0) 7146 - 89 56-40

E-Mail: support@neurocheck.com

Web: www.neurocheck.com

Before contacting us, please provide some important information about your system:

Information about your NeuroCheck installation and your PC setup:

- Use the NeuroCheck Diagnostics tool to check your installation and computer configuration.
- The NeuroCheck Diagnostics is installed in the "Tools" folder within your NeuroCheck installation.

Log file information:

- Logging for NeuroCheck can be activated in **System > Software Settings > Diagnosis > Logging**.

