GE VERNOVA

MTConnect Driver

User Guide

We want to hear from you. If you have any comments, questions, or suggestions about our documentation, send them to the following email address:
doc@ge.com

MT Connect Driver

Contents

Chapter 1. Welcome to the GE MTConnect OPC UA Server

Welcome to the GE MTConnect OPC UA Server

This document describes the GE MTConnect OPC UA Server. It includes the following sections:

About this Documentation

This help is designed both as a course in using the GE MTConnect OPC UA Server and as an ongoing reference while you are working with the program. You can skim it for easy reference, work through it systematically for in-depth knowledge and refer to it for additional information whenever you need.

Getting Started – New Users

Study the section to familiarize yourself with the basics of the program.

Chapter 2. Overview of the MT Connect OPC UA Server

Supported Software

The following operating systems are supported:

- Microsoft® Window® 10

- Microsoft® Windows® Server 2012 R2 (64 bit)

- Microsoft® Windows® Server 2016

- Microsoft® Windows® Server 2019

Supported MTConnect Standard

This version of the MTConnect OPC UA Server supports the MTConnect Standard 1.4.0.

The following tables list all Sample, Event and Condition data items supported by this version of the driver:

Sample Types

The sample types are subdivided into four groups, depending on the data type of the sample's value:

- Numeric Sample Types

    Most of the MTConnect sample items expose a numeric value. This value either is a floating point value (of data type Float or Double) or an integer value (data type Int32 or UInt32).

Type	Sub Type	Data Type	Unit
ACCELERATION		Double	MILLIMETER/SECOND^2
ACCUMULATED_TIME		Double	SECOND
ANGULAR_ACCELER-ATION		Double	DEGREE/SECOND^2
ANGULAR_VELOCITY		Double	DEGREE/SECOND
AMPERAGE		Double	AMPERE

Type	Sub Type	Data Type	Unit
AMPERAGE	ALTERNATING	Double	AMPERE
AMPERAGE	DIRECT	Double	AMPERE
AMPERAGE	ACTUAL	Double	AMPERE
AMPERAGE	TARGET	Double	AMPERE
ANGLE		Double	DEGREE
ANGLE	ACTUAL	Double	DEGREE
ANGLE	COMMANDED	Double	DEGREE
AXIS_FEEDRATE		Double	MILLIMETER/SECOND
AXIS_FEEDRATE	ACTUAL	Double	MILLIMETER/SECOND
AXIS_FEEDRATE	COMMANDED	Double	MILLIMETER/SECOND
AXIS_FEEDRATE	JOG	Double	MILLIMETER/SECOND
AXIS_FEEDRATE	PROGRAMMED	Double	MILLIMETER/SECOND
AXIS_FEEDRATE	RAPID	Double	MILLIMETER/SECOND
AXIS_FEEDRATE	OVERRIDE	Double	MILLIMETER/SECOND
CONCENTRATION		Double	PERCENT
CONDUCTIVITY		Double	SIEMENS/METER
DISPLACEMENT		Double	MILLIMETER
ELECTRICAL_ENERGY		Double	WATT_SECOND
EQUIPMENT_TIMER		Double	SECOND
EQUIPMENT_TIMER	LOADED	Double	SECOND
EQUIPMENT_TIMER	WORKING	Double	SECOND
EQUIPMENT_TIMER	OPERATING	Double	SECOND
EQUIPMENT_TIMER	POWERED	Double	SECOND
EQUIPMENT_TIMER	DELAY	Double	SECOND
FILL_LEVEL		Double	PERCENT
FLOW		Double	LITER/SECOND

Type	Sub Type	Data Type	Unit
FREQUENCY		Double	HERTZ
LEVEL		Double	FILL_LEVEL
LENGTH		Double	MILLIMETER
LENGTH	STANDARD	Double	MILLIMETER
LENGTH	REMAINING	Double	MILLIMETER
LENGTH	USEABLE	Double	MILLIMETER
LINEAR_FORCE		Double	NEWTON
LOAD		Double	PERCENT
MASS		Double	KILOGRAM
PATH_FEEDRATE		Double	MILLIMETER/SECOND
PATH_FEEDRATE	ACTUAL	Double	MILLIMETER/SECOND
PATH_FEEDRATE	COMMANDED	Double	MILLIMETER/SECOND
PATH_FEEDRATE	JOG	Double	MILLIMETER/SECOND
PATH_FEEDRATE	PROGRAMMED	Double	MILLIMETER/SECOND
PATH_FEEDRATE	RAPID	Double	MILLIMETER/SECOND
PATH_FEEDRATE	OVERRIDE	Double	MILLIMETER/SECOND
PH		Double	PH
POSITION		Double	MILLIMETER
POSITION	ACTUAL	Double	MILLIMETER
POSITION	COMMANDED	Double	MILLIMETER
POSITION	PROGRAMMED	Double	MILLIMETER
POSITION	TARGET	Double	MILLIMETER
POWER_FACTOR		Double	PERCENT
PRESSURE		Double	PASCAL
PROCESS_TIMER		Double	SECOND
PROCESS_TIMER	PROCESS	Double	SECOND

Type	Sub Type	Data Type	Unit
PROCESS_TIMER	DELAY	Double	SECOND
RESISTANCE		Double	OHM
ROTARY_VELOCITY		Double	REVOLUTION/MINUTE
ROTARY_VELOCITY	ACTUAL	Double	REVOLUTION/MINUTE
ROTARY_VELOCITY	COMMANDED	Double	REVOLUTION/MINUTE
ROTARY_VELOCITY	PROGRAMMED	Double	REVOLUTION/MINUTE
ROTARY_VELOCITY	OVERRIDE	Double	REVOLUTION/MINUTE
SOUND_LEVEL		Double	DECIBEL
SOUND_LEVEL	NO_SCALE	Double	DECIBEL
SOUND_LEVEL	A_SCALE	Double	DECIBEL
SOUND_LEVEL	B_SCALE	Double	DECIBEL
SOUND_LEVEL	C_SCALE	Double	DECIBEL
SOUND_LEVEL	D_SCALE	Double	DECIBEL
STRAIN		Double	PERCENT
TEMPERATURE		Double	CELSIUS
TENSION		Double	NEWTON
TILT		Double	MICRO_RADIAN
TORQUE		Double	NEWTON_METER
VOLT_AMPERE		Double	VOLT_AMPERE
VOLT_AMPERE_REACTIVE		Double	VOLT_AMPERE_REAC-TIVE
VELOCITY		Double	MILLIMETER/SECOND
VISCOSITY		Double	PASCAL_SECOND
VOLTAGE		Double	VOLT
VOLTAGE	ALTERNATING	Double	VOLT
VOLTAGE	DIRECT	Double	VOLT

Type	Sub Type	Data Type	Unit
VOLTAGE	ACTUAL	Double	VOLT
VOLTAGE	TARGET	Double	VOLT
WATTAGE		Double	WATT
WATTAGE	ACTUAL	Double	WATT
WATTAGE	TARGET	Double	WATT

• Numeric 3D Sample Types

The MTConnect sample data item PATH_POSITION represents a X/Y/Z coordinate, means this data item exposes three position values of type Double.

Type	Sub Type	Data Type
PATH_-POSITION		Double
PATH_-POSITION	ACTUAL	Double
PATH_-POSITION	COMMANDED	Double
PATH_-POSITION	TARGET	Double
PATH_-POSITION	PROBE	Double

• String Sample Types

If a sample data item exposes a value which can't be coded as numeric value the String sample type can be used. Even though the current MTConnect Standard 1.4.0 doesn't specify any string sample types, the MTConnect driver is already prepared to support this sample data type

• DateTime Sample Types

A few sample data items expose date, time, date and time or even time span values.

Type	Sub Type	Data Type
CLOCK_- TIME		DateTim

Event Types

The complete list of all supported event data items are documented in *MTConnect Part 3.0 Streams Information Model Version 1.4.0, chapter 6.2 Event Element Names.*

The event types are subdivided into three groups, depending on the data type of the event's value.

• Enumeration Event Types

All events with a limited/defined range of data values are listed in the following table. The link in the right most column (Enum type) leads to the list of valid values and their semantic.

Type	Sub Type	Enumeration Type	Valid Data Values
AVAILABILITY		EnumTypeAvailability	UNAVAILABLE (0), AVAILABLE(1)
ACTUATOR_STATE		EnumTypeActiveState	INACTIVE (0), ACTIVE (1)
AXIS_COUPLING		EnumTypeAxisCou- pling	MASTER (0), SLAVE (1), SYNCHRONOUS (2), TANDEM (3)
AXIS_INTERLOCK		EnumTypeActiveState	INACTIVE (0), ACTIVE (1)
AXIS_STATE		EnumTypeAxisState	HOME (0), PARKED (1), STOPPED (2),

Type	Sub Type	Enumeration Type	Valid Data Values
			TRAVEL (3)
CHUCK_INTERLOCK		EnumTypeActiveState	INACTIVE (0), ACTIVE (1
CHUCK_INTERLOCK	MANUAL_UN-CLAMP	EnumTypeActiveState	INACTIVE (0), ACTIVE (1
CHUCK_STATE		EnumTypeOpenState	OPEN (0), CLOSED (1), UNLATCHED (2)
COMPOSITION_STATE	ACTION	EnumTypeCompositionState	INACTIVE (0), ACTIVE (1
COMPOSITION_STATE	LATERAL	EnumTypeCompositionState	RIGHT (2), LEFT (3), TRANSITIONING (4)
COMPOSITION_STATE	MOTION	EnumTypeCompositionState	OPEN (0), CLOSED (1), UNLATCHED (2)
COMPOSITION_STATE	SWITCHED	EnumTypeCompositionState	ON (8), OFF (9)
COMPOSITION_STATE	VERTICAL	EnumTypeCompositionState	TRANSITIONING (4), UP (10), DOWN (11)
CONTROLLER_MODE		EnumTypeControllerMode	AUTOMATIC (0), EDIT (1), MANUAL (2),

Type	Sub Type	Enumeration Type	Valid Data Values
			MANUAL_DATA_INPUT (3), SEMI_AUTOMATIC
CONTROLLER_MODE_-OVERRIDE	DRY_RUN	EnumTypeOnOff	OFF (0), ON (1)
CONTROLLER_MODE_-OVERRIDE	SINGLE_BLOCK	EnumTypeOnOff	OFF (0), ON (1)
CONTROLLER_MODE_-OVERRIDE	MACHINE_AXIS_-LOCK	EnumTypeOnOff	OFF (0), ON (1)
CONTROLLER_MODE_-OVERRIDE	OPTIONAL_STOP	EnumTypeOnOff	OFF (0), ON (1)
CONTROLLER_MODE_-OVERRIDE	TOOL_CHANGE_-STOP	EnumTypeOnOff	OFF (0), ON (1)
DIRECTION	ROTARY	EnumTypeDirection	CLOCKWISE (2), COUNTER_CLOCKWISE (3)
DIRECTION	LINEAR	EnumTypeDirection	POSITIVE (0), NEGATIVE (1)
DOOR_STATE		EnumTypeDoorState	OPEN (0), CLOSED (1), UNLATCHED (2)
END_OF_BAR		EnumTypeYesNo	NO (0), YES (1)
END_OF_BAR	PRIMARY	EnumTypeYesNo	NO (0),

Type	Sub Type	Enumeration Type	Valid Data Values
			YES (1)
END_OF_BAR	AUXILIARY	EnumTypeYesNo	NO (0), YES (1)
EMERGENCY_STOP		EnumTypeEmergency-Stop	ARMED (0), TRIGGERED (1)
EQUIPMENT_MODE	LOADED	EnumTypeOnOff	OFF (0), ON (1)
EQUIPMENT_MODE	WORKING	EnumTypeOnOff	OFF (0), ON (1)
EQUIPMENT_MODE	OPERATING	EnumTypeOnOff	OFF (0), ON (1)
EQUIPMENT_MODE	POWERED	EnumTypeOnOff	OFF (0), ON (1)
EQUIPMENT_MODE	DELAY	EnumTypeOnOff	OFF (0), ON (1)
EXECUTION		EnumTypeExecution	ACTIVE (0), FEED_HOLD (1), INTERRUPTED (2), OPTIONAL_STOP (3), READY (4), PROGRAM_COMPLETED (5), PROGRAM_STOPPED (6), STOPPED (7)

Type	Sub Type	Enumeration Type	Valid Data Values
FUNCTIONAL_MODE		EnumTypeFunctional-Mode	MAINTENANCE (0), PRODUCTION (1), PROCESS_DEVELOP-MENT (2), SETUP (3), TEARDOWN (4)
INTERFACE_STATE		EnumTypeEnabledDis-abled	DISABLED (0), ENABLED (1)
PATH_MODE		EnumTypePathMode	INDEPENDENT (0), MASTER (1), SYNCHRONOUS (2), MIRROR (4)
PROGRAM_EDIT		EnumTypeProgramEd-it	NOT_READY (0), READY (1), ACTIVE (2)
POWER_STATE		EnumTypeOnOff	OFF (0), ON (1)
POWER_STATE	LINE	EnumTypeOnOff	OFF (0), ON (1)
POWER_STATE	CONTROL	EnumTypeOnOff	OFF (0), ON (1)
ROTARY_MODE		EnumTypeRotary-Mode	CONTOUR (0), INDEX (1), SPINDLE (2)

Type	Sub Type	Enumeration Type	Valid Data Values
SPINDLE_INTERLOCK		EnumTypeActiveState	INACTIVE (0), ACTIVE (1)

• String Event Types

All events with a non-numerical data value.

Type	Sub Type
ACTIVE_AXES	
BLOCK	
COUPLED_AXES	
LINE	
LINE_LABEL	
MATERIAL	
MESSAGE	
OPERATOR_ID	
PALLET_ID	
PART_ID	
PART_NUMBER	
PROGRAM	
PROGRAM_EDIT_NAME	
PROGRAM_COMMENT	
PROGRAM_HEADER	
SERIAL_NUMBER	
TOOL_ASSET_ID	
TOOL_NUMBER	
TOOL_OFFSET	RADIAL
TOOL_OFFSET	LENGTH

Type	Sub Type
USER	OPERATOR
USER	MAINTENANCE
USER	SET_UP
WIRE	
WORKHOLDING_ID	
WORK_OFFSET	

• Numeric Event Types

All events with a numeric value. The driver supports the four data types Float, Double, Int32 and UInt32 for numeric events.

Type	Sub Type	Data Type
AXIS_FEEDRATE_OVERRIDE		Double
AXIS_FEEDRATE_OVERRIDE	JOG	Double
AXIS_FEEDRATE_OVERRIDE	PROGRAMMED	Double
AXIS_FEEDRATE_OVERRIDE	RAPID	Double
BLOCK_COUNT		UInt32
HARDNESS	ROCKWELL	Double
HARDNESS	VICKERS	Double
HARDNESS	SHORE	Double
HARDNESS	BRINELL	Double
HARDNESS	LEEB	Double
HARDNESS	MOSH	Double
LINE_NUMBER	ABSOLUTE	UInt32
LINE_NUMBER	INCREMENTAL	UInt32
PART_COUNT		UInt32
PART_COUNT	ALL	UInt32

Type	Sub Type	Data Type
PART_COUNT	GOOD	UInt32
PART_COUNT	BAD	UInt32
PART_COUNT	TARGET	UInt32
PART_COUNT	REMAINING	UInt32
PATH_FEEDRATE_OVERRIDE		Double
PATH_FEEDRATE_OVERRIDE	JOG	Double
PATH_FEEDRATE_OVERRIDE	PROGRAMMED	Double
PATH_FEEDRATE_OVERRIDE	RAPID	Double
ROTARY_VELOCITY_OVER-RIDE		Double

Condition Types

The complete list of all supported condition data items are documented in *MTConnect Part 3.0 Streams Information Model Version 1.4.0, chapter 6.3 Types of Condition Elements.*

All supported conditions are listed in the following table.

Type	Descritpion
ACTUATOR	An indication of a fault associated with an actuator.
CHUCK_INTER-LOCK	An indication of the operational condition of the interlock function for an electronical-ly controller chuck.
COMMUNI-CATIONS	An indication that the piece of equipment has experienced a communications failure.
DATA_RANGE	An indication that the value of the data associated with a measured value or a calculation is outside of an expected range.
DIRECTION	An indication of a fault associated with the direction of motion of a Structural Element.
END_OF_BAR	An indication that the end of a piece of bar stock has been reached.

Type	Descritpion
HARDWARE	An indication of a fault associated with the hardware subsystem of the Structural Element.
INTERFACE_S-TATE	An indication of the operational condition of an Interface component.
LOGIC_PRO-GRAM	An indication that an error occurred in the logic program or programmable logic controller (PLC) associated with a piece of equipment.
MOTION_PRO-GRAM	An indication that an error occurred in the motion program associated with a piece of equipment
SYSTEM	A general purpose indication associated with an electronic component of a piece of equipment or a controller that represents a fault that is not associated with the operator, program, or hardware.

Enumeration Types

The following tables list all enumeration types which are used for enumeration event data items. The assignment of the enumeration name to its numeric value is inspired by the OPC UA / MTConnect Companion Specification 2.0 but some of the enumeration types use deviating (more meaningful) name-value relations. All type definitions which deviate from the Companion Specification are marked with a remark 1.

- EnumTypeActiveState1

Text	Value
INAC-TIVE	0
ACTIVE	1

- EnumTypeAvailability1

Text	Value
UN-AVAILABLE	0
AVAILABLE	1

- EnumTypeAxisCoupling

Text	Value
MASTER	0
SLAVE	1
SYNCHRONOUS	2
TANDEM	3

- EnumTypeAxisState

Text	Value
HOME	0
PARKED	1
STOPPED	2
TRAVEL	3

- EnumTypeCompositionState1

Text	Value
INACTIVE	0
ACTIVE	1
RIGHT	2
LEFT	3

Text	Value
TRANSITIONING	4
OPEN	5
CLOSED	6
UNLATCHED	7
ON	8
OFF	9
UP	10
DOWN	11

- EnumTypeConditionState1

Text	Value
NORMAL	0
WARNING	1
FAULT	2

- EnumTypeControllerMode

Text	Value
AUTOMATIC	0
EDIT	1
MANUAL	2
MANUAL_DATA_IN-PUT	3
SEMI_AUTOMATIC	4

- EnumTypeCoordinateSystem

Text	Value
MACHINE	0
WORK	1

- EnumTypeDirection1

Text	Value
POSITIVE	0
NEGATIVE	1
CLOCKWISE	2
COUNTER_CLOCK-WISE	3

- EnumTypeDoorState1

Text	Value
OPEN	0
CLOSED	1
UN-LATCHED	2

- EnumTypeEmergencyStop

Text	Value
ARMED	0
TRIGGERED	1

- EnumTypeExecution

Text	Value
ACTIVE	0
FEED_HOLD	1
INTERRUPTED	2
OPTIONAL_STOP	3
READY	4
PROGRAM_COMPLETED	5
PROGRAM_STOPPED	6
STOPPED	7

- EnumTypeFunctionalMode

Text	Value
MAINTENANCE	0
PRODUCTION	1
PROCESS_DEVELOPMENT	2
SETUP	3
TEARDOWN	4

- EnumTypeOnOff

Text	Value
OFF	0
ON	1

- EnumTypeOpenState1

Text	Value
OPEN	0
CLOSED	1
UN-LATCHED	2

• EnumTypeYesNo

Text	Value
NO	0
YES	1

• EnumTypePathMode1

Text	Value
INDEPENDENT	0
MASTER	1
SYNCHRONOUS	2
MIRROR	3

• EnumTypeProgramEdit1

Text	Value
NOT_-READY	0
READY	1
ACTIVE	2

• EnumTypeRotaryMode

Text	Value
CON-TOUR	0
INDEX	1
SPINDLE	2

• EnumTypeEnabledDisabled1

Text	Value
DISABLED	0
ENABLED	1

1) Deviant from OPC UA / MTConnect Companion Specification 2.0

Supported OPC UA Standard

The MTConnect OPC UA Server is compatible with OPC UA specification 1.03. Any third-party software packages with an OPC UA client interface (e.g. iFIX, Cimplicity HMI or Historian 7.0) can access this MTConnect OPC UA Server.

MT Connect Overview

• MT Connect standardizes manufacturing equipment (CNC machine) data in a structured non-proprietary format.
• It specifies a data model which is designed for any type of CNC machines like milling machines, lathes, grinding machines, 3D printers etc.
• It uses standards like HTTP(S) based on TCP/IP for transportation and XML for encoding of the data.

The following picture shows on how the MTConnect OPC UA Server, the Agents and the devices are structured:
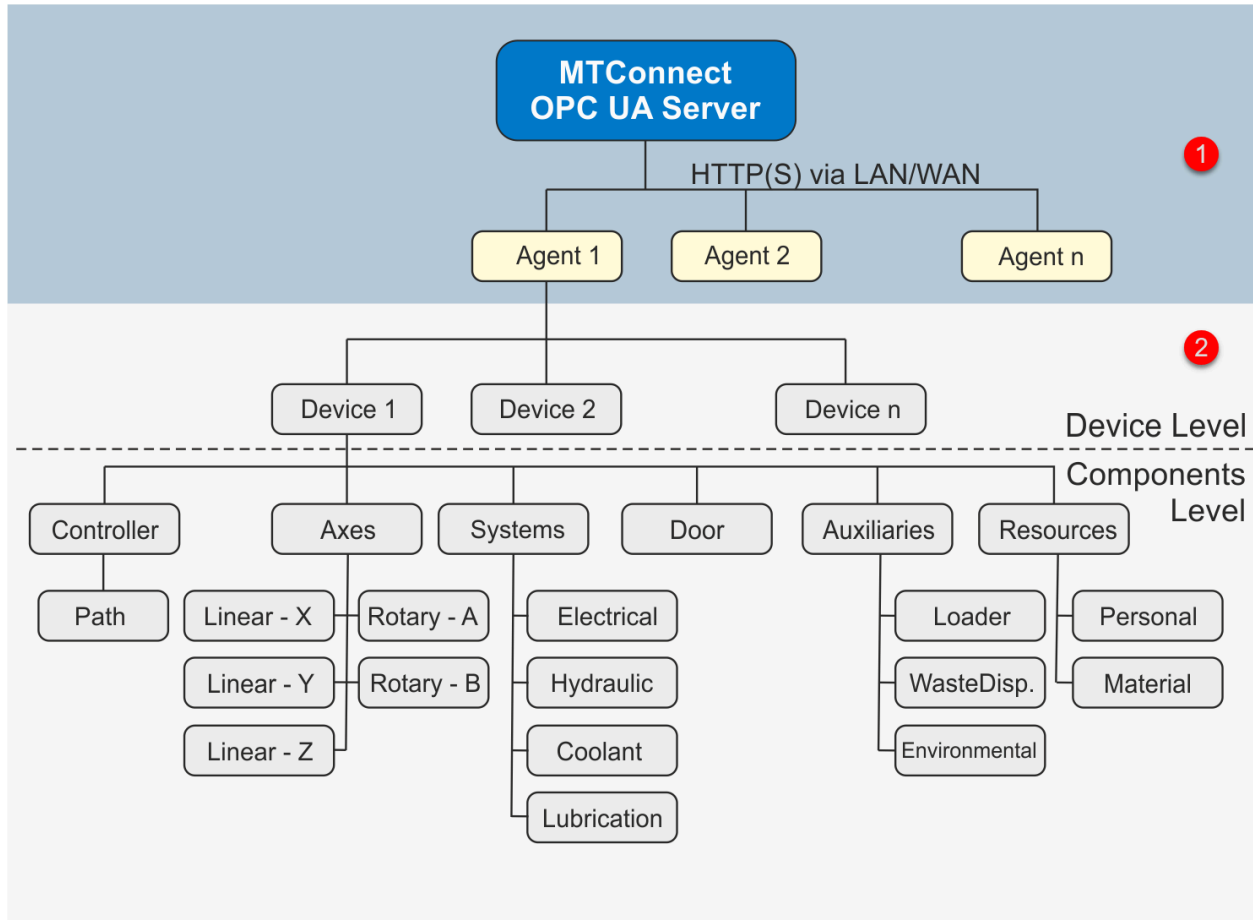
① The configuration parameters to connect to the MTConnect Agents (their URI and OPC UA browse name) has to be done 'manually' in the MTConnect Server Configuration Tool.

② The configuration of the MTConnect Agents itself (their device, component and data item configuration) takes place automatically by requesting these information via the so-called Probe request by the MTConnect Server Background process..
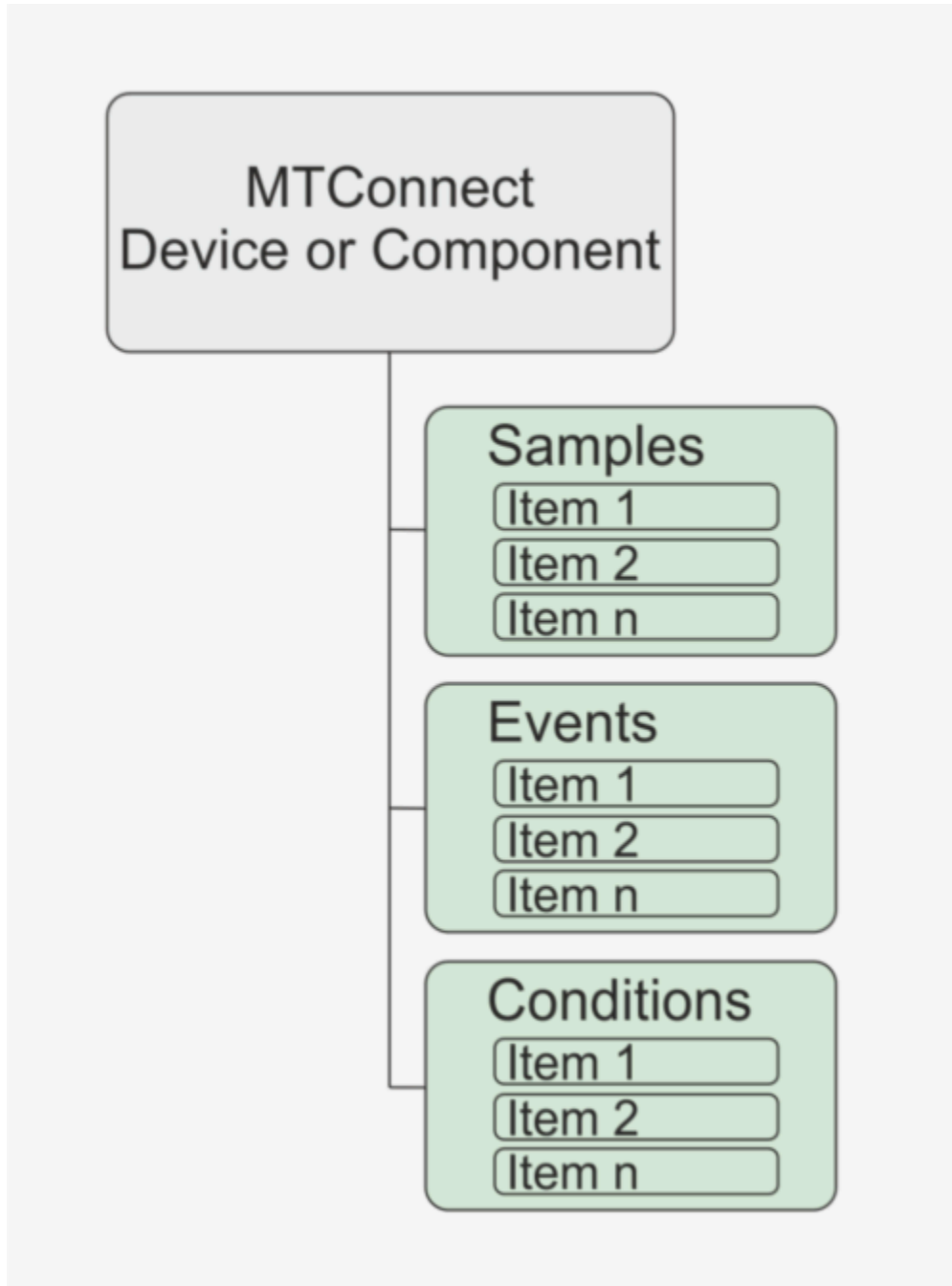
A single MTConnect Device or Component can expose one or multiple data items. These data items are classified into Samples, Events and Conditions.

How the OPC UA Server works

The following image contains clickable bullet points to help you navigate this topic. These hot spots lead you directly to the information you are looking for.

MTConnect Server Software Structure
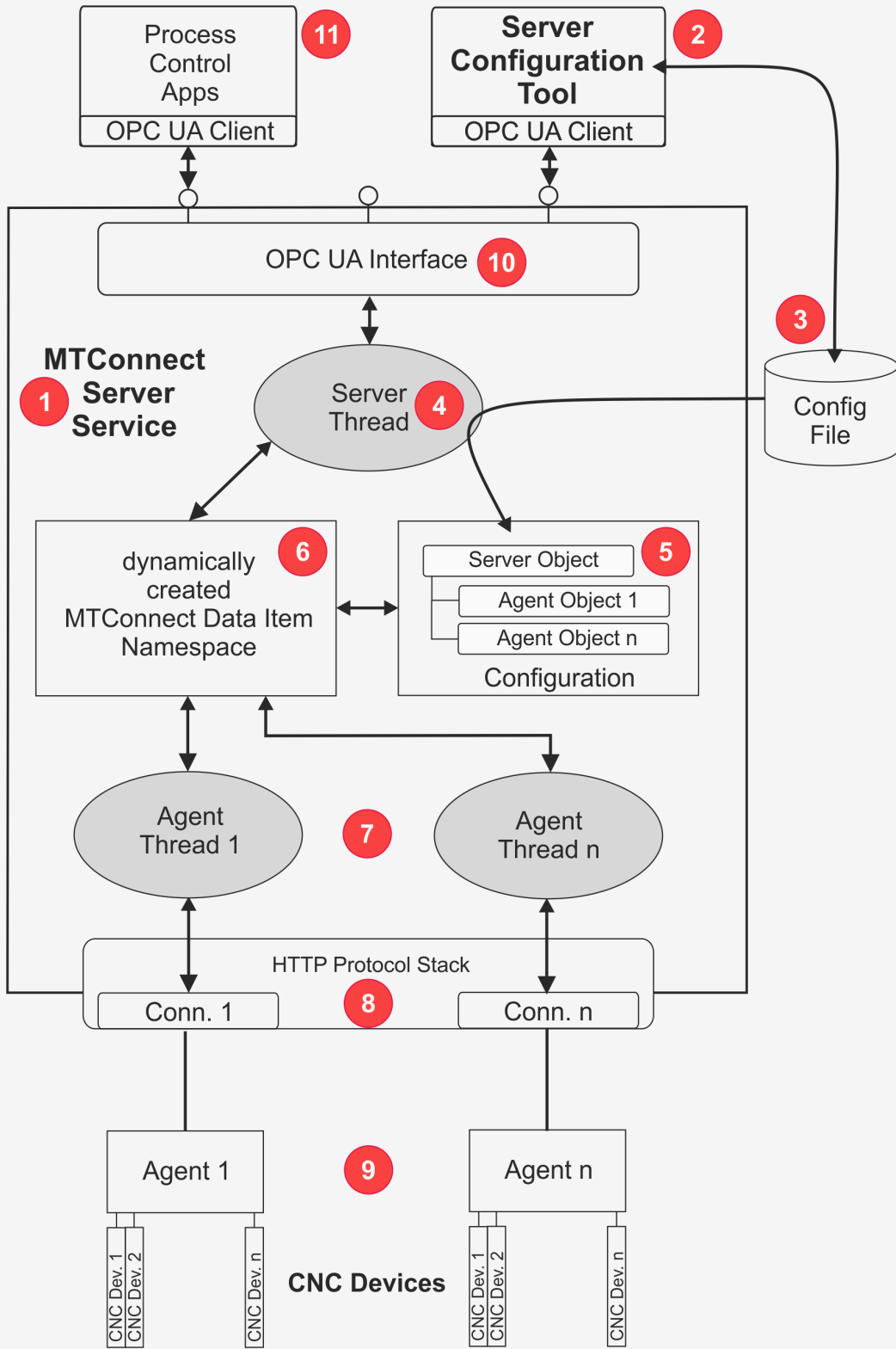
1 MTConnect Server Service

Is the core of the server. The Server Service performs the following tasks,

- Loads its configuration (MTConnect agents parameters, security settings etc.) from the configuration file.
- Establishes the connections to the MTConnect agents via HTTP protocol.
- Builds the MTConnect data item namespace from the *Probe* responses of the agents
- Listens for the process data the agents sent via *Sample* responses.
- Exposes the agent's process data through the OPC UA interface.

2 MTConnect Server Configuration Tool

Serves as a high-performance client /front end to the MTConnect Server Service with a graphical user interface for configuring and monitoring the server. The Server Configuration Tool directly modifies the MTConnect Server Service's configuration file and initiate the server service to a reload the modified configuration by calling a *Reload* method via OPC UA interface.

3 Configuration File

A XML file which contains the entire configuration (set of agents, security settings, etc.) of the driver. It is loaded by the server service during service start or when the server service's Reload method is called by the Server Configuration Tool. The configuration file is administrated by the Server Configuration Tool.

4 Server Thread

Is the main thread within the server service process. It loads the configuration, initializes the OPC UA server interface, starts the agent threads and coordinates the the internal message and data flow.

5 Server configuration objects

- **Server object** (Single instance): Manages agent objects and the overall state of the server.
- **Agent objects** (Multiple instances): Each agent is specified by its URI. The configuration of an agent is browsable via a so-called *Probe* request.

Server-to-Agent Communication

The following picture shows the request/response telegram sequence between the MTConnect driver and the agent.
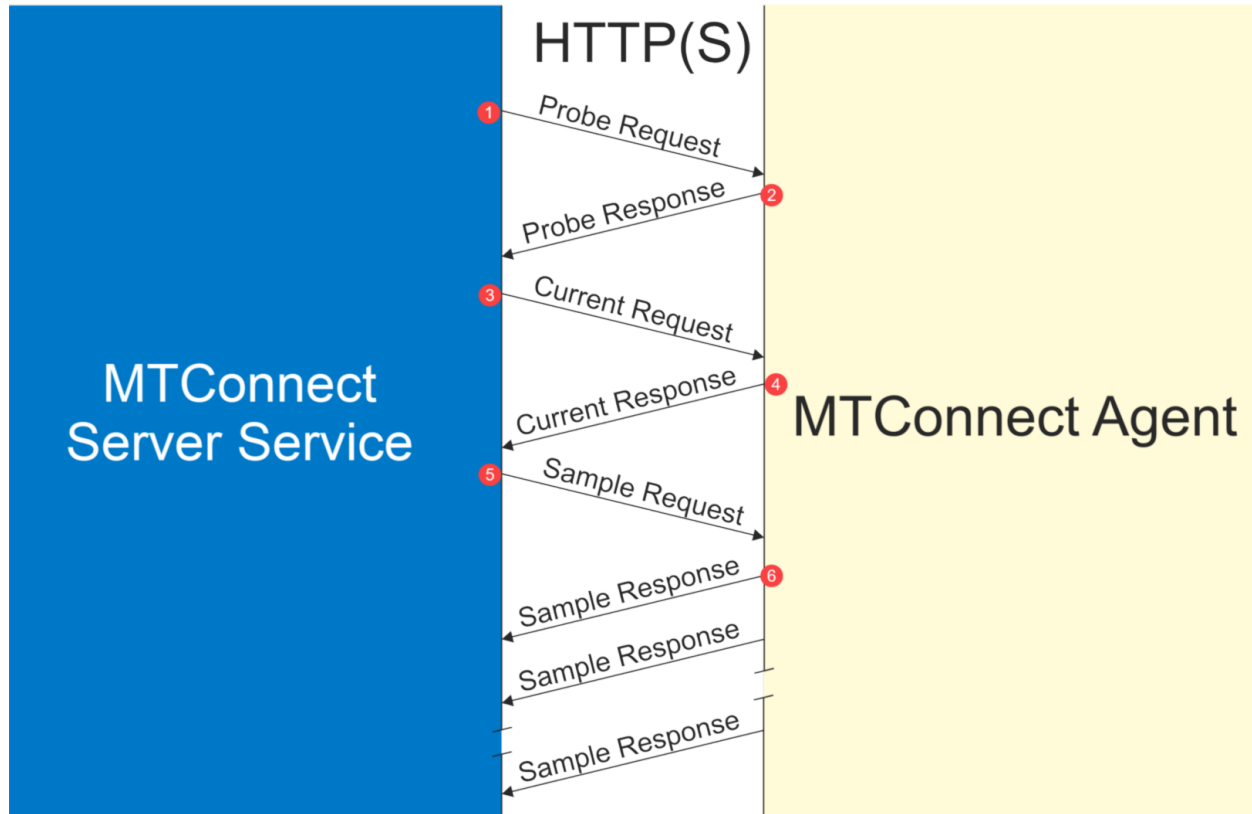
1 As the first step after startup, the server sends a ***Probe*** request to the agent to retrieve the agent's device and component configuration. For example: http://mtconnect.mazakcorp.com:5609/probe

2 The agent replies to the request with a ***Probe*** response telegram which contains the structure of its agents and their components and data items. The server uses this information to generate the OPC UA data model (name space) for this agent.

3 At the second step the server sends a Current request to the agent to retrieve the current values of all data items of the agent. For example: http://mtconnect.mazakcorp.com:5609/current

4 The agent replies to the request with a ***Current*** response telegram which contains the current values of all data items.

5 At the last step the server sends a ***Sample*** request to the agent. This *Sample* requests initiates the agent to cyclically send response telegrams whenever data items changes in value or state. For example: http://mtconnect.mazakcorp.com:5609/sample?interval=2000&count=1000&heartbeat=10000&from=3179164

6 The agent cyclically sends unsolicited ***Sample*** (response) telegrams. If no new data available for a time the server specifies in its *Sample* request telegram the agent sends a 'heartbeat' telegram to signalize to the server that it is still alive.

Getting Help

There are a number of different sources of help in the MTConnect OPC UA Server. In addition to this help file you can also access tutorials, the online user forum and GE Digital Software support. To get started, your main source of information should be this help file. We have designed it to provide all the information you will need for using the MTConnect OPC UA Server. Before contacting support, please make sure that you really can't find the information you need here. Thanks!

Displaying the Help

- The quickest way to display the help is to press F1. If context-sensitive help is available for the currently selected filed it will be displayed automatically.
- Some dialogs have a Help button that displays relevant information.
- Click the Help Button in the configuration tool Windows header to open the Help File.
- Select Show Help from the Help menu of the configuration tool's main menu.
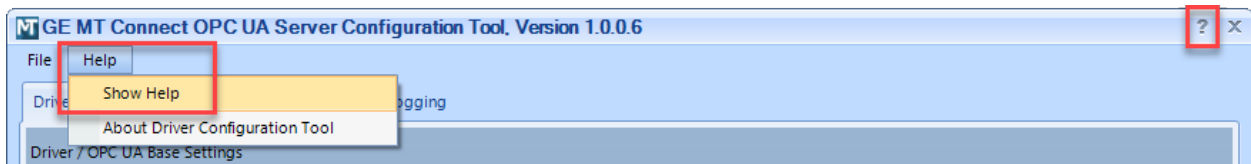
Chapter 3. Getting Started

Install the Software

The Setup program of the MTConnect OPC UA Server software is designed as a Setup Wizard which guides you through the setup procedure step-by-step. The setup program's file name is GE_MTConnectOPCUAServerSetup.msi. To start the Setup wizard either double-click on the setup file or select "Install" from the setup file's context menu. The following screen shots show all these steps in the order they occur during the setup procedure.

1. The first dialog of the Setup wizard shows the welcome text which contains the version number **1** of the MTConnect OPC UA Server which will be installed with this setup. If this is the version you want to install click the ***Next*** button **2** to start the setup wizard.
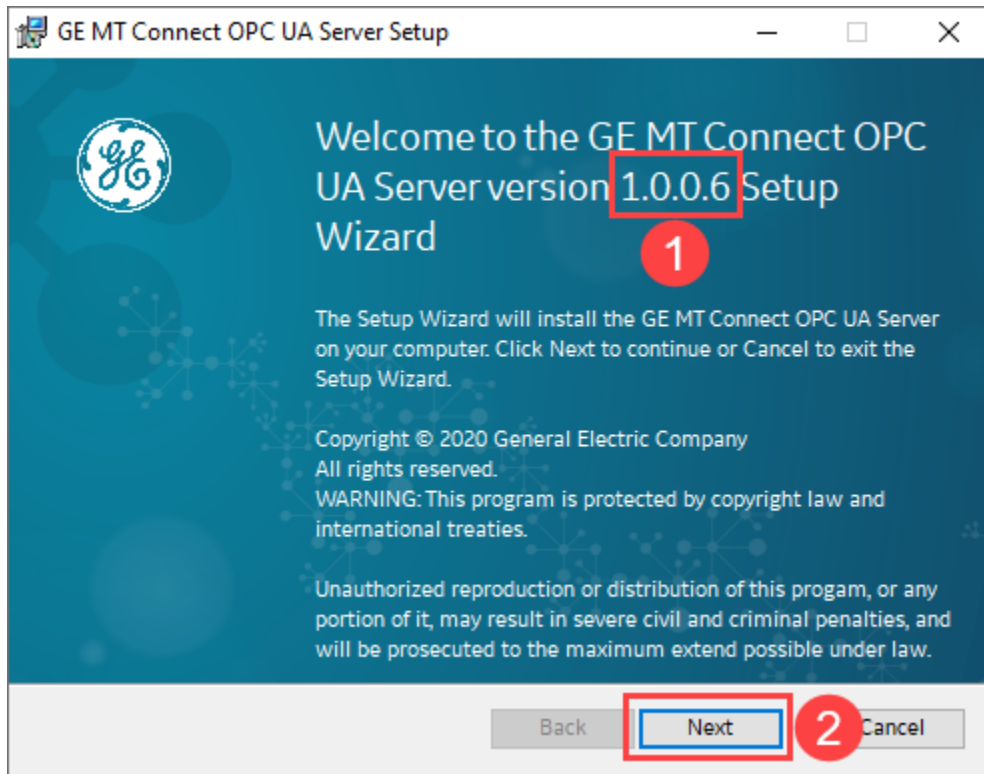
2. Please read the license terms **3** carefully! If required you can print out the license terms by clicking the ***Print*** button **4**. If you agree with these terms check the ***I accept...*** check box **5**. Only when this check box is checked the ***Next*** button **6** becomes enabled. Click the ***Next*** button to continue.
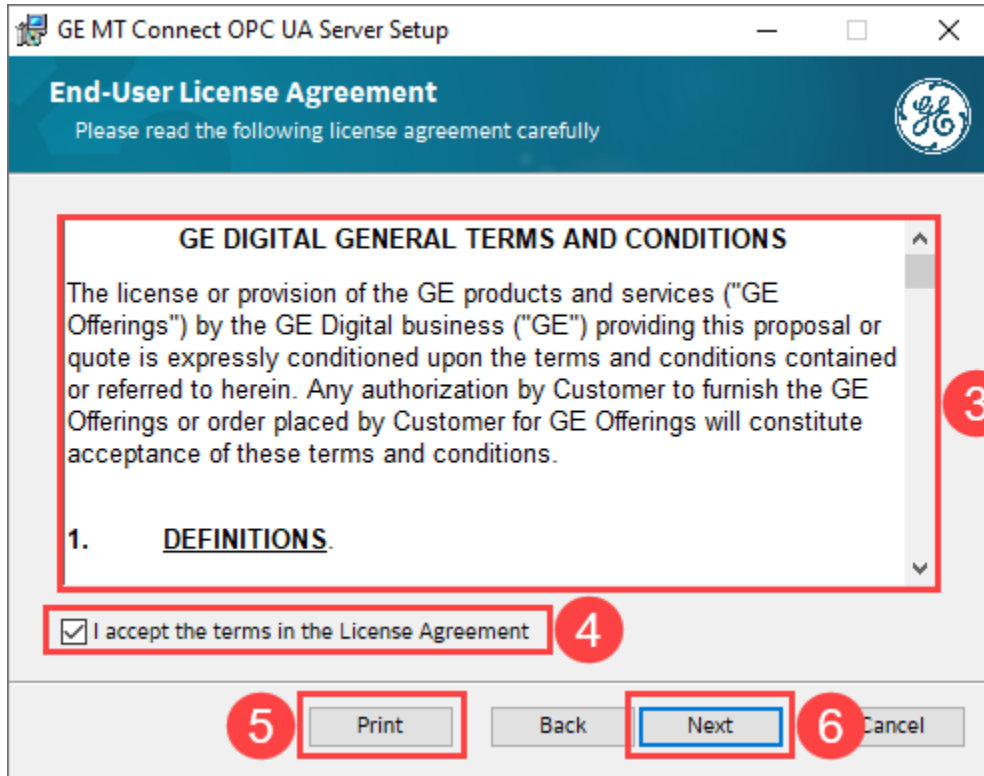
The setup wizard sets the installation folder for the MTConnect Driver software to **C:\Program Files (x86)\General Electric Company\MTConnect** as the default installation folder **7**. You can override this default folder by clicking the **Change** button **8** and selecting a new/different installation folder.

Click the **Next** button **9** to confirm the installation folder and to continue the setup.
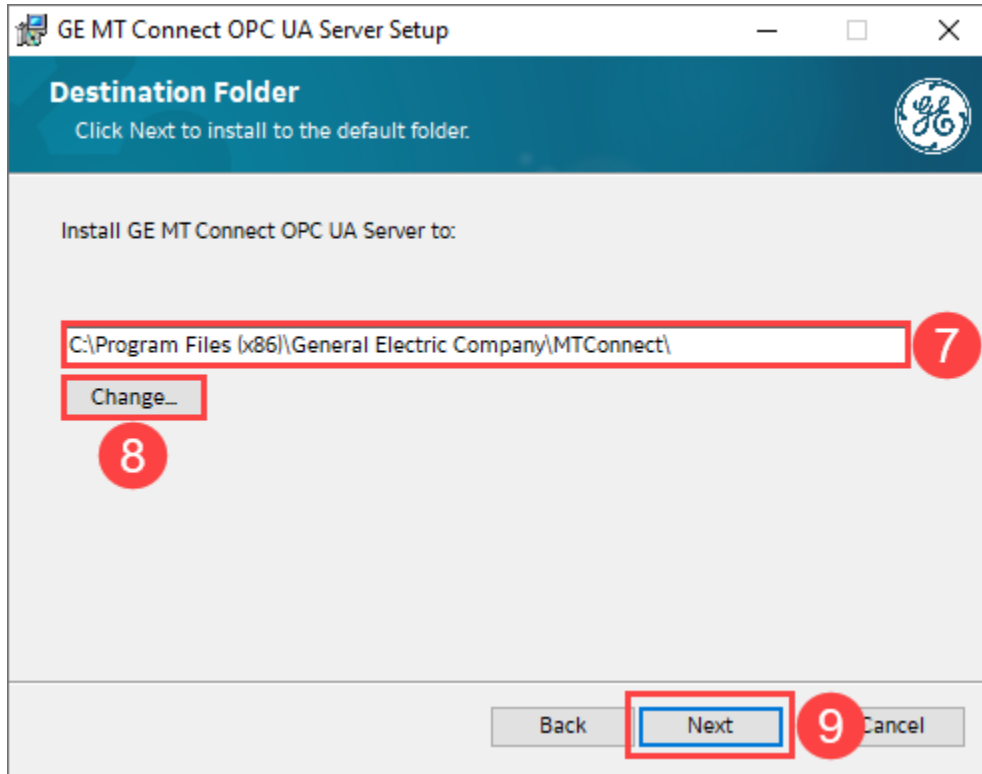
3. This Setup dialog allows you to set specific parameters for the MTConnect OPC US Server. The current version of the server only has one such parameter, namely the **TCP Port No**.⑩ used for the OPC UA Client-Server connections. The default port number is set to 48031 but you can override this number in case that the default number is already used by another OPC UA Server or other program.

> **ⓘ Tip:**
> Use the Microsoft Tool TCPView to check if a TCP port number is in use resp. free.
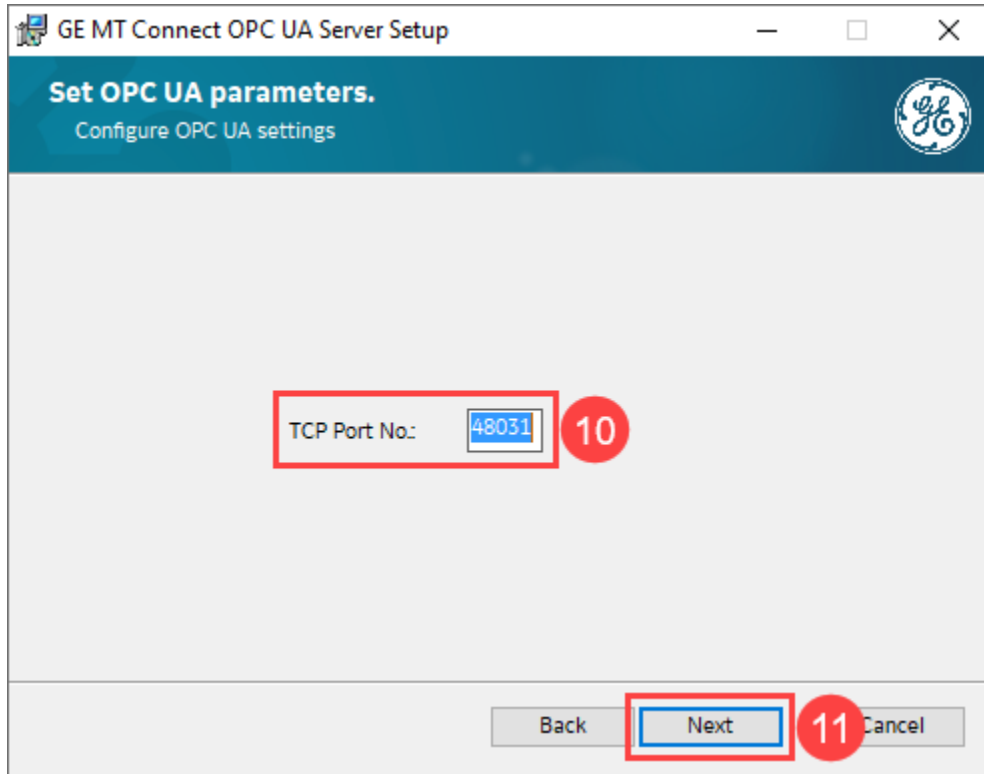
4. Click the Next button ⑪ to confirm the installation folder and to continue the setup.

5. When you are sure, that all installation settings are correct, then click the **Install** ⑫ button to start the installation process. You can click the **Back** button to go back to the previous setup dialogs and to change or review the settings.
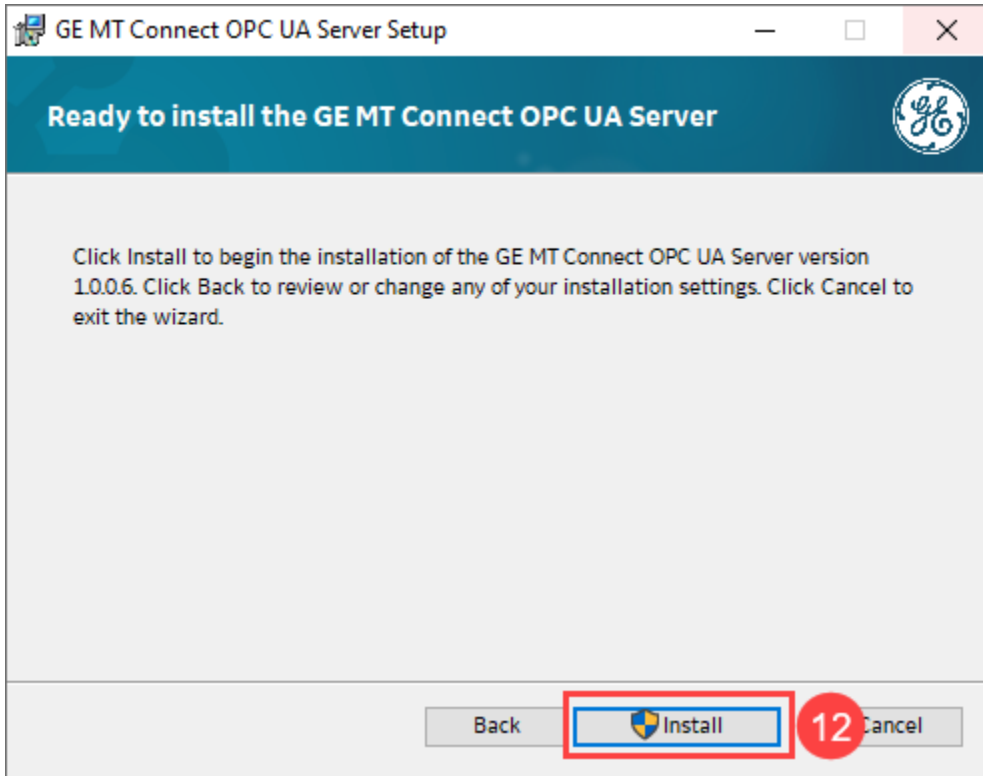
6. While the setup program is processing, the **Status** bar ⑬ show the progress of the installation and the current setup step.
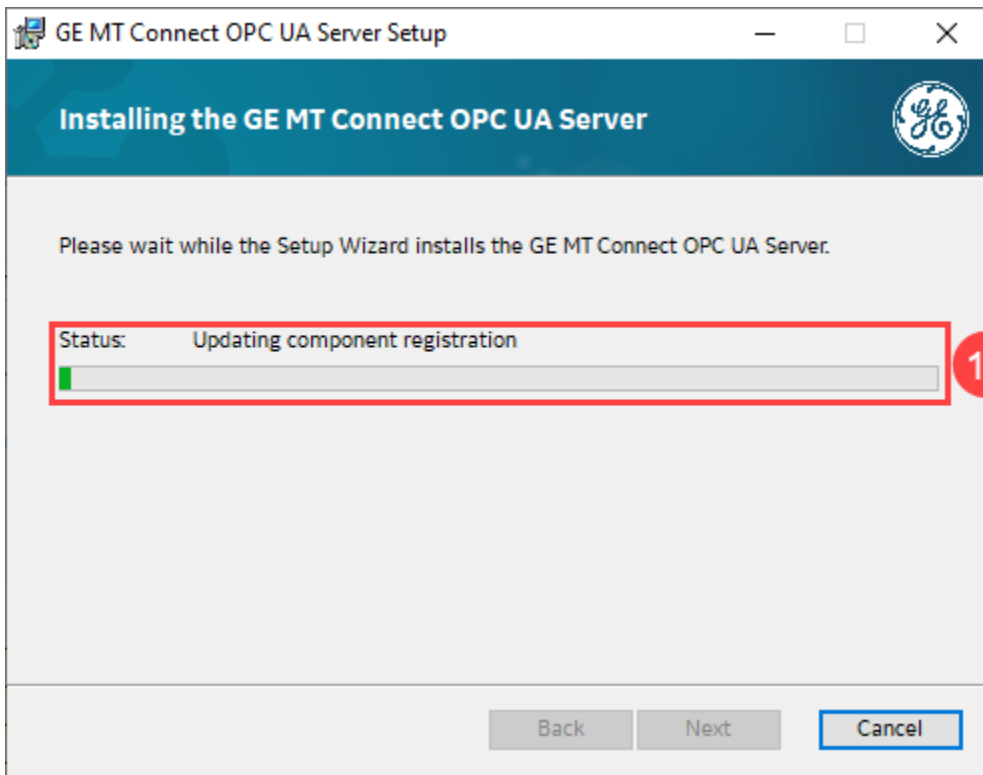
7. After the setup process is finished without any errors, this "Completed..." dialog will be displayed.

You can terminate the setup by clicking the Finish button 🔴14.
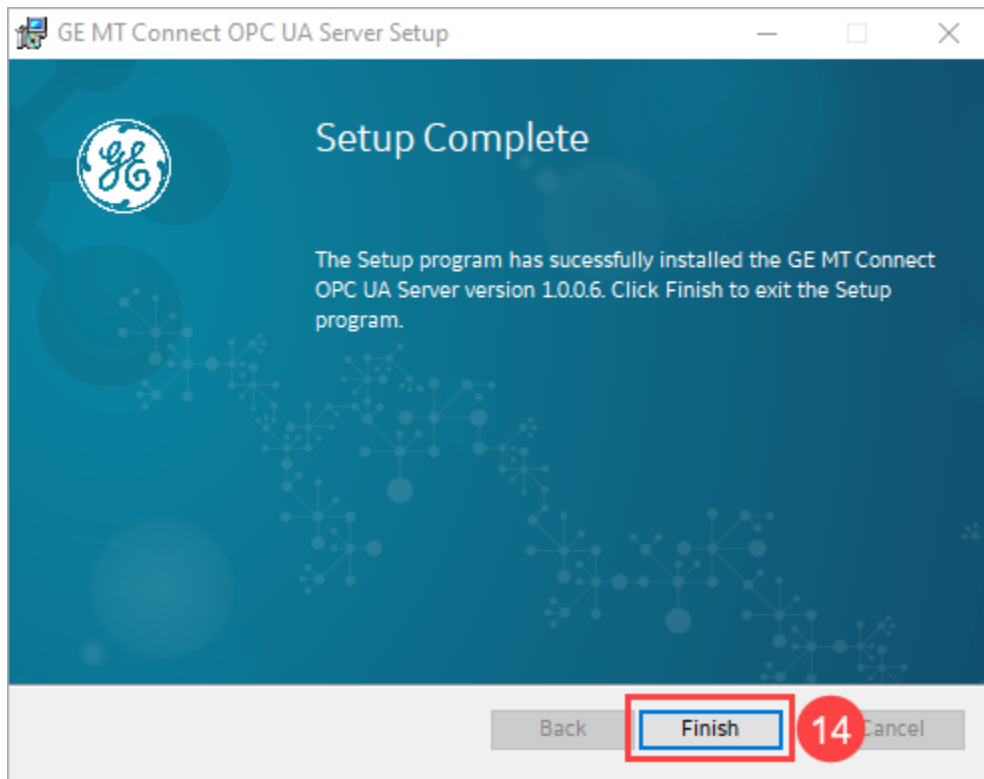
Verifying the Installation

To make sure that the setup actually has installed all software components properly you can work through the following checklist:

1. Installed Files:

Use the file explorer and check if the installation folder you specified in the Setup dialog contains the following files and sub folders:

- MTConnectServerConfigTool.exe
- MTConnectServerService.exe
- Opc.Ua.CertificateGenerator.exe
- MTConnectServerConfigTool.exe.config
- 129CCFLIC.dll
- MTConnectServerService.exe.config
- MTXMLDecoder.dll
- MTSharedClassLibrary.dll

- Telerik.WinControls.dll
- Telerik.WinControls.GridView.dll
- Telerik.WinControls.RadDock.dll
- Telerik.WinControls.UI.dll
- TelerikCommon.dll
- UnifiedAutomation.UaBase.dll
- UnifiedAutomation.UaClient.dll
- UnifiedAutomation.UaServer.dll
- MTConnect.chm
- logs (Folder)

2. Service Registration:

Use the Task Manager to check if the MTConnect OPC UA Server Service is installed and registered as a Windows service and if it is running. The following screen shot shows the expected entry in the list of services:
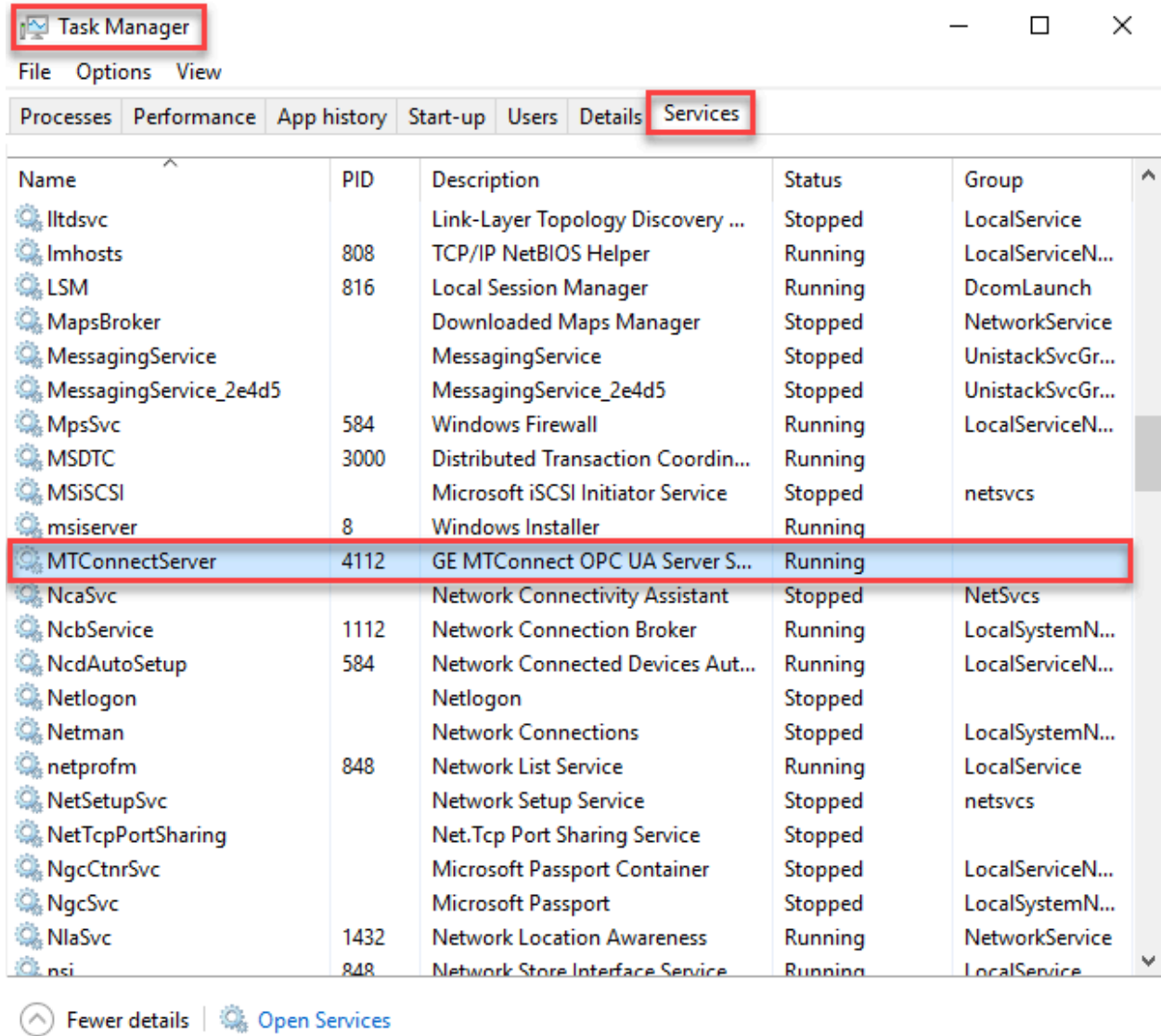
3. Configuration Tool Desktop Icon:

After a proper installation on the Windows Desktop the following program has to be found.
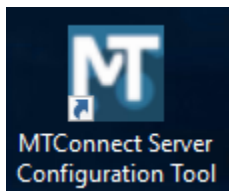
Furthermore the following Start Menu entry has to be found:
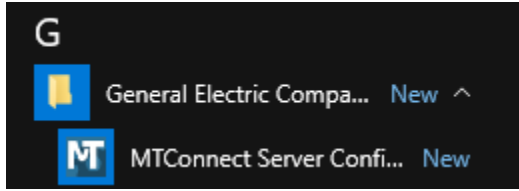
4. MTConnect Server Service Log File:

When the MTConnect Server Background service is running it generates log files. The default folder for these log files is the sub folder "Logs" of the installation folder of the server. The log file name is built from the prefix "MTCServer_" and the dynamic right part which is built by the current date in the format "<yyyy>_<mm>_<dd>.log". The initial log file (the one which was created after the server service was started immediately after the setup was finished) has to contain the following sequence of messages:

Chapter 4. Licensing

Licensing

The MTConnect OPC UA Server is licensed via GE's Common Licensing system. All licensing methods (Internet, local intranet, GE USB Hardware Key) are available.

> 📝 **Note:**
> The MTConnect Server runs in demo mode if not licensed. It can be configured with the Configuration Tool but it doesn't start the continous communication to the configured MTConnect Agents. Only Probe and Current data are requested at the agent but no Sample data.

Verifying the License

To check the current license state of your MTConnect Driver / OPC Server please execute the following steps:

1. **Start the GE License Client software**:Open the GE License Client. The **License Client** can be found in the General Electric start folder ① within the Windows Start Menu.
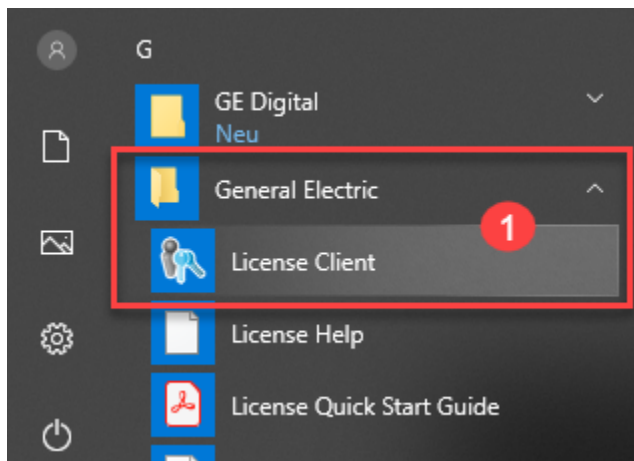
2. **Check the MTConnect license entry in the License Client**: Click on the *View Licenses* tab ② and select *Drivers* ③ from the *Licensed Products* list. In the *License Information* list you should find the entry **MTConnect** and this entry has to be set **Enabled** ④.
Starting with version 18.5.1553.0 of the License Client software, the MTConnect Driver has its own license entry in the licensed Drivers list.

3. **Check the MTConnect Driver Log Viewer for a license message**:

If the GE License Client shows a valid (enabled) MTConnect license, then you can check if this license is properly detected by the MTConnect Driver. When the MTConnect Driver has detected a valid license, it sends a license information message to the log viewer window of the Configuration Tool.

Start the MTConnect Server Configuration Tool and click on the *Logging* Tab 5 . In the MTConnect Server Service Log Viewer window scroll to the top and/or look for a driver start message 6 . 6 lines below this start message the window should show a message line which contains the information about the current license mode 7 .
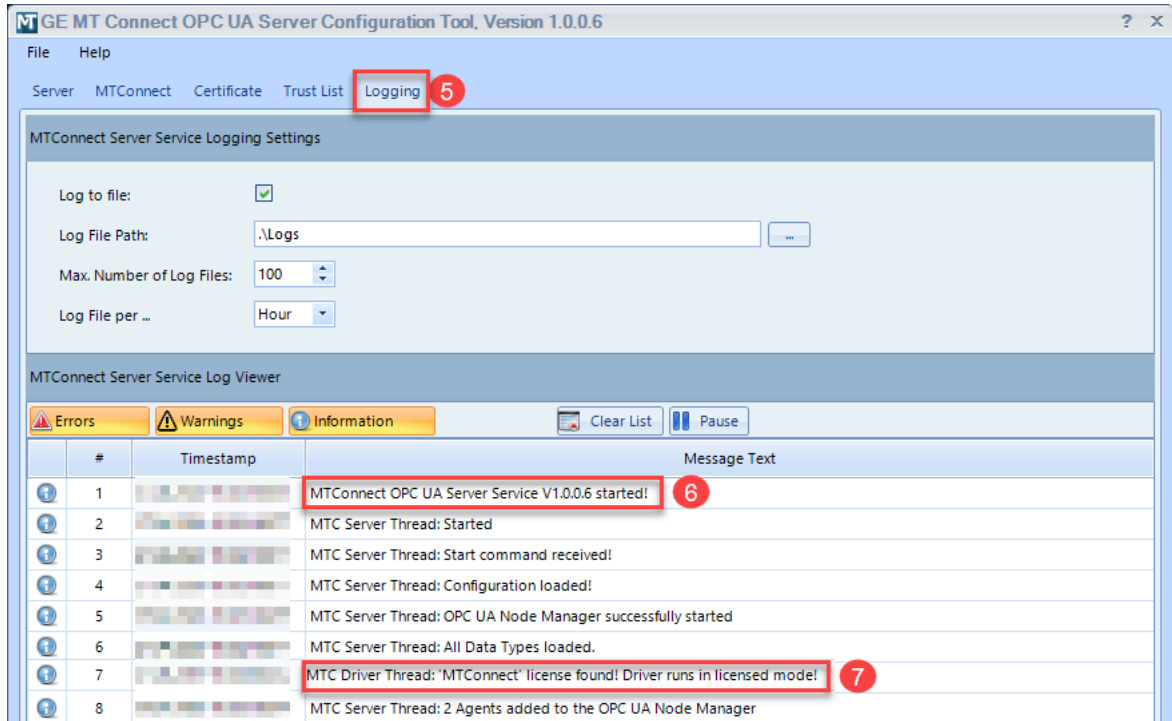
If the license was found the message is: MTC Server Thread: **'MTConnect' license found!** Server runs in licensed mode!

If no license was found the message is: MTC Server Thread: **No 'MTConnect' license found! Server** runs in demo mode!

Chapter 5. MTConnect Server Configuration Tool

Configuration Tool Overview

The MTConnect Server Configuration Tool is your main configuration utility for setting up and maintaining the MTConnect Server Service. It provides a means to specify the properties of the MTConnect agents. The configuration tool is a client of the MTConnect server service. The MTConnect server service maintains the driver's agent objects and performs all required functions for communicating with the agents. The configuration of the MTConnect server service is stored in a XML configuration file which is read by the server service at start-up or by request by the configuration tool. The configuration tool is the user front-end to modify the XML configuration file of the server service.

The following image shows this relation between Configuration Tool and Driver Service:
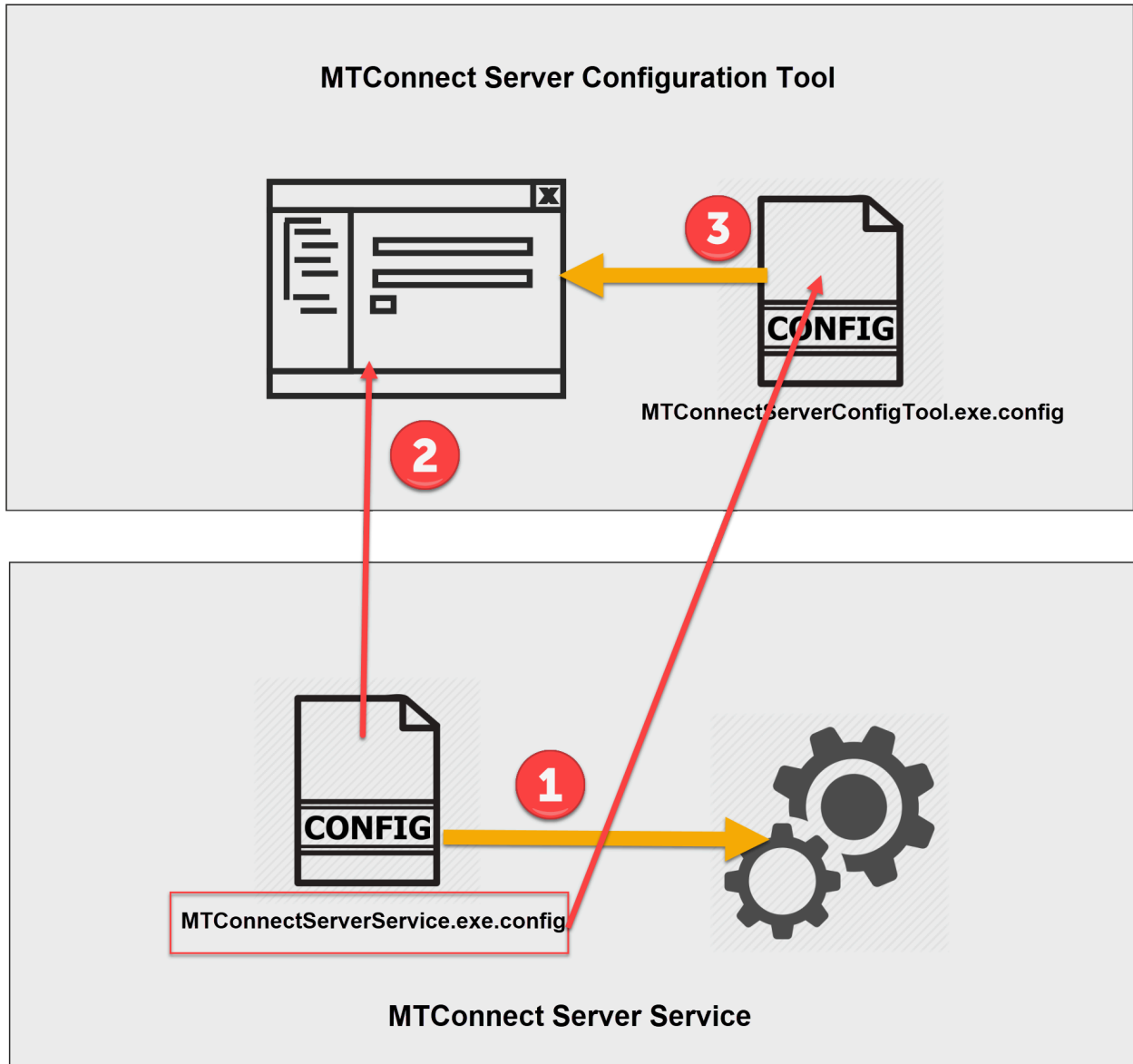
① The MTConnect Server Configuration Tool reads its configuration from the configuration file *MTConnectServerConfigTool.exe.config*.

> ✎ **Note:**
> The configuration file of a program always has the same name as the program executable (EXE) file with the extension *.config*. It has to be located in the same folder as the program's EXE file.

② MTConnect Server Service reads its configuration from the configuration file **MTConnectServerService.exe.config**. This configuration contains all OPC UA related parameters as well as the entire MTConnect configuration like agents, event types, trace settings etc.

The configuration settings are read on start-up of the server service.

3 The server configuration tool edits the configuration file of the server service.

> ✏️ **Note:**
> The configuration file of the server service contains a well-formed XML structure, To keep this structure consistent, only the configuration tool is allowed to make changes in the server service's configuration file.

Do not modify the configuration file "by hand" via a XML- or text editor!

The path and name of the server service's configuration file is stored as a configuration value in the configuration tool's configuration file. The following figure shows the

key (**MTConnectServerServiceConfigFilePathAndName**) and

value (**C:\Program Files (x86)\GE Digital\MTConnect\MTConnectServerService.exe.config**)

within the **appSettings** section of the configuration tool's default configuration file.

```xml
<?xml version="1.0" encoding="utf-8"?>
<configuration>
  <configSections>
    <section name="UaApplicationConfiguration" type="UnifiedAutomation.UaBase.ApplicationConfigurationSection,UnifiedAutomation.UaBase" />
  </configSections>
  <appSettings>
    <add key="MTConnectServerServiceConfigFilePathAndName" value="C:\Program Files (x86)\General Electric Company\MTConnect\MTConnectServerService.exe.config" />
    <add key="LogFilePath" value="" />
    <add key="LogViewerMaxLines" value="1000" />
    <add key="UseWebHelp" value="0" />
    <add key="WebHelpPort" value="8805" />
    <add key="WebHelpBasePath" value="C:\Program Files (x86)\General Electric Company\MTConnect\help\" />
    <add key="UseWebHelpRemote" value="0" />
    <add key="WebHelpRemotePath" value="http://example.com" />
    <add key="ClientSettingsProvider.ServiceUri" value="" />
  </appSettings>
</configuration>
```

The *path* (left) portion of the value is automatically set by the setup program to the selected installation folder. The *file name* (right) portion is fixed. It is built by the fixed name of the server service program name "MTConnectServerService.exe" and the extension ".config". This configuration value may not be changed "by hand". If you want to move the MTConnect Server to another folder, you must uninstall and reinstall the program via the setup program!

Start the MTConnect Configuration Tool

1. To start the MTConnect Configuration Tool from **Windows Start Menu**, open the Windows Start

   Menu, navigate to the General Electric Company program folder and expand the folder
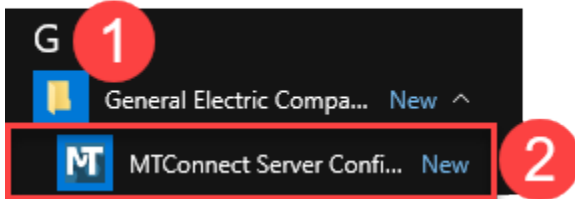
2. Click on the MTConnect Server Configuration Tool entry to start the Configuration Tool.
3. Alternatively, to start the MTConnect Configuration Tool from **Desktop**, Select the icon
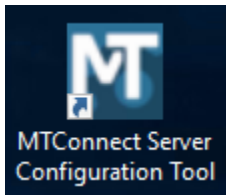
 on your desktop and start the program by double-clicking this icon.

Configuration Tool - The User Interface

The Configuration Tool Window is organized in five main display areas: The header line, the main menu
tab line, the tab window, the main operation button area and the log viewer window.
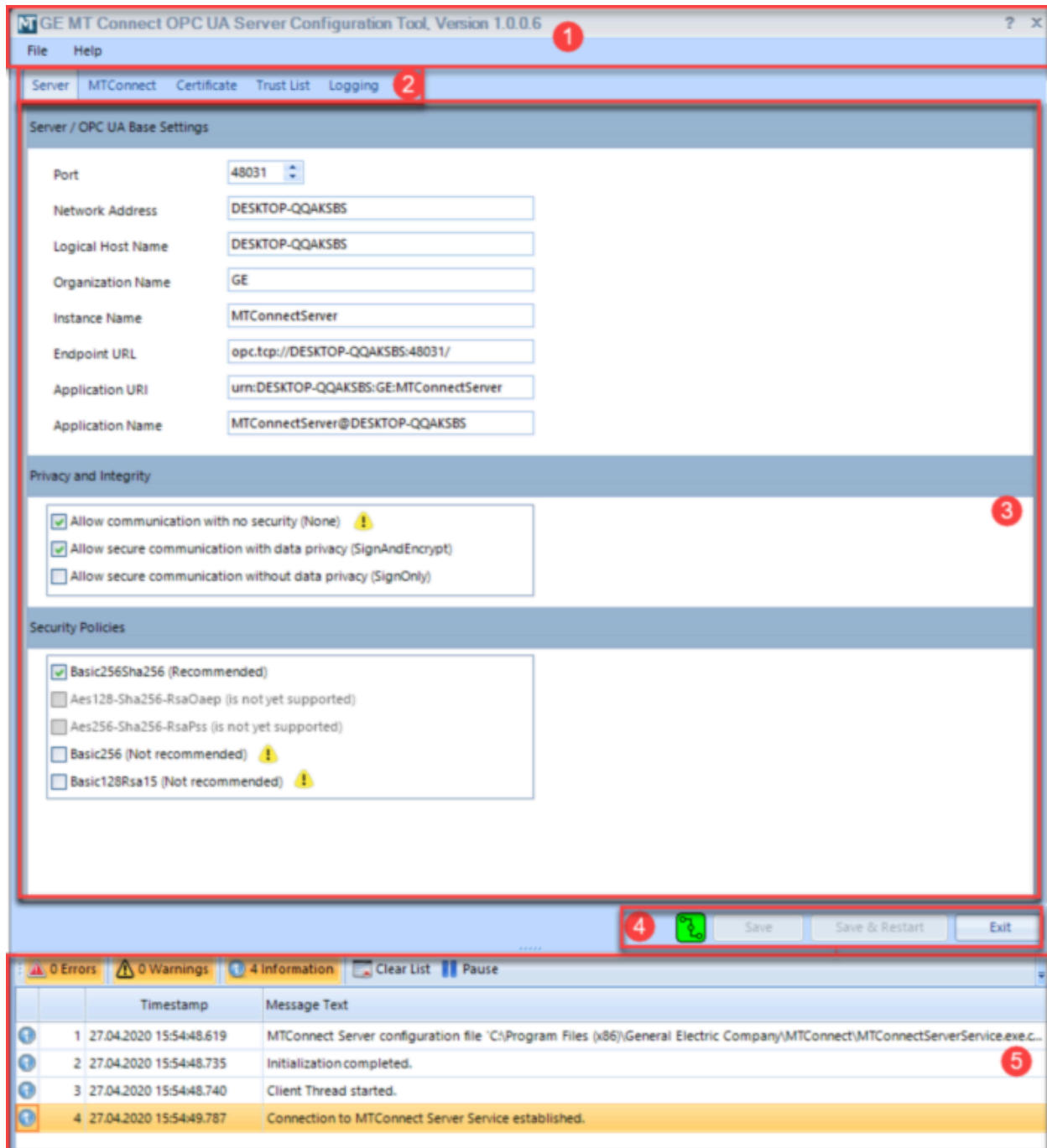
❶ The Header Line

The header line shows the program name and the version information.

The main menu item *File* contains the *Exit* item to close the program. The main menu item *Help* contains the two items *Show Help* (opens the help system of the program) and *About Server Configuration Tool* (shows the *About* dialog of the program). The button with the question mark icon in the top right corner

also leads to the online help system of the driver. The right most button with the exit icon is a second way to closes the program.

② The Main Tab Line

The various functions of the configuration tool are grouped and organized on individual dialogs. These dialogs can be opened (be brought into the foreground) via these tabs.

① General Server *(on page 50)* information, Privacy, Integrity and Security settings.

② Configuration of MTConnect MTConnect Settings *(on page 53)* Agents, Sample, Event and Enum types.

③ Management of Client and Server Certificates *(on page 73)*.

④ Trust List *(on page 76)* Management.

⑤ Configuration of the Serverr Service Logging *(on page 79)* options and Log Viewer Window for Server Service messages.

The Tab Window

In this area the tab specific dialogs are displayed.

The Main Operations Buttons

① This Icon indicates the current connection status between the configuration tool and the server service.

- The configuration tool is not connected to the server service. Possible reason: the server service is not running.

- The server service is running and the configuration tool is connected to it.

The configuration file of the server service and thus all changes you made will be saved.

The configuration file of the server service and thus all changes you made will be saved and the server service is notified about the new configuration. The server service immediately reloads the configuration file and reinitialize its database (OPC UA namespace) based on the new configuration settings.

Terminates the configuration tool (but not the server service!).

The Log Viewer

The Log Viewer is the Window of the configuration tool. All information messages, warnings or error messages of the configuration tool are displayed in this window.

Configuring the Server Service with the Configuration Tool

The various functions of the configuration tool are grouped and organized on individual dialogs. These dialogs can be opened (be brought into the foreground) via these tabs.

General Server *(on page 50)* information, Privacy, Integrity and Security settings.

Configuration of MTConnect *(on page 53)* Agents, Sample, Event and Enum types.

Management of Client and Server Certificates *(on page 73)*.

Trust List *(on page 76)* Management.

Configuration of the Serverr Service Logging *(on page 79)* options and Log Viewer Window for Server Service messages.

Driver/OPC UA Settings

Server / OPC UA Base Settings

Port	48031
Network Address	DESKTOP-QQAKSBS
Logical Host Name	DESKTOP-QQAKSBS
Organization Name	GE
Instance Name	MTConnectServer
Endpoint URL	opc.tcp://DESKTOP-QQAKSBS:48031/
Application URI	urn:DESKTOP-QQAKSBS:GE:MTConnectServer
Application Name	MTConnectServer@DESKTOP-QQAKSBS

Privacy and Integrity

- ☑ Allow communication with no security (None) ⚠
- ☑ Allow secure communication with data privacy (SignAndEncrypt)
- ☐ Allow secure communication without data privacy (SignOnly)

Security Policies

- ☑ Basic256Sha256 (Recommended)
- ☐ Aes128-Sha256-RsaOaep (is not yet supported)
- ☐ Aes256-Sha256-RsaPss (is not yet supported)
- ☐ Basic256 (Not recommended) ⚠
- ☐ Basic128Rsa15 (Not recommended) ⚠

Port

The TCP port on which the MTConnect OPC UA server is listening for connection requests of the OPC UA clients. The default port is 48031. The default port number is set during the MTConnect setup.
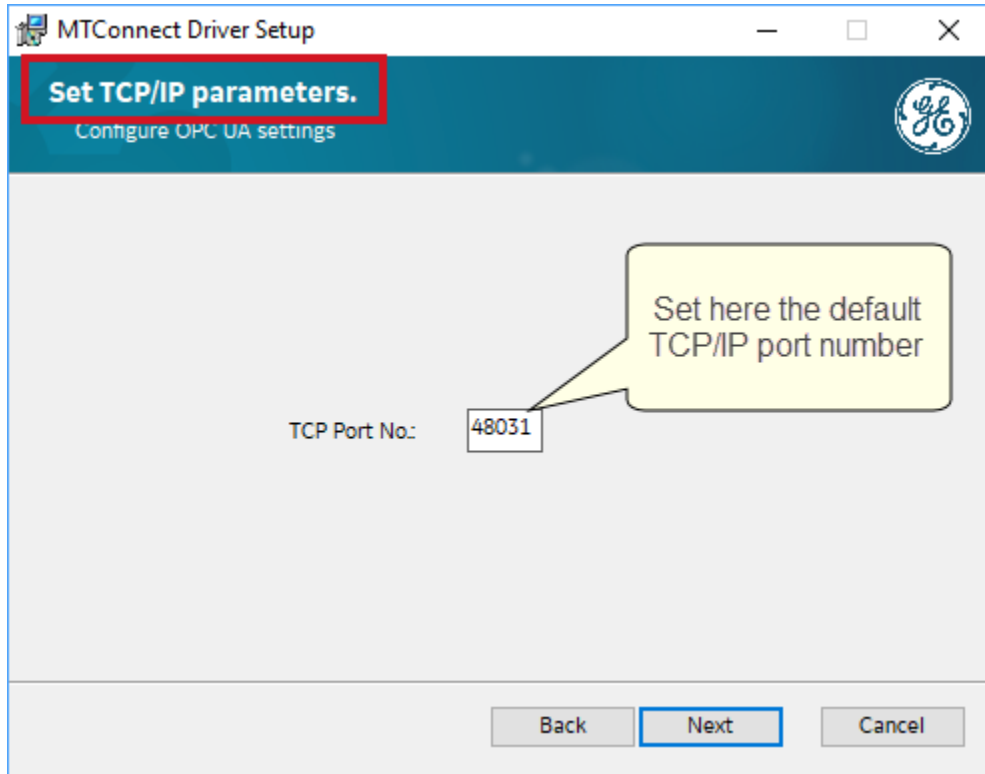
You can change the default value here. Make sure that the new port number is not yet used by another program/service!

- **Network Address**

  The DNS name or IP address for the machine where the MTConnect OPC UA Server is running. This address represents how OPC UA clients try to locate the MTConnect OPC UA Server.

- **Logical Host Name**

  The logical name for the machine where the MTConnect OPC UA Server is running. The value of this field is the 2nd part of the Application URI. With any change in this field the Application URI will be updated automatically

- **Organization Name**

  The name of the organization that is deploying the MTConnect OPC UA Server. The value of this field is the 3rd part of the Application URI. With any change in this field the Application URI will be updated automatically

- **Instance Name**

A unique name for the application instance of the MTConnect OPC UA Server. The value of this field is the 5th part of the Application URI. With any change in this field the Application URI will be updated automatically.

- **Endpoint URL**

The network endpoint which OPC UA clients use to communicate with the MTConnect OPC UA Server.

This field is read-only. It is a concatenation of the fixed prefix "opc.tcp" the *Logical Host Name* and the configured *Port* number.

- **Application URI**

A unique identifier for the MTConnect OPC UA Server.

This field is read-only. It is a concatenation of the fixed prefix "urn" the *Logical Host Name, the Organization Name,* the (fixed) *Product Name* and the *Instance Name*.

- **Application Name**

The name of the MTConnect OPC UA Server application. This name appears when OPC UA clients browse for MTConnect OPC UA Servers on a network.

This field is read-only. It is a concatenation of the *Instance Name and the Logical Host Name.*

OPC UA Privacy and Integrity Settings

- **Allow communication with no security**

Not recommended as it does not use a certificate to secure communications between client and server. For use only in a non-production environment.

- **Allow secure communication with data privacy**

If selected, ensures all traffic is kept private and that clients are authenticated.

- **Allow secure communication without data privacy**

If enabled, all network traffic is visible to eavesdroppers. However, clients can be authenticated.

OPC UA Security Policies Settings

- **Basic256Sha256**

  This policy is acceptable and more likely to be supported by older applications.

- **Aes128-Sha256-RsaOaep**

  This policy offers good security and is faster than the most secure policies; however, older applications will not support it. The current version of this OPC UA Server doesn't support this policy.

- **Aes256-Sha256-RsPss**

  This policy is the most secure available; however, older applications will not support it. The current version of this OPC UA Server doesn't support this policy.

- **Basic256**

  This policy has theoretical problems and is not recommended.

- **Basic128Rsa15**

  This policy has known vulnerabilities and should not be used unless absolutely necessary.

MTConnect Settings

All dialogs for the MTConnect related settings like Agents and Sample and Event types are summarized in the MTConnect tab page.
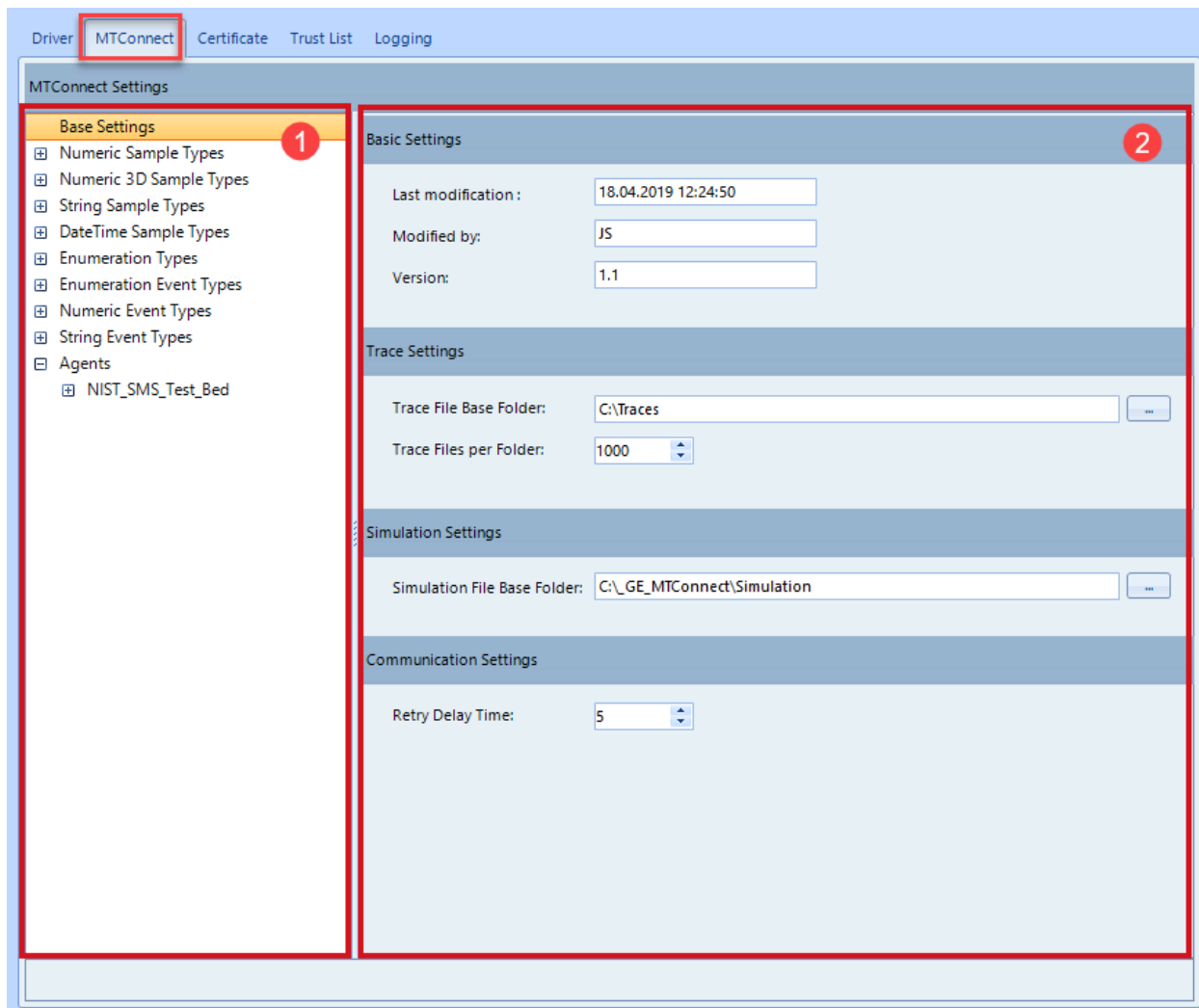
The MTConnect Tab page is divided into two main parts:

 The Tree View which organizes the different MTConnect configuration items in a tree structure.

Sample Types:

Event Types:

-
-
-

Enum Types:

-

Agents:

-
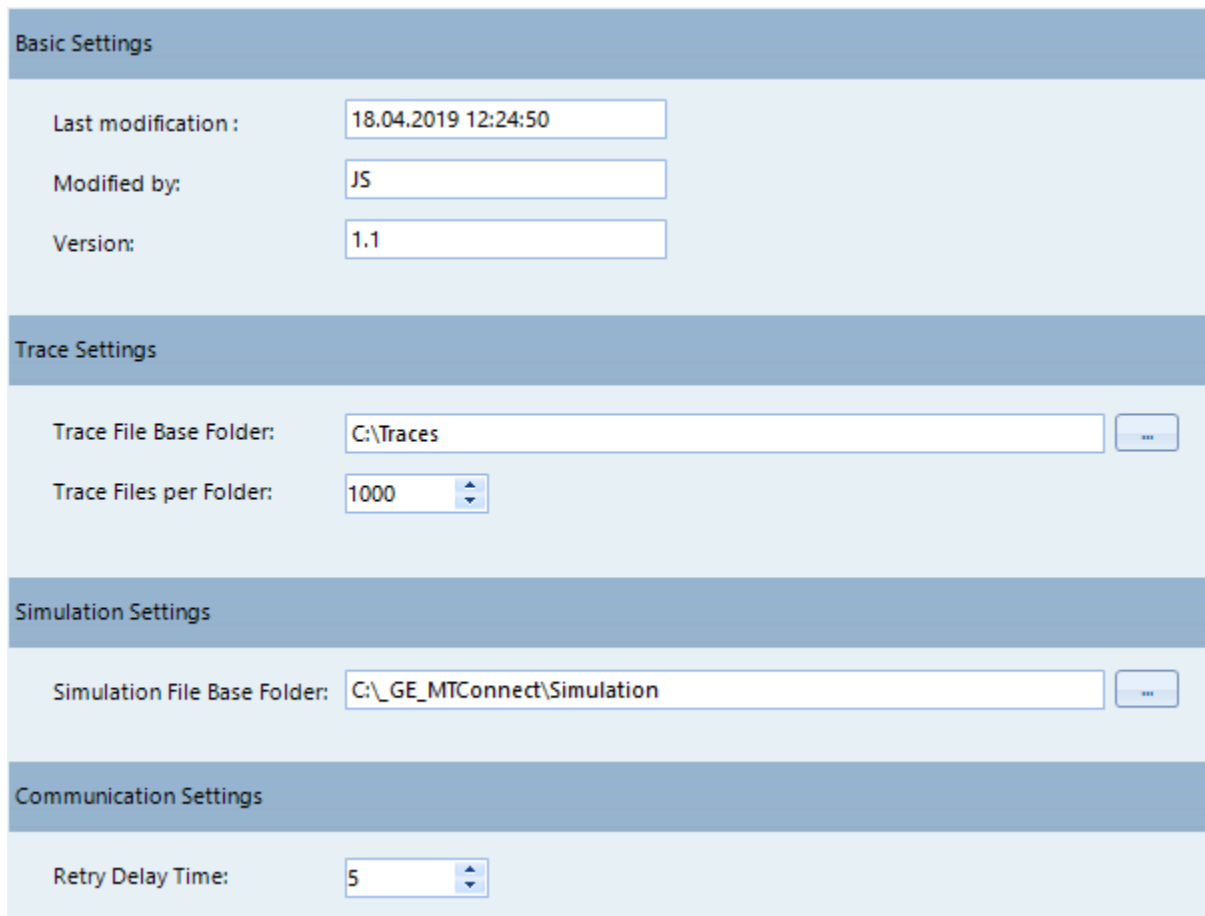
2 The Dialog panel which is dynamically loaded with a specific dialog for the different MTConnect configuration items.

Base Settings

Base Settings

- **Last modification**

  This is a read-only filed which displays the date and time the configuration file most recently was saved.

- **Modified by**

  This field can be used to enter the signature of the user who most recently has modified the configuration.

- **Version**

  This field can be used to enter a version string of the modified the configuration.

Trace Settings

The built-in trace functionality of the MTConnect server allows to log the MTConnect XML data streams received via HTTP from the agent(s). The tracing can be set individually for each agent and can be set separately for MTConnect *Probe*, *Current* and *Sample* responses.

Each XML data stream is saved into a separate file. Each agent has its individual trace file folder. All agent-related trace file folders have a common base folder. Under the agent sub-folder a "PROBES" folder will be created which contains all *Probe* responses. Each device of an agent has its individual trace file folder and at this level the two folders "CURRENT" and "SAMPLES" will be created to store the *Current* and *Sample* responses. The following two parameters are basic trace parameters. See Agent's Trace Settings for detailed information about the agent specific trace parameters.

- **Trace File Base Folder**

  The base folder for the trace files. This is a read-only field. To change this folder click on the

  Browse button and select an new folder. If the tracing is enabled for an agent, then this base folder is extended by the trace folder name for the specific agent.

- **Trace Files per Folder**

  To avoid a lack of disk space due to large and unlimited trace files, the number of trace files in the agent's CURRENT and SAMPLE trace folder is limited by this parameter. The number of files in the agent's PROBE folder is not limited. Valid range is 1 to 1000.

Simulation Settings

- **Simulation File Base Folder**

  The built-in simulation functionality of the MTConnect driver allows to provide the driver with file data streams instead of receiving MTConnect data streams via HTTP protocol. The simulation can be set individually for each agent. Each agent has its individual simulation file folder. All agent-related simulation file folders have a common base folder. The file data streams have to have the same XML structure as the online streams received via HTTP from a agent. Three different file names are allowed for the three MTConnect data stream types:

  - Probe.XML for a Probe response data stream
  - Current.XML for a Current response data stream
  - Sample.XML for a Sample response data stream

The following parameter is basic simulation parameter. See Agent's Simulation Settings for detailed information about the agent specific simulation parameters.

- **Simulation File Base Folder**

The base folder for the simulation files. This is a read-only field. To change this folder click the

Browse button and select an new folder. If the simulation is enabled for an agent, then this base folder is extended by the simulation folder name for the specific agent.

Communication Settings

- **Retry Delay Time**

This parameter specifies the delay time the driver waits before it retries to connect to an agent in case that the agent has not replied to the previous *Probe*, *Current* or *Sample* request. Valid range is 1 to 10000 minutes.

Sample Types

To achieve maximum flexibility with regard to future extensions and/or changes in the MTConnect Standard, the server allows to configure all sample item types specified in the MTConnect Standard. The predefined sample item type set which comes with the MTConnect server installation includes all sample item types defined in MTConnect Standard version 1.4. The complete list of the predefined sample item types you can find in topic Supported MTConnect Standard.

The sample types are subdivided into four groups, depending on the data type of the sample's value.

- **Numeric** *(on page 59)* **sample types**

Most of the MTConnect sample types expose a numeric value. This value either is a floating point value (of data type Float *(on page 84)* or Double *(on page 84)*) or an integer value (data type Int32 *(on page 84)* or UInt32 *(on page 84)*).

- **Numeric 3D** *(on page 60)* **sample types**

The MTConnect sample data item PATH_POSITION represents a X/Y/Z coordinate, means this data item exposes three position values of type Double *(on page 84)*.

- **String** *(on page 61)* **sample types**

If a sample data item exposes a value which can't be coded as numeric value the String *(on page 84)* sample type can be used. Even though the current MTConnect Standard 1.4.0 doesn't

specify any string sample types, the MTConnect server is already prepared to support this sample data type

- **DateTime** *(on page 62)* **sample types**

    A few sample data items expose date, time, date and time or even time span values.

You can extend the predefined sample type set by additional types as required but we strongly recommend to not change the predefined types! If you need to extend the sample type set by a agent specific sample type we strongly recommend to add such an agent specific type to the agent's sample type set. The global sample type set should only contain sample types which specified in the MTConnect Standard.

Numeric Sample Types

Numeric sample types report data which representing a continuously changing or analog data value. The data provided may be a scalar floating point number or integer value.

The predefined numeric sample type set which comes with the MTConnect server installation includes all numeric sample types defined in MTConnect Standard version 1.4. The complete list of the predefined numeric sample types you can find in topic Supported MTConnect Standard.

Type Name

The name of the sample type as defined in the MTConnect standard. This name must match exactly the type name in the MTConnect standard. If a type has one or multiple sub types, then multiple entries have to be defined, one for each type/sub type pair.

Sub Type Name

The name of the sample sub type as defined in the MTConnect standard. This name must match exactly the type name in the MTConnect standard. If no sub type is specified in the MTConnect standard then this field has to be empty.

Data Type

To supply the OPC UA client with the data value appropriate for the data value the MTConnect agent reports, the data type for a specific type/sub type can be set individually. The following picture shows the drop down list of the available data types:
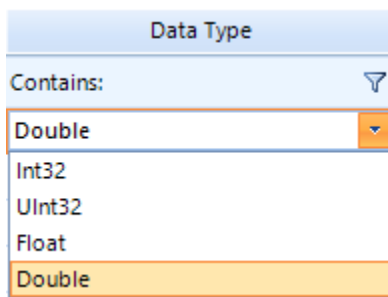
Numeric 3D Sample Types

Numeric 3D sample types report data which representing a set of 3 floating point numbers representing a point in Three-dimensional (3D) space. The three data values provided are double precision floating point values.

The predefined numeric 3D sample types which comes with the MTConnect server installation includes all numeric 3D sample types defined in MTConnect Standard version 1.4. The complete list of the predefined numeric sample types you can find in topic Supported MTConnect Standard.

Type Name

The name of the sample item type as defined in the MTConnect standard. This name must match exactly the type name in the MTConnect standard. If a type has one or multiple sub types, then multiple entries have to be defined, one for each type/sub type pair.

Sub Type Name

The name of the sample item sub type as defined in the MTConnect standard. This name must match exactly the type name in the MTConnect standard. If no sub type is specified in the MTConnect standard then this field has to be empty.

String Sample Types

String sample types report data which neither provides a numeric scalar or 3D value nor a Date or Time data value. The data provided can be a arbitrary text string of alphabetic or numeric characters.

The current MTConnect Standard version 1.4 does not specify any string sample type but MTConnect agents may use this type for its own specific extended sample types.

Type Name

The name of the sample item type as defined in the MTConnect agent. This name must match exactly the type name in the MTConnect agent. If a type has one or multiple sub types, then multiple entries have to be defined, one for each type/sub type pair.

Sub Type Name

The name of the sample item sub type as defined in the MTConnect agent. This name must match exactly the type name in the MTConnect agent. If no sub type is specified in the MTConnect agent then this field has to be empty.

DateTime Sample Types

DateTime sample types report data which either represents a date (year, month, day), a time (hour, minute, second), a date and time or a time span (days, hours, minutes, seconds). The current MTConnect Standard 1.4 defines only one sample type (CLOCK_TIME) which represents a date and time value.

Type Name

The name of the sample item type as defined in the MTConnect standard. This name must match exactly the type name in the MTConnect standard. If a type has one or multiple sub types, then multiple entries have to be defined, one for each type/sub type pair.

Sub Type Name

The name of the sample item sub type as defined in the MTConnect standard. This name must match exactly the type name in the MTConnect standard. If no sub type is specified in the MTConnect standard then this field has to be empty.

Date or Time Type

Currently only the DateTime (combination of date and time) type is supported.

Enum Types

To achieve maximum flexibility with regard to future extensions and/or changes in the MTConnect Standard, the server allows to configure -beside to the event and sample data item types- the enumeration types used by the enumeration event types. The predefined enumeration type set which comes with the

MTConnect server installation includes all enumeration types used for all the enumeration event types defined in MTConnect Standard version 1.4. The complete list of the predefined enumeration types you can find in topic Supported MTConnect Standard.

You can extend the predefined enumeration type set by additional types as required but we strongly recommend to not change the predefined types! If you need to extend the enumeration type set by a agent specific enumeration type we strongly recommend to add such an agent specific type to the agent's enumeration type set. The global type set should only contain enumeration types which specified in the MTConnect Standard.
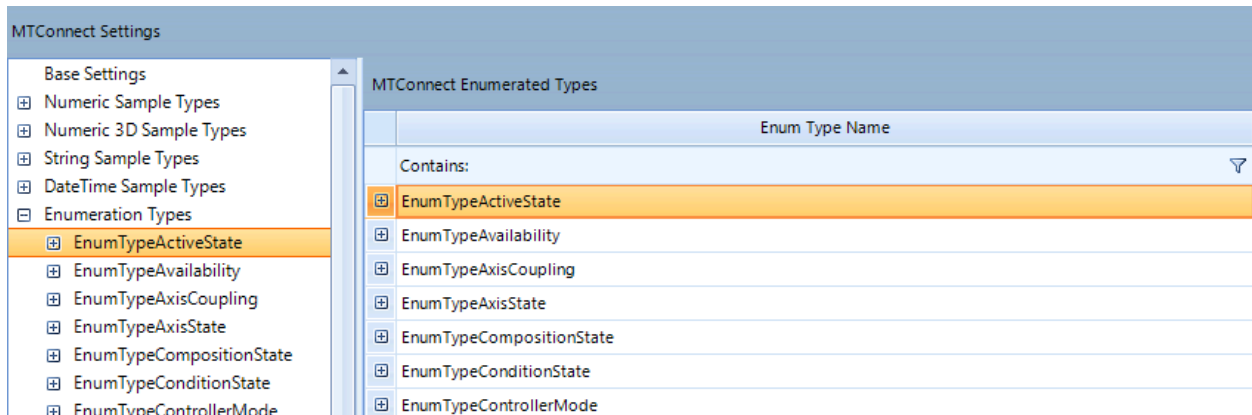
Type Name

By default all standard enumeration types are prefixed with "EnumType". The right part of the name specifies the unique name of the type.

To see the enumeration text-value-pairs of a specific type,click the expand button either in the left Tree View window or in the grid line in the right window.

Enumeration Text

This is the string value an OPC UA client receives when the enumeration event item is in the specific state.

Enumeration Value

This is the numeric value an OPC UA client receives when the enumeration event item is in the specific state.

Event Types

To achieve maximum flexibility with regard to future extensions and/or changes in the MTConnect Standard, the server allows to configure all event item types specified in the MTConnect Standard. The predefined event item type set which comes with the MTConnect server installation includes all event item types defined in MTConnect Standard version 1.4. The complete list of the predefined event item types you can find in topic Supported MTConnect Standard.

The complete list of all supported event data items you can find in the document *MTConnect Part 3.0 Streams Information Model Version 1.4.0, chapter 6.2 Event Element Names.*

The event types are subdivided into three groups, depending on the data type of the event's value.

- Enumeration *(on page 64)* event types have a limited/defined set of named values, means each value has a numeric value and a textual name
- Numeric *(on page 66)* event types have a numeric value. The server supports the four data types Float *(on page 84)*, Double *(on page 84)*, Int32 *(on page 84)* and UInt32 *(on page 84)* for numeric events.
- String *(on page 67)* event types have a non-numerical data value.

Enumeration Event Types

Event Types have a limited/defined set of named values, means each value has a numeric value and a textual name. The predefined enumeration event type set which comes with the MTConnect server installation includes all enumeration event types defined in MTConnect Standard version 1.4. The

complete list of the predefined enumeration event types you can find in topic Supported MTConnect

Standard.

Type Name

The name of the event type as defined in the MTConnect standard. This name must match exactly the type name in the MTConnect standard. If a type has one or multiple sub types, then multiple entries have to be defined, one for each type/sub type pair.

Sub Type Name

The name of the event sub type as defined in the MTConnect standard. This name must match exactly the type name in the MTConnect standard. If no sub type is specified in the MTConnect standard then this field has to be empty.

Enum Type Name

Depending on the possible named values of the enumeration event type, a predefined enumeration type can be selected for the event type. The selected enumeration type has to contain all possible name-value pairs the enumeration event can take-on. The complete list of the predefined enumeration types and their name-value pairs you can find in topic Supported MTConnect Standard.

Numeric Event Types

Numeric event types have a numeric value. The driver supports the four data types Float *(on page 84)*, Double *(on page 84)*, Int32 *(on page 84)* and UInt32 *(on page 84)* for numeric events. The predefined numeric event type set which comes with the MTConnect server installation includes all numeric event types defined in MTConnect Standard version 1.4. The complete list of the predefined numeric event types you can find in topic Supported MTConnect Standard.


Type Name

The name of the event type as defined in the MTConnect standard. This name must match exactly the type name in the MTConnect standard. If a type has one or multiple sub types, then multiple entries have to be defined, one for each type/sub type pair.

Sub Type Name

The name of the event sub type as defined in the MTConnect standard. This name must match exactly the type name in the MTConnect standard. If no sub type is specified in the MTConnect standard then this field has to be empty.
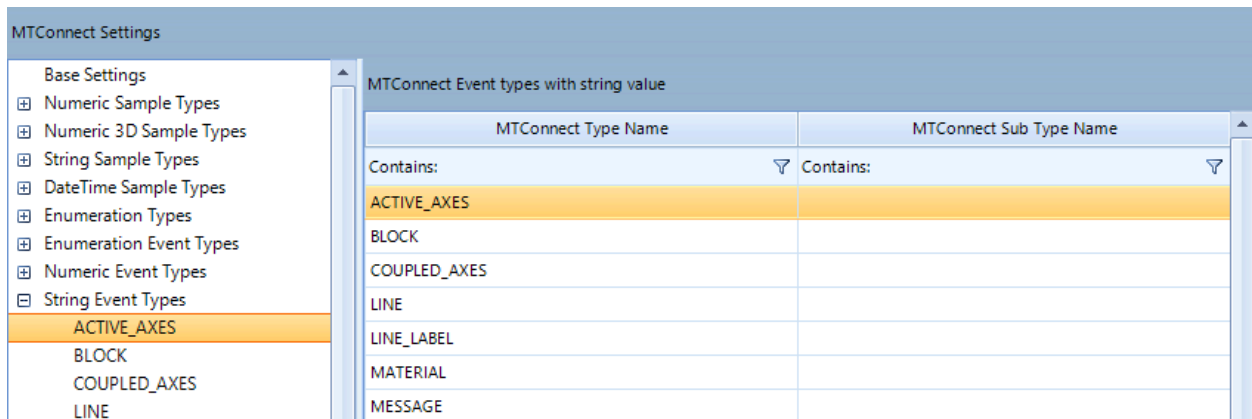
Data Type Name

To supply the OPC UA client with the data value appropriate for the data value the MTConnect agent reports, the data type for a specific type/sub type can be set individually. The following picture shows the drop down list of the available data types:
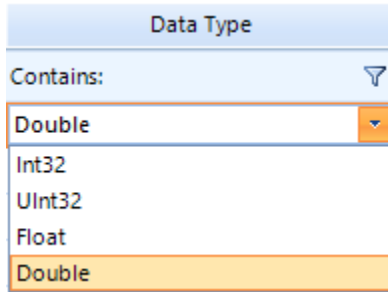
String Event Types

String event types typically have a non-numerical data value but they even can be used for numeric values because a string value allows to represent any kind of value. Due to this fact, the MTConnect server uses the string event type for all non-standard or extended event types a agent reports in its *Probe* response. The predefined string event type set which comes with the MTConnect server installation includes all string event types defined in MTConnect Standard version 1.4. The complete list of the predefined string event types you can find in topic Supported MTConnect Standard.


Type Name

The name of the event type as defined in the MTConnect standard. This name must match exactly the type name in the MTConnect standard. If a type has one or multiple sub types, then multiple entries have to be defined, one for each type/sub type pair.

Sub Type Name

The name of the event sub type as defined in the MTConnect standard. This name must match exactly the type name in the MTConnect standard. If no sub type is specified in the MTConnect standard then this field has to be empty.

Agents
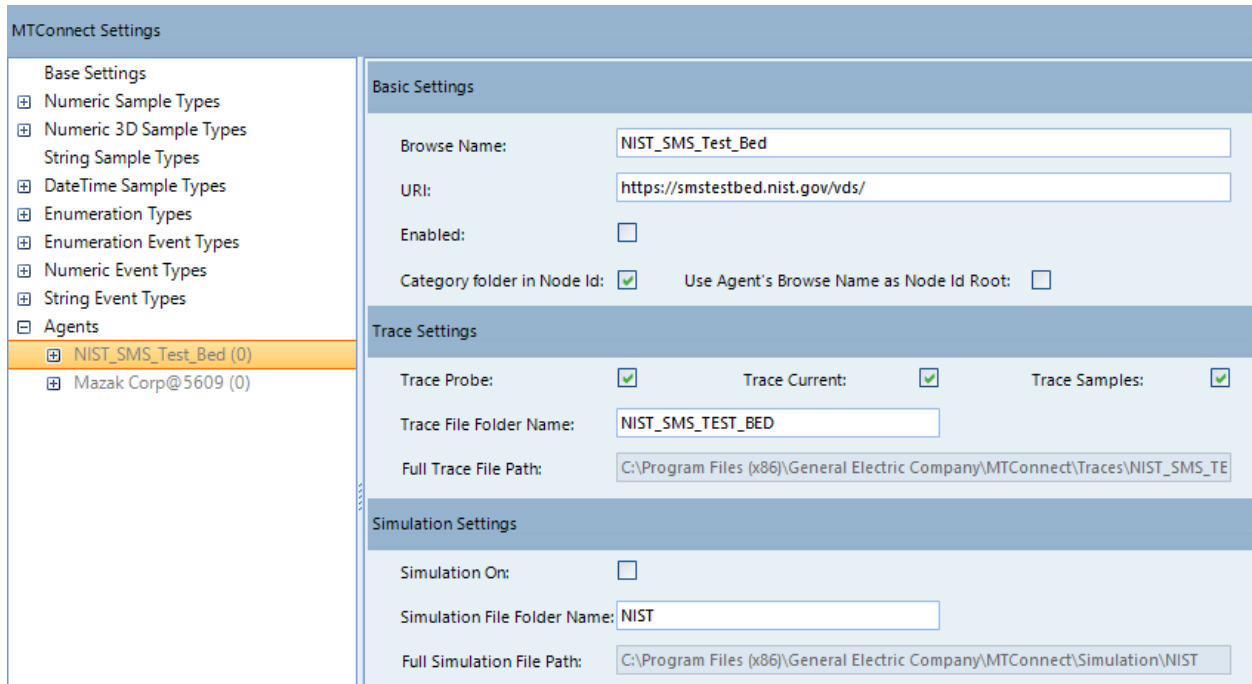
Browse Name

This name is used as browse name in the OPC UA client browse tree. The Browse Name has to be unique, means no other agent of the configuration can use the same name. The following screen shot of an OPC UA Client browser window shows the agents browse name (marked with the red box) within the browse tree:
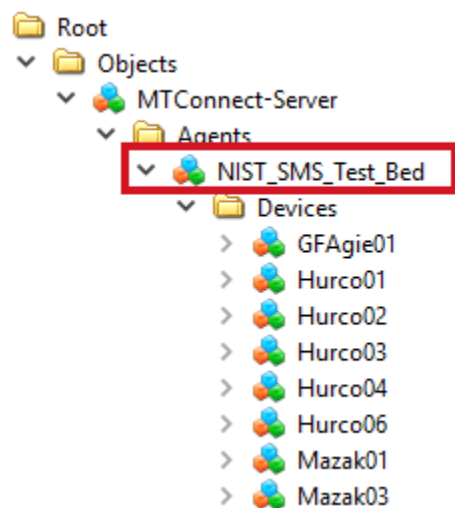
URI

The URI of the MTConnect agent. When Simulation is enabled then the URI can be left blank.

Enabled

The driver processes (connects to) this agent only when it is set enabled.

Category folder in Node Id

If checked, the server extents the node id path by the category field for the three data item categories SAMPLE, EVENT and CONDITION.

The following two pictures show OPC UA node Ids, the upper picture with category field, the lower picture without category field:

Node Id with data item category field

Node Id without data item category field

Using the category field in the node Id is mandatory for configurations where the same MTConnect type name is used for data items in different categories.

Use Agent's Browse Name as Node Id Root

If checked, the server uses the agent's browse name as node Id prefix, means the OPC UA node identifier string starts with the agent's browse name. This setting is required if multiple agents use the same device names (attribute **name** of a XML element **Device** in **Probe** response). To distinguish equal device names of different agents in the OPC UA node name space, the agent's (browse) name is used as root of the OPC UA node identifier.

The following two pictures show OPC UA node identifiers with and without leading agent browse name:

Node Id with data item category field

Node Id without data item category field

Trace Settings

- **Trace Probe**

  When checked, all *Probe* responses are saved the trace file folder. The trace file name is built from the prefix "Probe", the time stamp and the file extension ".log".

- **Trace Current**

  When checked, all *Current* responses are saved in the trace file folder. The trace file name is built from the last sequence number of the *Current* response and the file extension ".log".

- **Trace Samples**

  When checked, all *Sample* responses be saved in the trace file folder. The trace file name is built from the last sequence number of the *Sample* response and the file extension ".log".
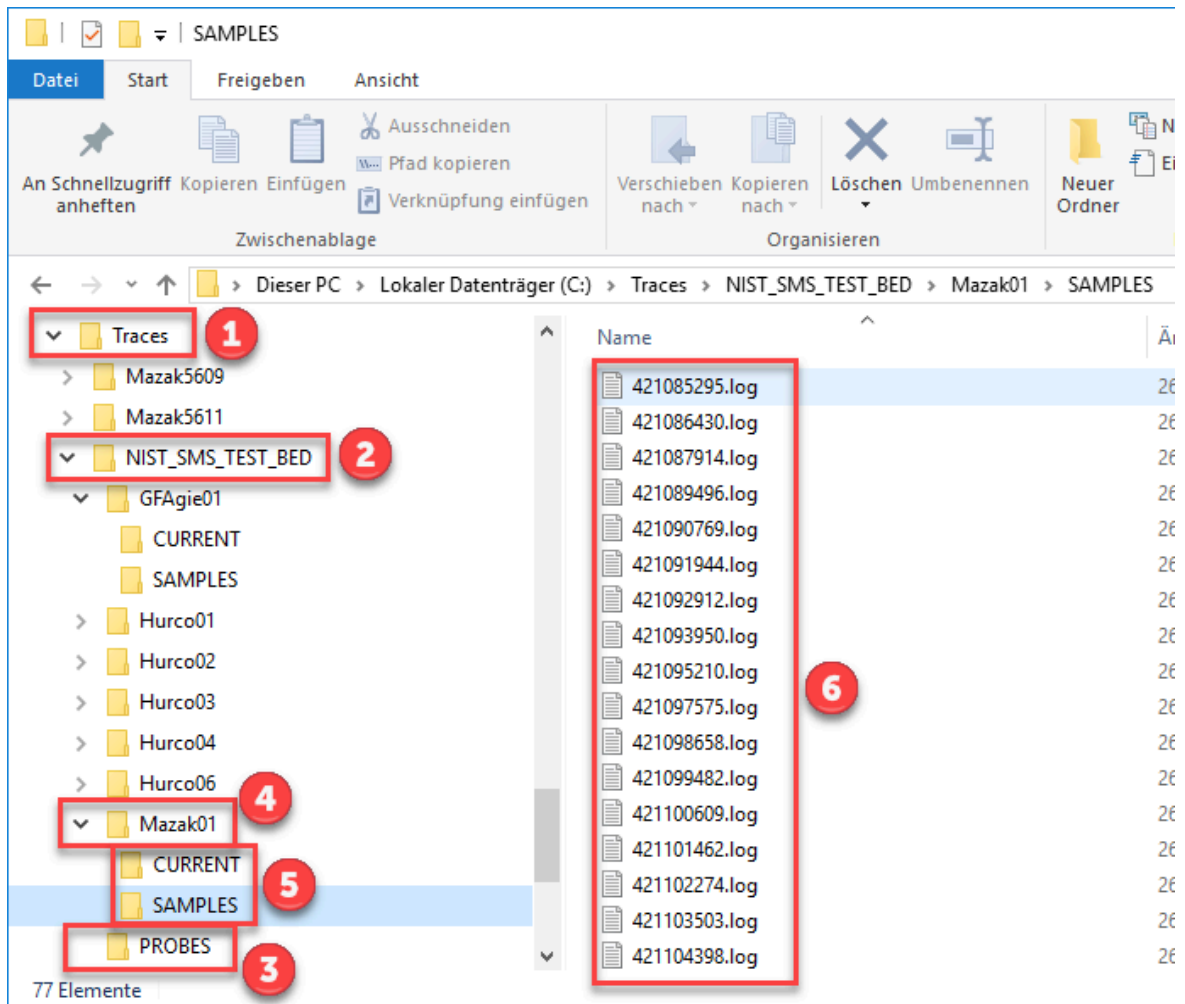
- **Trace File Folder Name**

  An agent-specific sub-folder for the trace files. The trace file root folder is specified in the Base Settings.

- **Full Trace File Path**

  This read-only field shows the full trace file folder path, which is the combination of trace file root folder and the agent specific trace file folder name.

- **Example trace folder structure**

The following figure shows the folder structure for the NIST-SMS-Test-Bed Agent.

1 The Trace File Base Folder.

2 The Agent-related Trace File Folder (See 2.2.1).

3 The Folder PROBES for the *Probe* responses of the Agent.

4 The specific folder for a single MTConnect device. The name of the folder is derived from the value of the "name" attribute of the "Device" element of the MTConnect *Probe* XML response stream.

5 The folders CURRENT and SAMPLE for the *Current* and *Sample* trace files of a specific device.

6 The file names of the *Current* and *Sample* trace files are derived from the "next sequence" attribute of the "Header" element of the MTConnect *Current* or *Sample* XML response stream.

Simulation Settings

- **Simulation On**

  When checked the driver doesn't try to connect to the agent's URI but reads the Probe, Current and Sample responses from XML files

- **Simulation File Folder Name**

  An agent-specific sub-folder for the simulation files. The simulation file root folder is specified in the Base Settings.

- **Full Simulation File Path**

  This read-only field shows the full simulation file folder path, which is the combination of simulation file root folder and the agent specific simulation file folder name.
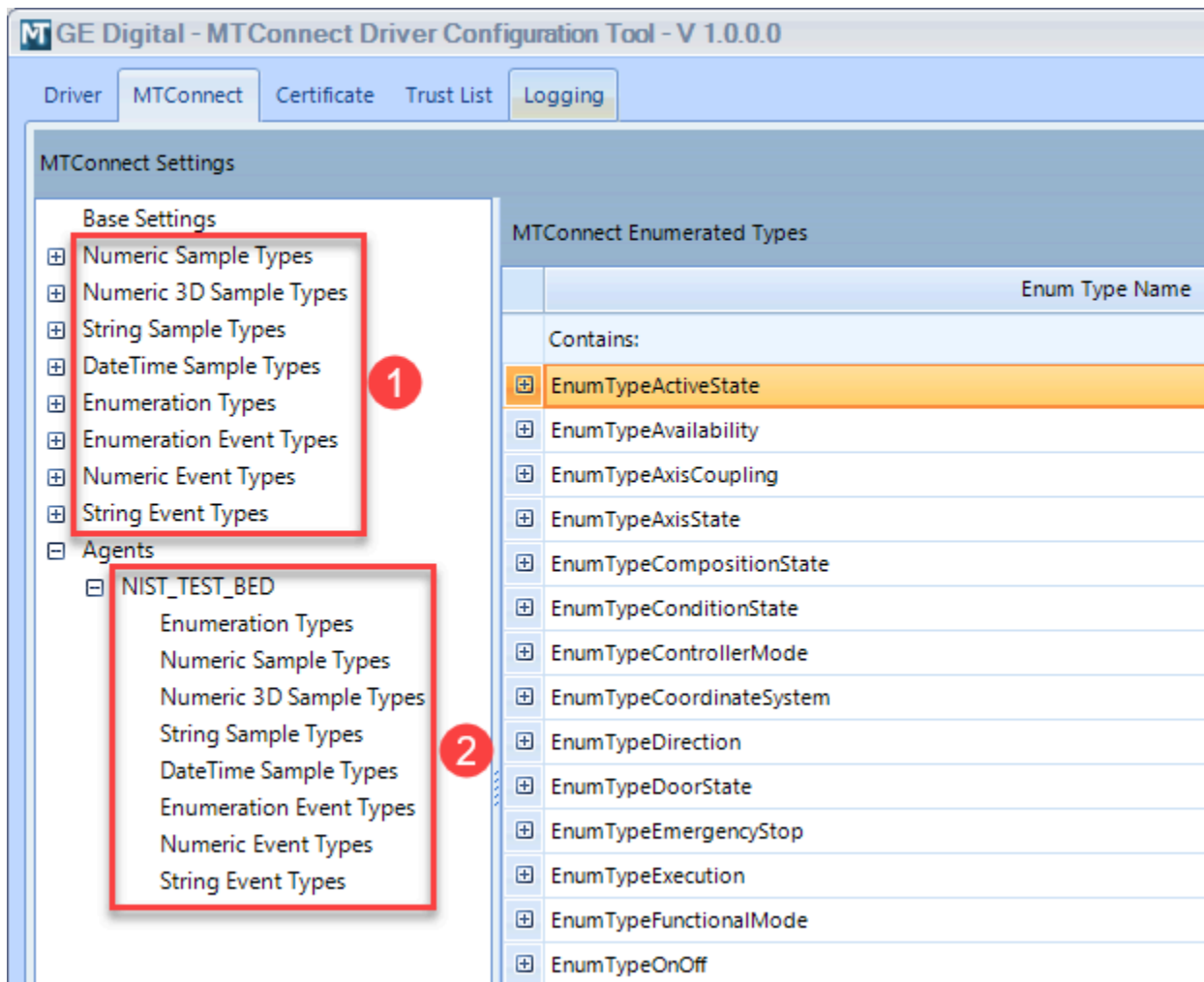
Agent specific vs. global types

The OPC UA server comes with a predefined set of enumeration, event and sample types. These sets are called the *global* data types. Global means that these data types are valid for all agents. The global data types are all the types which are specified in the MTConnect Standard. The global data types can be modified or extended by the user if e.g. a new release of the MTConnect Standard redefines existing or extent new data types.

To keep the server configuration consistent with existing OPC Client configurations we strongly recommend not to change or delete any global data types but only add new types!

A lot of MTConnect agents extend the standard data types by their own data types. Either they use additional sub types of a standard type or they define new types and sub types for specific sample or event items. This OPC UA server offers the possibility to deal with such agent-specific data types. Beside to the global data types, the server can manage agent-specific data types. Every single agent can be configured with its own set of specific data types. A agent-specific data type even can override a global data type, means the agent re-defines a global data type with the same name but with a different data type.

The following picture shows where the global and agent-specific data types can be found in the MTConnect configuration tree:
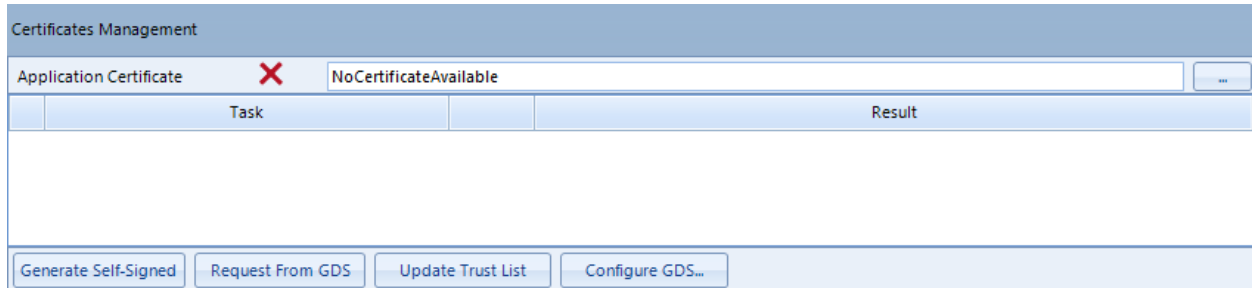

Global vs. agent specific types

Certificate

The iFIX OPC UA Server provides two ways to configure your certificates:

- Use a Self-Signed Certificate for the MTConnect OPC UA Server
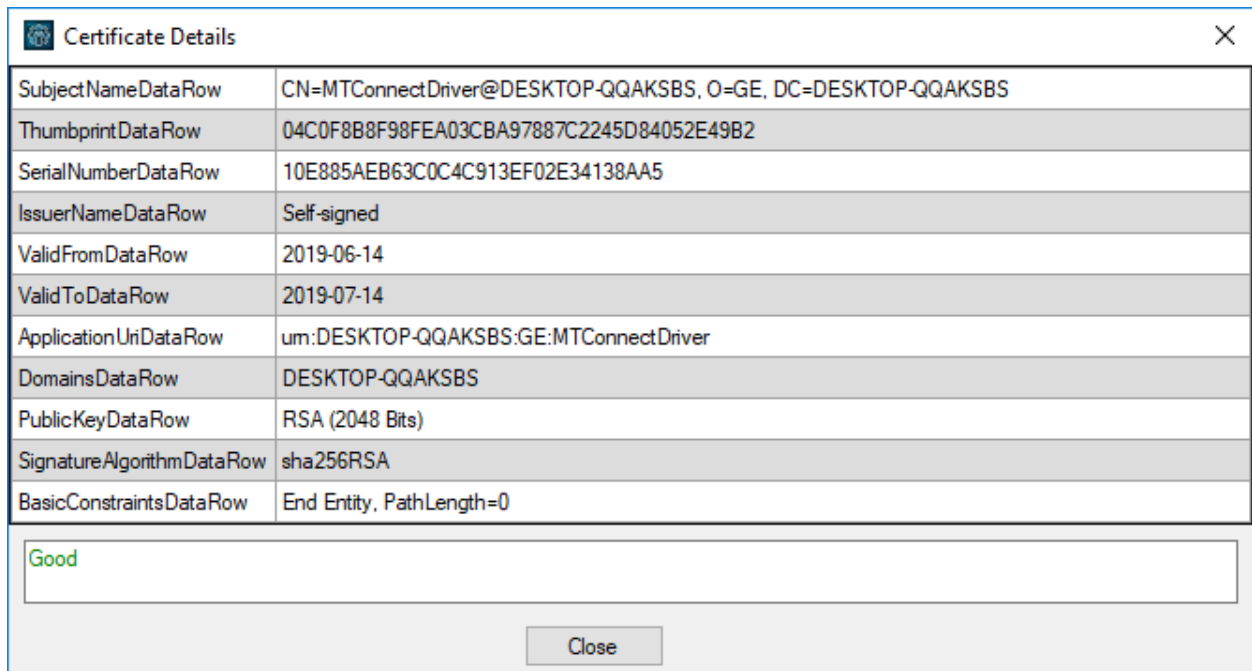- Use a GDS-Signed Certificate for the MTConnect OPC UA Server

Application Certificate

The certificate currently assigned to the MTConnect OPC UA Server. A red error icon appears to the left if the certificate is not useable.

Certificate Details

By clicking this button a detailed information about the certificate will be displayed as shown in the following picture.
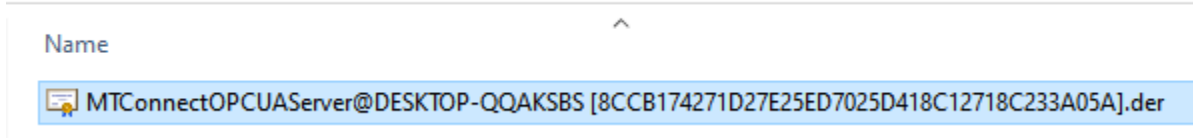

Generate Self-Signed

To generate a new self-signed certificate for the MTConnect OPC UA Server, click the Generate Self-Signed button. The Configuration tool then generates a new certificate for the MTConnect OPC UA Server (The MTConnect Driver service). When successfully finished, the *Task* and *Result* list should show entries similar to the following picture:

The certificate file is stored in the folder:

The pfx file, which includes both the public and private key for the associated certificate is stored in the folder:
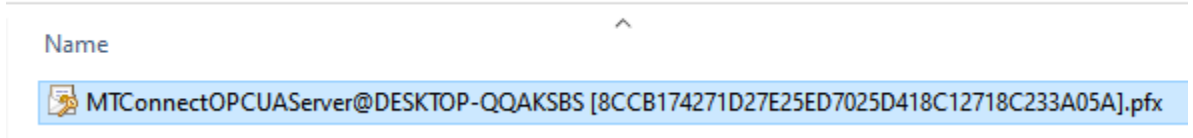
NEVER share this pfx file outside your organization!

Request From GDS

To request a certificate for MTConnect OPC UA Server from a Global Discover Server (GDS), click the *Request from GDS* button.

Update Trust List

Reads the trust list from the GDS and updates the trust list used by the MTConnect OPC UA Server.

Configure GDS...

Configures the endpoint and user credentials for the Global Discovery Service (GDS) to use.

Endpoint URL

The URL of the GDS service to use.

User Name

The login user name for the GDS.

Password

The login password for the GDS.

Trust List

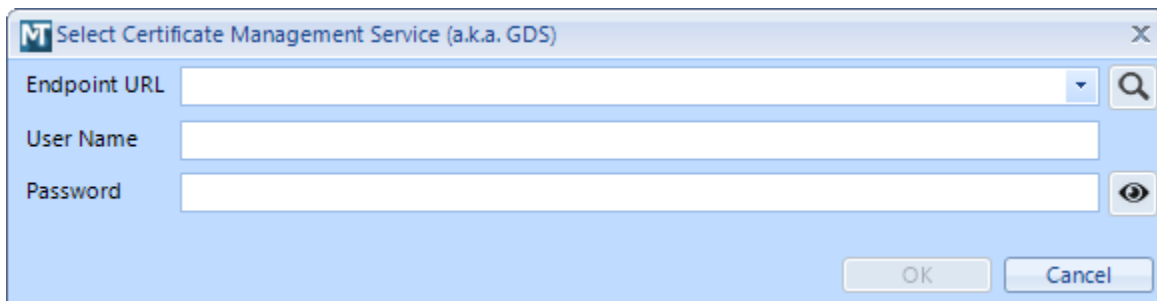You can manage all trusted connections from this tab. E.g. use this tab to add an OPC UA Client to the Trust List for your MTConnect OPC UA Server. Select the client's certificate from the certificate list and then click the *Trust* button.
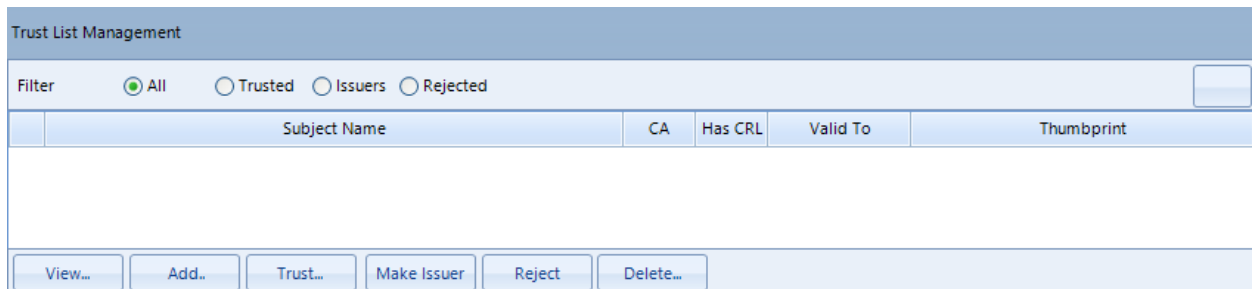
Filter

Allows you to reduce the number of certificate entries in the certificate list.

Reload List

Reloads the certificates in the trust list from the file system.

View...

Shows the details of the selected certificate.

Add...

Opens a file dialog to select a certificate file (.der file) to add to the trust list.

Trust…

Trusts the selected certificate.

Make Issuer

Adds the CA certificate to the list of certificates needed to verify trusted certificates.

Reject

Stops trusting the selected certificate.

Delete…

Deletes the selected certificate from the trust list.

When setting up the trusts relationships, the OPC UA Client must first trust the MTConnect OPC UA Server. Then, the server trusts the client. After that relationship is setup, you can then test the connection between the MTConnect OPC UA Server and your OPC UA Client.

If you are using the Global Discover Server to manage your certificates, the GDS automatically sets up your trusts between clients and servers.

If you are not using the GDS and instead have a self-signed certificate, the following diagram describes the workflow for a certificate exchange procedure between an OPC UA Client and the MTConenct OPC UA Server. This workflow assumes that the MTConnect OPC UA Server is already running.

Workflow for Self-Signed Certificate

An OPC UA Client attempts to connect to the MTConnect Server

↓

The Client receives an untrusted certificate from the Server

↓

Client User validates and trusts the Server's certificate

↓

Client reconnect to the (now trusted) Server and sends its own certificate

↓

The Server receives an untrusted certificate from the Client

↓

Server User validates and trusts the Client's certificate

↓

Trusted Client reconnect to the trusted Server and regular operation starts

Logging

If something is going wrong with with the MTConnect Driver service, the driver's log file should provide some useful information to locate and solve possible errors.

Driver Service Logging Settings

- **Log to file**

  The file logging of the MTConnect Driver service is enabled when this check box is set (checked).

- **Log File Path**

  Specifies the folder the MTConnect Driver service stores the log files. To change the folder either enter a valid path or use the browse button to open a folder browser dialog to select a new folder.

- **Max. Number of Log Files**

  To reduce the risk of a HD storage leak, the number of log files is limited by the parameter. Valid range is 1 to 100.

- **Log file per ...**

  Log files can be stored per hour or per day.

Server Service Log Viewer

Since Windows services (like the MTConnect Server Service) run in the background, they don't have a window to expose its status information in a direct way but the MTConnect Configuration Tool make the servers's information available in its *Server Service Log Viewer* window. This Log Viewer is connected to the Server Service via OPC UA (the Configuration Tool is the client) and receives all information, warning and error messages the Server Service sends.

- **Errors**

  If this toggle button is set On, all error messages are displayed in the message list.

- **Warnings**

  If this toggle button is set On, all warning messages are displayed in the message list.

- **Info Messages**

  If this toggle button is set On, all information messages are displayed in the message list.

- **Clear List**

 Used to clear the entire message list.

- **Pause**

  If this button is set On, then the update of the message list is stopped.

Chapter 6. Client-side Diagnostics and Monitoring

Client-side Diagnostics and Monitoring

The MTConnect OPC UA server exposes diagnostics information which can be accessed by any OPC UA Client via a specific set of data items.

1. Server State Data Item
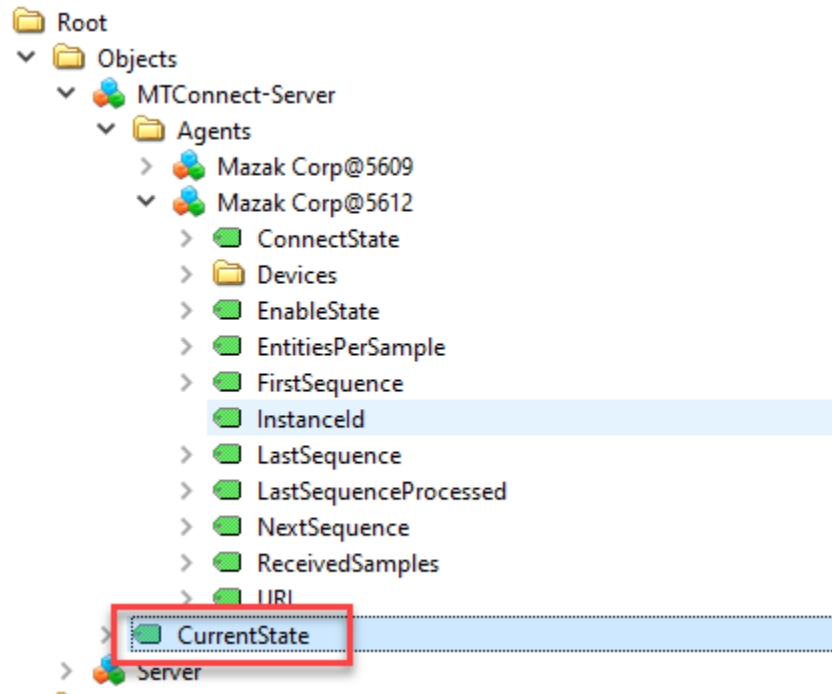
The MTConnect-Server's *CurrentState* data item exposes the current state of the OPC UA Server Thread within the server service. The following list shows all possible state values:

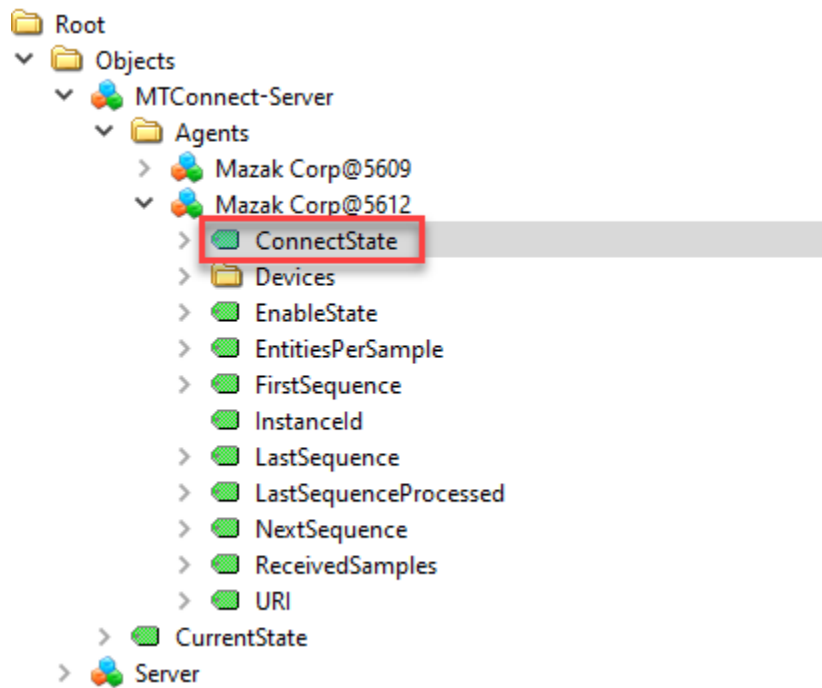The MTConnect-Server's *CurrentState* data item exposes the current state of the OPC UA Server Thread within the server service. The following list shows all possible state values:

Value	Description
0	Server Thread is stopped .
1	OPC UA Inititialization started.
2	OPC UA Node Manger started.
3	Server data items and methods created.
4	Agent folder created.

Value	Description
5	**All agent threads started and server is running in normal operation state.**
6	No agent threads started (since no agents are configured).
7	Server is restarting (due to a restart request from the configuration tool).
-1	Server is stopped since OPC UA Node Manger could not be started.
-2	Server is stopped due to a failure in the agent start sequence.

Agent State Data Item

The Agent's ConnectState data item exposes the current connection state of a specific MTConnect agent. The following list shows all possible state values:

Value	Description
0	Connection to agent not established. Occurs when the agent is not enabled.

Value	Description
1	The server has sent a *Probe* request and has received a proper *Probe* response.
-1	The server has sent a *Probe* request but the agent does not answered. This error indicates that the agent's URi is invalid or not reachable.
2	The server has sent a *Current* request and has received a proper *Current* response.
-2	The server has sent a *Current* request but the agent does not replied with a *Current* response.
3	**The server has sent a *Sample* request and cyclically receives *Sample* responses. This is the expected state for a proper connection to the agent.**
-3	The received Sample response contains invalid data or has an invalid structure.
-4	The server received a bad HTTP status code.
-5	An exception occurred when the server tried to send the *Sample* request*.
-6	A HTTP timeout occurred while the server waited for the *Sample* response.
-7	The *Sample* request has been canceled by the HTTP protocol layer.
-8	A Web exception occurred when the server tried to send the *Sample* request*.
-9	An Application exception occurred when the server tried to send the *Sample* request*.
-10	An unspecific exception occurred when the server tried to send the *Sample* request*.

* The log file of the OPC UA Server Service contains detailed information about the exception.

Chapter 7. Glossary

Glossary of Items

The following terms are used in the MTConnect Driver documentation. Click any term to expand or collapse a drop-down text with detailed information.

Float

A floating point value which is coded in 32 bits (4 bytes). The precession is limited to 6 decimal digits.

Double

A floating point value which is coded in 64 bits (8 bytes). The precession is limited to 15 decimal digits.

UInt32

An integral type which occupies 32 bits (4 bytes). It represents an unsigned (positive) value in the range between 0 to 4,294,967,295.

Int32

An integral type which occupies 32 bits (4 bytes). It represents a signed value in the range between −2,147,483,648 to +2,147,483,647.

String

A string is a data type is used to represent text rather than numbers. It is comprised of a set of characters that can even contain spaces and numbers.

DateTime

A DateTime value is encoded as a 64-bit signed integer which represents the number of 100 nanosecond intervals since January 1, 1601 (UTC).

MT

Manufacturing Technology

NIST

National Institute of Standards and Technology