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| EUROMAP 84.9 | OPC UA interfaces for plastics and rubber machinery – Extrusion – Part 9: Cutter |
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Release 1.00, 2020-06-01

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| <p>EUROMAP 84.9 (Release 1.00) is identical with OPC 40084-9 (Release 1.00) and VDMA 40084-9:2020-06</p> |
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Foreword

This specification was created by a joint working group of the OPC Foundation and EUROMAP. It is adopted identically as VDMA Specification.

EUROMAP

EUROMAP is the European umbrella association of the plastics and rubber machinery industry which accounts for annual sales of around 13.5 billion euro and a 40 per cent share of worldwide production. Almost 75 per cent of its European output is shipped to worldwide destinations. With global exports of 10.0 billion euro, EUROMAP's around 1,000 machinery manufacturers are market leaders with nearly half of all machines sold being supplied by EUROMAP members.

EUROMAP provides technical recommendations for plastics and rubber machines. In addition to standards for machine descriptions, dimensions and energy measurement, interfaces between machines feature prominently. The provision of manufacturer independent interfaces ensures high levels of machine compatibility.

OPC Foundation

OPC is the interoperability standard for the secure and reliable exchange of data and information in the industrial automation space and in other industries. It is platform independent and ensures the seamless flow of information among devices from multiple vendors. The OPC Foundation is responsible for the development and maintenance of this standard.

OPC UA is a platform independent service-oriented architecture that integrates all the functionality of the individual OPC Classic specifications into one extensible framework. This multi-layered approach accomplishes the original design specification goals of:

- Platform independence: from an embedded microcontroller to cloud-based infrastructure
- Secure: encryption, authentication, authorization and auditing
- Extensible: ability to add new features including transports without affecting existing applications
- Comprehensive information modelling capabilities: for defining any model from simple to complex

1 Scope

OPC 40084-9 describes the data exchange interface for cutters as part of an extrusion line. The interface is used by

- MES (Manufacturing Execution System) for collecting the information generated by extrusion lines at a central point for easier quality assurance and job and dataset management.
- Line controllers to monitor and set process parameters.

Safety related signals like emergency stop are not included.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies

OPC 10000-1, *OPC Unified Architecture - Part 1: Overview and Concepts*

<http://www.opcfoundation.org/UA/Part1/>

OPC 10000-2, *OPC Unified Architecture - Part 2: Security Model*

<http://www.opcfoundation.org/UA/Part2/>

OPC 10000-3, *OPC Unified Architecture - Part 3: Address Space Model*

<http://www.opcfoundation.org/UA/Part3/>

OPC 10000-4, *OPC Unified Architecture - Part 4: Services*

<http://www.opcfoundation.org/UA/Part4/>

OPC 10000-5, *OPC Unified Architecture - Part 5: Information Model*

<http://www.opcfoundation.org/UA/Part5/>

OPC 10000-6, *OPC Unified Architecture - Part 6: Mappings*

<http://www.opcfoundation.org/UA/Part6/>

OPC 10000-7, *OPC Unified Architecture - Part 7: Profiles*

<http://www.opcfoundation.org/UA/Part7/>

OPC 10000-8, *OPC Unified Architecture - Part 8: Data Access*

<http://www.opcfoundation.org/UA/Part8/>

OPC 10000-9, *OPC Unified Architecture - Part 9: Alarms and Conditions*

<http://www.opcfoundation.org/UA/Part9/>

OPC 10000-11, *OPC Unified Architecture - Part 11: Historical Access*

<http://www.opcfoundation.org/UA/Part11/>

OPC 10001-1, *OPC Unified Architecture V1.04 - Amendment 1: AnalogItem Types*

<http://www.opcfoundation.org/UA/Amendment1/>

OPC 10001-3, *OPC Unified Architecture V1.04 - Amendment 3: Method Metadata*

<http://www.opcfoundation.org/UA/Amendment3/>

OPC 10000-100, *OPC Unified Architecture - Part 100: Devices*

<http://www.opcfoundation.org/UA/Part100/>

OPC 40083: OPC UA interfaces for plastics and rubber machinery – General Type definitions (version 1.02)

<http://www.opcfoundation.org/UA/PlasticsRubber/GeneralTypes>

OPC 40084-1: OPC UA interfaces for plastics and rubber machinery – Extrusion – Part 1: General Type Definitions (version 1.0)

<http://www.opcfoundation.org/UA/PlasticsRubber/Extrusion/GeneralTypes/>

3 Terms, definitions and conventions

3.1 Overview

It is assumed that basic concepts of OPC UA information modelling are understood in this specification. This specification will use these concepts to describe the OPC 40084-9 Information Model. For the purposes of this document, the terms and definitions given in the documents referenced in Clause 2 apply.

Note that OPC UA terms and terms defined in this specification are *italicized* in the specification.

3.2 Conventions used in this document

The conventions described in OPC 40083 apply.

3.3 Abbreviations

MES Manufacturing Execution System

4 General information to OPC UA interfaces for plastics and rubber machinery and OPC UA

For general information on OPC UA interfaces for plastics and rubber machinery and OPC UA see OPC 40083.

5 Use cases

OPC 40084-9 describes the data exchange interface for cutters as part of an extrusion line. The interface is used by

- MES (Manufacturing Execution System) for collecting the information generated by extrusion lines at a central point for easier quality assurance and job and dataset management.
- Line controllers to monitor and set process parameters.

6 Basic security requirements

6.1 Application Security

For the communication between cutters and MES the OPC UA application authentication via X509 certificates shall be used. OPC UA provides functionalities for using self-signed certificates that have to be manually added to a “trust list” as well as for certificates issued by a certificate authority (CA).

The minimum requirements of the protocol level for a OPC 40084-9 compliant connection are:

- Use of (self-signed) certificates for OPC UA application authentication
- Security Policy: Basic256
- Message Security Mode: sign

NOTE: It is not fixed by this specification if the certificate includes a fixed IP address and/or the host name. However, if the certificate includes a host name, a DNS server is expected to resolve the host name. An OPC UA GDS (Global Discovery Server) can be used to manage the connections and certificates.

6.2 User security/Access control

6.2.1 On cutter

On the cutter authentication via user name and password is commonly used.

6.2.2 On MES

For the users and roles of the connection the following applies:

- User names can be manufacturer dependent.
- Standard roles are
 - “OPC40084”: read and write access for selected parameters
 - “OPC40084_read_only”: no writing permissions
- Manufacturers can add additional roles. They may not start with “OPC40084”. For these roles, more parameters can be writeable than for the OPC40084 role.
- The standard user “OPC40084” has the role “OPC40084” (and no other additional role), “OPC40084_read_only” has the role “OPC40084_read_only” (and no other additional role); the passwords for the standard users are defined by the manufacturers (they may be empty).

NOTE: OPC UA also allow an anonymous-token (e.g. for testing)

7 Cutter_InterfaceType

7.1 Cutter_InterfaceType Definition

This OPC UA *ObjectType* is used for the root *Object* representing a haul-off as part of an extrusion line. It is based on the *ExtrusionDeviceType* (defined in OPC 80084-1) and formally defined in Table 1.

The instance(s) of *Cutter_InterfaceType* shall be located under the *DeviceSet Object* of the Server (see OPC UA Part 100).

NOTE: If the OPC UA server is implemented in the control of the cutter so only one instance of *Cutter_InterfaceType* will be created. But it is also possible that one OPC UA server is connected to several machine controls as one interface to the MES. In this case several instances of *Cutter_InterfaceType* will be created.

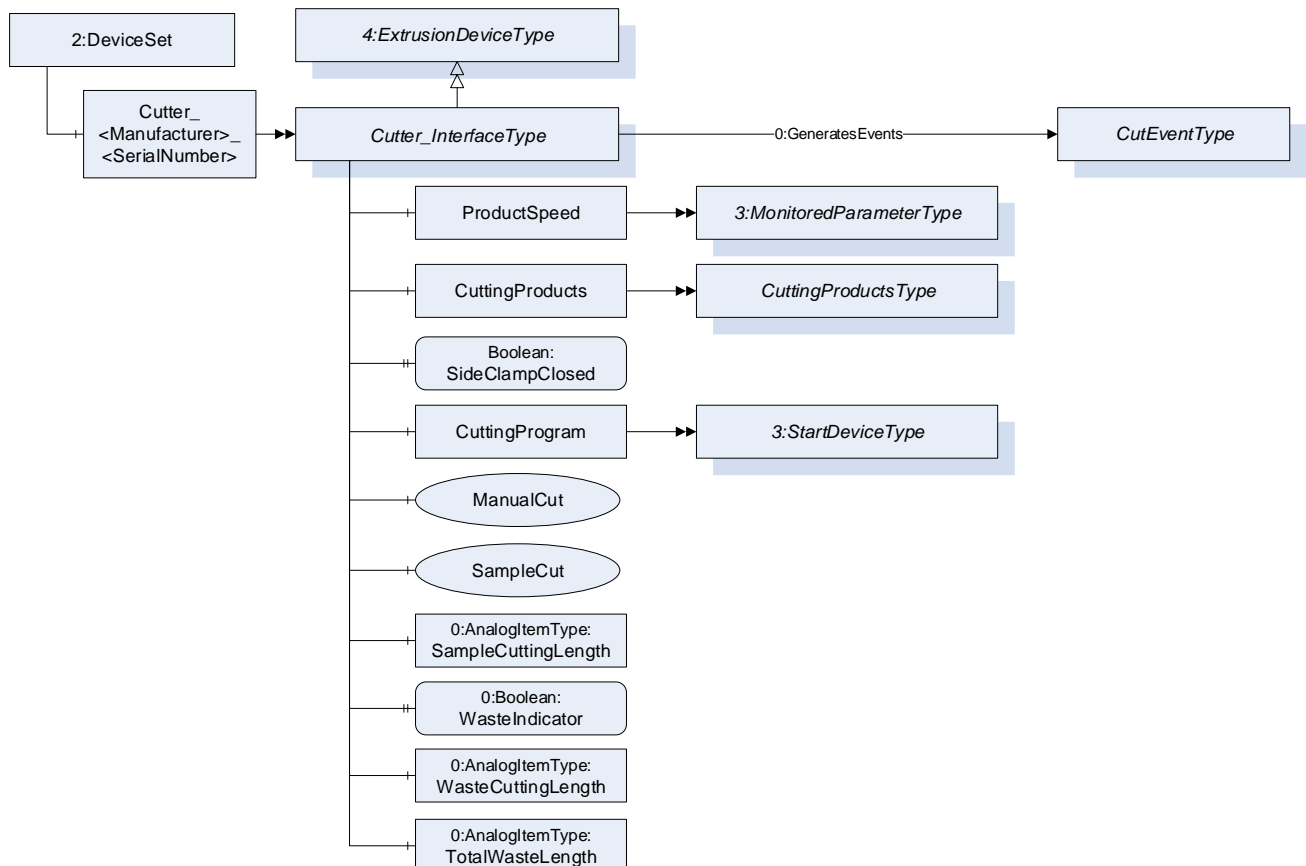


Figure 1 – Cutter_InterfaceType Overview

Table 1 – Cutter_InterfaceType Definition

| Attribute | Value | | | | |
|---|----------------------|---------------------|-----------|--------------------------|-------|
| BrowseName | Cutter_InterfaceType | | | | |
| IsAbstract | False | | | | |
| References | Node Class | BrowseName | DataType | TypeDefinition | Other |
| Subtype of 4:ExtrusionDeviceType (defined in OPC 40084-1) | | | | | |
| 0:HasComponent | Object | ProductSpeed | | 3:MonitoredParameterType | O |
| 0:HasComponent | Object | CuttingProducts | | CuttingProductsType | M |
| 0:HasComponent | Variable | SideClampClosed | 0:Boolean | 0:BaseDataVariableType | O |
| 0:HasComponent | Object | CuttingProgram | | 3:StartDeviceType | O |
| 0:HasComponent | Method | ManualCut | | | O |
| 0:HasComponent | Method | SampleCut | | | O |
| 0:HasComponent | Variable | SampleCuttingLength | 0:Double | 0:AnalogUnitType | O, RW |
| 0:HasComponent | Variable | WasteIndicator | 0:Boolean | 0:BaseDataVariableType | O, RW |
| 0:HasComponent | Variable | WasteCuttingLength | 0:Double | 0:AnalogUnitType | O, RW |
| 0:HasComponent | Variable | TotalWasteLength | 0:Double | 0:AnalogUnitType | O, RO |
| 0:GeneratesEvent | ObjectType | CutEventType | | | |

The *BrowseName* of the object instance shall be "Cutter_<Manufacturer>_<SerialNumber>"

Example: "Cutter_Weber_0123456".

7.2 DeviceClass

The *DeviceClass Property* in the *MachineInformation* Object inside the *ExtrusionDeviceType* shall have the value "Cutter".

7.3 Distances

The distances (length) for the cutting shall be put into the *Object AdditionalMeasuringDevices* which is part of the *ExtrusionDeviceType*.

7.4 ProductSpeed

This *Object* is used for monitoring the speed of the product which shall be cut. The *MonitoredParameterType* is defined in OPC 40083.

7.5 CuttingProductsType

This *Object* is a container for the description of the products to be cut.

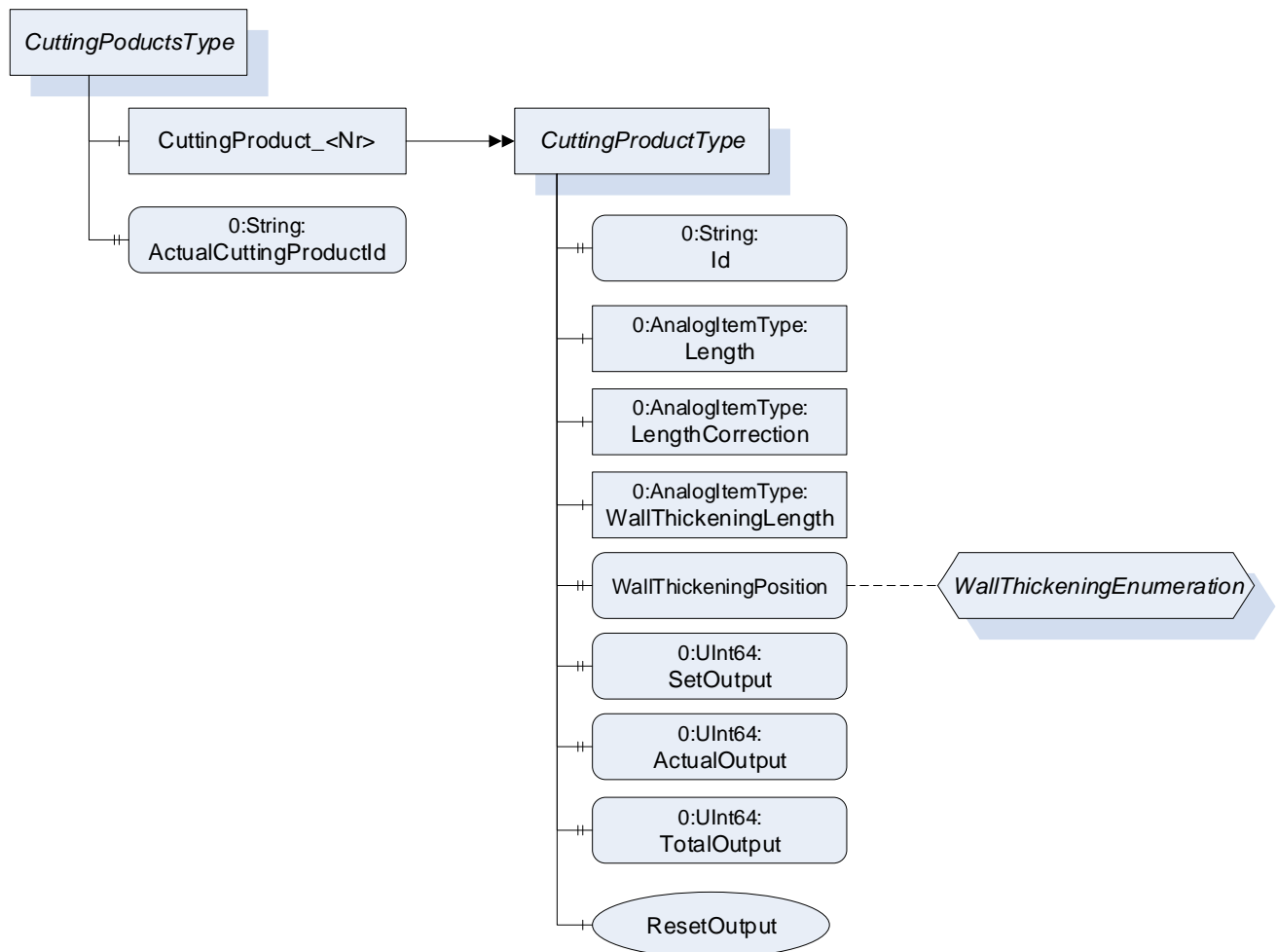


Figure 2 – CuttingProductsType Overview

Table 2 – CuttingProductsType Definition

| Attribute | Value | | | | |
|--|---------------------|------------------------|-----------|------------------------|-------|
| BrowseName | CuttingProductsType | | | | |
| IsAbstract | False | | | | |
| References | Node Class | BrowseName | Data Type | Type Definition | Other |
| Subtype of 0:BaseObjectType defined in OPC UA Part 5 | | | | | |
| 0:HasComponent | Object | CuttingProduct_<Nr> | | CuttingProductType | MP |
| 0:HasComponent | Variable | ActualCuttingProductId | 0:String | 0:BaseDataVariableType | M |

The number of instances of *CuttingProductType* is fixed by cutter (default 5)

If the current production does not use all provided instances, the *SetOutput* is set to 0.

The systematic of describing the products to be cut is similar to jobs described in OPC 40084-2. One *CuttingProduct* is produced (*SetOutput*) then the next. After the last *CuttingProduct*, the first one is active again.

ActualCuttingProductId: Id of the product which is currently produced.

7.6 CuttingProductType

Description of the product to be cut with Id, length, length correction wall thickening and amount of output.

Table 3 – CuttingProductType Definition

| Attribute | Value | | | | |
|--|--------------------|------------------------|---------------------------|------------------------|-------|
| BrowseName | CuttingProductType | | | | |
| IsAbstract | False | | | | |
| References | Node Class | BrowseName | DataType | TypeDefinition | Other |
| Subtype of 0:BaseObjectType defined in OPC UA Part 5 | | | | | |
| 0:HasProperty | Variable | Id | 0:String | 0:PropertyType | M, RO |
| 0:HasComponent | Variable | Length | 0:Double | 0:AnalogUnitType | M, RW |
| 0:HasComponent | Variable | LengthCorrection | 0:Double | 0:AnalogUnitType | O, RW |
| 0:HasComponent | Variable | WallThickeningLength | 0:Double | 0:AnalogUnitType | O, RW |
| 0:HasProperty | Variable | WallThickeningPosition | WallThickeningEnumeration | 0:PropertyType | O, RW |
| 0:HasComponent | Variable | SetOutput | 0:UInt64 | 0:BaseDataVariableType | M, RW |
| 0:HasComponent | Variable | ActualOutput | 0:UInt64 | 0:BaseDataVariableType | M, RO |
| 0:HasComponent | Variable | TotalOutput | 0:UInt64 | 0:BaseDataVariableType | M, RO |
| 0:HasComponent | Method | ResetOutput | | | O |

The *ActualOutput* is related to the output during producing one product type and automatically reset when the *CuttingProduct* is newly started

TotalOutput: Total sum of output

For the wall thickening the length and the position needs to be defined.

Table 4 – WallThickeningEnumeration Definition

| Name | Value | Description |
|-------|-------|--|
| NO | 0 | No wall thickening |
| FRONT | 1 | Wall thickening only at the front of the product |
| END | 2 | Wall thickening only at the end of the product |
| BOTH | 3 | Wall thickening at both sides of the product |

7.7 SideClampClosed

Information if the side clamp of the cutter is closed.

7.8 CuttingProgram

With this object the client is informed, if the cutting program is running. The client can also request the starting and stopping of the cutting program. The *StartDeviceType* is defined in OPC 40083.

7.9 ManualCut

With this *Method* (without arguments), the client can request an immediate cutting.

NOTE: This is usually destroying the current product.

Signature

```
ManualCut ();
```

7.10 SampleCut, SampleCutLength

With this *Method* (without arguments), the client can request to have a sample cut after the next regular cutting. The length of the cut is pre-defined by writing in the *Variable SampleCutLength*.

Signature

```
SampleCut ();
```

7.11 WasteIndicator, WasteCuttingLength, TotalWasteLength

Written from the client (e.g. extruder) to tell the cutter, that currently waste is produced. If true, the product is cut into pieces with the length set in *WasteCuttingLength*. *TotalWasteLength* gives the total length of the waste.

7.12 CutEventType

This event is fired after each cut

Table 5 – CutEventType Definition

| Attribute | Value | | | | |
|---|--------------|------------------|----------|----------------|-------|
| BrowseName | CutEventType | | | | |
| IsAbstract | True | | | | |
| References | Node Class | BrowseName | DataType | TypeDefinition | Other |
| Subtype of 0:BaseEventType defined in OPC UA Part 5 | | | | | |
| 0:HasProperty | Variable | CuttingProductId | 0:String | 0:PropertyType | M |
| 0:HasProperty | Variable | ActualOutput | 0:UInt64 | 0:PropertyType | M |
| 0:HasProperty | Variable | TotalOutput | 0:UInt64 | 0:PropertyType | M |

8 Profiles and Conformance Units

This chapter defines the corresponding profiles and conformance units for the OPC UA Information Model for OPC 40084-9. *Profiles* are named groupings of conformance units. Facets are profiles that will be combined with other *Profiles* to define the complete functionality of an OPC UA *Server* or *Client*. The following tables specify the facets available for *Servers* that implement the OPC 40084-9 Information Model companion specification.

NOTE: The names of the supported profiles are available in the *Server Object* under *ServerCapabilities.ServerProfileArray*

Table 6 lists all Profiles defined in this document and defines their URIs.

Table 6 – Profile URIs for OPC 40084-9

| Profile | URI |
|--|---|
| OPC 40084-9 Basic Server Profile | http://opcfoundation.org/UA-Profile/PlasticsRubber/Extrusion/Cutter/Server/Basic |
| OPC 40084-9 ProductionDatasetManagement Server Facet | http://opcfoundation.org/UA-Profile/PlasticsRubber/Extrusion/Cutter/Server/ProductionDatasetManagement |

Table 7 – OPC 40084-9 Basic Server Facet Definition

| Conformance Unit | Description | Optional/ Mandatory |
|---|---|------------------------|
| OPC 40084-9 Basic | Support of <i>Cutter_InterfaceType</i> and all mandatory child elements giving information on the cutter itself and its components. | M |
| Profile | | |
| ComplexType Server Facet (defined in OPC UA Part 7) | | M |
| Standard Event Subscription Server Facet (defined in OPC UA Part 7) | | M |
| Method Server Facet (defined in OPC UA Part 7) | | M |
| BaseDevice_Server_Facet (defined in OPC UA Part 100) | | M |

Table 8 – OPC 40084-9 ProductionDatasetManagement Server Facet Definition

| Conformance Unit | Description | Optional/ Mandatory |
|--|--|------------------------|
| OPC 40084-9 ProductionDatasetManagement | Support of <i>ProductionDatasetManagementType</i> (defined in OPC 40083) for the management and transfer of recipes (= production datasets) between MES and cutter | M |

9 Namespaces

9.1 Namespace Metadata

Table 9 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 Part5 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 Part5.

The version information is also provided as part of the *ModelTableEntry* in the *UANodeSet XML* file. The *UANodeSet XML* schema is defined in Part 6.

Table 9 – NamespaceMetadata Object for this Specification

| Attribute | Value | | |
|-------------|--|----------------|--|
| BrowseName | http://opcfoundation.org/UA/PlasticsRubber/Extrusion/Cutter/ | | |
| References | BrowseName | DataType | Value |
| HasProperty | NamespaceUri | String | http://opcfoundation.org/UA/PlasticsRubber/Extrusion/Cutter/ |
| HasProperty | NamespaceVersion | String | 1.00 |
| HasProperty | NamespacePublicationDate | DateTime | 2020-06-01 00:00:00 |
| HasProperty | IsNamespaceSubset | Boolean | False |
| HasProperty | StaticNodeIdTypes | IdType[] | {Numeric} |
| HasProperty | StaticNumericNodeIdRange | NumericRange[] | Null |
| HasProperty | StaticStringNodeIdPattern | String | Null |

9.2 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 10 provides a list of mandatory and optional namespaces used in an OPC 40084-9 OPC UA *Server*.

Table 10 – Namespaces used in an OPC 40084-9 Server

| NamespaceURI | Description | Use |
|--|---|-----------|
| http://opcfoundation.org/UA/ | Namespace for <i>NodeIds</i> and <i>BrowseNames</i> 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 <i>NodeIds</i> and <i>BrowseNames</i> defined in OPC UA Part 100. The namespace index is server specific. | Mandatory |
| http://opcfoundation.org/UA/PlasticsRubber/GeneralTypes/ | Namespace for <i>NodeIds</i> and <i>BrowseNames</i> defined in OPC 40083. The namespace index is server specific. | Mandatory |
| http://opcfoundation.org/UA/PlasticsRubber/Extrusion/GeneralTypes/ | Namespace for <i>NodeIds</i> and <i>BrowseNames</i> defined in OPC 40084-1. The namespace index is server specific. | Mandatory |
| http://opcfoundation.org/UA/PlasticsRubber/Extrusion/Cutter/ | Namespace for <i>NodeIds</i> and <i>BrowseNames</i> defined in this specification. The namespace index is server specific. | Mandatory |
| Vendor specific types and instances | A server may provide vendor specific types like types derived from <i>MachineType</i> or <i>MachineStatusType</i> or vendor specific instances of devices in a vendor specific namespace. | Optional |

Table 11 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 11 – 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/PlasticsRubber/GeneralTypes/ | 3 | 3:MachineInformationType |
| http://opcfoundation.org/UA/PlasticsRubber/Extrusion/GeneralTypes/ | 4 | 4:ExtrusionDeviceType |

Annex A (normative)

OPC 40084-9 Namespace and mappings

A.1 Namespace and identifiers for OPC 40084-9 Information Model

This appendix defines the numeric identifiers for all of the numeric *NodeIds* defined in this specification. The identifiers are specified in a CSV file with the following syntax:

<SymbolName>, <Identifier>, <NodeClass>

Where the *SymbolName* is either the *BrowseName* of a *Type Node* or the *BrowsePath* for an *Instance Node* that appears in the specification and the *Identifier* is the numeric value for the *NodeId*.

The *BrowsePath* for an *Instance Node* is constructed by appending the *BrowseName* of the instance *Node* to the *BrowseName* for the containing instance or type. An underscore character is used to separate each *BrowseName* in the path. Let's take for example, the *MachineInformationType ObjectType Node* which has the *ControllerName Property*. The **Name** for the *ControllerName InstanceDeclaration* within the *MachineInformationType* declaration is: *MachineInformationType_ControllerName*.

The *NamespaceUri* for all *NodeIds* defined here is <http://opcfoundation.org/UA/PlasticsRubber/Extrusion/Cutter/>

The CSV released with this version of the specification can be found here:

- <http://www.opcfoundation.org/UA/schemas/PlasticsRubber/Extrusion/Cutter/1.00/NodeIds.csv>

NOTE: The latest CSV that is compatible with this version of the specification can be found here:

- <http://www.opcfoundation.org/UA/schemas/PlasticsRubber/Extrusion/Cutter/NodeIds.csv>

A computer processible version of the complete Information Model defined in this specification is also provided. It follows the XML Information Model schema syntax defined in Part 6.

The Information Model Schema released with this version of the specification can be found here:

- <http://www.opcfoundation.org/UA/schemas/PlasticsRubber/Extrusion/Cutter/1.00/Opc.Ua.PlasticsRubber.Extrusion.Cutter.NodeSet2.xml>

NOTE: The latest Information Model schema that is compatible with this version of the specification can be found here:

- <http://www.opcfoundation.org/UA/schemas/PlasticsRubber/Extrusion/Cutter/Opc.Ua.PlasticsRubber.Extrusion.Cutter.NodeSet2.xml>
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