

OPC UA Specifications for Sensoft Vision. Version 1.7

The screenshot shows the 'Hardware configuration.vi' dialog window with the 'OPC UA' tab selected. The window is titled 'Hardware configuration.vi' and has a close button (X) in the top right corner. The 'OPC UA' tab is active, and the 'Server' section is expanded. The 'Server' section contains a radio button group with 'Sensoft' selected and 'Remote (e. g. PLC)' unselected. To the right of the radio buttons are input fields for 'Username', 'Password', and 'URL'. The 'URL' field contains the text 'opc.tcp://192.168.1.149:4840'. Below the radio buttons is a text field for 'Root node of variables' containing 'ns=2;s=Device'. To the right of this field is a 'Help' button. Below the 'Root node of variables' field is a 'Variables' section with a tree view. The tree view shows a hierarchy starting with 'Device', which has a sub-item 'To Sensoft'. Under 'To Sensoft', there is a list of variables, each with a checked checkbox: 'Spool ID', 'Product', 'Order', 'Description', 'Velocity [m/min]', 'Nominal diameter [um]', 'Threshold LU [um]', 'Threshold NE [um]', 'Nominal diameter (y-axis) [um]', 'Threshold LU (y-axis) [um]', 'Threshold NE (y-axis) [um]', 'Criteria', 'Flash duration [us]', 'Optical magnification', and 'Contour graph range [mm]'. To the right of the tree view is a text field containing an example of a Node ID string: 'ns=2;s=Device.To Sensoft.Nominal diameter (y-axis) [um]'. At the bottom of the dialog are 'OK' and 'Cancel' buttons.

Hardware configuration.vi

Box and Sensors OPC UA

Server

☒ Sensoft
☐ Remote (e. g. PLC)

Username
Password

URL
opc.tcp://192.168.1.149:4840

Root node of variables
ns=2;s=Device

Help

Variables

Device

- To Sensoft
 - ☒ Spool ID
 - ☒ Product
 - ☒ Order
 - ☒ Description
 - ☒ Velocity [m/min]
 - ☒ Nominal diameter [um]
 - ☒ Threshold LU [um]
 - ☒ Threshold NE [um]
 - ☒ Nominal diameter (y-axis) [um]
 - ☒ Threshold LU (y-axis) [um]
 - ☒ Threshold NE (y-axis) [um]
 - ☒ Criteria
 - ☒ Flash duration [us]
 - ☒ Optical magnification
 - ☒ Contour graph range [mm]

Example of Node ID string (for first sensor and hovered variable)
ns=2;s=Device.To Sensoft.Nominal diameter (y-axis) [um]

OK Cancel

Figure 1: OPC UA page of the *Hardware configuration* dialog window.

A change log for this document is given at the end.

Node ID structure

Some variables can be written by the remote device (typically a PLC). They are all in one OPC folder node, different from the OPC folder node containing the variables only read by the remote device.

The node ID on the OPC UA server of the variables written by the remote device is:

<Root_node>.To Sensoft.<Var_name>

where:

<Root_node> is the field **Root node of variables** in Figure 1

<Var_name> is the variable name as listed in Chapter **To Sensoft**.

Correspondingly, the variables only read by the remote device have node ID:

<Root_node>.From Sensoft.<Var_name>

where now the variable name is listed in Chapter **From Sensoft**.

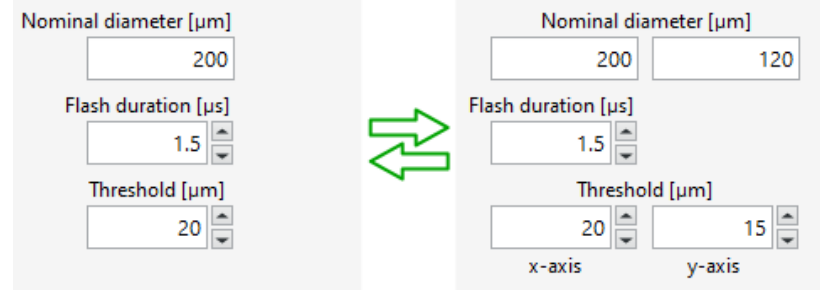

The resulting variable tree can be seen in the field **Variables** in Figure 1. The variables are the rows that have a checkbox. The field **Example of Node ID string (for first sensor and hovered variable)** in Figure 1 displays a resulting node ID, based on the values set in the fields.


Sensoft writes to all OPC variables. It writes to **From Sensoft** variables after measurement events (e.g. when a fault was detected). It writes to **To Sensoft** variables to maintain them consistent with its internal state (see peculiarities at the end of Chapter **To Sensoft**), so that the PLC can also read them.

Variables

To Sensoft

This chapter lists all OPC UA variables that can be written by the remote device and are read by Sensoft.

Variable name	Data type	Description
Spool ID	String (up to 255 characters)	<p>Corresponds to the field Spool ID on page Main of Sensoft Vision.</p> <p>This field specifies where Sensoft Vision saves the measurement data and supports subfolders. E.g. if Spool ID is Warmup\Product xy\Spool 123456 the measurement data will be saved to Data folder\Warmup\Product xy\Spool 123456 . Note: Changes to Spool ID are ignored while a measurement is running (i.e. while the variable From Sensoft.Measuring is True), since it affects data saving. It is therefore good practice to check that variable before writing to Spool ID.</p> <p>Invalid value handling: The command is ignored while Measuring is True</p>
Product	String (up to 255 characters)	<p>The product name or number for the current (if Measuring is True) and next spools. The corresponding field in Sensoft Vision is hidden by default. Product is written to the daily report file, so that it can be used for data mining in Sensoft Multiline</p>
Order	String (up to 255 characters)	<p>The order number for the current (if Measuring is True) and next spools. The corresponding field in Sensoft Vision is hidden by default. Order is written to the daily report file, so that it can be used for data mining in Sensoft Multiline</p>
Description	String (up to 255 characters)	<p>A description for the current (if Measuring is True) and next spools. The corresponding field in Sensoft Vision is hidden by default. Description is written to the daily report file, so that it can be used for data mining in Sensoft Multiline</p>
Velocity [m/min]	Double	<p>Corresponds to the field Velocity [m/min] on page Main.</p> <p>Note: Sensoft Vision can take the velocity information from different sources (the internal encoder, manual entry in the field, and via OPC UA). The source is specified via OPC UA by the variable Settings.Velocity source. If this variable is equal to "0" (= encoder) Sensoft ignores Velocity [m/min], if it is equal to "1" (= manual entry) it reads the variable Velocity [m/min] (when the variable Velocity [m/min] changes).</p> <p>Invalid value handling: NaN is ignored. The command is ignored unless Settings.Velocity source = 1</p>
Nominal diameter [um]	Double	<p>Corresponds to the field Nominal diameter [um] on page Main.</p> <p>To clear the field: Set value 0.</p> <p>Note: If Settings.Thr x equal Thr y = True sets also Nominal diameter (y-axis) [um].</p> <p>Invalid value handling: Negative values and NaN are ignored</p> <div>  </div> <p>Figure 2: Fields in Sensoft Vision with Settings.Thr x equal Thr y = True (left) and Settings.Thr x equal Thr y = False (right).</p>
Threshold LU [um]	Double	<p>Corresponds to the field Threshold [um] (respectively Threshold LU [um]) on page</p> <div>  </div>

		<p>Main. If (and only if) Sensoft Vision is in Advanced Criteria mode (with the Criteria field visible and the threshold fields hidden) Threshold LU [µm] is zero. Setting a valid value to Threshold LU [µm] automatically switches to Simple Criteria mode and makes the threshold field(s) visible. Invalid value handling: Negative values, 0 and NaN are ignored</p>	
Threshold NE [µm]	Double	<p>Corresponds to the field Threshold NE [µm] on page Main. Settings.Thr LU equal Thr NE is automatically set to False if Threshold NE [µm] is different from Threshold LU [µm] (see Figure 3). Note: Visibility is not toggled (neither on nor off) if the value you set to Threshold NE [µm] is equal to Threshold LU [µm]. Attention: Reading this variable may return an outdated value. Invalid value handling: 0 and NaN are ignored. Negative values are converted to positive by taking the absolute value</p>	<p><i>Figure 3: Fields in Sensoft Vision with Settings.Thr LU equal Thr NE = True (left) and Settings.Thr LU equal Thr NE = False (right). Can be combined with Settings.Thr x equal Thr y = False (Figure 2) to show all four threshold fields.</i></p>
Nominal diameter (y-axis) [µm]	Double	<p>Corresponds to the field Nominal diameter (y-axis) [µm] on page Main. Available only for sensors with 2 axes. Settings.Thr x equal Thr y is automatically set to False if Nominal diameter (y-axis) [µm] is different from Nominal diameter [µm] (see Figure 2). To clear the field: Set value 0. Invalid value handling: Negative values and NaN are ignored. Any value is ignored unless sensor has exactly 2 axes</p>	
Threshold LU (y-axis) [µm]	Double	<p>Corresponds to the field Threshold [µm] LU (y-axis) on page Main. Available only for sensors with 2 axes. Settings.Thr x equal Thr y is automatically set to False if Threshold LU (y-axis) [µm] is different from the value of the Threshold LU [µm] field (see Figure 2). If equal, visibility is not toggled (neither on nor off). Attention: Reading this variable may return an outdated value. Invalid value handling: Negative values, 0 and NaN are ignored. Any value is ignored unless sensor has exactly 2 axes</p>	
Threshold NE (y-axis) [µm]	Double	<p>Corresponds to the field Threshold [µm] NE (y-axis) on page Main. Available only for sensors with 2 axes. Settings.Thr x equal Thr y (resp. Settings.Thr LU equal Thr NE) is automatically set to False if Threshold NE (y-axis) [µm] is different from the value of the Threshold NE [µm] field (resp. Threshold LU (y-axis) [µm]), see Figure 2 and 3. If equal, visibility is not toggled (neither on nor off). Attention: Reading this variable may return an outdated value. Invalid value handling: 0 and NaN are ignored. Negative values are converted to positive by taking the absolute value. Any value is ignored unless sensor has exactly 2 axes</p>	
Criteria	Array (up to 6 elements) of Strings	<p>Corresponds to the field Criteria on page Main. Faults are defined in Sensoft Vision either by Criteria or by Threshold * [µm], and correspondingly either is visible the Criteria field or the Threshold * [µm] fields. When you write to the variable Criteria, the Criteria field is automatically made visible, the threshold fields are hidden, and the Threshold * [µm] variables are set to zero.</p>	

		<p>To determine if the Criteria field is visible, test if Threshold LU [um] is zero.</p> <p>Invalid value handling: An empty array is ignored. An array of more than 6 elements is truncated, as Sensoft Vision allows no more than 6 criteria</p>
Flash duration [us]	Double	<p>Corresponds to the field Flash duration [µs] on page Main.</p> <p>Invalid value handling: Negative values, 0 and NaN are ignored</p>
Optical magnification	UInt32	<p>Corresponds to the element index of the field Optical magnification on page Main.</p> <p>The corresponding magnification values depend on the installed optics, but 0 = "" (no value set), 1 = lowest magnification, ...</p> <p>Invalid value handling: Values larger than the number of available elements are ignored</p>
Contour graph range [mm]	Double	<p>Changes the range of the horizontal axis of the graph on page Main.</p> <p>The given value is the full range of the x-axis, which is centered on x = 0.</p> <p>Invalid value handling: Negative values, 0 and NaN are ignored. Values are coerced to be between Slit width [mm] (typically 0.25 mm) and 1000 mm</p>
Start	Boolean	<p>Setting it to True corresponds to pressing the Start button on page Main.</p> <p>The variable is latched back to False by Sensoft. Invalid value handling: False is ignored. The command is not executed if Sensoft is in Focus adjustment mode or if it is already measuring. The variable is nevertheless latched back.</p> <p>Note: If there are really many faults (i.e. when the fault threshold was accidentally set below the noise level) it can take Sensoft an arbitrary long time after the Stop (or Stop and discard data) command to process the queued photos. It is therefore good practice to check that From Sensoft.Measuring is False before the Start command and checking that it changed to True afterwards</p>
Stop	Boolean	<p>Setting it to True corresponds to pressing the Stop button on page Main.</p> <p>The variable is latched back to False by Sensoft. Invalid value handling: False is ignored. The command is not executed if Sensoft is in Focus adjustment mode or if it is not measuring. The variable is nevertheless latched back.</p>
Stop and discard data	Boolean	<p>Setting it to True corresponds to pressing the Stop button on page Main and discarding all the measured data, i.e. not saving it to disk.</p> <p>The variable is latched back to False by Sensoft. Invalid value handling: False is ignored. The command is not executed if Sensoft is in Focus adjustment mode or if it is not measuring. The variable is nevertheless latched back.</p>
Take and save photo now	Boolean	<p>Setting it to True takes a photo and stores it with the name "<Date>T<Time> Section without defects.jpg" in the same directory as the other photos.</p> <p>The variable is latched back to False by Sensoft. Invalid value handling: False is ignored</p>
Switch to tab	UInt32	<p>Switches to that page.</p> <p>The values are 0 = Main, 1 = Results, 2 = Statistics, 3 = Settings</p> <p>Invalid value handling: Values larger than the number of available elements are ignored</p>

Settings.Mean data interval [m]	Double	Corresponds to the field Mean data interval [m] on page Settings . Setting the value 0 prevents taking the mean data. Invalid value handling: Negative values and NaN are ignored
Settings.Filament type	UInt32	Corresponds to the field Filament type on page Settings . The values are 0 = Enameled wire, 1 = Monofilament, 2 = Multifilament Invalid value handling: Values larger than the number of available elements are ignored
Settings.Data folder	String (up to 255 characters)	Corresponds to the field Data folder on page Settings . Note: It is good practice to set Data folder just once, as parent folder of all measurements, and use Spool ID to specifying the subfolders. This permits to load all measurements. Changes to Settings.Data folder are ignored while a measurement is running (i.e. while the variable From Sensoft. Measuring is True), since it affects data saving. Invalid value handling: The command is ignored if Measuring is True
Settings.Velocity source	UInt32	Determines from where Sensoft Vision takes the velocity information. The values are 0 = Encoder (internal tachometer), 1 = Manual entry (by the field in the GUI or by OPC UA). Invalid value handling: Values larger than the number of available elements are ignored
Settings.Thr LU equal Thr NE	Boolean	Hide or show separate threshold fields for lumps and neck-downs. Corresponds to clicking with the right mouse button on the threshold field and select Use different LU and NE thresholds from the context menu. True corresponds to the situation shown in the left side of Figure 3, False to the right side. Settings.Thr LU equal Thr NE is automatically set to False when the LU and NE thresholds are different. Setting Settings.Thr LU equal Thr NE = True adapts Threshold NE [um] and Threshold NE (y-axis) [um]
Settings.Thr x equal Thr y	Boolean	Hide or show separate threshold and diameter fields for x-axis and y-axis. Available only for sensors with 2 axes. Corresponds to clicking with the right mouse button on the diameter or threshold field and select Use different thresholds for x and y from the context menu. True corresponds to the situation shown in the left side of Figure 2, False to the right side. Settings.Thr x equal Thr y is automatically set to False when the y-axis diameter or thresholds are different from those of the x-axis. Setting Settings.Thr x equal Thr y = True adapts Nominal diameter (y-axis) [um] , Threshold LU (y-axis) [um] and Threshold NE (y-axis) [um] . Invalid value handling: Ignored unless sensor has exactly 2 axes.

Sensoft is subscribed to the variables listed in **To Sensoft**, i.e. receives the variable when its value on the server changes. The publishing interval is 50 ms, which means that changes happening faster are not received. Sensoft treats changes to the values of the OPC UA variables like manual changes to the corresponding fields in Sensoft. This means in particular that manual changes are not disallowed. The variables in **To Sensoft** are updated by Sensoft when the value of the corresponding field changes, both if the change originated from a manual change and from an OPC change. The exceptions are latching Booleans and **Velocity [m/min]**. The **To Sensoft** variables are consistent with the local variables in Sensoft, with the following peculiarities:

- **Start**, **Stop**, **Stop and discard data** and **Take and save photo now** do not correspond to a local variable. They are latching Booleans, i.e. written by Sensoft just to latch them back to False after an OPC change. To read if a measurement is going on use **From Sensoft.Measuring**
- **Velocity [m/min]** is never written to OPC UA by Sensoft, in order not to interfere with a possibly fast-changing variable. To read the velocity use **From Sensoft.Velocity [m/min]**

- **Threshold NE [um]**, **Threshold LU (y-axis) [um]** and **Threshold NE (y-axis) [um]** should not be trusted when read from the remote client. Writing works. The reason is that for **Settings.Thr LU equal Thr NE = True** or **Settings.Thr x equal Thr y = True** these variables are dependent from each other and **Threshold LU [um]**. This dependence is honored for the local variables of Sensoft, but not for the OPC UA variables, because it could interfere with your OPC UA write commands to these variables.

When Sensoft starts in OPC UA mode or changes to OPC UA mode, it updates all **To Sensoft** variables to match their corresponding fields. It updates also the **From Sensoft** variables **Status**, **Measuring** and **Line name**, while the others are only updated while measuring.

From Sensoft

This chapter lists all OPC UA variables that can be read by the remote device and are written by Sensoft.

Variable name	Data type	Description
Last fault.Nr	Int32	The number of the last fault, i.e. also the number of faults since the beginning of the measurement. Supports Historical access, see note 1. One cannot rely on Last fault.Nr being consecutive, see note 2
Last fault.Time	DateTime	Time of the last fault. Supports Historical access, see note 1
Last fault.Position [m]	Double	Position of the last fault. Supports Historical access, see note 1
Last fault.Size [um]	Double	Size of the last fault. Supports Historical access, see note 1
Last fault.Type	UInt32	Type of the last fault (0 = Lump, 1 = Neck-down). Supports Historical access, see note 1
Last fault.Velocity [m/min]	Double	Speed at the moment of the last fault. Supports Historical access, see note 1
Last fault.Length [mm]	Double	Length of the fault. Supports Historical access, see note 1
Last fault.Has photo	Boolean	True if a photo of the defect was taken. Supports Historical access, see note 1
Last fault.Has graph	Boolean	True if the profile graph of the defect was recorded. Supports Historical access, see note 1

Last fault.Diameter [um]	Double	Reserved for future use. Supports Historical access, see note 1
Measurement start time	DateTime	Start time of the latest measurement
Measuring	Boolean	True while measuring
File path	String (up to 255 characters)	Path of the TDMS file, relative to To Sensoft.Settings.Data folder . The TDMS file contains all measured data and information about the spool. The photos are in the same folder as File path and their file name can be created with Last fault.Time and Last fault.Nr using the format string "%<%Y-%m-%dT%H_%M_%S>T Fault %d.jpg"
Line name	String (up to 15 characters)	The name of the line (i.e. the sensor) as specified in the field Line name on page Box and Sensors of dialog Hardware settings...
Position [m]	Double	Current position of the wire, i.e. wire length since the start of the measurement. Updated only while measuring, every 150 ms
Velocity [m/min]	Double	Current velocity of the wire. Updated only while measuring, every 150 ms
Signal [%]	Double	Current signal level, in percent of the expected signal. A sensor with clean optical windows has signal > 90%, below 80% it requires cleaning. Requires non-zero Nominal diameter [um] . Updated only while measuring, every 150 ms
Status	UInt32	Status of the Sensoft Vision software. The values are 0: Not running, 1: Running and ok, 2: Running, but overloaded, 3: Running, but camera not ok, 4: Running, but camera not ok
Mean data	Array [up to 32] of Double	Last Mean data values. Mean data is periodic data about the spool, written to disc every Settings.Mean data interval [m] and displayed in Sensoft on page Statistics in Mean graph . This variable is an array containing the following elements: Position [m], Relative diameter [um], Relative ovality [um], Max LU [um], Max NE [um]. More elements could be added in the future, but the total number of elements will stay below or equal 32. NaN is used for missing elements, e.g. for Relative ovality [um] with uniaxial sensors. For biaxial sensors Relative ovality [um] is signed, so that the the x and y components of Relative diameter [um] can be calculated ($\varnothing_x = \varnothing + \text{ovality}$, $\varnothing_y = \varnothing - \text{ovality}$). The neck-down value Max NE [um] is negative. Updated only while measuring, normally every 3 seconds. Updates are skipped if there is no data (i.e. if Settings.Mean data interval [m] takes longer than 3 s) and advanced if there is much data (more than 100 mean data intervals in 3 s) or the measurement ends.
Alerts.Nr of alarms	Int32	Total number of alarms since the start of the measurement. Spool is a PASS if this variable is zero and a FAIL if greater than zero. While measuring, updated at least every 3 seconds.

Alerts.Nr of warnings	Int32	Total number of warnings since the start of the measurement. While measuring, updated at least every 3 seconds.
Alerts.Alerts	Array[Nr. of criteria] of Int32	Number of warnings/alarms for each criterion. While measuring, updated at least every 3 seconds.

Clients typically read **From Sensoft** variables by subscribing to them, so that the OPC UA server sends them a notification when the value of variable changes. Note that the variables **Last fault.Type**, **Last fault.Has photo**, **Last fault.Has graph** and **Last fault.Length [mm]** often have the same value as for the fault before. To get a notification each time a variable is written to, i.e. even if the value stays the same, at subscription to the variable use [DataChangeTrigger](#) = StatusValueTimestamp instead of the default value StatusValue.

Note 1: For accessing data of previous faults, the OPC UA server provides [Historical Access](#) to all **Last fault.*** variables. If Sensoft is the OPC UA server, 10'000 old points of each variable are available. A remote server is free on how many samples to give access, if any. Sensoft writes the data of each fault (see note 2) exactly once to the OPC UA server, therefore reading the historical data of **Last fault.*** from the measurement start time (as stored in the variable **Measurement start time**) to now without limiting the number of resulting points, should return the data from the first to the last fault (an array normally of length **Last fault.Nr**, see note 2). The OPC UA Source timestamp of the **Last fault.*** variables is the time of the fault, i.e. equal to **Last fault.Time**.

Note 2: If the system is overloaded by faults, i.e. if there over 100 faults per second for a second or more, a batch of at least 50 faults is not written to OPC UA (and neither to the TDMS file). This means that **Last fault.Nr** can jump by 50 or more units.

Server and client

Sensoft can act either as OPC UA server or as OPC UA client. The user can choose it in the Hardware configuration dialog (Figure 1).

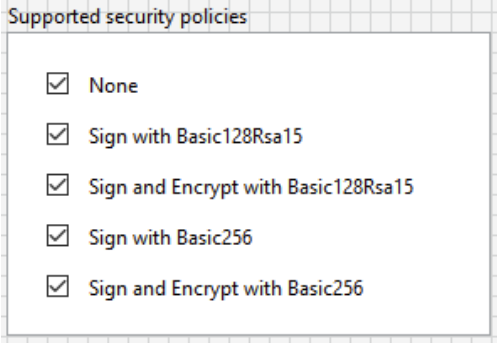
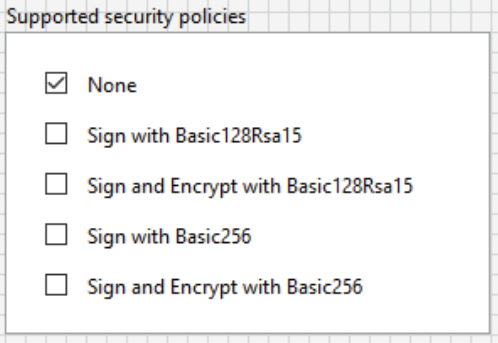
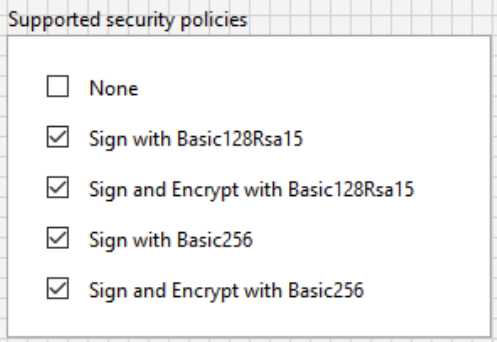
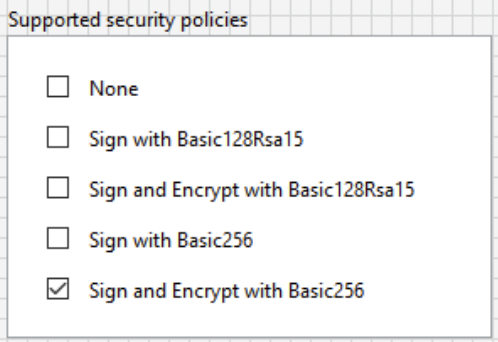
The server has to provide the node structure for at least the activated variables. By default, the server is Sensoft. It provides the node structure for all variables.

Security

Supported security policies

Sensoft supports the following security policies:

	Sensoft as Server	Sensoft as Client
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Without Username or Password		
With Username and Password	 <p>Important: Username and Password are not verified, since NI does not support this.</p>	

If you need to limit access to the OPC UA server, we recommend to use the Windows firewall to limit the access to port 4840, which is used by the OPC UA server.

Server certificate files

As of now, no certificate files are used by Sensoft neither as client nor as server. We can implement it if our partners need it.

Changes

[V 1.7](#) (Sensoft Vision 1.7):

- Variables - To Sensoft.Criteria: Specified that Criteria can have at most 6 elements
- Variables - From Sensoft: Added variable From Sensoft.File path
- Variables - From Sensoft: Added Note 2, i.e. that one cannot rely on Last fault.Nr on being consecutive
- Variables - From Sensoft.File path: Corrected a bug that File path was absolute instead of relative if Data folder is empty

- Security - Supported security policies: Added a note that Sensoft as OPC UA server does not use Username and Password

V 1.6 (Sensoft Vision 1.6):

- Variables - To Sensoft: Added variables Product, Order and Description, which behave as in Sensoft Multiline

V 1.5 (Sensoft Vision 1.5):

- Added support for Advanced Criteria like in Sensoft Multiline: Added variables To Sensoft.Criteria, From Sensoft.Alerts.* . Updated description of To Sensoft.Threshold LU [um]
- Variables - From Sensoft: Added variable Mean data

The version of this document now corresponds to the version of Sensoft Vision

V 1.1 (Sensoft Vision 1.4):

- The variables To Sensoft are now consistent with the local variables in Sensoft, i.e. can also be read, with the restrictions specified at the end of Chapter Variables - To Sensoft
- Variables - To Sensoft: Added variables Nominal diameter (y-axis) [um], Threshold LU (y-axis) [um] and Threshold NE (y-axis) [um]
- Variables - To Sensoft: Reformulated description of Nominal diameter [um], Threshold LU [um] (without semantic change) and Threshold NE [um] (warned that read value may be outdated)
- Variables - From Sensoft: Added variable Signal [%]
- Variables - From Sensoft: Added paragraph after table on subscription to an OPC UA variable

V 1.0 (Sensoft Vision 1.3):

- Initial release