vibro-meter®

How to implement a custom OPC UA Server compatible with VibroSight





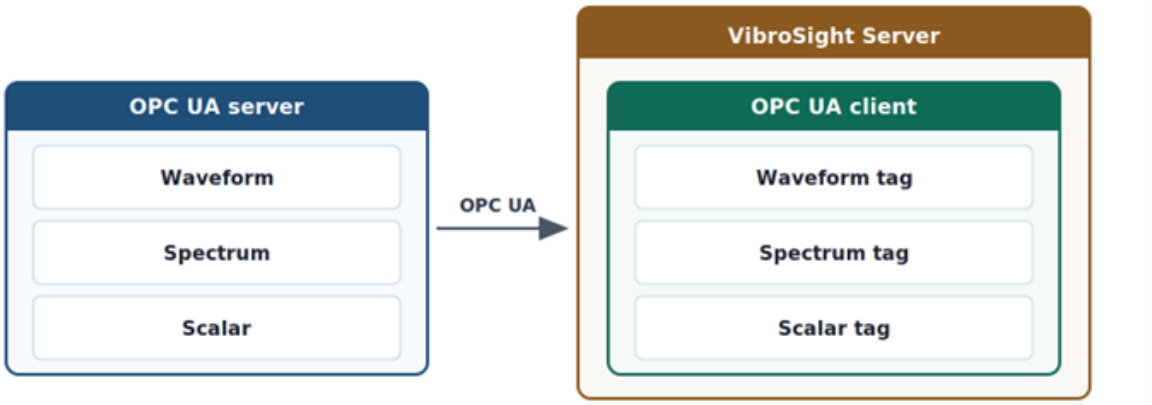
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1. Scope

This document describes how to implement a custom OPC UA server that exposes waveform, spectrum and scalar data so that it can be acquired by the OPC UA client embedded in the VibroSight Server.

2. Principle of operation

The OPC UA client embedded in the VibroSight Server connects to the OPC UA server and subscribes to a set of variable nodes. Each subscribed node is mapped to a **tag** in VibroSight.



The OPC UA server transmits only raw amplitude values, in float or array of floats. All parameters are entered manually when the tag is configured in VibroSight Capture. The OPC UA server and client configurations must therefore be kept consistent — see section 5.

3. Variables to expose

3.1. Variable nodes

For each measurement point, expose one variable node per data type:

Data	Node type	Value	Array length
Waveform	Array of floats	Amplitude values of the waveform data item	Number of samples
Spectrum	Array of floats	Amplitude values of the spectrum data item	Number of lines
Scalar	Float	Amplitude value of the scalar data item	Not applicable

For waveforms and spectra, only the amplitude arrays are necessary. Reading the phase array for spectrum is currently not supported.

3.2. Variable node attributes

Below are the attributes expected for each data type:

Attribute	Waveform / Spectrum	Scalar
NodeClass	Variable	Variable
DataType	Float	Float
ValueRank	1 (OneDimension)	-1 (Scalar)

3.3. Variable node value attributes

In addition to the value itself, every OPC UA node exposed by the server carries a quality indicator (StatusCode), a Source Timestamp and a Server Timestamp. These three attributes are part of the standard OPC UA DataValue and must be set correctly by the OPC UA server for every value it publishes:

Quality (StatusCode):
The StatusCode indicates whether the value is valid (e.g. Good, Bad, Uncertain) and reflects the health of the underlying data acquisition. The OPC UA server must update the StatusCode of a node whenever the validity of its underlying data changes.
The quality set by the OPC UA server is read by the VibroSight OPC UA client for every monitored node, and each data item received by VibroSight is flagged with that quality. As a result, a Good, Bad or Uncertain status reported by the server is propagated to and visible on the corresponding data item in VibroSight.

Source Timestamp:
The Source Timestamp indicates the time at which the value was actually generated or acquired by the device or data source — see section 6.3.

Server Timestamp:
The Server Timestamp indicates the time at which the OPC UA server processed the value and made it available to its clients — see section 6.3.

4. Array content and size for waveforms and spectra

4.1. Waveform

The array contains every amplitude sample of the waveform, in chronological order, first sample first. The array length is the number of samples.

4.2. Spectrum

The array contains every amplitude line of the spectrum, in ascending frequency order, lowest frequency first. The array length is the number of lines.

4.3. Array length is defined by the OPC UA server

The number of samples or lines are configured in VibroSight Capture.
Nevertheless, this parameter is declarative only and does not truncate or pad the received data.
The number of samples or lines displayed in Vision is the number of items actually received in the array.

This means:

- if a client spectrum tag is configured with 1600 lines and the OPC UA server sends 800 values, Vision displays an 800-line spectrum;
- the array length may even change from one update to the next; each received array is processed with its own length.

5. Tag parameters consistency between OPC UA server and client

The OPC UA server transmits only raw values. It sends no metadata: no unit, no qualifier, no number of samples or lines, no frequency span... Everything that gives those values a meaning comes from the tag configuration in VibroSight Capture.

The client applies that configuration to whatever it receives, without checking it. It does not detect a mismatch, and it does not convert anything (apart from the scale factor and the offset for scalar).
Every parameter of the tag is therefore a contract that the data produced by the OPC UA server must honour.

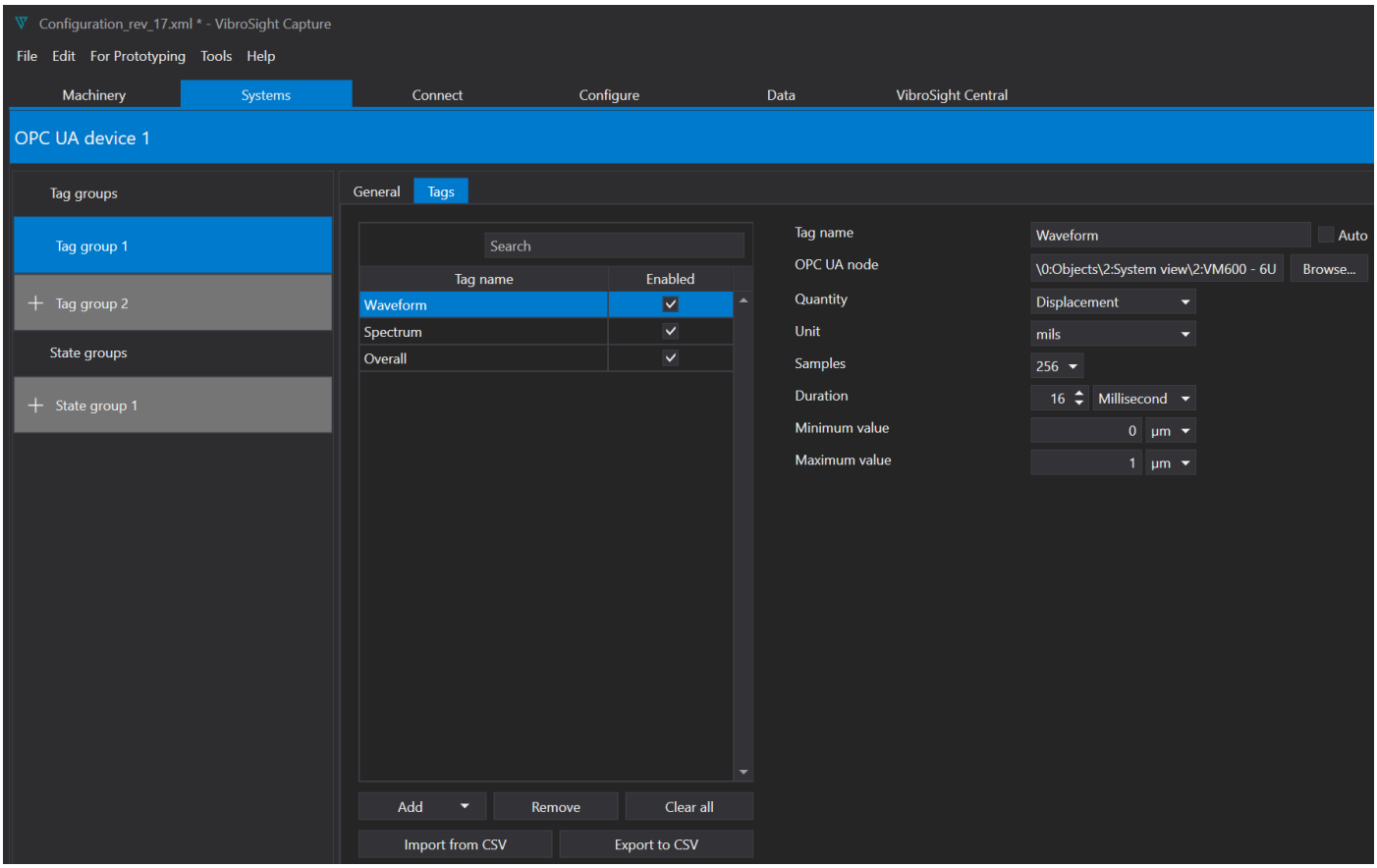
In particular, the values exposed by the OPC UA server can be expressed in any unit and with any qualifier (RMS, peak, peak-to-peak, …). Therefore, is it important that the corresponding tag is configured to match what the OPC UA server node provide.

A mismatch is silent and produces plausible but wrong data. For example:

- values sent in m/s^2 against a tag configured in mm/s are stored as mm/s
- RMS values against a tag declaring a peak qualifier are stored with peak qualifier
- a wrong frequency span or duration shifts the whole frequency or time axis.

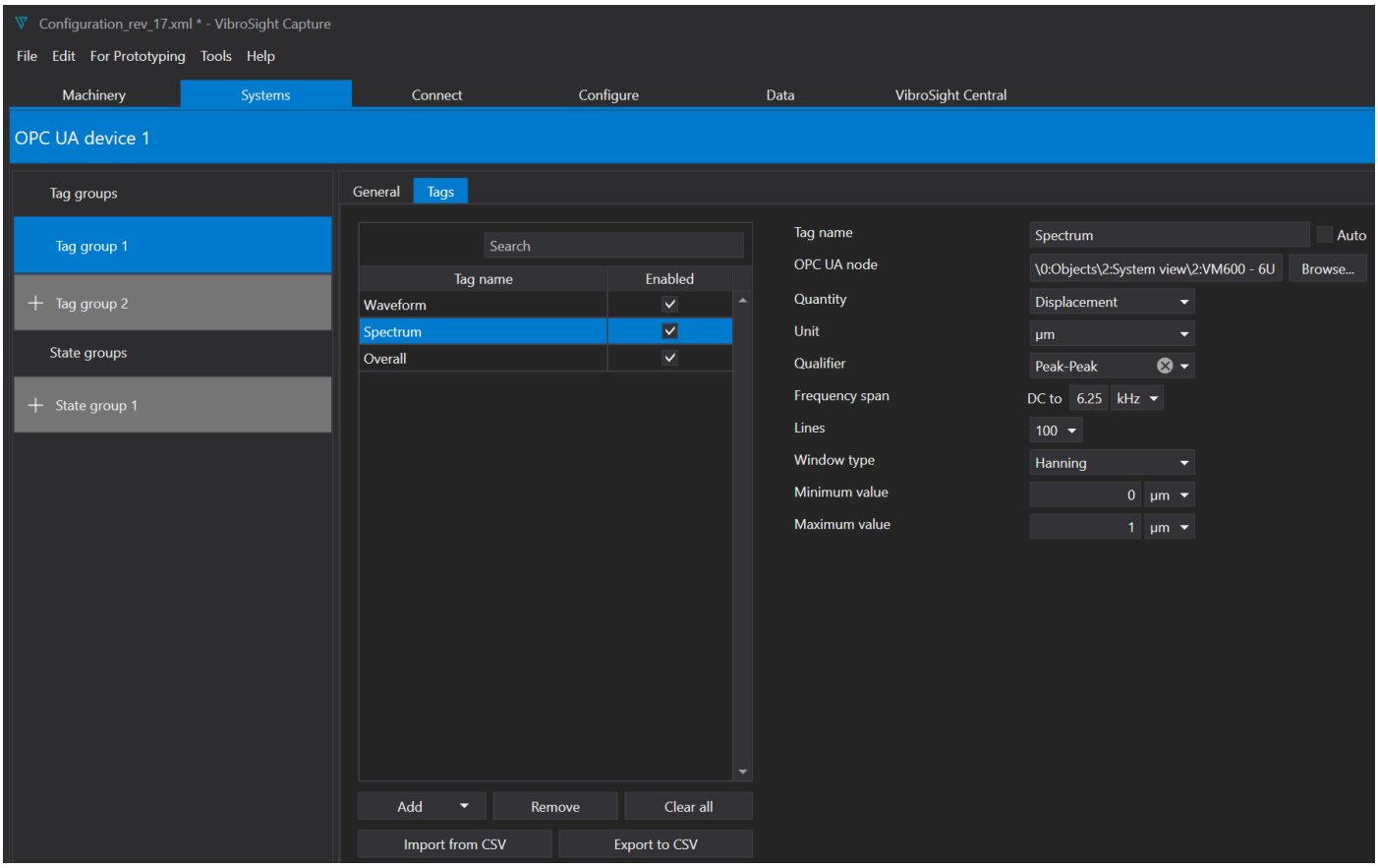
The tables below list, for each tag type, what each parameter means and what the OPC UA server must guarantee.

5.1. Waveform tag parameters



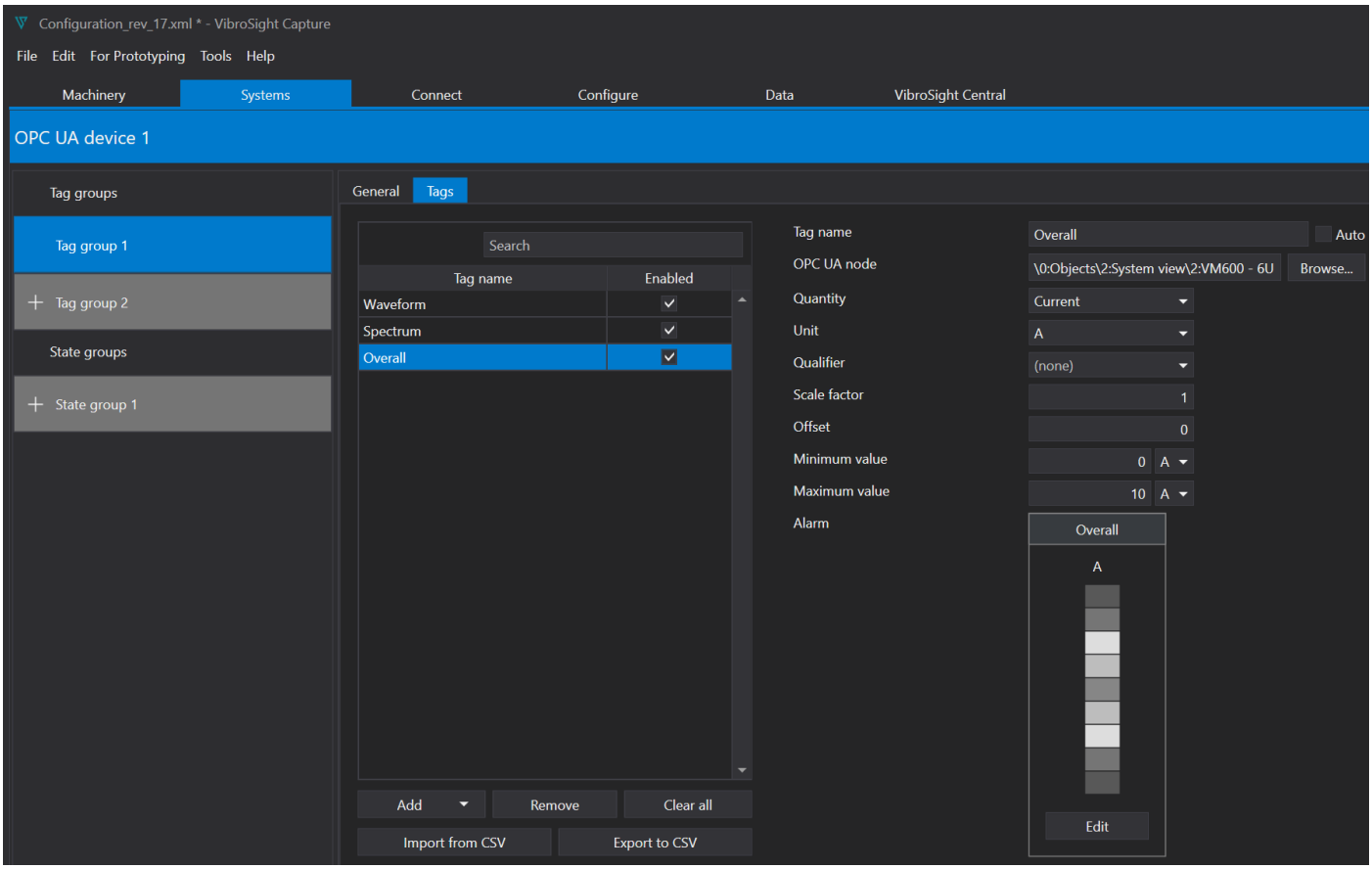
Parameter	Meaning	What the OPC UA server must guarantee
Quantity	Physical quantity (acceleration, velocity, displacement, …)	The array contains that quantity.
Unit	Unit of the amplitude values	The array values are expressed in that unit.
Samples	Declared number of samples	Informative; the actual number of items received is used. Keep consistent.
Duration	Time length of the waveform block	The array covers exactly this time span. Defines the time axis.
Minimum value	Lower bound of the expected amplitude range. Used for display range in Vision.	Values should stay within this range.
Maximum value	Upper bound of the expected amplitude range. Used for display range in Vision.	Values should stay within this range.

5.2. Spectrum tag parameters



Parameter	Meaning	What the OPC UA server must guarantee
Quantity	Physical quantity	The array contains that quantity.
Unit	Unit of the amplitude values	The array values are expressed in that unit.
Qualifier	Amplitude qualifier (RMS, peak, peak-to-peak, …)	The lines are computed with that qualifier.
Frequency span	Frequency range covered by the spectrum	The array covers exactly this span. Defines the frequency axis.
Lines	Declared number of lines	Informative; the actual number of items received is used. Keep consistent.
Window type	Weighting window applied before the FFT (Hanning, Flat top, …)	The OPC UA server applies that window.
Minimum value	Lower bound of the expected amplitude range. Used for display range in Vision.	Values should stay within this range.
Maximum value	Upper bound of the expected amplitude range. Used for display range in Vision.	Values should stay within this range.

5.3. Scalar tag parameters



Parameter	Meaning	What the OPC UA server must guarantee
Quantity	Physical quantity	The value is that quantity.
Unit	Unit of the value	The value is expressed in that unit.
Qualifier	Qualifier of the value, where applicable	The value is computed with that qualifier.
Scale factor	Multiplier applied by the client to every received value. Used when the OPC UA server publishes values on a different scale than the unit declared for the tag.	Nothing, provided the factor matches the values actually published. Leave it at 1 when the OPC UA server already publishes in the declared unit.
Offset	Constant added by the client to every received value, after the scale factor is applied. Used to shift a zero reference or remove a known bias.	Nothing, provided the offset matches the values actually published. Leave it at 0 when no shift is needed.
Minimum value	Lower bound of the expected range. Used for display range in Vision.	Values should stay within this range.
Maximum value	Upper bound of the expected range. Used for display range in Vision.	Values should stay within this range.

6. Update rate, sampling and timestamping

6.1. Update rate (OPC UA server side)

The update rate is decided by the OPC UA server, and it may vary during a session. The client does not command the server to produce data; it samples whatever the server exposes.

The server simply publishes a new array whenever a new waveform or spectrum and scalar data are available.

6.2. Sampling interval (OPC UA client side)

Each tag group is configured with a sampling interval, with a minimum of 100 ms. This is the rate at which the client acquires values from the OPC UA server.

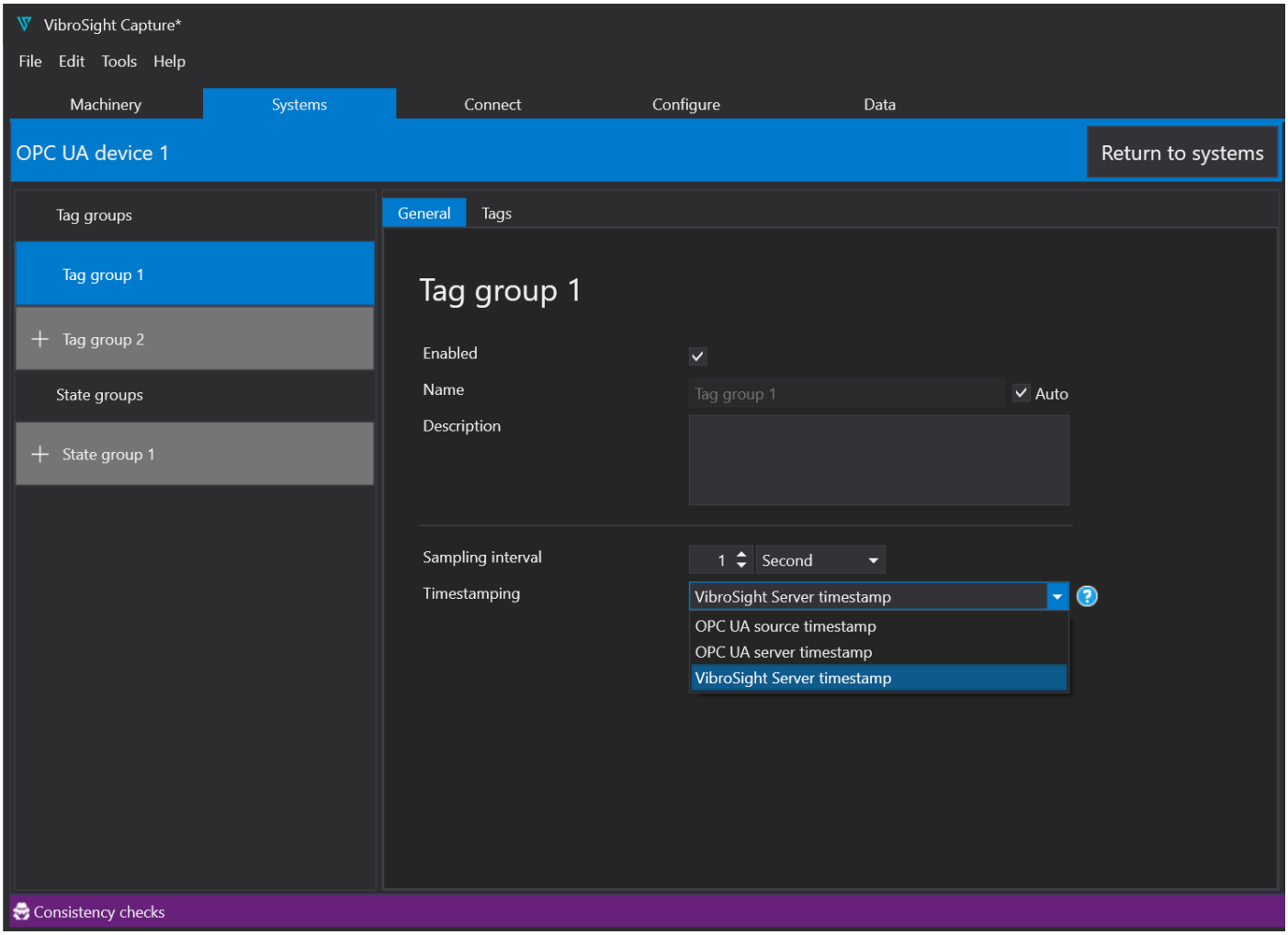
6.3. Timestamping mode (OPC UA client side)

The tag group also defines how the acquired values are timestamped. Three modes are available:

VibroSight Server timestamp:
The OPC data values will be timestamped in VibroSight using the VibroSight server PC time when the values are received.
A new data item will be created in VibroSight every sampling interval. The timestamp will be rounded in VibroSight to 100ms.

OPC UA source timestamp:
The OPC data values will be timestamped in VibroSight using the OPC UA source timestamp which indicates the time of the last change of the value.
A new data item will be created in VibroSight every sampling interval but only if the OPC UA source timestamp changes. The timestamp will be rounded in VibroSight to 100ms.

OPC UA server timestamp:
The OPC data values will be timestamped in VibroSight using the OPC UA server timestamp which indicates the time OPC UA server received a variable value or knew it to be accurate.
A new data item will be created in VibroSight every sampling interval but only if the OPC UA server timestamp changes. The timestamp will be rounded in VibroSight to 100ms.


VibroSight Capture*
File Edit Tools Help
Machinery
Systems
Connect
Configure
Data
OPC UA device 1
Return to systems
Tag groups
Tag group 1
Tag group 2
State groups
State group 1
General
Tags
Tag group 1
Enabled
Name
Tag group 1
Auto
Description
Sampling interval
1
Second
Timestamping
VibroSight Server timestamp
OPC UA source timestamp
OPC UA server timestamp
VibroSight Server timestamp
Consistency checks