



MTConnect® Standard
Guide: MTConnect and OPC/UA
Companion Specification
Version 2.0

Prepared for: MTConnect Institute
Prepared by: William Sobel
Prepared on: September 29, 2018

MTConnect® is a registered trademark of AMT - The Association for Manufacturing Technology.
Use of MTConnect® is limited to use as specified on <http://www.mtconnect.org/>.

1 MTConnect[®] Specification and Materials

2

3 AMT – The Association For Manufacturing Technology (“AMT”) owns the copy-
4 right in this MTConnect[®] Specification or Material. AMT grants to you a non-
5 exclusive, non-transferable, revocable, non-sublicensable, fully-paid-up copyright
6 license to reproduce, copy and redistribute this MTConnect[®] Specification or Ma-
7 terial, provided that you may only copy or redistribute the MTConnect[®] Speci-
8 fication or Material in the form in which you received it, without modifications,
9 and with all copyright notices and other notices and disclaimers contained in the
10 MTConnect[®] Specification or Material.

11 If you intend to adopt or implement an MTConnect[®] Specification or Material
12 in a product, whether hardware, software or firmware, which complies with an
13 MTConnect[®] Specification, you **SHALL** agree to the MTConnect[®] Specifica-
14 tion Implementer License Agreement (“Implementer License”) or to the MTConnect[®]
15 Intellectual Property Policy and Agreement (“IP Policy”). The Implementer Li-
16 cense and IP Policy each sets forth the license terms and other terms of use for
17 MTConnect[®] Implementers to adopt or implement the MTConnect[®] Specifica-
18 tions, including certain license rights covering necessary patent claims for that
19 purpose. These materials can be found at www.MTConnect.org, or by contact-
20 ing Paul Warndorf at [mailto:pwarndorf@mtconnect.hyperoffice.](mailto:pwarndorf@mtconnect.hyperoffice.com)
21 [com](http://www.MTConnect.org).

22 MTConnect[®] Institute and AMT have no responsibility to identify patents, patent
23 claims or patent applications which may relate to or be required to implement
24 a Specification, or to determine the legal validity or scope of any such patent
25 claims brought to their attention. Each MTConnect[®] Implementer is responsible
26 for securing its own licenses or rights to any patent or other intellectual property
27 rights that may be necessary for such use, and neither AMT nor MTConnect[®]
28 Institute have any obligation to secure any such rights.

29 This Material and all MTConnect[®] Specifications and Materials are provided “as
30 is” and MTConnect[®] Institute and AMT, and each of their respective members,
31 officers, affiliates, sponsors and agents, make no representation or warranty of
32 any kind relating to these materials or to any implementation of the MTConnect[®]
33 Specifications or Materials in any product, including, without limitation, any ex-
34 pressed or implied warranty of noninfringement, merchantability, or fitness for

September 29, 2018

35 particular purpose, or of the accuracy, reliability, or completeness of information
36 contained herein. In no event shall MTConnect[®] Institute or AMT be liable to
37 any user or implementer of MTConnect[®] Specifications or Materials for the cost
38 of procuring substitute goods or services, lost profits, loss of use, loss of data or
39 any incidental, consequential, indirect, special or punitive damages or other di-
40 rect damages, whether under contract, tort, warranty or otherwise, arising in any
41 way out of access, use or inability to use the MTConnect[®] Specification or other
42 MTConnect[®] Materials, whether or not they had advance notice of the possibility
43 of such damage.

44 Table of Contents

45	1 Introduction	1
46	1.1 Overview	1
47	2 Types	1
48	2.1 Components	1
49	2.1.1 Defintion of ChannelType	1
50	2.1.2 Defintion of DescriptionType	3
51	2.1.3 Defintion of MTComponentType	4
52	2.1.4 Defintion of MTCompositionType	5
53	2.1.5 Defintion of MTConfigurationType	6
54	2.1.6 Defintion of MTDeviceType	6
55	2.1.7 Defintion of SensorConfigurationType	7
56	2.1.8 Defintion of ComponentType	7
57	2.1.9 Defintion of CompositionType	8
58	2.2 Data Items	8
59	2.2.1 Defintion of AssetChangedType	8
60	2.2.2 Defintion of AssetEventType	10
61	2.2.3 Defintion of AssetRemovedType	10
62	2.2.4 Defintion of MTDataItemType	11
63	2.2.5 Defintion of MTEnumeratedEventType	11
64	2.2.6 Defintion of MTFilterType	12
65	2.2.7 Defintion of MTMessageType	12
66	2.2.8 Defintion of MTNumericDataItemType	13
67	2.2.9 Defintion of MTNumericEventType	14
68	2.2.10 Defintion of MTSampleType	14
69	2.2.11 Defintion of MTStringEventType	14
70	2.2.12 Defintion of MinimumDeltaFilterType	15
71	2.2.13 Defintion of PeriodFilterType	15
72	2.2.14 Defintion of DataItemType	16
73	2.3 Conditions	16
74	2.3.1 Defintion of MTExclusiveLimitConditionType	16
75	2.3.2 Defintion of MTNonExclusiveConditionType	17
76	2.3.3 Defintion of ConditionClassType	18
77	2.4 Factories	18
78	2.4.1 Defintion of ComponentObjectFactory	19
79	2.4.2 Defintion of ComponentTypeFactory	19

80	2.4.3	Defintion of CompositionObjectFactory	20
81	2.4.4	Defintion of CompositionTypeFactory	20
82	2.4.5	Defintion of ConditionClassFactory	21
83	2.4.6	Defintion of ConditionObjectFactory	21
84	2.4.7	Defintion of DataItemObjectFactory	22
85	2.4.8	Defintion of DataItemTypeFactory	22
86	2.4.9	Defintion of DeviceObjectFactory	22
87	2.4.10	Defintion of FilterObjectFactory	23
88	2.4.11	Defintion of ObjectFactory	23
89	2.4.12	Defintion of SensorChannelObjectFactory	24
90	2.4.13	Defintion of SensorObjectFactory	24
91	2.4.14	Defintion of TypeFactory	25
92	2.5	MTConnect Device Profile	25
93	2.5.1	Defintion of Dynamic Type	25
94	2.5.2	Defintion of MIXes In	26
95	2.5.3	Defintion of MTConnect XML	27
96	2.5.4	Defintion of MTRelationshipType	27
97	2.5.5	Defintion of Object Factory	27
98	2.5.6	Defintion of Type Factory	28
99	2.5.7	Defintion of bind	28
100	2.5.8	Defintion of constrains	28
101	2.5.9	Defintion of mixin	29
102	2.5.10	Defintion of use	29

103 **List of Figures**

104 **Figure 1: Components Diagram** 2

105 **Figure 2: Data Items Diagram** 9

106 **Figure 3: Conditions Diagram** 17

107 **Figure 4: Factories Diagram** 18

108 **Figure 5: MTConnect Device Profile Diagram** 26

1 Introduction

109 The following conventions will be used throughout the document to provide a
110 clear and consistent understanding of the use of each type of data and information
111 used to define the MTConnect[®] standard and associated data.

1.1 Overview

112 Overview of the standards...

2 Types

2.1 Components

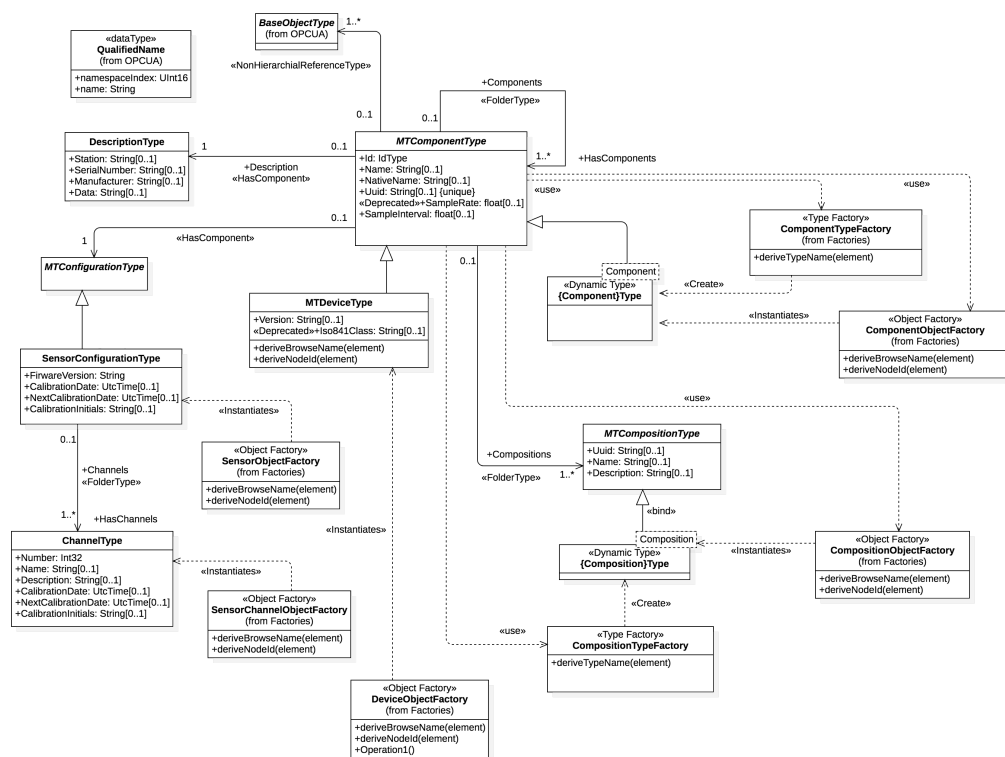


Figure 1: Components Diagram

113 The Components documents the Component models and the owned objects.

2.1.1 Defintion of ChannelType

114 Refer to Table 1 for detailed definition.

Table 1: ChannelType Definition

Attribute	Value				
BrowseName	ChannelType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of BaseObjectType (See OPCUA Documentation)					
HasProperty	Variable	Number	Int32	PropertyType	Manditory
HasProperty	Variable	Name	String	PropertyType	Optional
HasProperty	Variable	MTDescription	String	PropertyType	Optional
HasProperty	Variable	CalibrationDate	UtcTime	PropertyType	Optional
HasProperty	Variable	NextCalibrationDate	UtcTime	PropertyType	Optional
HasProperty	Variable	CalibrationInitials	String	PropertyType	Optional

2.1.2 Defintion of DescriptionType

115 The desription provides some general information about the manufacture and se-
 116 rial number of the component. In the XML, the CDATA is freeform text that is
 117 represented in the Data Property of the Description Object.

118 Refer to Table 2 for detailed definition.

Table 2: DescriptionType Definition

Attribute	Value				
BrowseName	DescriptionType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of BaseObjectType (See OPCUA Documentation)					
HasProperty	Variable	Station	String	PropertyType	Optional
HasProperty	Variable	SerialNumber	String	PropertyType	Optional
HasProperty	Variable	Manufacturer	String	PropertyType	Optional
HasProperty	Variable	Data	String	PropertyType	Optional

2.1.3 Defintion of MTComponentType

119 The base Component Type from which all MTConnect Components are derived
 120 from. The component type factory is used to create the specific OPC/UA types as
 121 subtypes of the MTConnect ‘MTComponentType’. The component types will be
 122 created once for all Component objects of that type based on the ‘QName’ of the
 123 MTConnect XML element.

124 The object factory will instantiate the Component Objects and insert them into
 125 the Components folder with a browse name of the Component QName and the
 126 ‘name’ element if specified surrounded by square brackets, ‘[]’. For example if
 127 the MTConnect Element is:

128 ‘<Linear name=’X’>...</...>’

129 The OPC/UA Object with browse name ‘Linear[X]’ will be created with the
 130 HasTypeDefinition referencing the ‘Linear’ OPC/UA type.

131 The meta data for the component and it’s relationships are static. The dynamic
 132 data will be represented using the _OPC/UA Part 8_

133 Refer to Table 3 for detailed definition.

Table 3: MTComponentType Definition

Attribute	Value				
BrowseName	MTComponentType				
IsAbstract	True				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
HasProperty	Variable	Id	IdType	PropertyType	Mandatory
HasProperty	Variable	Name	String	PropertyType	Optional
HasProperty	Variable	NativeName	String	PropertyType	Optional
HasProperty	Variable	Uuid	String	PropertyType	Optional
HasProperty	Variable	SampleRate	float	PropertyType	Optional
HasProperty	Variable	SampleInterval	float	PropertyType	Optional
HasComponent	Object	Description		DescriptionType	Optional
HasComponent	Object	Configuration		MTConfigurationType	Optional
Organizes	Object	Components	MTComponentType	FolderType	Optional
Organizes	Object	Compositions	MTCompositionType	FolderType	Optional
HasProperty	Variable	<Dynamic>	DataItemType	<Dynamic>	Optional
HasProperty	Variable	<Dynamic>	BaseObjectType	<Dynamic>	Optional
Organizes	Object	Conditions	MTNonExclusiveConditionType	FolderType	Optional
HasProperty	Variable	<Dynamic>	DataItemType	<Dynamic>	Mandatory

2.1.4 Defintion of MTCompositionType

134 Refer to Table 4 for detailed definition.

Table 4: MTCompositionType Definition

Attribute	Value				
BrowseName	MTCompositionType				
IsAbstract	True				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of BaseObjectType (See OPCUA Documentation)					
HasProperty	Variable	Uuid	String	PropertyType	Optional
HasProperty	Variable	Name	String	PropertyType	Optional
HasProperty	Variable	MTDescription	String	PropertyType	Optional
NonHierarchicalReferenceType	Object	ecomposition	DataItemType	NonHierarchicalReferenceType	Optional

2.1.5 Defintion of MTConfigurationType

135 Refer to Table 5 for detailed definition.

Table 5: MTConfigurationType Definition

Attribute	Value				
BrowseName	MTConfigurationType				
IsAbstract	True				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of BaseObjectType (See OPCUA Documentation)					

2.1.6 Defintion of MTDeviceType

136 The MTDevice is a special type whose object will be the root of the device graph.
 137 The Device uses the component type factory and the component object factories
 138 to create each of the first level components.

139 The compositions, relationships, and data items are then recursively created as
 140 one decendes the MTConnect informaiton model.

141 Refer to Table 6 for detailed definition.

Table 6: MTDeviceType Definition

Attribute	Value				
BrowseName	MTDeviceType				
IsAbstract	False				
References	NodeClass	BrowseName	Data Type	TypeDefinition	Modeling Rule
Subtype of MTComponentType (see section 2.1.3)					
HasProperty	Variable	Version	String	PropertyType	Optional
HasProperty	Variable	Iso841Class	String	PropertyType	Optional

2.1.7 Defintion of SensorConfigurationType

- 142 The SensorConfiguration browse name will be created as an Object relationship
 143 with the parent component.
 144 Refer to Table 7 for detailed definition.

Table 7: SensorConfigurationType Definition

Attribute	Value				
BrowseName	SensorConfigurationType				
IsAbstract	False				
References	NodeClass	BrowseName	Data Type	TypeDefinition	Modeling Rule
Subtype of MTConfigurationType (see section 2.1.5)					
HasProperty	Variable	FirwareVersion	String	PropertyType	Manditory
HasProperty	Variable	CalibrationDate	UtcTime	PropertyType	Optional
HasProperty	Variable	NextCalibrationDate	UtcTime	PropertyType	Optional
HasProperty	Variable	CalibrationInitials	String	PropertyType	Optional
Organizes	Object	Channels	ChannelType	FolderType	Optional

2.1.8 Defintion of ComponentType

- 145 Refer to Table 8 for detailed definition.

Table 8: ComponentType Definition

Attribute	Value				
BrowseName	ComponentType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of MTComponentType (see section 2.1.3)					

2.1.9 Defintion of CompositionType

146 Refer to Table 9 for detailed definition.

Table 9: CompositionType Definition

Attribute	Value				
BrowseName	CompositionType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of MTCompositionType (see section 2.1.4)					

2.2 Data Items

Items.png Items.png

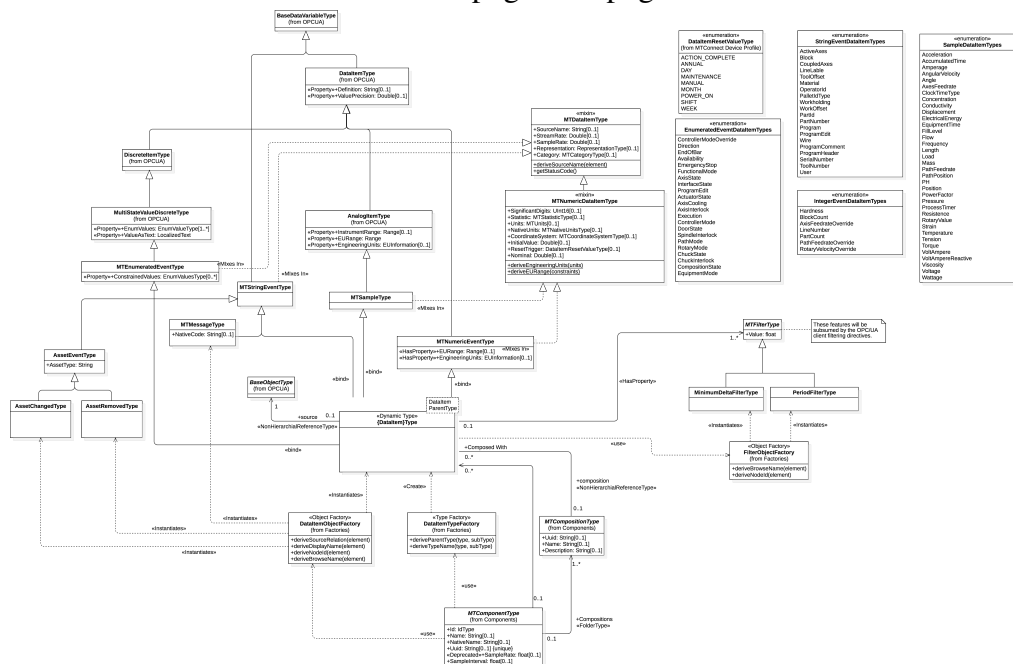


Figure 2: Data Items Diagram

2.2.1 Defintion of AssetChangedType

147 Refer to Table 10 for detailed definition.

Table 10: AssetChangedType Definition

Attribute	Value				
BrowseName	AssetChangedType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of AssetEventType (see section 2.2.2)					

2.2.2 Defintion of AssetEventType

148 Refer to Table 11 for detailed definition.

Table 11: AssetEventType Definition

Attribute	Value				
BrowseName	AssetEventType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of MTStringEventType (see section 2.2.11)					
HasProperty	Variable	AssetType	String	PropertyType	Mandatory

2.2.3 Defintion of AssetRemovedType

149 Refer to Table 12 for detailed definition.

Table 12: AssetRemovedType Definition

Attribute	Value				
BrowseName	AssetRemovedType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of AssetEventType (see section 2.2.2)					

2.2.4 Defintion of MTDataItemType

- 150 The data item mixin will inject the properties and the methods into the related
 151 classes. This facility is similar to the Ruby module mixin or the Scala traits.
- 152 Refer to Table 13 for detailed definition.

Table 13: MTDataItemType Definition

Attribute	Value				
BrowseName	MTDataItemType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
HasProperty	Variable	SourceName	String	PropertyType	Optional
HasProperty	Variable	StreamRate	Double	PropertyType	Optional
HasProperty	Variable	SampleRate	Double	PropertyType	Optional
HasProperty	Variable	Representation	RepresentationType	PropertyType	Optional
HasProperty	Variable	Category	MTCategoryType	PropertyType	Optional
HasProperty	Variable	<Dynamic>	MTFilterType	<Dynamic>	Optional
HasComponent	Object	source		BaseObjectType	Optional

2.2.5 Defintion of MTEnumeratedEventType

- 153 All Data Items with Category EVENT having a Controlled Vocabularies will be
 154 of this type. Otherwise, MTString

155 Refer to Table 14 for detailed definition.

Table 14: MTEnumeratedEventType Definition

Attribute	Value				
BrowseName	MTEnumeratedEventType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of MultiStateValueDiscreteType (See OPCUA Documentation)					
HasProperty	Variable	ConstrainedValues	EnumValuesType	PropertyType	Mandatory

2.2.6 Defintion of MTFilterType

156 These features will be subsumed by the OPC/UA client filtering directives.

157 Refer to Table 15 for detailed definition.

Table 15: MTFilterType Definition

Attribute	Value				
BrowseName	MTFilterType				
IsAbstract	True				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
HasProperty	Variable	Value	float	PropertyType	Mandatory

2.2.7 Defintion of MTMessageType

158 Refer to Table 16 for detailed definition.

Table 16: MTMessageType Definition

Attribute	Value				
BrowseName	MTMessageType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of MTStringEventType (see section 2.2.11)					
HasProperty	Variable	NativeCode	String	PropertyType	Optional

2.2.8 Defintion of MTNumericDataItemType

159 These are the additional attributes that are relevent to numeric data items. The
 160 factory will evaluate these values and will set the engineering units and the range
 161 associated with the parent entity.

162 Refer to Table 17 for detailed definition.

Table 17: MTNumericDataItemType Definition

Attribute	Value				
BrowseName	MTNumericDataItemType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of MTDataType (see section 2.2.4)					
HasProperty	Variable	SignificantDigits	UInt16	PropertyType	Optional
HasProperty	Variable	Statistic	MTStatisticType	PropertyType	Optional
HasProperty	Variable	Units	MTUnits	PropertyType	Optional
HasProperty	Variable	NativeUnits	MTNativeUnitsType	PropertyType	Optional
HasProperty	Variable	CoordinateSystem	MTCoordinateSystemType	PropertyType	Optional
HasProperty	Variable	InitialValue	Double	PropertyType	Optional
HasProperty	Variable	ResetTrigger	DataItemResetValueType	PropertyType	Optional
HasProperty	Variable	Nominal	Double	PropertyType	Optional

2.2.9 Defintion of MTNumericEventType

163 All data items with category EVENT and a numeric value.

164 Refer to Table 18 for detailed definition.

Table 18: MTNumericEventType Definition

Attribute	Value				
BrowseName	MTNumericEventType				
IsAbstract	False				
References	NodeClass	BrowseName	Data Type	TypeDefinition	Modeling Rule
Subtype of DataItemType (See OPCUA Documentation)					
HasProperty	Variable	EURange	Range	PropertyType	Optional
HasProperty	Variable	EngineeringUnits	EUInformation	PropertyType	Optional

2.2.10 Defintion of MTSampleType

165 Data Items with category SAMPLE

166 Refer to Table 19 for detailed definition.

Table 19: MTSampleType Definition

Attribute	Value				
BrowseName	MTSampleType				
IsAbstract	False				
References	NodeClass	BrowseName	Data Type	TypeDefinition	Modeling Rule
Subtype of AnalogItemType (See OPCUA Documentation)					

2.2.11 Defintion of MTStringEventType

167 All data items with category EVENT where the data is freeform text. The set_-
 168 data_type constraint derives makes the data type a string for this type.

169 Refer to Table 20 for detailed definition.

Table 20: MTStringEventType Definition

Attribute	Value				
BrowseName	MTStringEventType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of BaseDataVariableType (See OPCUA Documentation)					

2.2.12 Defintion of MinimumDeltaFilterType

170 Refer to Table 21 for detailed definition.

Table 21: MinimumDeltaFilterType Definition

Attribute	Value				
BrowseName	MinimumDeltaFilterType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of MTFilterType (see section 2.2.6)					

2.2.13 Defintion of PeriodFilterType

171 Refer to Table 22 for detailed definition.

Table 22: PeriodFilterType Definition

Attribute	Value				
BrowseName	PeriodFilterType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of MTFilterType (see section 2.2.6)					

2.2.14 Defintion of DataItemType

- 172 For each DataItem the Sub Type, and the Type will be composed to be the HasType-
 173 Definition relationship of the object. The BrowseName will also include the Com-
 174 position Type if a composition Id is provided.
- 175 Refer to Table 23 for detailed definition.

Table 23: DataItemType Definition

Attribute	Value				
BrowseName	DataItemType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of MTNumericEventType (see section 2.2.9)					

2.3 Conditions

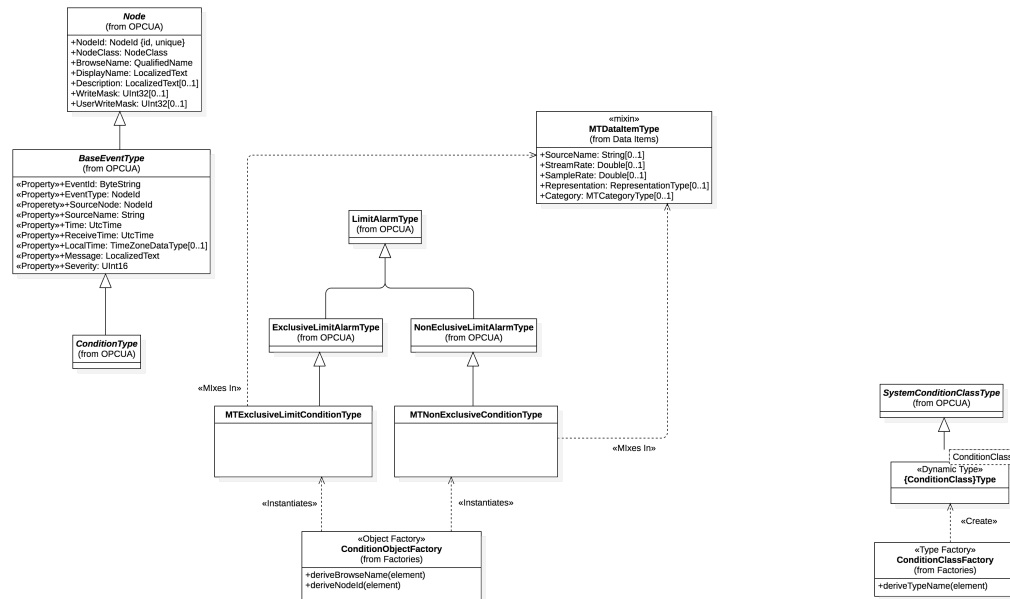


Figure 3: Conditions Diagram

2.3.1 Defintion of MTExclusiveLimitConditionType

176 Refer to Table 24 for detailed definition.

Table 24: MTExclusiveLimitConditionType Definition

Attribute	Value				
BrowseName	MTExclusiveLimitConditionType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of ExclusiveLimitAlarmType (See OPCUA Documentation)					

2.3.2 Defintion of MTNonExclusiveConditionType

177 Refer to Table 25 for detailed definition.

Table 25: MTNonExclusiveConditionType Definition

Attribute	Value				
BrowseName	MTNonExclusiveConditionType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of NonEclusiveLimitAlarmType (See OPCUA Documentation)					

2.3.3 Defintion of ConditionClassType

178 Refer to Table 26 for detailed definition.

Table 26: ConditionClassType Definition

Attribute	Value				
BrowseName	ConditionClassType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of SystemConditionClassType (See OPCUA Documentation)					

2.4 Factories

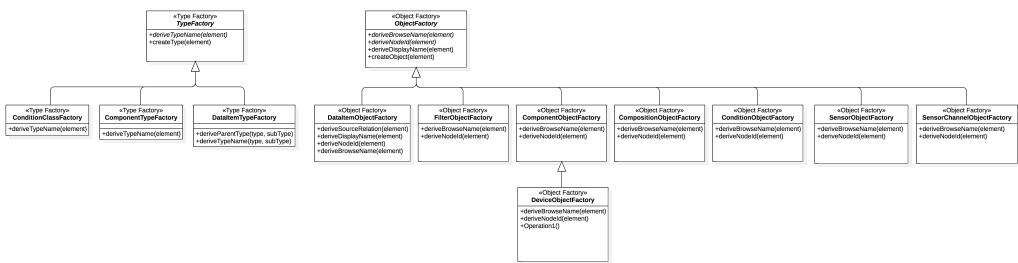


Figure 4: Factories Diagram

179 The factories are not part of the OPC/UA information model. They are a set
 180 of helper classes that are used to create dynamic types and objects. Since the
 181 MTConnect information model can be layered on top of the OPC/UA abstractions,
 182 the factories provide the rules for creating the browse and display names for each
 183 type.

184 The factories also create dynamic objects when required for variables of various
 185 classes when they are required, such as the Data Items and the Components. Some
 186 of the relationships are more complex since they require a dynamic super-type
 187 relationship that relies on the correct placement of the MTConnect elements to be
 188 correctly represented using the OPC/UA base types.

189 This is especially evident when mapping the DataItems and the Conditions to the
 190 MTConnect Information Models and providing sufficient definition to allow for
 191 unambiguous implementation.

2.4.1 Defintion of ComponentObjectFactory

192 Refer to Table 27 for detailed definition.

Table 27: ComponentObjectFactory Definition

Attribute	Value				
BrowseName	ComponentObjectFactory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of ObjectFactory (see section 2.4.11)					

2.4.2 Defintion of ComponentTypeFactory

193 The 'ComponentTypeFactory' creates component types using the MTConnect
 194 XML element as an input. The factory takes the 'QName' (or qualified name)
 195 of the XML element and then appends 'Type'. For example an '<Controller

196 id='...'></...>' element will create an OPC/UA 'ControllerType' type definition
 197 as an extension of the base 'MTControllerType'.

198 Currently there is no additional abstractions or super types required by the com-
 199 panion specification. The types will be a single level where each Component is a
 200 sub-type of the base 'MTComponentType'.

201 Refer to Table 28 for detailed definition.

Table 28: ComponentTypeFactory Definition

Attribute	Value				
BrowseName	ComponentTypeFactory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of TypeFactory (see section 2.4.14)					

2.4.3 Defintion of CompositionObjectFactory

202 Refer to Table 29 for detailed definition.

Table 29: CompositionObjectFactory Definition

Attribute	Value				
BrowseName	CompositionObjectFactory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of ObjectFactory (see section 2.4.11)					

2.4.4 Defintion of CompositionTypeFactory

203 Refer to Table 30 for detailed definition.

Table 30: CompositionTypeFactory Definition

Attribute	Value				
BrowseName	CompositionTypeFactory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule

2.4.5 Defintion of ConditionClassFactory

204 Refer to Table 31 for detailed definition.

Table 31: ConditionClassFactory Definition

Attribute	Value				
BrowseName	ConditionClassFactory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of TypeFactory (see section 2.4.14)					

2.4.6 Defintion of ConditionObjectFactory

205 Refer to Table 32 for detailed definition.

Table 32: ConditionObjectFactory Definition

Attribute	Value				
BrowseName	ConditionObjectFactory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of ObjectFactory (see section 2.4.11)					

2.4.7 Defintion of DataItemObjectFactory

206 Refer to Table 33 for detailed definition.

Table 33: DataItemObjectFactory Definition

Attribute	Value				
BrowseName	DataItemObjectFactory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of ObjectFactory (see section 2.4.11)					

2.4.8 Defintion of DataItemTypeFactory

207 Based on the data item category, type, and subType, this class creates a new
 208 OPC/UA type and also provides the template parameter for the ParentType from
 209 which this type is derived.

210 See the Data Item Type Factory.

211 Refer to Table 34 for detailed definition.

Table 34: DataItemTypeFactory Definition

Attribute	Value				
BrowseName	DataItemTypeFactory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of TypeFactory (see section 2.4.14)					

2.4.9 Defintion of DeviceObjectFactory

212 The model instantiation for MTConnect begins with the ‘Device‘ MTConnect
 213 element and then recursively traverses the sub-elements. The device will the ca-

- 214 pabilities in the component factory to generate all the data items and component
 215 types.
- 216 Refer to Table 35 for detailed definition.

Table 35: DeviceObjectFactory Definition

Attribute	Value				
BrowseName	DeviceObjectFactory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of ComponentObjectFactory (see section 2.4.1)					

2.4.10 Defintion of FilterObjectFactory

- 217 Creates filters based on the type attribute of the Filter element.
- 218 Refer to Table 36 for detailed definition.

Table 36: FilterObjectFactory Definition

Attribute	Value				
BrowseName	FilterObjectFactory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of ObjectFactory (see section 2.4.11)					

2.4.11 Defintion of ObjectFactory

- 219 Refer to Table 37 for detailed definition.

Table 37: ObjectFactory Definition

Attribute	Value				
BrowseName	ObjectFactory				
IsAbstract	True				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule

2.4.12 Defintion of SensorChannelObjectFactory

220 Refer to Table 38 for detailed definition.

Table 38: SensorChannelObjectFactory Definition

Attribute	Value				
BrowseName	SensorChannelObjectFactory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of ObjectFactory (see section 2.4.11)					

2.4.13 Defintion of SensorObjectFactory

221 Refer to Table 39 for detailed definition.

Table 39: SensorObjectFactory Definition

Attribute	Value				
BrowseName	SensorObjectFactory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of ObjectFactory (see section 2.4.11)					

2.4.14 Defintion of TypeFactory

222 Refer to Table 40 for detailed definition.

Table 40: TypeFactory Definition

Attribute	Value				
BrowseName	TypeFactory				
IsAbstract	True				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule

2.5 MTConnect Device Profile

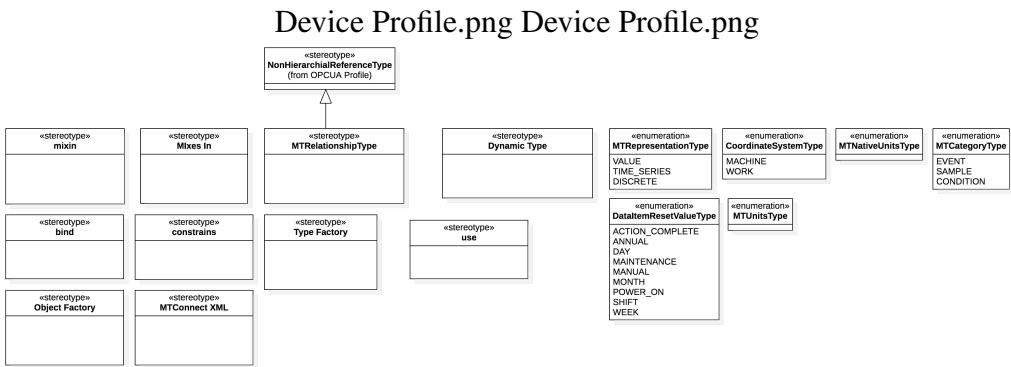


Figure 5: MTConnect Device Profile Diagram

223 The device profile documents the common data types and stereotypes that are used
224 to construct the model. A stereotype is a design or modeling pattern that provides
225 additional information about the type or the relationship between types.

226 It can also identify the behavior of a property or the role the type or relation will
227 play in the model.

228 Stereotypes are used throughout the model to provide additional information that
229 will help provide context and definition to aid in better understanding the data
230 model.

2.5.1 Defintion of Dynamic Type

231 Refer to Table 41 for detailed definition.

Table 41: Dynamic Type Definition

Attribute	Value				
BrowseName	Dynamic Type				
IsAbstract	False				
References	NodeClass	BrowseName	Data Type	TypeDefinition	Modeling Rule

2.5.2 Defintion of MIXes In

232 Refer to Table 42 for detailed definition.

Table 42: MIXes In Definition

Attribute	Value				
BrowseName	MIXes In				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule

2.5.3 Defintion of MTConnect XML

233 Refer to Table 43 for detailed definition.

Table 43: MTConnect XML Definition

Attribute	Value				
BrowseName	MTConnect XML				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule

2.5.4 Defintion of MTRelationshipType

234 Refer to Table 44 for detailed definition.

Table 44: MTRelationshipType Definition

Attribute	Value				
BrowseName	MTRelationshipType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of NonHierarchicalReferenceType (See OPCUA Profile Documentation)					

2.5.5 Defintion of Object Factory

235 Refer to Table 45 for detailed definition.

Table 45: Object Factory Definition

Attribute	Value				
BrowseName	Object Factory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule

2.5.6 Defintion of Type Factory

236 Refer to Table 46 for detailed definition.

Table 46: Type Factory Definition

Attribute	Value				
BrowseName	Type Factory				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule

2.5.7 Defintion of bind

237 Refer to Table 47 for detailed definition.

Table 47: bind Definition

Attribute	Value				
BrowseName	bind				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule

2.5.8 Defintion of constrains

238 Refer to Table 48 for detailed definition.

Table 48: constrains Definition

Attribute	Value				
BrowseName	constrains				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule

2.5.9 Defintion of mixin

239 The contents properties and the behavior of the class are combined with another
 240 class.

241 Refer to Table 49 for detailed definition.

Table 49: mixin Definition

Attribute	Value				
BrowseName	mixin				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule

2.5.10 Definition of use

242 The use stereotype indicates that one class uses as a helper to perform a specific
 243 operation or activity. This stereotype is mainly used to indicate that a specific
 244 factory is being employed by another type to create dynamic properties or rela-
 245 tionships.

246 Refer to Table 50 for detailed definition.

Table 50: use Definition

Attribute	Value				
BrowseName	use				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule