VISION MANUAL
V3.9

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Simple by Design

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1. INSTALLATION

For the installation of VISIONELEMENTS3 you need the following files:

- VISIONELEMENTS_3.9.*.zip

Optional (Processdatabase)

- mysql-installer-community-5.7.26.0.msi
- mysql-connector-c-6.1.11-win32.msi

Unpack the content of VISIONELEMENTS_3.9.*.zip in a folder as e.g., C:\EngRoTec\. In the sub-folder \VisionElements_3.9.*\VisionElements 3.9.*\Bin you can find the executable file VisionElements.exe you can start the application with. It is recommended to link this file on the desktop, the task bar or the start menu.

MySQL provides a database for the storage of process data. Process data are pictures or profiles of acquisitions with the corresponding information as for example serial number (from context) and time stamp. Alternatively, an already existing database can be used. For the installation you need installation rights on Windows. Follow the instructions of the installer and install only the MySQL server. In the appendix you will find a detailed description of the installation process.

STARTING VISIONELEMENTS3

Start **VISIONELEMENTS3** by executing the file VisionElements.exe. Now you can select the language for the surface as well as create or load projects.

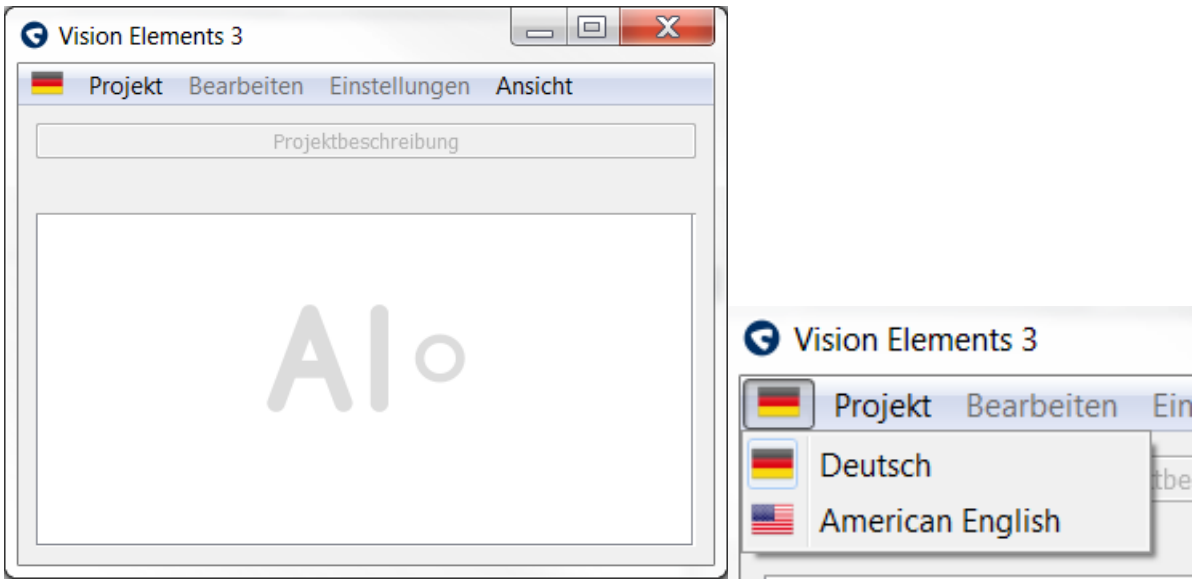


Figure 1: VISIONELEMENTS3 in initial state and language selection

COMMAND LINE PARAMETERS

Help feature

The parameters "--help", "-h" or "-?" display the help function for the command line parameters.

Version

The version can be queried with the parameter "-v".

Load/start projects

Projects can be loaded and started directly via a command line parameter. Open a command prompt and navigate to the VisionElements path. The parameter "-a" can be used to specify the absolute project path or only the project name. If the project name is specified, the project must be stored in the default project folder.

2. GENERAL USE

PROJECT MANAGEMENT

Create new project

Select the menu item Project -> New. Now specify a project folder in the dialog and click “create“.

The following settings are available:

Type: Specifies on which device the project will run.

- PC is master: PC runs all analyses and communicates with the higher-level controller (robot, PLC, …). Connected sensors only deliver the raw data. This type is absolutely required when several sensors are used.
- Smart sensor is master: The higher-level controller (robot, PLC, …) communicates directly with the sensor. The sensor runs all analyses and calculations. The PC is not necessary during regular operation.

Template: You can choose between several pre-configured projects, they cover simple applications and a quick start in the project configuration.

- VISIONSCANNER2: This template contains a **VISIONSCANNER2** with a pre-configured acquisition.
- ROBOTGUIDANCE: This is a demo project for a 2D and 6D robot guidance.
- INLINE PROCESS INSPECTION: This is a demo project for an inline process control (glue line control).

Create in: Select the path where the new project will be saved.

Project folder: Specifies the folder name for the project.

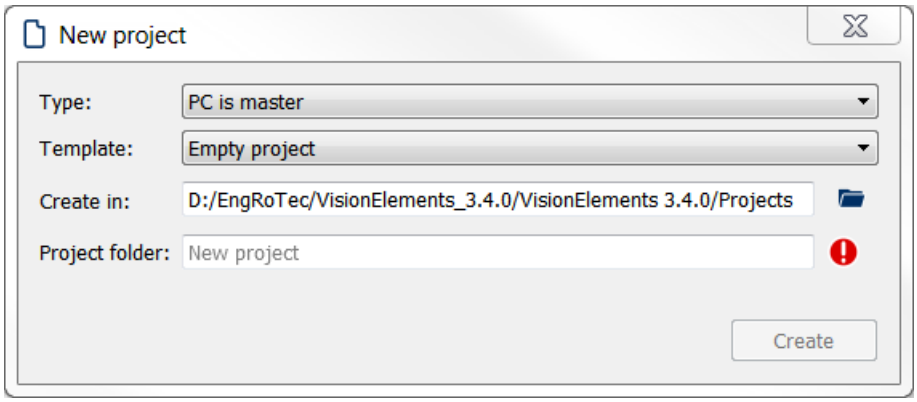


Figure 2: Dialog - New project

Tip: The project folder can later be moved as desired (only if the project is not loaded).

Load existing project

Select the menu item “Project” -> “Load”. To choose the project in the dialog the project folder is marked with the symbol . Before you open the project, you have to enter your login data for the correct authorizations.

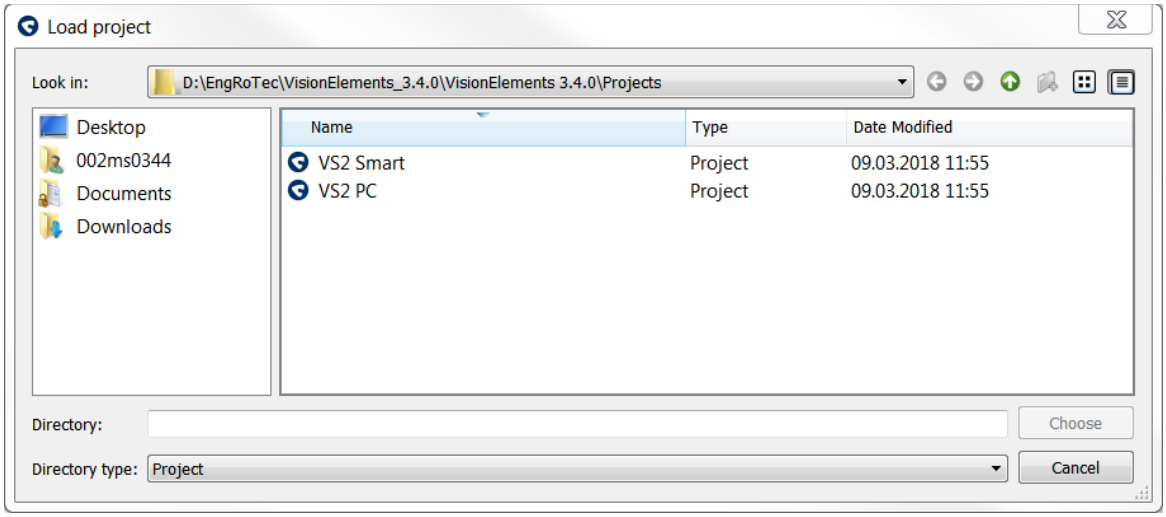


Figure 3: Dialog - Load project

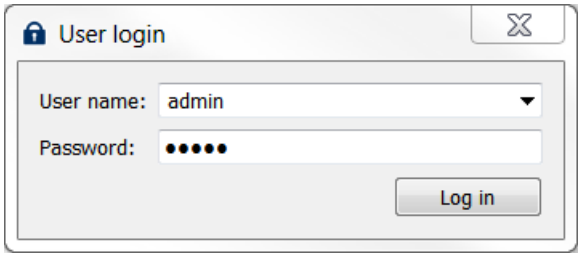


Figure 4: Dialog – User login

Closing

An open project can be close if the logged in user has the required privileges. In case of a PC project this will interrupt the process immediately and stop the measurement system from responding.

When closing a smart project with an active Automation Interface the sensor will take over responsibility and respond to any communication from the higher-level controller (Robot, PLC). The sensor will use the configuration that was last uploaded which is not necessarily the one last used on the PC. To avoid interruptions in the process and data loss make sure the project is closed before a context is selected with the init command.

Autostart

VISIONELEMENTS3 can load PC projects automatically at startup. In the menu select “Project” -> “Autostart” -> “Set current project” while a project is loaded. By using this and the autostart functionality of Windows the measurement system can be activated reliably on every start of the PC.

For smart projects this feature is not available in this form. The availability of the measurement system is ensured by the sensor itself and independently from the PC.

Version management

VISIONELEMENTS3 offers an automated version management making all modifications in the project comprehensible. This happens in two steps. As the first step, each modification is shown in the “Changes” view (view -> Show changes).

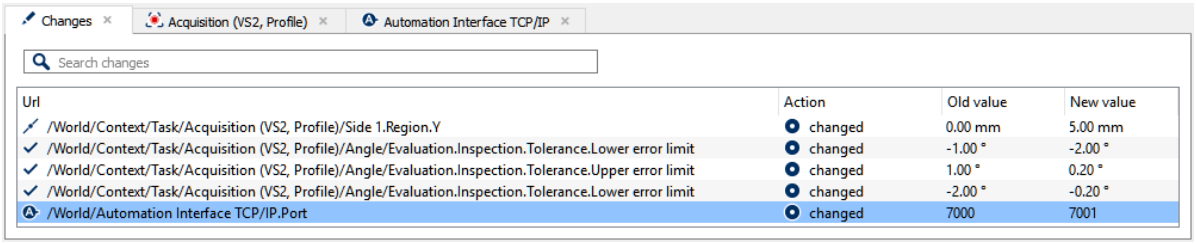


Figure 5: Changes

When saving, the second step will follow. The changes list will be cleared and a new project version will be created. At the same time, a description of the undertaken modifications can be entered. Open the version management by clicking the version display in the menu bar.

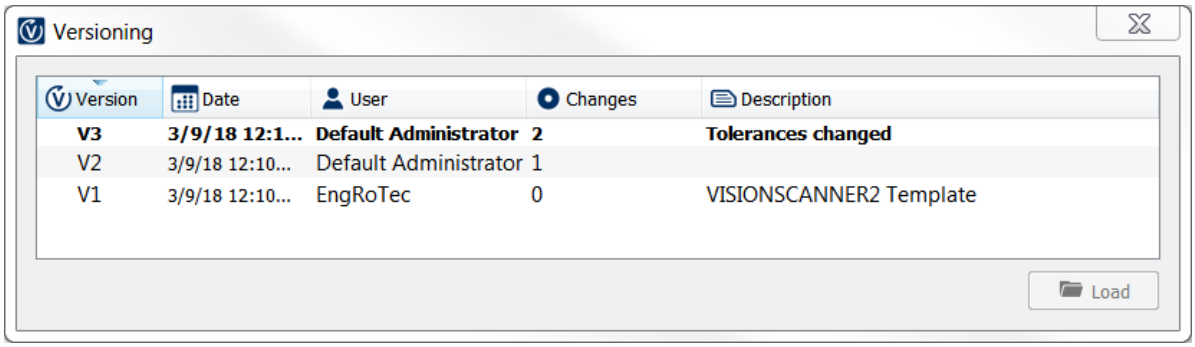


Figure 6: Dialog – Versioning

Here you can see the existing versions. Date and user indicate when the version has been saved and who did it. Furthermore, the number of modifications to the previous version is indicated. The currently loaded version is shown in bold.

For smart projects an additional “uploaded” column indicates when this version has been uploaded to the sensor.

When loading a project the latest version is loaded. If you want to change permanently to an older version, you have to load it first via the version management and then save the project (even if you didn’t make any modifications).

Limitations of smart projects

Smart projects run completely on the sensor. At the moment, this is only possible with a **VISIONSCANNER2**. The communication always runs directly between sensor and controller (PLC,

robot,…). That is the reason why in smart projects only one World and one sensor can be created. Furthermore the elements Group, Camera (VS2), Model, Point and Robot (6A) are not available in smart projects. Smart projects cannot be loaded automatically with the Autostart feature. This is a safety mechanism to avoid disturbing the production. Be aware that the project has to be uploaded to the sensor before production without the PC is possible.

USER INTERFACE

VISIONELEMENTS3 uses different areas in which configurations are made or results are shown. The usual conventions for moving and resizing windows apply. The width of columns can be changed. The user experience is best with mouse and keyboard, but touch displays are also supported.

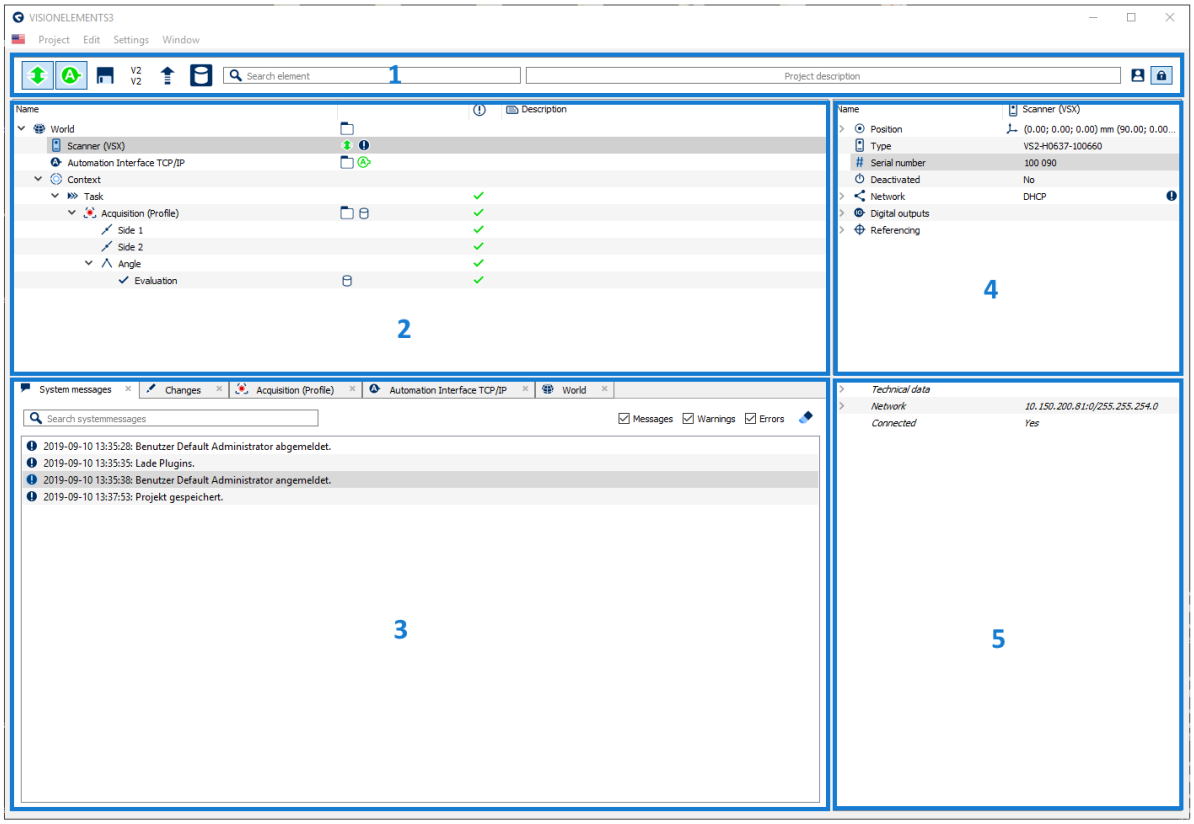


Figure 7: Overview user interface

The following areas are marked in the figure:

1. Menu bar
2. Element tree
3. Views
4. Properties
5. Result display

Menu bar

The most important settings can be accessed directly from the menu bar. You can also see the status of different subsystems.

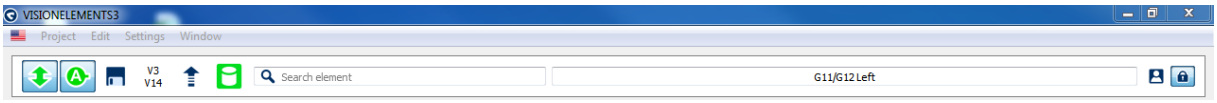


Figure 8: Menu bar

The symbols have the following functions:

	Function
	Controls and shows the status of the connections to the configured sensors. This symbol can only be seen if a sensor is configured in the project.

	Status
	Sensors are included in the project, but not connected to **VISIONELEMENTS3**.
	All (active) sensors are connected to **VISIONELEMENTS3**. In smart projects the Automation Interface will automatically activate when the connection is established.
	At least one sensor could not be connected to **VISIONELEMENTS3**. In the element tree you can see which sensors are affected.

	Function
	Controls and displays the status of the Automation Interface. This symbol only exists when an Automation Interface is configured in a project.

	Status
	Automation Interfaces are configured in the smart project but the current status is unknown as there is no connection to the sensor.
	Automation Interfaces are configured in the projected but not activated. External automated control is not possible.
	All configured Automation Interfaces are activated. The higher-level controller (PLC, robot, …) can connect to the measuring system and take over the control. In smart projects the sensor remains the communication partner for the controller. But all commands are passed on to the PC and processed there.
	At least one Automation Interface could not be activated. In the element tree you can see which Automation Interfaces are affected.

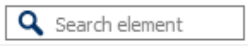
	Function
	Saves the project..

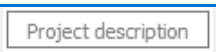
	Status
	The project has not been changed since the last save.
	Changes have been made in the project without being saved.

	Function
V4 V5	Opens the version management and shows which versions of the project are loaded on the sensor (top) and in **VISIONELEMENTS3** (bottom). In PC projects only the current loaded version will be shown.

	Function
	This symbol only exists in smart projects. It shows whether the current version of the project has been uploaded to the sensors and starts the upload.

Status
 No sensor is connected therefore the status is unknown. An upload is impossible.
 The project on the sensor is identical to the version on the PC.
 Sensor and PC have different versions.

	Function
	Here you can filter which elements are shown in the element tree. Only those elements with the search term in their names (and their parents) are displayed. Tip: With the keyword “TYPE:“ all elements of a certain type can be shown, e.g., “TYPE:Acquisition“ for all Acquisitions.

	Function
	Enter the project description. It will be shown in the network monitor and if a sensor is already connected to a project.

Function
 Opens the configuration of the process data interface.

Status
 Process database is not connected.
 Process database is connected.
 A connection to the process database cannot be established. Check the network settings and the login credentials.

Function
 Opens the user management.

Function
 Opens the dialog for the user login or logs out the current user.

Element tree

The element tree is the primary tool used to configure the measuring process. With it the physical world, the components of the measuring system, the interfaces and the actual measurements can be managed and connected to one another.

Tip: Use the arrow keys and tab to navigate the tree.

To add a new element right click and a context menu will open which contains all elements that can be inserted below the clicked element.

The elements can be moved using drag & drop and the usual functions to cut, copy, paste and delete are available. Furthermore they can be renamed by double-click or F2.

Some elements represent a physical element of reality. They always have a position in space. Those elements include robots, scanners, cameras, parts and coordinate systems.

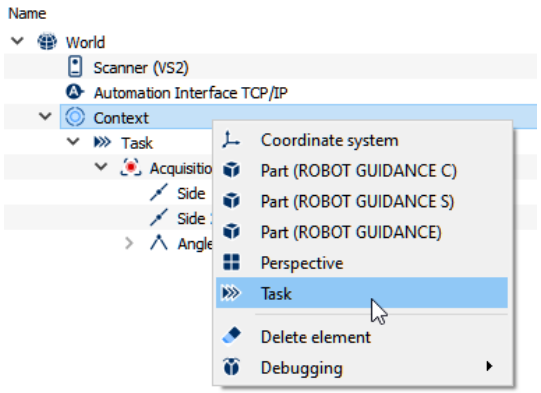


Figure 9: Insert element

Other elements serve for structuring and configuration of the measurement task. These are for example Context, Task, acquisitions and interfaces. These elements are mostly active, that means they can control components (Task, Acquisition) or run the analysis.

Some elements belong to both groups (parts, scanners, …).

Both groups are connected via dataflows. These can for example change the position of a coordinate system with the result of a measurement.

The measuring process is controlled via Automation Interfaces and shows the communication to the surroundings (robot, PLC, …).

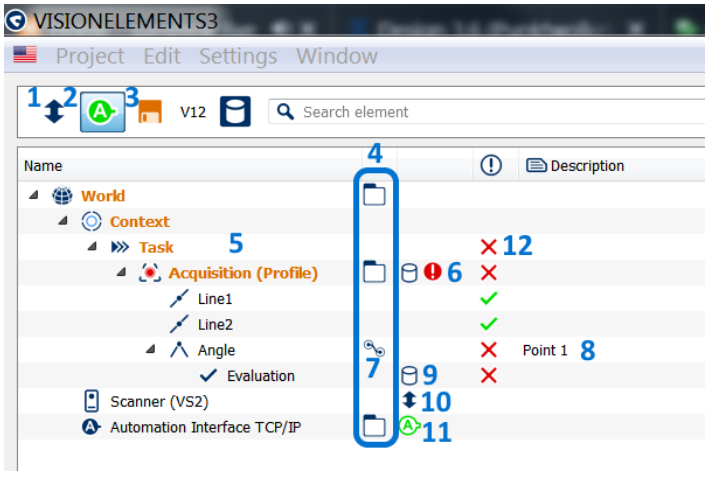


Figure 10: Overview Element tree

Here you can see the following information to the elements:

1. No sensor is connected.
2. The Automation Interface is active.
3. The project has been changed.
4. For World, Acquisition and Automation Interface Views are available. They can be opened by double clicking .

5. The Task has been modified, so it and its parents are displayed in orange.
6. The Acquisition is not correctly configured.
7. The angle measurement has a dataflow. The related configuration window can be opened by double clicking .
8. The angle measurement has a description.
9. The logging of the process data is activated, but there is no connection to the process data server.
10. The Scanner is not connected.
11. The Automation Interface is active and waiting for a connection from the higher-level controller.
12. Displays the status of the series (Non/In Tolerance, Error or Invalid)

Properties

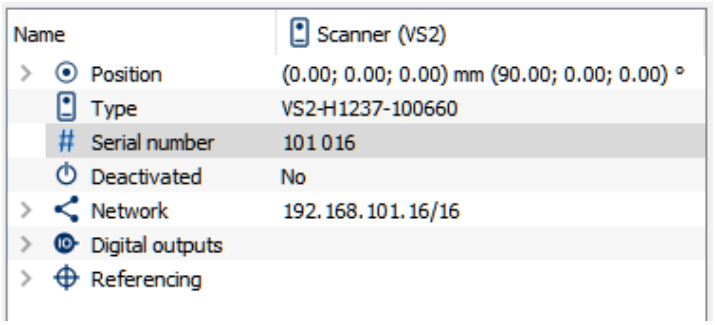


Figure 11: Properties of a Scanner (VSX)

Each element has different properties which can be shown and changed on the right side of the window. To change a property click on the value of the respective line and enter the desired value. Some properties offer a dropdown menu for choosing the parameter. In many cases various properties are combined to one group. They can be expanded and hidden to change the single properties. A tool tip shows the description and (if existing) the standard value as well as the value range. With the two buttons at the end of the line you can get the last stored value or the standard value .

For the property “position“, which you can find in many elements, you also have the possibility to select data from a list. Click on ... and select the correct data. The list entries will be provided specifically for the project.

Tip: Use the arrow keys, Enter and Tab to navigate the tree.

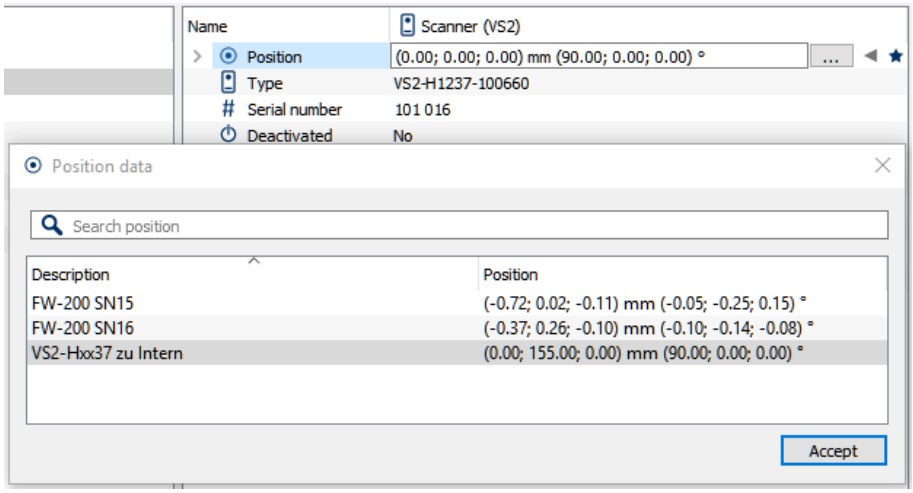


Figure 12: List with position data

The property “position“ can be displayed as global and local positions. The symbol in front of the position coordinates indicates whether the reference coordinate system is local or global. All position properties can be configured and used in the same way. This means that all position properties can be written and read as local and global coordinates. The following figure shows an example of a scanner position with local coordinates. Since the position of the scanner is specified locally, the global coordinates are grayed out, but can be edited here exactly like the local coordinates.

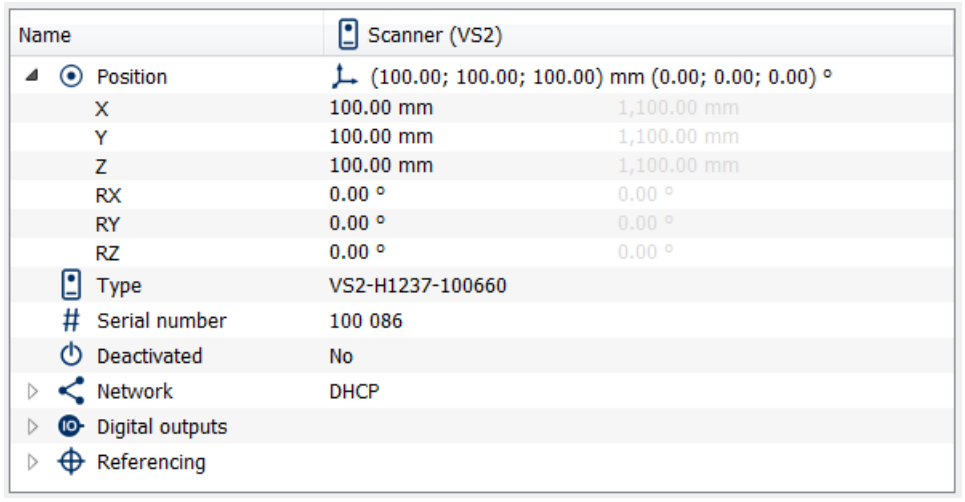


Figure 13: Scanner position with local and global (gray) coordinates

Views

Views are available for the elements Acquisition, Automation Interface, Perspective and World and for system messages and change tracking. They are normally shown in the lower left area of the main window and are separated in tabs. They may be split into their own windows. Their function is described at the related elements. In the element Perspective several views can be shown together.

Result display

All results of the currently selected element are displayed here. For example you can see all the calculated statistical values of an Evaluation at once.

DATAFLOW

Right click on an element and then on “add dataflow“ in the context menu to create a dataflow. (If the entry does not exist, no dataflow can be created). A window opens showing the already chosen element. (A dataflow can also be opened by double clicking). Insert further elements per drag & drop from the element tree. To add dataflow inputs and outputs, right-click an element in the window and add the desired inputs and outputs. At this point, you can select both local and global coordinates for use in the dataflow.

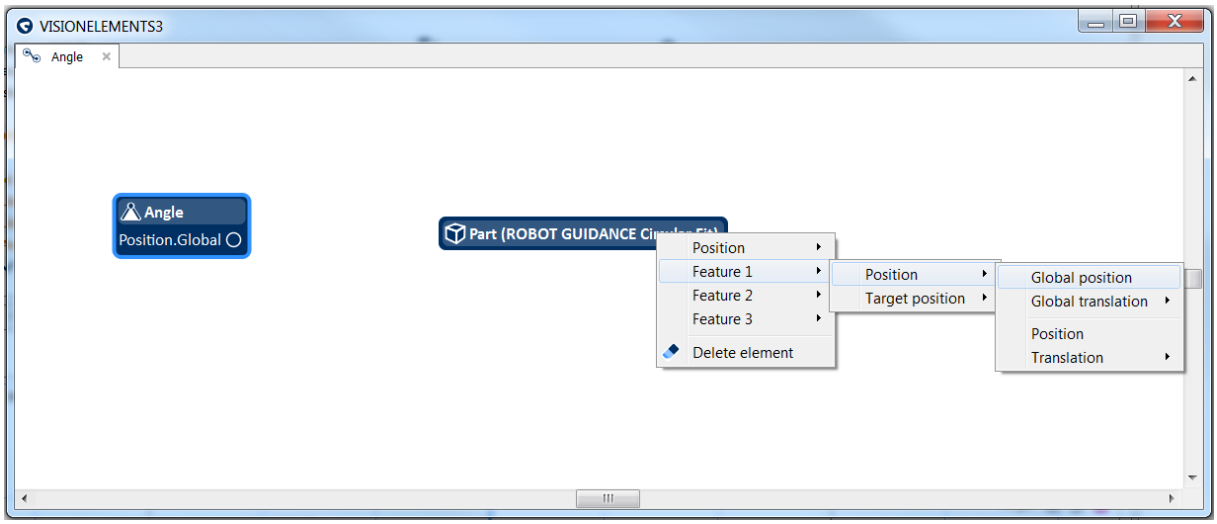


Figure 14: Selection of the desired inputs and outputs in the dataflow window

Connect the features of the elements by mouse. The software only allows sensible connections. You can see the possible targets while clicking on the circle next to a feature and holding it. For features that can receive data from a dataflow (input), the circle will be on the left side; for features that can provide data (output) it will be on the right.

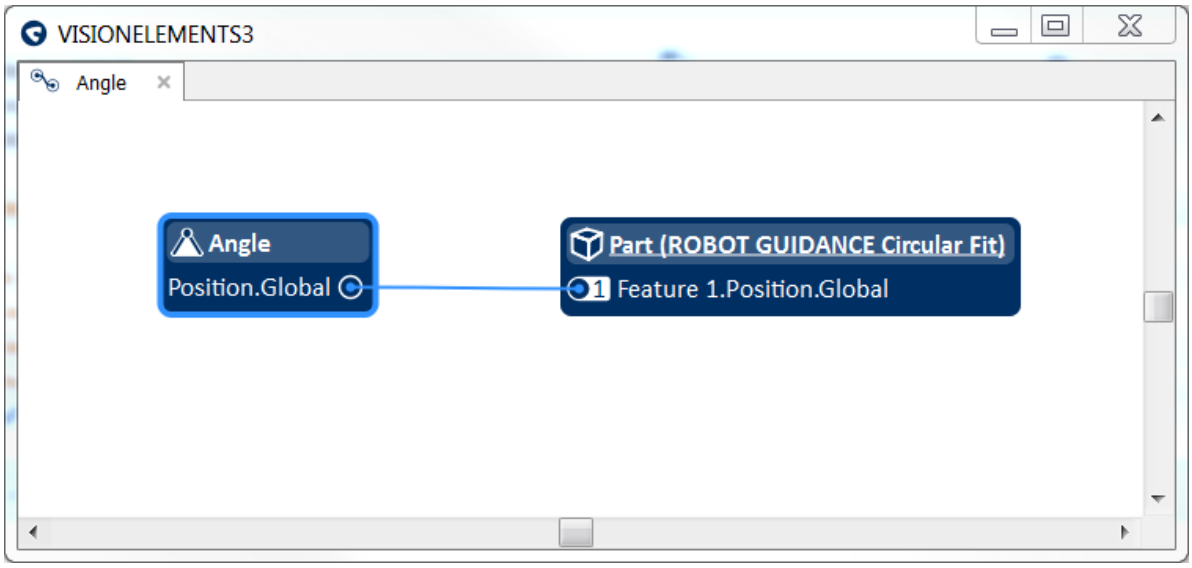
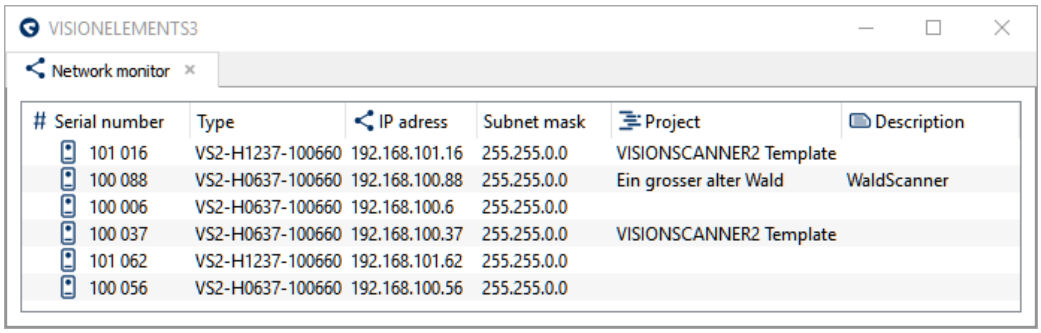


Figure 15: Dialog – Dataflow from Angle to Part

NETWORK MONITOR

This tool shows all compatible devices in the network that may be bound to a project. Depending on the type of device different information like serial number, type, IP address, … are available.

Open the Network Monitor from the menu “Window” -> “Display network monitor”. This will open a new View.



# Serial number	Type	IP adress	Subnet mask	Project	Description
101 016	VS2-H1237-100660	192.168.101.16	255.255.0.0	VISIONSCANNER2 Template	
100 088	VS2-H0637-100660	192.168.100.88	255.255.0.0	Ein grosser alter Wald	WaldScanner
100 006	VS2-H0637-100660	192.168.100.6	255.255.0.0		
100 037	VS2-H0637-100660	192.168.100.37	255.255.0.0	VISIONSCANNER2 Template	
101 062	VS2-H1237-100660	192.168.101.62	255.255.0.0		
100 056	VS2-H0637-100660	192.168.100.56	255.255.0.0		

Figure 16. Network monitor

USER MANAGEMENT

Different users can be created using the user management. It enables tracking changes on the project and prevents unauthorized changes.

The user level “Maintenance engineer“ does not allow any structural changes to the project. No elements can be created or moved. This level is intended for observing the process, adjusting tolerance limits or loading an old version. It is also suitable for exchanging a sensor.

The user level “Commissioning engineer“ provides unlimited access to the project. The Process data interface can be configured, new users can be created or new measuring tasks can be added.

PROCESS DATA INTERFACE

The Process data interface provides access to a MySQL database where images and profiles from measurements can be stored.

Configuration

Prerequisite is an installed MySQL database with known access data. The installation of the process database is described in the appendix “Installation MySQL database”. It must be installed on the PC on which **VISIONELEMENTS3** is installed even if an existing external database is used.

Click on the symbol in the menu bar. The installation is checked automatically. If the installation is faulty, this is indicated as shown in Figure 17. If the installation was successfully validated, the database connection can be configured.

Enter the IP address of the PC where the database is installed (in smart projects not “localhost”!) and the login credentials in the dialog. Make sure that the database accepts connections from the sensors and PC. (This procedure depends on the used database; therefore, this step cannot be done in **VISIONELEMENTS3**). After that click “Connect”.

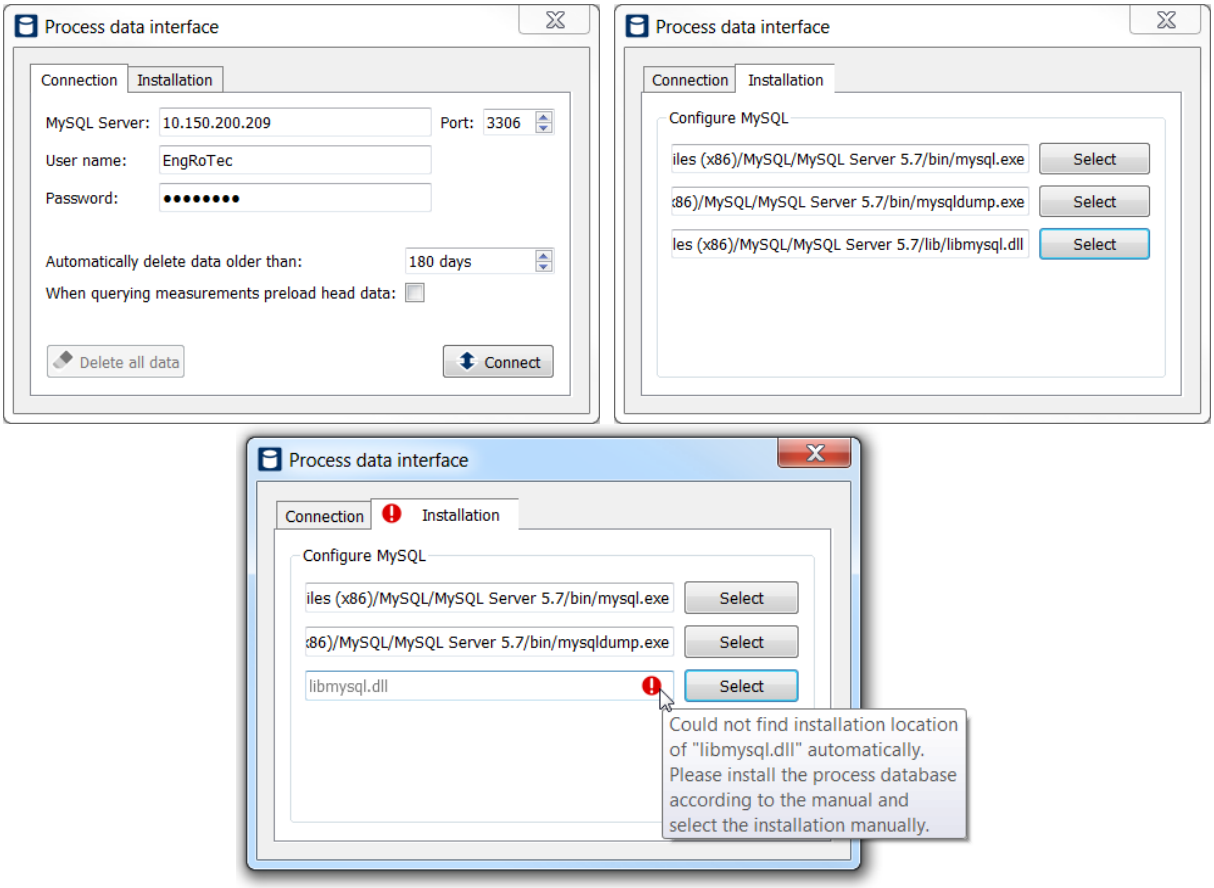


Figure 17: Configuration of database connection and installation of the process data interface

3. PROJECT STRUCTURE

With **VISIONELEMENTS3** you can solve very different tasks that have minor to significant complexity. Complete solutions for specific applications go beyond the scope of the manual. Here you will find general information and support for the structuring of projects.

PROCEDURES

For the configuration of a new project please use the following questions and procedures as a guideline:

- Which measuring results are required?
- What features/characteristics have to be measured?
- How many and which sensors can be used?
- What is the overall process flow?
- Create elements.
- Test step-by-step.
- Copy elements.

BINDING A SENSOR

Any device has to be bound to a project before it can be used. This binding is the connection between the element in the project and the actual hardware device. To bind a device select the corresponding element in the element tree. Then specify the device type and network settings under properties.

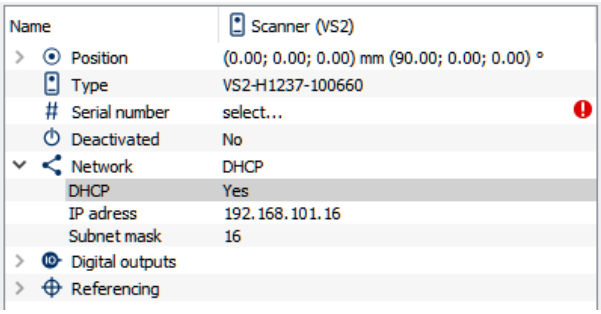


Figure 18: Device properties

If a DCHP server exists within the network the sensor can automatically obtain its IP address. If no DHCP server is available the configured IP will be used. If you always want to have a fixed IP, then set DHCP to “No”.

Then open the Dropdown menu behind the serial number and choose the required device. The list contains all sensors in the network.

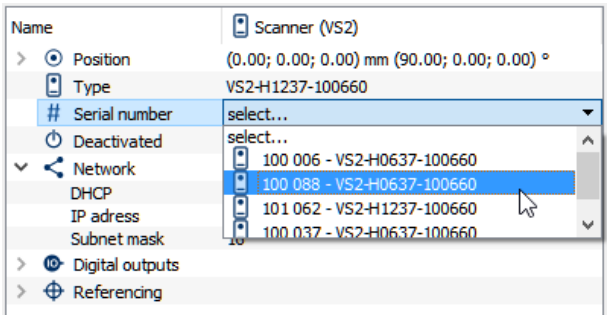


Figure 19: Choose serial number

All configurations will be transmitted to the device and it will be restarted. After that it will be ready for use in the project.

Figure 20: Binding a sensor

To receive data from the sensor it has to be connected. Therefor click on “connect sensors” in the menu bar. Network connections to all devices configured in the project will be established.

CONFIGURATION OF A MEASUREMENT

The following conditions have to be fulfilled before a measurement can be configured:

- Project is created
- Sensor is bound
- Sensor is connected
- Object is within the measuring range of the sensor
- An Acquisition has been created and is selected
- The View of the Acquisition is open

Start a live image in the Acquisition and adjust parameters until you get a clear picture or profile. The object should be in an almost central position. Limit the range as much as possible.

Create an appropriate measurement under the Acquisition and select it. Measure the feature and adjust the measuring range in such a way that it will also be measured when the object moves slightly.

Now adjust the parameters of Acquisition and measurement until you receive a stable correct result.

In principle, measurements can be configured without a sensor when the measuring task is precisely known or when stored process data are available.

4. THE ELEMENTS

All Elements with description of all parameters.

GENERAL PARAMETERS

Some parameters occur in many different elements but always have the same function.

Position

Some elements have a physical position in space. This includes coordinate systems, sensors, parts, models and robots. All positions are indicated with 6 coordinates in Euler angles using the ZYX convention.

Region

Acquisitions and some measurements have a region. It defines where the element is used. For an Acquisition the measuring range property specifies which part auf the CCD sensor is used. Measurements are done only with points within the region.

Regions have a position in X and Y in the internal coordinate system of the sensor as well as a width and a height. In the View of the respective element regions can be modified using the mouse. They can be moved by simply dragging the light blue rectangle. To resize move to the corners and drag the appearing triangular handle. Regions of measurements can also be rotated. This is done with the circular handle that appears at the middle of the regions sides.

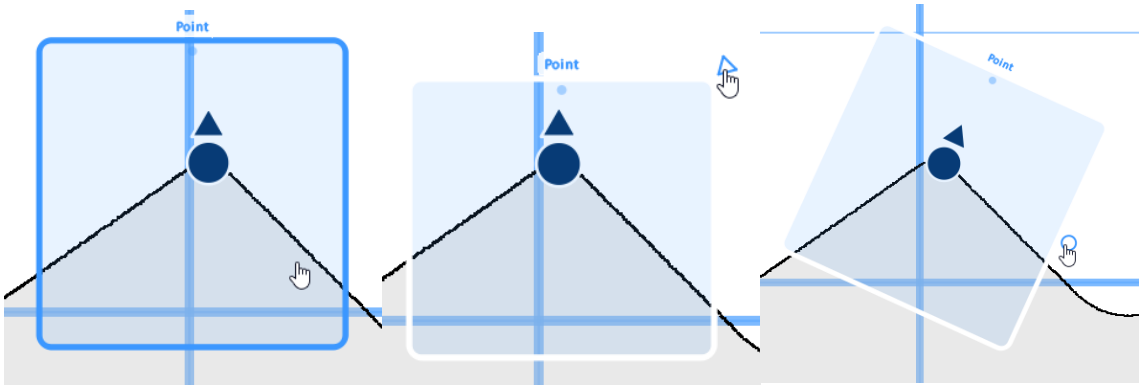


Figure 21: Region – Resizing and rotating

Alignment

All measurements (except Angle and Dimension) have an alignment property for position and angle where you can select another measurement. In this way you can connect the region of one measurement with the result of another. This means that the position and rotation of the region of the second measurement will always be in the same relative position to the feature detected in the first measurement. When used correctly even large changes in position of the part can be compensated and the features can be measured reliably. Furthermore most regions can be very small which improves

performance and avoids errors. Make sure the element that will be aligned is placed lower than the reference measurement in the element tree. Position and angle may be aligned with different elements.

Error check

All measurements and parts have a parameter for error checking. Below this value is the series tolerance value specified as a percentage. If the error rate (see series) exceeds the set tolerance value, the status of the series is set to error.

GENERAL RESULTS

All measurements return a position in X and Y of the feature. It is indicated in millimeters within the internal coordinate system of the sensor (X, Y, position) and within the World coordinate system (global position). Except for Circle and Area all measurement also provide an angle as a result (angle, rotation). This is displayed in the World coordinate system (global rotation).

An additional result is the measurement error. It indicates whether the measurement was successful. A measurement will fail for example when there are no profile points in the specified region.

Status

All measurements, acquisitions, parts, features and evaluations have a status Result. In general, a distinction is made between Last Status and Series Status. The Invalid value indicates whether all status values have been set and whether the status is meaningful. Both statuses each hold a value for "Error" and "Not in tolerance". An error occurs, for example, if no profile points are within the measuring range.

Series

All measurements, parts and evaluations have a series of results. This result describes how often the measurement was performed and how many errors occurred. From this, an error rate can be calculated which is checked against the parameter of the series tolerance. During evaluation, the "Not in tolerance" values are checked instead of "Errors".

Error check

All profile-evaluating measurements have an error check. The plausibility of the profile is checked on the basis of the number of profile points and its quality on the basis of consistency. If, for example, reflections are present, this value decreases.

TASK

Tasks group all the required Acquisitions for a specific measurement task. They can be used to trigger all those Acquisitions at once and to trigger the calculation in a Part.

Parameters

Name	Description
Time restriction	Specifies a time limit for the execution of the task. This includes any acquisitions and measurements under this element, if the behaviour is set to Measurement or Measurement and part position calculation.
Behavior	Measurement: All Acquisitions (and subsequent measurements) under this Task are triggered at once. This is useful when more than one sensor is involved. Time restriction applies. Calculate part position: Triggers the calculation in a Part. After all measurements have been executed the Part needs to be informed that all relevant data for the calculation is available. This is done by running a Task with this behaviour. Measurement and part position calculation: Combines the two previous behaviours. The calculation will start when all Acquisitions are finished.
Part	Connects a Part to the Task. This setting has no effect when the behaviour is set to Measurement.

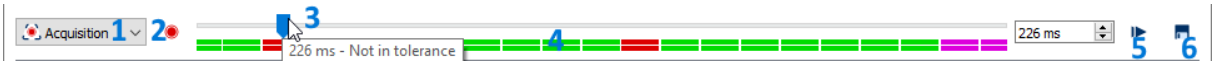
Parents

Context

ACQUSITION (ACQUSITION (PROFILE), ACQUSITION (IMAGE), DUAL-ACQUSITION (PROFILE))

Each recording view has a control section where you can switch between different sources for profiles or images and perform different actions. These actions include manual starting and stopping of a measurement, overview and selection of individual profiles or images of a longer measurement series, loading and saving of profiles or images from a file or loading from a database.

Live Recording



The combobox (1) can be used to select the source of the profiles/images from the live recording ("Acquisition"), "Database" and "File System" options. A switch " " (2) appears in the live recording, which starts a manual continuous recording and, once started, stops it again.

A continuous recording consists of several individual profiles/images, each of which is indicated by two markers stacked one above the other in the status display (4).

The color indicates the status of the single measurement: green ( ) means "In tolerance", red ( ) "Out of tolerance" and violet ( ) "Measurement error", while gray ( ) indicates an undefined status (e.g. the loaded profile does not match the recording).

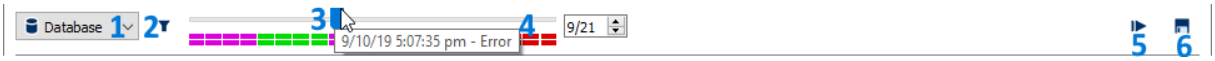
The slider (3) can be used to jump through the individual profiles/images and view the individual measurements. A click to the left or right of the slider, like the arrow keys on the keyboard, performs a single step in the direction of the previous or subsequent profile/image.

The currently displayed profile/image can be saved to the file system by pressing the "Save" button " " (6).

The measurement can be parameterized subsequently, for example by changing ranges or tolerances of processors under the recording. This makes it possible to parameterize a measurement that has already been performed without re-measuring or sensor, or to optimize parameters of a productive system without interfering with production.

The simulate button "▶" (5) is used to re-evaluate the measurement series with the updated parameters. The result of this re-evaluation is visible in the lower line of the status display by new colors. In the following example, the tolerance has been increased so that all individual measurements are "In tolerance" after reparameterization.

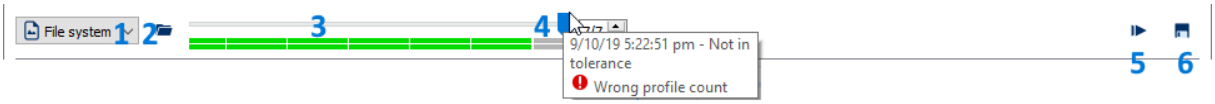
Database



If "Database" is selected as the source, a filter button " ▼ " (2) appears. The resulting dialog can be used to display all profiles/images of a specific period with a specific status (Without error, Not in tolerance, Measurement error).

(3) to (6) behave analogously to live recording.

Filesystem



If "File system" is specified as the source, a file(s) open button "📂" (2) appears. If this button is pressed, a file selection dialog opens in which profiles (.csv files) or images (.png files) previously saved with **VISIONELMENTS3** can be opened. It is possible to select several profiles/images in the corresponding dialog.

(3) to (6) behave analogously to live recording.

ACQUISITION (IMAGE)

This element controls the settings for the image acquisition of Camera (VC2) or Scanner (VSX). When the recording is triggered, it configures the sensor and activates the recording of the picture. At the end an image is available, on which measurements can be carried out by further plugins.

Standard settings are suitable for most of the applications. But the measuring range should always be adjusted to the task. If the image is overexposed, first reduce the exposure time and the maximum exposure time. Exposure time. This is particularly useful for light or reflective metallic surfaces. If the image is too dark (underexposed), increase the exposure time.

View

The View to an Acquisition is the most versatile tool to configure measurements. It shows the current and the maximum measuring range as well as all measurements and Evaluations belonging to the acquisition. The relevant elements can be selected and regions can be changed in this View.

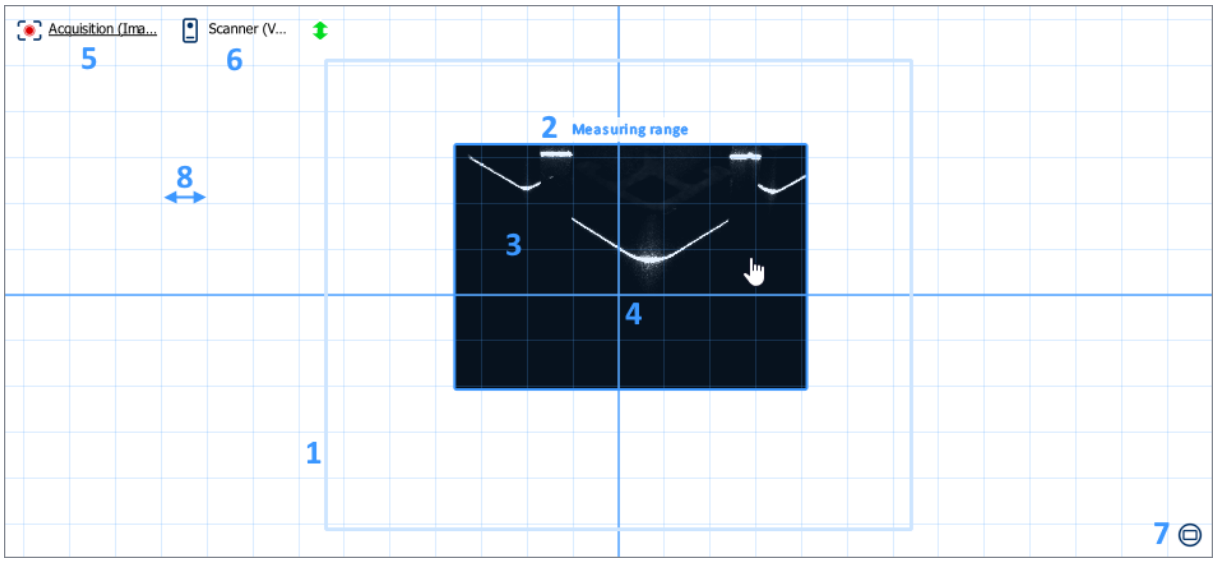


Figure 22: View of an Acquisition (Image)

The figure shows the following:

1. The maximum measuring range of the sensor
2. The current measuring range
3. The recognized image
4. The internal coordinate system origin
5. Clicking this text selects the acquisition. This allows quick access to its properties.
6. Clicking this text selects the sensor. This allows quick access to its properties.
7. Those buttons center the View on the current measuring range. The mouse wheel can be used to zoom. With a right click and drag the visible area can be moved.
8. The unit of measurement of the view is 10 mm

Parameters

Name	Description
Camera	Specifies on which sensor the recording is done.
Measuring plane	Defines in which measurement plane the recording should be made and evaluated. If Uncalibrated is selected, a 1 to 1 calibration is used.
Storage	Specifies in which case images will be stored. Off: No storing. Measurement error: The current image is saved when a measurement under this acquisition fails. Not in tolerance and measurement error: The current image is saved when a measurement under this acquisition fails or when the tolerances in an Evaluation are exceeded. All acquisitions: All images will be saved. Saving images does not work when using the live view or in scanning processes.
Measuring range	It limits the maximum measuring range. This improves performances and error rate (see General Parameters)
Illumination	Contains all settings that affect the illumination.

→ Trigger output	Specifies which trigger output is to be controlled with the image recording. For VC2 cameras, only internal and syncOut1 can be used. For GigE cameras, SyncOut1 to SyncOut4 is usable.
→ Illumination intensity	Specifies the brightness of the illumination during exposure. Since the current amperage of the LEDs is limited, the maximum brightness depends on the illumination (internal / external) and the set exposure time. Depending on the setting from a certain percentage no more control is visible.
→ Max. frame rate	Specifies how fast the images are taken at maximum to maintain the cooling times of the illumination.
Exposure	This group combines parameters for the exposure time and process.
→ Delay	A delay between the trigger signal and the start of the acquisition. This can be necessary to control external lighting synchronously.
→ Shutter time	Sets the base value for the exposure time. A higher value means a brighter image.
→ Automatic shutter	Off: No automatic adjustment of the exposure time. The value set as shutter time will always be used. Single field measurement: Shutter time is automatically adjusted so that certain conditions are met within a reference range. This can make the resulting profile independent from changing external lighting conditions.
→ Max. shutter measurements	Specifies how many acquisitions are used for the automatic exposure adjustment.
→ Exposure measuring region	The reference range for the automatic shutter adjustment
→ X, Y, Width, Height	Position and size of the reference range
→ Exposure target	Defines the requested brightness and width of the laser line within the reference range. A target value of 100% corresponds to a width of 4 pixels with maximum brightness.
→ Tol. exposure target	Specifies the tolerance regarding the exposure target value.
→ Min. shutter time	Specifies the minimum exposure time which the automatic shutter adjustment can set.
→ Max. shutter time	Specifies the maximum exposure time which the automatic shutter adjustment can set.
→ Shutter start value	Shutter time: The exposure adjustment always starts with the value set under shutter time. Last shutter time: The exposure adjustment starts with the last used value for this Acquisition.
Filter	This group combines the properties of the applied filters.
→ Binning	Specifies the number of pixels in the horizontal and vertical direction to be combined.
→ Horizontal, Vertical	Horizontal and Vertical

Results

Name	Unit	Description
State		(see General Results)
Exposure value	Grayscale	Returns the current exposure value in the measuring region.
Shutter time	µs	Returns the current shutter time.
Scan rate	Hz	Specifies the rate at which the scan is performed, including evaluation.
Execution time	ms	Specifies the time taken to complete all measurements.

Parents

Task

ACQUISITION (PROFILE)

This element controls the settings for the image acquisition of a Scanner (VSX). When the recording is triggered, it configures the sensor and activates the recording of the picture and the profile recognition. At the end, you have a profile on which you can activate the measurements.

Standard settings are suitable for most of the applications. But the measuring range should always be adjusted to the task. If no clear profile is identified, first reduce the exposure time and the maximum exposure time. This is helpful with bright or reflecting metallic surfaces.

View

The View to an Acquisition is the most versatile tool to configure measurements. It shows the current and the maximum measuring range as well as all measurements and Evaluations belonging to the acquisition. The relevant elements can be selected and regions can be changed in this View.

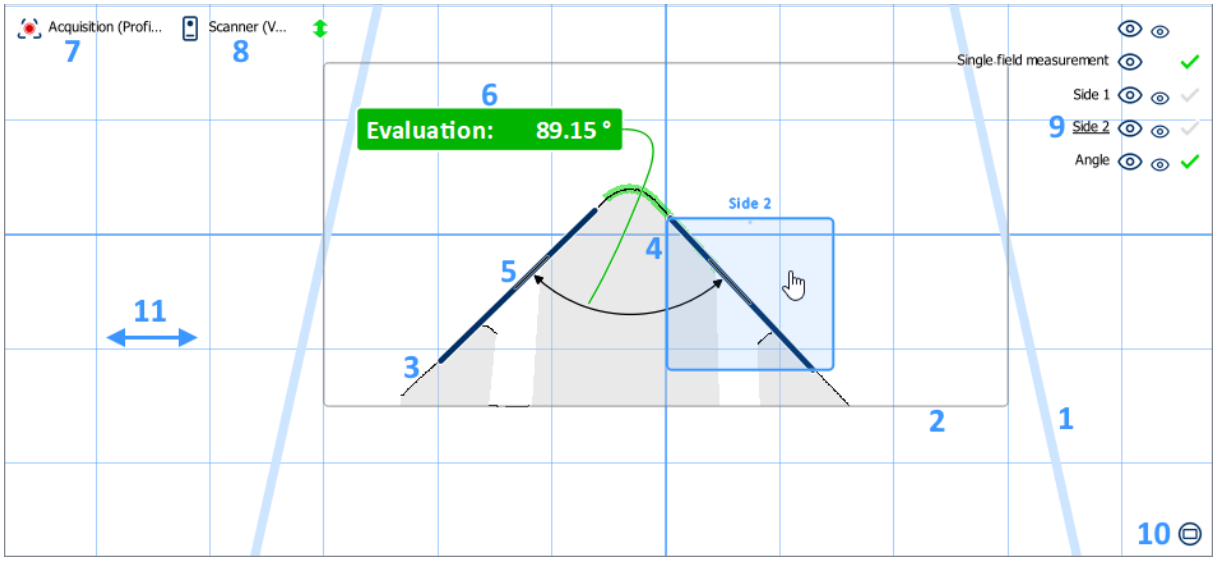


Figure 23: View of an Acquisition (Profile)

The figure shows the following:

1. The maximum measuring range of the sensor
2. The current measuring range
3. The recognized profile
4. The internal coordinate system origin
5. Result of a measurement
6. An evaluation
7. Clicking this text selects the acquisition. This allows quick access to its properties.
8. Clicking this text selects the sensor. This allows quick access to its properties.
9. A list of measurements that belong to this Acquisition. Clicking the text selects the measurement so that its measuring range becomes visible and it can be parameterised. The measurement can be shown or hidden via the larger eye. The smaller eye controls the display of the dimensioning and evaluation. The status of the respective measurement is displayed is displayed on the right.

Parameters

Name	Description
Scanner	Specifies on which sensor the recording is done.
Measuring plane	Specifies the mesauring plane. Any coordinate system can be selected.

Storage	Specifies in which case profiles will be stored. Off: No storing. Measurement error: The current profile is saved when a measurement under this acquisition fails. Not in tolerance and measurement error: The current profile is saved when a measurement under this acquisition fails or when the tolerances in an Evaluation are exceeded. All acquisitions: All profiles will be saved. Saving profiles does not work when using the live view or in scanning processes.
Measuring range	It limits the maximum measuring range. This improves performances and error rate (see General Parameters)
Exposure	This group combines parameters for the exposure time and process.
→ Delay	A delay between the trigger signal and the start of the acquisition. This can be necessary to control external lighting synchronously.
→ Shutter time	Sets the base value for the exposure time. A higher value means a brighter image.
→ Automatic shutter	Off: No automatic adjustment of the exposure time. The value set as shutter time will always be used. Single field measurement: Shutter time is automatically adjusted so that certain conditions are met within a reference range. This can make the resulting profile independent from changing external lighting conditions.
→ Max. shutter measurements	Specifies how many acquisitions are used for the automatic exposure adjustment.
→ Exposure measuring region	The reference range for the automatic shutter adjustment
→ X, Width	Position and size of the reference range
→ Exposure target	Defines the requested brightness and width of the laser line within the reference range. A target value of 100% corresponds to a width of 4 pixels with maximum brightness.
→ Tol. exposure target	Specifies the tolerance regarding the exposure target value.
→ Min. shutter time	Specifies the minimum exposure time which the automatic shutter adjustment can set.
→ Max. shutter time	Specifies the maximum exposure time which the automatic shutter adjustment can set.
→ Shutter start value	Shutter time: The exposure adjustment always starts with the value set under shutter time. Last shutter time: The exposure adjustment starts with the last used value for this Acquisition.
Profile recognition VS2	This group combines the settings for the profile recognition algorithm of VS2 sensors.
→ Undersampling	Undersampling can increase performance significantly by reducing the number of points in a profile. The value specifies the step width between columns on the CCD sensor that are used for profile recognition. A value of 1 will return a profile with the all points that can be detected. A value of 2 will return a profile with half as many points.
→ Threshold	The threshold specifies the minimum grayscale value for the laser line recognition. That means: threshold in grayscale = average brightness + (maximum brightness – average brightness) * threshold in percent.
→ Max. average brightness	Indicates the highest allowed value of the average brightness in a column. If the value is higher no point will be detected in this column.
→ Min. line brightness	Indicates the minimum required brightness of the laser line.
→ Min. line width	Indicates the minimum required width of laser line.
→ Max. line width	Indicates the maximum width of laser line.
→ Reflection suppression	Specifies the method to handle reflections in the image. Off: No reflection suppression. Automatic: Reflections are filtered out automatically. Laser line below: If more than one line is detected, the lowest in the image is used. Laser line above: If more than one line is detected, the highest in the image is used.
→ Profile recognition VS3	This group combines the settings for the profile recognition algorithm of VS3 sensors
→ Preprocessing	This subgroup contains the parameters for preprocessing the image before profile recognition.

→ Smooth Horizontal	Specifies how much the image should be smoothed horizontally before the laser line is detected. At a value of 1, smoothing is disabled.
→ Smooth Vertical	Specifies how much the image should be vertically smoothed before the laser line is detected. At a value of 1, smoothing is disabled.
→ High-pass filter	The high-pass filter allows the image to be resharpened after smoothing. If the value is too high, light reflections may be incorrectly recognized as a laser line. At a value of 0, the high pass filter is deactivated.
→ Threshold	The threshold value determines the gray level for laser line detection. All pixels with a gray level higher than the threshold value are classified as possible laser lines. The line selection mode indicates how this is handled if several possible laser lines are found in a column.
→ Min. line width	Specifies the minimum permissible laser line width. When below no laser line is found.
→ Max. line width	Specifies the maximum allowed laser line width. No laser line is found if this is exceeded.
→ Line selection	This subgroup contains the parameters for selecting the correct laser line.
→ Mode	Specifies the strategy according to which the laser line is to be selected for several possible laser lines in a column. Possible strategies are: highest grayscale, optimal line width and line number.
→ Optimal line width	Specifies the line width after which a laser line is to be selected if several possible laser lines occur in a column.
→ Line number	Specifies the line number after which a laser line is to be selected if several possible laser lines occur in a column.
Filter	This group combines the properties of the applied filters.
→ Median width	Specifies the width of the median filter that smoothens the profile.
→ Max. plane deviation	Specifies the maximum plane deviation.

Results

Name	Unit	Description
State		(see General Results)
Plane deviation	mm	Specifies the current plane deviation.
Exposure value	%	Returns the current exposure value in the measuring region.
Shutter time	µs	Returns the current shutter time.
Scan rate	Hz	Specifies the rate at which the scan is performed, including evaluation.
Execution time	ms	Specifies the time taken to complete all measurements.
Measurement position	mm	Displays the global measurement position (coordinate system measuring plane) of the profile. The profile points refer to the coordinate system of the measuring plane.

Parents

Task

DUAL-ACQUISITION (PROFILE)

This element controls the acquisition parameters for a dual system of two scanners (VSX). When the acquisition is triggered, it configures the sensors and takes the pictures, profile searches and merging of both profiles. At the end, a profile is available on which measurements can be taken.

Before the measurement can be started, the sensor positions must be adapted to their real positions. The coordinate system of the dual acquisition corresponds under standard settings to the middle position of both sensors, but can also be chosen freely.

Separate settings can be made for both sensors as described under Acquisition (Profile). This is done via the view. A live view and the loading of error images as under Acquisition (Profile) is also possible.

View

The View to an Acquisition is the most versatile tool to configure measurements. It shows the current and the maximum measuring range as well as all measurements and Evaluations belonging to the acquisition. The relevant elements can be selected and regions can be changed in this View.

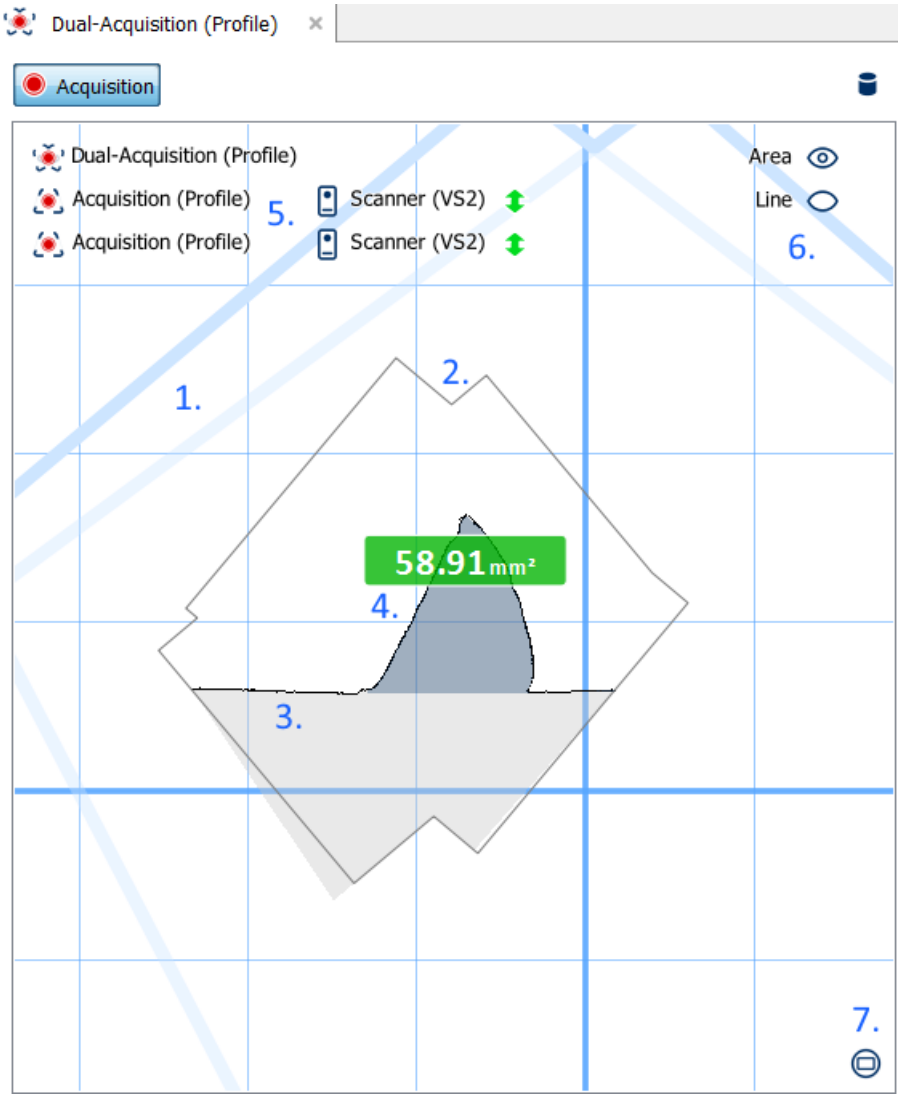


Figure 24: View of a Dual-Acquisition (Profile)

The figure shows the following:

1. The maximum measuring ranges of the sensors
2. The current measuring ranges
3. The recognized profile
4. Result of a measurement and an evaluation
5. Clicking this text selects the sensor or the Acquisition. This allows quick access to their properties.
6. A list of measurements belonging to this Acquisition. Clicking the text selects the measurement. This allows quick access to its region and properties.

7. Those buttons center the View on the current measuring range. The mouse wheel can be used to zoom. With a right click and drag the visible area can be moved.

Parameters

Name	Description
Measuring plane	Defines the common measurement plane of both sensors. " Select..." uses the middle measuring position between both sensors. Any coordinate system can be selected.
Storage	Specifies in which case profiles will be stored. Off: No storing. Measurement error: The current profile is saved when a measurement under this acquisition fails. Not in tolerance and measurement error: The current profile is saved when a measurement under this acquisition fails or when the tolerances in an Evaluation are exceeded. All acquisitions: All profiles will be saved. Saving profiles does not work when using the live view or in scanning processes.
Filter	This group combines the properties of the applied filters.
→ Max. plane deviation	Sets the maximum distance of the vertices of the maximum measuring range of the scanner to the common measuring plane and to the measurement plane of the other scanner.
→ Max. time offset	Defines the maximum time difference between two profiles up to which they can still be join.

Results

Name	Unit	Description
State		(see General Results)
Plane deviation	mm	Specifies the current plane deviation.
Scan rate	Hz	Specifies the rate at which the scan is performed, including evaluation.
Measurement position	mm	Displays the global measurement position (coordinate system measuring plane) of the profile. The profile points refer to the coordinate system of the measuring plane.

Parents

Task

DIMENSION

The Dimension calculates different relations between the results of two measurements (e.g., the distance between two points). The alignment will change the base for the calculation of width (ΔX) and height (ΔY).

Parameters

Name	Description
Alignment	(see General Parameters)
Error check	(see General Parameters)
Measurement 1 & 2	Select a measurement from the list.

Results

Name	Unit	Description
Status		(see General Results)
Series		(see General Results)
Position	mm	The position of the center position of feature 1 + 2
Distance	mm	The distance between the two features.
Alignment	°	Alignment of the dimension.
Width (ΔX)	mm	The horizontal distance between the two features. (Alignment is taken into account.)
Height (ΔY)	mm	The vertical distance between the two features. (Alignment is taken into account.)

Parents

Acquisition (Profile)

AREA

This element calculates the area between a line and the profile within a region. Any measurement except Circle and area can be used as the baseline since they all return a position and an angle. By rotating the region you can select whether the area above or below the baseline is measured. This translates into measuring a section through the object (glue bead, …) or the free space between the sensor and the object (gap, greave, …).

Tip: Points ● can be used as a baseline. With a fixed Point you can simulate a fixed line in space.

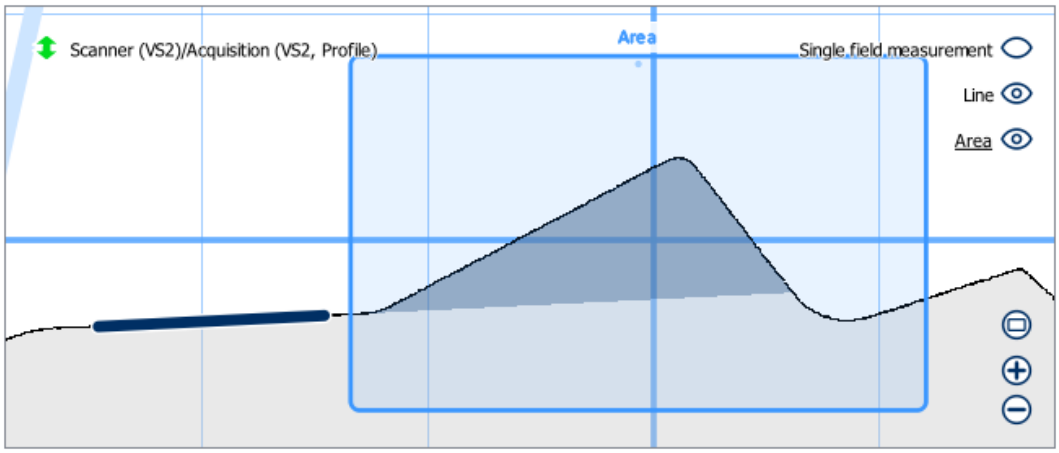


Figure 25: Area – Section through object

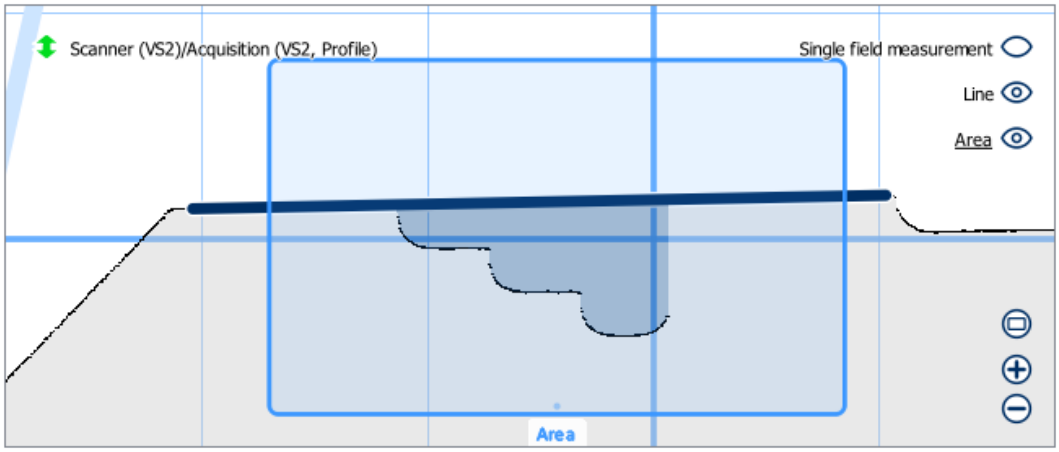


Figure 26: Area – Free space between line and object

Parameters

Name	Description
Alignment	(see General Parameters)
Region	(see General Parameters)
Error check	(see General Parameters)
Baseline	Select a measurement as one border of the area.
Calculation type	Determines how the area is to be calculated.

Results

Name	Unit	Description
Status		(see General Results)
Series		(see General Results)
Error check		(see General Results)
Position	mm	The centre of mass of the area in the internal coordinate system of the sensor
Area	mm²	Size of the area

Parents

Acquisition (Profile)

LINE

This measurement will fit a line into all profile points within the region. It will than return its centre and the largest distance of any profile point to the line. The latter can be used to detect irregularities on a surface.

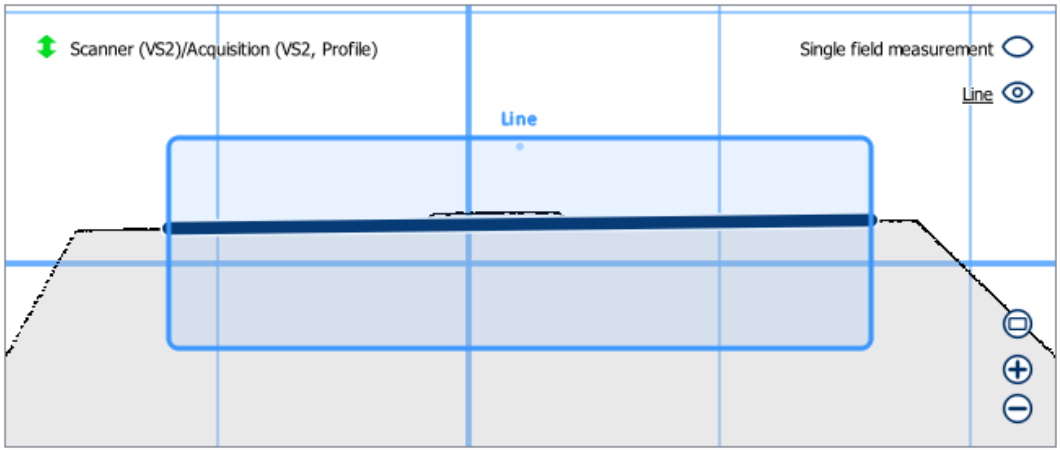


Figure 27: Line

Parameters

Name	Description
Alignment	(see General Parameters)
Region	A line is fitted to all points within this region. (see General Parameters)
Error check	(see General Parameters)

Results

Name	Unit	Description
Status		(see General Results)
Series		(see General Results)
Error check		(see General Results)
Position	mm	The position of the line position.
Shape deviation	mm	The largest distance between the profile and the line.

Parents

Acquisition (Profile)

CIRCLE

This measurement will fit a circle into all profile points within the region. It will than return its centre and radius as well as the largest distance of any profile point to the circle.

Set the region and be aware that all points within are used for the fit.

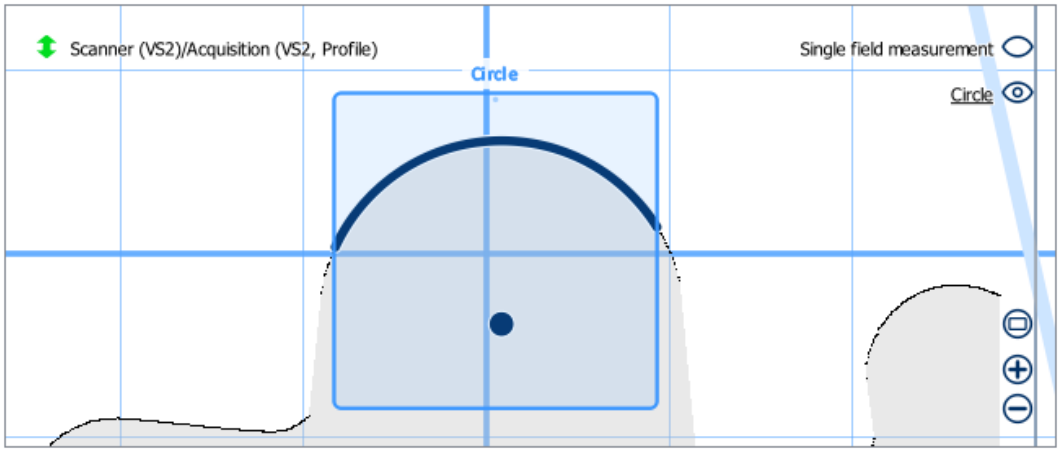


Figure 28: Circle

Parameters

Name	Description
Alignment	(see General Parameters)
Region	A circle is fitted to all points within this region. (see General Parameters)
Error check	(see General Parameters)

Results

Name	Unit	Description
Status		(see General Results)
Series		(see General Results)
Error check		(see General Results)
Position	mm	The circles centre in the internal coordinate system.
Radius	mm	The radius of the circle.
Shape deviation	mm	The largest distance between the profile and the circle.

Parents

Acquisition (Profile)

POINT (MEASUREMENT)

A Point measurement returns the position of a single point on the profile. Set the region position and rotation and specify the type of measurement.

Parameters

Name	Description
Alignment	(see General Parameters)
Region	(see General Parameters)
Error check	(see General Parameters)
Type	Fixed: The results are the centre and rotation of the region. Max: The result is the highest point of the profile in the region. By rotating the region, the search direction is changed. Average: Returns the centre of mass of all points in the region. Edge: Returns the most prominent corner within the region.

Results

Name	Unit	Description
Status		(see Generals Results)
Series		(see Generals Results)
Error check		(see General Results)
Position	mm	Position in the internal coordinate system.

Parents

Acquisition (Profile)

ANGLE

This measurement calculates the angle between two lines and their intersection. The angle is returned counter clockwise from measurement 1 to measurement 2. For the configuration simply select two measurements that return an angle (Point , Line , Dimension).

Parameters

Name	Description
Alignment	(see General Parameters)
Region	(see General Parameters)
Error check	(see General Parameters)
Measurement 1 & 2	The specified measurements are used as lines defined by a position and an angle.

Results

Name	Unit	Description
Status		(see General Results)
Series		(see General Results)
Position	mm	Position of the intersection of the two lines from the measurements.
Angle	°	The angle between the two lines counter clockwise from measurement 1 to measurement 2.

Parents

Acquisition (Profile)

PRESENCE

This measurement checks whether an object is present in the specified area. The presence is defined by the fact that there is a minimum number of profile points in the area and the profile is plausible. For example, if there are reflections, the plausibility decreases and the presence of the object is rejected.

Define the minimum number of profile points and the minimum profile quality.

Parameters

Name	Description
Alignment	(see General Parameters)
Region	(see General Parameters)
Error check	(see General Parameters)
Min. profile points	Indicates the minimum number of profile points required for the object to be considered present.
Min. profile quality	Specifies the minimum profile quality for the object to be considered present.

Results

Name	Unit	Description
Status		(see General Results)
Series		(see General Results)
Profile points		Indicates the number of profile points in the range.
Profile quality		Indicates the quality of the profile. The quality is judged by the consistency of the profile.
Present		Indicates whether the object is present or not. The object is present when the profile points and the quality of the profile exceed the set limits.

Parents

Acquisition (Profile)

EVALUATION

To visualize results and to check them against tolerances you can use Evaluations.

Add an evaluation under the measurement in the element tree. In the properties, select the measurement to be evaluated. Now define the reference value and the tolerance limits. Under Filters you will find options to perform an offset or scaling of the measurement results before testing. To display the parameterized evaluation, drag and drop the evaluation from the element tree to the view. The label of the created evaluation will then appear with a connector to assign the evaluation in the view. In this way, several displays can be created for each evaluation. The visibility of the labels and connectors is determined by the small eye next to the visibility setting for the measurement (large eye). With a global pair of eyes on top of the measurement and evaluation displays, all measurement and evaluation displays can be activated and deactivated at once. The labels and connectors can be rotated and shifted using drag handles. Right-click on the label to show/hide the connector. In addition, the statistical values can also be displayed. For a quick control of the values, evaluations with a successful inspection are displayed in green, evaluations with errors in red, evaluations without error check in blue and invalid evaluations in magenta. In addition, a status is displayed to the right of each measurement. The green checkmark stands for "All evaluations in order", the red cross for "at least one evaluation not in order", the grey checkmark for "no evaluation with check below the measurement" and the magenta-coloured exclamation mark for a measurement error.

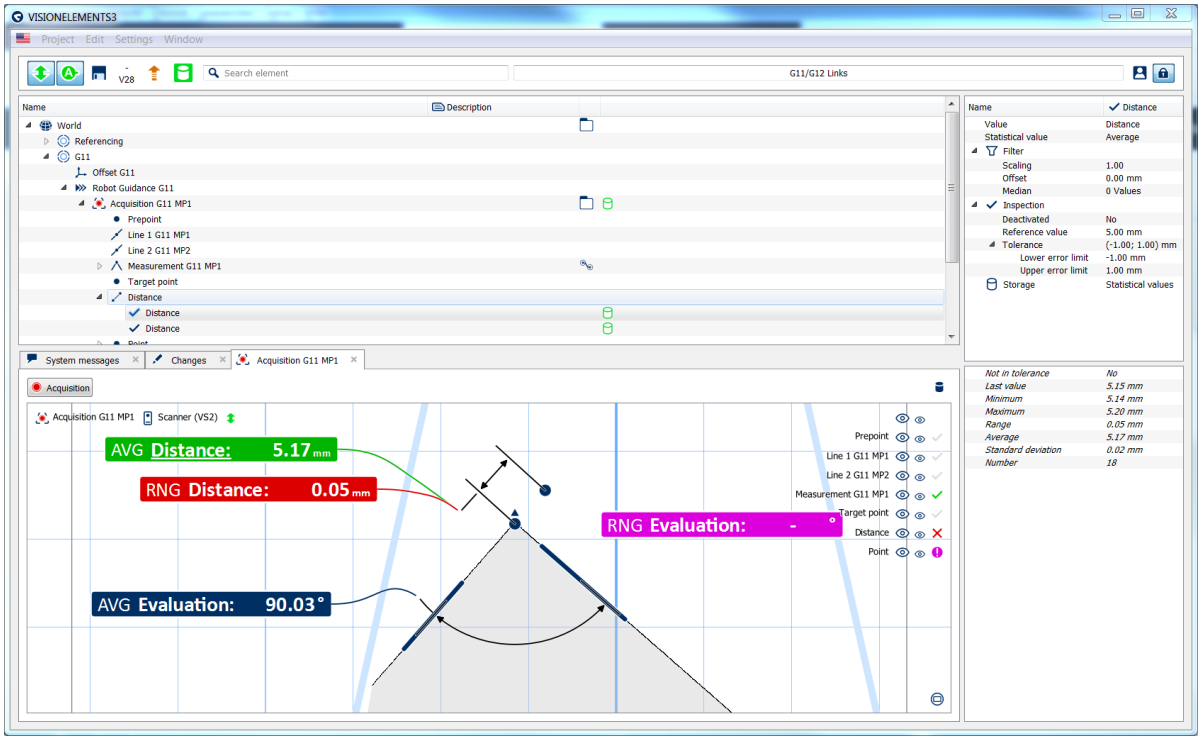


Figure 29: Evaluations

Parameters

Name	Description
Value	Selects the result of the measurement that is to be displayed and checked.
Caluclation	The calculation allows an adjustment of the measurement results.
→ Scaling	Allows the measurement result to be adjusted by a scaling factor.
→ Offset	Allows the measurement result to be adjusted by one offset.
→ Median	The median filter allows the removal of ejectors from a series.
Tolerance check	Parameters for the tolerance checking.
→ Deactivated	Specifies whether the tolerance check is activated/deactivated. If the check is deactivated, the evaluation is also not evaluated in the overall results of the higher-level elements. The evaluation then always returns an in tolerance (last) and so also for the series.
→ Reference value	Specifies the reference value around which the tolerance interval is set. This is the basis for the not in tolerance (last) and (series) check.
→ Lower limit	Specifies the lower limit of the tolerance interval. The absolute tolerance limits result from the addition with the reference value.
→ Upper limit	Specifies the upper limit of the tolerance interval. The absolute tolerance limits result from the addition with the reference value.
→ Series tolerance	Specifies the tolerance for the rate of not in tolerance results. Only when the series tolerance is exceeded by the not in tolerance rate the series of evaluations is evaluated with a not in tolerance (series).
Storage	Specifies whether and which values should be stored in the process database.

Results

Name	Description
Status	(see General Results)
Series	(see General Results)
Statistics	Displays of statistical values.
→ Minimum	Specifies the minimum of the value within a series.

→ Average	Specifies the average value of the value within a series.
→ Maximum	Specifies the maximum of the value within a series.
→ Range	Specifies the difference between maximum and minimum within a series.
→ Standard deviation	Specifies the standard deviation of the value within a series.
Value	Specifies the value from the last execution.

Parents

Point (measurement), Area, Circle, Angle, Line, Dimension, Plane, Edge, Point (on Part)

AUTOMATION INTERFACE INDUSTRIAL ETHERNET

This interface provides communication via digital IOs. It is only available in PC projects since a field bus adapter card is required. **VISIONELEMENTS3** supports CIFX 50 card from Hilscher which can be configured to work with any filed bus system based on the Industrial Ethernet standard (ProfiNet, EtherCat, …).

To configure the interface simply add the Element to the project and set the preferred byte order and select the card.

Further information about the protocol is available in the manual "Automation Interface Industrial Ethernet V1.0".

View

The View is the same as in the Automation Interface TCP/IP.

Parameter

Name	Description
Byte order	Here you can choose whether the most significant byte is the first or the last byte. The setting must match the bus configuration
Board	All compatible Hilscher cards installed in the PC are displayed here. Select the one configured in the bus for the measurement system.

Parents

World

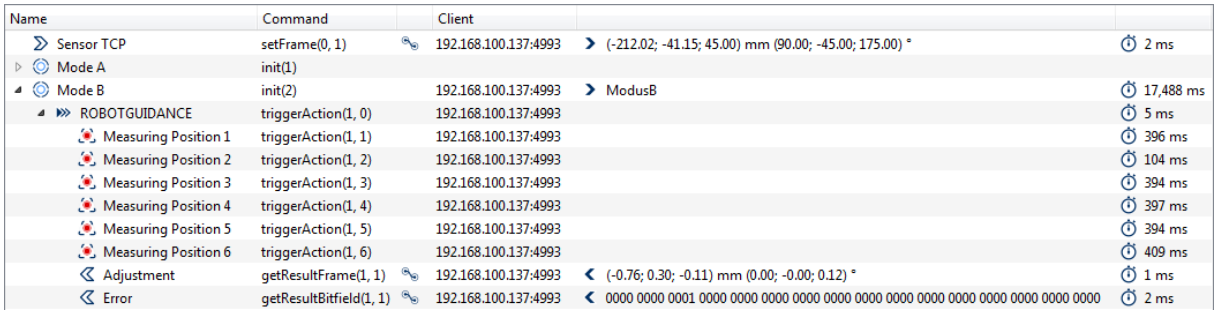
AUTOMATION INTERFACE TCP/IP

This interface is mostly used to communicate with robots. These need to have the appropriate technology package **AUTOMATION INTERFACE TCP/IP** installed.

For configuration, first create an "Automation interface TPC/IP" in the element tree. The only property that has to be configured is the port of the TCP/IP connection. The IP addresses of the interface are displayed in the results. Several robots can connect to the same automation interface.

View

In the corresponding View you will find all the elements from the project that can be addressed by the interface.



Name	Command	Client		
Sensor TCP	setFrame(0, 1)	192.168.100.137:4993	(-212.02; -41.15; 45.00) mm (90.00; -45.00; 175.00) °	2 ms
Mode A	init(1)			
Mode B	init(2)	192.168.100.137:4993	ModusB	17,488 ms
ROBOTGUIDANCE	triggerAction(1, 0)	192.168.100.137:4993		5 ms
Measuring Position 1	triggerAction(1, 1)	192.168.100.137:4993		396 ms
Measuring Position 2	triggerAction(1, 2)	192.168.100.137:4993		104 ms
Measuring Position 3	triggerAction(1, 3)	192.168.100.137:4993		394 ms
Measuring Position 4	triggerAction(1, 4)	192.168.100.137:4993		397 ms
Measuring Position 5	triggerAction(1, 5)	192.168.100.137:4993		394 ms
Measuring Position 6	triggerAction(1, 6)	192.168.100.137:4993		409 ms
Adjustment	getResultFrame(1, 1)	192.168.100.137:4993	(-0.76; 0.30; -0.11) mm (0.00; -0.00; 0.12) °	1 ms
Error	getResultBitfield(1, 1)	192.168.100.137:4993	0000 0000 0001 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000 0000	2 ms

Figure 30: Configured Automation Interface TCP/IP

By right clicking an element you can add a command that it will respond to. For some elements further elements may be added that are required for the communication. Commands may also be executed in this way so that the process can be simulated without a robot. On the right side of the View the current results for each command are shown.

All commands have one or two parameters that can be changed by double clicking them. The commands and parameters basically correspond to the standard command set of the **AUTOMATION INTERFACE TCP/IP** on the robot.

Before a task or acquisition can be executed, the respective context must first be initialized using the "init" command.

The following table provides an overview of the elements and the corresponding commands.

Element	Commands	Function
Context	init(n)	Selects the Context. This can be used to separate different types of parts.
Task	triggerAction(t, 0)	Executes a task. Depending on the configured behaviour this can lead to the execution of Acquisitions and calculations on Parts. t specifies the Task. Under one task this parameter is used for all other commands.
	startAction(t, 0)	Starts the Task. It is continuously repeated until the command stopAction() is received. This is required for scanning processes.
Acquisition	triggerAction(t, a) startAction(t, a)	Works similar to a Task, but cannot trigger other Acquisitions.
Result (different types)	getResultTYPE(t, a)	Sends a command of the corresponding type to the controller. The source of the result must be defined using a dataflow.
Frame	setFrame(c, n)	This command is used to send the current robot position to the measurement system. Using a dataflow you can select a coordinate system to which this position will be written. c is 0, when the command does not require a context to be set. This is usually the case when on sensor measures different positions on different parts. If c is 1 only coordinate system within the same context as the command can be set.

complete(n)	Closes the context.

Be aware that an additional command is available on the robot: “stopAction“ stops a continuous measurement.

Parameters

Name	Description
Port	Sets the port for the TCP/IP connection.

Results

Name	Unit	Description
Network addresses		Shows all network addresses of the system.
Client addresses		Displays all network addresses of the connected clients (robots).

Parents

World

AUTOMATION INTERFACE VW

This interface is used for communication with robots using the VW standard. The robot is configured according to the VW documentation („Ethernet – Kamerasysteme V2.0 zur Roboterführung für KUKA VKRC 4 Softwarestand ab Version 8.2“). Some examples are given in the section Robot programming below.

For configuration, first create an "Automation interface VW" in the element tree. The only property that has to be configured is the port of the TCP/IP connection. The IP addresses of the interface are displayed in the results. Several robots can connect to the same automation interface.

View

In the corresponding View you will find all the elements from the project that can be addressed by the interface.

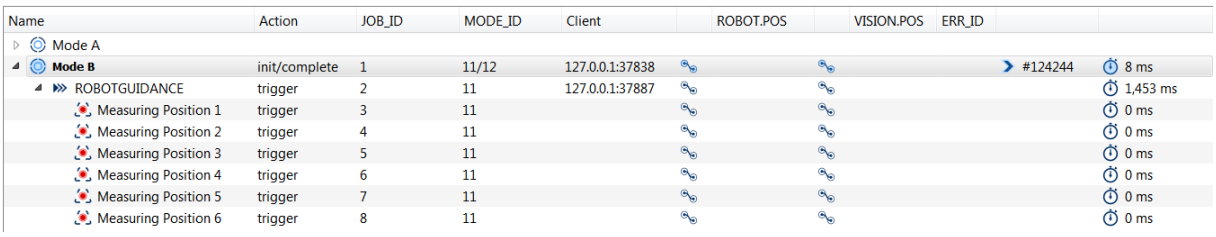


Figure 31: Automation Interface VW

By right clicking an element you can add a command that it will respond to. The defining parameter here is the JOB_ID. MODE_IDs can be chosen freely. Please refer to the documentation of the VW standard for details. The Action “trigger” triggers a one-time task or measurement while “begin/end” is used to start or stop a continuous measurement (scan). In this case to MODE_IDs have to be provided. In every

command two dataflows can be connected. Since the robot sends its current position with every command, the setFrame functionality of the other interfaces is achieved by simply connecting the first dataflow “ROBOT.POS” to a coordinate system. The second dataflow “VISION.POS” is used to send a set of coordinates as a result to the robot. In a single command all required steps for a simple robot guidance process can be executed.

Before a task or acquistion can be executed, the respective context must first be initialized using the "init" command to signal the arrival and start of the measurement sequence of a part. The transmitted serial number is displayed in the second to last column of the view.

The following table provides an overview of the elements and the corresponding commands.

Element		Action	Function
	Context	init/complete	Selects the Context. This can be used to separate different types of parts.
	Task	trigger	Executes a task. Depending on the configured behaviour this can lead to the execution of Acquisitions and calculations on Parts.
		begin/end	Starts the Task when the JOB_ID is received in combination with the first MODE_ID. It is continuously repeated until the same command is received again with the second MODE_ID. This is required for scanning processes.
	Acquisition	trigger begin/end	Works similar to a Task, but cannot trigger other Acquisitions.

Robot programming

Figure 31 shows a completely configured interface. In Context 1 a single measurement is executed and the result is returned to the robot.

```
1  PTP VB=100% VE=0% ACC=100% RobWzg=32 Base=0
  ↳SPSTrig=0[1/100s] P
   Warte auf Folgenstart
   -- Folge125  Grundstellung --
2  PTP VB=100% VE=0% ACC=100% RobWzg=0 Base=0
  ↳SPSTrig=0[1/100s] P
   1: TECH8_ EKI Job_ID = 10 Mode_ID = Port(s) oeffnen -
  ↳korr. Base Nr 0..32 = 1 Grenzwertearray = 00: keine
  ↳Ueberwachung - Realign Grenzwerte = 00: keine
  ↳Ueberwachung - EIN
   2: TECH8_ EKI Job_ID = 10 Mode_ID = Production - korr.
  ↳Base Nr 0..32 = 1 Grenzwertearray = 01: pruefen -
  ↳Realign Grenzwerte = 00: keine Ueberwachung - EIN
```

Figure 32: Robot program for Context 1

Context 2 is a complex 6D robot guidance task using three Acquisitions. In the last step the result is calculated and sent to the robot.

```
3  PTP VB=100% VE=0% ACC=100% RobWzg=0 Base=0
  ↳SPSTrig=0[1/100s] P
   1: TECH8_ EKI Job_ID = 21 Mode_ID = Validation - korr.
  ↳Base Nr 0..32 = 1 Grenzwertearray = 00: keine
  ↳Ueberwachung - Realign Grenzwerte = 00: keine
  ↳Ueberwachung - EIN
4  PTP VB=100% VE=0% ACC=100% RobWzg=0 Base=0
  ↳SPSTrig=0[1/100s] P
   1: TECH8_ EKI Job_ID = 22 Mode_ID = Validation - korr.
  ↳Base Nr 0..32 = 1 Grenzwertearray = 00: keine
  ↳Ueberwachung - Realign Grenzwerte = 00: keine
  ↳Ueberwachung - EIN
5  PTP VB=100% VE=0% ACC=100% RobWzg=0 Base=0
  ↳SPSTrig=0[1/100s] P
   1: TECH8_ EKI Job_ID = 23 Mode_ID = Validation - korr.
  ↳Base Nr 0..32 = 1 Grenzwertearray = 00: keine
  ↳Ueberwachung - Realign Grenzwerte = 00: keine
  ↳Ueberwachung - EIN
6  PTP VB=100% VE=0% ACC=100% RobWzg=0 Base=0
  ↳SPSTrig=0[1/100s] P
   1: TECH8_ EKI Job_ID = 20 Mode_ID = Production - korr.
  ↳Base Nr 0..32 = 1 Grenzwertearray = 01: pruefen -
  ↳Realign Grenzwerte = 00: keine Ueberwachung - EIN
```

Figure 33: Robot program for Context 2

Context 3 covers a scanning process (i.e. glue bead inspection). No position data from the robot is used. In case of an ERR_ID 4 (Validation failed) is returned when finishing the process.

```
7  PTP VB=100% VE=0% ACC=100% RobWzg=0 Base=0
  ↳SPSTrig=0[1/100s] P
   1: TECH8_ EKI Job_ID = 30 Mode_ID = Validation - korr.
  ↳Base Nr 0..32 = 1 Grenzwertearray = 00: keine
  ↳Ueberwachung - Realign Grenzwerte = 00: keine
  ↳Ueberwachung - EIN
8  PTP VB=100% VE=0% ACC=100% RobWzg=0 Base=0
  ↳SPSTrig=0[1/100s] P
   1: TECH8_ EKI Job_ID = 30 Mode_ID = Validation_End -
  ↳korr. Base Nr 0..32 = 1 Grenzwertearray = 00: keine
  ↳Ueberwachung - Realign Grenzwerte = 00: keine
  ↳Ueberwachung - EIN
```

Figure 34: Robot program for Context 3

Parameters

Name	Description
Port	Sets the port for the TCP/IP connection.

Results

Name	Unit	Description
Network addresses		Shows all network addresses of the system.
Client addresses		Displays all network addresses of the connected clients (robots).

Parents

World

PART (ROBOT GUIDANCE)

This is a specialized element for **ROBOT GUIDANCE** applications. It offers a 6D BestFit process, that can be used for very different geometries. This is done by modelling the defining features of the object and measuring them. These features are represented by elements that are added under the Part. The Part will use all feature elements that are placed under it for the calculation.

The usual configuration has the part placed in the origin of the car coordinate system. The calculated current position can then be used directly as a base correction for the car coordinate system.

Parameters

Name	Description
Position	This is the fixed target position of the part. It is usually 0 or taken from CAD data (see General Parameters).
Error check	(see General Parameters)
Model	You can specify a CAD file in WRL format that will be rendered in the World View.

Results

Name	Unit	Description
Status		(see General Results)
Series		(see General Results)
Position	mm	The position of the part taking into account the result of the calculation. In most cases this is the required correction value.

Parents

Robot (6A), Group, World, Context, Coordinate System

FEATURE (PLANE)

This is a feature element for the Part (ROBOT GUIDANCE). It is used to measure the position of a plane on the part. Three positions define the reference position of the plane. Only one point on this plane on the part is measured. The calculation in the Part considers the shortest distance vector form the measured point to the plane.

Parameters

Name	Description
Position 1, 2, 3	These three positions define the reference plane.
Target position	The measured position relative to the part. In most cases the global target position is connected to a measurement result.
Weighting 1	Specifies with which weighting the feature should be included in calculation 1 of the part position
Weighting 2	Specifies with which weighting the feature should be included in calculation 2 of the part position

Results

Name	Unit	Description
Status		(see General Results)
Distance vector before calculation	mm	Returns the minimum distance between the reference plane and the measured position as a vector.
Distance before calculation	mm	Returns the minimum distance between the reference plane and the measured position as a value (length of the vector). Can be used for a tolerance check.
Distance vector after calculation	mm	Distance between reference plane and measured position as a vector where the correction has been applied to the reference plane.
Distance after calculation	mm	Distance between reference plane and measured position as a value (length of the vector) where the correction has been applied to the reference plane. Can be used for a tolerance check.

Parents

Part (ROBOT GUIDANCE)

FEATURE (EDGE)

This is a feature element for the Part (ROBOT GUIDANCE). It is used to measure the position of a straight edge on the part. Two positions define the reference position of the Edge. Only one point on this edge on the part is measured. The calculation in the Part considers the shortest distance vector form the measured point to the edge.

Parameters

Name	Description
Position 1, 2	These two positions define the reference edge.
Target position	The measured position relative to the part. In most cases the global target position is connected to a measurement result.
Weighting 1	Specifies with which weighting the feature should be included in calculation 1 of the part position
Weighting 2	Specifies with which weighting the feature should be included in calculation 2 of the part position

Results

Name	Unit	Description
Status		(see General Results)
Distance vector before calculation	mm	Returns the minimum distance between the reference edge and the measured position as a vector.
Distance before calculation	mm	Returns the minimum distance between the reference edge and the measured position as a value (length of the vector). Can be used for a tolerance check.
Distance vector after calculation	mm	Distance between reference edge and measured position as a vector where the correction has been applied to the reference edge.
Distance after calucation	mm	Returns the minimum distance between the reference edge and the measured position as a value (length of the vector). Can be used for a tolerance check.

Parents

Part (ROBOT GUIDANCE)

FEATURE (POINT)

This is a feature element for the Part (ROBOT GUIDANCE). It is used to measure the position of a defined position on the part. The calculation in the Part considers the shortest distance vector form the measured point to the reference position.

Parameters

Name	Description
Position	The reference position.
Target position	The measured position relative to the part. In most cases the global target position is connected to a measurement result.
Weighting 1	Specifies with which weighting the feature should be included in calculation 1 of the part position
Weighting 2	Specifies with which weighting the feature should be included in calculation 2 of the part position

Results

Name	Unit	Description
Status	mm	(see Generals Results)
Distance vector before calculation	mm	Returns the minimum distance between the reference point and the measured position as a vector.
Distance before calculation	mm	Returns the minimum distance between the reference point and the measured position as a value (length of the vector). Can be used for a tolerance check.
Distance vector after calculation	mm	Distance between reference point and measured position as a vector where the correction has been applied to the reference point.
Distance after calculation	mm	Returns the minimum distance between the reference point and the measured position as a value (length of the vector). Can be used for a tolerance check.

Parents

Part (ROBOT GUIDANCE)

FEATURE (RPS POINT)

This is a special element for ROBOT GUIDANCE applications. It is used to determine the component position using a reference point system (RPS). The characteristic also enables you to deal with over-determination and weighting per RPS point. The distance vector between position and target position is included in the calculation. The calculation takes place in the component (ROBOT GUIDANCE).

Parameters

Name	Description
Position	Specifies the position of the RPS point on the part.
Target position	Specifies the target position for which the characteristic position is to be positioned, taking into account the fixing direction.
Type	Specifies which fixation the RPS point provides for determining the part position. The fixing direction always refers to the coordinate system of the part.
Weighting 1	Specifies with which weighting the feature should be included in calculation 1 of the part position.
Weighting 2	Specifies with which weighting the feature should be included in calculation 2 of the part position

Results

Name	Unit	Description
Status	mm	(see General Results)
Distance vector before calculation	mm	Returns the minimum distance between position and target position as a vector before calculation.
Distance before calculation	mm	Returns the minimum distance between position and target position as a value (length of the vector) before calculation.
Distance vector after calculation	mm	Returns the minimum distance between position and target position as a vector after calculation.
Distance after calculation	mm	Returns the minimum distance between position and target position as a value (length of the vector) after calculation.

Parents

Part (ROBOT GUIDANCE)

FEATURE (GAP)

This is a special element for ROBOT GUIDANCE applications. It is used to optimize the relative gap dimension between two components using a best-fit algorithm. The calculation takes place in the component (ROBOT GUIDANCE).

Parameters

Name	Unit	Description
Position	mm	Specifies the position of the feature gap on the part.
Target position	mm	Specifies the target position for which the characteristic position is to be positioned, taking into account the gap and flush values.
Gap and flush		
→ Direction	mm	Specifies the direction vector in world coordinates, in whose direction the gap/transition between position and target position is calculated.
→ Reference value	mm	Specifies the distance at which position and target position should have in gap direction/transition direction.
→ Offset	mm	Specifies the amount by which the nominal value of the gap/transition should be off-set.
→ Weighting 1	%	Specifies with which weighting the feature should be included in calculation 1 of the part position
→ Weighting 2	%	Specifies with which weighting the feature should be included in calculation 2 of the part position

Results

Name	Unit	Description
Status		(see General results)
Gap		Gaps results
→ Gap before calculation	mm	Specifies the actual distance between position and target position in the direction of the gap vector before the calculation.
→ Gap after calculation	mm	Specifies the actual distance between position and target position in the direction of the gap vector after calculation.
Flush		Flush results
→ Flush before calculation	mm	Specifies the actual distance between position and target position in the direction of the flush vector before the calculation.
→ Flush after calculation	mm	Specifies the actual distance between position and target position in the direction of the flush vector after calculation.

Parents

Part (ROBOT GUIDANCE)

CIRCLE CENTRE

This is a feature element for the Part (ROBOT GUIDANCE). It is used to measure the position of the centre of a circle. It requires a Point (on Part) as a reference value. Three positions on the circumference of the circle are measured. The result is the centre of the circle defined by those points. It has to be connected to the global current position of the parent Point (on Part).

Parameters

Name	Unit	Description
Current position 1, 2, 3	mm	Three measured positions. They need to be connected to measurement results.

Results

Name	Unit	Description
Position	mm	Centre position of the calculated circle. Needs to be connected to the Point (on Part).
Radius	mm	Displays the calculated radius of the circle.

Parents

Can be created under all elements.

PART (ROBOT GUIDANCE CIRCULAR FIT)

This is a specialized element for robot guidance on circular objects. It is used in the FS-200 application to do optimized roller hemming on the wheel house. It determines a correction from three measurements that are placed on a circle.

The usual configuration places the part in the origin of the car coordinate system. The calculated current position can then be used as a correction for the car coordinate system.

Parameters

Name	Description
Position	This is the fixed target position of the part. It is usually 0 or taken from CAD data (see General Parameters).
Error check	(see General Parameters)
Model	You can specify a CAD file in WRL format that will be rendered in the World View.
Feature 1, 2, 3	These groups contain the configuration of the measurement positions.
→ Position	The expected position of the measurement point relative to the part. This Value is usually taken for CAD data but can also be measured manually.
→ Target position	The last measured position. This value is usually connected to the result of a measurement by a dataflow.
Circle diameter	To determine the position, the system determines the centers of the circles that result from the feature positions and target positions. Equal - The circle resulting from the feature positions is fitted into the feature target positions to determine the target center. Different - The circle centers are determined on the basis of the feature positions and feature target positions.

Results

Name	Unit	Description
Status		(see General Results)
Series		(see General Results)
Position	mm	Specifies the current position of the part using the Cartesian coordinates X, Y and Z and the Euler angles RX, RY and RZ. The coordinates relate to the parent coordinate system.
Feature 1, 2, 3		These groups contain results that can be used to compare the result of the calculation against what is expected.
→ Distance vector before calculation	mm	Distance between reference and measured position as a vector.

→ Distance before calculation	mm	Distance between reference and measured position as a value (length of the vector). Can be used for a tolerance check.
→ Distance vector after calculation	mm	Distance between reference and measured position as a vector where the correction has been applied to the reference value.
→ Distance after calculation	mm	Distance between reference and measured position as a value (length of the vector) where the correction has been applied to the reference value. Can be used for a tolerance check.

Parents

Robot (6A), Group, World, Context, Coordinate System

PART (ROBOT GUIDANCE SINGLE SPOT)

This is a specialized element for simple robot guidance applications. With a single measurement a correction for up to 3 dimensions (2 translations, 1 rotation) can be calculated based on a reference position.

The usual configuration places the part in the origin of the car coordinate system. The calculated current position can then be used as a correction for the car coordinate system.

Parameters

Name	Description
Position	This is the fixed target position of the part. It is usually 0 or taken from CAD data (see General Parameters).
Error check	(see General Parameters)
Model	You can specify a CAD file in WRL format that will be rendered in the World View.
Feature	Contains all settings that affect the feature.
→ Position	The target position of the measured feature. This value may be connected to a fixed Point measurement in global coordinates using a dataflow.
→ Target position	The measured position of the feature. This value is usually connected to the result of a measurement by a dataflow.

Results

Name	Unit	Description
Status		(see General Results)
Series		(see General Results)
Position	mm	Specifies the current position of the part using the Cartesian coordinates X, Y and Z and the Euler angles RX, RY and RZ. The coordinates relate to the parent coordinate system.
Feature		
→ Distance vector before calculation	mm	Returns the minimum distance between the reference point and the measured position as a vector.
→ Distance before calculation	mm	Returns the minimum distance between the reference point and the measured position as a value (length of the vector). Can be used for a tolerance check.

Parents

Robot (6A), Group, World, Context, Coordinate System, Task

GROUP

A Group is used to provide structure in the element tree. For example it might collect several Parts or Models.

Parents

Can be created under all elements including the Group.

CONTEXT

The Context serves as a structuring element. In many cases different part types are assigned different Contexts. Tasks can only be placed under a Context. The Automation Interfaces can connect a serial number to the selected context.

Parents

World

COORDINATE SYSTEM

To move several elements in space at once without changing their relative positions to one another they can be placed in the same Coordinate System. All elements know their position in the next higher Coordinate System and in the World coordinate system (global position). In many cases the same coordinate systems as in the actual plant can be used. This means that measurement points in the part coordinate system from the CAD data can be used directly. The sensor can be placed in a Coordinate System that corresponds to the base coordinate system of the robot. This makes using the setFrame() command very intuitive.

Parameters

Name	Description
Position	(see General Parameters)

Parents

Robot (6A), Group, World, Context, Coordinate System, Part

MODEL

For visualization purposes CAD files can be displayed in the World View. Add this Element to the project and make sure it is in the correct position using Coordinate Systems. Provide the path to the file in the properties otherwise **VISIONELEMENTS3** will search the folder “models“ in the project folder. The file has to be in the VRML (.wrl) format.

Parameters

Name	Description
Model file	Path to a file in VRML format

Parents

Robot (6A), Group, World, Coordinate System

PERSPECTIVE

A Perspective is a View that can be configured to display several Views of different elements at once. For example, it can be used to show all Acquisitions that belong to one Task in a separate window.

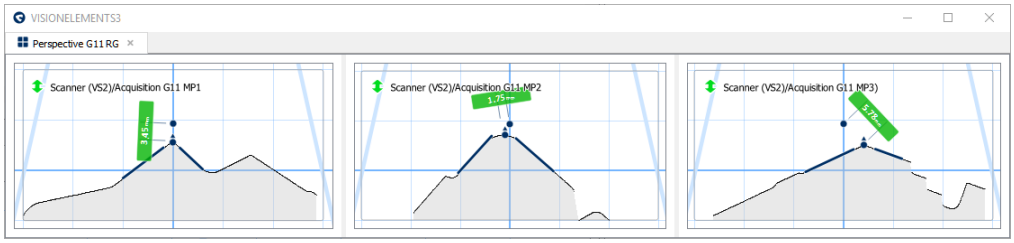


Figure 35: Perspective with three Acquisitions

You can add more spaces by right clicking in the View. Then add elements using drag & drop.

Parents

World, Context

POINT (3D)

This Point can display a position in the World View. Using dataflows measurement result can be connected to the Point and thus be stored and displayed in the 3D environment.

Parameters

Name	Description
Position	(see General Parameters)

Parents

Coordinate System, World, Robot (6A), Group

ROBOT (6A)

The robot represents the kinematic model of a 6-axis robot. At the same time, it offers a communication interface to various robot controllers for real-time adjustment of the robot.

Parameters

Name	Description
Position	Specifies the constructive position of the robot base using the Cartesian coordinates X, Y and Z and the Euler angles RX, RY and RZ. The coordinates relate to the parent coordinate system.
Typ	Specifies the type of the robot.
Achsen	Sets the 6 axis angles of the robot kinematics. The meaning of each axis coordinates depends on the selected type.
Robot Interface	Contains all settings related to the Robot Interface.
→ Robot Interface	Specifies the interface type for the Robot Interface.
→ Port	Specifies the TCP/IP port of the Robot Interface server.

Results

Name	Description
Position	Returns the position of Tool 0 using the Cartesian coordinates X, Y and Z and the Euler angles RX, RY and RZ. The coordinates relate to the parent coordinate system.
Robot Interface	Contains all settings related to the Robot Interface.
→ Robot Interface	Specifies the interface type for the Robot Interface.
→ Port	Specifies the TCP/IP port of the Robot Interface server.

Parents

Coordinate System, World, Group

SCANNER (VSX)

This Element is the interface to a **VISIONSCANNER2** or **VISIONSCANNER3**. Its position defines the global position of the measurement results, which are based on acquisitions from this device. It is also used to define the type and the network settings of the sensor.

Parameters

Name	Description
Position	(see General Parameters)
Type	Select the exact type of the sensor out of the list.
Serial number	Via this property the sensor will be bound (see bind sensor)
Deactivated	When the sensor is deactivated, there will be no connection to the device.
Network	Here you will find the network configuration of the sensor in CIDR notation.
→ DHCP	Specifies whether the IP address should be obtained via DHCP server or not.
→ IP address	IP address of the device. Is used when DHCP is deactivated or not available.
→ Subnet mask	The subnet mask. Can be entered in dotted decimal format or CIDR.
Digital outputs	The Outputs of the sensor are not used.
Referencing	The calibration of the sensor can be moved by the referencing. This is helpful when changing a sensor or inn case of a crash that affects the mechanical position of the sensor. At the commissioning a reproducible measuring position is defined and measured. The result is saved and serves as a reference value for the next measurements. After a sensor exchange the same measurement is done and the result is compared to the reference value. Now the offsets can be adjusted until the result equals the reference value.
→ X offset	Shifts the calibration in X direction
→ Y offset	Shifts the calibration in Y direction

Parents

Coordinate System, World, Robot (6A)

CAMERA (VC2)

This Element is the interface to a **VISIONSCAMERA2**. Its position defines the global position of the measurement results, which are based on acquisitions from this device. It is also used to define the type and the network settings of the sensor.

Parameter

Name	Description
Position	(see General Parameters)
Type	Select the exact type of the sensor out of the list.
Serial number	Via this property the sensor will be bound (see bind sensor)
Deactivated	When the sensor is deactivated, there will be no connection to the device.
Network	Here you will find the network configuration of the sensor in CIDR notation.
→ DHCP	Specifies whether the IP address should be obtained via DHCP server or not.
→ IP address	IP address of the device. Is used when DHCP is deactivated or not available.
→ Subnet mask	The subnet mask. Can be entered in dotted decimal format or CIDR.
Digital outputs	The Outputs of the sensor are not used.
Referencing	The calibration of the sensor can be moved by the referencing. This is helpful when changing a sensor or inn case of a crash that affects the mechanical position of the sensor. At the commissioning a reproducible measuring position is defined and measured. The result is saved and serves as a reference value for the next measurements. After a sensor exchange the same measurement is done and the result is compared to the reference value. Now the offsets can be adjusted until the result equals the reference value.
Lens	Group for settings of the used lens
→ Type	Standard or Telecentric
→ Focal length	Specifies the focal length of the standard lens.
→ Reproduction scale	Specifies the reproduction scale of the telecentric lens.

Parents

Coordinate System, World, Robot (6A)

PROCESS DATA EXPORT

The process data export allows the manual export of values from the process database to a CSV file.

Parameters

Name	Description
From, To	Specifies the action period from which the process data is to be exported.
Without error	Specifies whether values should be exported without measurement errors and tolerance overruns.
Measurement error	Specifies whether values with measurement errors are to be exported.
Not in tolerance	Specifies whether values with tolerance overruns should be exported.
Advanced Filters	Here you will find further filter options
→ Action mode	Specifies with which action mode the values are to be exported.
→ Action counter Serial number	Specifies the action counter with which the serial number values are to be exported. Specify the counters separated by commas or as a range with a hyphen. (e. g.: 1, 3, 5-10)
→ Action counter Action	Specifies the action counter action with which the values are to be exported. Specify the counters separated by commas or as a range with a hyphen. (e. g.: 1, 3, 5-10)
File	Specifies the path and file name. The file name is automatically extended by a date and time specification and terminated with the corresponding file format ending.
Localization	Specifies in which language the file is exported. The export language is independent of the language set in the application.
Value export	Specifies whether single values of a continuous measurement and/or the statistical result of the evaluation are exported.
Max. number of values	Specifies to how many values the export is limited to.

Results

Name	Unit	Description
Export is running	Bool	Specifies whether the export is currently running.
Execution time	ms	Specifies the execution time of the export.
Export error	Bool	Indicates whether an error occurred during the export.
Last export		Indicates when the last export was executed.
Value count		Specifies how many values were exported.

View

In the corresponding view, all evaluations whose values are exported are displayed.

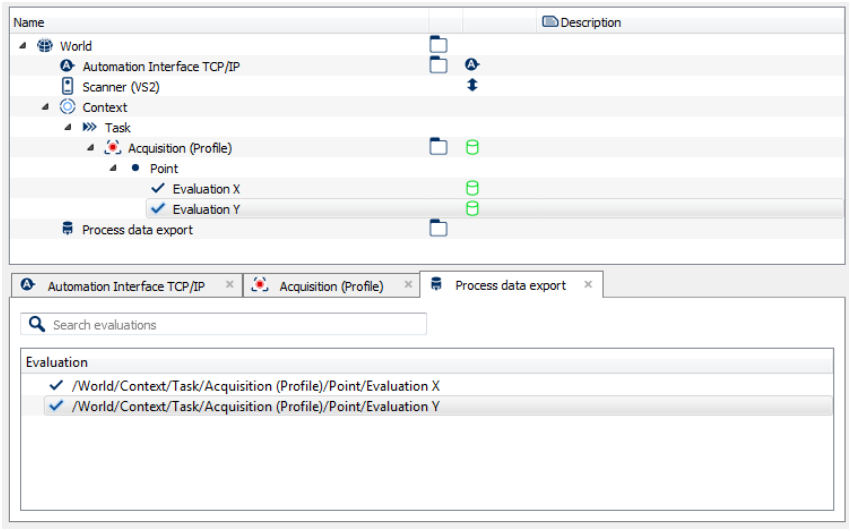


Figure 36: Process data export

You can add evaluations from the element tree to the list using drag & drop. They can be removed from the list using the context menu by right-clicking on them.

The export is started via the button Export below the properties.

Parents

World, Group, Context

PROCESS DATA INTERFACE UDP

This element enables the transmission of process data in real time. 16 arbitrary numerical values can be sent via UDP/IP packet

Parameters

Name	Unit	Description
IP address		Specifies the IP address of the UDP / IP receiver.
Port		Specifies the port of the UDP / IP receiver.
Id		Specifies a number for identifying the process data package.
Byte order		Sets the storage organization.
Error check		(see General Parameters)
Value 1 - 16		Displays the values defined by the flow and last determined.

Results

Name	Unit	Description
Status		(see General Results)
Series		(see General Results)
Timestamp	ms	The time stamp indicates the time of the measurement data acquisition, e.g. The exposure time. The time stamp has no reference to a defined date and time. It can thus only be used as a relative time measure within a measuring process. Several process data interfaces all use the same clock so that the process data can be related in time.
Serial number		Displays the serial number from the parent context.

Parents

Acquisition (Image), Acquisition (Profile), Dual-Acquisition (Profile)

Data packet format

Process data interface UDP

Byte from	to	Bit	Field	Data type	Description
0			VERSION	UInt 8	Version number of the process data packet format.
1		0	reserved		
		1	reserved		
		2	reserved		
		3	BYTE_ORDER	Bit	0 = Little Endian, 1 = Big Endian
		4	reserved		
		5	reserved		
		6	MEASUREMENT_ERROR	Bit	A measurement error has occurred.
		7	OUT_OF_TOLERANCE	Bit	An out-of-tolerance condition has occurred.
2	3		ID	UInt16	A number to identify the process data package.
4	7		COUNTER	UInt 32	A continuous counter for detection of lost packages.
8	15		TIMESTAMP	UInt 64	The time stamp specifies the time of data acquisition, e. g. the exposure time.
16	31		SERIAL	ASCII(16)	Displays the serial number from the parent context.
32	35		VALUE_1	Real 32	Value 1
36	39		VALUE_2	Real 32	Value 2
40	43		VALUE_3	Real 32	Value 3
44	47		VALUE_4	Real 32	Value 4
48	51		VALUE_5	Real 32	Value 5
52	55		VALUE_6	Real 32	Value 6
56	59		VALUE_7	Real 32	Value 7
60	63		VALUE_8	Real 32	Value 8
64	67		VALUE_9	Real 32	Value 9
68	71		VALUE_10	Real 32	Value 10
72	75		VALUE_11	Real 32	Value 11
76	79		VALUE_12	Real 32	Value 12
80	83		VALUE_13	Real 32	Value 13
84	87		VALUE_14	Real 32	Value 14
88	91		VALUE_15	Real 32	Value 15
92	95		VALUE_16	Real 32	Value 16

WORLD

The World is the global reference coordinate system. All global positions are indicated in this system. It is always the on the top level in the element tree. There can only be one World in smart projects.

View

The World View is used for visualization only. Coordinate Systems, sensors, Parts and models are rendered and updated in real time. This can help to understand the position of the sensor relative to the part.

You can use the right mouse button to move and the left button to rotate the view. Objects can be selected by left clicking them.

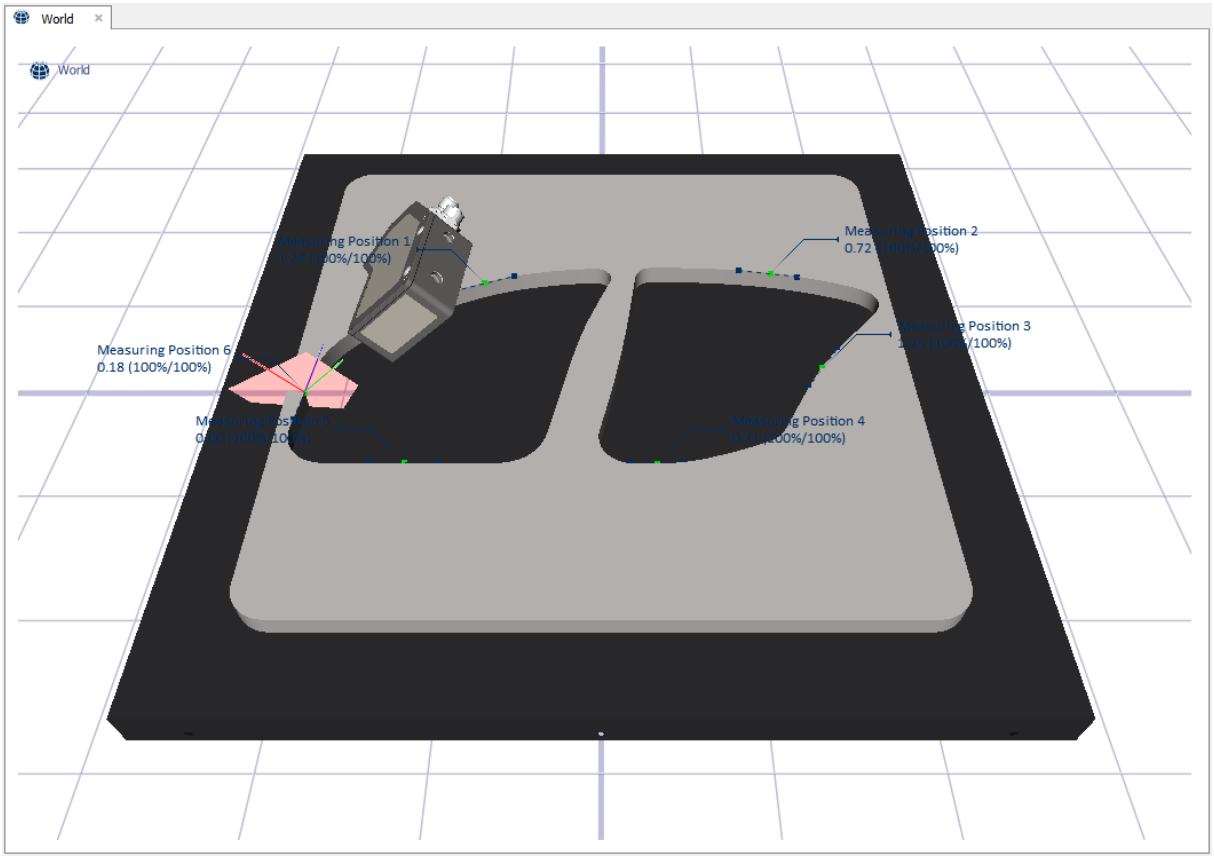


Figure 37: World View (The scene represents a Part (ROBOT GUIDANCE) with 6 edge features)

5. APPENDIX

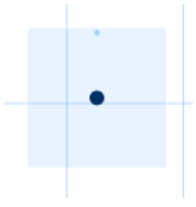
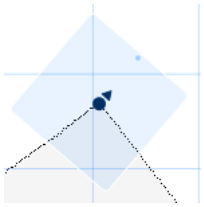
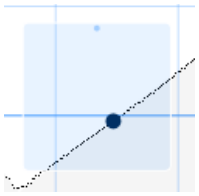
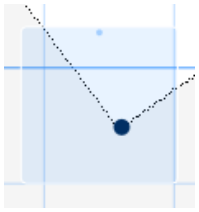
ACCURACY ESTIMATION

On the following pages, the formulas for calculating the accuracy of the individual measurements in VisionElements3 are presented. The local resolution applies to the formulas:

A_S = Field of view Resolution in mm (X)

A_M = Measuring range Resolution in mm (Y)

Point (measurement)

	Fixed	Max	Average	Edge
				
$\Delta x =$	$0 + \Delta A_x$	A_S	$\frac{1}{N}A_S$	A_S
$\Delta y =$	$0 + \Delta A_y$	A_M	$\frac{1}{N}A_M$	A_M
$\Delta \alpha =$	$0 + \Delta A_\alpha$	$0 + \Delta A_\alpha$	$0 + \Delta A_\alpha$	$0 + \Delta A_\alpha$

ΔA = Alignment error

Worst Case:
$N = 1$
Best Case:
N = Points in the measuring range

Line

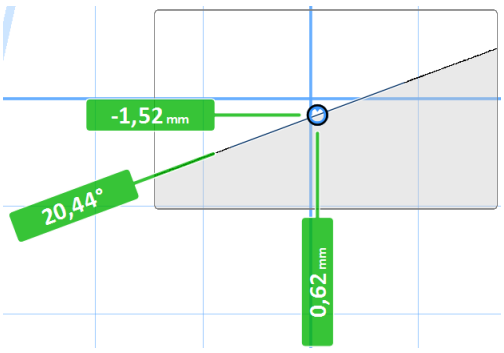
$\Delta x = |\cos \beta| A_S$

$\Delta y = |\sin \beta| A_M$

$\Delta \alpha = \tan^{-1}\left(\frac{2A_M}{B}\right)$

β = Angle of the measuring range

B = Width of the measuring range



Angle

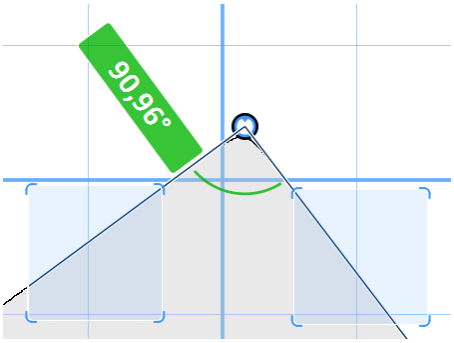
$\Delta x = 2A_S$

$\Delta y = 2A_M$

$\Delta\alpha = \tan^{-1}\left(\frac{2A_M}{B_1}\right) + \tan^{-1}\left(\frac{2A_M}{B_2}\right)$

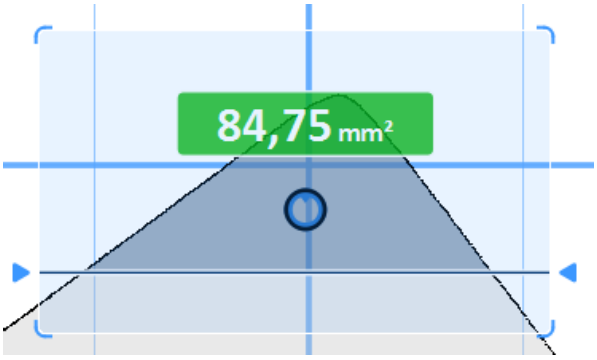
B_1 = Width of the measuring range 1

B_2 = Width of the measuring range 2



Area

Fixed

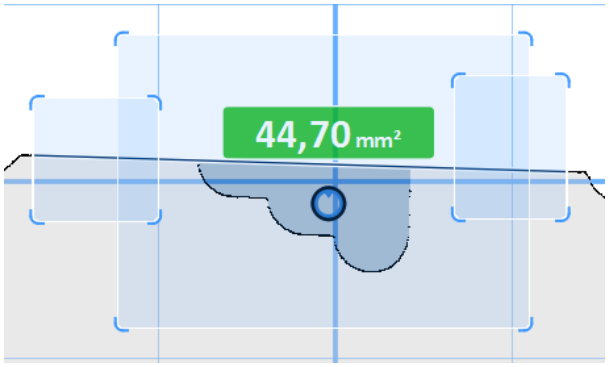


$\Delta x = \frac{1}{N}A_S$

$\Delta y = \frac{1}{N}A_M$

$\Delta F = NA_MA_S$

Line



$\Delta x = \frac{1}{N}A_S$

$\Delta y = 2\frac{1}{N}A_M$

$\Delta F = 2NA_MA_S$

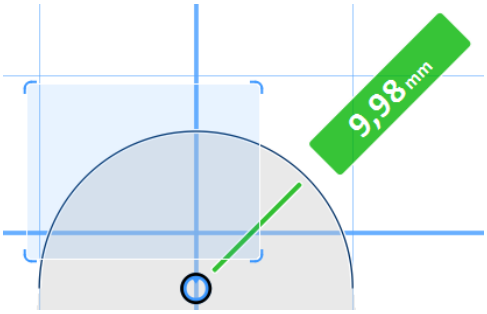
N = Points on the edge of the area

Circle

$\Delta x = A_S$

$\Delta y = A_M$

$\Delta R = \max(A_M, A_S)$



Dimension

$$\Delta x = \max(\Delta x_1, \Delta x_2)$$

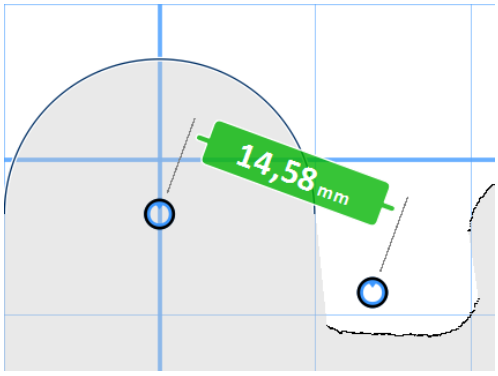
$$\Delta y = \max(\Delta y_1, \Delta y_2)$$

$$\Delta\alpha = \tan^{-1}\left(\frac{\Delta y_1 + \Delta y_2}{B}\right)$$

$$\Delta D = \sqrt{\Delta x_1^2 + \Delta y_1^2} + \sqrt{\Delta x_2^2 + \Delta y_2^2}$$

$$\Delta H = \Delta y_1 + \Delta y_2$$

$$\Delta B = \Delta x_1 + \Delta x_2$$



INSTALLATION MYSQL DATABASE

The installation of the MySQL database is done in 2 steps:

- The MySQL server is installed as database server: "Installation of the MySQL server"
- The MySQL-Connector provides the client-side drivers: "Installing the MySQL-Connector"

The separate installation of these two components is necessary because the drivers are required in 32-bit architecture. For licensing reasons, they cannot be delivered directly with VISIONELEMENTS3.

The server must also be installed on the PC with the VISIONELEMENTS3 application so that a backup and restore of the process data is available.

It can still be connected to a remote MySQL server, which is accessible via the network.

Installation MySQL server

Run the "**mysql-installer-community-5.7.26.0.msi**" file. This file can be downloaded from the official website at https://dev.mysql.com/downloads/installer/ by listing all versions as described in the following image:

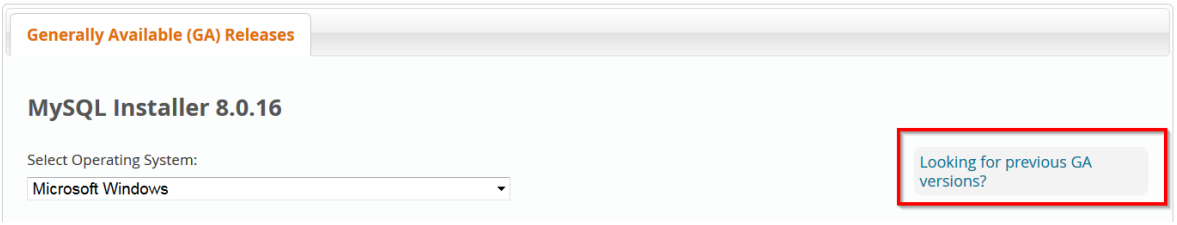


Figure 38: To download the correct version of the installer, previous versions must be displayed.

Then select the settings as shown in the following illustrations.

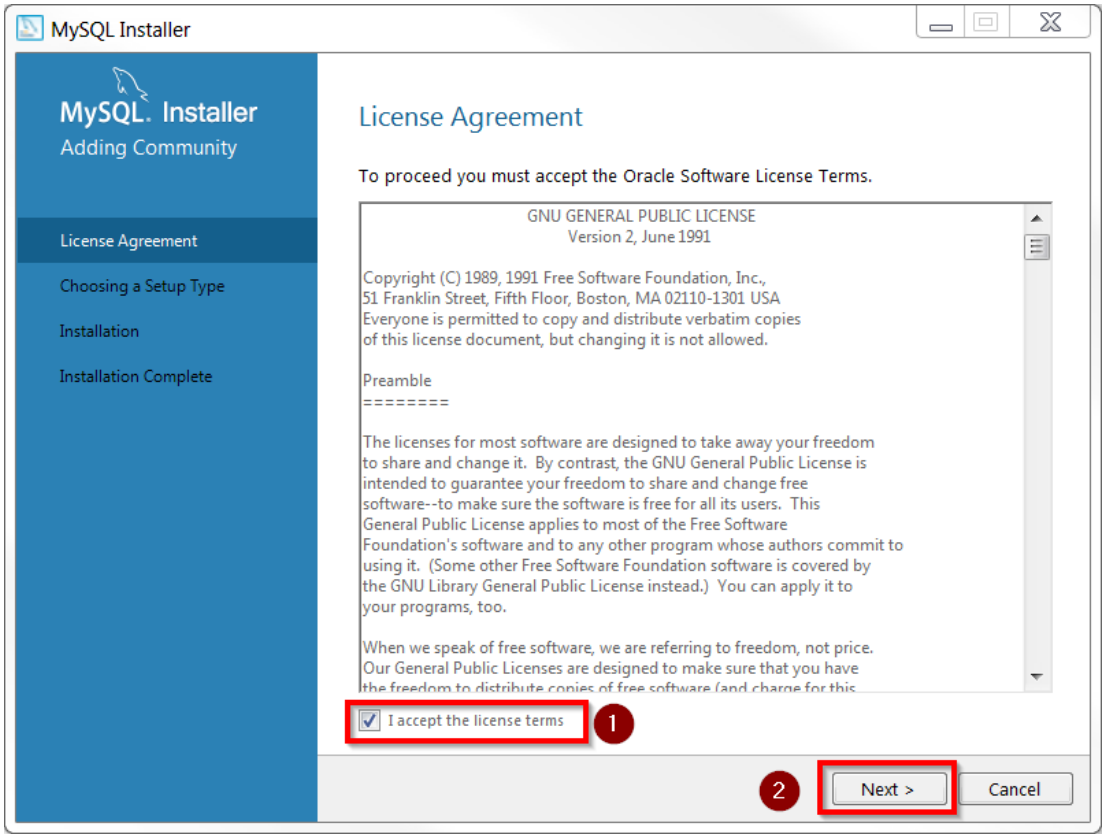


Figure 39: Accept the license terms (1) and proceed (2) to the next step.

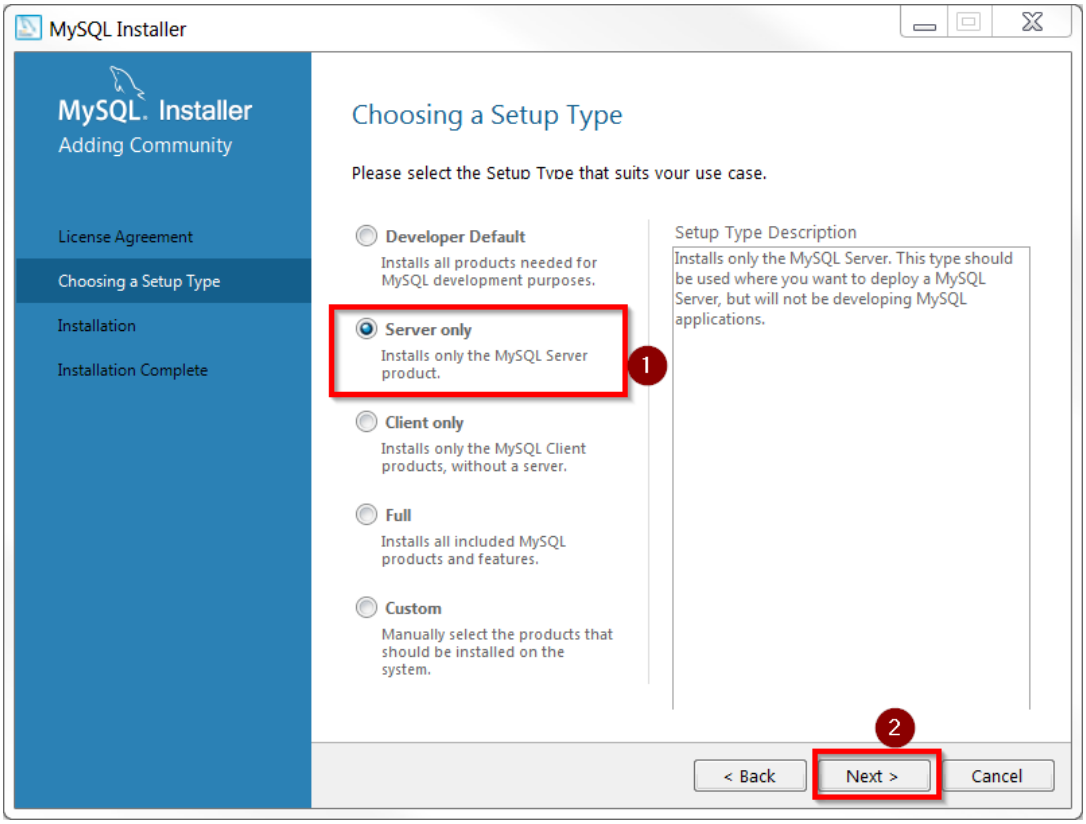


Figure 40: Select the server installation (1) and continue (2).

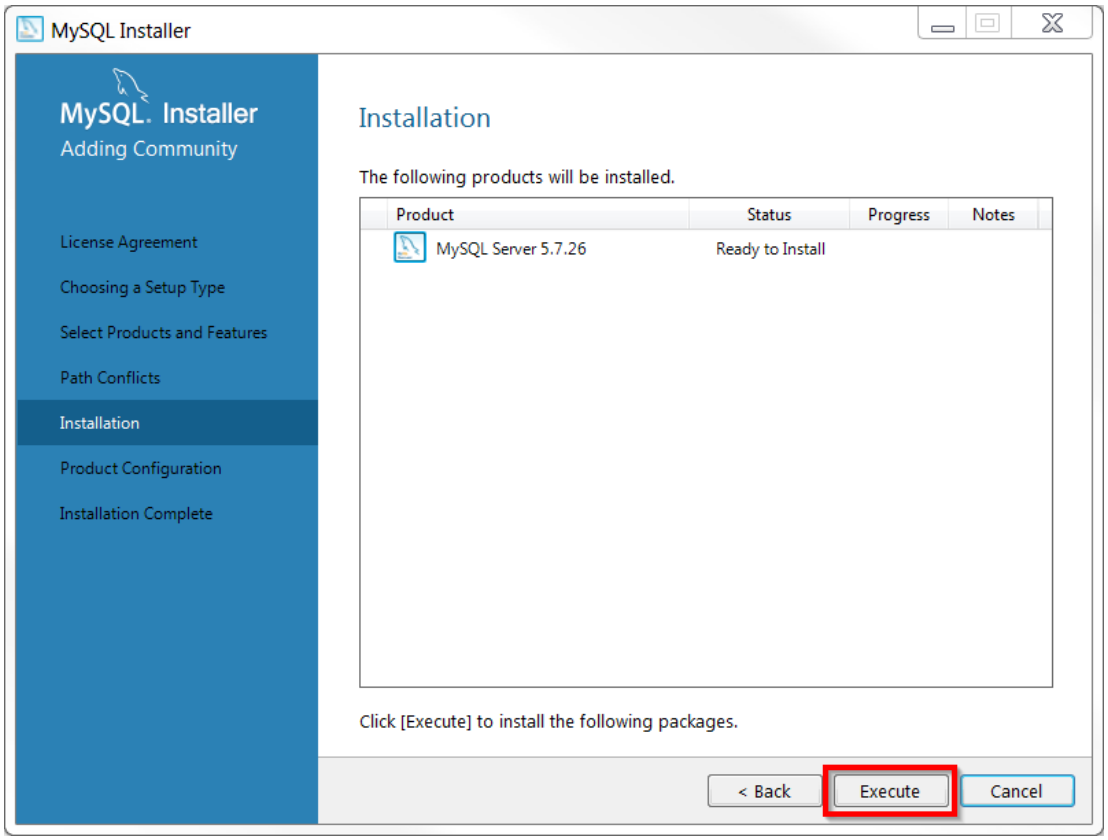


Figure 41: Confirm the components to be installed.

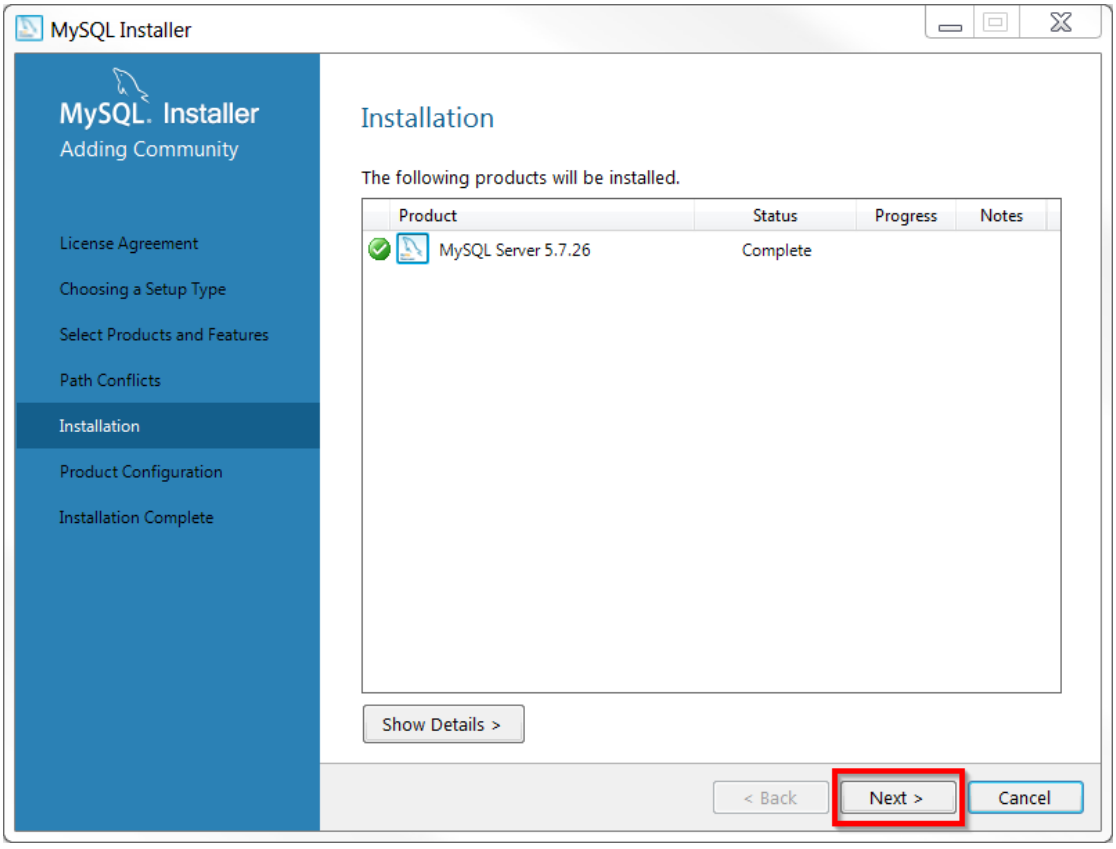


Figure 42: Continue with the next step.

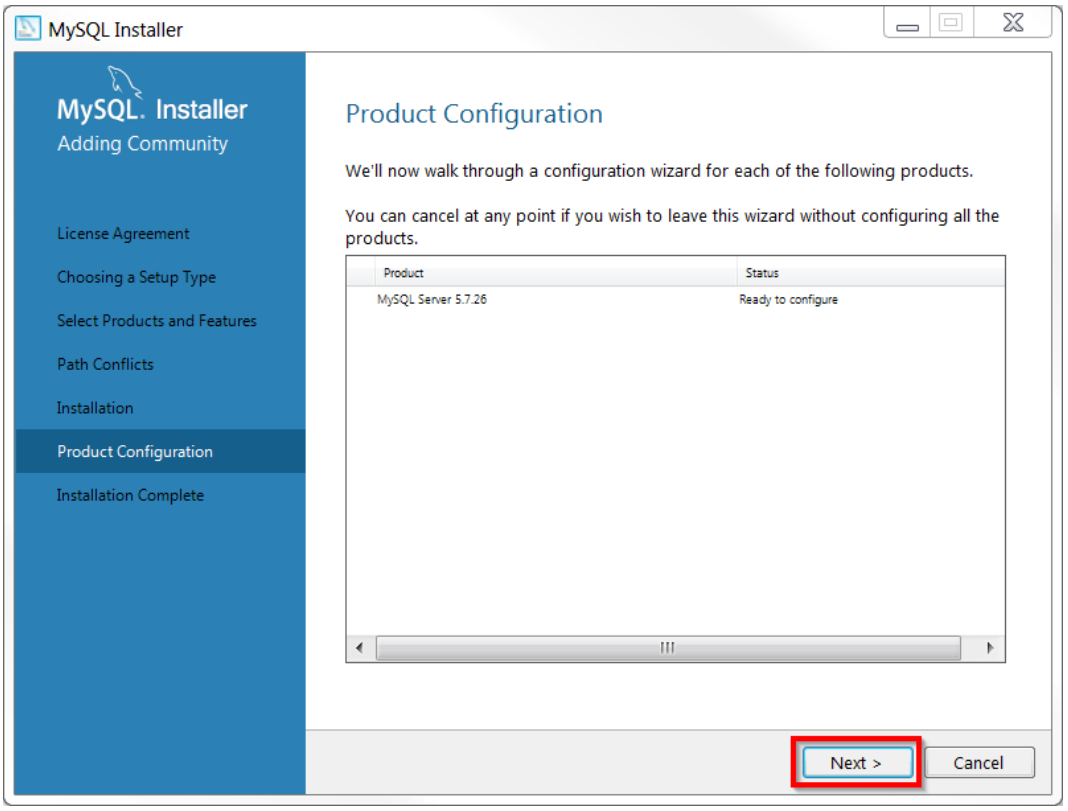


Figure 43: Confirm the components to be configured.

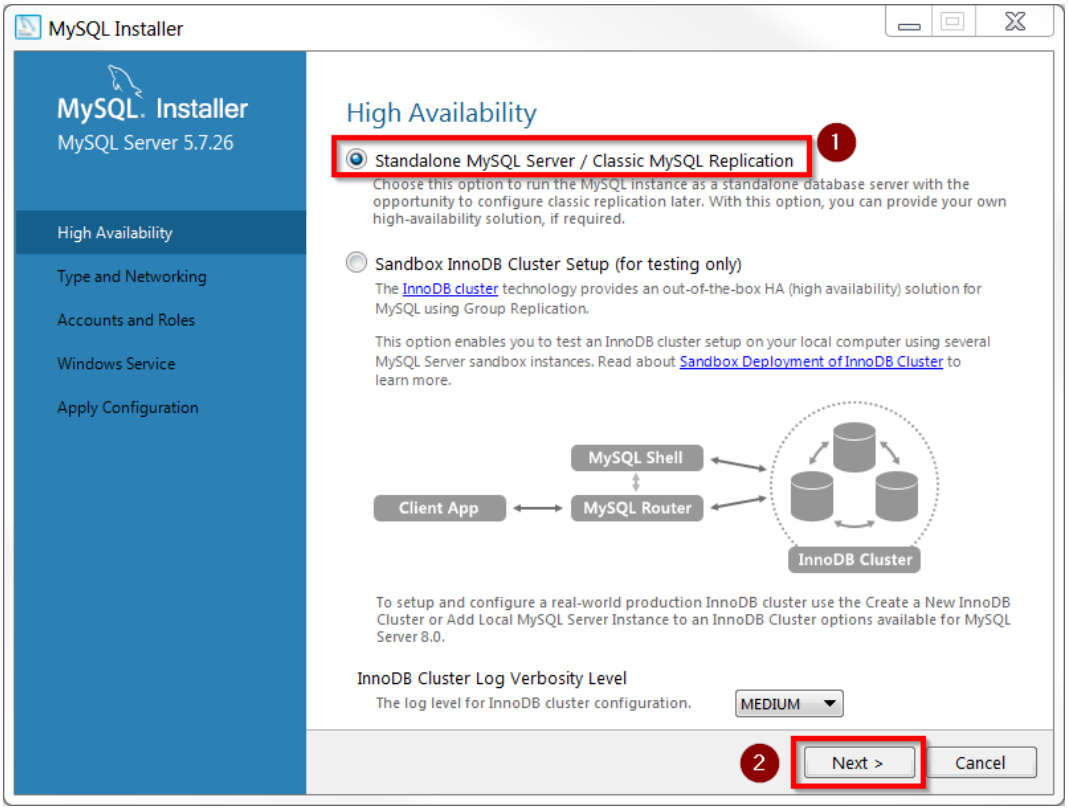


Figure 44: Select the standard configuration (1) and continue (2).

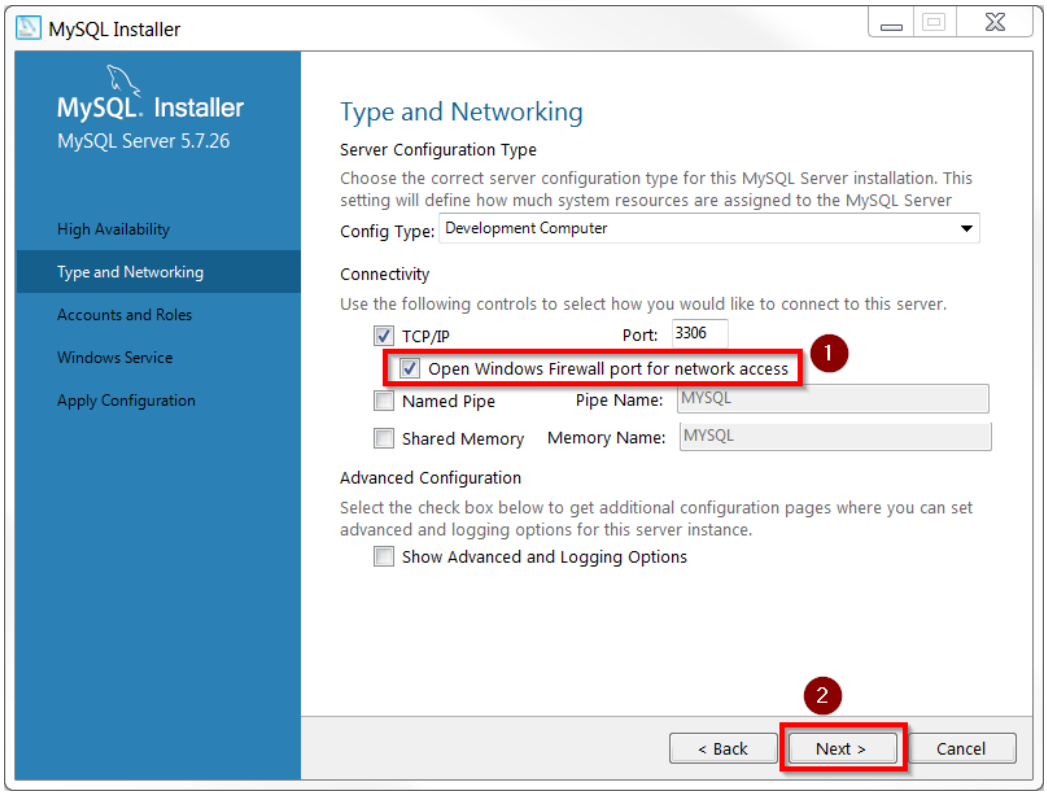


Figure 45: Automatically create an exception in the Windows firewall settings (1) so that the database can also be reached externally and continue (2).

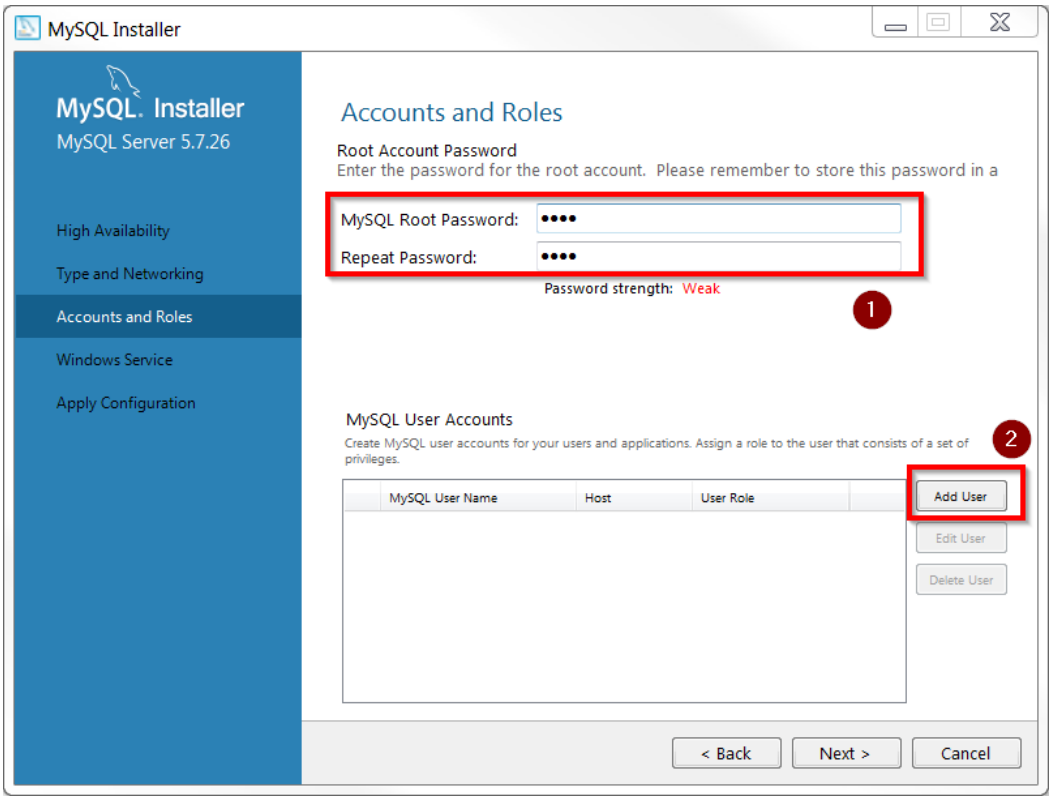


Figure 46: Set the root credentials (1), such as "root" / "root" and add a database user (2).

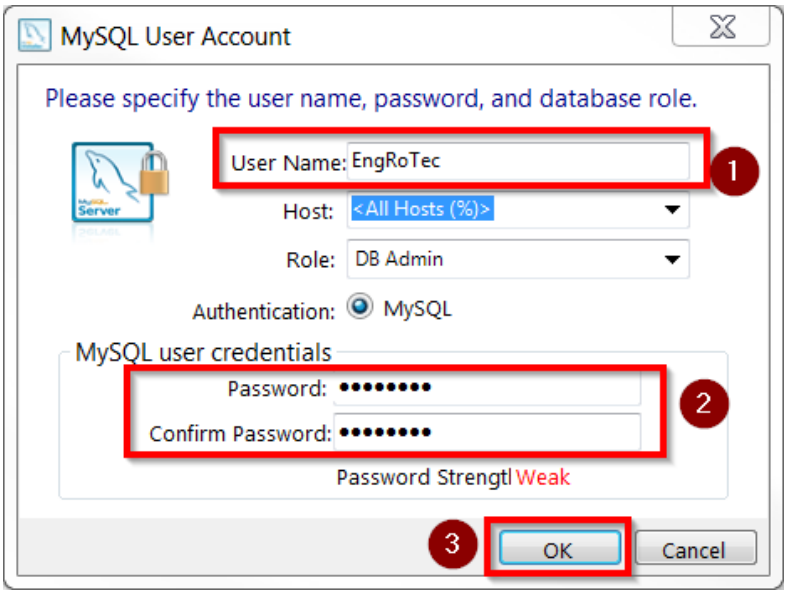


Figure 47: Define the database user access data (1) and (2), here "EngRoTec" / "EngRoTec".

The MySQL root password as well as the name and password of the new user can be chosen arbitrarily. However, they must be documented and known to authorized persons.

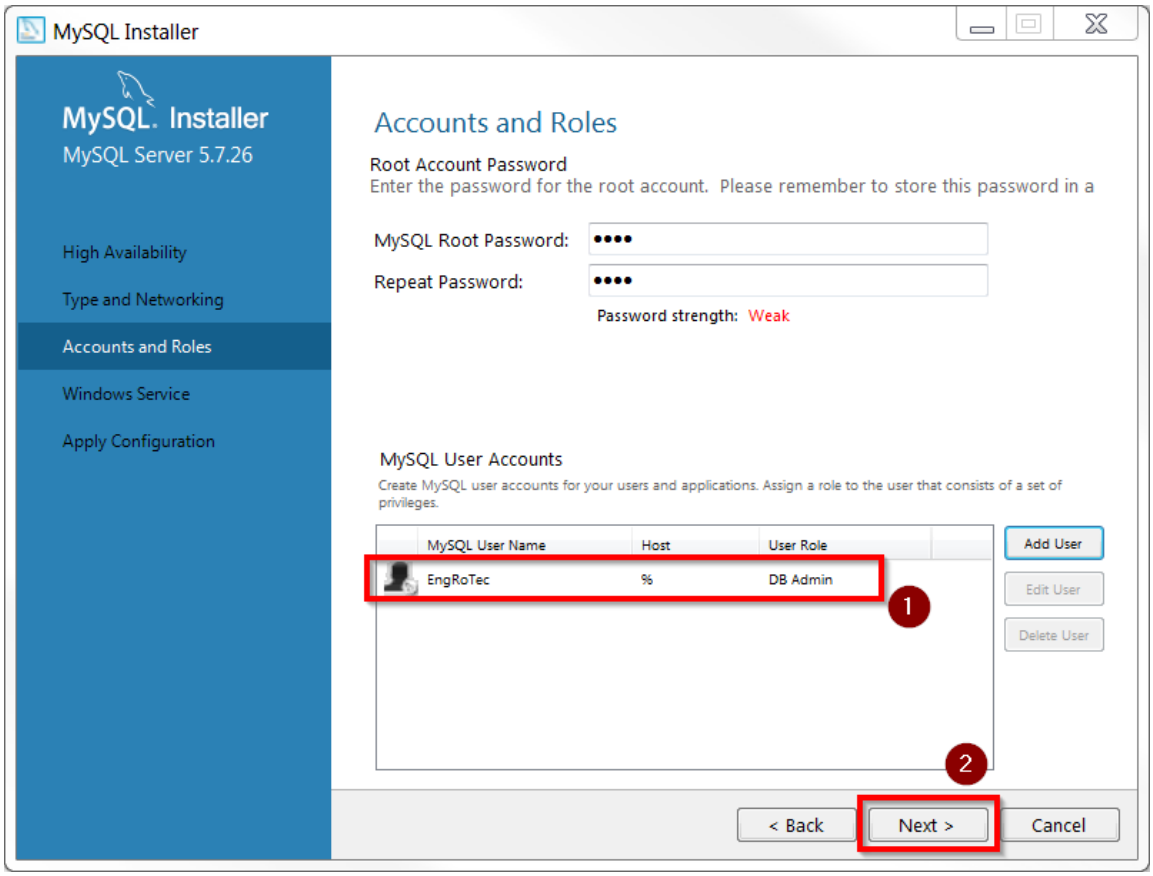


Figure 48: Now that the user has been added (1), continue the installation (2).

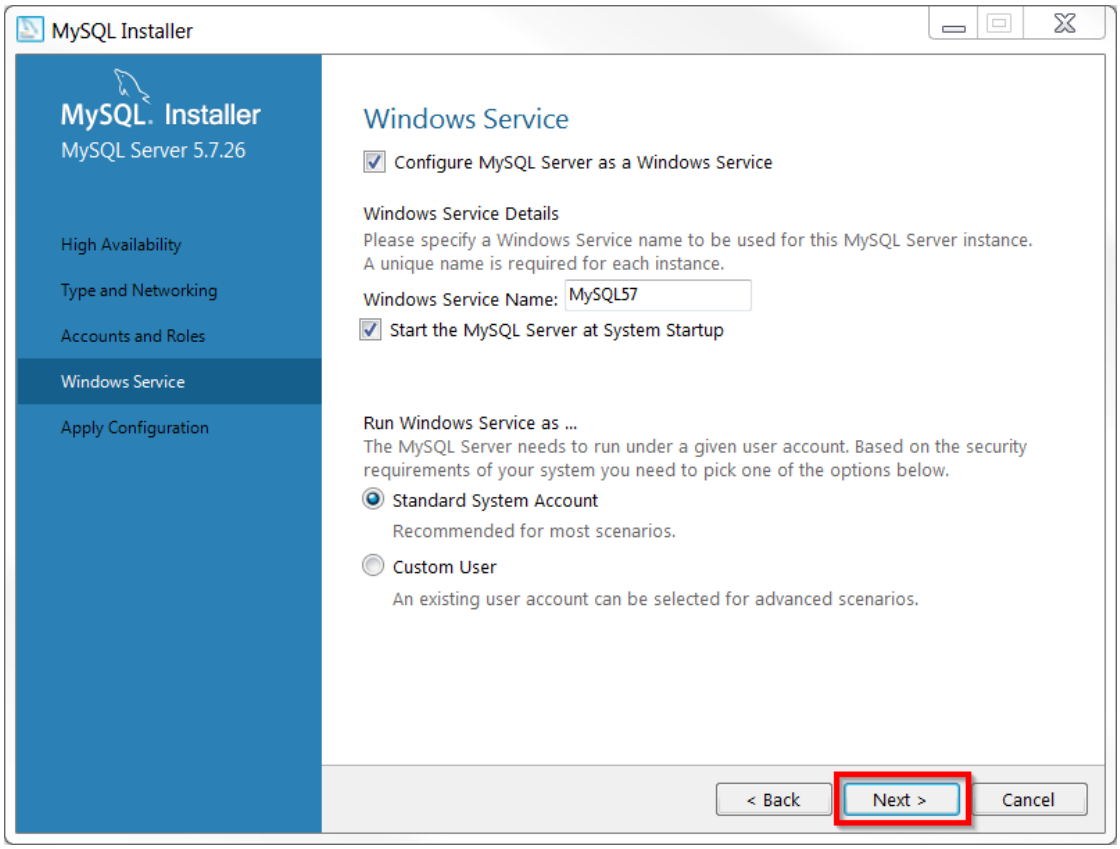


Figure 49: Leave the Windows Service settings unchanged and continue.

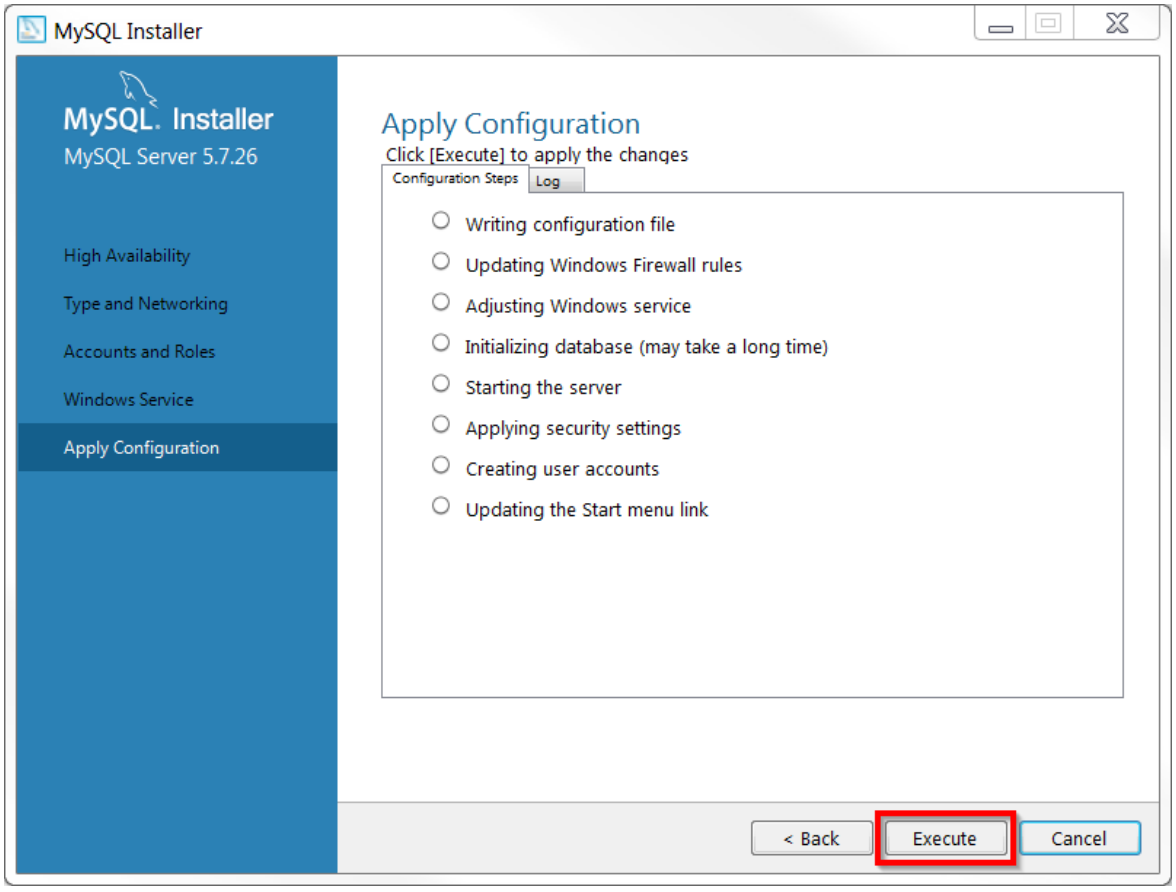


Figure 50: Execute the configuration.

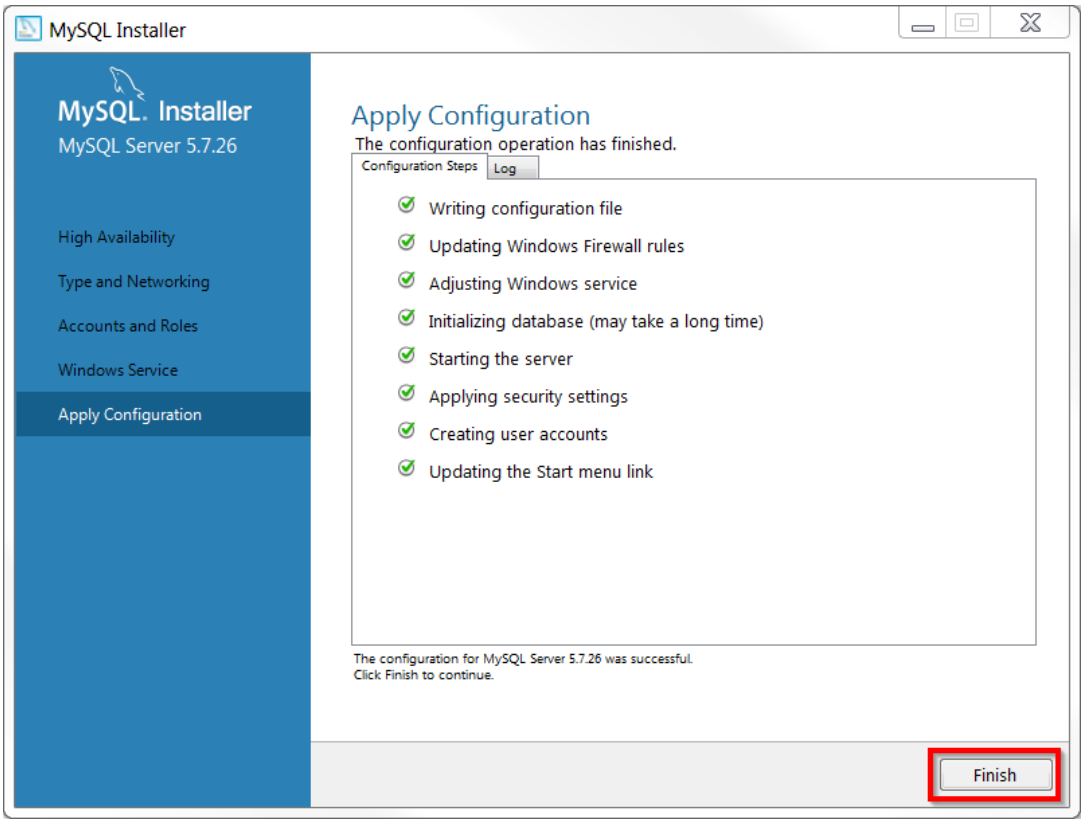


Figure 51: Complete the configuration.

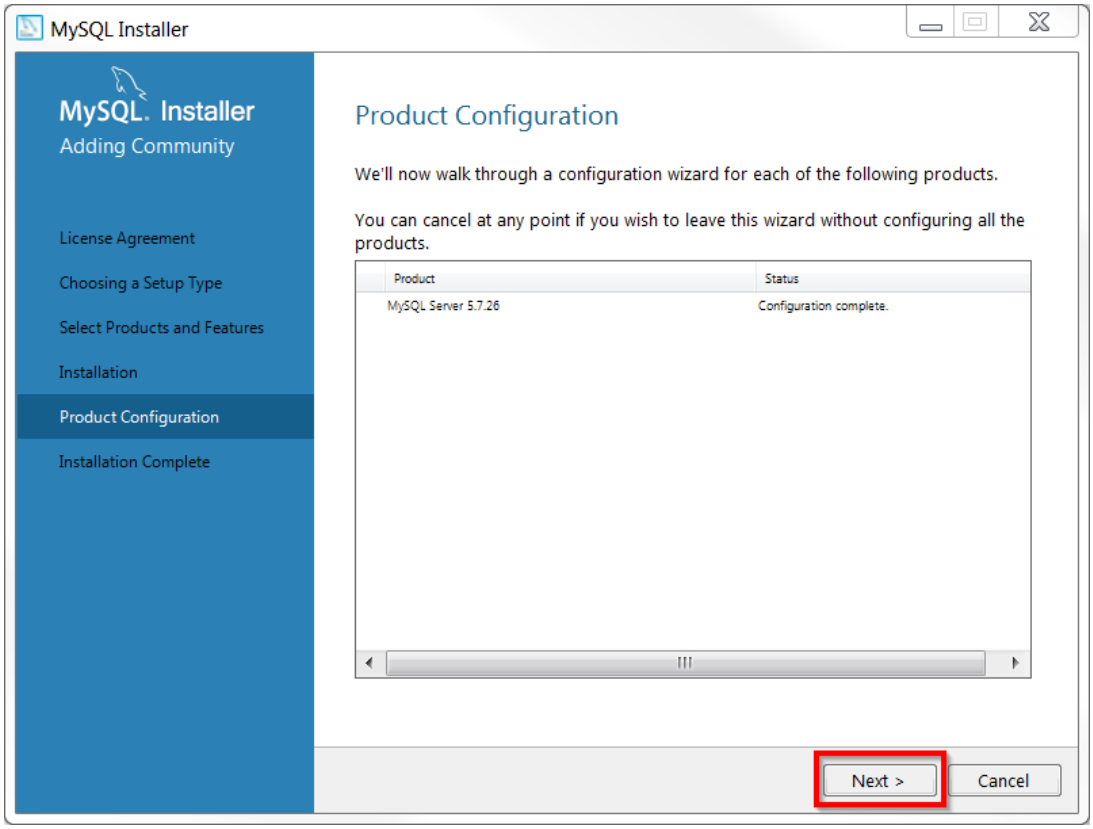


Figure 52: Go to the final screen.

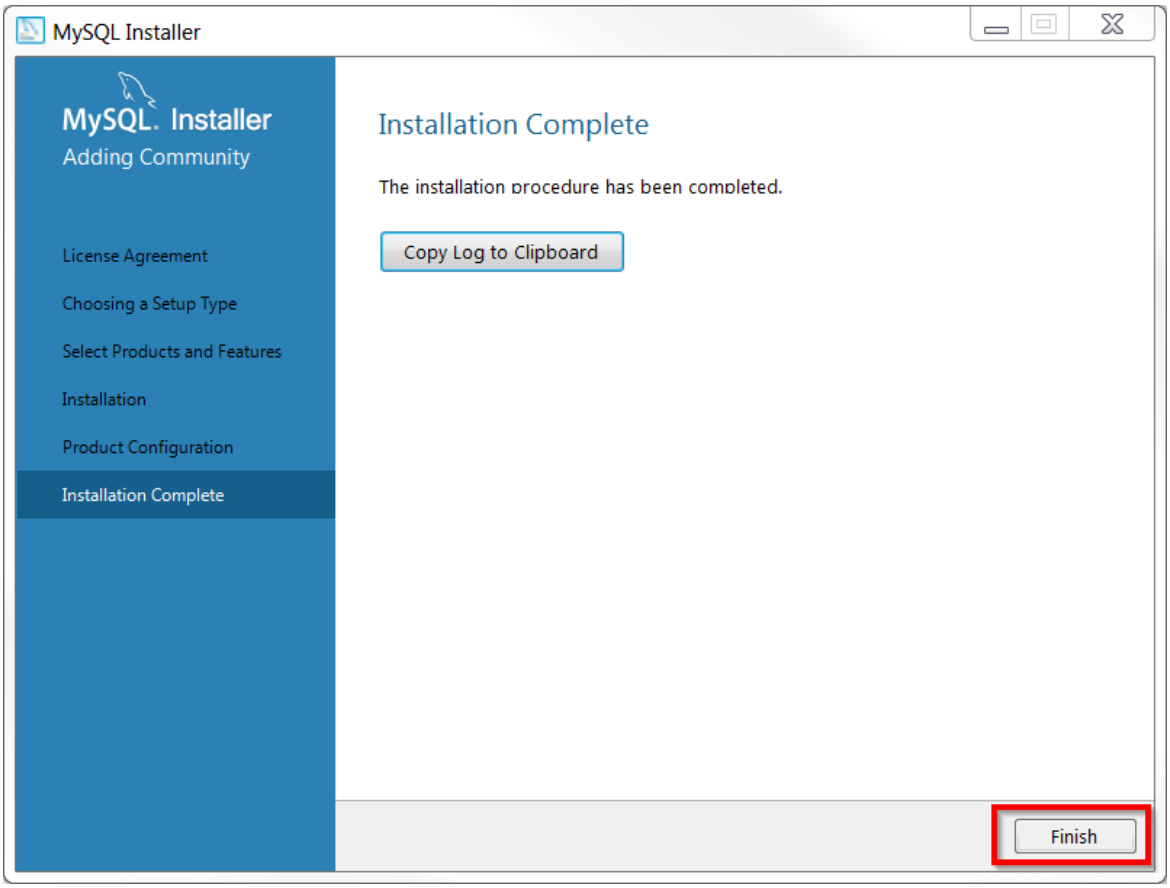


Figure 53: Complete the installation.

After installation the path “C:\ProgramData\MySQL\MySQL Server 5.7” contains the file “my.ini”.

Since the folder "ProgramData" is invisible by default, the visibility must first be switched on in the Windows folder options:

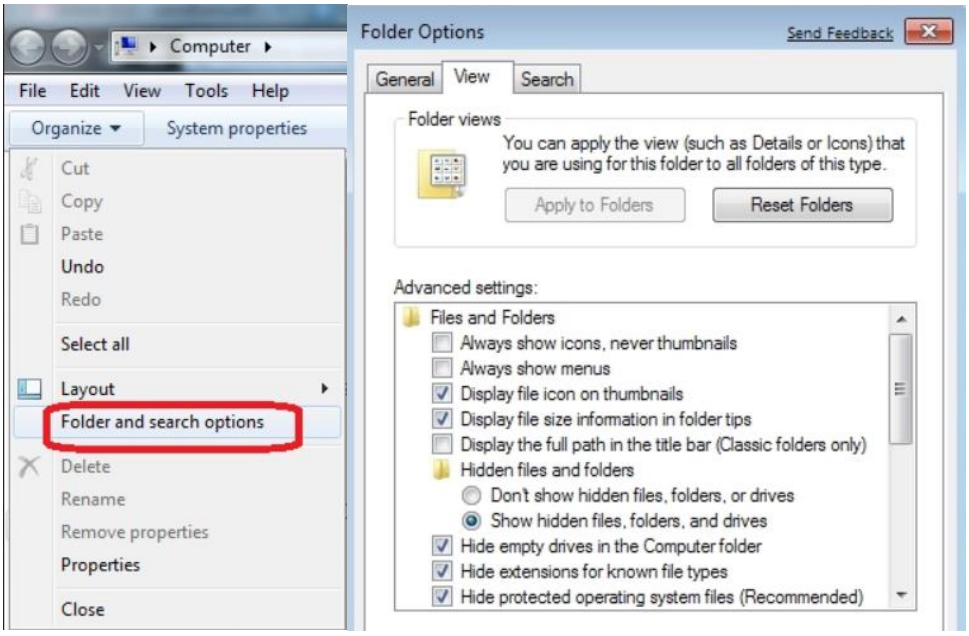


Figure 54: Change visibility settings of folders, here under Windows 7.

Open the file "my.ini" with a text editor of your choice and change the value for max_allowed_packet to 50M. Then add the following lines:

Enable Event-Scheduler on MySQL start

event_scheduler=ON

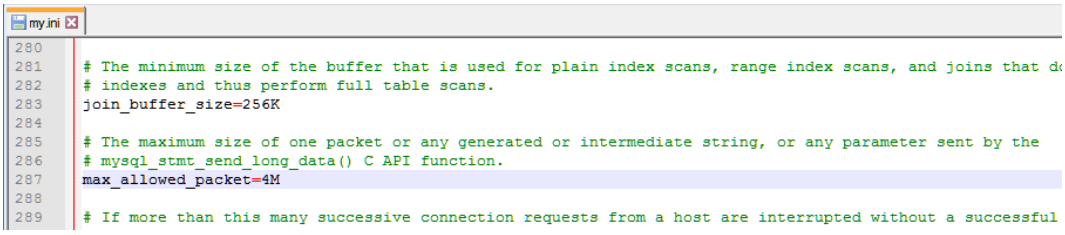


Figure 55: my.ini without changes

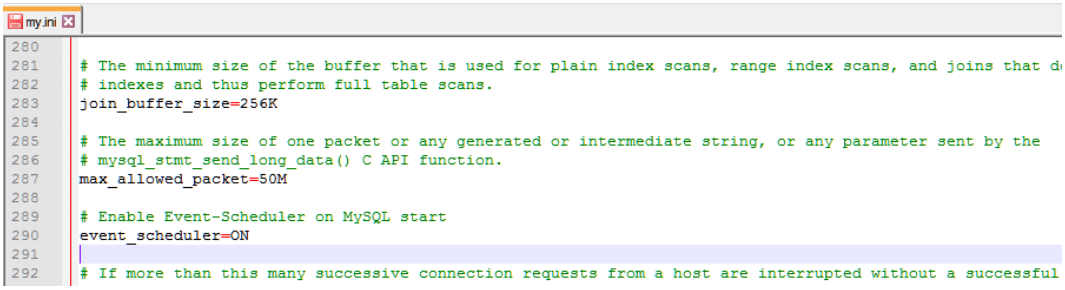


Figure 56: my.ini with changes

The changes will take effect after rebooting the PC or the MySQL server.

Here you will find further detailed information:

https://dev.mysql.com/doc/refman/5.7/en/windows-installation.html

Installation MySQL-Connectors

Run the file "**mysql-connector-c-6.1.12-win32.msi**". This file can be downloaded from the official MySQL website at https://downloads.mysql.com/archives/c-c/. It is important to ensure that this is a 32-bit (x86) version so that the architecture is compatible with VISIONELEMENTS3.

Then follow the steps shown in the images below:

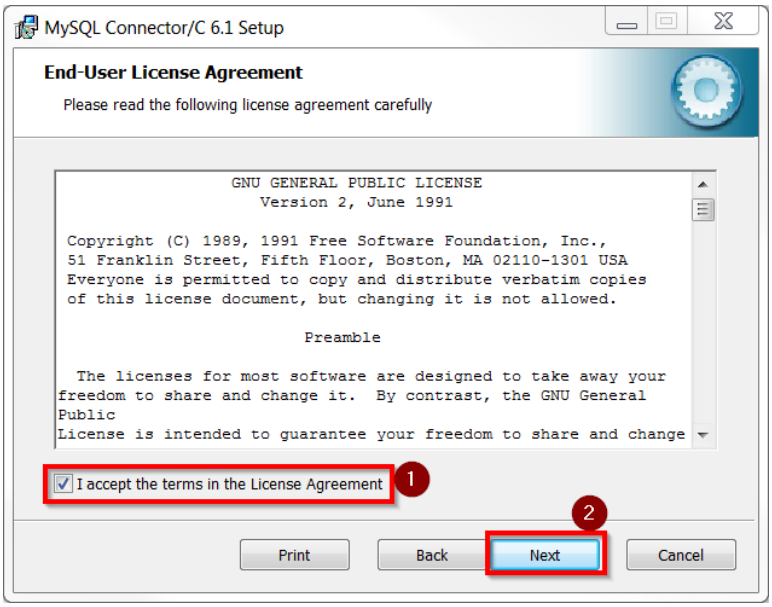


Figure 57: Accept the license condition (1) and proceed to the next step (2).

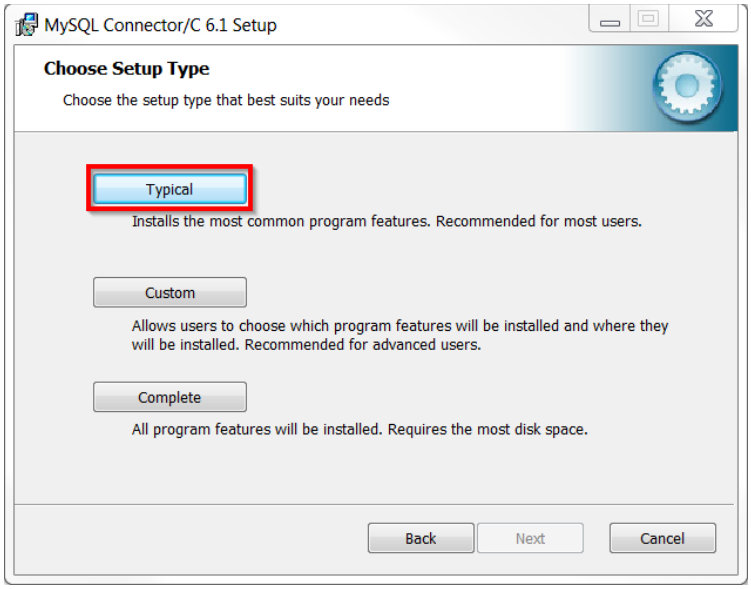


Figure 58: Select the default installation.

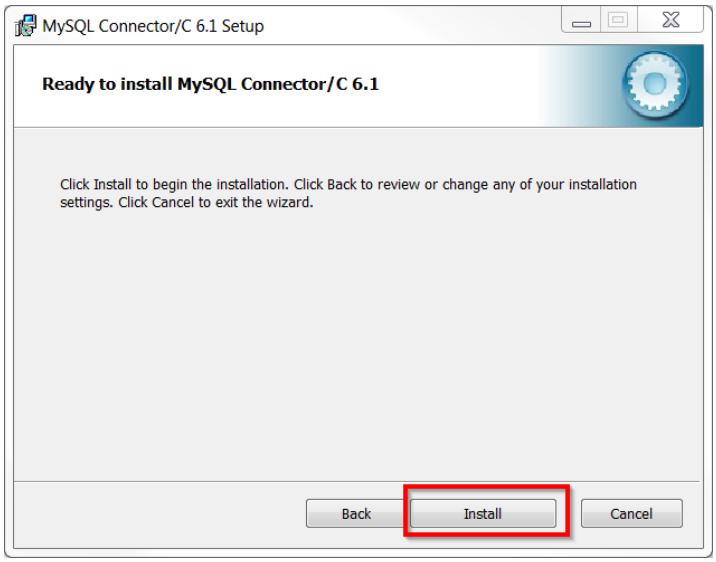


Figure 59: Start the installation and wait.

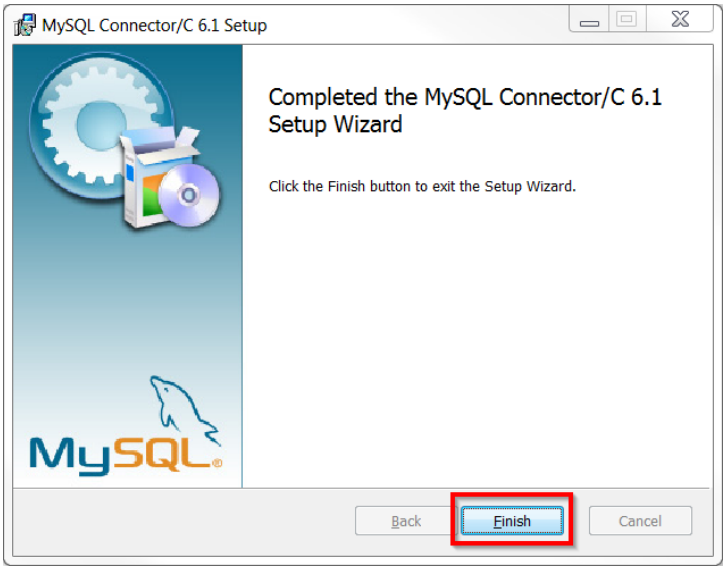


Figure 60: Complete the installation.

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