



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

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1 Introduction

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

1.1 Overview

131 Overview of the standards...

2 Types

2.1 Components

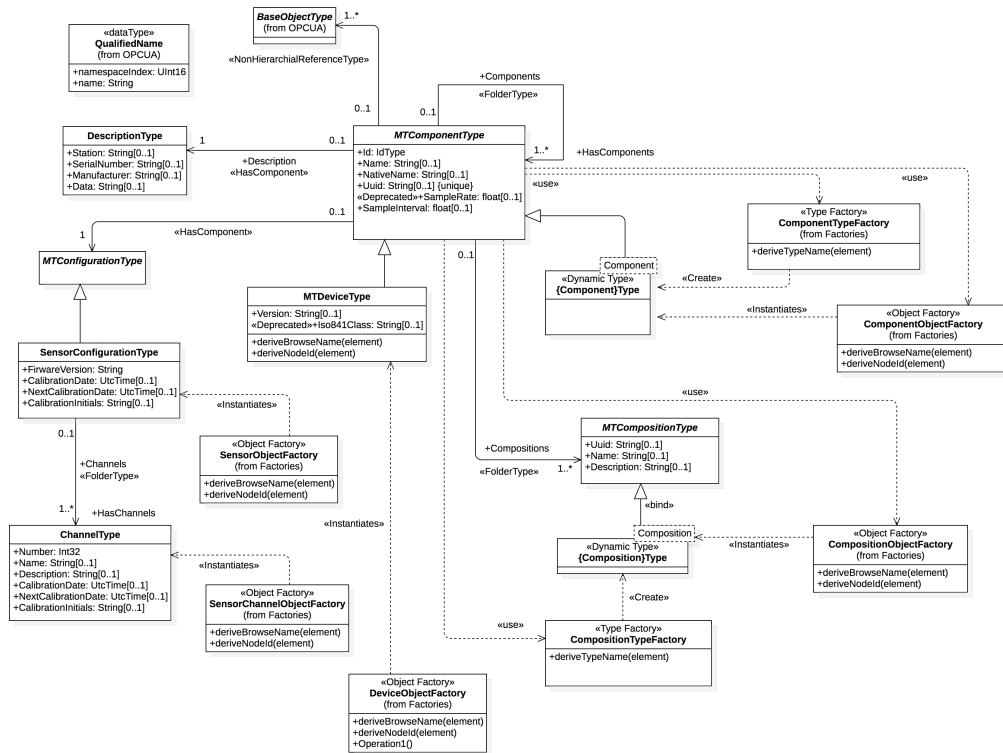


Figure 1: Components Diagram

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

2.1.1 Defintion of ChannelType

Table 1: ChannelType Definition

Attribute	Value				
BrowseName	ChannelType				
IsAbstract	False				
References	NodeClass	BrowseName	Data Type	TypeDefinition	Modeling Rule
Subtype of BaseObjectType (See OPCUA Documentation)					
HasProperty	Variable	Number	Int32	PropertyType	Mandatory
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

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

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

2.1.2.1 Operations

- `deriveBrowseName(element)`

Specification: "Description"

- `deriveNodeId(element)`

Specification: `concat(self.parent.NodeId, BrowseName)`

2.1.3 Defintion of MTComponentType

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

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

```
'<Linear name='X'>...</...>'
```

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

151 The OPC/UA Object with browse name 'Linear[X]' will be created with the
 152 HasTypeDefinition referencing the 'Linear' OPC/UA type.

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

2.1.4 Defintion of MTCompositionType

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

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

- 155 The MTDevice is a special type whose object will be the root of the device graph.
 156 The Device uses the component type factory and the component object factories
 157 to create each of the first level components.
- 158 The compositions, relationships, and data items are then recursively created as
 159 one decendes the MTConnect informaiton model.

Table 6: MTDeviceType Definition

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

160 **2.1.6.1 Operations**

- 161 • `deriveBrowseName(element)`
162 **Specification:** `self.name`
- 163 • `deriveNodeId(element)`
164 **Specification:** `self.uuid`

2.1.7 Defintion of `SensorConfigurationType`

- 165 The `SensorConfiguration` browse name will be created as an Object relationship
166 with the parent component.

Table 7: SensorConfigurationType Definition

Attribute	Value				
BrowseName	SensorConfigurationType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	TypeDefinition	Modeling Rule
Subtype of MTConfigurationType (see section 2.1.5)					
HasProperty	Variable	FirmwareVersion	String	PropertyType	Mandatory
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

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

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)					

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2.2 Data Items

Items.png Items.png

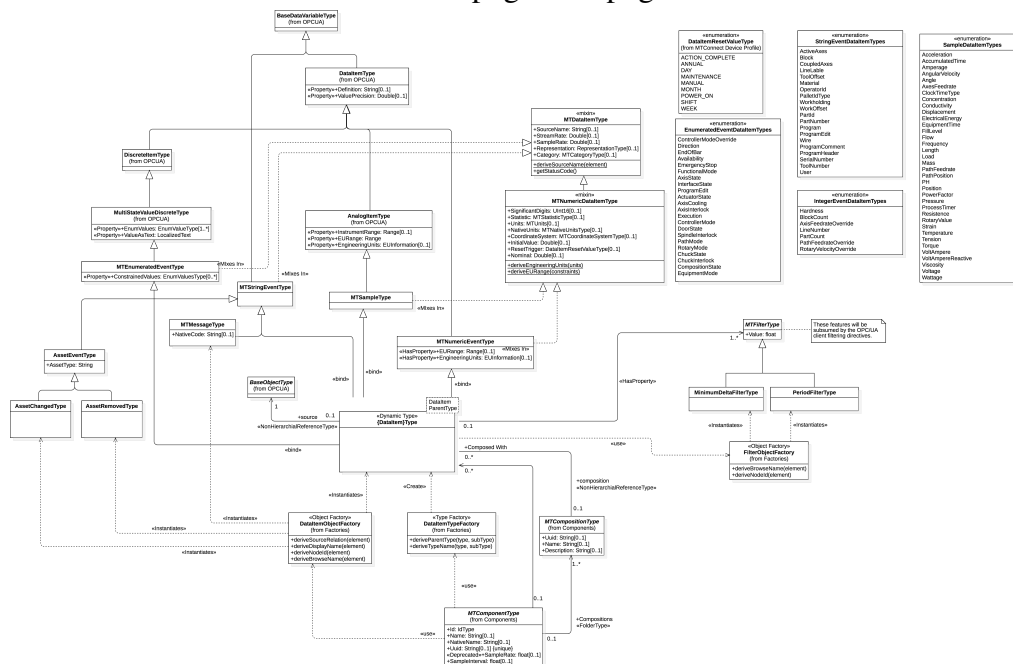


Figure 2: Data Items Diagram

2.2.1 Defintion of AssetChangedType

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

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

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

167 The data item mixin will inject the properties and the methods into the related
168 classes. This facility is similar to the Ruby module mixin or the Scala traits.

Table 13: MTDataItemType Definition

Attribute	Value				
BrowseName	MTDataItemType				
IsAbstract	False				
References	NodeClass	BrowseName	Data Type	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	Mandatory
HasProperty	Variable	<Dynamic>	MTFilterType	<Dynamic>	Optional
HasComponent	Object	source		BaseObjectType	Optional

169 2.2.4.1 Operations

- 170 • `deriveSourceName(element)`
171 Specification: `self.Source.CDATA`
172 Documentation: Derive the source name from the Source element CDATA.
173 This will represent the alternative long name for the data item's source.
- 174 • `getStatusCode()`
175 Documentation: The OPC/UA status code will be created using the follow-
176 ing process:
- 177 * If the value of the data item is 'UNAVAILABLE' a status code of 'Un-
178 certain_NoCommunicationLastUsable'. * When a reset trigger is specified,
179 new 'Good_' status codes will be created. See 'ResetTrigger' enumeration.

2.2.5 Defintion of MTEnumeratedEventType

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

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

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

Table 15: MTFilterType Definition

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

183 **2.2.6.1 Operations**

- 184 • `deriveBrowseName(element)`
 185 **Specification:** `concat(parent.BrowseName, pascalCase(element.type))`
- 186 • `deriveNodeId(element)`
 187 **Specification:** `concat(parent.NodeId, pascalCase(element.type))`

2.2.7 Defintion of MTMessageType**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

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

Table 17: MTNumericDataItemType Definition

Attribute	Value				
BrowseName	MTNumericDataItemType				
IsAbstract	False				
References	NodeClass	BrowseName	Data Type	TypeDefinition	Modeling Rule
Subtype of MTDataItemType (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

2.2.8.1 Operations

- `deriveEngineeringUnits(units)`

Specification: `EngineeringUnits <- self.units`

- `deriveEURange(constraints)`

Specification: `EURange.Low <- self.Constraints.Minimum EURange.High <- self.Constraints.Maximum`

Documentation: Uses the MTConnect Constraints element if present to derive the minimum and maximum values for the numeric values. This applies to both the Numeric Event and the Sample types.

2.2.9 Defintion of MTNumericEventType

All data items with category EVENT and a numeric value.

Table 18: MTNumericEventType Definition

Attribute	Value				
BrowseName	MTNumericEventType				
IsAbstract	False				
References	NodeClass	BrowseName	DataType	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

201 Data Items with category SAMPLE

Table 19: MTSampleType Definition

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

2.2.11 Definition of `MTStringEventType`

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

Table 20: `MTStringEventType` Definition

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

2.2.12 Defintion of MinimumDeltaFilterType

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

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 Definition of `DataItemType`

204 For each `DataItem` the Sub Type, and the Type will be composed to be the HasType-
 205 Definition relationship of the object. The `BrowseName` will also include the Com-
 206 position Type if a composition Id is provided.

Table 23: `DataItemType` Definition

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

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2.3 Conditions

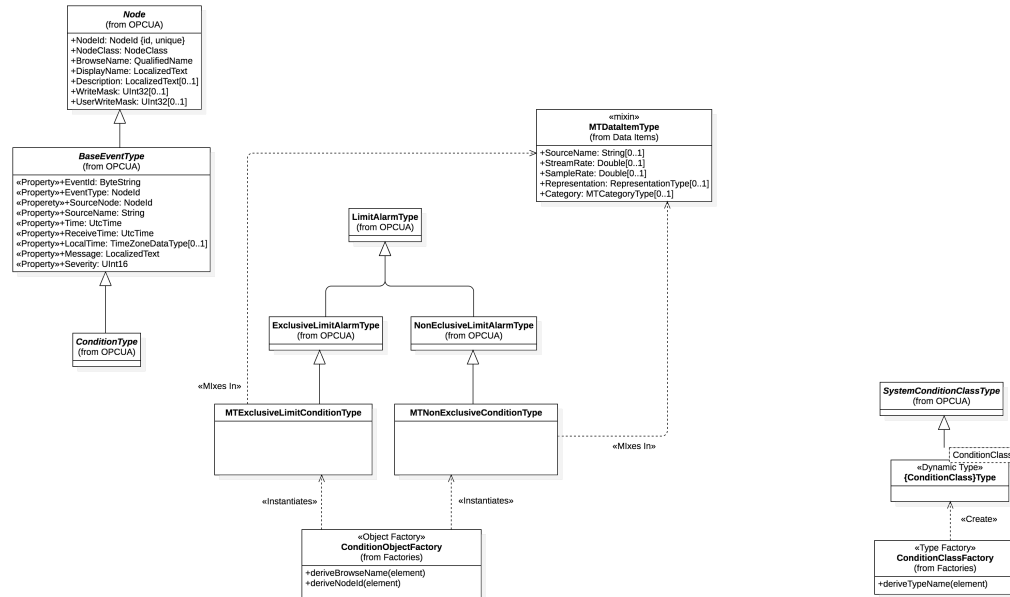


Figure 3: Conditions Diagram

2.3.1 Defintion of MTEExclusiveLimitConditionType

Table 24: MTEExclusiveLimitConditionType Definition

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

2.3.2 Defintion of MTNonExclusiveConditionType

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

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

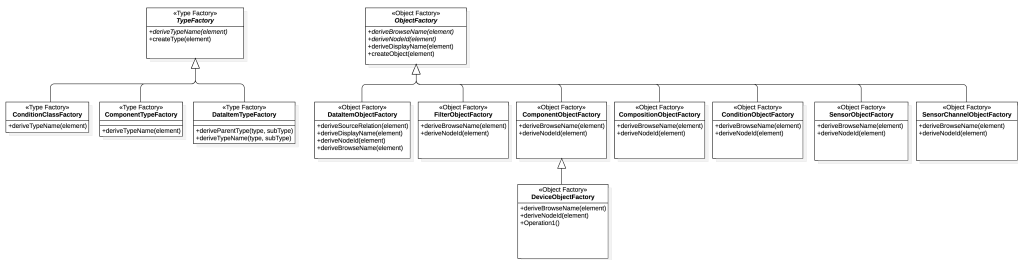


Figure 4: Factories Diagram

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

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

217 This is especially evident when mapping the DataItems and the Conditions to the
 218 MTConnect Information Models and providing sufficient definition to allow for
 219 unambiguous implementation.

2.4.1 Defintion of ComponentObjectFactory

220 2.4.1.1 Operations

221 • `deriveBrowseName(element)`
 222 Specification: `concat(element.QName, (if self.name.notEmpty()`
 223 `then concat('[' , self.name, ']')) else " endif))`
 224 • `deriveNodeId(element)`
 225 Specification: `concat(self.findDevice().uuid, element.id)`

2.4.2 Defintion of ComponentTypeFactory

226 The ‘ComponentTypeFactory’ creates component types using the MTConnect
 227 XML element as an input. The factory takes the ‘QName’ (or qualified name)
 228 of the XML element and then appends ‘Type’. For example an ‘<Controller
 229 id=’...’></...>’ element will create an OPC/UA ‘ControllerType’ type definition
 230 as an extension of the base ‘MTControllerType’.

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

234 2.4.2.1 Operations

235 • `deriveTypeName(element)`
 236 Specification: `derive: Component <- element.QName`
 237 Documentation: The QName of the element for the component will be used
 238 to derive the type of the node.

2.4.3 Defintion of `CompositionObjectFactory`

239 2.4.3.1 Operations

240 • `deriveBrowseName(element)`
 241 Specification: `concat(pascalCase(element.type), (if self.name.notEmpty()`
 242 `then concat('[', self.name, ']')) else " endif))`
 243 • `deriveNodeId(element)`
 244 Specification: `concat(self.findDevice().uuid, element.id)`

2.4.4 Defintion of `CompositionTypeFactory`

245 2.4.4.1 Operations

246 • `deriveTypeName(element)`
 247 Specification: `derive: Composition <- pascalCase(element.type)`
 248 Documentation: The type for the composition will be created using the pas-
 249 cal case of the 'type' from the composition element.

2.4.5 Defintion of `ConditionClassFactory`

250 2.4.5.1 Operations

- 251 • `deriveTypeName(element)`
252 Documentation: Create condition classes based on the OPC/UA three con-
253 dition types.

2.4.6 Defintion of `ConditionObjectFactory`

254 2.4.6.1 Operations

- 255 • `deriveBrowseName(element)`
- 256 • `deriveNodeId(element)`

2.4.7 Defintion of `DataItemObjectFactory`

257 2.4.7.1 Operations

- 258 • `deriveSourceRelation(element)`
259 Documentation: Use the source composition, component id, or data item id
260 to locate the source node id for this relationship. If one exists, add an object
261 with browse name "source" that relates to the entity referenced by the id.
262 The most specific identity should be used in the following order:
 - 263 – `DataItemId`
 - 264 – `CompositionId`
 - 265 – `ComponentId`
- 266 Since the data item implies composition and component and the compo-
267 sition implies component, there should only be one attribute given for the
268 source.

269 • `deriveDisplayName(element)`
 270 Documentation: Same as the `BrowseName`.

271 • `deriveNodeId(element)`
 272 Documentation: The `nodeId` will be given by the device `uuid` and the `DataItem`
 273 `id` attribute.

274 • `deriveBrowseName(element)`
 275 Documentation: The browse name will be composed of the following parts
 276 of the model:

- 277 1. If the `compositionId` is present, the `compositionId` will be resolved the
 278 the `Composition` element and the pascal case of the type attribute will
 279 be placed first.
- 280 2. If the `subType` is present, the pascal case of the `subType` will be placed
 281 next.
- 282 3. The pascal case of the type will be placed last.

283 For example, for a data item with the following attributes:

- 284 – type: `TEMPERATURE`
- 285 – composition type: `STORAGE_BATTERY`

286 will have the following browse name: `StorageBatteryTemperature`

287 For the data item with the following attributes:

- 288 – type: `ANGLE`
- 289 – subType: `ACTUAL`
- 290 – composition type: `ENCODER`

291 will have the following browse name: `EncoderActualAngle`

2.4.8 Defintion of `DataItemTypeFactory`

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

295 2.4.8.1 Operations

- 296 • `deriveParentType(type, subType)`
 297 Documentation: The parent type is derived from the category as follows:
 - 298 – `SAMPLE -> SampleType`
 - 299 – `EVENT ->`
 - 300 * `Enumerated Value -> MTEnumeratedEventType`
 - 301 * `Integer Value -> MTNumericEventType`
 - 302 * `Otherwise -> MTStringEventType`
- 303 • `deriveTypeName(type, subType)`
 304 Specification: `concat(pascalCase(subType), pascalCase(type))`
 305 Documentation: Used to derive the class name for creating a pascal case
 306 name from the sub type and the type. For example type `ROTARY_VE-`
 307 `LOCITY` and subType `ACTUAL` will become `ActualRotaryVelocity`.

2.4.9 Defintion of DeviceObjectFactory

308 The model instantiation for `MTConnect` begins with the ‘Device’ `MTConnect`
 309 element and then recursively traverses the sub-elements. The device will the ca-
 310 pabilities in the component factory to generate all the data items and component
 311 types.

312 2.4.9.1 Operations

- 313 • `deriveBrowseName(element)`
 314 Specification: `derive: element.name`
- 315 • `deriveNodeId(element)`
 316 Specification: `derive: element.uuid`

2.4.10 Defintion of **FilterObjectFactory**

317 Creates filters based on the type attribute of the Filter element.

318 2.4.10.1 Operations

- 319 • `deriveBrowseName(element)`
- 320 • `deriveNodeId(element)`
- 321 Documentation: The node id is composed of the data item id and the browse
- 322 name.

2.4.11 Defintion of **ObjectFactory**

323 2.4.11.1 Operations

- 324 • `deriveBrowseName(element)`
- 325 • `deriveNodeId(element)`
- 326 • `deriveDisplayName(element)`
- 327 Specification: `deriveBrowseName(element)`
- 328 • `createObject(element)`

2.4.12 Defintion of **SensorChannelObjectFactory**

329 2.4.12.1 Operations

- 330 • `deriveBrowseName(element)`
- 331 Specification: `concat('Channel', self.number)`
- 332 • `deriveNodeId(element)`
- 333 Specification: `concat(self.parent.NodeId, BrowseName)`

2.4.13 Defintion of **SensorObjectFactory**

334 2.4.13.1 Operations

- 335 • `deriveBrowseName(element)`
336 Specification: `element.QName`
- 337 • `deriveNodeId(element)`
338 Specification: `concat(self.parent.NodeId, BrowseName)`

2.4.14 Defintion of **TypeFactory**

339 2.4.14.1 Operations

- 340 • `deriveTypeName(element)`
- 341 • `createType(element)`

2.5 MTConnect Device Profile

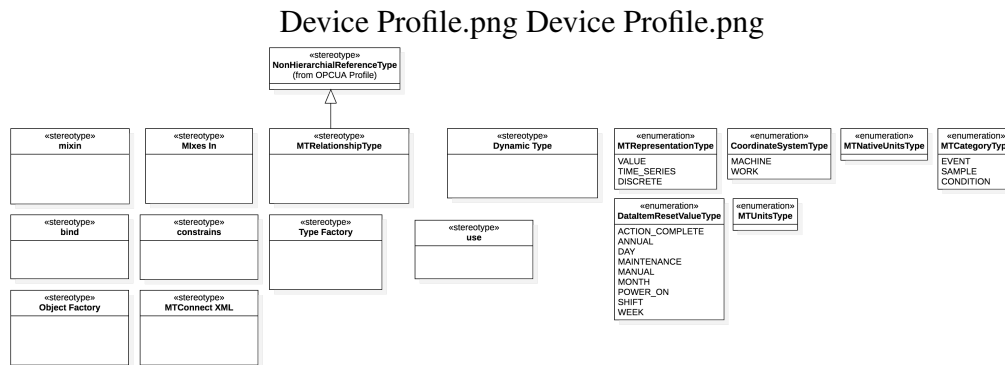


Figure 5: MTConnect Device Profile Diagram

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

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

347 Stereotypes are used throughout the model to provide additional information that
 348 will help provide context and definition to aid in better understanding the data
 349 model.

2.5.1 Defintion of Dynamic Type

2.5.2 Defintion of MTConnect XML

2.5.3 Defintion of MTRelationshipType

2.5.4 Defintion of Mixes In

350 This stereotype is associated with the dependency between a type and a mixin.
 351 See Section 2.5.9 for a complete description of the mixin.

2.5.5 Defintion of Object Factory

2.5.6 Defintion of Type Factory

2.5.7 Defintion of bind

352 When a dynamic type (See Section 2.5.1) creates an instance where the super-type
353 can be associated based on the data item category and type, the `Type Factory`
354 will specify which supertype is to be referenced.

355 The `bind` stereotype indicates the relationship between the dynamic sub-type and
356 the parent type are resolved baed on the `MTConnect DataItem` meta data.

2.5.8 Defintion of constrains

2.5.9 Defintion of mixin

357 The mixin pattern injects the properties and operations into the types that are
358 related to the using the `Mixes In` dependency. Mixins allow for lightweight
359 multiple inheritance. Since OPC/UA does not allow for multiple inheritance and
360 the `MTConnect` types require the same set of properties when they are sub-typed
361 from existing OPC/UA types, this mechanism allows for this relationship to be
362 expressed.

2.5.10 Defintion of use

363 The `use` stereotype indicates that one class uses as a helper to perform a specific
364 operation or activity. This stereotype is mainly used to indicate that a specific
365 factory is being employed by another type to create dynamic properties or rela-
366 tionships.