Generic OPC UA model Plastics and Rubber Machinery for umati

1 Scope

This document describes a generic model for plastics and rubber machinery for participation in the umati demonstrator. This is not a companion specification for productive use. The purpose is to promote OPC UA as global machine language. By using OPC UA for machinery it also demonstrates the benefits of standardization of the information models.

The following functionalities are covered:

– General information about the machine/device (manufacturer, model, serial number…)

– Status of the machine/device

– Transfer of sample process values in a generic way

Note: Please contact Marc Schmitt (marc.schmitt@vdma.org) or Dr. Harald Weber (harald.weber@vdma.org) if your machine type (Section 4.2) is not available.

2 UmatiPlasticsRubberGenericType

2.1 UmatiPlasticsRubberGenericType Definition

This OPC UA *ObjectType* is used for the root *Object* representing a generic machine/device.

The instance(s) of *UmatiPlasticsRubberGenericType* shall be located under the *Machines Object* of the Server (see OPC UA for Machinery).

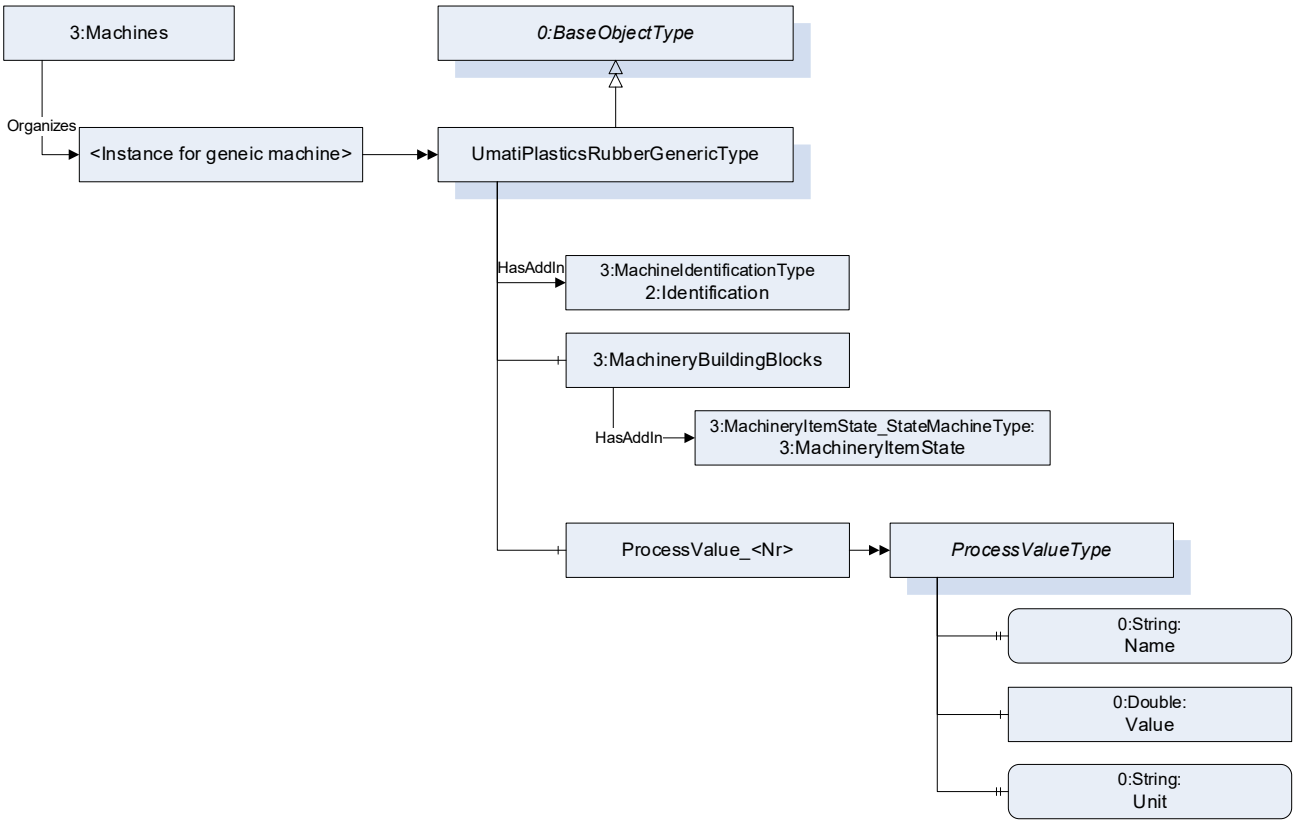

Figure 1 – UmatiPlasticsRubberGenericType Overview

Table 1 – UmatiPlasticsRubberGenericType Definition

Attribute	Value				
BrowseName	UmatiPlasticsRubberGenericType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of 0:BaseObjectType defined in OPC 40000-5					
0:HasAddIn	Object	2:Identification		3:MachineIdentificationType	M
0:HasAddIn	Object	3:MachineryBulidingBlocks		0:FolderType	M
0:HasComponent	Object	ProcessValue_<Nr>		ProcessValueType	OP

2.2 Identification and MachineryBuildingBlocks

The *MachineIdentificationType* is defined in OPC UA for Machinery (**Fehler! Verweisquelle konnte nicht gefunden werden.**) and provides basic information on a machine/device.

For the *InstanceDeclaration* the *ModellingRules* of the *Properties Model, DeviceClass* and *Location* are overridden to mandatory.

The *Object MachineryBuildingBlocks* contains building blocks from OPC UA for Machinery as defined in **Fehler! Verweisquelle konnte nicht gefunden werden.**. Here, the *Object* uses the *AddIn MachineryItemState*.

Table 2 – UmatiPlasticsRubberGenericType Additional Subcomponents

BrowsePath	References	NodeClass	BrowseName	DataType	TypeDefinition	Other
2:Identification	0:HasProperty	Variable	2:Model	0:LocalizedText	0:PropertyType	M, RO
2:Identification	0:HasProperty	Variable	2:DeviceClass	0:String	0:PropertyType	M, RO
2:Identification	0:HasProperty	Variable	3:Location	0:LocalizedText	0:PropertyType	M, RO
4:MachineryBuilding Blocks	0:HasAddIn	Object	3:MachineryItem State		3:MachineryItemState_State MachineType	M

2.3 ProcessValueType

In the umati demonstrator, sample process values (e.g. temperatures, pressures, cycle counters) are displayed. This model defined here, provides this information in a generic way. However, the organizers of the demonstrator make specifications, what shall be inside for the several machine types.

Table 3 – ProcessValueType Definition

Attribute	Value				
BrowseName	ProcessValueType				
IsAbstract	False				
References	**Node Class**	**BrowseName**	**DataType**	**TypeDefinition**	**Other**
Subtype of 0:BaseObjectType defined in OPC 40000-5					
0:HasProperty	Object	Name	0:String	0:PropertyType	M
0:HasComponent	Variable	Value	0:Double	0:BaseDataVariableType	M
0:HasProperty	Object	Unit	0:String	0:PropertyType	M

Note: For simplicity, the Value is not of AnalogUnitType and the unit is given as a separate Variable (String) for just displaying it in the dashboard.

3 Namespaces

3.1 Namespace Metadata

Table 4 defines the namespace metadata for this specification. The *Object* is used to provide version information for the namespace and an indication about static *Nodes*. Static *Nodes* are identical for all *Attributes* in all *Servers*, including the *Value Attribute*. See OPC 40000-5 for more details.

The information is provided as *Object* of type *NamespaceMetadataType*. This *Object* is a component of the *Namespaces Object* that is part of the *Server Object*. The *NamespaceMetadataType ObjectType* and its *Properties* are defined in Part 5.

Table 4 – NamespaceMetadata Object for this Specification

Attribute	Value	
BrowseName	**http://opcfoundation.org/UA/PlasticsRubber/umati/generic/**	
Property	**DataType**	**Value**
NamespaceUri	String	http://opcfoundation.org/UA/PlasticsRubber/umati/generic/
NamespaceVersion	String	1.00
NamespacePublicationDate	DateTime	2022-06-10
IsNamespaceSubset	Boolean	False
StaticNodeIdTypes	IdType[]	0
StaticNumericNodeIdRange	NumericRange[]	
StaticStringNodeIdPattern	String	

3.2 Handling of OPC UA Namespaces

Namespaces are used by OPC UA to create unique identifiers across different naming authorities. The *Attributes* *NodeId* and *BrowseName* are identifiers. A *Node* in the UA *AddressSpace* is unambiguously identified using a *NodeId*. Unlike *NodeIds*, the *BrowseName* cannot be used to unambiguously identify a *Node*. Different *Nodes* may have the same *BrowseName*. They are used to build a browse path between two *Nodes* or to define a standard *Property*.

Servers may often choose to use the same namespace for the *NodeId* and the *BrowseName*. However, if they want to provide a standard *Property*, its *BrowseName* shall have the namespace of the standards body although the namespace of the *NodeId* reflects something else, for example the *EngineeringUnits Property*. All *NodeIds* of *Nodes* not defined in this document shall not use the standard namespaces.

Table 5 provides a list of mandatory and optional namespaces used in an *Server* using this specification.

Table 5 – Namespaces used in an OPC 40084-3 Server

NamespaceURI	Description	Use
http://opcfoundation.org/UA/	Namespace for *NodeIds* and *BrowseNames* defined in the OPC UA specification. This namespace shall have namespace index 0.	Mandatory
Local Server URI	Namespace for nodes defined in the local server. This may include types and instances used in a device represented by the server. This namespace shall have namespace index 1.	Mandatory
http://opcfoundation.org/UA/DI/	Namespace for *NodeIds* and *BrowseNames* defined in OPC 10000-100. The namespace index is server specific.	Mandatory
http://opcfoundation.org/UA/Machinery/	Namespace for *NodeIds* and *BrowseNames* defined in OPC 40001-1. The namespace index is server specific.	Mandatory
http://opcfoundation.org/UA/PlasticsRubber/umati/generic/	Namespace for *NodeIds* and *BrowseNames* defined in this specification. The namespace index is server specific.	Mandatory

Table 6 provides a list of namespaces and their index used for *BrowseNames* in this specification. The default namespace of this specification is not listed since all *BrowseNames* without prefix use this default namespace.

Table 6 – Namespaces used in this specification

NamespaceURI	Namespace Index	Example
http://opcfoundation.org/UA/	0	0:NodeVersion
http://opcfoundation.org/UA/DI/	2	2:DeviceClass
http://opcfoundation.org/UA/Machinery/	3	3:MachineIdentificationType

4 Instance for umati Demonstrator

4.1 General

Table 6 shows the complete structure of the instance needed for the umati demonstrator when two process values are used. The demonstrator requires, that all mandatory elements of used *MachineIdentificationType* are existent, even if there are not displayed in the dashboard. If the value of a variable a not displayed, is can be filled with a static dummy value (e.g. empty string). All displayed values are highlighted in light-blue.

The namespace for the instances is manufacturer specific, e.g.
`http://samplemanufacturer.com/umati_plasticsrubber_generic_sample_instance/`

Table 7 – Sample instance of UmatiPlasticsRubberGenericType

BrowseName	Type	Example Value	Remarks
Objects			
↳ Machines			
↳ <EntryNodeforMachine>	UmatiPlasticsRubberGenericType		
↳ 2:Identification	3:MachineIdentificationType		
– 2:ProductInstanceUri		“http://samplemanufacturer.com/BM123”	1)
– 2:Manufacturer	0:LocalizedText	“Sample Manufacturer”	
– 2:Model	0:LocalizedText	“Machine Model 3000”	2)
– 2:SerialNumber	0:String	“BM123”	
– 2:DeviceClass	0:String	“Blow moulding machine”	
– 3:Location	0:String	“K 14 F42/N 51.260407 E 6.744588”	2), 3)
↳ 3:MachineryBulidingBlocks	0:FolderType		
↳ MachineryItemState	3:MachineryItemState_ StateMachineType		
↳ 0:CurrentState	0:LocalizedText	“Executing”	
– 0:Id	0:NodeId	ns=3,i=5006	
↳ ProcessValue_1	ProcessValueType		
– Name	0:String	“Temperature”	
– Value	0:Double	120.5	
– Unit	0:String	“°C”	
↳ ProcessValue_2	ProcessValueType		
– Name	0:String	“Pressure”	
– Value	0:Double	5.2	
– Unit	0:String	“bar”	

1) This variable is mandatory in the model but will not be displayed in the demonstrator
2) Not mandatory in OPC UA for Machinery but for this model and will be displayed in the demonstrator
3) See https://showcase.umati.org/Dashboard.html#location-of-fair-machine-and-software-icons-on-the-dashboard for rules for filling the location.

4.2 Process values for different machine types

The process values are modelled as optional placeholder in the generic model. This allows the model to be used for different machine types with reasonable effort. However, the contents should be the same for all machines of the same type.

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